

Fuel System

GENERAL

GASOLINE ENGINE CONTROL SYSTEM

ETC (ELECTRONIC THROTTLE CONTROL) SYSTEM
MASS AIR FLOW SENSOR (MAFS)
INTAKE AIR TEMPERATURE SENSOR (IATS)
MANIFOLD ABSOLUTE PRESSURE SENSOR (MAPS)
ENGINE COOLANT TEMPERATURE SENSOR (ECTS)
CAMSHAFT POSITION SENSOR (CMPS)
CRANKSHAFT POSITION SENSOR (CKPS)
HEATED OXYGEN SENSOR (HO2S)

KNOCK SENSOR (KS)
INJECTOR
CVVT OIL CONTROL VALVE (OCV)
CVVT OIL TEMPERATURE SENSOR(OTS)
PURGE CONTROL SOLENOID VALVE (PCSV)
VARIABLE INTAKE SOLENOID (VIS) VALVE
ACCELERATOR POSITION SENSOR (APS)
POWERTRAIN CONTROL MODULE (PCM)

DTC TROUBLESHOOTING PROCEDURES

FUEL DELIVERY SYSTEM

FUEL PUMP
FUEL TANK

GENERAL

SPECIFICATIONS E347D44B

FUEL DELIVERY SYSTEM

Items	Specification	
Fuel Tank	Capacity	80 lit. (21.1 U.S.gal., 17.6 Imp.gal.)
Fuel Filter (built in Fuel Pump assembly)	Type	High pressure type
Fuel Pressure Regulator (built in Fuel Pump assembly)	Regulated Fuel Pressure	375 ~ 385 kPa(3.82 ~ 3.92 kgf/cm ² , 54.3 ~ 55.8 psi)
Fuel Pump	Type	Electrical, in-tank type
	Driven by	Electric motor

SENSORS

MASS AIR FLOW SENSOR (MAFS)

- ▷ Type: Hot-film type
- ▷ Specification

Air Flow (kg/h)	Frequency (Hz)
12.6 kg/h	2,617Hz
18.0 kg/h	2,958Hz
23.4 kg/h	3,241Hz
32.4 kg/h	3,653Hz
43.2 kg/h	4,024Hz
57.6 kg/h	4,399Hz
72.0 kg/h	4,704Hz
108.0 kg/h	5,329Hz
144.0 kg/h	5,897Hz
198.0 kg/h	6,553Hz
270.0 kg/h	7,240Hz
360.0 kg/h	7,957Hz
486.0 kg/h	8,738Hz
666.0 kg/h	9,644Hz
900.0 kg/h	10,590Hz

INTAKE AIR TEMPERATURE SENSOR (IATS)

- ▷ Type: Thermistor type
- ▷ Specification

Temperature		Resistance (k Ω)
°C	°F	
-40	-40	100.87
-20	-4	28.58
0	32	9.40
10	50	5.66
20	68	3.51
40	104	1.47
60	140	0.67
80	176	0.33

MANIFOLD ABSOLUTE PRESSURE SENSOR (MAPS)

- ▷ Type: Piezo-resistive pressure type
- ▷ Specification

Pressure (kPa)	Output Voltage (V)
20.0kPa	0.79
46.66kPa	1.84
101.32kPa	4.0

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FUEL SYSTEM

ENGINE COOLANT TEMPERATURE SENSOR (ECTS)

- ▷ Type: Thermistor type
- ▷ Specification

Temperature		Resistance ($k\Omega$)
$^{\circ}\text{C}$	$^{\circ}\text{F}$	
-40	-40	48.14
-20	-4	14.13 ~ 16.83
0	32	5.79
20	68	2.31 ~ 2.59
40	104	1.15
60	140	0.59
80	176	0.32

THROTTLE POSITION SENSOR (TPS)

- ▷ Type: Variable resistor type
- ▷ Specification (When reference voltage = 5.0V)

Throttle Angle ($^{\circ}$)	Output Voltage(V)	
	TPS1	TPS2
0	0	5.0
10	0.5	4.5
20	0.9	4.1
30	1.4	3.6
40	1.8	3.2
50	2.3	2.7
60	2.7	2.3
70	3.2	1.8
80	3.6	1.4
90	4.1	0.9
100	4.5	0.5
110	5.0	0.0

Item	Sensor Resistance ($k\Omega$)
TPS1	4.0 ~ 6.0 [20°C (68°F)]
TPS2	2.7 ~ 4.1 [20°C (68°F)]

ACCELERATOR POSITION SENSOR (APS)

- ▷ Type: Variable resistor type
- ▷ Specification (When reference voltage = 5.0V)

Accelerator Position	Output Voltage (V)	
	APS1	APS2
C.T	0.70 ~ 0.80	0.29 ~ 0.46
W.O.T	3.85 ~ 4.35	1.93 ~ 2.18

Item	Sensor Resistance ($k\Omega$)
APS1	0.7 ~ 1.3 [20°C (68°F)]
APS2	1.4 ~ 2.6 [20°C (68°F)]

HEATED OXYGEN SENSOR (HO2S)

- ▷ Type: Zirconia (ZrO_2) type
- ▷ Specification

A/F Ratio	Output Voltage (V)
RICH	0.80 ~ 0.92
LEAN	0.1

Item	Resistance (Ω)
Sensor Heater	3.0 ~ 4.0 [21°C (69.8°F)]

CAMSHAFT POSITION SENSOR (CMPS)

- ▷ Type: Hall effect type
- ▷ Specification

Item	Specification
Output Voltage (V)	High: 4.75 ~ 5.25
	Low: 0 ~ 0.7
Air Gap (mm)	0.5 ~ 1.5

CRANKSHAFT POSITION SENSOR (CKPS)

- ▷ Type: Magnetic field sensitive type
- ▷ Specification

Item	Specification
Coil Resistance (Ω)	630 ~ 770 [20°C (68°F)]
Air Gap (mm)	0.5 ~ 1.5

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KNOCK SENSOR (KS)

- ▷ Type: Piezo-electricity type
- ▷ Specification

Item	Specification
Capacitance (pF)	950 ~ 1,350pF

CVVT OIL TEMPERATURE SENSOR (OTS)

- ▷ Type: Thermistor type
- ▷ Specification

Temperature		Resistance (k Ω)
$^{\circ}\text{C}$	$^{\circ}\text{F}$	
-40	-40	52.0
-20	-4	16.5
0	32	6.0
20	68	2.45
40	104	1.10
60	140	0.544
80	176	0.290
100	212	0.164
120	248	0.099

ACTUATORS

INJECTOR

- ▷ Number: 6
- ▷ Specification

Item	Specification
Coil Resistance (Ω)	13.8 ~ 15.2 [20 $^{\circ}\text{C}$ (68 $^{\circ}\text{F}$)]

PURGE CONTROL SOLENOID VALVE (PCSV)

- ▷ Specification

Item	Specification
Coil Resistance (Ω)	14.0 ~ 18.0 [20 $^{\circ}\text{C}$ (68 $^{\circ}\text{F}$)]

VARIABLE INTAKE SOLENOID (VIS) VALVE #1 (SURGE TANK SIDE)

- ▷ Specification

Item	Specification
Coil Resistance (Ω)	29.0 ~ 35.0 [22 $^{\circ}\text{C}$ (71.6 $^{\circ}\text{F}$)]

VARIABLE INTAKE SOLENOID (VIS) VALVE #2 (INTAKE MANIFOLD SIDE)

- ▷ Specification

Item	Specification
Coil Resistance (Ω)	29.0 ~ 35.0 [20 $^{\circ}\text{C}$ (68 $^{\circ}\text{F}$)]

CVVT OIL CONTROL VALVE (OCV) [BANK 1]

- ▷ Specification

Item	Specification
Coil Resistance (Ω)	6.7 ~ 7.7 [20 $^{\circ}\text{C}$ (68 $^{\circ}\text{F}$)]

CVVT OIL CONTROL VALVE (OCV) [BANK 2]

- ▷ Specification

Item	Specification
Coil Resistance (Ω)	6.7 ~ 7.7 [20 $^{\circ}\text{C}$ (68 $^{\circ}\text{F}$)]

ETC MOTOR

- ▷ Specification

Item	Specification
Coil Resistance (Ω)	1.275 ~ 1.725 [20 $^{\circ}\text{C}$ (68 $^{\circ}\text{F}$)]

IGNITION COIL

- ▷ Type: Stick type
- ▷ Specification

Item	Specification
1st Coil Resistance (Ω)	0.62 Ω ±10% [20 $^{\circ}\text{C}$ (68 $^{\circ}\text{F}$)]
2nd Coil Resistance (k Ω)	7.0k Ω ±15% [20 $^{\circ}\text{C}$ (68 $^{\circ}\text{F}$)]

SERVICE STANDARD

E85141FD

Ignition Timing	BTDC 7° ± 10°		
Idle Speed	A/CON OFF	Neutral,N,P-range	650 ± 100 rpm
		D-range	650 ± 100 rpm
	A/CON ON	Neutral,N,P-range	650 ± 100 rpm
		D-range	650 ± 100 rpm

TIGHTENING TORQUES

EAEFE8E8

ENGINE CONTROL SYSTEM

Item	kgf·m	N·m	lbf·ft
PCM installation bolts (on bracket)	1.0 ~ 1.2	9.8 ~ 11.8	7.2 ~ 8.7
PCM bracket installation bolts/nuts (on air cleaner assembly)	1.0 ~ 1.2	9.8 ~ 11.8	7.2 ~ 8.7
Camshaft position sensor [Bank 1] installation bolt	0.7 ~ 1.0	6.9 ~ 9.8	5.1 ~ 7.2
Camshaft position sensor [Bank 2] installation bolt	0.7 ~ 1.0	6.9 ~ 9.8	5.1 ~ 7.2
Crankshaft position sensor installation bolt	0.7 ~ 1.0	6.9 ~ 9.8	5.1 ~ 7.2
CVVT Oil control valve [Bank 1] installation bolt	0.8 ~ 1.0	7.8 ~ 9.8	5.8 ~ 7.2
CVVT Oil control valve [Bank 2] installation bolt	0.8 ~ 1.0	7.8 ~ 9.8	5.8 ~ 7.2
CVVT Oil temperature sensor installation	2.0 ~ 4.0	19.6 ~ 39.2	14.5 ~ 28.9
Engine coolant temperature sensor installation	2.0 ~ 4.0	19.6 ~ 39.2	14.5 ~ 28.9
ETC module installation bolt	0.9 ~ 1.1	8.8 ~ 10.8	6.5 ~ 8.0
Heated oxygen sensor (Bank 1 / Sensor 1) installation	3.5 ~ 4.5	34.3 ~ 44.1	25.3 ~ 32.6
Heated oxygen sensor (Bank 1 / Sensor 2) installation	3.5 ~ 4.5	34.3 ~ 44.1	25.3 ~ 32.6
Heated oxygen sensor (Bank 2 / Sensor 1) installation	3.5 ~ 4.5	34.3 ~ 44.1	25.3 ~ 32.6
Heated oxygen sensor (Bank 2 / Sensor 2) installation	3.5 ~ 4.5	34.3 ~ 44.1	25.3 ~ 32.6
Ignition coil installation bolt	1.0 ~ 1.2	9.8 ~ 11.8	7.2 ~ 8.7
Knock sensor [Bank 1] installation	1.9 ~ 2.4	18.6 ~ 23.5	13.7 ~ 17.4
Knock sensor [Bank 2] installation	1.9 ~ 2.4	18.6 ~ 23.5	13.7 ~ 17.4
Manifold absolute pressure sensor installation bolt	0.8 ~ 1.2	7.8 ~ 11.8	5.8 ~ 8.7

FUEL DELIVERY SYSTEM

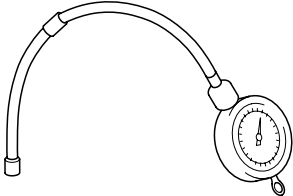
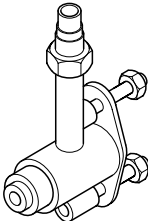
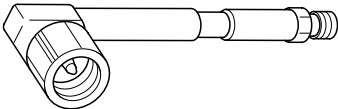
Item	kgf·m	N·m	lbf·ft
Fuel tank band mounting nuts	4.0 ~ 5.5	39.2 ~ 53.9	28.9 ~ 39.8
Fuel pump assembly mounting bolts	0.2 ~ 0.3	2.0 ~ 2.9	1.4 ~ 2.2
Delivery pipe installation bolts	0.9 ~ 1.4	8.8 ~ 13.7	6.5 ~ 10.1
Accelerator pedal module installation bolts	1.3 ~ 1.6	12.8 ~ 15.7	9.4 ~ 11.6

GENERAL

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SPECIAL SERVICE TOOLS

E5DDDC6

Tool (Number and name)	Illustration	Application
09353-24100 Fuel Pressure Gauge	 EFDA003A	Measuring the fuel line pressure
09353-38000 Fuel Pressure Gauge Adapter	 BF1A025D	Connection between the delivery pipe and fuel feed line
09353-24000 Fuel Pressure Gauge Connector	 EFDA003C	Connection between Fuel Pressure Gauge (09353-24100) and Fuel Pressure Gauge Adapter (09353-38000)

BASIC TROUBLESHOOTING

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BASIC TROUBLESHOOTING GUIDE

1	Bring Vehicle to Workshop
2	Analyze Customer's Problem Ask the customer about the conditions and environment relative to the issue (Use CUSTOMER PROBLEM ANALYSIS SHEET).
3	Verify Symptom, and then Check DTC and Freeze Frame Data Connect Hi-Scan (Pro) to Diagnostic Link Connector (DLC). Record the DTC and freeze frame data.  NOTE <i>To erase DTC and freeze frame data, refer to Step 5.</i>
4	Confirm the Inspection Procedure for the System or Part Using the SYMPTOM TROUBLESHOOTING GUIDE CHART, choose the correct inspection procedure for the system or part to be checked.
5	Erase the DTC and Freeze Frame Data  WARNING NEVER erase DTC and freeze frame data before completing Step 2 MIL/DTC in "CUSTOMER PROBLEM ANALYSIS SHEET".
6	Inspect Vehicle Visually Go to Step 11, if you recognize the problem.
7	Recreate (Simulate) Symptoms of the DTC Try to recreate or simulate the symptoms and conditions of the malfunction as described by customer. If DTC(s) is/are displayed, simulate the condition according to troubleshooting procedure for the DTC.
8	Confirm Symptoms of Problem If DTC(s) is/are not displayed, go to Step 9. If DTC(s) is/are displayed, go to Step 11.
9	Recreate (Simulate) Symptom Try to recreate or simulate the condition of the malfunction as described by the customer.
10	Check the DTC If DTC(s) does(do) not occur, refer to INTERMITTENT PROBLEM PROCEDURE in BASIC INSPECTION PROCEDURE. If DTC(s) occur(s), go to Step 11.
11	Perform troubleshooting procedure for DTC
12	Adjust or repair the vehicle
13	Confirmation test
14	END

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GENERAL

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CUSTOMER PROBLEM ANALYSIS SHEET

1. VEHICLE INFORMATION

VIN No.		Transmission	☐ M/T ☐ A/T ☐ CVT ☐ etc.
Production date		Driving type	☐ 2WD (FF) ☐ 2WD (FR) ☐ 4WD
Odometer Reading	_____km/mile		

2. SYMPTOMS

☐ Unable to start	☐ Engine does not turn over ☐ Incomplete combustion ☐ Initial combustion does not occur
☐ Difficult to start	☐ Engine turns over slowly ☐ Other _____
☐ Poor idling	☐ Rough idling ☐ Incorrect idling ☐ Unstable idling (High: _____ rpm, Low: _____ rpm) ☐ Other _____
☐ Engine stall	☐ Soon after starting ☐ After accelerator pedal depressed ☐ After accelerator pedal released ☐ During A/C ON ☐ Shifting from N to D-range ☐ Other _____
☐ Others	☐ Poor driving (Surge) ☐ Knocking ☐ Poor fuel economy ☐ Back fire ☐ After fire ☐ Other _____

3. ENVIRONMENT

Problem frequency	☐ Constant ☐ Sometimes (_____) ☐ Once only ☐ Other _____
Weather	☐ Fine ☐ Cloudy ☐ Rainy ☐ Snowy ☐ Other _____
Outdoor temperature	Approx. _____ °C/°F
Place	☐ Highway ☐ Suburbs ☐ Inner City ☐ Uphill ☐ Downhill ☐ Rough road ☐ Other _____
Engine temperature	☐ Cold ☐ Warming up ☐ After warming up ☐ Any temperature
Engine operation	☐ Starting ☐ Just after starting (____ min) ☐ Idling ☐ Racing ☐ Driving ☐ Constant speed ☐ Acceleration ☐ Deceleration ☐ A/C switch ON/OFF ☐ Other _____

4. MIL/DTC

MIL (Malfunction Indicator Lamp)	☐ Remains ON ☐ Sometimes lights up ☐ Does not light
DTC	Normal check (Pre-check) ☐ Normal ☐ DTC (_____) ☐ Freeze Frame Data
	Check mode ☐ Normal ☐ DTC (_____) ☐ Freeze Frame Data

5. ECM/PCM INFORMATION

ECM/PCM Part No.	
ROM ID	

SCMFL6150L

BASIC INSPECTION PROCEDURE

MEASURING CONDITION OF ELECTRONIC PARTS' RESISTANCE

The measured resistance at high temperature after vehicle running may be high or low. So all resistance must be measured at ambient temperature (20°C, 68°F), unless stated otherwise.



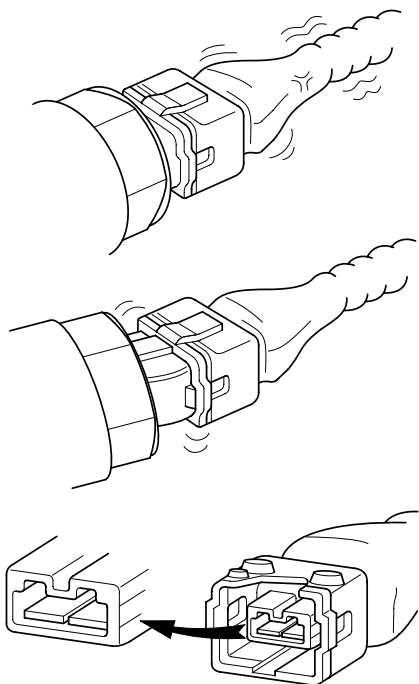
NOTE

The measured resistance in except for ambient temperature (20°C, 68°F) is reference value.

INTERMITTENT PROBLEM INSPECTION PROCEDURE

Sometimes the most difficult case in troubleshooting is when a problem symptom occurs but does not occur again during testing. An example would be if a problem appears only when the vehicle is cold but has not appeared when warm. In this case, the technician should thoroughly make out a "CUSTOMER PROBLEM ANALYSIS SHEET" and recreate (simulate) the environment and condition which occurred when the vehicle was having the issue.

1. Clear Diagnostic Trouble Code (DTC).
2. Inspect connector connection, and check terminal for poor connections, loose wires, bent, broken or corroded pins, and then verify that the connectors are always securely fastened.



BFGE321A

3. Slightly shake the connector and wiring harness vertically and horizontally.

4. Repair or replace the component that has a problem.
5. Verify that the problem has disappeared with the road test.

● SIMULATING VIBRATION

- a. Sensors and Actuators
: Slightly vibrate sensors, actuators or relays with finger.



WARNING

Strong vibration may break sensors, actuators or relays

- b. Connectors and Harness
: Lightly shake the connector and wiring harness vertically and then horizontally.

● SIMULATING HEAT

- a. Heat components suspected of causing the malfunction with a hair dryer or other heat source.



WARNING

- **DO NOT** heat components to the point where they may be damaged.
- **DO NOT** heat the ECM directly.

● SIMULATING WATER SPRINKLING

- a. Sprinkle water onto vehicle to simulate a rainy day or a high humidity condition.



WARNING

DO NOT sprinkle water directly into the engine compartment or electronic components.

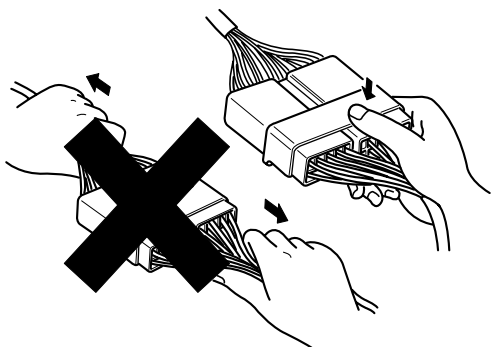
● SIMULATING ELECTRICAL LOAD

- a. Turn on all electrical systems to simulate excessive electrical loads (Radios, fans, lights, rear window defogger, etc.).

CONNECTOR INSPECTION PROCEDURE

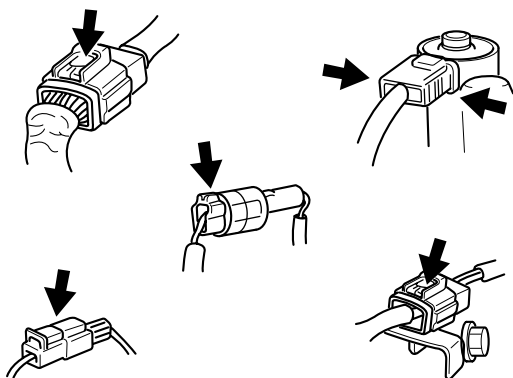
1. Handling of Connector

- a. Never pull on the wiring harness when disconnecting connectors.



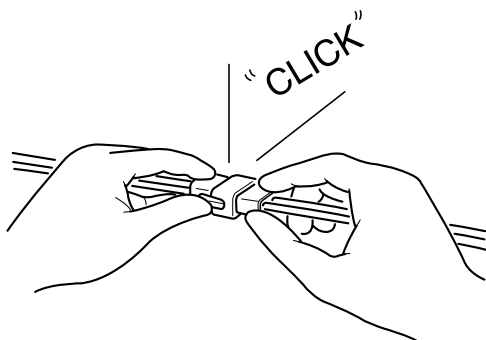
BFG015F

- b. When removing the connector with a lock, press or pull locking lever.



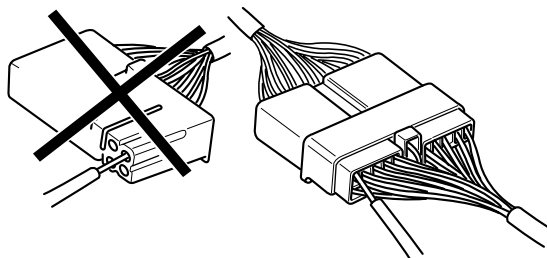
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- c. Listen for a click when locking connectors. This sound indicates that they are securely locked.



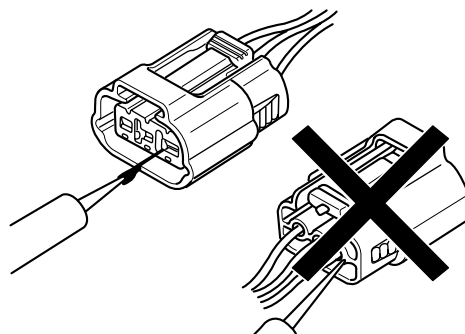
BFG015H

- d. When a tester is used to check for continuity, or to measure voltage, always insert tester probe from wire harness side.



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- e. Check waterproof connector terminals from the connector side. Waterproof connectors cannot be accessed from harness side.



BFG015J



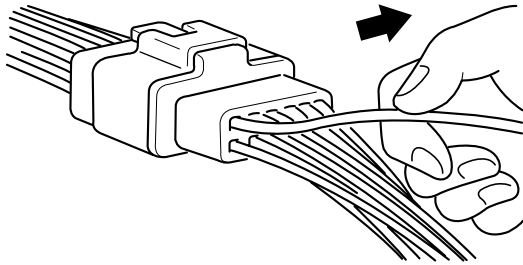
NOTE

- Use a fine wire to prevent damage to the terminal.
- Do not damage the terminal when inserting the tester lead.

2. Checking Point for Connector

- a. While the connector is connected:
Hold the connector, check connecting condition and locking efficiency.
- b. When the connector is disconnected:
Check missed terminal, crimped terminal or broken core wire by slightly pulling the wire harness. Visually check for rust, contamination, deformation and bend.
- c. Check terminal tightening condition:
Insert a spare male terminal into a female terminal, and then check terminal tightening conditions.

- d. Pull lightly on individual wires to ensure that each wire is secured in the terminal.



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3. Repair Method of Connector Terminal
 - a. Clean the contact points using air gun and/or shop rag.

NOTE

Never use sand paper when polishing the contact points, otherwise the contact point may be damaged.

- b. In case of abnormal contact pressure, replace the female terminal.

WIRE HARNESS INSPECTION PROCEDURE

1. Before removing the wire harness, check the wire harness position and crimping in order to restore it correctly.
2. Check whether the wire harness is twisted, pulled or loosened.
3. Check whether the temperature of the wire harness is abnormally high.
4. Check whether the wire harness is rotating, moving or vibrating against the sharp edge of a part.
5. Check the connection between the wire harness and any installed part.
6. If the covering of wire harness is damaged; secure, repair or replace the harness.

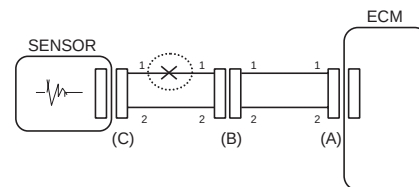
ELECTRICAL CIRCUIT INSPECTION PROCEDURE

● **CHECK OPEN CIRCUIT**

1. Procedures for Open Circuit
 - Continuity Check
 - Voltage Check

If an open circuit occurs (as seen in [FIG. 1]), it can be found by performing Step 2 (Continuity Check Method) or Step 3 (Voltage Check Method) as shown below.

FIG 1



BFGE501A

2. Continuity Check Method

NOTE

When measuring for resistance, lightly shake the wire harness above and below or from side to side.

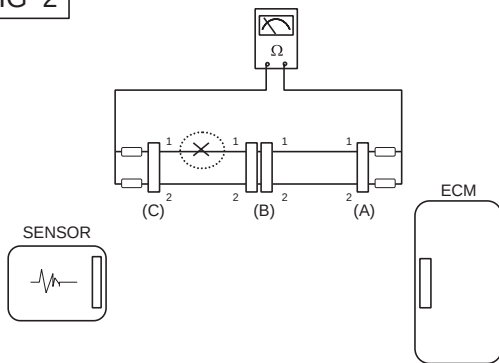
Specification (Resistance)

1Ω or less → Normal Circuit
1MΩ or Higher → Open Circuit

- a. Disconnect connectors (A), (C) and measure resistance between connector (A) and (C) as shown in [FIG. 2].

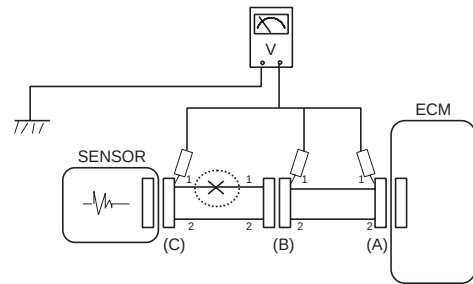
In [FIG.2.] the measured resistance of line 1 and 2 is higher than 1MΩ and below 1Ω respectively. Specifically the open circuit is line 1 (Line 2 is normal). To find exact break point, check sub line of line 1 as described in next step.

FIG 2



BFG501B

FIG 4

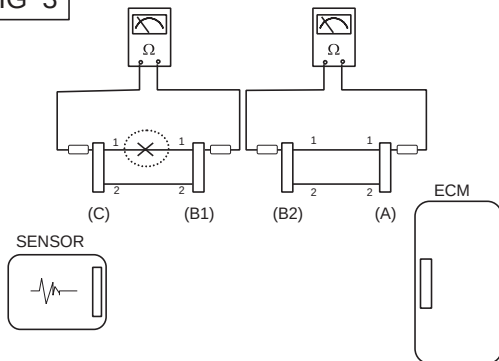


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- b. Disconnect connector (B), and measure for resistance between connector (C) and (B1) and between (B2) and (A) as shown in [FIG. 3].

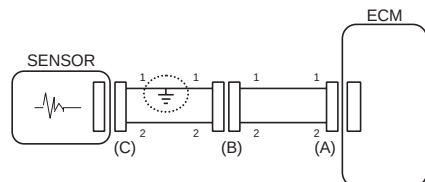
In this case the measured resistance between connector (C) and (B1) is higher than $1M\Omega$ and the open circuit is between terminal 1 of connector (C) and terminal 1 of connector (B1).

FIG 3



BFG501C

FIG 5



BFG501E

3. Voltage Check Method

- a. With each connector still connected, measure the voltage between the chassis ground and terminal 1 of each connectors (A), (B) and (C) as shown in [FIG. 4].

The measured voltage of each connector is 5V, 5V and 0V respectively. So the open circuit is between connector (C) and (B).

● CHECK SHORT CIRCUIT

1. Test Method for Short to Ground Circuit
 - Continuity Check with Chassis Ground

If short to ground circuit occurs as shown in [FIG. 5], the broken point can be found by performing Step 2 (Continuity Check Method with Chassis Ground) as shown below.

2. Continuity Check Method (with Chassis Ground)

NOTE

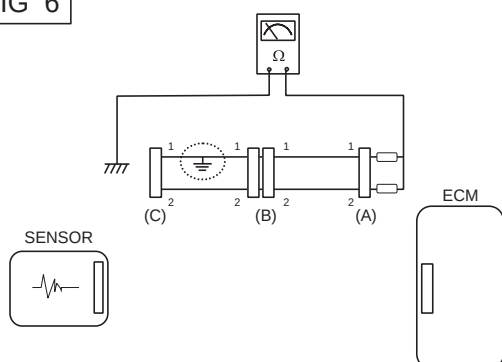
Lightly shake the wire harness above and below, or from side to side when measuring the resistance.

Specification (Resistance)	
1Ω or less	→ Short to Ground Circuit
$1M\Omega$ or Higher	→ Normal Circuit

- a. Disconnect connectors (A), (C) and measure for resistance between connector (A) and Chassis Ground as shown in [FIG. 6].

The measured resistance of line 1 and 2 in this example is below $1\ \Omega$ and higher than $1M\Omega$ respectively. Specifically the short to ground circuit is line 1 (Line 2 is normal). To find exact broken point, check the sub line of line 1 as described in the following step.

FIG 6

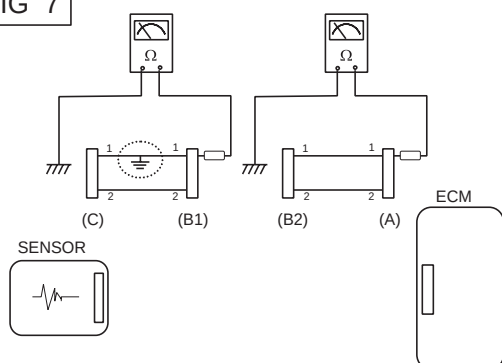


BFG501F

- b. Disconnect connector (B), and measure the resistance between connector (A) and chassis ground, and between (B1) and chassis ground as shown in [FIG. 7].

The measured resistance between connector (B1) and chassis ground is 1Ω or less. The short to ground circuit is between terminal 1 of connector (C) and terminal 1 of connector (B1).

FIG 7



BFG501G

SYMPTOM TROUBLESHOOTING GUIDE CHART

MAIN SYMPTOM	DIAGNOSTIC PROCEDURE	ALSO CHECK FOR
Unable to start (Engine does not turn over)	1. Test the battery 2. Test the starter 3. Inhibitor switch (A/T) or clutch start switch (M/T)	
Unable to start (Incomplete combustion)	1. Test the battery 2. Check the fuel pressure 3. Check the ignition circuit 4. Troubleshooting the immobilizer system (In case of immobilizer lamp flashing)	• DTC • Low compression • Intake air leaks • Slipped or broken timing belt • Contaminated fuel
Difficult to start	1. Test the battery 2. Check the fuel pressure 3. Check the ECTS and circuit (Check DTC) 4. Check the ignition circuit	• DTC • Low compression • Intake air leaks • Contaminated fuel • Weak ignition spark
Poor idling (Rough, unstable or incorrect Idle)	1. Check the fuel pressure 2. Check the Injector 3. Check the long term fuel trim and short term fuel trim (Refer to CUSTOMER DATASTREAM) 4. Check the idle speed control circuit (Check DTC) 5. Inspect and test the Throttle Body 6. Check the ECTS and circuit (Check DTC)	• DTC • Low compression • Intake air leaks • Contaminated fuel • Weak ignition spark
Engine stall	1. Test the Battery 2. Check the fuel pressure 3. Check the idle speed control circuit (Check DTC) 4. Check the ignition circuit 5. Check the CKPS Circuit (Check DTC)	• DTC • Intake air leaks • Contaminated fuel • Weak ignition spark
Poor driving (Surge)	1. Check the fuel pressure 2. Inspect and test Throttle Body 3. Check the ignition circuit 4. Check the ECTS and Circuit (Check DTC) 5. Test the exhaust system for a possible restriction 6. Check the long term fuel trim and short term fuel trim (Refer to CUSTOMER DATASTREAM)	• DTC • Low compression • Intake air leaks • Contaminated fuel • Weak ignition spark
Knocking	1. Check the fuel pressure 2. Inspect the engine coolant 3. Inspect the radiator and the electric cooling fan 4. Check the spark plugs	• DTC • Contaminated fuel

MAIN SYMPTOM	DIAGNOSTIC PROCEDURE	ALSO CHECK FOR
Poor fuel economy	1. Check customer's driving habits • Is A/C on full time or the defroster mode on? • Are tires at correct pressure? • Is excessively heavy load being carried? • Is acceleration too much, too often? 2. Check the fuel pressure 3. Check the injector 4. Test the exhaust system for a possible restriction 5. Check the ECTS and circuit	• DTC • Low compression • Intake air leaks • Contaminated fuel • Weak ignition spark
Hard to refuel (Overflow during refueling)	1. Test the canister close valve 2. Inspect the fuel filler hose/pipe • Pinched, kinked or blocked? • Filler hose is torn 3. Inspect the fuel tank vapor vent hose between the EVAP. canister and air filter 4. Check the EVAP. canister	• Malfunctioning gas station filling nozzle (If this problem occurs at a specific gas station during refueling)

GASOLINE ENGINE CONTROL SYSTEM

DESCRIPTION E722E9A3

If the Gasoline Engine Control system components (sensors, ECM, injector, etc.) fail, interruption to the fuel supply or failure to supply the proper amount of fuel for various engine operating conditions will result. The following situations may be encountered.

1. Engine is hard to start or does not start at all.
2. Unstable idle.
3. Poor driveability

If any of the above conditions are noted, first perform a routine diagnosis that includes basic engine checks (ignition system malfunction, incorrect engine adjustment, etc.). Then, inspect the Gasoline Engine Control system components with the HI-SCAN (Pro).

NOTE

- Before removing or installing any part, read the diagnostic trouble codes and then disconnect the battery negative (-) terminal.
- Before disconnecting the cable from battery terminal, turn the ignition switch to OFF. Removal or connection of the battery cable during engine operation or while the ignition switch is ON could cause damage to the ECM.
- The control harnesses between the ECM and heated oxygen sensor are shielded with the shielded ground wires to the body in order to prevent the influence of ignition noises and radio interference. When the shielded wire is faulty, the control harness must be replaced.
- When checking the generator for the charging state, do not disconnect the battery '+' terminal to prevent the ECM from damage due to the voltage.
- When charging the battery with the external charger, disconnect the vehicle side battery terminals to prevent damage to the ECM.

MALFUNCTION INDICATOR LAMP (MIL)

[EOBD]

A malfunction indicator lamp illuminates to notify the driver that there is a problem with the vehicle. However, the MIL will go off automatically after 3 subsequent sequential driving cycles without the same malfunction. Immediately after the ignition switch is turned on (ON position - do not start), the MIL will illuminate continuously to indicate that the MIL operates normally.

Faults with the following items will illuminate the MIL.

- Catalyst
- Fuel system
- Mass Air Flow Sensor (MAFS)
- Intake Air Temperature Sensor (IATS)
- Engine Coolant Temperature Sensor (ECTS)
- Throttle Position Sensor (TPS)
- Upstream Oxygen Sensor
- Upstream Oxygen Sensor Heater
- Downstream Oxygen Sensor
- Downstream Oxygen Sensor Heater
- Injector
- Misfire
- Crankshaft Position Sensor (CKPS)
- Camshaft Position Sensor (CMPS)
- Evaporative Emission Control System
- Vehicle Speed Sensor (VSS)
- Idle Speed Control Actuator (ISCA)
- Power Supply
- ECM/ PCM
- MT/AT Encoding
- Acceleration Sensor
- MIL-on Request Signal
- Power Stage

NOTE

Refer to "INSPECTION CHART FOR DIAGNOSTIC TROUBLE CODES (DTC)" for more information.

[NON-EOBD]

A malfunction indicator lamp illuminates to notify the driver that there is a problem with the vehicle. However, the MIL will go off automatically after 3 subsequent sequential driving cycles without the same malfunction. Immediately after the ignition switch is turned on (ON position - do not start), the MIL will illuminate continuously to indicate that the MIL operates normally.

Faults with the following items will illuminate the MIL

- Heated oxygen sensor (HO2S)
- Mass Air Flow sensor (MAFS)
- Throttle position sensor (TPS)
- Engine coolant temperature sensor (ECTS)
- Idle speed control actuator (ISCA)
- Injectors
- ECM

NOTE

Refer to "INSPECTION CHART FOR DIAGNOSTIC TROUBLE CODES (DTC)" for more information.

[INSPECTION]

1. After turning ON the ignition key, ensure that the light illuminates for about 5 seconds and then goes out.

2. If the light does not illuminate, check for an open circuit in the harness, a blown fuse or a blown bulb.

erased when the battery terminal or ECM connector is disconnected, or by the HI-SCAN (Pro).

SELF-DIAGNOSIS

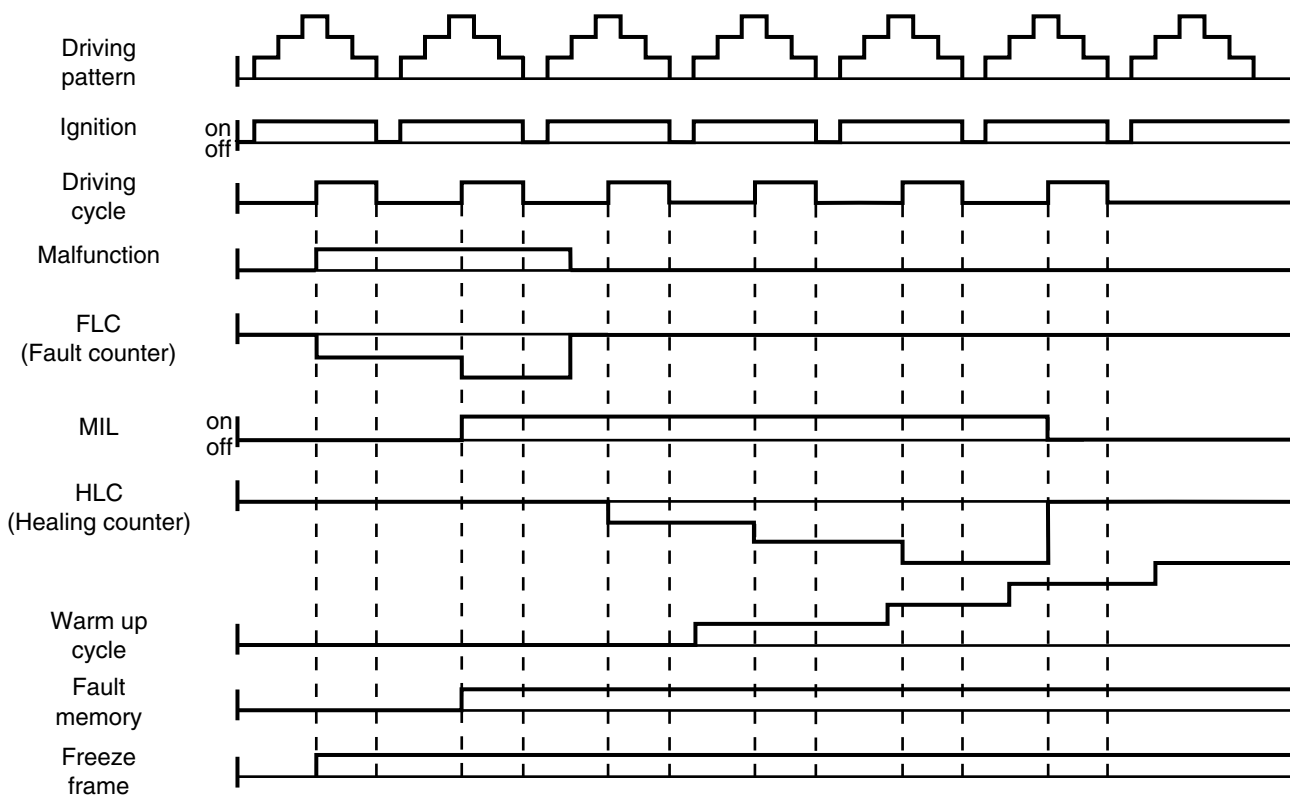
The ECM monitors the input/output signals (some signals at all times and the others under specified conditions). When the ECM detects an irregularity, it records the diagnostic trouble code, and outputs the signal to the Data Link connector. The diagnosis results can be read with the MIL or HI-SCAN (Pro). Diagnostic Trouble Codes (DTC) will remain in the ECM as long as battery power is maintained. The diagnostic trouble codes will, however, be



NOTE

If a sensor connector is disconnected with the ignition switch turned on, the diagnostic trouble code (DTC) is recorded. In this case, disconnect the battery negative terminal (-) for 15 seconds or more, and the diagnosis memory will be erased.

THE RELATION BETWEEN DTC AND DRIVING PATTERN IN EOBd SYSTEM



LGIF601Q

1. When the same malfunction is detected and maintained during two sequential driving cycles, the MIL will automatically illuminate.
2. The MIL will go off automatically if no fault is detected after 3 sequential driving cycles.
3. A Diagnostic Trouble Code(DTC) is recorded in ECM memory when a malfunction is detected after two sequential driving cycles. The MIL will illuminate when the malfunction is detected on the second driving cycle.
If a misfire is detected, a DTC will be recorded, and the MIL will illuminate, immediately after a fault is first detected.

4. A Diagnostic Trouble Code(DTC) will automatically erase from ECM memory if the same malfunction is not detected for 40 driving cycles.



NOTE

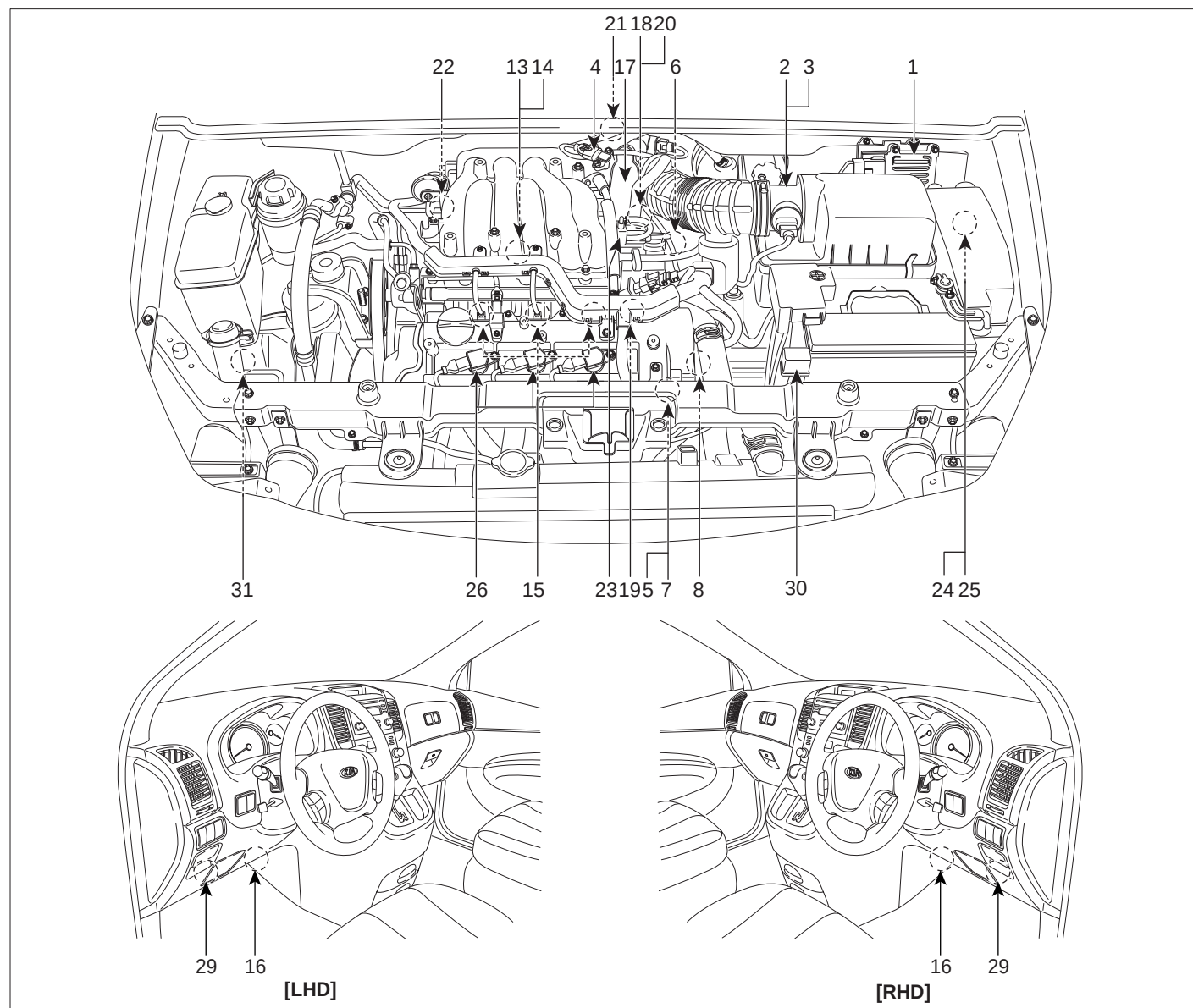
- A "warm-up cycle" means sufficient vehicle operation such that the coolant temperature has risen by at least 40 degrees Fahrenheit from engine starting and reaches a minimum temperature of 160 degrees Fahrenheit.
- A "driving cycle" consists of engine startup, vehicle operation beyond the beginning of closed loop operation.

GASOLINE ENGINE CONTROL SYSTEM

FLA -19

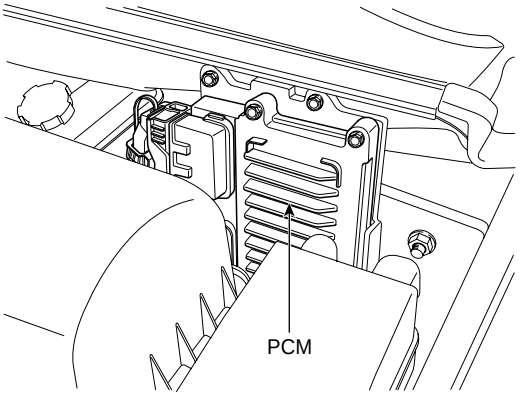
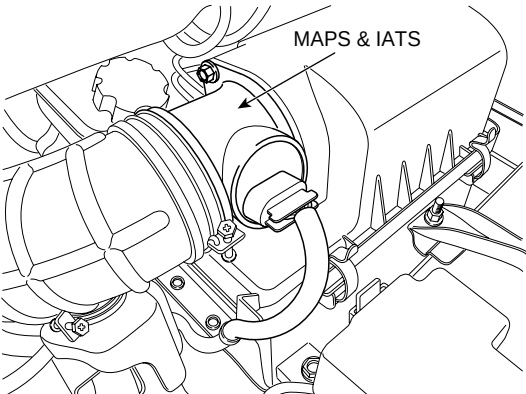
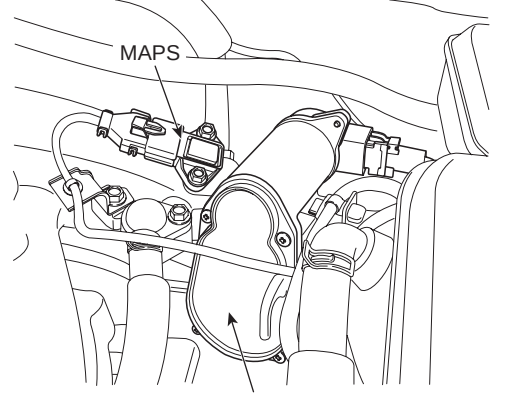
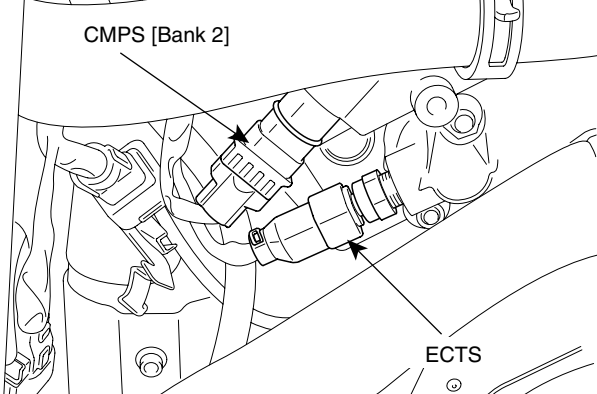
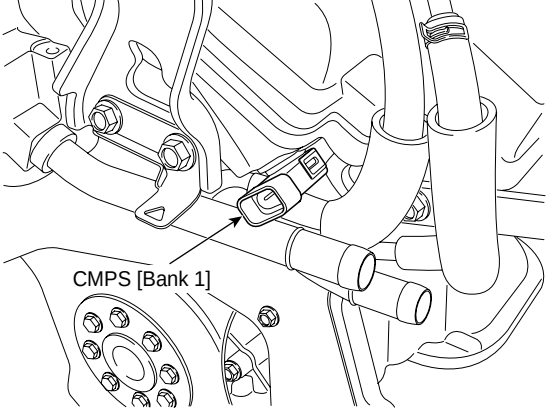
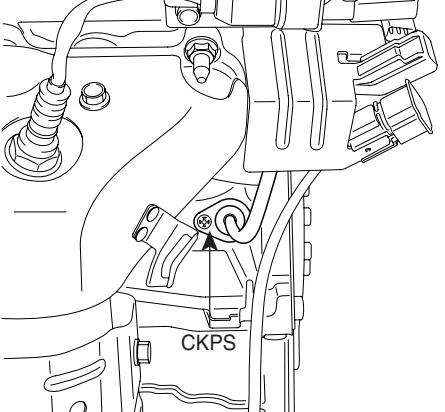
COMPONENT LOCATION

E478BABD



1. PCM (Powertrain Control Module)	17. ETC Module [Throttle Position Sensor (TPS) + ETC Motor]
2. Mass Air Flow Sensor (MAFS)	18. CVVT Oil Control Valve (OCV) [Bank 1]
3. Intake Air Temperature Sensor (IATS)	19. CVVT Oil Control Valve (OCV) [Bank 2]
4. Manifold Absolute Pressure Sensor (MAPS)	20. CVVT Oil Temperature Sensor (OTS)
5. Engine Coolant Temperature Sensor (ECTS)	21. Purge Control Solenoid Valve (PCSV)
6. Camshaft Position Sensor (CMPS) [Bank 1]	22. Variable Intake Solenoid (VIS) Valve #1 (Surge Tank Side)
7. Camshaft Position Sensor (CMPS) [Bank 2]	23. Variable Intake Solenoid (VIS) Valve #2 (Intake Manifold Side)
8. Crankshaft Position Sensor (CKPS)	24. Fuel Pump Relay
9. Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 1]	25. Main Relay
10. Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 2]	26. Ignition Coil
11. Heated Oxygen Sensor (HO2S) [Bank 2 / Sensor 1]	27. Wheel Speed Sensor (WSS) [Without ABS/ESP (Euro-III/IV)]
12. Heated Oxygen Sensor (HO2S) [Bank 2 / Sensor 2]	28. Vehicle Speed Sensor (VSS) [Except for Euro-III/IV]
13. Knock Sensor (KS) [Bank 1]	29. Data Link Connector (DLC)
14. Knock Sensor (KS) [Bank 2]	30. Multi-Purpose Connector
15. Injector	31. A/C Pressure Transducer (APT)
16. Accelerator Position Sensor (APS)	

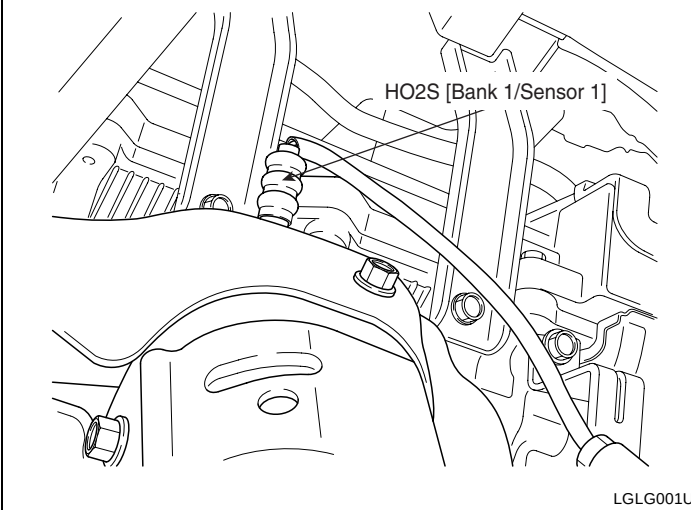
SVQF16001L

1. PCM (Powertrain Control Module)	2. Mass Air Flow Sensor (MAFS) 3. Intake Air Temperature Sensor (IATS)
 PCM SVQF16006L	 MAPS & IATS SVQF16003L
4. Manifold Absolute Pressure Sensor (MAPS) 17. ETC Module [Throttle Position Sensor (TPS) + ETC Motor]	5. Engine Coolant Temperature Sensor (ECTS) 7. Camshaft Position Sensor (CMPS) [Bank2]
 MAPS ETC Module (TPS + ETC Motor) SCMF16005L	 CMPS [Bank 2] ECTS LGLG001R
6. Camshaft Position Sensor (CMPS) [Bank 1]	8. Crankshaft Position Sensor (CKPS)
 CMPS [Bank 1] SVQF16009L	 CKPS LGLG001T

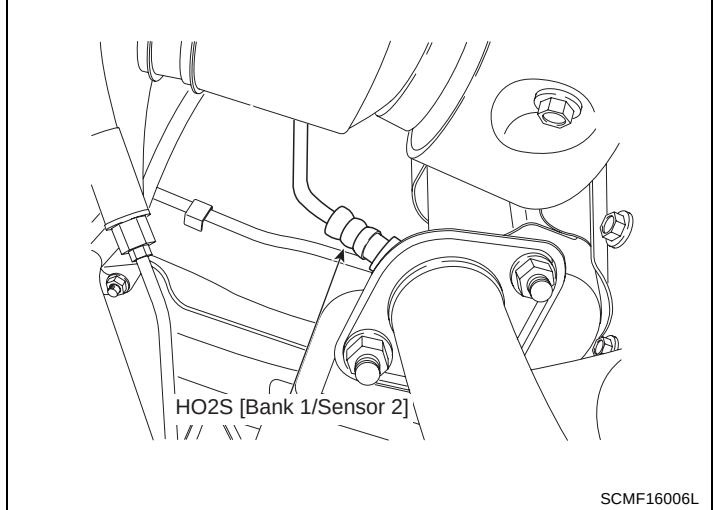
GASOLINE ENGINE CONTROL SYSTEM

FLA -21

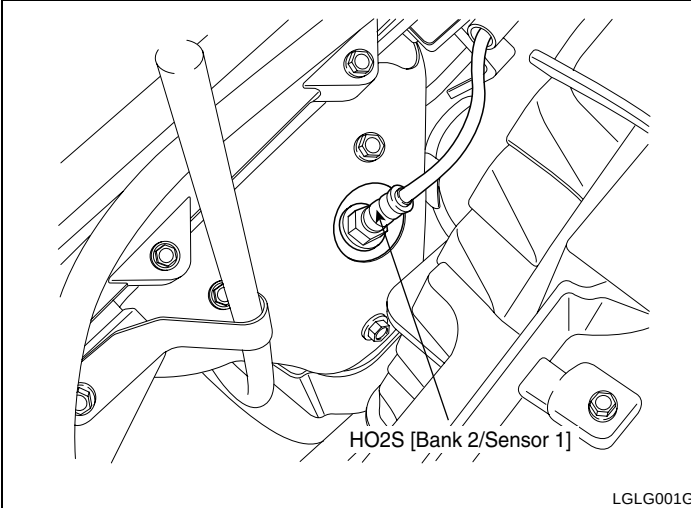
9. Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 1]



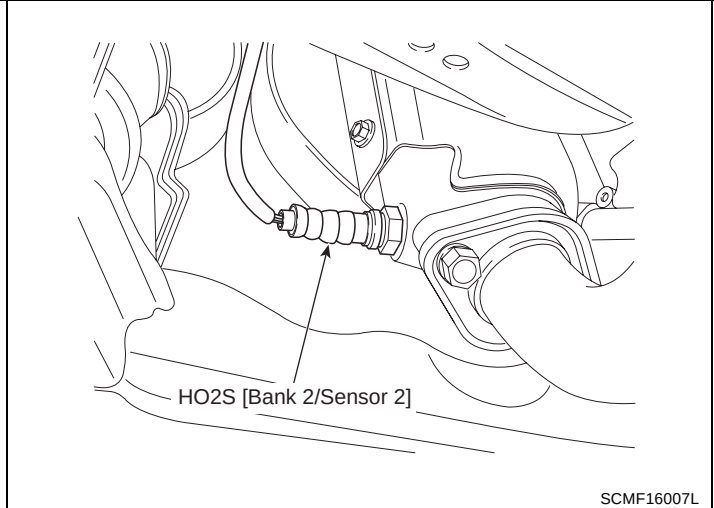
10. Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 2]



11. Heated Oxygen Sensor (HO2S) [Bank 2 / Sensor 1]

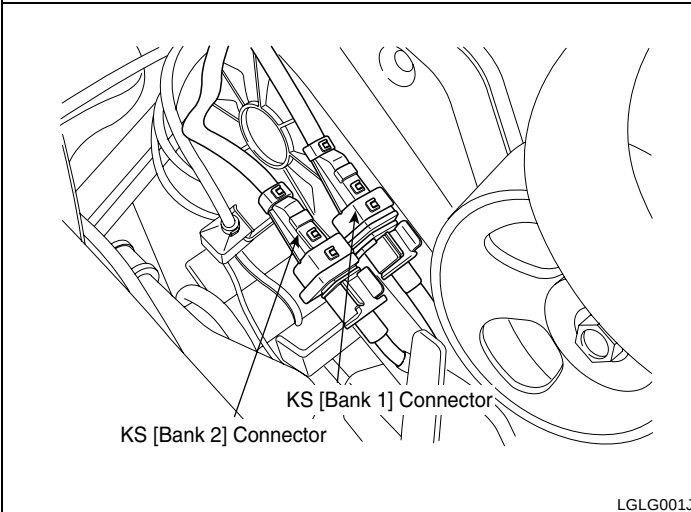


12. Heated Oxygen Sensor (HO2S) [Bank 2 / Sensor 2]



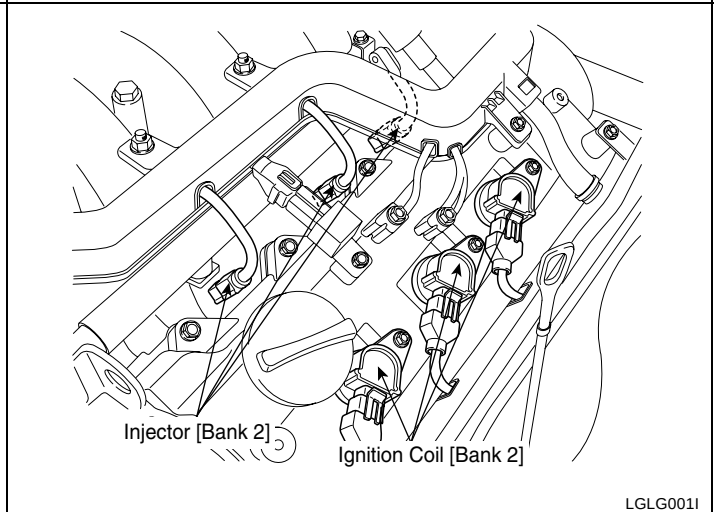
13. Knock Sensor (KS) [Bank 1]

14. Knock Sensor (KS) [Bank 2]

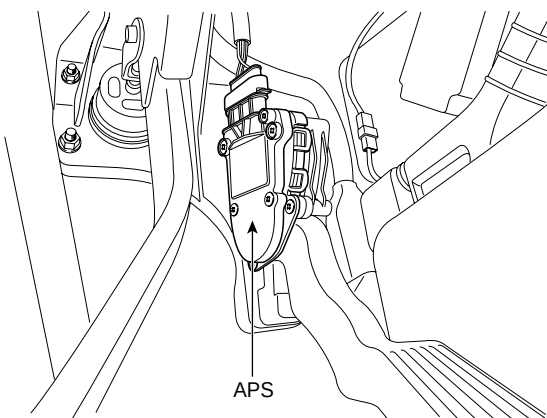


15. Injector

26. Ignition Coil

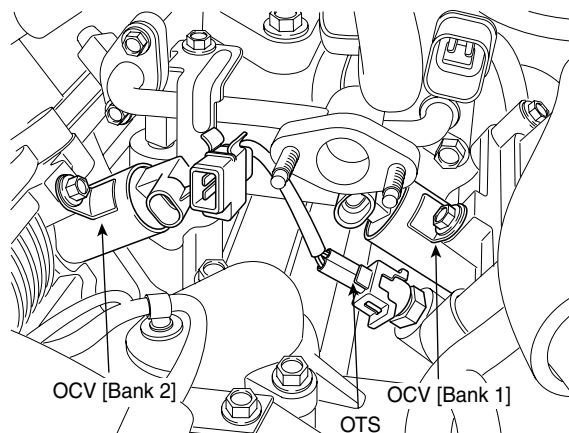


16. Accelerator Position Sensor (APS)



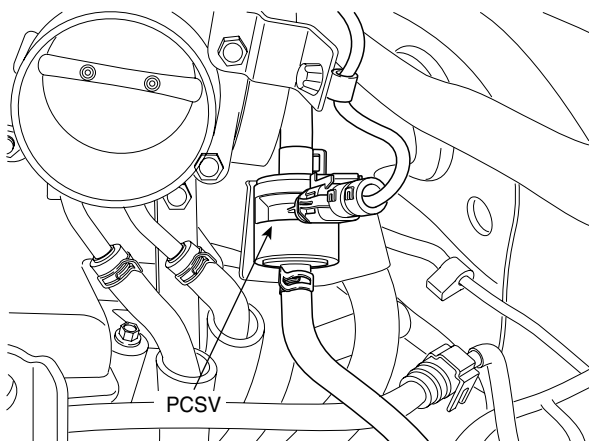
SVQF16002L

18. CVVT Oil Control Valve (OCV) [Bank 1]
19. CVVT Oil Control Valve (OCV) [Bank 2]
20. CVVT Oil Temperature Sensor (OTS)



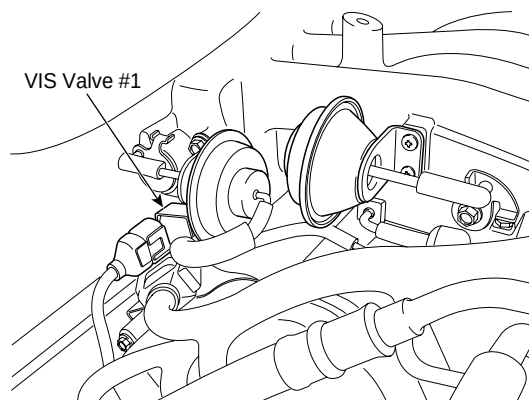
LGLG001K

21. Purge Control Solenoid Valve (PCSV)



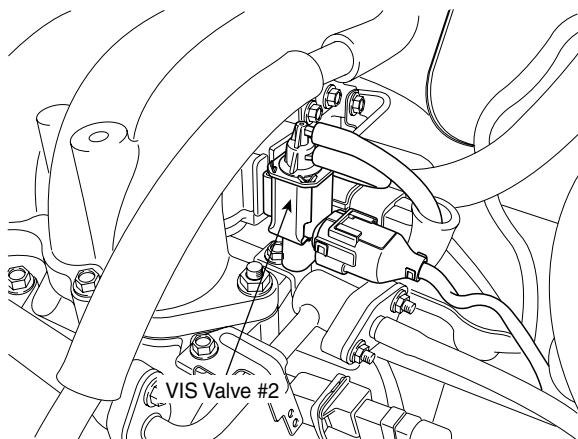
LGLG001L

22. Variable Intake Solenoid (VIS) #1 Valve (Surge Tank Side)



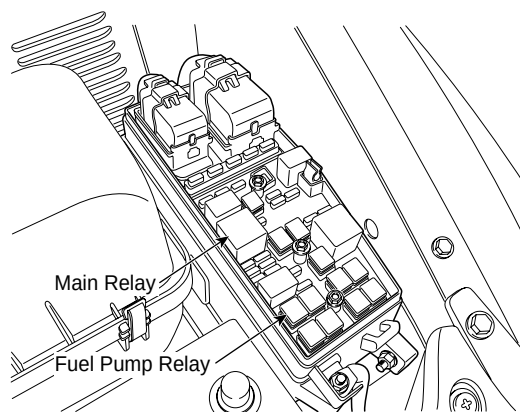
SVQF16008L

23. Variable Intake Solenoid (VIS) #2 Valve (Intake Manifold Side)

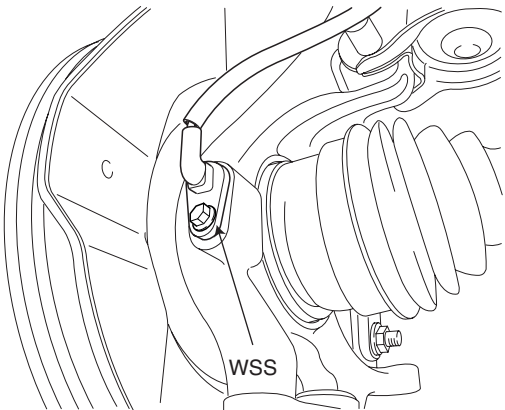
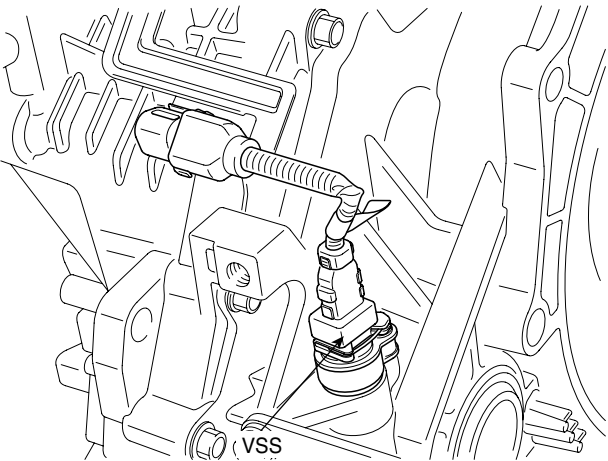
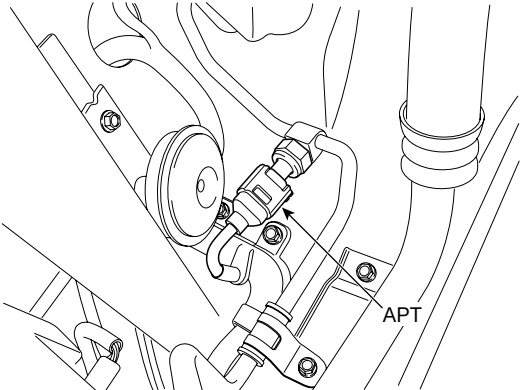


LGLG001O

24. Fuel Pump Relay
25. Main Relay



SVQF16005L

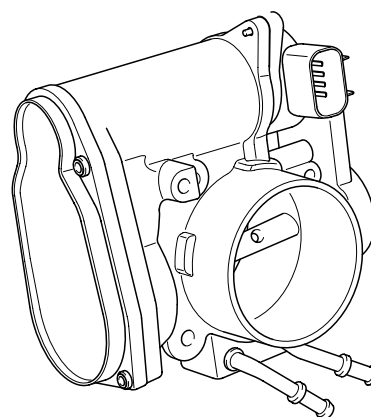
27. Wheel Speed Sensor (WSS)	28. Vehicle Speed Sensor (VSS)
 A line drawing showing a wheel speed sensor (WSS) mounted on a wheel hub. The sensor is a small cylindrical component with a wiring harness, positioned near the brake disc. The label 'WSS' is placed near the sensor. AFLG500C	 A line drawing showing a vehicle speed sensor (VSS) mounted on a transmission housing. The sensor is a cylindrical component with a wiring harness, connected to the transmission. The label 'VSS' is placed near the sensor. LGLG001V
31. A/C Pressure Transducer (APT)	
 A line drawing showing an A/C pressure transducer (APT) installed on an A/C line. The transducer is a small cylindrical component with a wiring harness, connected to the A/C line. The label 'APT' is placed near the transducer. SVQF16004L	

ETC (ELECTRONIC THROTTLE CONTROL) SYSTEM

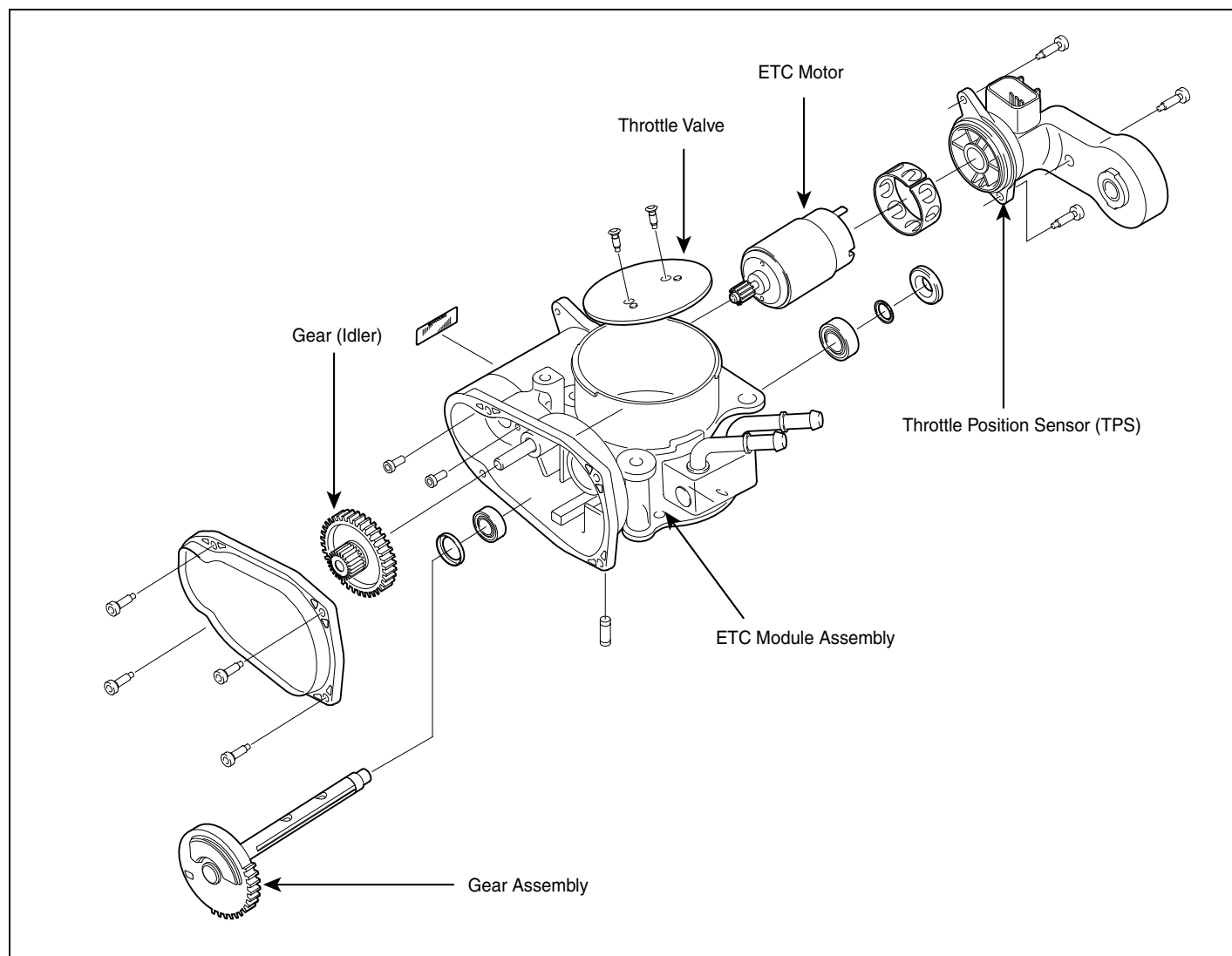
INSPECTION E4C099A0

FUNCTION AND OPERATION PRINCIPLE

ETC (Electronic Throttle Control) system is electronically controlled throttle device which controls the throttle valve. It consists of ETC motor, throttle body and throttle position sensor (TPS). A mechanical throttle control system receives a driver's intention via a wire cable between the accelerator and the throttle valve, while this ETC system uses the signal from the Accelerator Position Sensor (APS) installed on the accelerator pedal. After the PCM receives the APS signal and calculates the throttle opening angle, it activates the throttle valve by using the ETC motor. Additionally, it can handle cruise control function without any special devices.

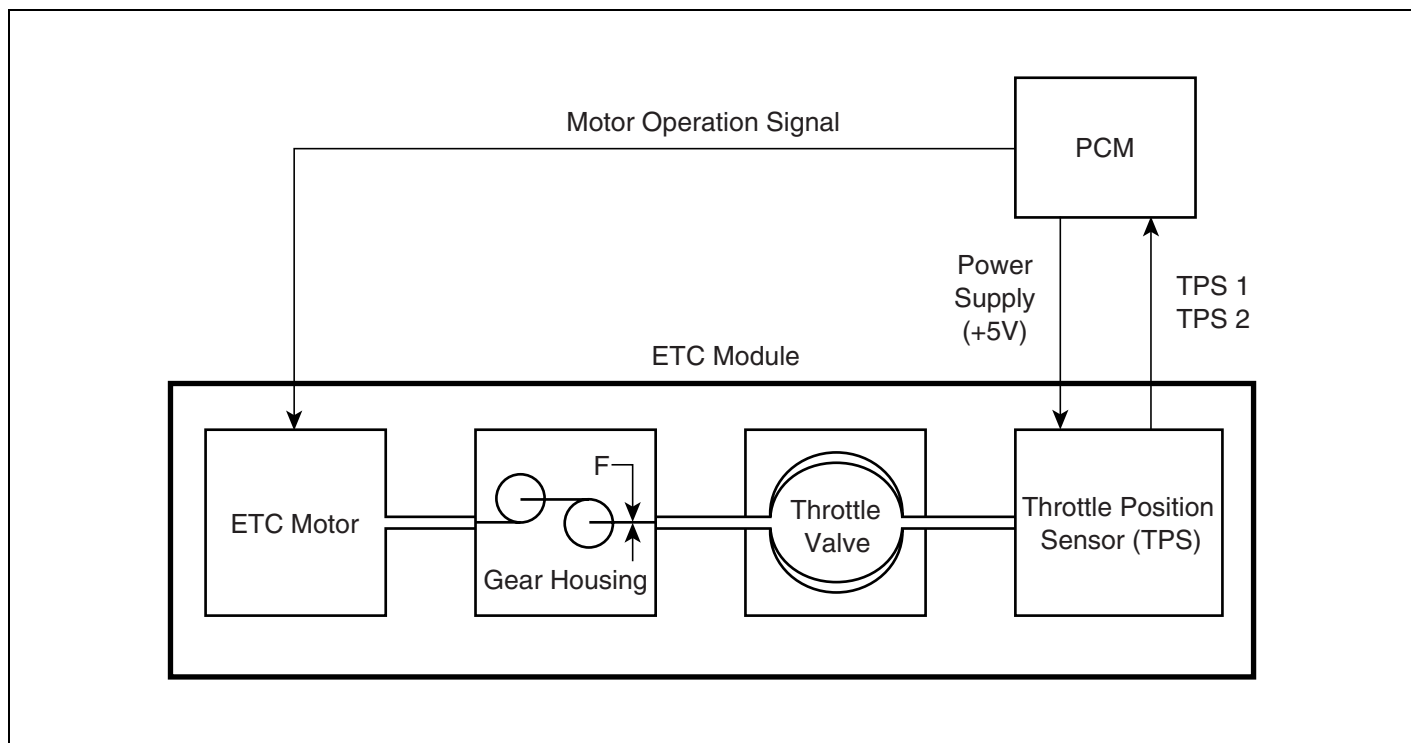


KGBF004U



LGLG001W

SHEMATIC DIAGRAM



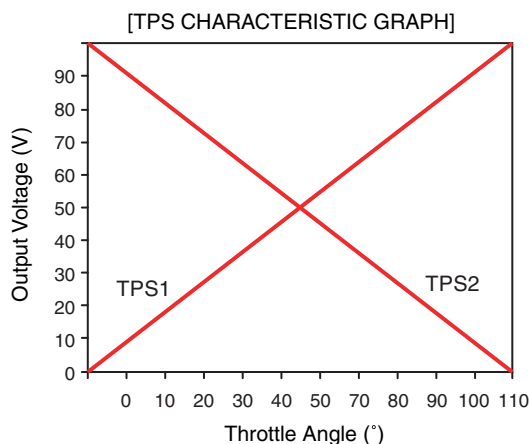
EGRF234A

SPECIFICATION

[THROTTLE POSITION SENSOR]

Throttle Angle(°)	Output Voltage(V) [Vref = 5.0V]	
	TPS1	TPS2
0°	0V	5.0V
10°	0.5V	4.5V
20°	0.9V	4.1V
30°	1.4V	3.6V
40°	1.8V	3.2V
50°	2.3V	2.7V
60°	2.7V	2.3V
70°	3.2V	1.8V
80°	3.6V	1.4V
90°	4.1V	0.9V
100°	4.5V	0.5V
110°	5.0V	0V

Item	Sensor Resistance
TPS1	4.0 ~ 6.0k Ω at 20°C (68°F)
TPS2	2.7 ~ 4.1k Ω at 20°C (68°F)

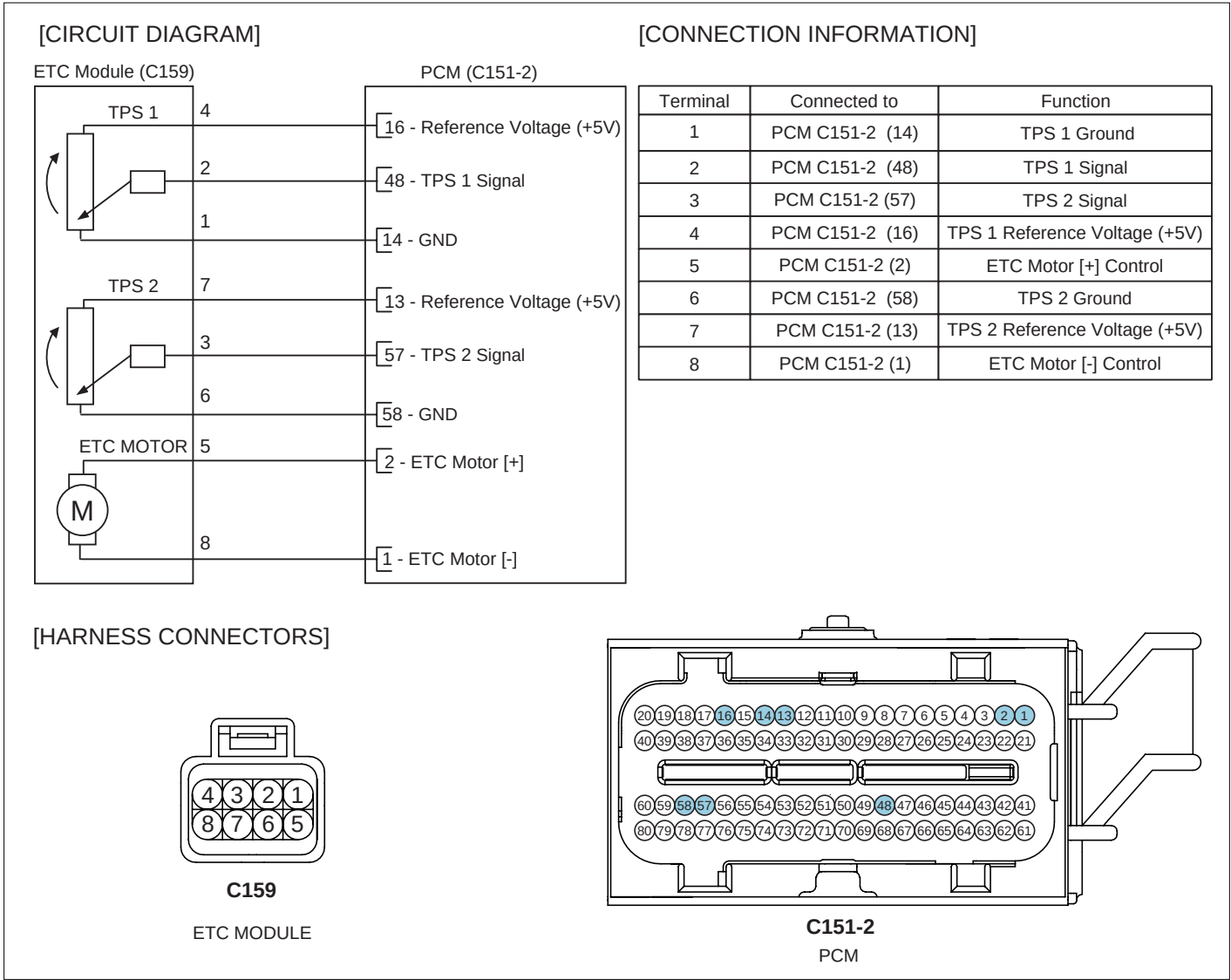


EGRF235A

[ETC MOTOR]

Item	Sensor Resistance
Coil Resistance (Ω)	1.275 ~ 1.725 Ω at 20°C (68°F)

CIRCUIT DIAGRAM



GASOLINE ENGINE CONTROL SYSTEM

FLA -27

FAIL-SAFE MODE

Mode	Description	Symptom	Possible Cause
MODE 1	FORCED ENGINE SHUTDOWN	Engine stop	- ETC system can't proceed reliable algorithm procedure - Fatal PCM internal programming error - Faulty intake system or throttle body
MODE 2	FORCED IDLE & POWER MANAGEMENT	Forced idle state controlled by fuel quantity regulation and ignition timing adjustment	- ETC system can't control engine power via throttle device - Disabled throttle control or broken throttle position information
MODE 3	FORCED IDLE	Forced idle state and no response for accelerator activation	- No information about the accelerator position - Malfunctioning APS 1 and 2, faulty A/D converter or internal controller
MODE 4	LIMIT PERFORMANCE & POWER MANAGEMENT	Engine power is determined by accelerator position and idle power requirement (Limited vehicle running)	ETC system can't securely control engine power
MODE 5	LIMIT PERFORMANCE	- Engine power varies with accelerator position, but driver perceives lack of engine power. - MIL ON (Normal vehicle running)	- Not reliable accelerator position signal or bad maximum power generation - Faulty APS, ignition voltage or internal controller
MODE 6	NORMAL	Normal	

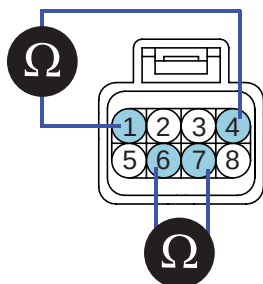
COMPONENT INSPECTION

THROTTLE POSITION SENSOR (TPS)

1. Connect a scantool on Diagnosis Link Connector (DLC).
2. Start engine and check output voltages of TPS 1 and 2 at C.T and W.O.T.

Condition	Output Voltage (V)	
	TPS 1	TPS 2
C.T	0.25 ~ 0.9V	Min. 4.0V
W.O.T	Min. 4.0V	0.25 ~ 0.9V

3. Turn ignition switch OFF and disconnect the scantool from the DLC.
4. Disconnect ETC module connector and measure resistance between ETC module terminals 4 and 1 (TPS 1).
5. Measure resistance between ETC module terminals 7 and 6 (TPS 2).

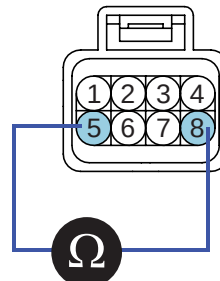


SCMF16102L

Specification: Refer to SPECIFICATION.

ETC MOTOR

1. Disconnect ETC module connector and measure resistance between ETC module terminals 5 and 8.



SCMF16103L

Specification: Refer to SPECIFICATION.

ETC SYSTEM INITIALIZATION

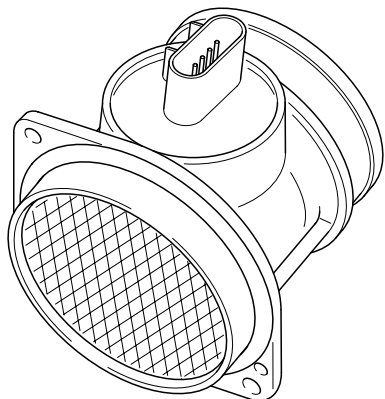
1. Erase DTC(s) memorized in PCM with a scan tool.
2. Turn ignition switch off and wait for about 10 seconds.
3. Turn ignition switch on for more than 1 second. (At this time, the PCM records initial position of ETC motor on its EEPROM).

MASS AIR FLOW SENSOR (MAFS)

INSPECTION ECF3BEA5

FUNCTION AND OPERATION PRINCIPLE

Mass Air Flow Sensor (MAFS) is a hot-film type sensor and is located in between the air cleaner and the throttle body. It consists of a tube, a sensor assembly and honeycomb cell and detects intake air quantity flowing into the intake manifold. Air flows from the air cleaner assembly through the honeycomb cell and over the hot film element. At this time, heat transfer is generated by convection and this sensor loses its energy. This sensor detects the mass air flow by using the energy loss and transfers the information to the PCM by frequency. The PCM calculates fuel quantity and ignition timing.

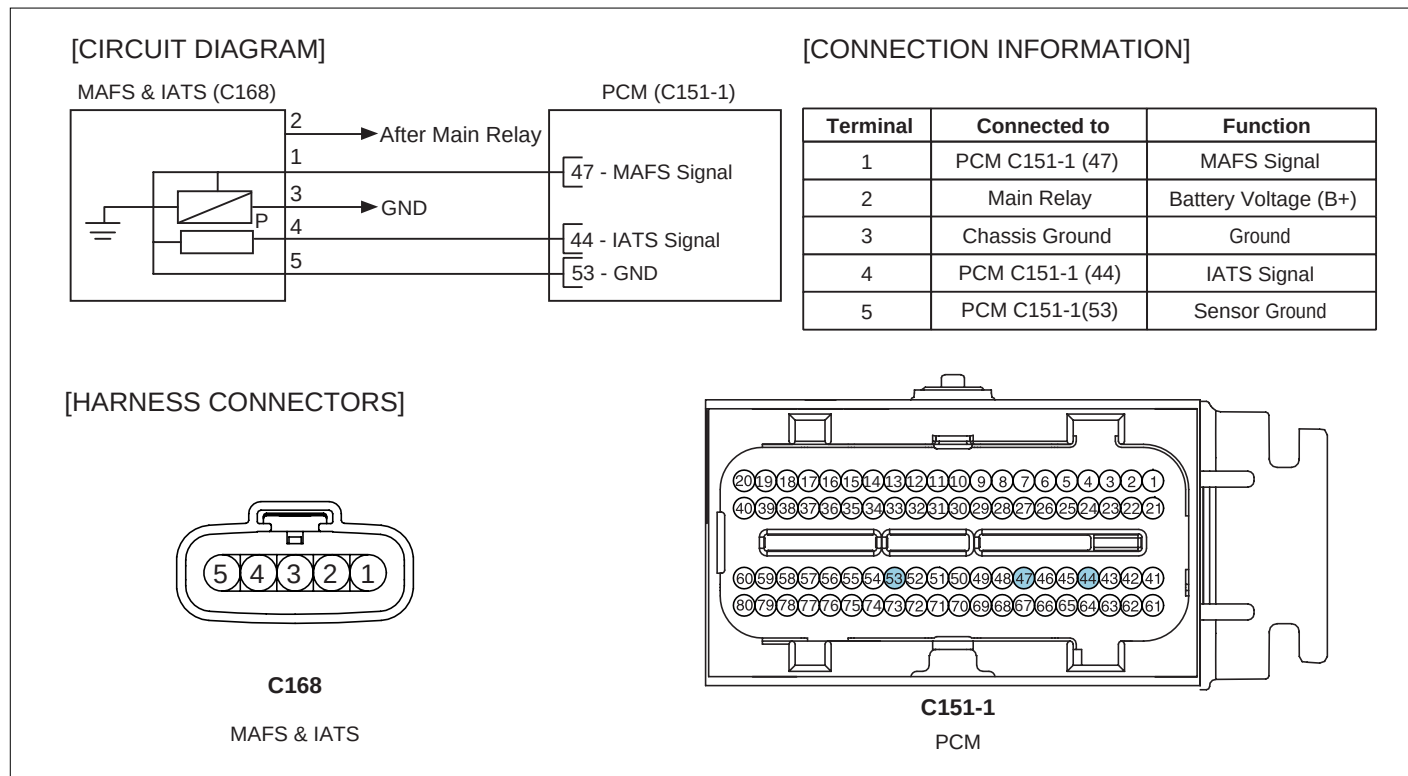


KFCF1021

SPECIFICATION

Air Flow (kg/h)	Output Frequency (Hz)
12.6 kg/h	2,617Hz
18.0 kg/h	2,958Hz
23.4 kg/h	3,241Hz
32.4 kg/h	3,653Hz
43.2 kg/h	4,024Hz
57.6 kg/h	4,399Hz
72.0 kg/h	4,704Hz
108.0 kg/h	5,329Hz
144.0 kg/h	5,897Hz
198.0 kg/h	6,553Hz
270.0 kg/h	7,240Hz
360.0 kg/h	7,957Hz
486.0 kg/h	8,738Hz
666.0 kg/h	9,644Hz
900.0 kg/h	10,590Hz

CIRCUIT DIAGRAM



SVQF16104L

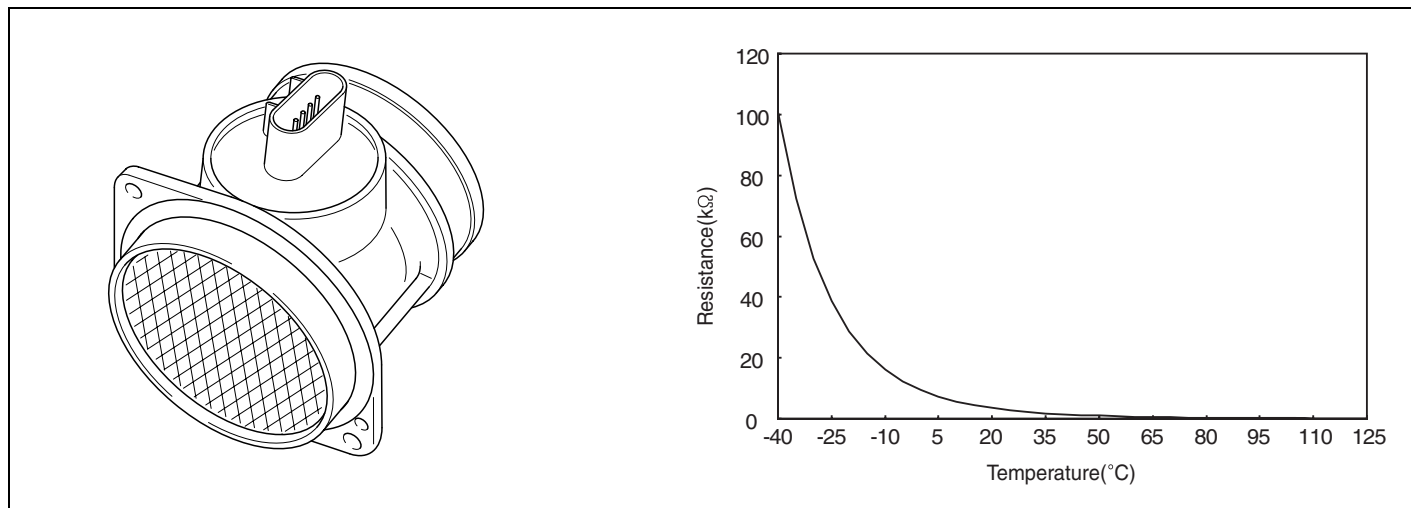
COMPONENT INSPECTION

- Check the MAFS visually.
 - Mounting direction correct.
 - Any contamination, corrosion or damage on connector.
 - Air cleaner's clogging or wet.
 - MAFS cylinder's deforming or blocking by any foreign material.
- Check any leakage on intake system and intercooler system.

INTAKE AIR TEMPERATURE SENSOR (IATS)

INSPECTION EF56EBCD

FUNCTION AND OPERATION PRICIPLE



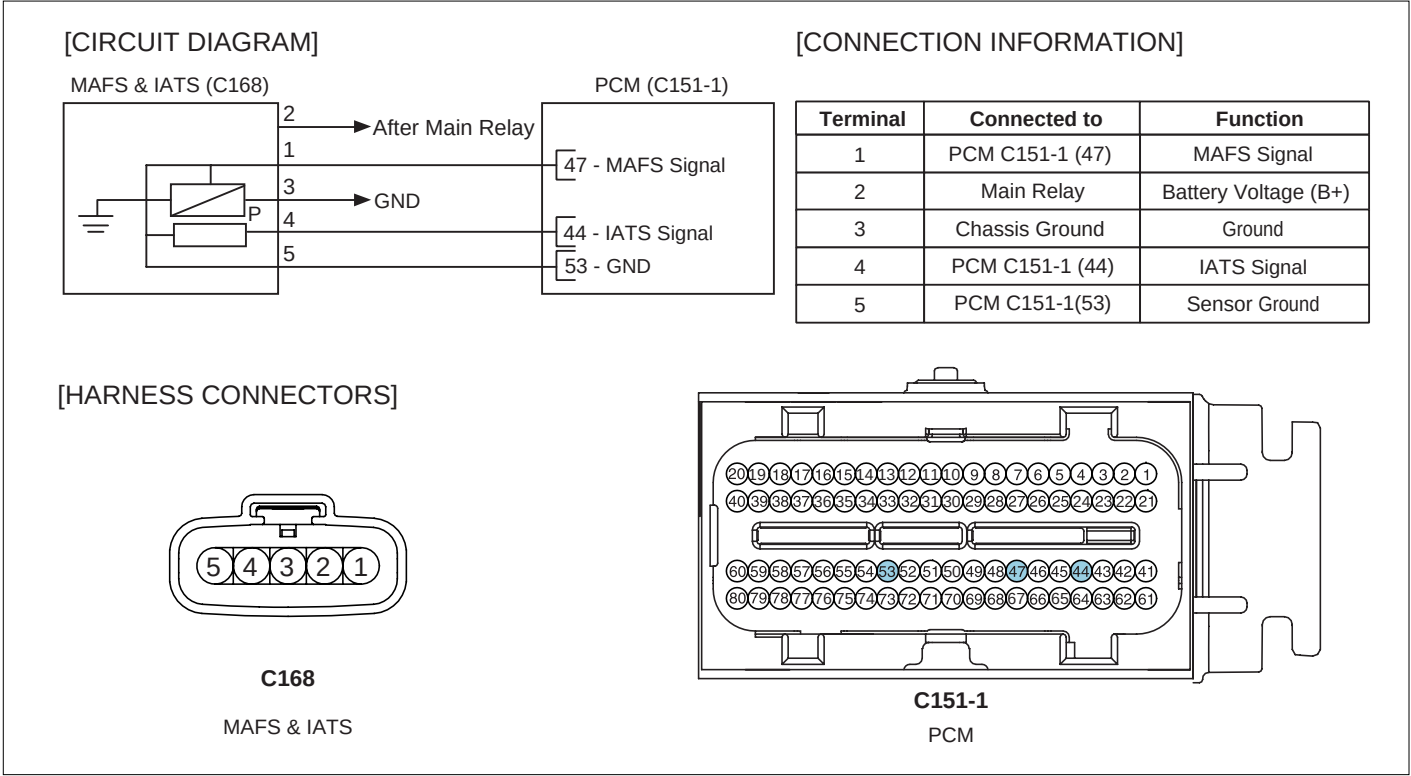
EGRF238A

Intake Air Temperature Sensor (IATS) is installed inside the Mass Air Flow Sensor (MAFS) and detects the intake air temperature. To calculate precise air quantity, correction of the air temperature is needed because air density varies according to the temperature. So the PCM uses not only MAFS signal but also IATS signal. This sensor has a Negative Temperature Coefficient (NTC) and its resistance is in inverse proportion to the temperature.

SPECIFICATION

Temperature		Resistance (kΩ)
℃	℉	
-40	-40	100.87
-20	-4	28.58
0	32	9.40
10	50	5.66
20	68	3.51
40	104	1.47
60	140	0.67
80	176	0.33

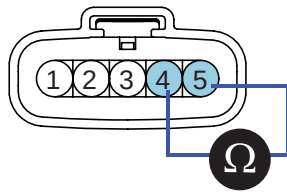
CIRCUIT DIAGRAM



SVQF16104L

COMPONENT INSPECTION

1. Turn ignition switch OFF.
2. Disconnect IATS connector.
3. Measure resistance between IATS terminals 4 and 5.



SCMF16146L

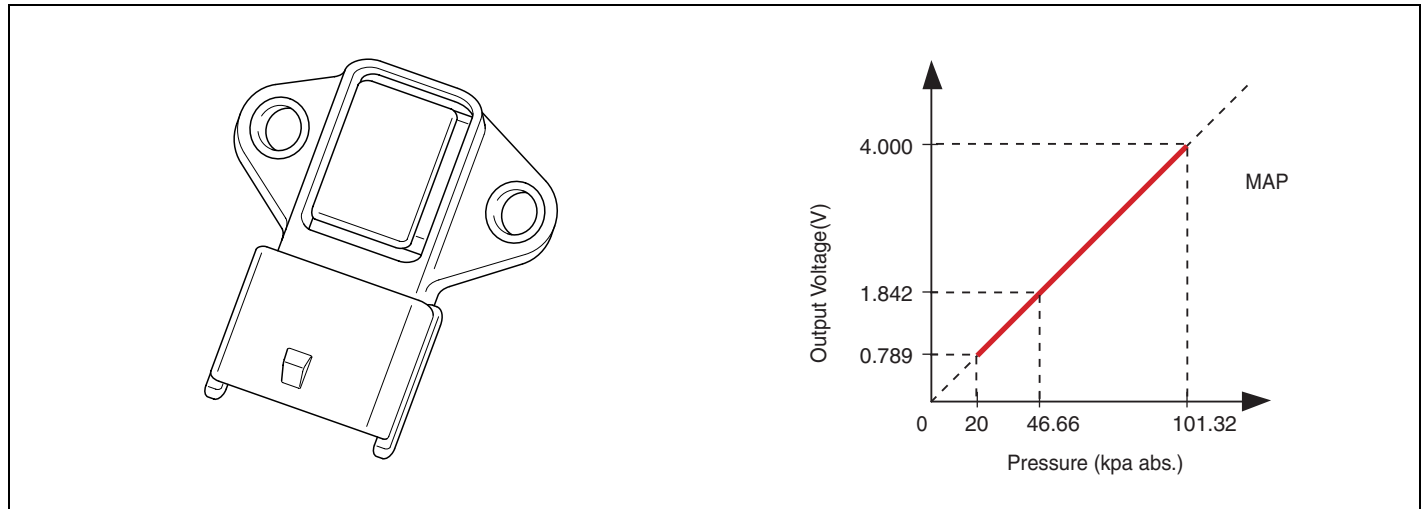
4. Check that the resistance is within the specification.

Specification: Refer to SPECIFICATION.

MANIFOLD ABSOLUTE PRESSURE SENSOR (MAPS)

INSPECTION E99BD12F

FUNCTION AND OPERATION PRICIPLE



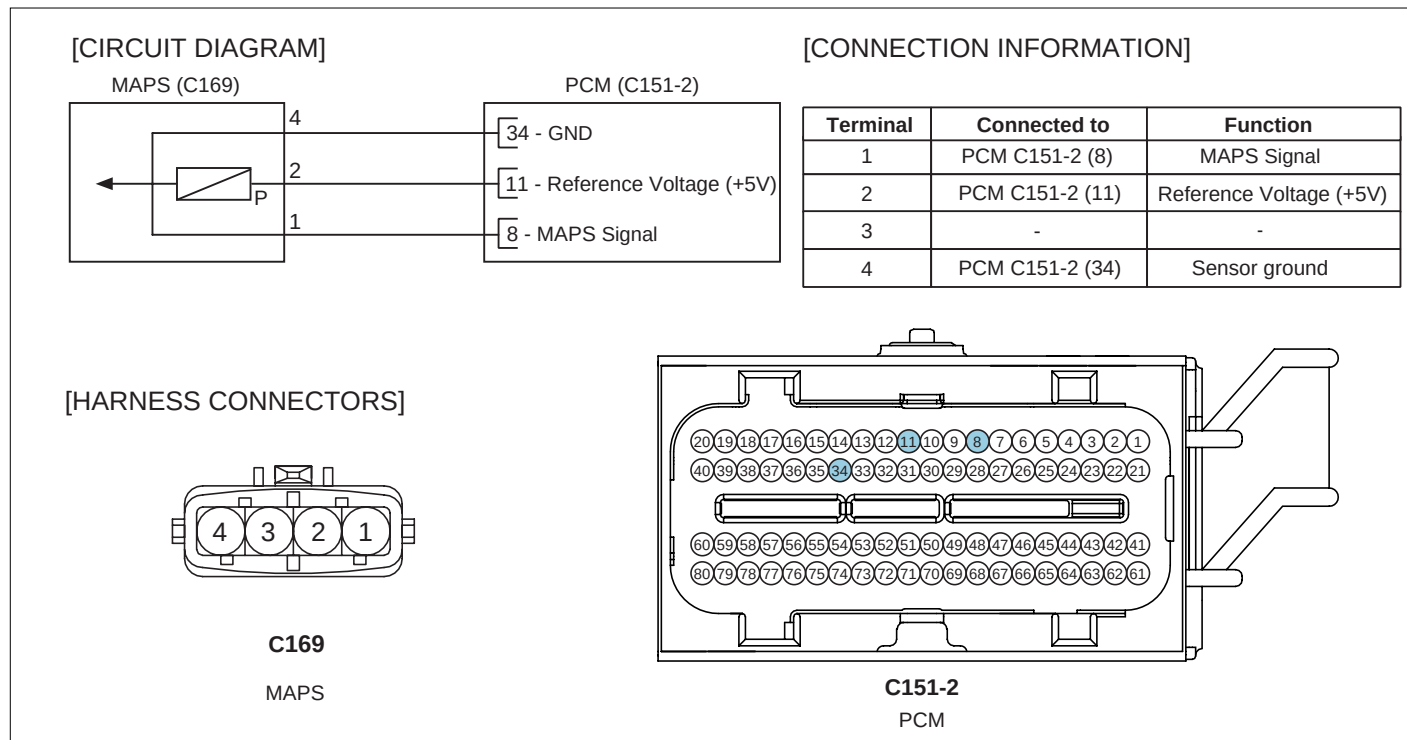
LGLG002A

Manifold Absolute Pressure Sensor (MAPS) is speed-density type sensor and is installed on the surge tank. This MAPS senses absolute pressure in surge tank and transfers this analog signal proportional to the pressure to the PCM. The PCM calculates the intake air quantity and engine speed based on this signal. This MAPS consists of piezo-electric element and hybrid IC that amplifies the element output signal. The element is silicon diaphragm type and adapts pressure sensitive variable resistor effect of semi-conductor. 100% vacuum and the manifold pressure applies to both sides of it respectively. That is, this sensor outputs the silicon variation proportional to pressure change by voltage.

SPECIFICATION

Pressure(kPa)	Output Voltage (V)
20.0	0.79
46.66	1.84
101.32	4.0

CIRCUIT DIAGRAM



SVQF16105L

COMPONENT INSPECTION

1. Connect a scantool on Diagnosis Link Connector (DLC).
2. Check MAPS output voltage at idle and IG ON.

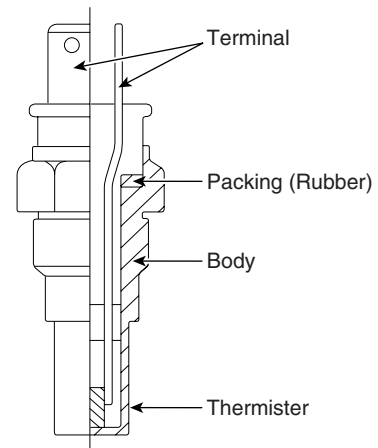
Condition	Output Voltage (V)
Idle	0.8V ~ 1.6V
IG ON	3.9V ~ 4.1V

ENGINE COOLANT TEMPERATURE SENSOR (ECTS)

INSPECTION E6DCDBAC

FUNCTION AND OPERATION PRICIPLE

Engine Coolant Temperature Sensor (ECTS) is located in the engine coolant passage of the cylinder head for detecting the engine coolant temperature. The ECTS uses a thermistor whose resistance changes with the temperature. The electrical resistance of the ECTS decreases as the temperature increases, and increases as the temperature decreases. The reference 5 V in the PCM is supplied to the ECTS via a resistor in the PCM. That is, the resistor in the PCM and the thermistor in the ECTS are connected in series. When the resistance value of the thermistor in the ECTS changes according to the engine coolant temperature, the output voltage also changes. During cold engine operation the PCM increases the fuel injection duration and controls the ignition timing using the information of engine coolant temperature to avoid engine stalling and improve drivability.

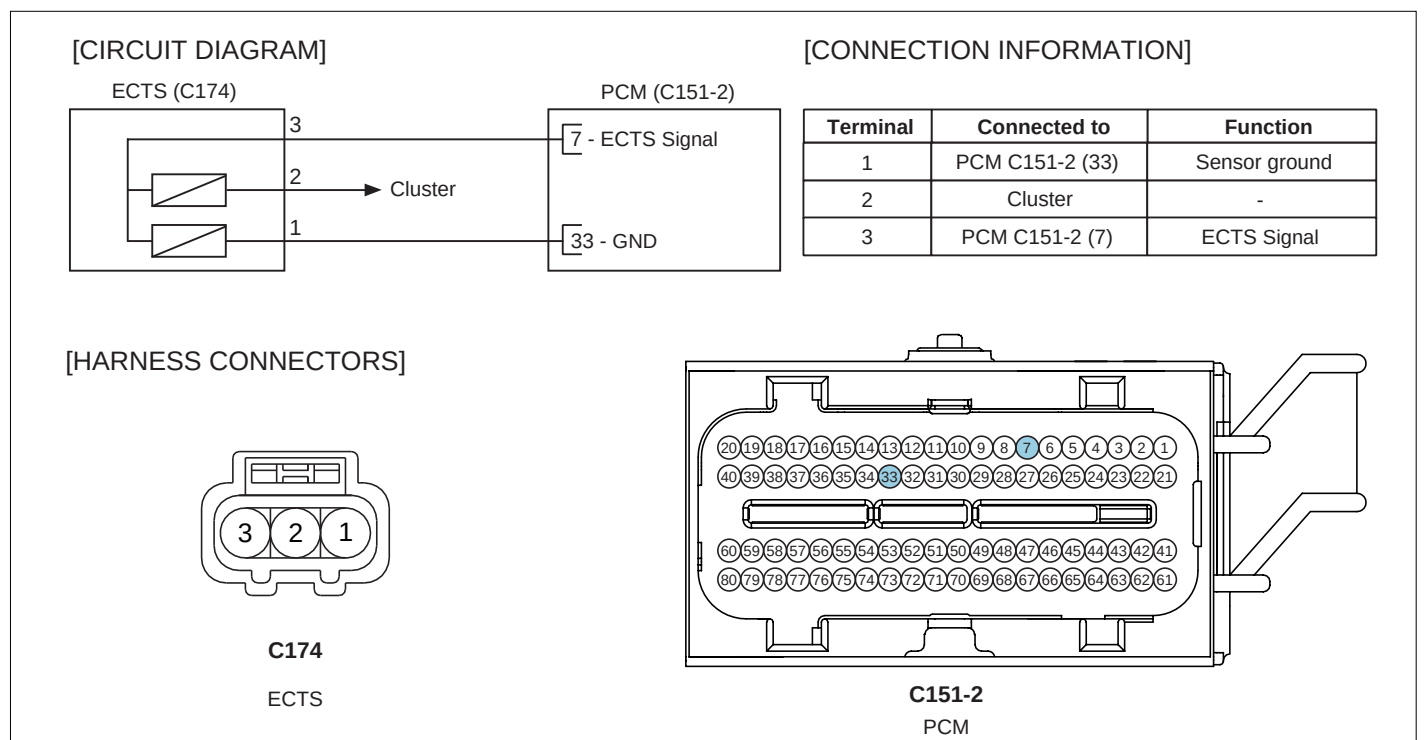


EGRF241A

SPECIFICATION

Temperature		Resistance(k Ω)
$^{\circ}\text{C}$	$^{\circ}\text{F}$	
-40	-40	48.14
-20	-4	14.13 ~ 16.83
0	32	5.79
20	68	2.31 ~ 2.59
40	104	1.15
60	140	0.59
80	176	0.32

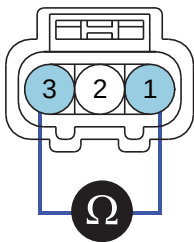
CIRCUIT DIAGRAM



SVQF16106L

COMPONENT INSPECTION

1. Turn ignition switch OFF.
2. Disconnect ECTS connector.
3. Remove the ECTS.
4. After immersing the thermistor of the sensor into engine coolant, measure resistance between ECTS terminals 1 and 3.



SVQF16107L

5. Check that the resistance is within the specification.

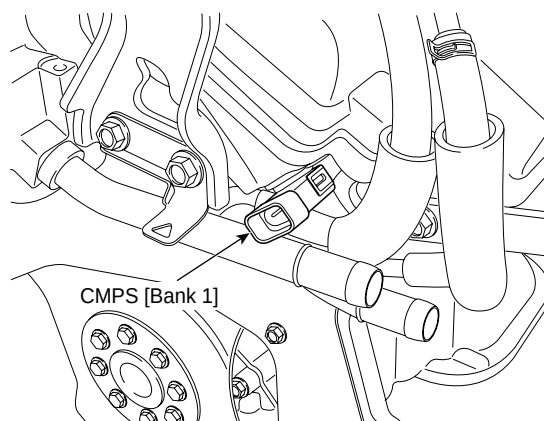
Specification: Refer to SPECIFICATION.

CAMSHAFT POSITION SENSOR (CMPS)

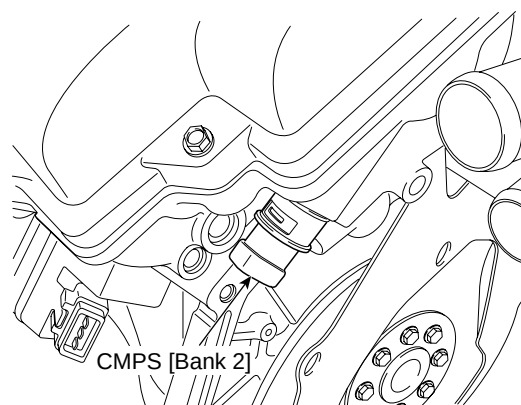
INSPECTION E2A0AFAD

FUNCTION AND OPERATION PRICIPLE

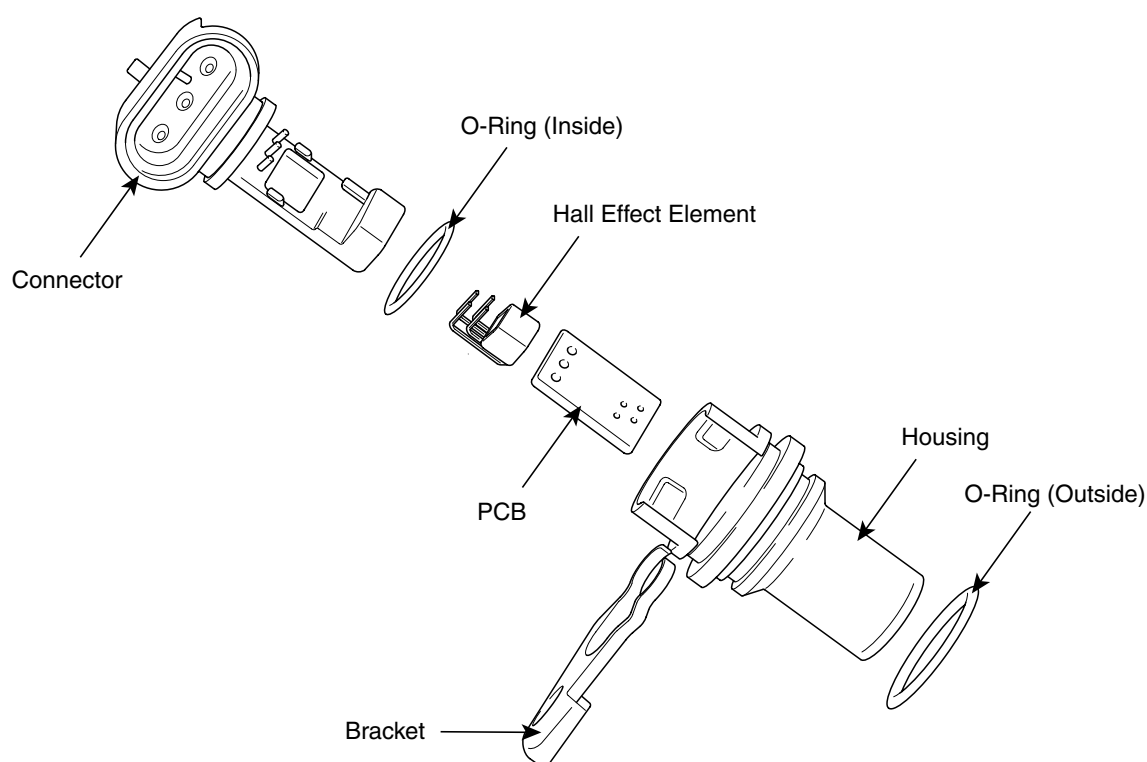
Camshaft Position Sensor (CMPS) is a hall sensor and detects the camshaft position by using a hall element. It is related with Crankshaft Position Sensor (CKPS) and detects the piston position of each cylinder which the CKPS can't detect. The two CMPS are installed on engine head cover of bank 1 and 2 and uses a target wheel installed on the camshaft. This sensor has a hall-effect IC which output voltage changes when magnetic field is made on the IC with current flow.



SVQF16009L

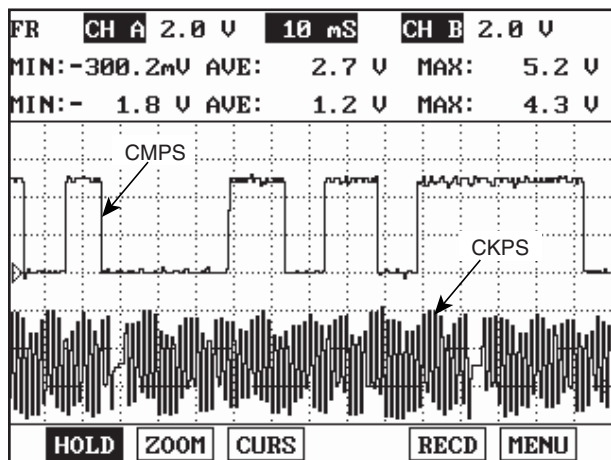


SVQF16010L

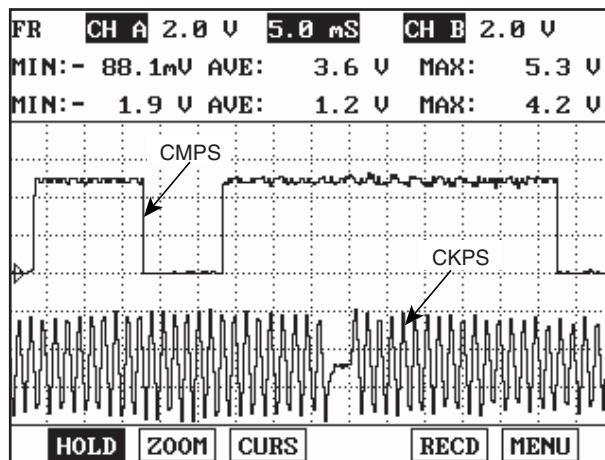


EGRF243A

WAVEFORM



At Idle

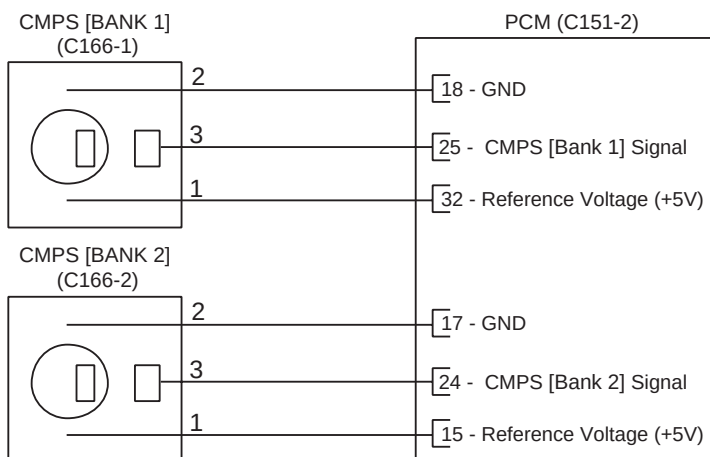


At Idle

LGLG002C

CIRCUIT DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

CMPS [BANK 1]

Terminal	Connected to	Function
1	PCM C151-2 (32)	Reference Voltage (+5V)
2	PCM C151-2 (18)	Sensor ground
3	PCM C151-2 (25)	CMPS [Bank 1] signal

CMPS [BANK 2]

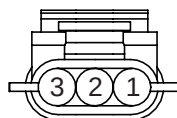
Terminal	Connected to	Function
1	PCM C151-2 (15)	Reference Voltage (+5V)
2	PCM C151-2 (17)	Sensor ground
3	PCM C151-2 (24)	CMPS [Bank 2] signal

[HARNESS CONNECTORS]



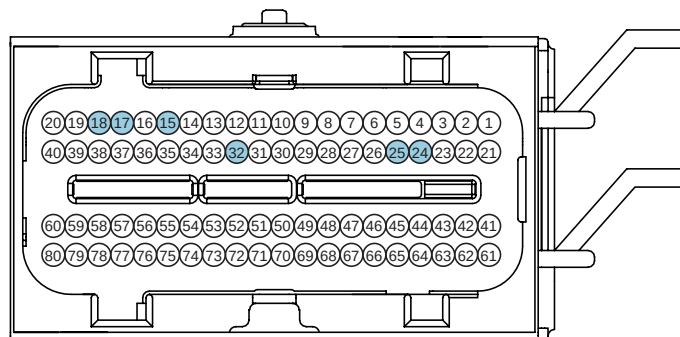
C166-1

CMPS [BANK 1]



C166-2

CMPS [BANK 2]



C151-2

PCM

SVQF16108L

COMPONENT INSPECTION

1. Check signal waveform of CMPS and CKPS using a scantool.

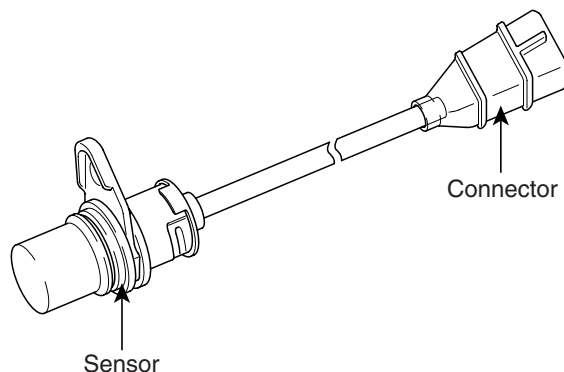
Specification : Refer to "WAVE FORM"

CRANKSHAFT POSITION SENSOR (CKPS)

INSPECTION EE4B998F

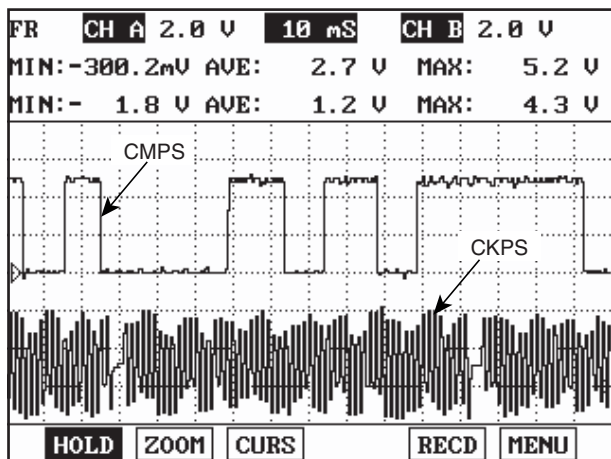
FUNCTION AND OPERATION PRICIPLE

Crankshaft Position Sensor (CKPS) detects the crankshaft position and is one of the most important sensors of the engine control system. If there is no CKPS signal input, fuel is not supplied and the main relay does not operate. That is, vehicle can't run without CKPS signal. This sensor is installed on transaxle housing and generates alternating current by magnetic flux field which is made by the sensor and the target wheel when engine runs. The target wheel consists of 58 slots and 2 missing slots on 360 CA (Crank Angle).

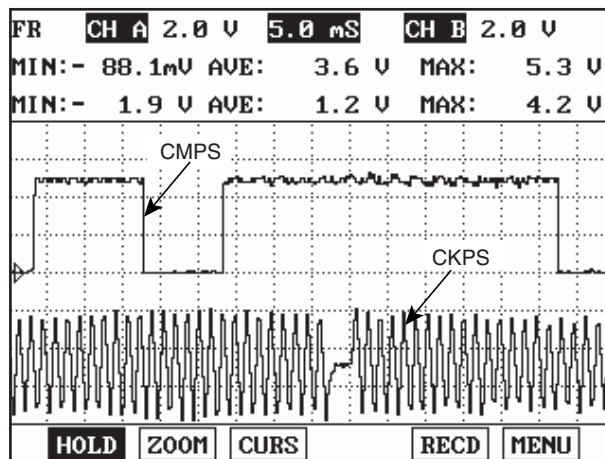


LGLG002D

WAVEFORM



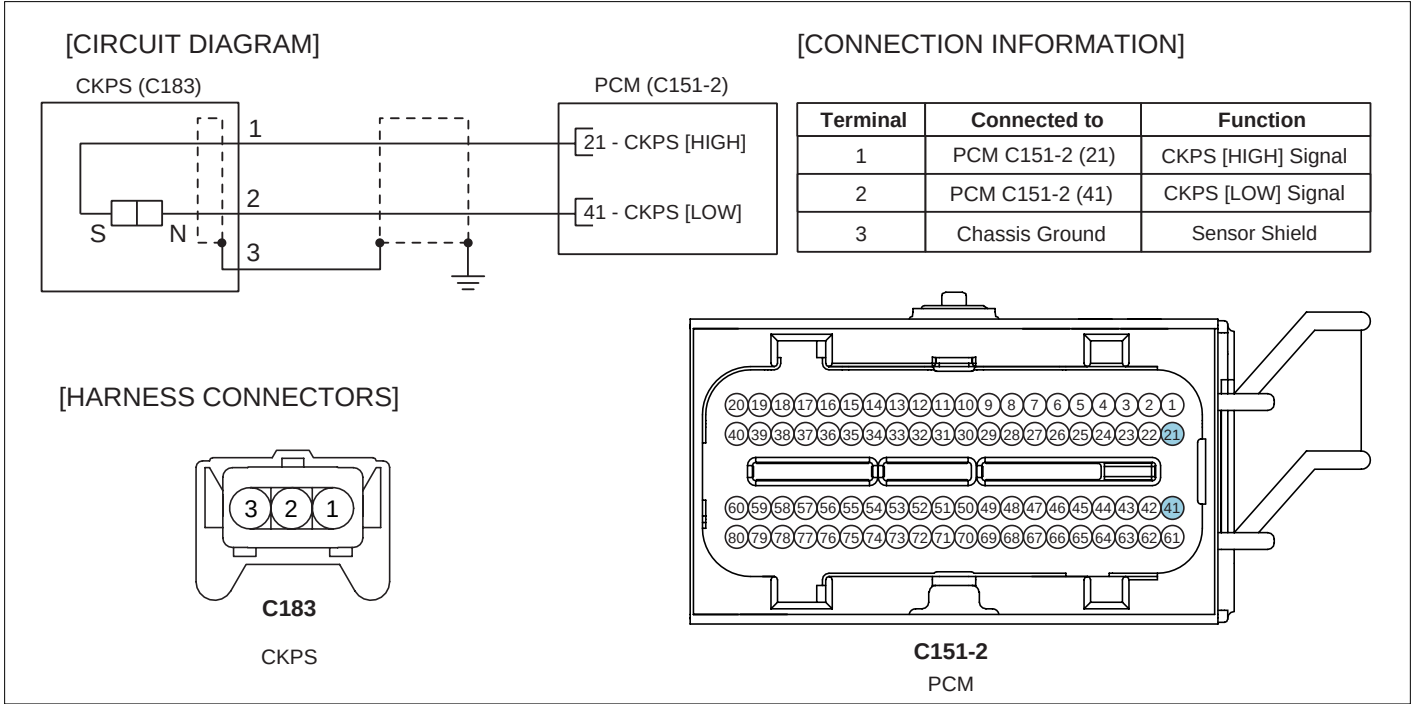
At Idle



At Idle

LGLG002C

CIRCUIT DIAGRAM



SVQF16109L

COMPONENT INSPECTION

1. Check signal waveform of CKPS and CMPS using a scantool.

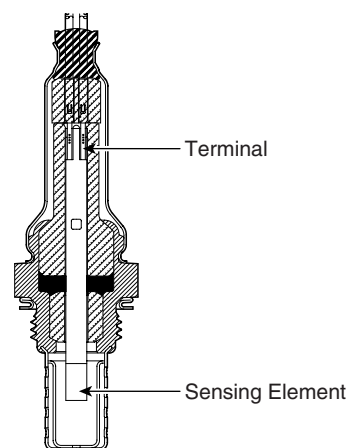
Specification : Refer to "WAVE FORM"

HEATED OXYGEN SENSOR (HO2S)

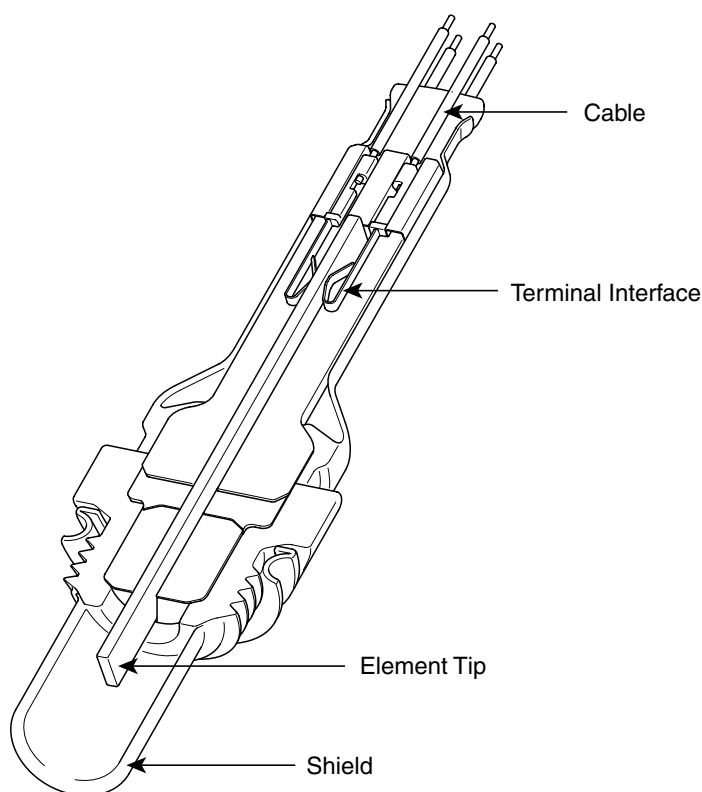
INSPECTION E1DADE40

FUNCTION AND OPERATION PRICIPLE

Heated Oxygen Sensor (HO2S) consists of zirconium and alumina and is installed on upstream and downstream of the Manifold Catalyst Converter (MCC). After it compares oxygen consistency of the atmosphere with the exhaust gas, it transfers the oxygen consistency of the exhaust gas to the PCM. When A/F ratio is rich or lean, it generates approximately 1V or 0V respectively. In order that this sensor normally operates, the temperature of the sensor tip is higher than 370°C (698°F). So it has a heater which is controlled by the PCM duty signal. When the exhaust gas temperature is lower than the specified value, the heater warms the sensor tip.



EGRF247A



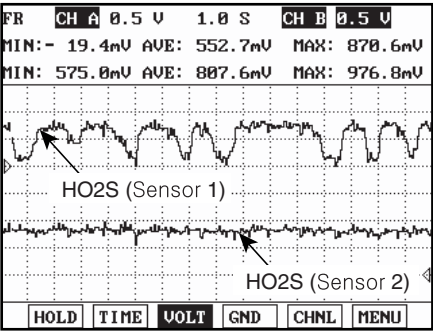
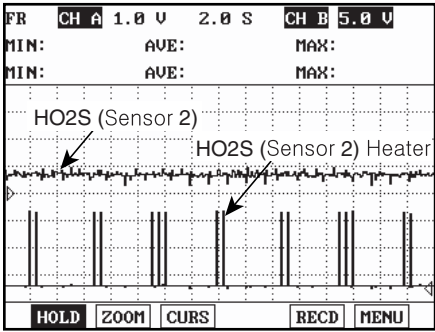
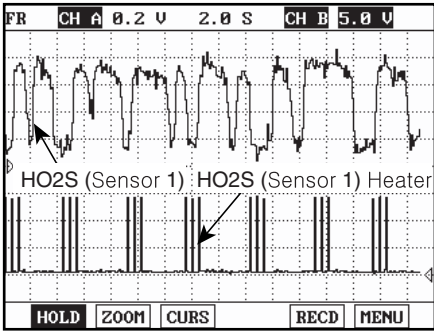
EGRF248A

SPECIFICATION

A/F Ratio	Output Voltage (V)
RICH	0.80 ~ 0.92
LEAN	0.1

Item	Specification
Heater Resistance (Ω)	3.0 ~ 4.0 Ω at 21 $^{\circ}$ C (69.8 $^{\circ}$ F)

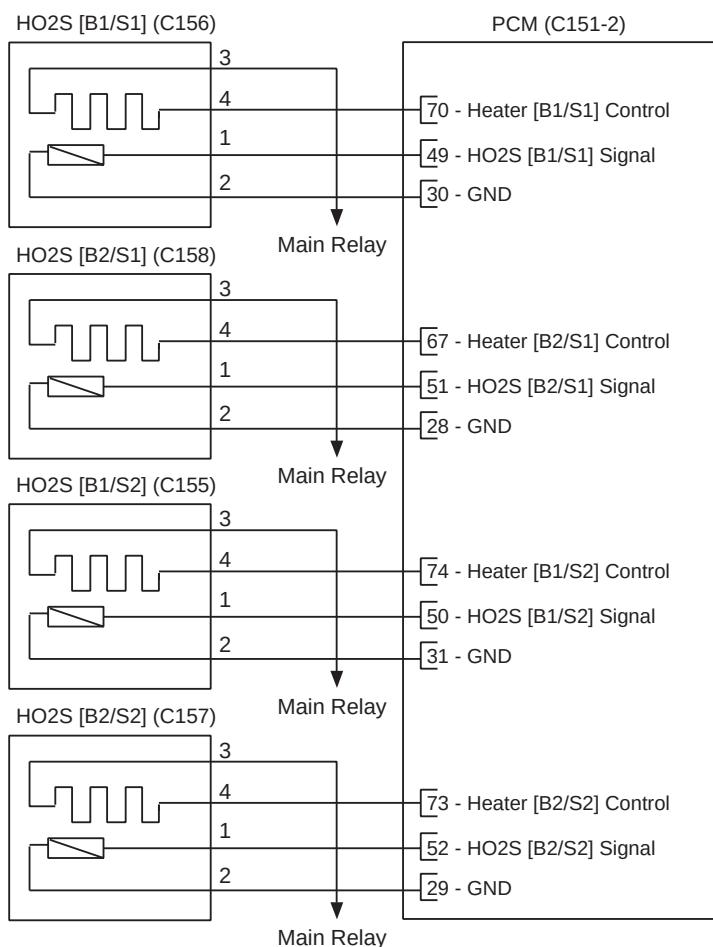
WAVEFORM



LGLG002E

CIRCUIT DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

HO2S [B1/S1]

Terminal	Connected to	Function
1	PCM C151-2 (49)	HO2S [B1/S1] Signal
2	PCM C151-2 (30)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C151-2 (70)	Heater [B1/S1] Control

HO2S [B2/S1]

Terminal	Connected to	Function
1	PCM C151-2 (51)	HO2S [B2/S1] Signal
2	PCM C151-2 (28)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C151-2 (67)	Heater [B2/S1] Control

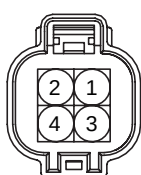
HO2S [B1/S2]

Terminal	Connected to	Function
1	PCM C151-2(50)	HO2S [B1/S2] Signal
2	PCM C151-2 (31)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C151-2 (74)	Heater [B1/S2] Control

HO2S [B2/S2]

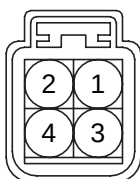
Terminal	Connected to	Function
1	PCM C151-2 (52)	HO2S [B2/S2] Signal
2	PCM C151-2 (29)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C151-2 (73)	Heater [B2/S2] Control

[HARNESS CONNECTORS]



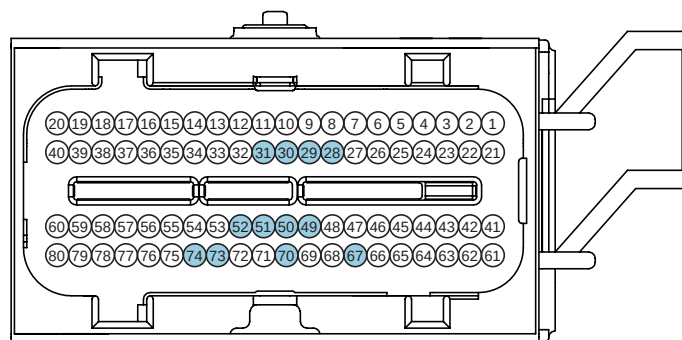
C156, C158

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]



C155, C157

HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]



C151-2

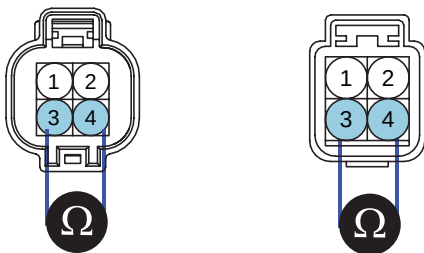
PCM

COMPONENT INSPECTION

1. Check signal waveform of HO2S using a scantool.

Specification: Refer to "waveform".

2. Disconnect the HO2S connector.
3. Measure resistance between HO2S heater terminals 3 and 4.



SCMF16111L

4. Check that the resistance is within the specification.

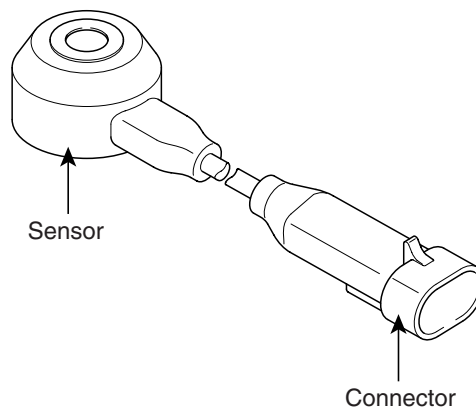
Specification: Refer to SPECIFICATION.

KNOCK SENSOR (KS)

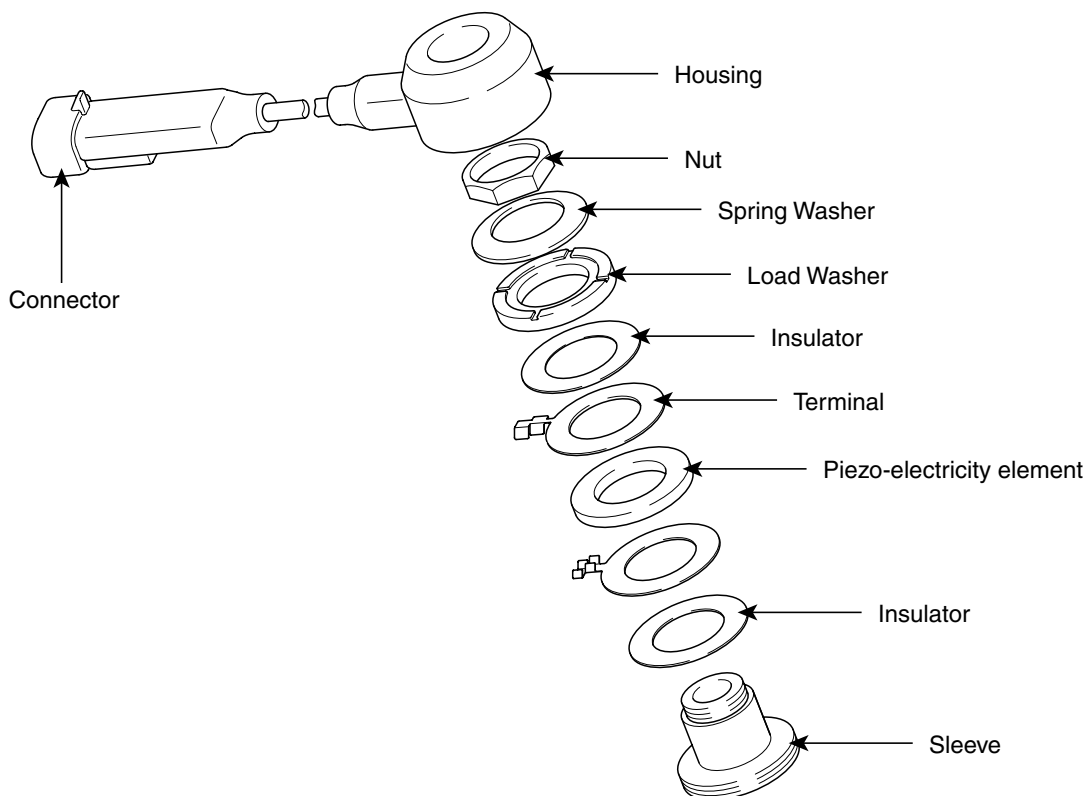
INSPECTION EC4B1DA6

FUNCTION AND OPERATION PRICIPLE

Knocking is a phenomenon characterized by undesirable vibration and noise and can cause engine damage. Knock Sensor (KS) senses engine knocking and the two sensors are installed inside the V-valley of the cylinder block. When knocking occurs, the vibration from the cylinder block is applied as pressure to the piezoelectric element. At this time, this sensor transfers the voltage signal higher than the specified value to the PCM and the PCM retards the ignition timing. If the knocking disappears after retarding the ignition timing, the PCM will advance the ignition timing. This sequential control can improve engine power, torque and fuel economy.



EGRF251A

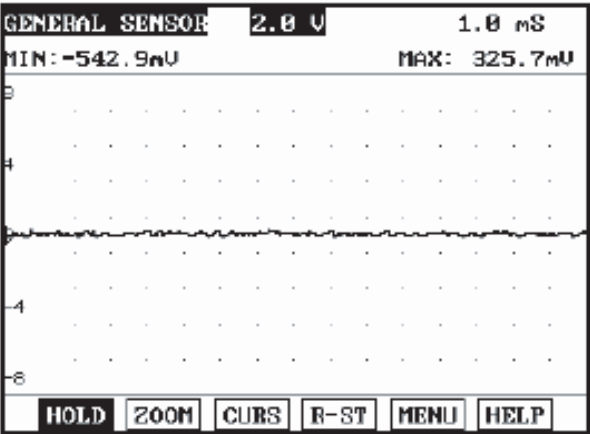


EGRF252A

SPECIFICATION

Item	Specification
Capacitance (pF)	950 ~ 1,350pF

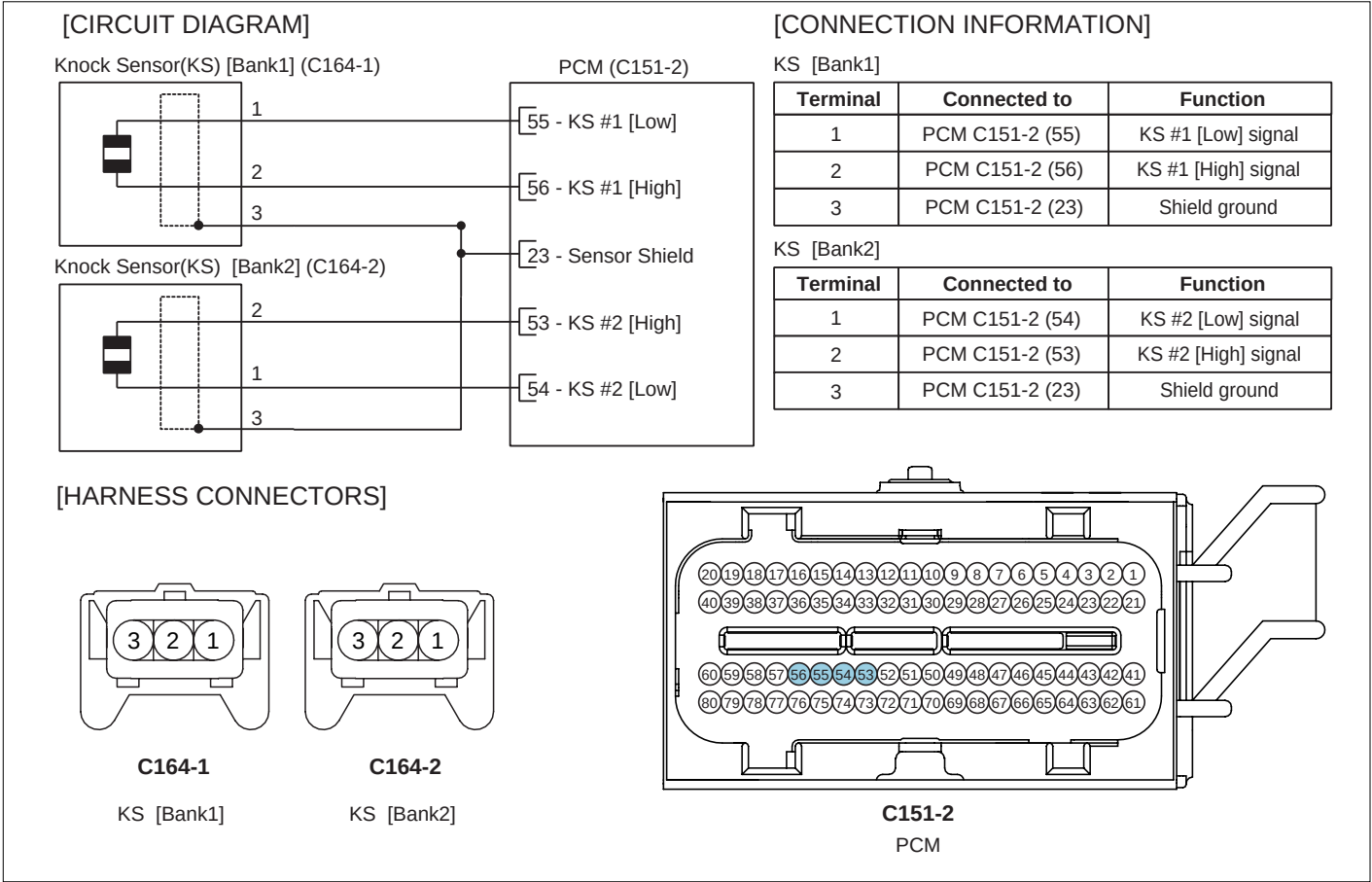
WAVEFORM



The knock sensor is installed at cycliner block to detect the vibration effectively during engine running. The above waveform shows the signal waveform of knock sensor when knock dosen't happen. Generally, knock signal has more noise than other sensor.

EGRF610B

CIRCUIT DIAGRAM



SVQF16112L

INJECTOR

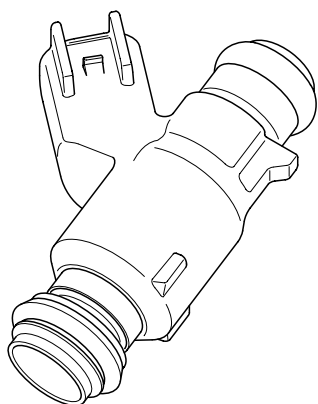
INSPECTION EBCA1EAE

FUNCTION AND OPERATION PRICIPLE

Based on information from various sensors, the PCM measures the fuel injection amount. The fuel injector is a solenoid-operated valve and the fuel injection amount is controlled by length of time that the fuel injector is held open. The PCM controls each injector by grounding the control circuit. When the PCM energizes the injector by grounding the control circuit, the circuit voltage should be low (theoretically 0V) and the fuel is injected. When the PCM de-energizes the injector by opening control circuit, the fuel injector is closed and circuit voltage should momentarily peak.

⊗ WARNING

If an injector connector is disconnected for more than 46 seconds while the engine runs, the PCM will determine that the cylinder is misfiring and cut fuel supply. So be careful not to exceed 46 seconds. But the engine runs normally in 10 seconds after turning the ignition key off.



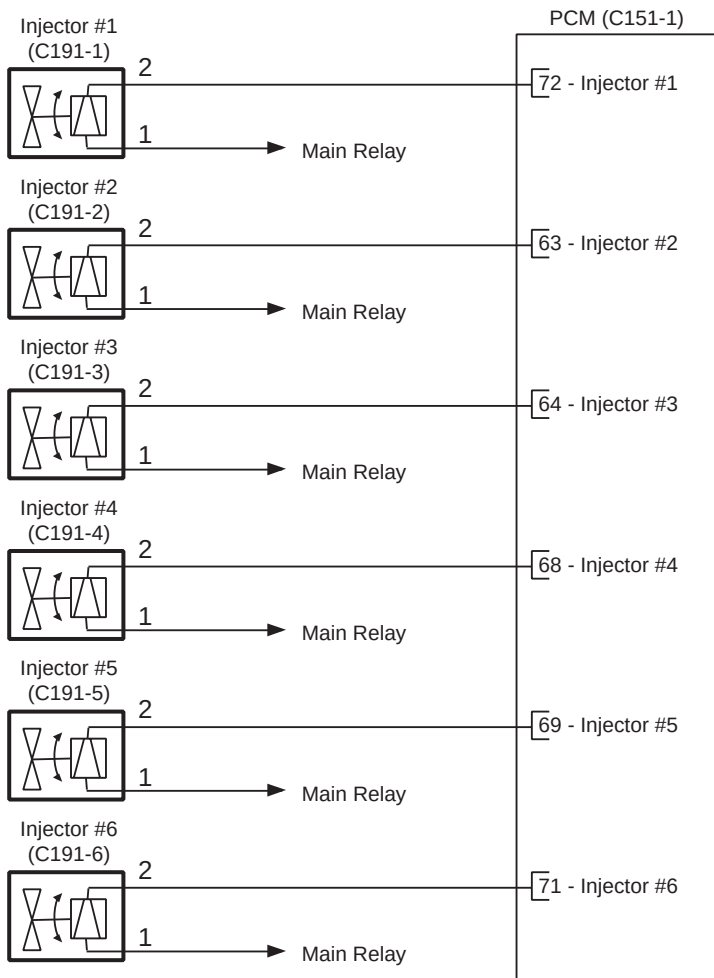
KFCF1026

SPECIFICATION

Item	Specification
Coil Resistance (Ω)	13.8 ~ 15.2 Ω at 20°C (68°F)

CIRCUIT DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Injector #1

Terminal	Connected to	Function
1	PCM C151-1 (72)	Injector #1 control
2	Main Relay	Battery Voltage (B+)

Injector #2

Terminal	Connected to	Function
1	PCM C151-1 (63)	Injector #2 control
2	Main Relay	Battery Voltage (B+)

Injector #3

Terminal	Connected to	Function
1	PCM C151-1 (64)	Injector #3 control
2	Main Relay	Battery Voltage (B+)

Injector #4

Terminal	Connected to	Function
1	PCM C151-1 (68)	Injector #4 control
2	Main Relay	Battery Voltage (B+)

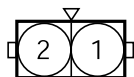
Injector #5

Terminal	Connected to	Function
1	PCM C151-1 (69)	Injector #5 control
2	Main Relay	Battery Voltage (B+)

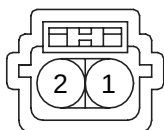
Injector #6

Terminal	Connected to	Function
1	PCM C151-1 (71)	Injector #6 control
2	Main Relay	Battery Voltage (B+)

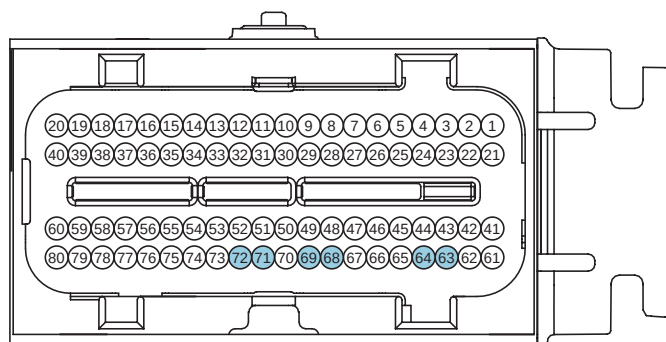
[HARNESS CONNECTORS]



C191-1,3,5
Injector #1,3,5



C191-2,4,6
Injector #2,4,6

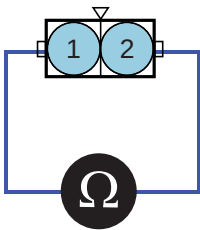


C151-1
PCM

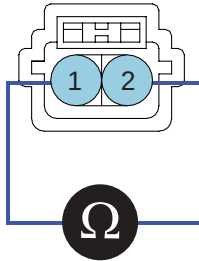
COMPONENT INSPECTION

1. Turn ignition switch OFF.
2. Disconnect injector connector.
3. Measure resistance between injector terminals 1 and 2.

Injector #1,3,5



Injector #2,4,6



SVQF16114L

4. Check that the resistance is within the specification.

Specification: Refer to SPECIFICATION.

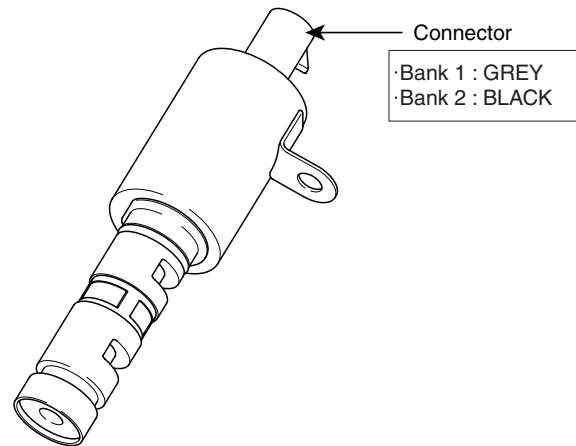
CVVT OIL CONTROL VALVE (OCV)

INSPECTION E4CF7FB9

FUNCTION AND OPERATION PRICIPLE

The Continuously Variable Valve Timing (CVVT) system controls the amount of valve overlap by varying the amount of oil flow into an assembly mounted on each intake camshaft through PCM control of an oil control valve. This system uses two oil control valves, one on each bank. An Oil Temperature Sensor (OTS) is used to allow PCM monitoring of engine oil temperature. As oil is directed into the chambers of the CVVT assembly, the cam phase is changed to suit various performance and emissions requirements..

1. When camshaft rotates engine rotation-wise: Intake-Advance / Exhaust-Retard
2. When camshaft rotates counter engine rotation-wise: Intake- Retard / Exhaust- Advance



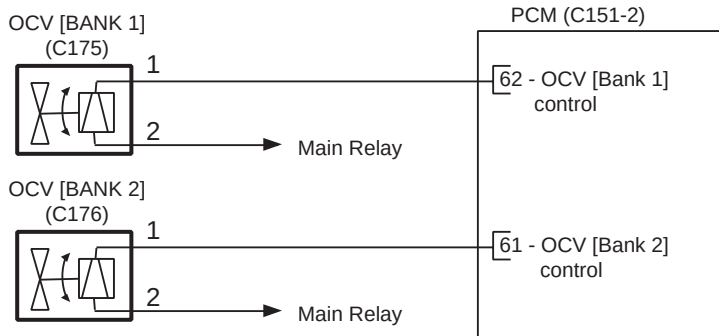
EFBF1027

SPECIFICATION

Item	Specification
Coil Resistance (Ω)	6.7 ~ 7.7Ω at 20℃ (68°F)

CIRCUIT DIAGRAM

[CIRCUIT DIAGRAM]

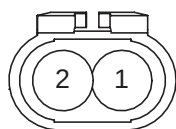


[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	PCM C151-2 (62)	OCV [Bank 1] control
2	Main Relay	Battery Voltage (B+)

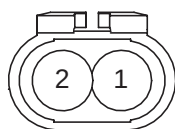
Terminal	Connected to	Function
1	PCM C151-2 (61)	OCV [Bank 2] control
2	Main Relay	Battery Voltage (B+)

[HARNESS CONNECTORS]



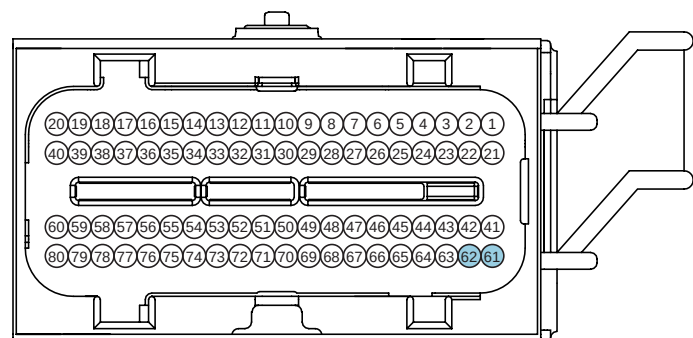
C175

OCV [Bank 1]



C176

OCV [Bank 2]



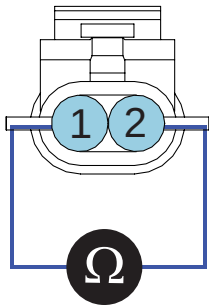
C151-2

PCM

SVQF16115L

COMPONENT INSPECTION

1. Turn ignition switch OFF.
2. Disconnect OCV connector.
3. Measure resistance between OCV terminals 1 and 2.



SCMF16116L

4. Check that the resistance is within the specification.

Specification: Refer to SPECIFICATION.

INSTALLATION E4DB08BD

CAUTION

*If the OCVs are installed incorrectly, the vehicle may be damaged.
So when installing them, ensure the OCV and harness connector colors match(Components and harness side).*

[BANK AND ITS COLOR]

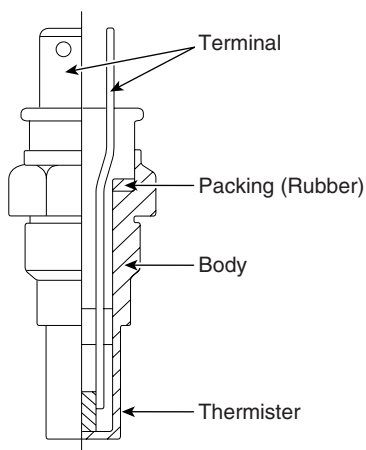
Bank	Component side	Harness side
Bank 1 (RH)	Grey	Grey
Bank 2 (LH)	Black	Black

CVVT OIL TEMPERATURE SENSOR(OTS)

INSPECTION E046CB17

FUNCTION AND OPERATION PRICIPLE

The CVVT Oil Temperature Sensor (OTS) is a negative coefficient thermistor used by the PCM to measure engine oil temperature for the purpose of adjusting CVVT calculations.



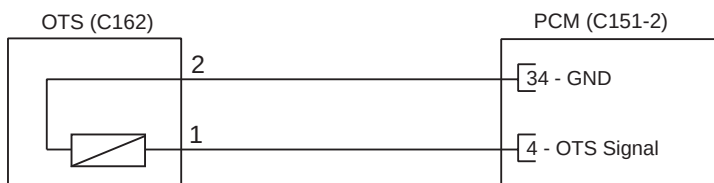
EGRF241A

SPECIFICATION

Temperature		Resistance (k Ω)
$^{\circ}\text{C}$	$^{\circ}\text{F}$	
-40	-40	52.0
-20	-4	16.5
0	32	6.0
20	68	2.45
40	104	1.10
60	140	0.544
80	176	0.290
100	212	0.164
120	248	0.099

CIRCUIT DIAGRAM

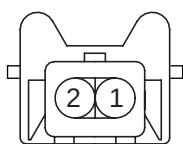
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

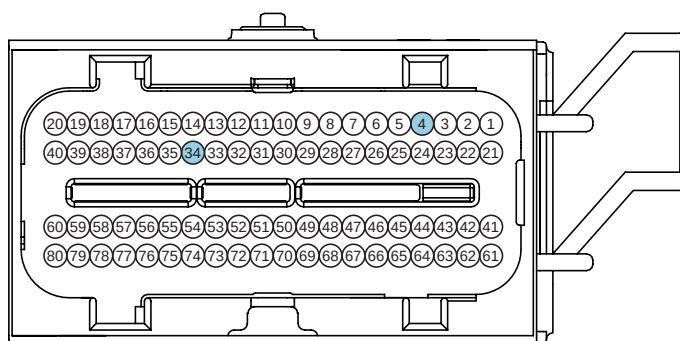
Terminal	Connected to	Function
1	PCM C151-2 (4)	OTS Signal
2	PCM C151-2 (34)	Sensor ground

[HARNESS CONNECTORS]



C162

OTS



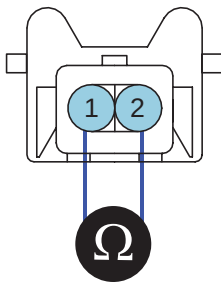
C151-2

PCM

SVQF16117L

COMPONENT INSPECTION

1. Turn ignition switch OFF.
2. Disconnect OTS connector.
3. Remove the OTS.
4. After immersing the thermistor of the sensor into water (or engine coolant), measure resistance between OTS terminals 1 and 2.



SCMF16118L

5. Check that the resistance is within the specification.

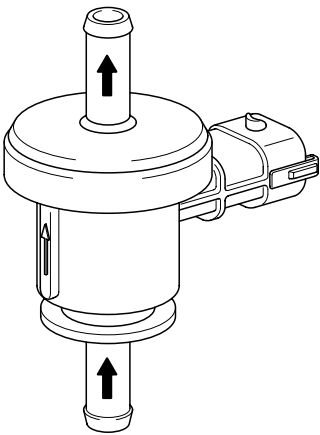
Specification: Refer to SPECIFICATION.

PURGE CONTROL SOLENOID VALVE (PCSV)

INSPECTION EDCE4B32

FUNCTION AND OPERATION PRICIPLE

Purge Control Solenoid Valve (PCSV) is installed on the surge tank and controls the passage between the canister and the intake manifold. It is a solenoid valve and is open when the PCM grounds the valve control line. When the passage is open (PCSV ON), fuel vapors stored in the canister is transferred to the intake manifold.

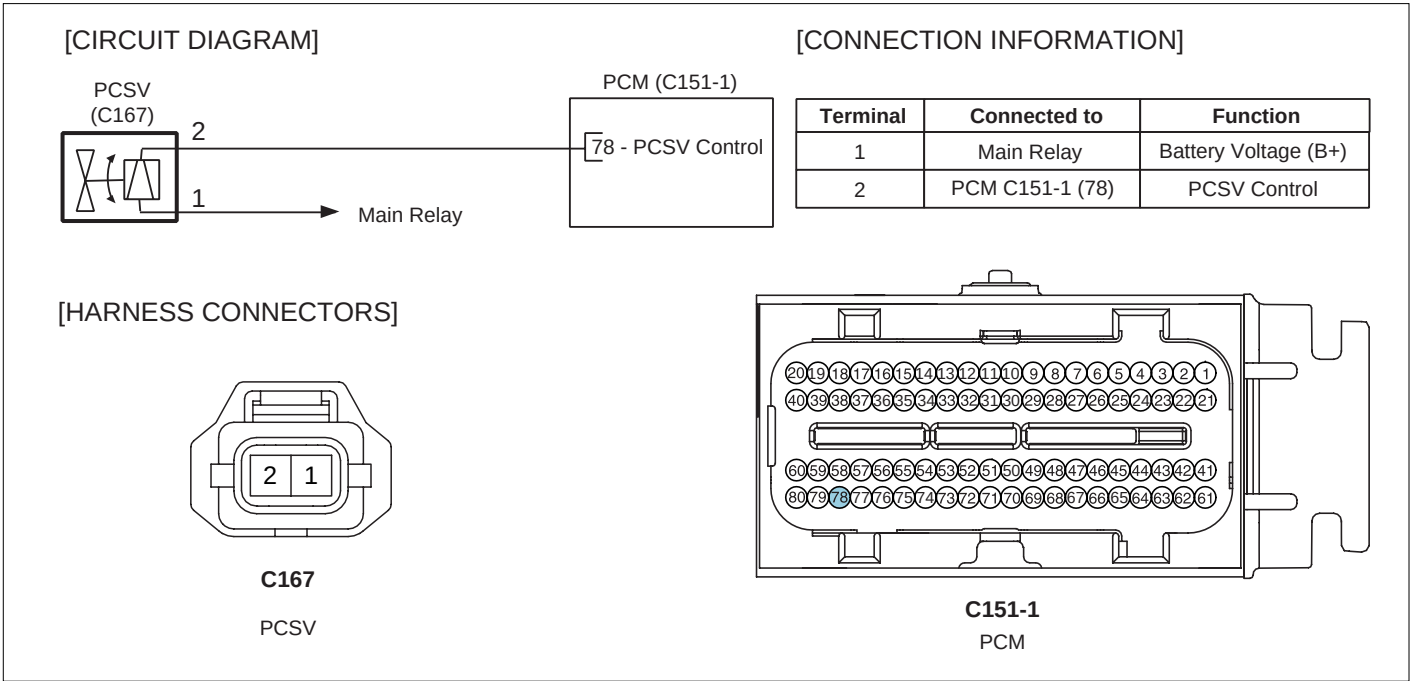


KGBF004W

SPECIFICATION

Item	Specification
Coil Resistance (Ω)	14.0 ~ 18.0Ω at 20℃ (68°F)

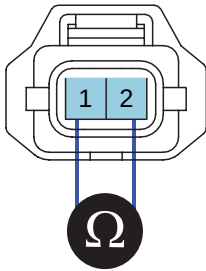
CIRCUIT DIAGRAM



SVQF16119L

COMPONENT INSPECTION

1. Turn ignition switch OFF.
2. Disconnect PCSV connector.
3. Measure resistance between PCSV terminals 1 and 2.



SCMF16120L

4. Check that the resistance is within the specification.

Specification: Refer to SPECIFICATION.

VARIABLE INTAKE SOLENOID (VIS) VALVE

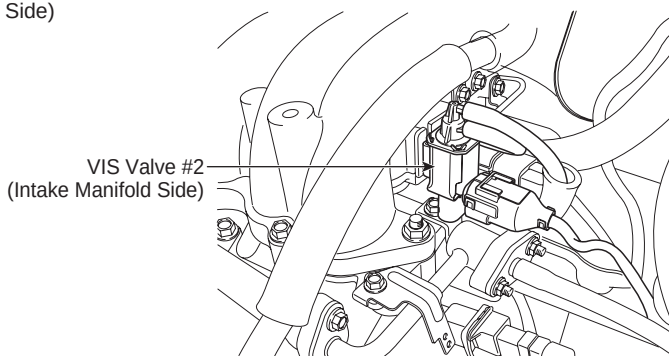
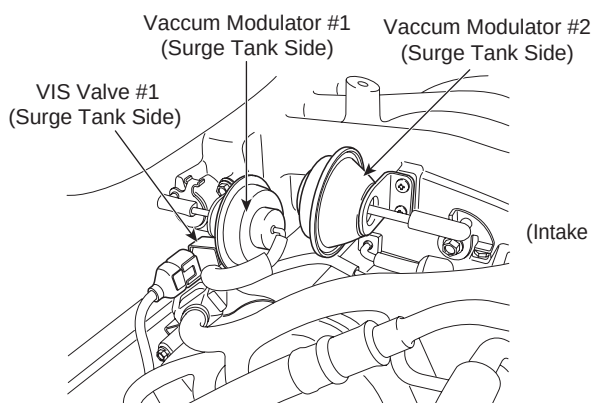
(VIS Valve #2). These VIS valve #1 and #2 control vacuum modulators which activate valves in surge tank and intake manifold. These valves are opened or closed by PCM according to engine condition (Refer to below table).

INSPECTION E7DF6662

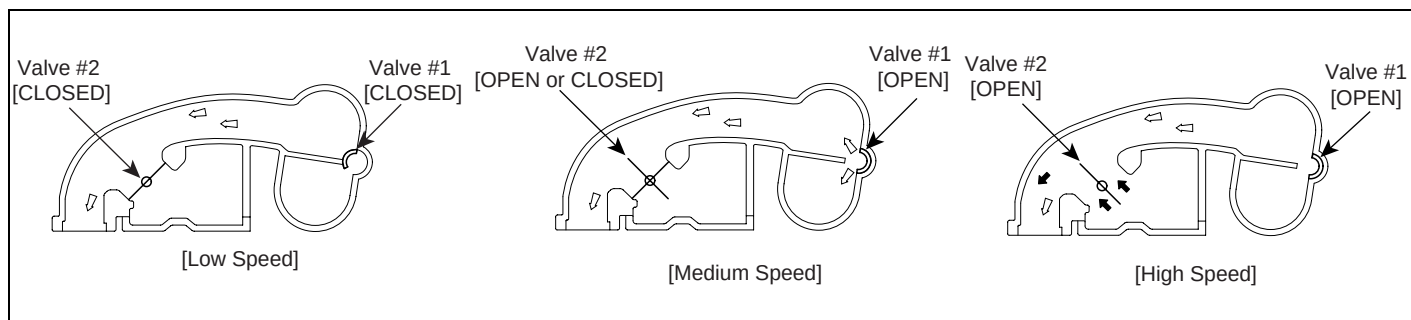
FUNCTION AND OPERATION PRICIPLE

Variable Intake manifold Solenoid (VIS) valves are installed on surge tank (VIS Valve #1) and intake manifold

Engine Condition	VIS Valve #1 (Surge Tank)	VIS Valve #2 (In-manifold)	Operation
Low Speed	Closed	Closed	Increasing engine performance in low engine speed by reducing intake interference among cylinders
Medium Speed	Open	Open or closed	Increasing intake efficiency
High Speed	Open	Open	Minimizing intake resistance by shortening intake manifold length and increasing area of air entrance



SVQF16120L

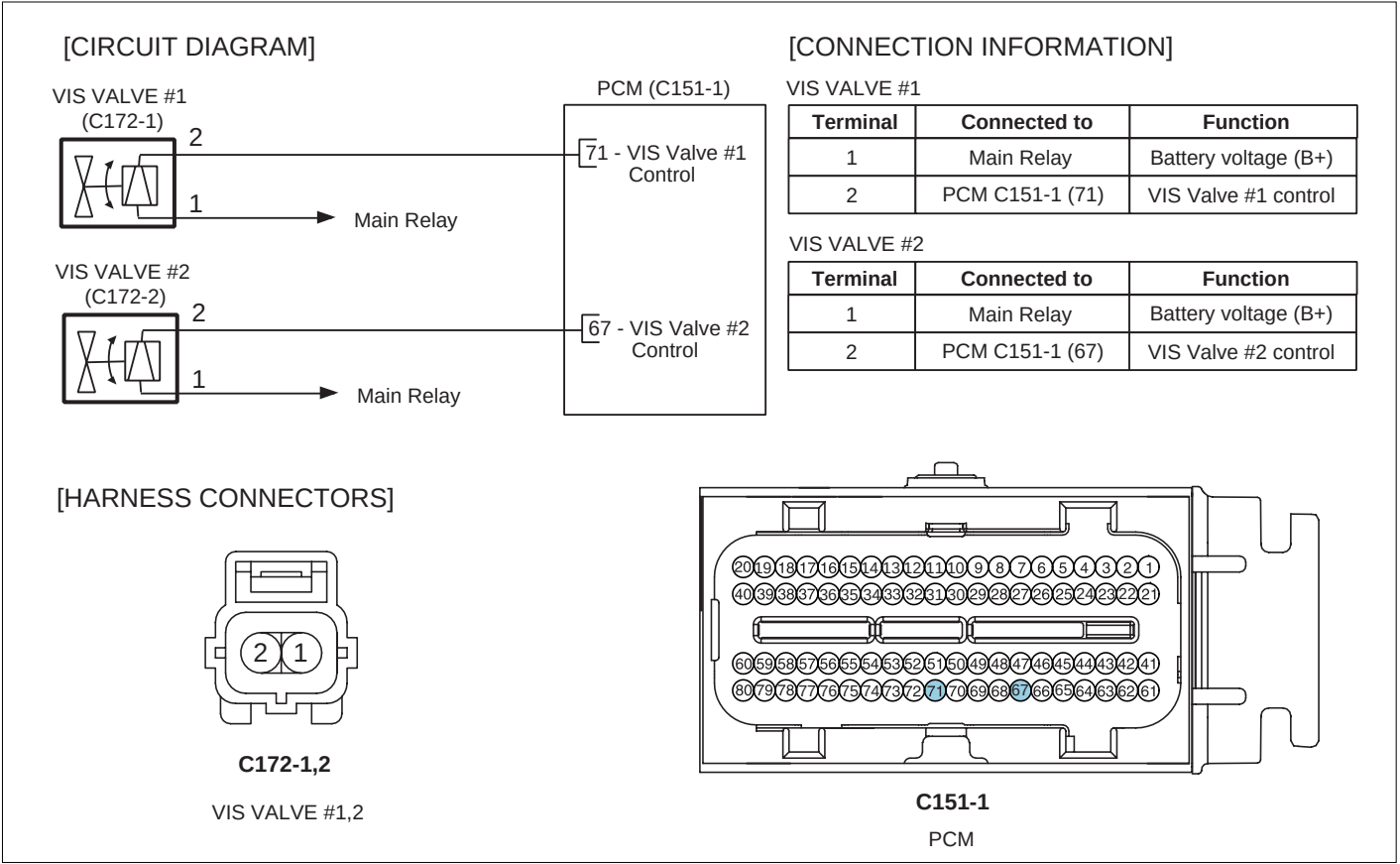


SCMF16004L

SPECIFICATION

Item	Specification
Coil Resistance (Ω)	29.0 ~ 35.0 Ω at 20°C (68°F)

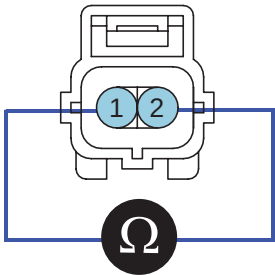
CIRCUIT DIAGRAM



SVQF16121L

COMPONENT INSPECTION

1. Turn ignition switch OFF.
2. Disconnect VIS Valve connector.
3. Measure resistance between VIS Valve #1,2 terminals 1 and 2.



SCMF16122L

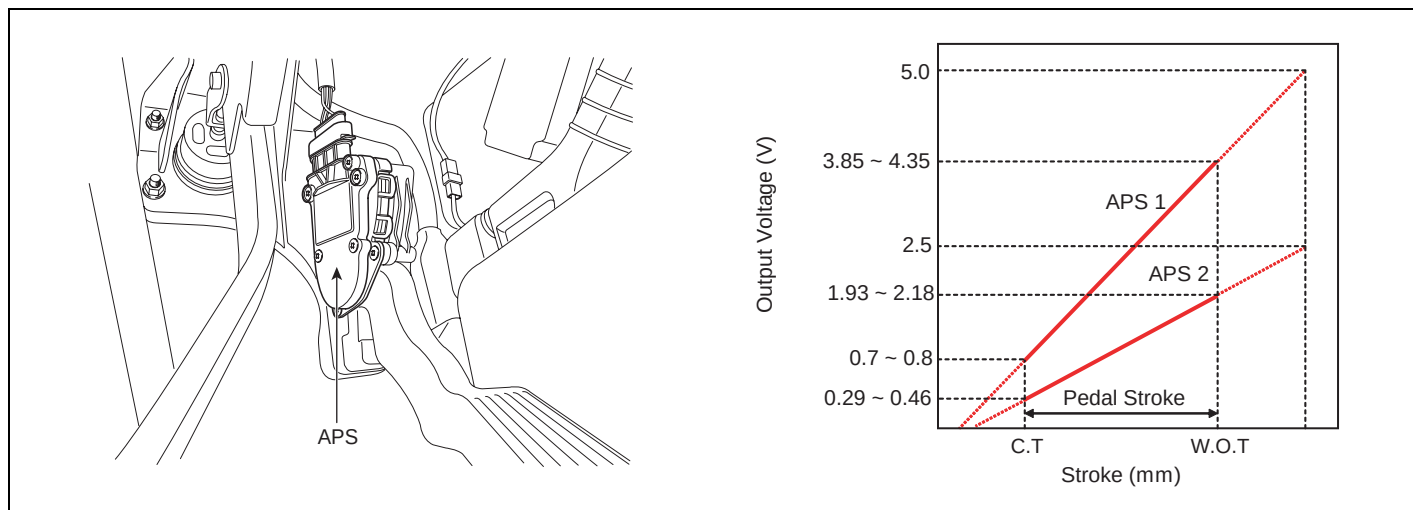
4. Check that the resistance is within the specification.

Specification: Refer to SPECIFICATION.

ACCELERATOR POSITION SENSOR (APS)

INSPECTION EFDE8560

FUNCTION AND OPERATION PRICIPLE



SVQF16123L

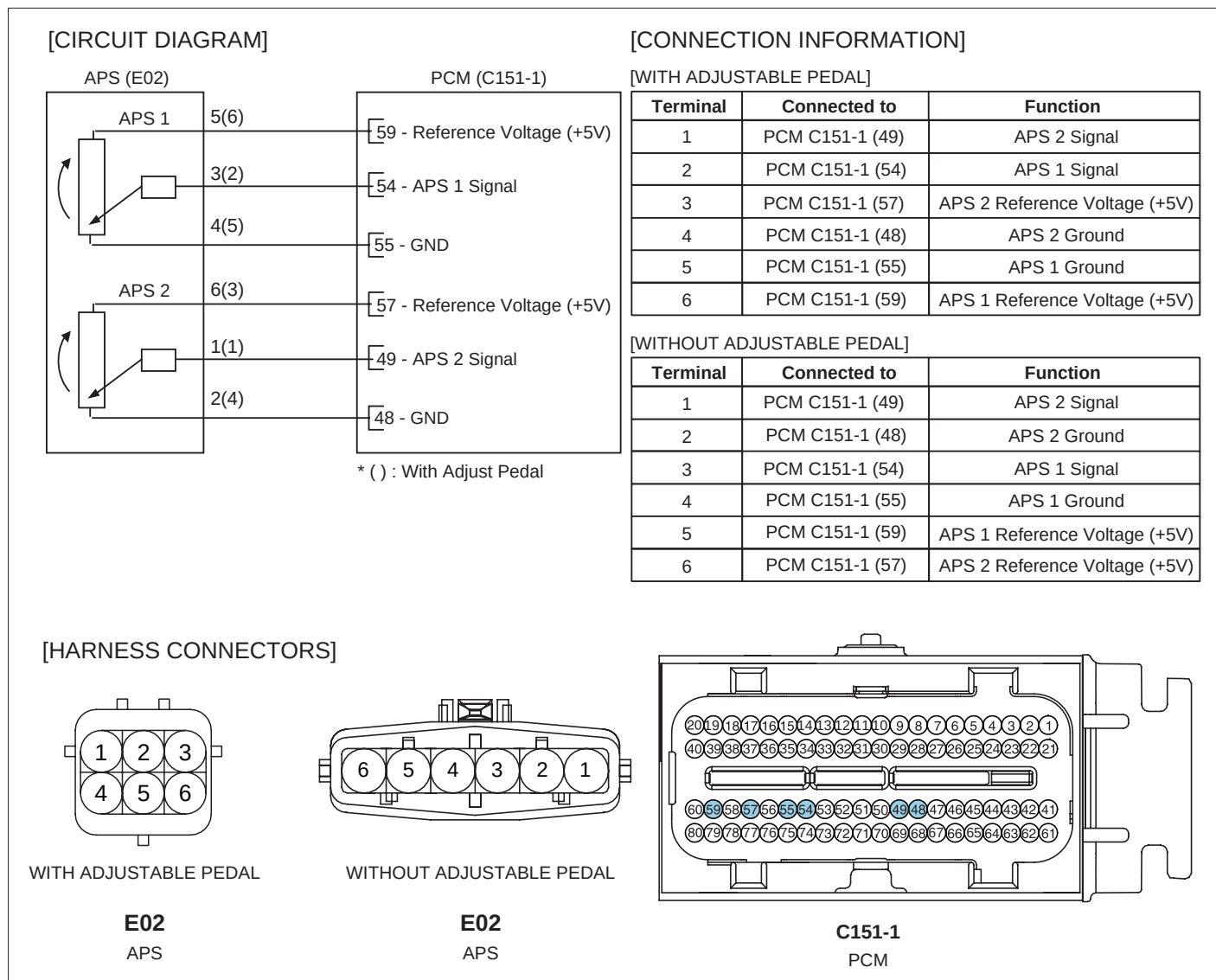
Accelerator Position Sensor (APS) is installed on the accelerator pedal module and detects the rotation angle of the accelerator pedal. The APS is one of the most important sensors in engine control system, so it consists of the two sensors which adapt individual sensor power and ground line. The second sensor monitors the first sensor and its output voltage is half of the first one. If the ratio of the sensor 1 and 2 is out of the range (approximately 1/2), the diagnostic system judges that a malfunction has occurred.

SPECIFICATION

Pedal Position	Output Voltage (V) [Vref = 5.0V]	
	APS1	APS2
C.T	0.7 ~ 0.8V	0.29 ~ 0.46V
W.O.T	3.85 ~ 4.35V	1.93 ~ 2.18V

Item	Sensor Resistance
APS1	0.7 ~ 1.3k Ω at 20 $^{\circ}$ C (68 $^{\circ}$ F)
APS2	1.4 ~ 2.6k Ω at 20 $^{\circ}$ C (68 $^{\circ}$ F)

CIRCUIT DIAGRAM



SVQF16124L

COMPONENT INSPECTION

1. Connect a scantool on Diagnosis Link Connector (DLC).
2. Start engine and check output voltages of APS 1 and 2 at C.T and W.O.T.

SPECIFICATION

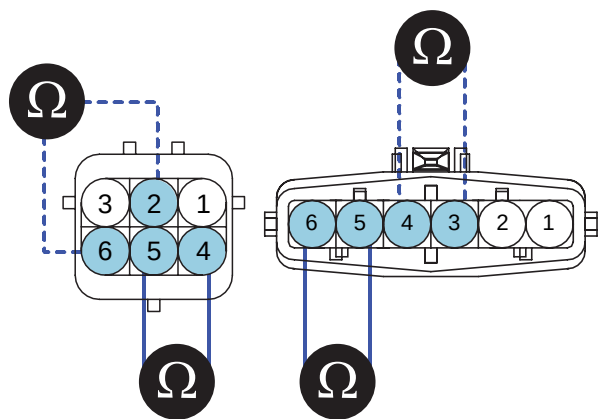
Condition	Output Voltage (V)	
	APS1	APS2
C.T	0.70 ~ 0.80	0.29 ~ 0.46
W.O.T	3.85 ~ 4.35	1.93 ~ 2.18

3. Turn ignition switch OFF and disconnect the scantool from the DLC.

4. Disconnect APS connector and measure resistance between APS terminals 5(6) and 4(5) (APS 1).

Specification: Refer to SPECIFICATION.

5. Disconnect APS connector and measure resistance between APS terminals 6(3) and 2(4) (APS 2).



SVQF16125L

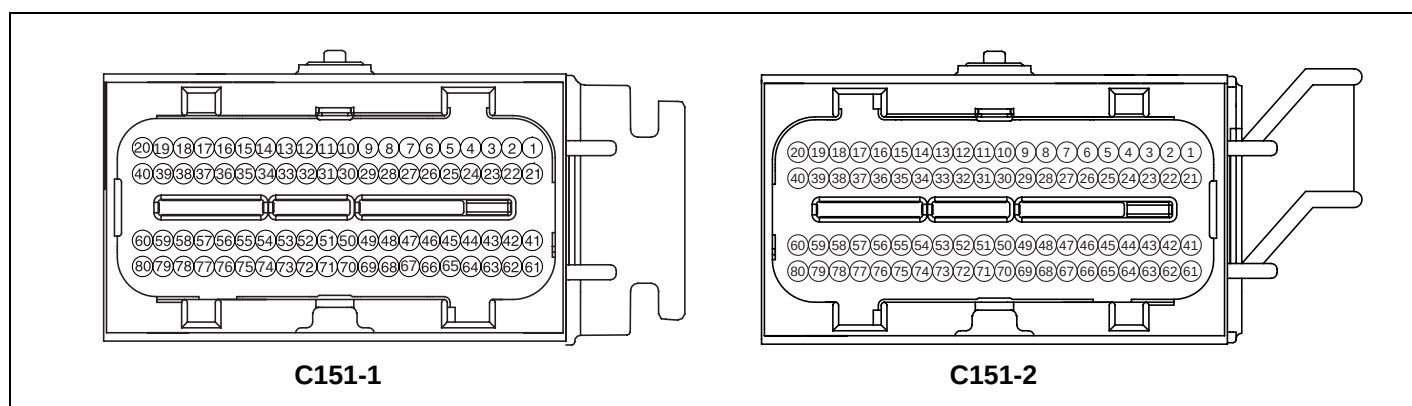
Specification: Refer to SPECIFICATION.

POWERTRAIN CONTROL MODULE (PCM)

POWERTRAIN CONTROL MODULE (PCM)

E75F1EFA

1. HARNESS CONNECTOR



SVQF16126L

2. TERMINAL FUNCTION

CONNECTOR [C151-1]

Pin No.	Description	Connected to
1	2nd CAN [High]	Multi-Purpose Check Connector
2	2nd CAN [Low]	Multi-Purpose Check Connector
3	-	
4	-	
5	-	
6	-	
7	-	
8	-	
9	-	
10	Power Steering Switch signal input	Power Steering Switch
11	-	
12	-	
13	Clutch Switch signal input	Clutch Switch
14	-	
15	Alternator load signal input	Alternator
16	Cruise Switch ground	Cruise Switch
17	-	
18	A/C switch "ON" signal input	A/C Switch
19	-	
20	-	

Pin No.	Description	Connected to
21	Brake switch signal input	Brake Switch
22	-	
23	Brake lamp signal input	Brake Switch
24	-	
25	Cruise Switch signal input	Cruise Switch
26	A/C thermal switch signal input	A/C Thermal Switch
27	Diagnostic Data Line (K-Line)	Data Link Connector (DLC)
28	-	
29	-	
30	-	
31	-	
32	A/C Pressure Transducer signal input	A/C Pressure Transducer (APT)
33	Sensor ground	A/C Pressure Transducer (APT)
34	-	
35	-	
36	-	
37	-	
38	Battery voltage supply after main relay	Main Relay
39	Battery voltage supply after main relay	Main Relay
40	Battery voltage supply after main relay	Main Relay
41	CAN [High]	ABS/ESP Control Module
42	CAN [Low]	ABS/ESP Control Module
43	Main Relay control output	Main Relay
44	Intake Air Temperature Sensor signal input	Intake Air Temperature Sensor (IATS)
45	Immobilizer communication line	Immobilizer control module
46	-	
47	Mass Air Flow Sensor signal input	Mass Air Flow Sensor (MAFS)
48	Sensor ground	Accelerator Position Sensor (APS) #2
49	Accelerator Position Sensor #2 signal input	Accelerator Position Sensor (APS) #2
50	-	
51	Cruise "SET" lamp control output	Cruise "SET" Lamp
52	Vehicle speed signal input	ABS/ESP Control Module (With ABS/ESP [Euro-III/IV])
		Vehicle Speed Sensor (VSS) (Except Euro-III/IV)
53	Sensor ground	Intake Air Temperature Sensor (IATS)
54	Accelerator Position Sensor #1 signal input	Accelerator Position Sensor (APS) #1
55	Sensor ground	Accelerator Position Sensor (APS) #1
56	-	

GASOLINE ENGINE CONTROL SYSTEM

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Pin No.	Description	Connected to
57	Sensor (+5V)	Accelerator Position Sensor (APS) #2
58	Sensor (+5V)	A/C Pressure Transducer (APT)
59	Sensor (+5V)	Accelerator Position Sensor (APS) #1
60	-	
61	Engine speed signal output	Cluster (Tachometer)
62	Fuel consumption signal output	Trip Computer
63	Malfunction Indicator Lamp (MIL) control output	Cluster (Malfunction Indicator Lamp)
64	A/C Compressor Relay control output	A/C Compressor Relay
65	Cooling Fan [Low] control output	Cooling Fan Relay [Low]
66	Cooling Fan [High] control output	Cooling Fan Relay [High]
67	Variable Intake Solenoid Valve #2 control output	Variable Intake Solenoid (VIS) Valve #2 [Intake Manifold Side]
68	Throttle Position Sensor signal (PWM) output	ABS/ESP Control Module
69	Cruise "MAIN" lamp control output	Cruise "MAIN" Lamp
70	Fuel Pump Relay control output	Fuel Pump Relay
71	Variable Intake Solenoid Valve #1 control output	Variable Intake Solenoid (VIS) Valve #1 Surge Tank Side]
72	Immobilizer lamp control output	Immobilizer Lamp
73	-	
74	-	
75	-	
76	-	
77	-	
78	Purge Control Solenoid Valve control output	Purge Control Solenoid Valve (PCSV)
79	Wheel Speed Sensor [Low] signal input	Wheel Speed Sensor (WSS)(Without ABS/ESP [Euro-III/IV])
80	Wheel Speed Sensor [High] signal input	Wheel Speed Sensor (WSS)(Without ABS/ESP [Euro-III/IV])

CONNECTOR [C151-2]

Pin No.	Description	Connected to
1	ETC Motor [-] control output	ETC Motor (in ETC Module)
2	ETC Motor [+] control output	ETC Motor (in ETC Module)
3	-	
4	CVVT Oil Temperature Sensor signal input	CVVT Oil Temperature Sensor (OTS)
5	-	
6	-	
7	Engine Coolant Temperature Sensor signal input	Engine Coolant Temperature Sensor (ECTS)
8	Manifold Absolute Pressure Sensor signal input	Manifold Absolute Pressure Sensor (MAPS)

Pin No.	Description	Connected to
9	-	
10	-	
11	Reference voltage (+5V)	Manifold Absolute Pressure Sensor (MAPS)
12	Battery voltage supply after ignition switch	Ignition Switch
13	Reference voltage (+5V)	Throttle Position Sensor (TPS) #2
14	Sensor ground	Throttle Position Sensor (TPS) #1
15	Reference voltage (+5V)	Camshaft Position Sensor (CMPS) [Bank 2]
16	Reference voltage (+5V)	Throttle Position Sensor (TPS) #1
17	Sensor ground	Camshaft Position Sensor (CMPS) [Bank 2]
18	Sensor ground	Camshaft Position Sensor (CMPS) [Bank 1]
19	Ignition Coil (Cylinder #6) control output	Ignition Coil (Cylinder #6)
20	-	
21	Crankshaft Position Sensor [High] signal input	Crankshaft Position Sensor (CKPS)
22	-	
23	Sensor Shield	Knock Sensor (KS) [Bank 1], Knock Sensor (KS) [Bank 2]
24	Camshaft Position Sensor [Bank 2] signal input	Camshaft Position Sensor (CMPS) [Bank 2]
25	Camshaft Position Sensor [Bank 1] signal input	Camshaft Position Sensor (CMPS) [Bank 1]
26	-	
27	-	
28	Sensor ground	HO2S [B2 / S1] [Except for LEADED]
29	Sensor ground	HO2S [B2 / S2] [Euro-III/IV]
30	Sensor ground	HO2S [B1 / S1] [Except for LEADED]
31	Sensor ground	HO2S [B1 / S2] [Euro-III/IV]
32	Reference voltage (+5V)	Camshaft Position Sensor (CMPS) [Bank 1]
33	Sensor ground	Engine Coolant Temperature Sensor (ECTS)
34	Sensor ground	Manifold Absolute Pressure Sensor (MAPS), CVVT Oil Temperature Sensor (OTS)
35	Power ground	Chassis Ground
36	Power ground	Chassis Ground
37	Power ground	Chassis Ground
38	Power ground	Chassis Ground
39	Power ground	Chassis Ground
40	Ignition Coil (Cylinder #4) control output	Ignition Coil (Cylinder #4)
41	Crankshaft Position Sensor [Low] signal input	Crankshaft Position Sensor (CKPS)
42	-	
43	-	
44	-	

GASOLINE ENGINE CONTROL SYSTEM

FLA -65

Pin No.	Description	Connected to
45	-	
46	-	
47	-	
48	Throttle Position Sensor #1 signal input	Throttle Position Sensor (TPS) #1
49	Heated Oxygen Sensor [Bank 1 / Sensor 1] signal input	HO2S (B1/S1) [Except for LEADED]
50	Heated Oxygen Sensor [Bank 1 / Sensor 2] signal input	HO2S (B1/S2) [Euro-III/IV]
51	Heated Oxygen Sensor [Bank 2 / Sensor 1] signal input	HO2S (B2/S1) [Except for LEADED]
52	Heated Oxygen Sensor [Bank 2 / Sensor 2] signal input	HO2S (B2/S2) [Euro-III/IV]
53	Knock Sensor (KS) [Bank 2] [High] signal input	Knock Sensor (KS) [Bank 2]
54	Knock Sensor (KS) [Bank 2] [Low] signal input	Knock Sensor (KS) [Bank 2]
55	Knock Sensor (KS) [Bank 1] [Low] signal input	Knock Sensor (KS) [Bank 1]
56	Knock Sensor (KS) [Bank 1] [High] signal input	Knock Sensor (KS) [Bank 1]
57	Throttle Position Sensor #2 signal input	Throttle Position Sensor (TPS) #2
58	Sensor ground	Throttle Position Sensor (TPS) #2
59	-	
60	Ignition Coil (Cylinder #2) control output	Ignition Coil (Cylinder #2)
61	CVVT Oil Control Valve [Bank 2] control output	CVVT Oil Control Valve (OCV) [Bank 2]
62	CVVT Oil Control Valve [Bank 1] control output	CVVT Oil Control Valve (OCV) [Bank 1]
63	Injector (Cylinder #2) control output	Injector (Cylinder #2)
64	Injector (Cylinder #3) control output	Injector (Cylinder #3)
65	-	
66	-	
67	Heated Oxygen Sensor [Bank 2 / Sensor 1] Heater control output	HO2S [B2 / S1] [Except for LEADED]
68	Injector (Cylinder #4) control output	Injector (Cylinder #4)
69	Injector (Cylinder #5) control output	Injector (Cylinder #5)
70	Heated Oxygen Sensor [Bank 1 / Sensor 1] Heater control output	HO2S [B1 / S1] [Except for LEADED]
71	Injector (Cylinder #6) control output	Injector (Cylinder #6)
72	Injector (Cylinder #1) control output	Injector (Cylinder #1)
73	Heated Oxygen Sensor [Bank 2 / Sensor 2] Heater control output	HO2S [B2 / S2] [Euro-III/IV]
74	Heated Oxygen Sensor [Bank 1 / Sensor 2] Heater control output	HO2S [B1 / S2] [Euro-III/IV]
75	-	
76	Battery Power	Battery
77	Ignition Coil (Cylinder #3) control output	Ignition Coil (Cylinder #3)

FLA -66

FUEL SYSTEM

Pin No.	Description	Connected to
78	Ignition Coil (Cylinder #5) control output	Ignition Coil (Cylinder #5)
79	Ignition Coil (Cylinder #1) control output	Ignition Coil (Cylinder #1)
80	-	

GASOLINE ENGINE CONTROL SYSTEM

FLA -67

3. TERMINAL INPUT/OUTPUT SIGNAL

CONNECTOR [C151-1]

Pin No.	Description	Condition	Type	Level	Test Result
1	2nd CAN [High]	Idle	DC	2.0 ~ 3.0V	2.5V
2	2nd CAN [Low]	Idle	DC	2.0 ~ 3.0V	2.5V
3	-				
4	-				
5	-				
6	-				
7	-				
8	-				
9	-				
10	Power Steering Switch signal input	S/W ON	DC	Max. 0.5V	-0.125V
		S/W OFF		Battery Voltage	13.47V
11	-				
12	-				
13	Clutch Switch signal input				
14	-				
15	Alternator load signal input	Idle	Pulse	Hi: Battery Voltage	13.67V
				Lo: Max 1.5 V	-0.125mV
16	Cruise Switch ground	Idle	DC	Max. 50 mV	22.44mV
17	-				
18	A/C switch "ON" signal input	A/C Relay OFF	DC	Battery Voltage	12.37V
		A/C Relay ON		Max. 1.0V	-25mV
19	-				
20	-				
21	Brake switch signal input	Pedal Release	DC	Battery Voltage	13.97V
		Pedal Push		Max. 0.5V	-25mV
22	-				
23	Brake lamp signal input	Pedal Release	DC	Max. 0.5V	-225mV
		Pedal Push		Battery Voltage	12.97V
24	-				

Pin No.	Description	Condition	Type	Level	Test Result
25	Cruise Switch signal input	All Release	DC	4.3 ~ 4.7V	4.39V
		Main SW		Battery Voltage	13.37V
		Set SW		1.3 ~ 1.7V	1.38V
		Resume SW		2.8 ~ 3.2V	2.82V
		Cancel SW		-0.2 ~ 0.2V	-37.54mV
26	A/C thermal switch signal input	A/C OFF	DC	Max. 1.0V	-25mV
		A/C ON		Battery Voltage	12.57V
27	Diagnostic Data Line (K-Line)	When transmitting	Pulse	Hi: Min. Vbatt × 80%	11.57V
				Lo: Max. Vbatt × 20%	175mV
		When receiving		Hi: Min. Vbatt × 70%	
				Lo: Max. Vbatt × 30%	
28	-				
29	-				
30	-				
31	-				
32	A/C Pressure Transducer signal input	A/C OFF	DC	0 ~ 5V	1.36V
		A/C ON			1.83V
33	Sensor ground	Idle	DC	Max. 50 mV	22.66mV
34	-				
35	-				
36	-				
37	-				
38	Battery voltage supply after main relay	IG OFF	DC	Max. 1.0 V	-25mV
		IG ON		Battery Voltage	12.77V
39	Battery voltage supply after main relay	IG OFF	DC	Max. 1.0 V	-25mV
		IG ON		Battery Voltage	12.77V
40	Battery voltage supply after main relay	IG OFF	DC	Max. 1.0 V	-25mV
		IG ON		Battery Voltage	12.37V
41	CAN [High]	Recessive	Pulse	2.0 ~ 3.0 V	2.4V
		Dominant		2.75~4.5 V	3.56V
42	CAN [Low]	Recessive	Pulse	2.0 ~ 3.0 V	2.42V
		Dominant		0.5~2.25 V	1.62V
43	Main Relay control output	Relay ON	DC	Battery Voltage	0.875V
		Relay OFF		Max. 1.0V	12.47V

GASOLINE ENGINE CONTROL SYSTEM

FLA -69

Pin No.	Description	Condition	Type	Level	Test Result
44	Intake Air Temperature Sensor signal input	Idle	Ana-log	0 ~ 5V	2.05V
45	Immobilizer communication line	When communicating after IG ON	Pulse	Hi: Min. 8.5V	11.87V
				Lo: Max. 3.5V	875mV
46	-				
47	Mass Air Flow Sensor signal input	Idle	Pulse	Hi: Vcc	4.97V
				Lo: Max. 0.5V	70mV
48	Sensor ground	Idle	DC	Max. 50 mV	22.52mV
49	Accelerator Position Sensor #2 signal input	C.T	Ana-log	0.3 ~ 0.9V	0.38V
		W.O.T		1.5 ~ 3.0V	2V
50	-				
51	Cruise "SET" lamp control output	Cruise OFF	DC	Battery Voltage	12.57V
		Cruise ON		Max. 1.0V	-25mV
52	Vehicle speed signal input	Vehicle Run	Pulse	Hi: Min. 5.0V	11.07V
				Lo: Max. 1.0V	-125mV
53	Sensor ground	Idle	DC	Max. 50 mV	22.37mV
54	Accelerator Position Sensor #1 signal input	C.T	Ana-log	0.3 ~ 0.9V	819mV
		W.O.T		4.0 ~ 4.8V	4.01V
55	Sensor ground	Idle	DC	Max. 50mV	22.6mV
56	-				
57	Reference voltage (+5V)	IG OFF	DC	Max. 0.5V	4.95V
		IG ON		4.9 ~ 5.1V	-10mV
58	Reference voltage (+5V)	IG OFF	DC	Max. 0.5V	4.95V
		IG ON		4.9 ~ 5.1V	-10mV
59	Reference voltage (+5V)	IG OFF	DC	Max. 0.5V	4.95V
		IG ON		4.9 ~ 5.1V	-10mV
60	-				
61	Engine speed signal output	Idle	Pulse	Hi: Battery Voltage	13.57V
				Lo: Max. 0.5V	-25mV
				20 ~ 26Hz	
62	Fuel consumption signal output	Idle	Pulse	Hi: Battery Voltage	13.57V
				Lo: Max. 0.5V	-25mV
63	Malfunction Indicator Lamp (MIL) control output	Lamp OFF	DC	Hi: Battery Voltage	13.37V
		Lamp ON		Lo: Max. 2.0V	-25mV
64	A/C Compressor Relay control output	A/C OFF	DC	Battery Voltage	13.97V
		A/C ON		Max. 1.0V	175mV

FLA -70

FUEL SYSTEM

Pin No.	Description	Condition	Type	Level	Test Result
65	Cooling Fan [Low] control output	Fan OFF	DC	Battery Voltage	13.77V
		Fan ON		Max. 1.0V	175mV
66	Cooling Fan [High] control output	Fan OFF	DC	Battery Voltage	13.57V
		Fan ON		Max. 1.0V	-25mV
67	Variable Intake Solenoid Valve #2 control output	Active	DC	Max. 1.0 V	13.77
		Inactive		Battery Voltage	-25mV
68	Throttle Position Sensor signal (PWM) output	Idle	Pulse	Hi: Battery Voltage	13.37V
				Lo: 0 ~ 0.5 V	-25mV
69	Cruise "MAIN" lamp control output	Cruise OFF	DC	Battery Voltage	12.37V
		Cruise ON		Max. 1.0V	-25mV
70	Fuel Pump Relay control output	Relay OFF	DC	Battery Voltage	12.57V
		Relay ON		Max. 1.0V	-25mV
71	Variable Intake Solenoid Valve #1 control output	Active	DC	Max. 1.0 V	175mV
		Inactive		Battery Voltage	13.77V
72	Immobilizer lamp control output	Lamp OFF	DC	Battery Voltage	12.77V
		Lamp ON		Max. 1.0V	-25mV
73	-				
74	-				
75	-				
76	-				
77	-				
78	Purge Control Solenoid Valve control output	Inactive	Pulse	Hi: Battery Voltage	13.83V
		Active		Lo: Max. 1.0V	31.54mV
79	Wheel Speed Sensor [Low] signal input				
80	Wheel Speed Sensor [High] signal input				

CONNECTOR [C151-2]

Pin No.	Description	Condition	Type	Level	Test Result
1	ETC Motor [-] control output	Idle	Pulse	Hi: Battery Voltage	14.07V
				Lo: Max . 1.0V	-125mV
2	ETC Motor [+] control output	Idle	Pulse	Hi: Battery Voltage	14.07V
				Lo: Max . 1.0V	-325mV
3	-				
4	CVVT Oil Temperature Sensor signal input	Idle	Ana-log	0 ~ 5.0V	282mV at 96 °C

GASOLINE ENGINE CONTROL SYSTEM

FLA -71

Pin No.	Description	Condition	Type	Level	Test Result
5	-				
6	-				
7	Engine Coolant Temperature Sensor signal input	Idle	Ana-log	0 ~ 5.0V	1.88V
8	Manifold Absolute Pressure Sensor signal input	IG ON	Ana-log	3.9 ~ 4.1V	3.96V
		Idle		0.8 ~ 1.6V	1.31V
9	-				
10	-				
11	Reference voltage (+5V)	IG OFF	DC	Max. 0.5V	4.91V
		IG ON		4.9 ~ 5.1V	-50mV
12	Battery voltage supply after ignition switch	IG OFF	DC	Max. 0.5 V	13.87V
		IG ON		Battery Voltage	-125mV
13	Reference voltage (+5V)	IG OFF	DC	Max. 0.5V	4.89V
		IG ON		4.9 ~ 5.1V	-70mV
14	Sensor ground	Idle	DC	Max. 50 mV	19.77mV
15	Reference voltage (+5V)	IG OFF	DC	Max. 0.5V	4.91V
		IG ON		4.9 ~ 5.1V	-50mV
16	Reference voltage (+5V)	IG OFF	DC	Max. 0.5V	4.91V
		IG ON		4.9 ~ 5.1V	-50mV
17	Sensor ground	Idle	DC	Max. 50 mV	21.1mV
18	Sensor ground	Idle	DC	Max. 50 mV	20.87mV
19	Ignition Coil (Cylinder #6) control output	Idle	Pulse	1st Voltage: 200~400V	278V
				ON Voltage: Max. 2V	1.97V
20	-				
21	Crankshaft Position Sensor [High] signal input	Idle	SINE WAVE	Vp_p : Min.1.0V	41.6V
22	-				
23	Sensor Shield	Idle	DC	Max. 50 mV	21.41mV
24	Camshaft Position Sensor [Bank 2] signal input	Idle	Pulse	Hi: Vcc	4.95V
				Lo: Max . 0.5V	-10mV
25	Camshaft Position Sensor [Bank 1] signal input	Idle	Pulse	Hi: Vcc	4.95V
				Lo: Max . 0.5V	-10mV
26	-				
27	-				
28	Sensor ground	Idle	DC	Max. 50 mV	20.73mV
29	Sensor ground	Idle	DC	Max. 50 mV	21.9mV
30	Sensor ground	Idle	DC	Max. 50 mV	20.16mV

Pin No.	Description	Condition	Type	Level	Test Result
31	Sensor ground	Idle	DC	Max. 50 mV	20.63mV
32	Reference voltage (+5V)	IG OFF	DC	Max. 0.5V	4.91V
		IG ON		4.9 ~ 5.1V	-50mV
33	Sensor ground	Idle	DC	Max. 50 mV	22.52mV
34	Sensor ground	Idle	DC	Max. 50 mV	20.99mV
35	Power ground	Idle	DC	Max. 50 mV	
36	Power ground	Idle	DC	Max. 50 mV	
37	Power ground	Idle	DC	Max. 50 mV	
38	Power ground	Idle	DC	Max. 50 mV	
39	Power ground	Idle	DC	Max. 50 mV	
40	Ignition Coil (Cylinder #4) control output	Idle	Pulse	1st Voltage: 2300~400V	294V
				ON Voltage: Max. 2V	1.93V
41	Crankshaft Position Sensor [Low] signal input	Idle	SINE WAVE	Vp_p: Min.1.0V	8.24V
42	-				
43	-				
44	-				
45	-				
46	-				
47	-				
48	Throttle Position Sensor #1 signal input	C.T	Ana-log	0.25 ~ 0.9V	0.68V
		W.O.T		Min. 4.0V	4.27V
49	Heated Oxygen Sensor [Bank 1 / Sensor 1] signal input	Racing	DC	Rich: 0.6 ~ 1.0V	774mV
				Lean: 0 ~ 0.4V	137mV
50	Heated Oxygen Sensor [Bank 1 / Sensor 2] signal input	Racing	DC	Rich: 0.6 ~ 1.0V	
				Lean: 0 ~ 0.4V	
51	Heated Oxygen Sensor [Bank 2 / Sensor 1] signal input	Racing	DC	Rich: 0.6 ~ 1.0V	705.2mV
				Lean: 0 ~ 0.4V	82mV
52	Heated Oxygen Sensor [Bank 2 / Sensor 2] signal input	Racing	DC	Rich: 0.6 ~ 1.0V	
				Lean: 0 ~ 0.4V	
53	Knock Sensor (KS) [Bank 2] [High] signal input	Knocking	Variable Frequency	-0.3 ~ 0.3 V	
		Normal		0 V	
54	Knock Sensor (KS) [Bank 2] [Low] signal input	Knocking	Variable Frequency	-0.3 ~ 0.3 V	
		Normal		0 V	

GASOLINE ENGINE CONTROL SYSTEM

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Pin No.	Description	Condition	Type	Level	Test Result
55	Knock Sensor (KS) [Bank 1] [Low] signal input	Knocking	Variable Frequency	-0.3 ~ 0.3 V	
		Normal		0 V	
56	Knock Sensor (KS) [Bank 1] [High] signal input	Knocking	Variable Frequency	-0.3 ~ 0.3 V	
		Normal		0 V	
57	Throttle Position Sensor #2 signal input	C.T	Analog	Min. 4.0V	4.23V
		W.O.T		0.25 ~ 0.9V	703mV
58	Sensor ground	Idle	DC	Max. 50 mV	21.64mV
59	-				
60	Ignition Coil (Cylinder #2) control output	Idle	Pulse	1st Voltage: 200~400V	305V
				ON Voltage: Max. 2V	1.85V
61	CVVT Oil Control Valve [Bank 2] control output	Idle	Pulse	Battery Voltage	14.45V
				Max. 1.0V	50mV
62	CVVT Oil Control Valve [Bank 1] control output	Idle	Pulse	Battery Voltage	14.47V
				Max. 1.0V	75mV
63	Injector (Cylinder #2) control output	Idle	Pulse	Battery Voltage	14.06V
				Max. 1.0V	44.2mV
64	Injector (Cylinder #3) control output	Idle	Pulse	Battery Voltage	14V
				Max. 1.0V	38.31mV
65	-				
66	-				
67	Heated Oxygen Sensor [Bank 2 / Sensor 1] Heater control output	Engine Run	Pulse	Hi: Battery Voltage	14.07V
				Lo: Max. 1.0V	275mV
68	Injector (Cylinder #4) control output	Idle	Pulse	Hi: Battery Voltage	13.96V
				Lo: Max. 1.0V	55.71mV
69	Injector (Cylinder #5) control output	Idle	Pulse	Hi: Battery Voltage	14V
				Lo: Max. 1.0V	40.82mV
70	Heated Oxygen Sensor [Bank 1 / Sensor 1] Heater control output	Engine Run	Pulse	Hi: Battery Voltage	14.07V
				Lo: Max. 1.0V	275mV
71	Injector (Cylinder #6) control output	Idle	Pulse	Hi: Battery Voltage	13.95mV
				Lo: Max. 1.0V	55.77mV

FLA -74

FUEL SYSTEM

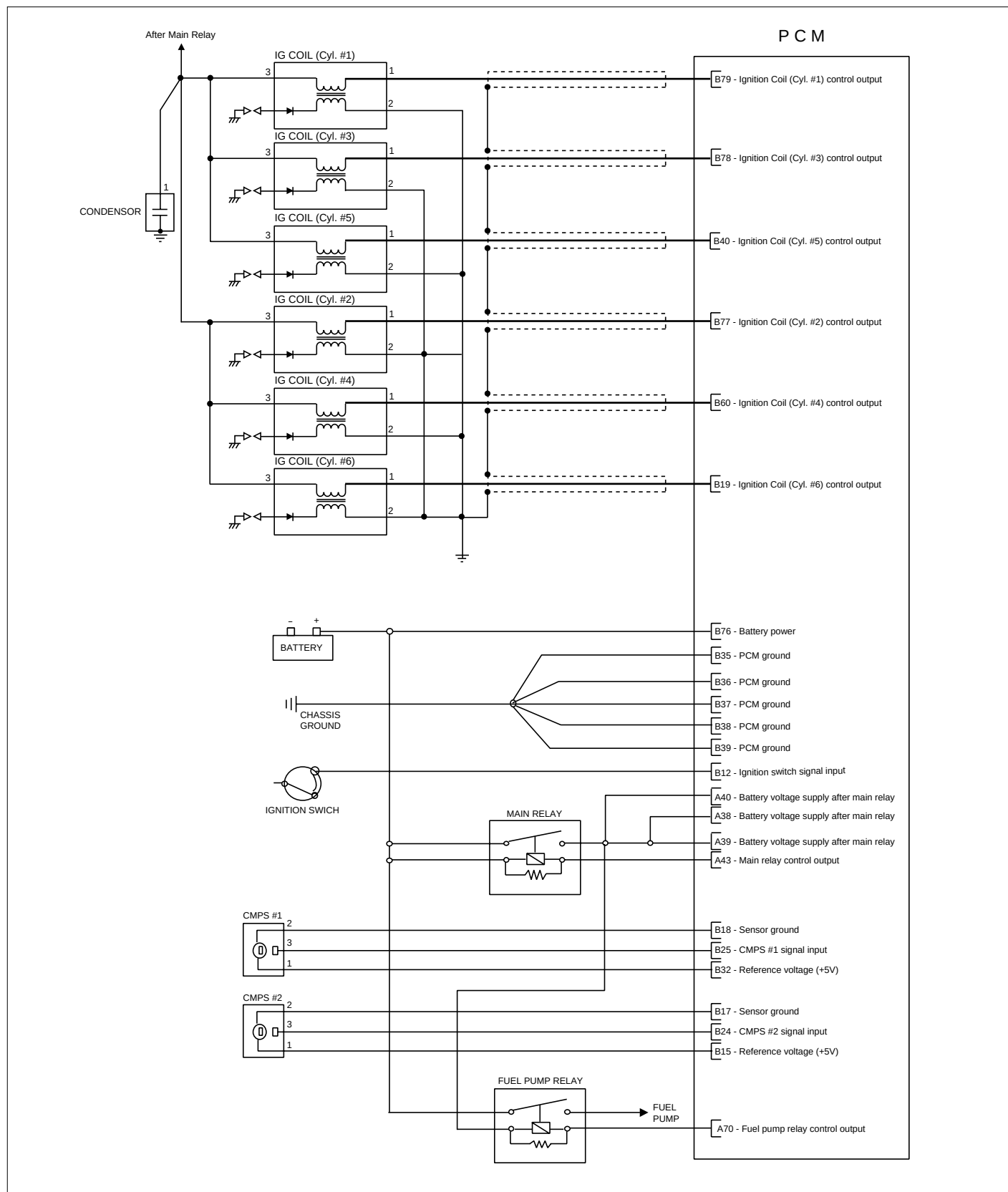
Pin No.	Description	Condition	Type	Level	Test Result
72	Injector (Cylinder #1) control output	Idle	Pulse	Hi: Battery Voltage	14.07V
				Lo: Max. 1.0V	56.7mV
73	Heated Oxygen Sensor [Bank 2 / Sensor 2] Heater control output	Engine Run	Pulse	Hi: Battery Voltage	13.87V
				Lo: Max. 1.0V	275mV
74	Heated Oxygen Sensor [Bank 1 / Sensor 2] Heater control output	Engine Run	Pulse	Hi: Battery Voltage	14.07V
				Lo: Max. 1.0V	275mV
75	-				
76	Battery Power	Always	DC	Battery Voltage	12.39V
				1.0 mA or below 1.5 mA	0.34mA
77	Ignition Coil (Cylinder #3) control output	Idle	Pulse	1st Voltage: 200~400V	289V
				ON Voltage: Max. 2V	1.87V
78	Ignition Coil (Cylinder #5) control output	Idle	Pulse	1st Voltage: 200~400V	279V
				ON Voltage: Max. 2V	1.93V
79	Ignition Coil (Cylinder #1) control output	Idle	Pulse	1st Voltage: 200~400V	269V
				ON Voltage: Max. 2V	1.91V
80	-				

GASOLINE ENGINE CONTROL SYSTEM

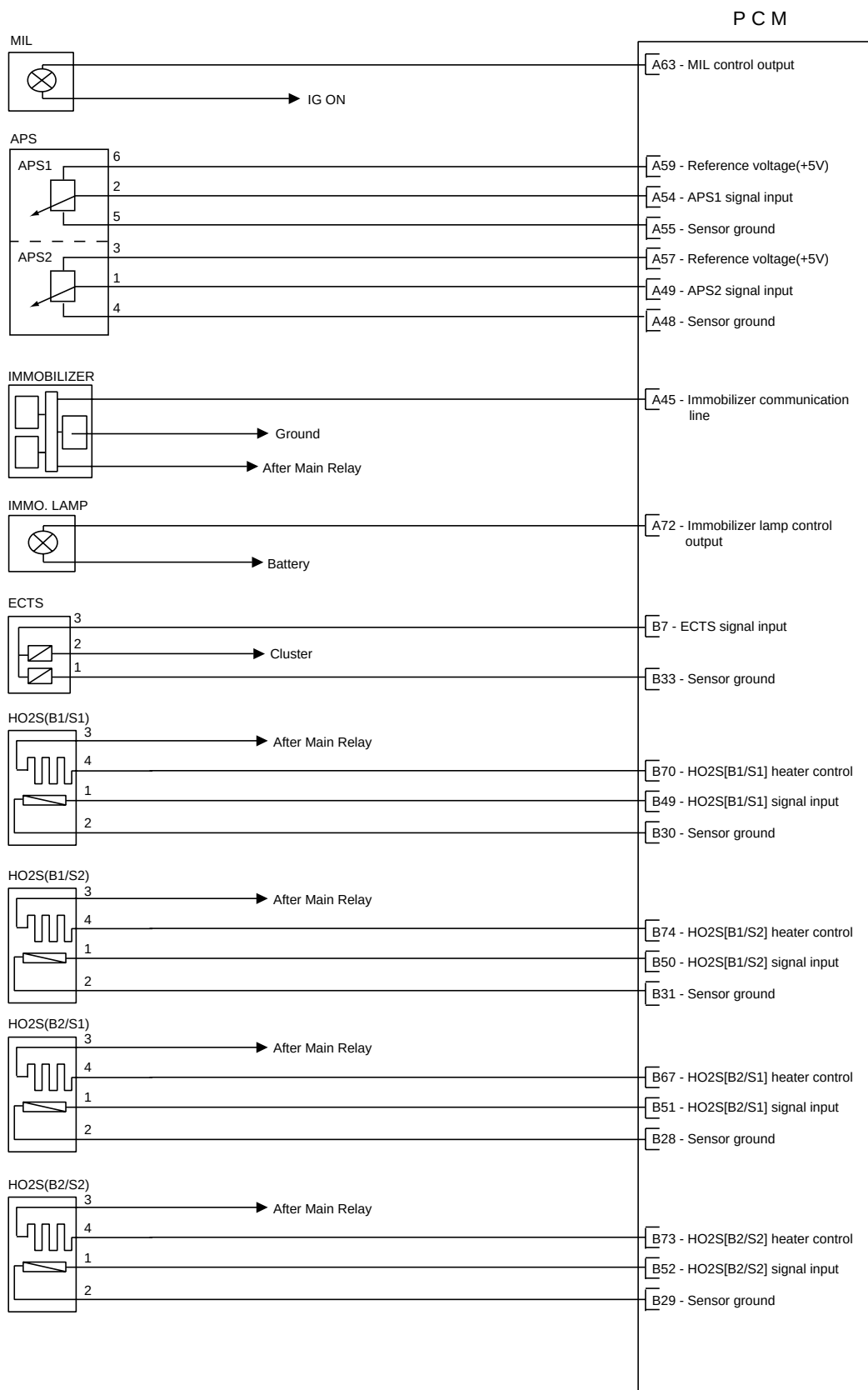
FLA -75

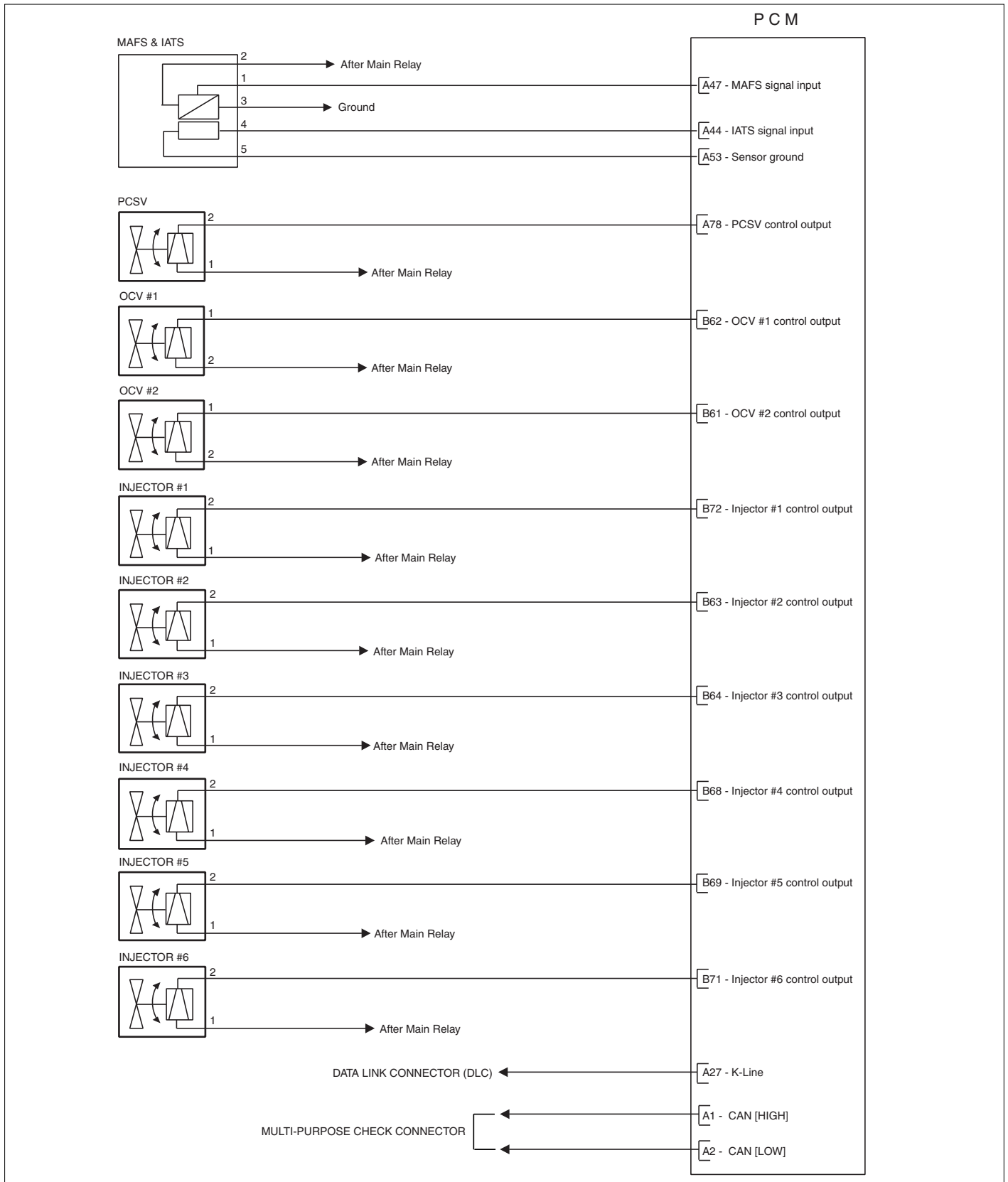
CIRCUIT DIAGRAM

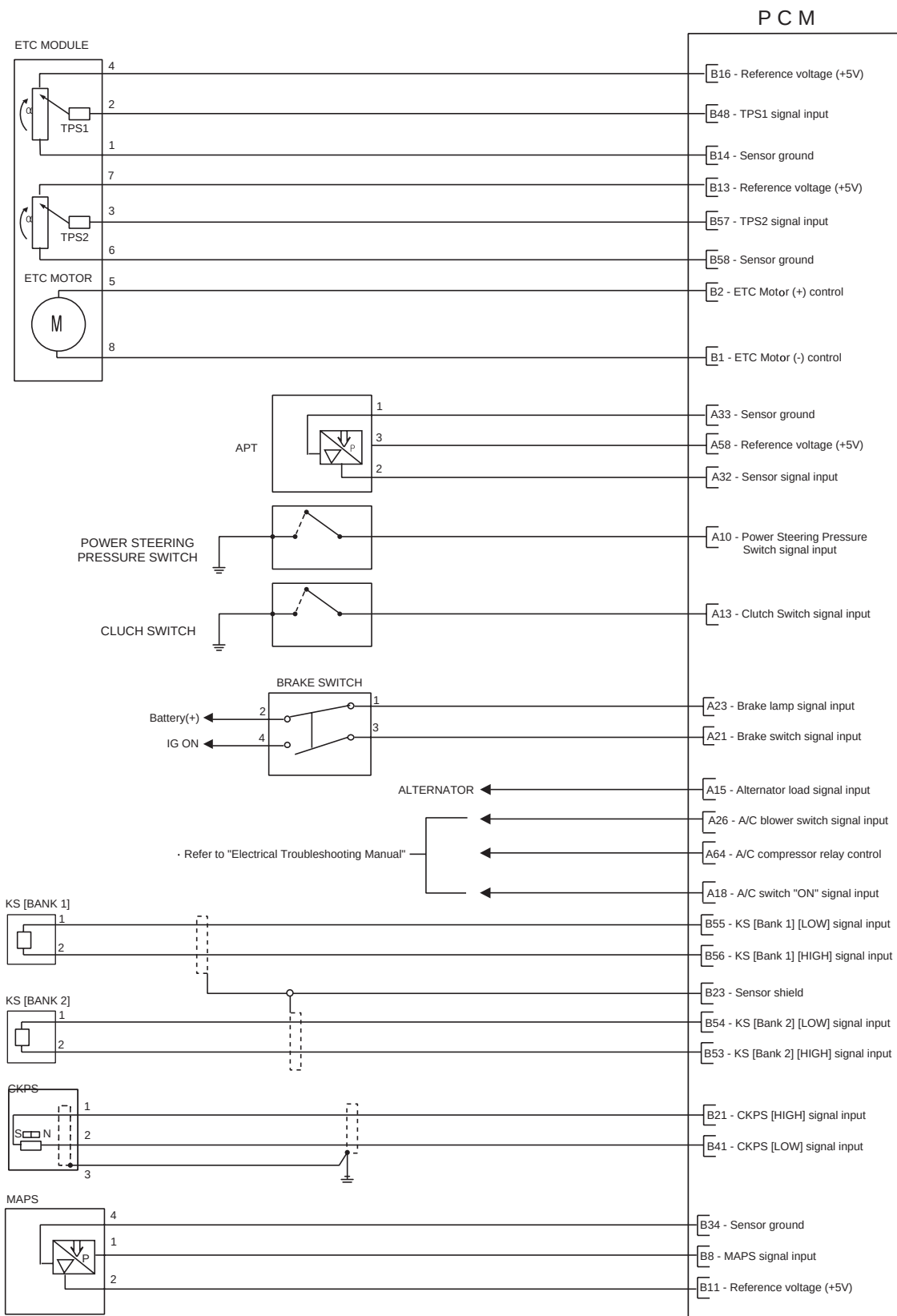
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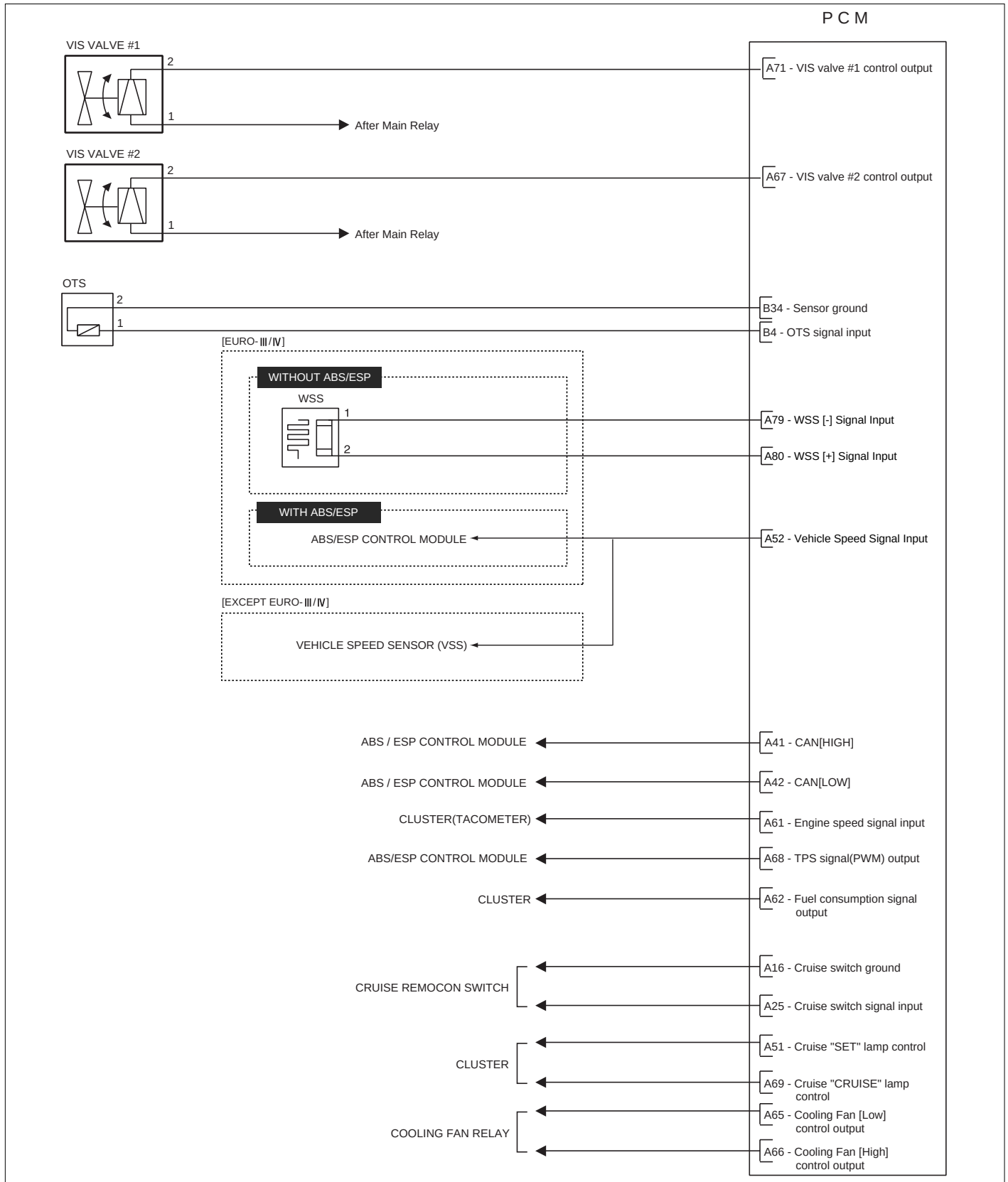


SCMF16127L









PCM PROBLEM INSPECTION

PROCEDURE

E8D133BD

1. TEST PCM GROUND CIRCUIT: Measure resistance between PCM and chassis ground using the backside of PCM harness connector as PCM side check point. If the problem is found, repair it.

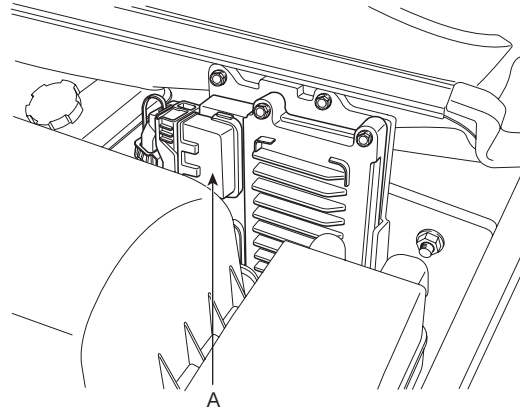
Specification (Resistance): 1Ω or less

2. TEST PCM CONNECTOR: Disconnect the PCM connector and visually check the ground terminals on PCM side and harness side for bent pins or poor contact pressure. If the problem is found, repair it.
3. If problem is not found in Step 1 and 2, the PCM could be faulty. If so, replace the PCM with a new one, and then check the vehicle again. If the vehicle operates normally then the problem was likely with the PCM.
4. RE-TEST THE ORIGINAL PCM : Install the original PCM (may be broken) into a known-good vehicle and check the vehicle. If the problem occurs again, replace the original PCM with a new one. If problem does not occur, this is intermittent problem (Refer to INTERMITTENT PROBLEM PROCEDURE in BASIC INSPECTION PROCEDURE).

REPLACEMENT

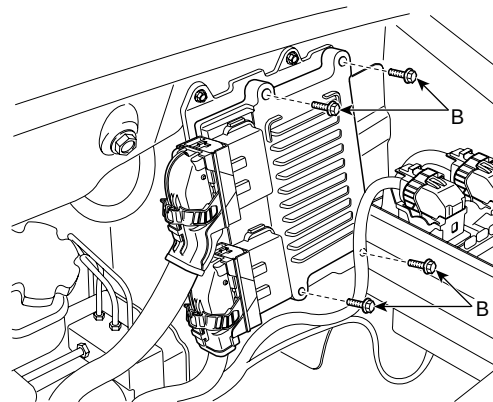
E46FE7BF

1. Turn ignition switch off.
2. Disconnect the battery (-) cable from the battery.
3. Disconnect the PCM connectors (A).



SVQF16131L

4. Unscrew the PCM mounting bolts (B) and remove the PCM from the air cleaner assembly.



SVQF16132L

5. Install a new PCM.

PCM installation bolts: 9.8 ~ 11.8 N·m (1.0 ~ 1.2 kgf·m, 7.2 ~ 8.7 lbf·ft)

DTC TROUBLESHOOTING PROCEDURES

INSPECTION CHART FOR DIAGNOSTIC

TROUBLE CODES (DTC) EDC4C348

DTC	Description	MIL			Page
		Euro-III/IV	Euro-II	Leaded	
P0012	"A" Camshaft Position-Timing Over-Retarded (Bank 1)	●	▲	▲	FLA-87
P0016	Crankshaft Position-Camshaft Position Correlation (Bank 1 Sensor A)	●	▲	▲	FLA-92
P0018	Crankshaft Position-Camshaft Position Correlation (Bank 2 Sensor A)	●	▲	▲	FLA-98
P0022	"A" Camshaft Position-Timing Over-Retarded (Bank 2)	●	▲	▲	FLA-103
P0026	Intake Valve Control Solenoid Circuit Range/Performance (Bank 1)	●	▲	▲	FLA-107
P0028	Intake Valve Control Solenoid Circuit Range/Performance (Bank 2)	●	▲	▲	FLA-114
P0030	HO2S Heater Control Circuit (Bank 1 / Sensor 1)	●			FLA-118
P0031	HO2S Heater Circuit Low (Bank 1 / Sensor 1)	●	▲		FLA-123
P0032	HO2S Heater Circuit High (Bank 1 / Sensor 1)	●	▲		FLA-126
P0036	HO2S Heater Control Circuit (Bank 1 / Sensor 2)	●			FLA-129
P0037	HO2S Heater Circuit Low (Bank 1 / Sensor 2)	●			FLA-134
P0038	HO2S Heater Circuit High (Bank 1 / Sensor 2)	●			FLA-137
P0050	HO2S Heater Control Circuit (Bank 2 / Sensor 1)	●			FLA-140
P0051	HO2S Heater Circuit Low (Bank 2 / Sensor 1)	●	▲		FLA-145
P0052	HO2S Heater Circuit High (Bank 2 / Sensor 1)	●	▲		FLA-148
P0056	HO2S Heater Control Circuit (Bank 2 / Sensor 2)	●			FLA-151
P0057	HO2S Heater Circuit Low (Bank 2 / Sensor 2)	●			FLA-156
P0058	HO2S Heater Circuit High (Bank 2 / Sensor 2)	●			FLA-159
P0076	Intake Valve Control Solenoid Circuit Low (Bank 1)	●	▲	▲	FLA-162
P0077	Intake Valve Control Solenoid Circuit High (Bank 1)	●	▲	▲	FLA-168
P0082	Intake Valve Control Solenoid Circuit Low (Bank 2)	●	▲	▲	FLA-171
P0083	Intake Valve Control Solenoid Circuit High (Bank 2)	●	▲	▲	FLA-177
P0101	Mass or Volume Air Flow Circuit Range/Performance	●	▲	▲	FLA-180
P0102	Mass or Volume Air Flow Circuit Low Input	●	●	●	FLA-185
P0103	Mass or Volume Air Flow Circuit High Input	●	●	●	FLA-190
P0106	Manifold Absolute Pressure/Barometric Pressure Circuit Range/Performance	▲			FLA-193

DTC	Description	MIL			Page
		Euro-III/IV	Euro-II	Leaded	
P0107	Manifold Absolute Pressure/Barometric Pressure Circuit Low Input	●	●	●	FLA-198
P0108	Manifold Absolute Pressure/Barometric Pressure Circuit High Input	●	●	●	FLA-202
P0110	Intake Air Temperature Sensor1 Circuit	▲			FLA-206
P0111	Intake Air Temperature Sensor1 Circuit Range/Performance	▲			FLA-211
P0112	Intake Air Temperature Sensor 1 Circuit Low Input	●	▲	▲	FLA-214
P0113	Intake Air Temperature Sensor 1 Circuit High Input	●	▲	▲	FLA-218
P0117	Engine Coolant Temperature Circuit Low Input	●	●	●	FLA-223
P0118	Engine Coolant Temperature Circuit High Input	●	●	●	FLA-229
P0122	Throttle/Pedal Position Sensor/Switch "A" Circuit Low Input	●	●	●	FLA-234
P0123	Throttle/Pedal Position Sensor/Switch "A" Circuit High Input	●	●	●	FLA-240
P0131	HO2S Circuit Low Voltage (Bank 1 / Sensor 1)	●	▲		FLA-244
P0132	HO2S Circuit High Voltage (Bank 1 / Sensor 1)	●	▲		FLA-251
P0133	HO2S Circuit Slow Response (Bank 1 / Sensor 1)	●			FLA-254
P0134	HO2S Circuit No Activity Detected (Bank 1 / Sensor 1)	●	▲		FLA-256
P0137	HO2S Circuit Low Voltage (Bank 1 / Sensor 2)	●			FLA-260
P0138	HO2S Circuit High Voltage (Bank 1 / Sensor 2)	●			FLA-267
P0140	HO2S Circuit No Activity Detected (Bank 1 / Sensor 2)	●			FLA-270
P0151	HO2S Circuit Low Voltage (Bank 2 / Sensor 1)	●	▲		FLA-274
P0152	HO2S Circuit High Voltage (Bank 2 / Sensor 1)	●	▲		FLA-281
P0153	HO2S Circuit Slow Response (Bank 2 / Sensor 1)	●			FLA-284
P0154	HO2S Circuit No Activity Detected (Bank 2 / Sensor 1)	●	▲		FLA-286
P0157	HO2S Circuit Low Voltage (Bank 2 / Sensor 2)	●			FLA-290
P0158	HO2S Circuit High Voltage (Bank 2 / Sensor 2)	●			FLA-297
P0160	HO2S Circuit No Activity Detected (Bank 2 / Sensor 2)	●			FLA-300
P0171	System Too Lean (Bank 1)	●	▲		FLA-304
P0172	System Too Rich (Bank 1)	●	▲		FLA-308
P0174	System Too Lean (Bank 2)	●	▲		FLA-311
P0175	System Too Rich (Bank 2)	●	▲		FLA-315
P0197	Engine Oil Temp. Sensor Low Input	●	▲	▲	FLA-318
P0198	Engine Oil Temp. Sensor High Input	●	▲	▲	FLA-324
P0217	Engine Coolant Over Temperature Condition	▲			FLA-328
P0222	Throttle/Pedal Position Sensor/Switch "B" Circuit Low Input	●	●	●	FLA-332

DTC TROUBLESHOOTING PROCEDURES

FLA -83

DTC	Description	MIL			Page
		Euro-III/IV	Euro-II	Leaded	
P0223	Throttle/Pedal Position Sensor/Switch "B" Circuit High Input	●	●	●	FLA-339
P0230	Fuel Pump Primary Circuit	▲	▲	▲	FLA-343
P0261	Cylinder 1-Injector Circuit Low	●	●	●	FLA-349
P0262	Cylinder 1-Injector Circuit High	●	●	●	FLA-355
P0264	Cylinder 2-Injector Circuit Low	●	●	●	FLA-358
P0265	Cylinder 2-Injector Circuit High	●	●	●	FLA-364
P0267	Cylinder 3-Injector Circuit Low	●	●	●	FLA-367
P0268	Cylinder 3-Injector Circuit High	●	●	●	FLA-373
P0270	Cylinder 4-Injector Circuit Low	●	●	●	FLA-376
P0271	Cylinder 4-Injector Circuit High	●	●	●	FLA-382
P0273	Cylinder 5-Injector Circuit Low	●	●	●	FLA-385
P0274	Cylinder 5-Injector Circuit High	●	●	●	FLA-391
P0276	Cylinder 6-Injector Circuit Low	●	●	●	FLA-394
P0277	Cylinder 6-Injector Circuit High	●	●	●	FLA-400
P0300	Random/Multiple Cylinder Misfire Detected	●			FLA-403
P0301	Cylinder 1-Misfire detected	●			FLA-409
P0302	Cylinder 2-Misfire detected	●			FLA-409
P0303	Cylinder 3-Misfire detected	●			FLA-409
P0304	Cylinder 4-Misfire detected	●			FLA-409
P0305	Cylinder 5-Misfire detected	●			FLA-409
P0306	Cylinder 6-Misfire detected	●			FLA-409
P0315	Segment Time Acquisition Incorrect	▲			FLA-415
P0325	Knock Sensor 1 Circuit	▲	▲	▲	FLA-418
P0326	Knock Sensor 1 Circuit Range/Performance (Bank 1)	▲	▲	▲	FLA-422
P0330	Knock Sensor 2 Circuit	▲	▲	▲	FLA-424
P0331	Knock Sensor 2 Circuit Range/Performance (Bank 2)	▲	▲	▲	FLA-428
P0335	Crankshaft Position Sensor A Circuit	●	▲	▲	FLA-430
P0336	Crankshaft Position Sensor A Circuit Range/Performance	●	▲	▲	FLA-436
P0340	Camshaft Position Sensor A Circuit Malfunction (Bank 1 or Single Sensor)	●	▲	▲	FLA-440
P0341	Camshaft Position Sensor A Circuit Range/Performance (Bank 1 or Single Sensor)	●	▲	▲	FLA-446
P0346	Camshaft Position Sensor "A" Circuit Range/Performance (Bank 2)	●	▲	▲	FLA-449

DTC	Description	MIL			Page
		Euro-III/IV	Euro-II	Leaded	
P0351	Ignition Coil 'A' Primary / Secondary Circuit	●	▲	▲	FLA-454
P0352	Ignition Coil 'B' Primary / Secondary Circuit	●	▲	▲	FLA-454
P0353	Ignition Coil 'C' Primary / Secondary Circuit	●	▲	▲	FLA-454
P0354	Ignition Coil 'D' Primary / Secondary Circuit	●	▲	▲	FLA-454
P0355	Ignition Coil 'E' Primary / Secondary Circuit	●	▲	▲	FLA-454
P0356	Ignition Coil 'F' Primary / Secondary Circuit	●	▲	▲	FLA-454
P0420	Catalyst System Efficiency below Thershold (Bank 1)	●			FLA-461
P0430	Catalyst System Efficiency below Thershold (Bank 2)	●			FLA-464
P0444	Evap. Emission System-Purge Ctrl. Valve Circuit Open	●			FLA-467
P0445	Evap. Emission System-Purge Ctrl. Valve Circuit Shorted	●			FLA-473
P0501	Vehicle Speed Sensor A Range/Performance	●	●	●	FLA-475
P0504	Brake pedal position A/B correaltion	●	▲	▲	FLA-484
P0506	Idle Air Control System-RPM lower than expected	●			FLA-489
P0507	Idle Air Control System-RPM higher than expected	●			FLA-491
P0532	A/C Refrigerant Pressure Sensor "A" Circuit Low Input	▲	▲	▲	FLA-493
P0533	A/C Refrigerant Pressure Sensor "A" Circuit High Input	▲	▲	▲	FLA-499
P0562	System Voltage Low	●	▲	▲	FLA-503
P0563	System Voltage High	●	▲	▲	FLA-510
P0571	Brake Switch "A" Circuit	●	▲	▲	FLA-515
P0601	EEPROM-Check sum Error	●	▲	▲	FLA-520
P0602	EEPROM-Programing Error	●	▲	▲	FLA-523
P0604	Internal Control Module Random Access Memory (RAM) Error	●	▲	▲	FLA-524
P0606	ECM/PCM Processor(ECM-SELF TEST Failed)	●	▲	▲	FLA-525
P0638	Throttle Actuator Control Range/Performance	●	▲	▲	FLA-526
P0641	Sensor Reference Voltage "A" Circuit Open	●	▲	▲	FLA-534
P0646	A/C Clutch Relay Control Circuit Low	▲	▲	▲	FLA-539
P0647	A/C Clutch Relay Control Circuit High	▲	▲	▲	FLA-545
P0650	Malfunction Indicator Lamp(MIL) Control Circuit	▲			FLA-548
P0651	Sensor Reference Voltage "B" Circuit Open	●	▲	▲	FLA-553
P0660	Intake Manifold Tuning Valve Control Circuit/Open (Bank 1)	●	▲	▲	FLA-558
P0663	Intake Manifold Tuning Valve Control Circuit/Open (Bank 2)	●	▲	▲	FLA-564
P0685	ECM/PCM Power Relay Control Circuit /Open	▲	▲	▲	FLA-570

DTC TROUBLESHOOTING PROCEDURES

FLA -85

DTC	Description	MIL			Page
		Euro-III/IV	Euro-II	Leaded	
P1106	Manifold Absolute Pressure Sensor Circuit Short - Intermittent High Input	▲	▲	▲	FLA-577
P1107	Manifold Absolute Pressure Sensor Circuit Short - Intermittent Low Input	▲	▲	▲	FLA-584
P1111	Intake Air Temperature Sensor Circuit Short - Intermittent High Input	▲	▲	▲	FLA-588
P1112	Intake Air Temperature Sensor Circuit Short - Intermittent Low Input	▲	▲	▲	FLA-595
P1114	Engine Coolant Temperature Sensor Circuit - Intermittent Low Input	▲	▲	▲	FLA-599
P1115	Engine Coolant Temperature Sensor Circuit - Intermittent High Input	▲	▲	▲	FLA-605
P1295	ETC (Electronic Throttle Control) System Malfunction - Power Management	●	●	●	FLA-610
P1523	ETC (Electronic Throttle Control) System Malfunction - Throttle Valve Stuck	▲	▲	▲	FLA-613
P2104	ETC (Electronic Throttle Control) System Malfunction - Forced Idle	●	●	●	FLA-617
P2105	ETC (Electronic Throttle Control) System Malfunction - Forced Engine Shutdown	●	●	●	FLA-618
P2106	ETC (Electronic Throttle Control) System Malfunction - Forced Limited Power	●	●	●	FLA-619
P2122	Throttle/Pedal Position Sensor/Switch "D" Circuit Low Input	●	▲	▲	FLA-620
P2123	Throttle/Pedal Position Sensor/Switch "D" Circuit High Input	●	▲	▲	FLA-626
P2127	Throttle/Pedal Position Sensor/Switch "E" Circuit Low Input	●	▲	▲	FLA-629
P2128	Throttle/Pedal Position Sensor/Switch "E" Circuit High Input	●	▲	▲	FLA-633
P2135	Throttle/Pedal Position Sensor/Switch "A" / "B" Voltage Correlation	●	▲	▲	FLA-639
P2138	Throttle/Pedal Position Sensor/Switch "D" / "E" Voltage Correlation	●	▲	▲	FLA-645
P2173	ETC (Electronic Throttle Control) System Malfunction - High Air flow Detected	●	▲	▲	FLA-648
P2187	System Too Lean at Idle (←Additive) (Bank 1)	●	▲		FLA-653
P2188	System Too Rich at Idle (Bank 1)	●	▲		FLA-657
P2189	System Too Lean at Idle (←Additive) (Bank 2)	●	▲		FLA-660
P2190	System Too Rich at Idle (Bank 2)	●	▲		FLA-663
P2195	HO2S Signal Stuck Lean (Bank 1 / Sensor 1)	●	▲		FLA-666
P2196	HO2S Signal Stuck Rich (Bank 1 / Sensor 1)	●	▲		FLA-672
P2197	HO2S Signal Stuck Lean (Bank 2 / Sensor 1)	●	▲		FLA-675
P2198	HO2S Signal Stuck Rich (Bank 2 / Sensor 1)	●	▲		FLA-681
P2270	HO2S Signal Stuck Lean (Bank 1 / Sensor 2)	●			FLA-684
P2271	HO2S Signal Stuck Rich (Bank 1 / Sensor 2)	●			FLA-690
P2272	HO2S Signal Stuck Lean (Bank 2 / Sensor 2)	●			FLA-693

DTC	Description	MIL			Page
		Euro-III/IV	Euro-II	Leaded	
P2273	HO2S Signal Stuck Rich (Bank 2 / Sensor 2)	●			FLA-699
P2610	ECM/PCM Internal Engine Off Timer Performance	●	▲	▲	FLA-702
U0001	CAN Communication Malfunction	●	▲	▲	FLA-705



NOTE

●: MIL ON & MEMORY

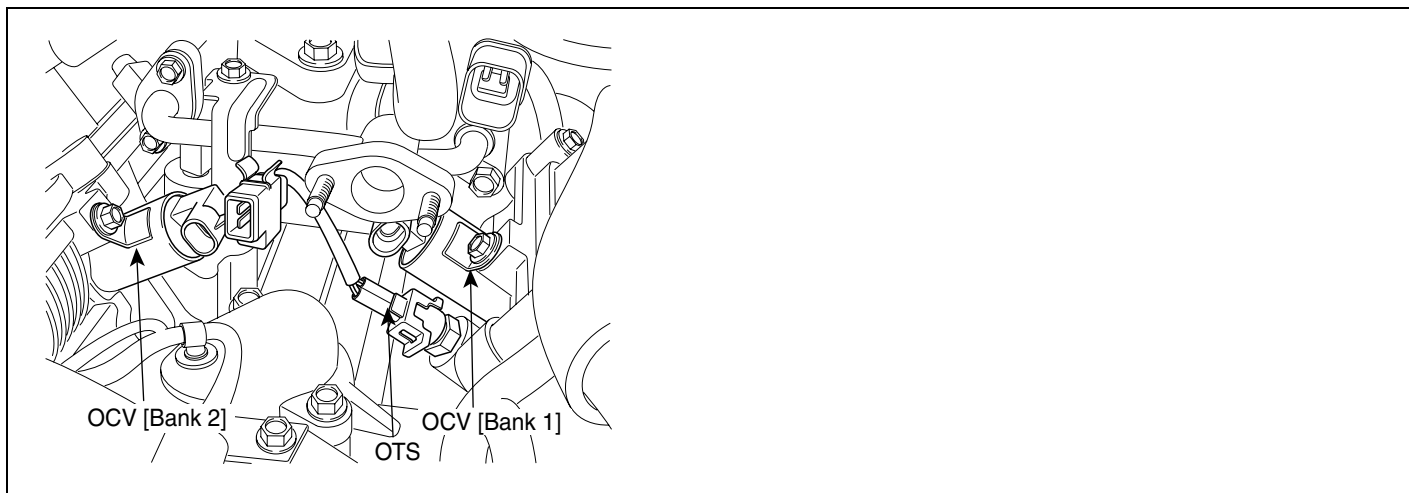
▲: MIL OFF & MEMORY

DTC TROUBLESHOOTING PROCEDURES

FLA -87

DTC P0012 "A" CAMSHAFT POSITION-TIMING OVER-RETARDED (BANK 1)

COMPONENT LOCATION EB1C8851



LGLG500A

GENERAL DESCRIPTION E79D28F8

The CVVT (Continuously Variable Valve Timing) system is installed to the chain sprocket of the intake camshaft. This system controls the intake camshaft to provide the optimal valve timing for every driving condition. The ECM controls the Oil Control Valve(OCV), based on the signals output from mass air flow, throttle position and engine coolant temperature. The CVVT controller regulates the intake camshaft angle using oil pressure through the OCV. As result, the relative position between the camshaft and the crankshaft becomes optimal, and the engine torque improves, fuel economy improves, exhaust emissions decrease under overall driving conditions.

DTC DESCRIPTION E2078BC1

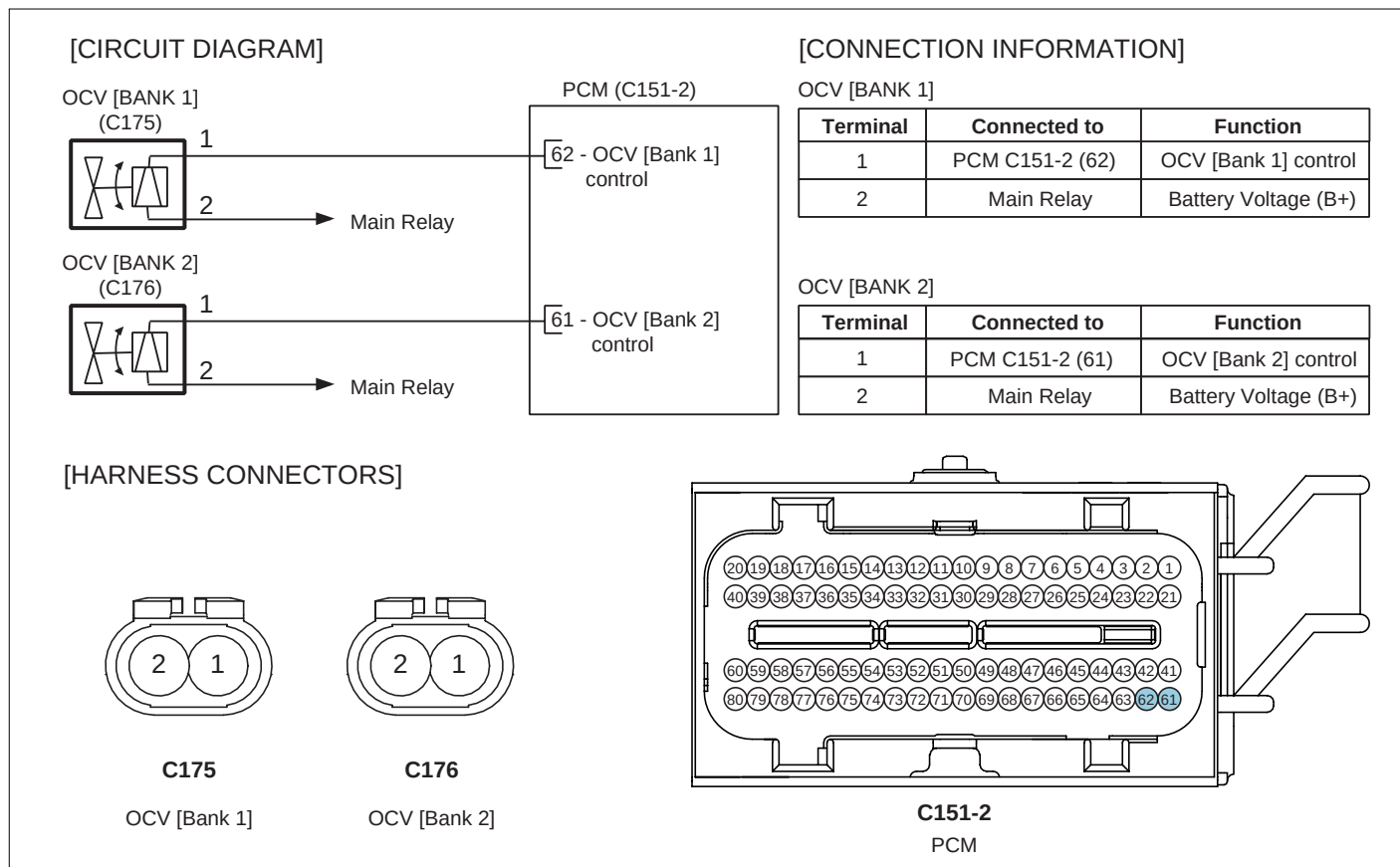
PCM monitors CAM phaser error while CMP signal is normally generating and vehicle is driving in 2000 ~ 3000rpm. If the CAM phaser does not move although PCM commands OCV duty cycle PCM determines that a fault exists and a DTC is stored.

DTC DETECTING CONDITION E2DF22AE

Item		Detecting Condition	Possible cause
DTC Strategy		Determines if the phaser is stuck or has steady-state error	- Engine Oil - OCV stuck - CVVT stuck
Enable Conditions		- CAM signal is normally generating - Vehicle is on driving (2000 ~ 3000RPM) for 5 minutes.	
Thresh old value	Case 1	5 CAD < Cam Actual Position < 50 CAD - Duty Cycle > 90% or Duty Cycle < 10%	
	Case 2	- Cam Position error > 15 CAD (Difference between Actual Postion and Desire Position is more than 15°) - Timing Counter > 80	
Diagnosis Time		Continuous (within 5min.)	
MIL On Condition		2 Driving Cycles	

SCHEMATIC DIAGRAM

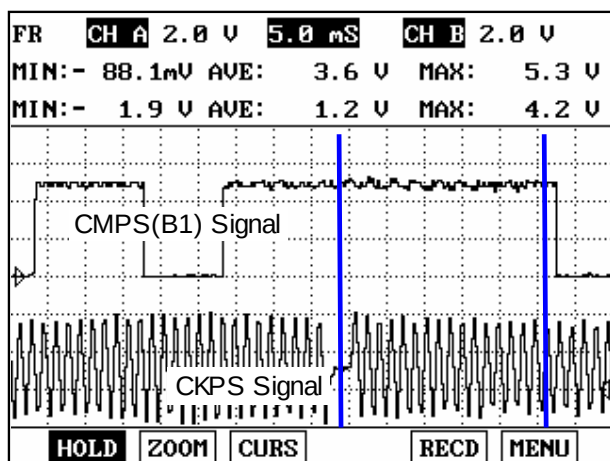
E6FF558E



SVQF16115L

SIGNAL WAVEFORM AND DATA

ED93FF6C



This example shows a typical Crankshaft Position Sensor (CKPS) and Camshaft Position Sensor (CMPS) waveform at idle. If the 17th signal of the CKPS after missing tooth is aligned with the high signal of the CMPS at idle, PCM recognizes that Synchronization between CKPS and CMPS is completed.

SVQF16600L

MONITOR DTC STATUS

E962DDB8

1. Check DTC Status
 - 1) Connect scantool to Data Link Connector(DLC).
 - 2) IG "ON".

DTC TROUBLESHOOTING PROCEDURES

FLA -89

- 3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F4(DTAL) to check DTC's information from the DTCs menu
- 4) Read "DTC Status" parameter.

1.1 DIAGNOSTIC TROUBLE CODES		
PXXXX DTC TITLE		
NUMBER OF DTC : 1 ITEMS		
PART	ERAS	DTAL

PXXXX TITLE	
1.MIL STATUS:	ON/OFF
2.DTC STATUS:	PRESENT/HISTORY
3.DIAG.STATUS:	DIAGNOSIS FINISHED
DTC CAUSE TO SYSTEM ERROR : PXXXX	

SCMF16159L

- 5) Is parameter displayed "Present fault"?

YES

- ▶ Go to "System Inspection" procedure.

NO

- ▶ Fault is intermittent caused by PCM memory was not cleared after repair. Erase DTC and drive the vehicle to satisfy the enable codition then, go to " System Inspection" procedure.

SYSTEM INSPECTION E77A6F95

1. Visual Inspection

- 1) Check oil level is O.K.
- 2) Check oil is contaminated.
- 3) Has a problem been found ?

YES

- ▶ Repair or replace as necessary and then, go to " Verification of Vehicle Repair" procedure.

NO

- ▶ Go to "Component Inspection" procedure.

COMPONENT INSPECTION E696E30F

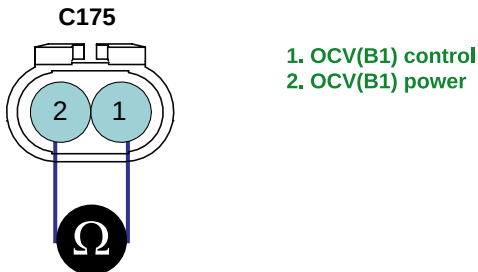
1. Check OCV resistance

- 1) IG "OFF" and disconnect OCV connector.

- 2) Measure resistance between terminal 1 and 2 of OCV. (Component Side)

SPECIFICATION :

Resistance (Ω)	6.6 ~ 7.7



SVQF16154L

- 3) Is the measured resistance within specification ?

YES

- Go to "Check CAM PHASER with actuation test" as follows.

NO

- Substitute with a known - good OCV and check for proper operation.
If the problem is corrected, replace OCV and go to "Verification of Vehicle Repair" procedure.

2. Check CAM PHASER with actuation test

- 1) Connect scantool and IG "ON".
- 2) Select "CAM PHASER INTAKE BANK 1" on the Actuation Test.
- 3) Select "OIL CONTROL VALVE" on the Actuation Test.
- 4) Activates "CAM PHASER INTAKE BANK 1" by pressing "STRT(F1)" key.
- 5) Activates "OIL CONTROL VALVE" by pressing "STRT(F1)" key.
- 6) Repeat this procedure 4 or 5 times to ensure CAM PHASER and intake valve control solenoid reliability.

1.4 ACTUATION TEST		24/29
CAM PHASER INTAKE BANK 1		
DURATION	UNTIL STOP KEY	
METHOD	ACTIVATION	
CONDITION	IG.KEY ON ENGINE RUNNING	
PRESS [STRT], IF YOU ARE READY ? SELECT TEST ITEM USING UP/DOWN KEY		
STRT	STOP	

1.11 ACTUATION TEST		12/25
OIL CONTROL VALVE		
DURATION	UNTIL STOP KEY	
METHOD	ACTIVATION	
CONDITION	IG.KEY ON ENGINE OFF	
PRESS [STRT], IF YOU ARE READY ! SELECT TEST ITEM USING UP/DOWN KEY		
STRT	STOP	

SVQF16601L

DTC TROUBLESHOOTING PROCEDURES

FLA -91

7) Has a problem been found ?

YES

► Substitute with a known - good CVVT or OCV and check for proper operation.
If the problem is corrected, replace CVVT or OCV and go to "Verification of Vehicle Repair" procedure.

NO

► Fault is intermittent. Drive the vehicle to meet the enable condition for the DTC. and Go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E9B7C331

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

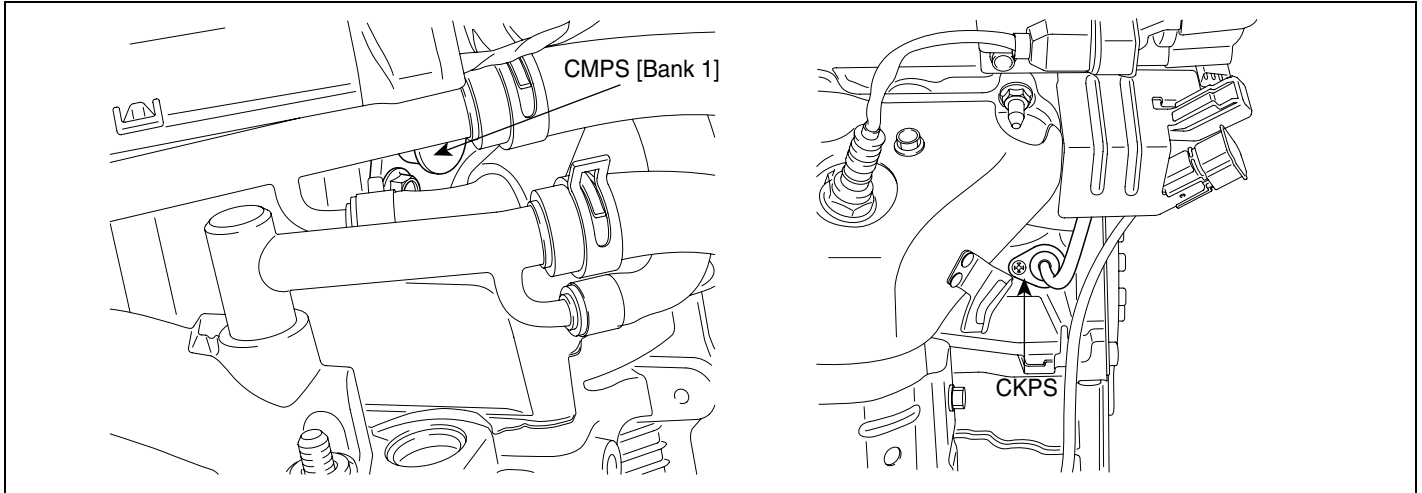
► System performing to specification at this time. Clear the DTC.

NO

► Go to the applicable troubleshooting procedure.

DTC P0016 CRANKSHAFT POSITION-CAMSHAFT POSITION CORRELATION (BANK 1 SENSOR A)

COMPONENT LOCATION EAA97372



LGLG501A

GENERAL DESCRIPTION E10B26F9

The CVVT (Continuously Variable Valve Timing) system is installed to the chain sprocket of the intake camshaft. This system controls the intake camshaft to provide the optimal valve timing for every driving condition. The ECM controls the Oil Control Valve(OCV), based on the signals output from mass air flow, throttle position and engine coolant temperature. The CVVT controller regulates the intake camshaft angle using oil pressure through the OCV. As result, the relative position between the camshaft and the crankshaft becomes optimal, and the engine torque improves, fuel economy improves, exhaust emissions decrease under overall driving conditions.

DTC DESCRIPTION EAEA7CB5

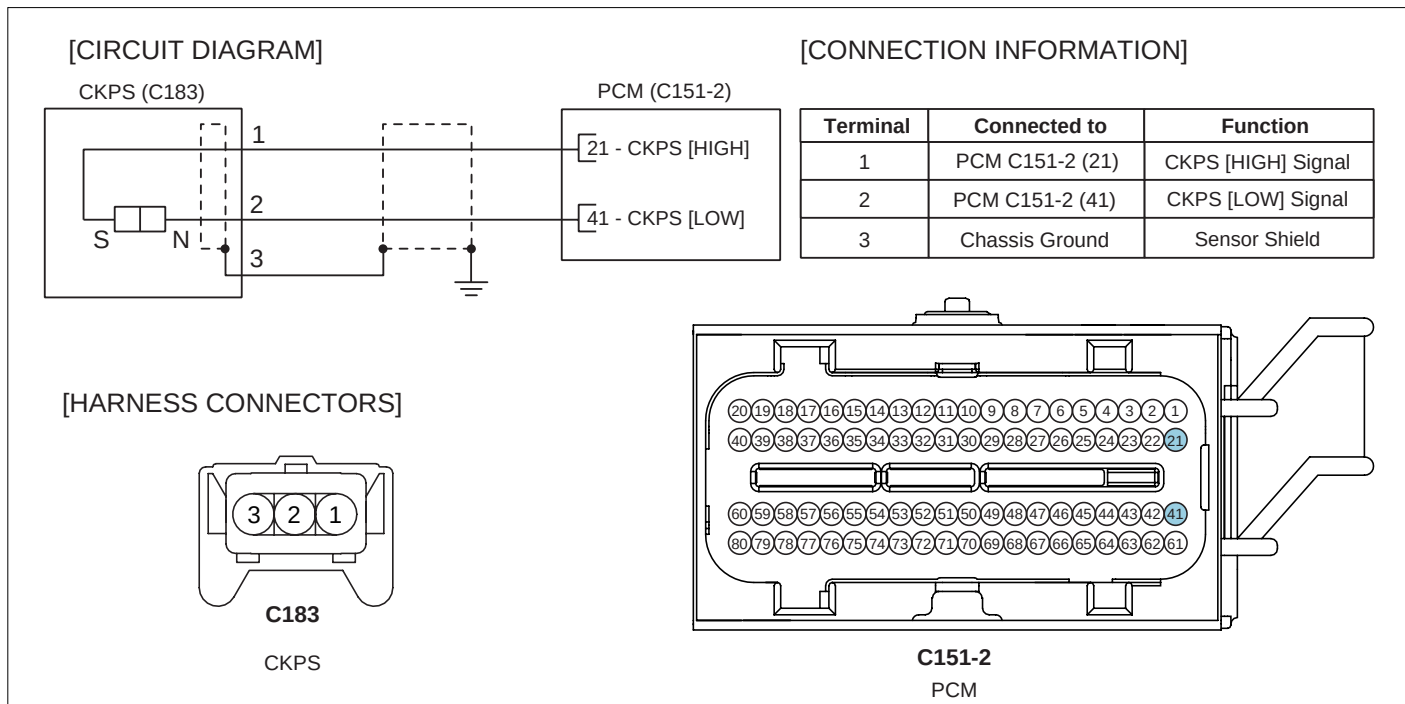
PCM monitors timing misalignment while no active faults is present and fully warmed up engine oil at idle. If the timing is misaligned PCM determines that a fault exists and a DTC is stored.

DTC DETECTING CONDITION EB7F927C

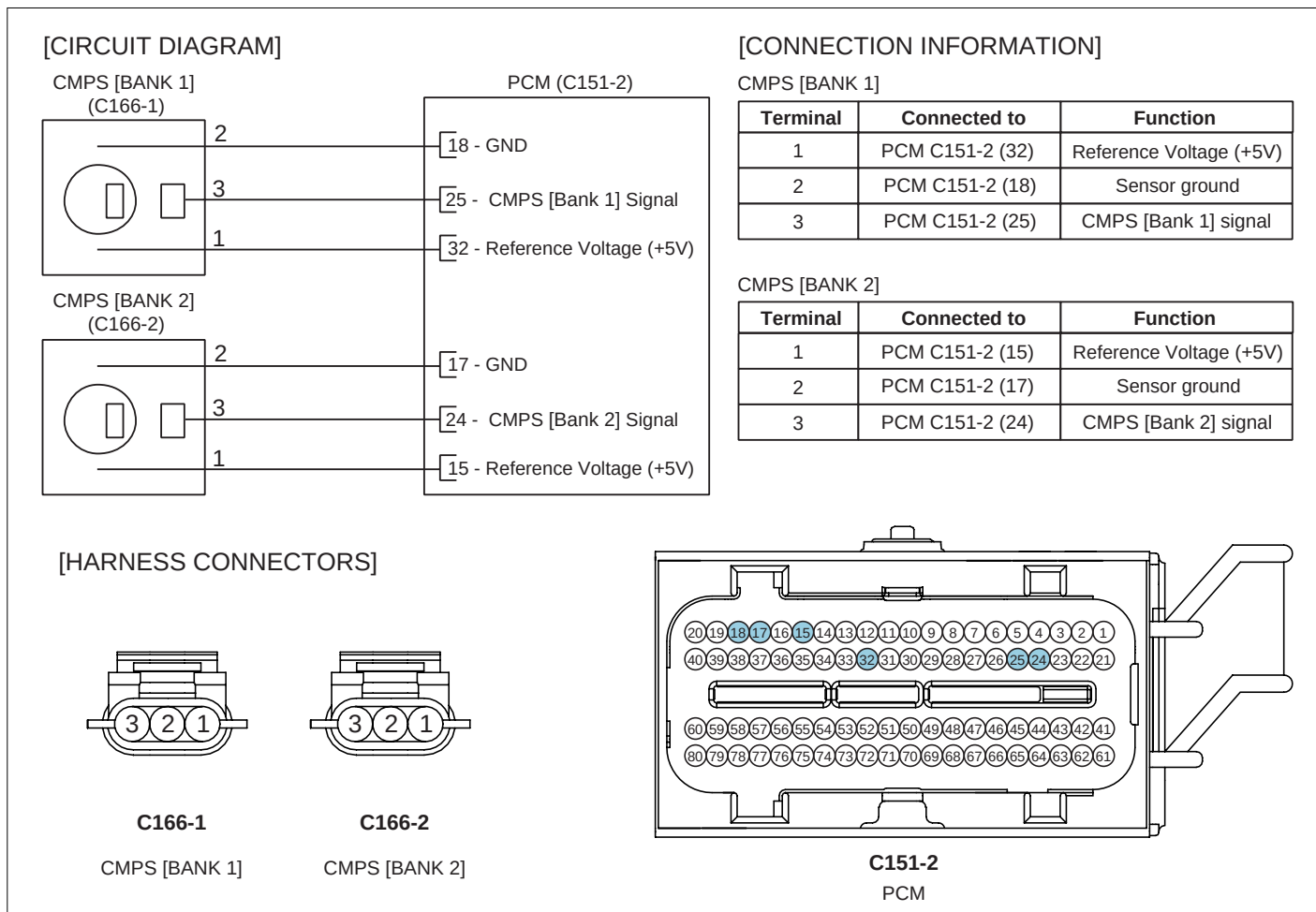
Item		Detecting Condition	Possible cause
DTC Strategy		Determines if CAM target is aligned correctly to crank	- loosened CKPS - Timing Misalignment
Enable Conditions		- No active faults - Fully warmed up at idle	
Thresh old value	Case 1	1 teeth misalignment at 80 °C(176 °F) < Oil Temperature < 90 °C(194°F)	
	Case 2	2 tooth misalignment at Lower than 80 °C(176 °F) or Higher than 90 °C(194°F)	
Diagnosis Time		Continuous (Within 1min.)	
MIL On Condition		2 driving Cycles	

SCHEMATIC DIAGRAM

E40CE2FC



SVQF16109L



SVQF16108L

YES

- Repair or replace as necessary and then, go to " Verification of Vehicle Repair" procedure.

NO

- Go to "Visually check CKPS and target wheel" as follow.

2. Visually check CKPS and target wheel

- 1) IG "OFF.
- 2) Visually check CKPS is loosened or target wheel is deformed or damaged.
- 3) Is the above items normal ?

YES

- Go to " Check CAM PHASER with actuation test" as follows.

NO

- Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

3. Check CAM PHASER with actuation test.

- 1) connect scantool and IG "ON".
- 2) Select "CAM PHASER INTAKE BANK 1" on the Actuation Test.
- 3) Select "OIL CONTROL VALVE" on the Actuation Test.
- 4) Activates "CAM PHASER INTAKE BANK 1" by pressing "STRT(F1)" key.
- 5) Activates "OIL CONTROL VALVE" by pressing "STRT(F1)" key.
- 6) Repeat this procedure 4 or 5 times to ensure CAM PHASER and intake valve control solenoid reliability.

1.4 ACTUATION TEST		24/29
CAM PHASER INTAKE BANK 1		
DURATION	UNTIL STOP KEY	
METHOD	ACTIVATION	
CONDITION	IG.KEY ON ENGINE RUNNING	
PRESS [STRT], IF YOU ARE READY ! SELECT TEST ITEM USING UP/DOWN KEY		
STRT	STOP	

1.11 ACTUATION TEST		12/25
OIL CONTROL VALVE		
DURATION	UNTIL STOP KEY	
METHOD	ACTIVATION	
CONDITION	IG.KEY ON ENGINE OFF	
PRESS [STRT], IF YOU ARE READY ? SELECT TEST ITEM USING UP/DOWN KEY		
STRT	STOP	

SVQF16601L

7) Has a problem been found ?

YES

► Substitute with a known - good CVVT or OCV and check for proper operation. If the problem is corrected, replace CVVT or OCV and go to "Verification of Vehicle Repair" procedure.

NO

► Fault is intermittent. Drive the vehicle to meet the enable condition for the DTC. and Go to "Component Inspection" procedure.

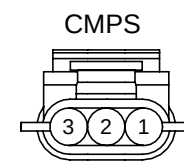
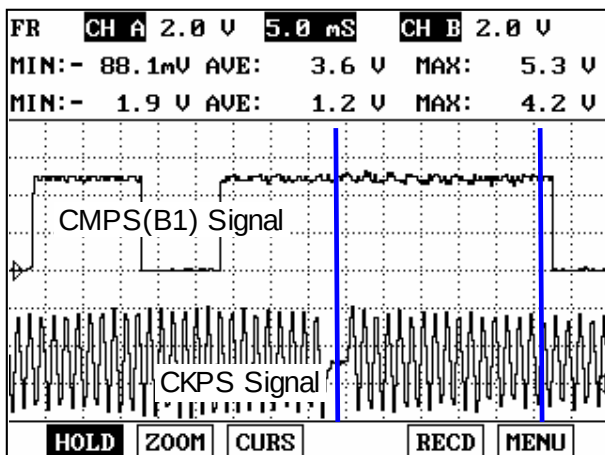
COMPONENT INSPECTION E7B4B3FB

1. CMPS, CKPS Inspection

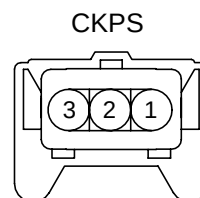
- 1) IG "OFF" and connect scantool.
- 2) ENG "ON" and Measure signal waveform at terminal 3 of CMPS.
- 3) Measure signal waveform at terminal 1 or 2 of CKPS.

Specification :

17th signal of the CKPS after missing tooth is aligned with the high signal of the CMPS at idle, PCM recognizes that Synchronization between CKPS and CMPS is completed.



1. Sensor Power
2. Sensor Ground
3. CMPS signal



1. CKPS Signal High
2. CKPS Signal Low
3. Shield Ground

SVQF16602L

- 4) Is the measured signal waveform O.K ?

YES

► Fault is intermittent. Drive the vehicle to meet the enable condition for the DTC. and go to "Verification of Vehicle Repair" procedure.

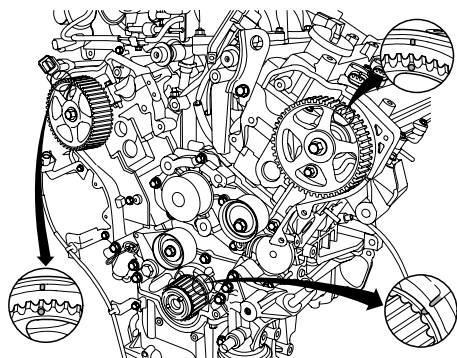
NO

► Go to "Timing Mark Inspection" procedure as follow.

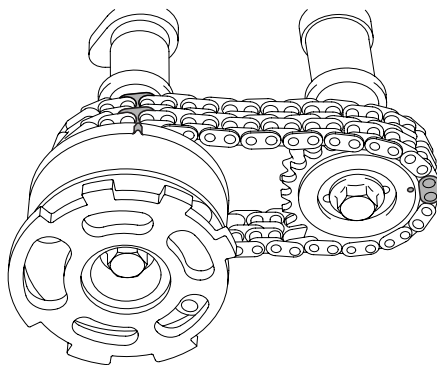
2. Timing Mark Inspection.

- 1) IG "OFF" and check the timing mark is correctly aligned.

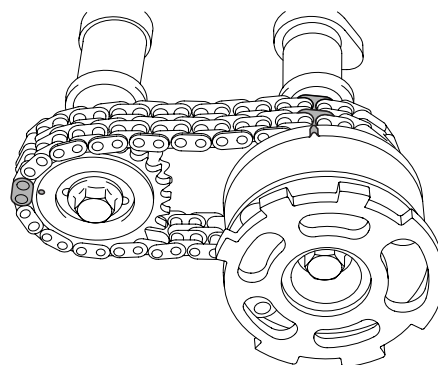
REFERENCE :



[Timing Belt]



[Cam (Bank 1)]



[Cam (Bank 2)]

LGLG502A

2) Is the timing mark correctly aligned

YES

► Fault is intermittent. Drive the vehicle to meet the enable condition for the DTC. and go to "Verification of Vehicle Repair" procedure.

NO

► Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E0018BFF

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

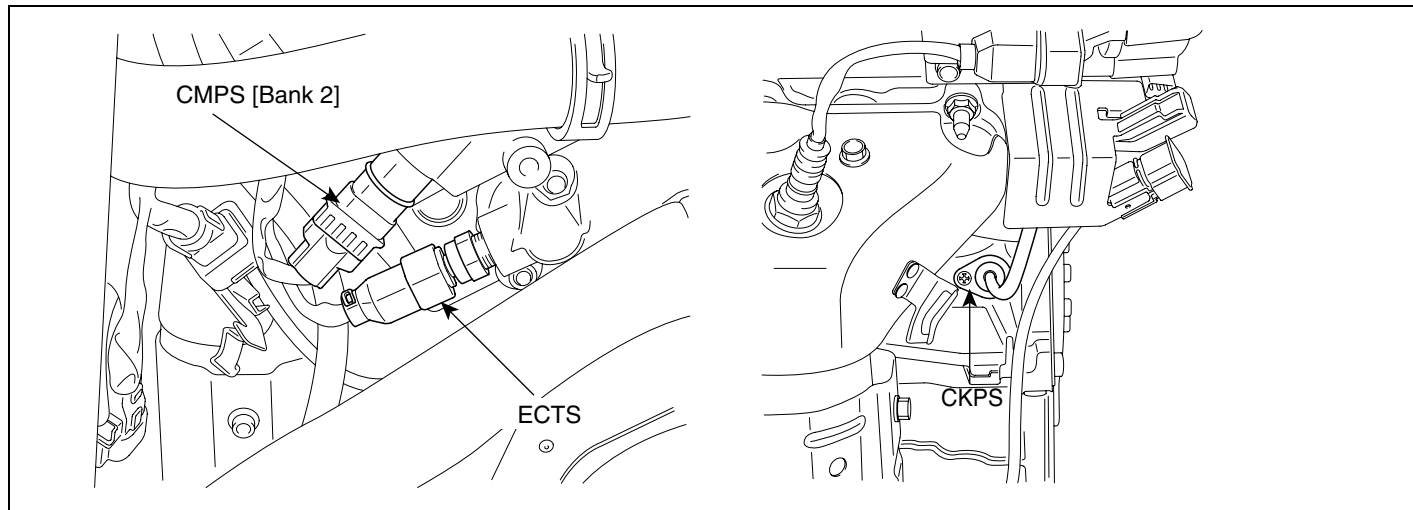
► System performing to specification at this time. Clear the DTC.

NO

► Go to the applicable troubleshooting procedure.

DTC P0018 CRANKSHAFT POSITION-CAMSHAFT POSITION CORRELATION (BANK 2 SENSOR A)

COMPONENT LOCATION E9A57234



LGLG503A

GENERAL DESCRIPTION E89D6CDB

Refer to DTC P0016.

DTC DESCRIPTION EC70DF23

PCM monitors timing misalignment while no active faults is present and fully warmed up engine oil at idle. If the timing is misaligned PCM determines that a fault exists and a DTC is stored.

DTC DETECTING CONDITION E48B7379

Item		Detecting Condition	Possible cause
DTC Strategy		Determines if CAM target is aligned correctly to crank	- loosened CKPS - Timing Misalignment
Enable Conditions		- No active faults - Fully warmed up at idle	
Thresh old value	Case 1	1 teeth misalignment at 80 °C(176 °F) < Oil Temperature < 90 °C(194°F)	
	Case 2	2 tooth misalignment at Lower than 80 °C(176 °F) or Higher than 90 °C(194°F)	
Diagnosis Time		Continuous (Within 1min.)	
MIL On Condition		2 driving Cycles	

DTC TROUBLESHOOTING PROCEDURES

FLA -99

SPECIFICATION E413654A

Engine Oil Temperature	Misalignment
80 °C(176 °F) < Engine Oil Temperature < 90 °C(194°F)	1 teeth
Less than 80 °C(176 °F) or Higher than 90 °C(194°F)	2 tooth

SCHEMATIC DIAGRAM EE238604

Refer to DTC P0016.

MONITOR DTC STATUS EF8C30BD

Refer to DTC P0016.

SYSTEM INSPECTION EBF927C6

1. Visual Inspection

- 1) Check oil level is O.K.
- 2) Check Oil and OCV is contaminated.
- 3) Has a problem been found ?

YES

► Repair or replace as necessary and then, go to " Verification of Vehicle Repair" procedure.

NO

► Go to "Visually check CKPS and target wheel" as follow.

2. Visually check CKPS and target wheel

- 1) IG "OFF.
- 2) Visually check CKPS is loosened or target wheel is deformed or damaged.
- 3) Is the above items normal ?

YES

► Go to " Check CAM PHASER with actuation test" as follows.

NO

► Repair or replace as necessary and then go to"Verification of Vehicle Repair" procedure.

3. Check CAM PHASER with actuation test.

- 1) connect scantool and IG "ON".
- 2) Select "CAM PHASER INTAKE BANK 2" on the Actuation Test.
- 3) Select "OIL CONTROL VALVE" on the Actuation Test.
- 4) Activates "CAM PHASER INTAKE BANK 2" by pressing "STRT(F1)" key.

- 5) Activates "OIL CONTROL VALVE" by pressing "STRT(F1)" key.
- 6) Repeat this procedure 4 or 5 times to ensure CAM PHASER and intake valve control solenoid reliability.

1.4 ACTUATION TEST		24/29
CAM PHASER INTAKE BANK 2		
DURATION	UNTIL STOP KEY	
METHOD	ACTIVATION	
CONDITION	IG.KEY ON ENGINE RUNNING	
PRESS [STRT], IF YOU ARE READY ! SELECT TEST ITEM USING UP/DOWN KEY		
STRT STOP		

1.11 ACTUATION TEST		12/25
OIL CONTROL VALVE		
DURATION	UNTIL STOP KEY	
METHOD	ACTIVATION	
CONDITION	IG.KEY ON ENGINE OFF	
PRESS [STRT], IF YOU ARE READY ! SELECT TEST ITEM USING UP/DOWN KEY		
STRT STOP		

SVQF16603L

- 7) Has a problem been found ?

YES

► Substitute with a known - good CVVT or OCV and check for proper operation. If the problem is corrected, replace CVVT or OCV and go to "Verification of Vehicle Repair" procedure.

NO

► Fault is intermittent. Drive the vehicle to meet the enable condition for the DTC. and Go to "Component Inspection" procedure.

COMPONENT INSPECTION

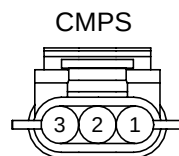
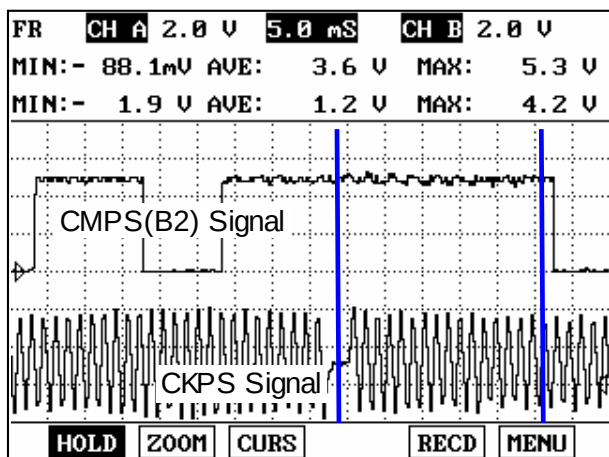
E9433B12

1. CMPS, CKPS Inspection

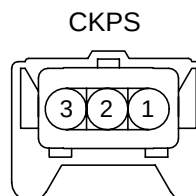
- 1) IG "OFF" and connect scantool.
- 2) ENG "ON" and Measure signal waveform at terminal 3 of CMPS.
- 3) Measure signal waveform at terminal 1 or 2 of CKPS.

Specification :

17th signal of the CKPS after missing tooth is aligned with the high signal of the CMPS at idle, PCM recognizes that Synchronization between CKPS and CMPS is completed.



1. Sensor Power
2. Sensor Ground
3. CMPS signal



1. CKPS Signal High
2. CKPS Signal Low
3. Shield Ground

SVQF16604L

4) Is the measured signal waveform O.K ?

YES

► Fault is intermittent. Drive the vehicle to meet the enable condition for the DTC. and go to "Verification of Vehicle Repair" procedure.

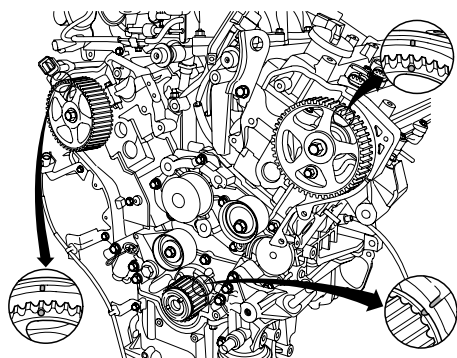
NO

► Go to "Timing Mark Inspection" procedure as follow.

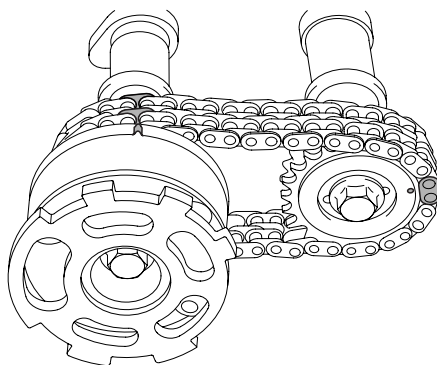
2. Timing Mark Inspection.

1) IG "OFF" and check the timing mark is correctly aligned.

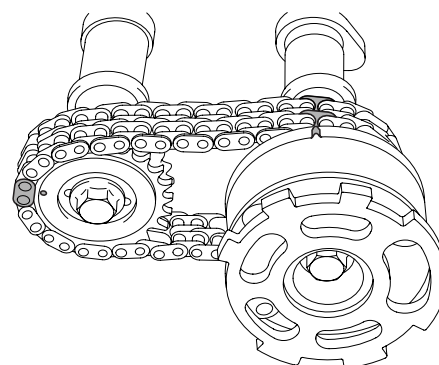
REFERENCE :



[Timing Belt]



[Cam (Bank 1)]



[Cam (Bank 2)]

LGLG502A

2) Is the timing mark correctly aligned

YES

► Fault is intermittent. Drive the vehicle to meet the enable condition for the DTC. and go to "Verification of Vehicle Repair" procedure.

NO

- Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E3AD0E05

Refer to DTC P0016.

DTC TROUBLESHOOTING PROCEDURES

FLA -103

DTC P0022 "A" CAMSHAFT POSITION-TIMING OVER-RETARDED (BANK 2)

COMPONENT LOCATION E7FF1842

Refer to DTC P0012.

GENERAL DESCRIPTION E21EF412

Refer to DTC P0012.

DTC DESCRIPTION E297FB9C

PCM monitors CAM phaser error while CMP signal is normally generating and vehicle is driving in 2000 ~ 3000rpm . If the CAM phaser does not move although PCM commands OCV duty cycle PCM determines that a fault exists and a DTC is stored.

DTC DETECTING CONDITION E522EBB2

Item		Detecting Condition	Possible cause
DTC Strategy		Determines if the phaser is stuck or has steady-state error	- Engine Oil - OCV stuck - CVVT stuck
Enable Conditions		- CAM signal is normally generating - Vehicle is on driving (2000 ~ 3000RPM) for 5 minutes.	
Thresh old value	Case 1	5 CAD < Cam Actual Position < 50 CAD - Duty Cycle > 90% or Duty Cycle < 10%	
	Case 2	- Cam Position error > 15 CAD (Difference between Actual Postion and Desire Position is more than 15°) - Timing Counter > 80	
Diagnosis Time		Continuous (within 5min.)	
MIL On Condition		2 Driving Cycles	

SCHEMATIC DIAGRAM E7441C39

Refer to DTC P0012.

DTC TROUBLESHOOTING PROCEDURES

FLA -105

► Fault is intermittent caused by PCM memory was not cleared after repair. Erase DTC and drive the vehicle to satisfy the enable condition then, go to "System Inspection" procedure.

SYSTEM INSPECTION ED859258

1. Visual Inspection

- 1) Check oil level is O.K.
- 2) Check oil is contaminated.
- 3) Has a problem been found ?

YES

► Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Component Inspection" procedure.

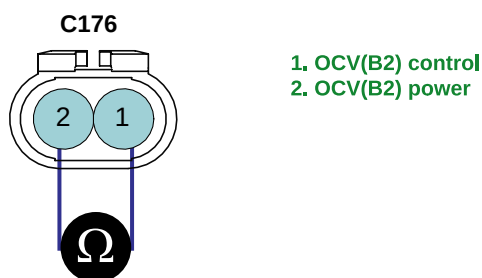
COMPONENT INSPECTION E394AA8B

1. Check OCV resistance

- 1) IG "OFF" and disconnect OCV connector.
- 2) Measure resistance between terminal 1 and 2 of OCV. (Component Side)

SPECIFICATION :

Resistance (Ω)	6.6 ~ 7.7



SVQF16157L

- 3) Is the measured resistance within specification ?

YES

► Go to "Check CAM PHASER with actuation test" as follows.

NO

► Substitute with a known - good OCV and check for proper operation.
If the problem is corrected, replace OCV and go to "Verification of Vehicle Repair" procedure.

2. Check CAM PHASER with actuation test

- 1) Connect scantool and IG "ON".

- 2) Select "CAM PHASER INTAKE BANK 2" on the Actuation Test.
- 3) Select "OIL CONTROL VALVE" on the Actuation Test.
- 4) Activates "CAM PHASER INTAKE BANK 2" by pressing "STRT(F1)" key.
- 5) Activates "OIL CONTROL VALVE" by pressing "STRT(F1)" key.
- 6) Repeat this procedure 4 or 5 times to ensure CAM PHASER and intake valve control solenoid reliability.

1.4 ACTUATION TEST		24/29
CAM PHASER INTAKE BANK 2		
DURATION	UNTIL STOP KEY	
METHOD	ACTIVATION	
CONDITION	IG.KEY ON ENGINE RUNNING	
PRESS [STRT], IF YOU ARE READY ! SELECT TEST ITEM USING UP/DOWN KEY		
STRT STOP		

1.11 ACTUATION TEST		12/25
OIL CONTROL VALVE		
DURATION	UNTIL STOP KEY	
METHOD	ACTIVATION	
CONDITION	IG.KEY ON ENGINE OFF	
PRESS [STRT], IF YOU ARE READY ! SELECT TEST ITEM USING UP/DOWN KEY		
STRT STOP		

SVQF16603L

- 7) Has a problem been found ?

YES

► Substitute with a known - good CVVT or OCV and check for proper operation.
If the problem is corrected, replace CVVT or OCV and go to "Verification of Vehicle Repair" procedure.

NO

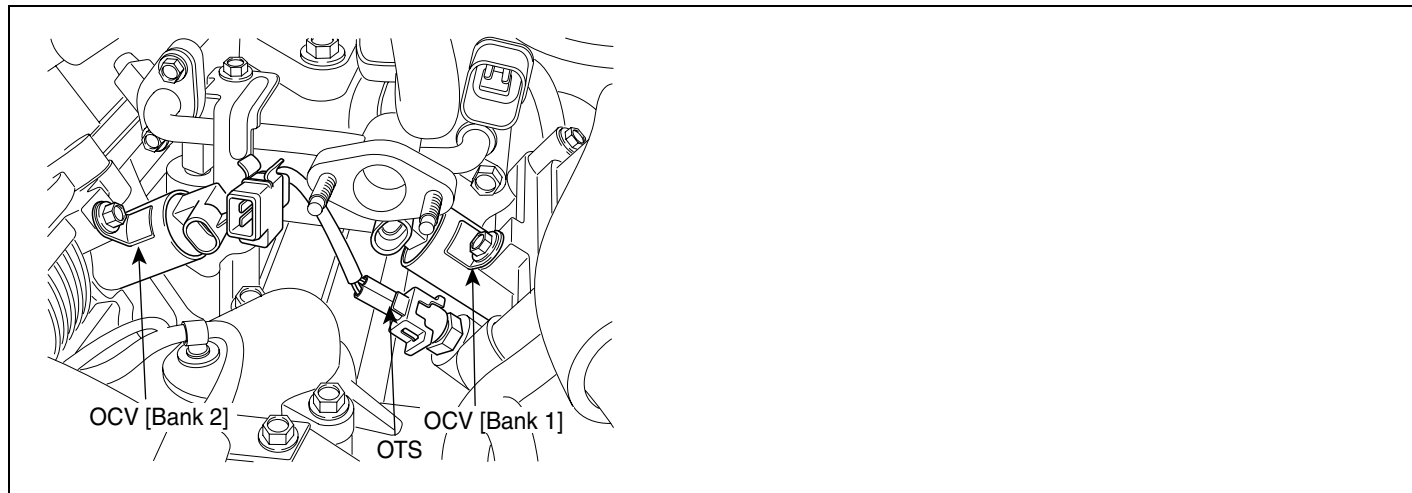
► Fault is intermittent. Drive the vehicle to meet the enable condition for the DTC. and Go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EB5E0D58

Refer to DTC P0012.

DTC P0026 INTAKE VALVE CONTROL SOLENOID CIRCUIT RANGE/PERFORMANCE (BANK 1)

COMPONENT LOCATION EDDD8B9



LGLG500A

GENERAL DESCRIPTION E58BD36

The CVVT (Continuously Variable Valve Timing) system is installed to the chain sprocket of the intake camshaft. This system controls the intake camshaft to provide the optimal valve timing for every driving condition. The ECM controls the Oil Control Valve(OCV), based on the signals output from mass air flow, throttle position and engine coolant temperature. The CVVT controller regulates the intake camshaft angle using oil pressure through the OCV. As result, the relative position between the camshaft and the crankshaft becomes optimal, and the engine torque improves, fuel economy improves, exhaust emissions decrease under overall driving conditions.

DTC DESCRIPTION EB3171E9

PCM monitors OCV stuck while cam sinal is normally generating and Valve cleaning is not in progress. If the CAM Acutal Position is too high or low and Difference between Cam Actual Position and Desire Position is higher than 20° PCM determines that a fault exists and a DTC is stored.

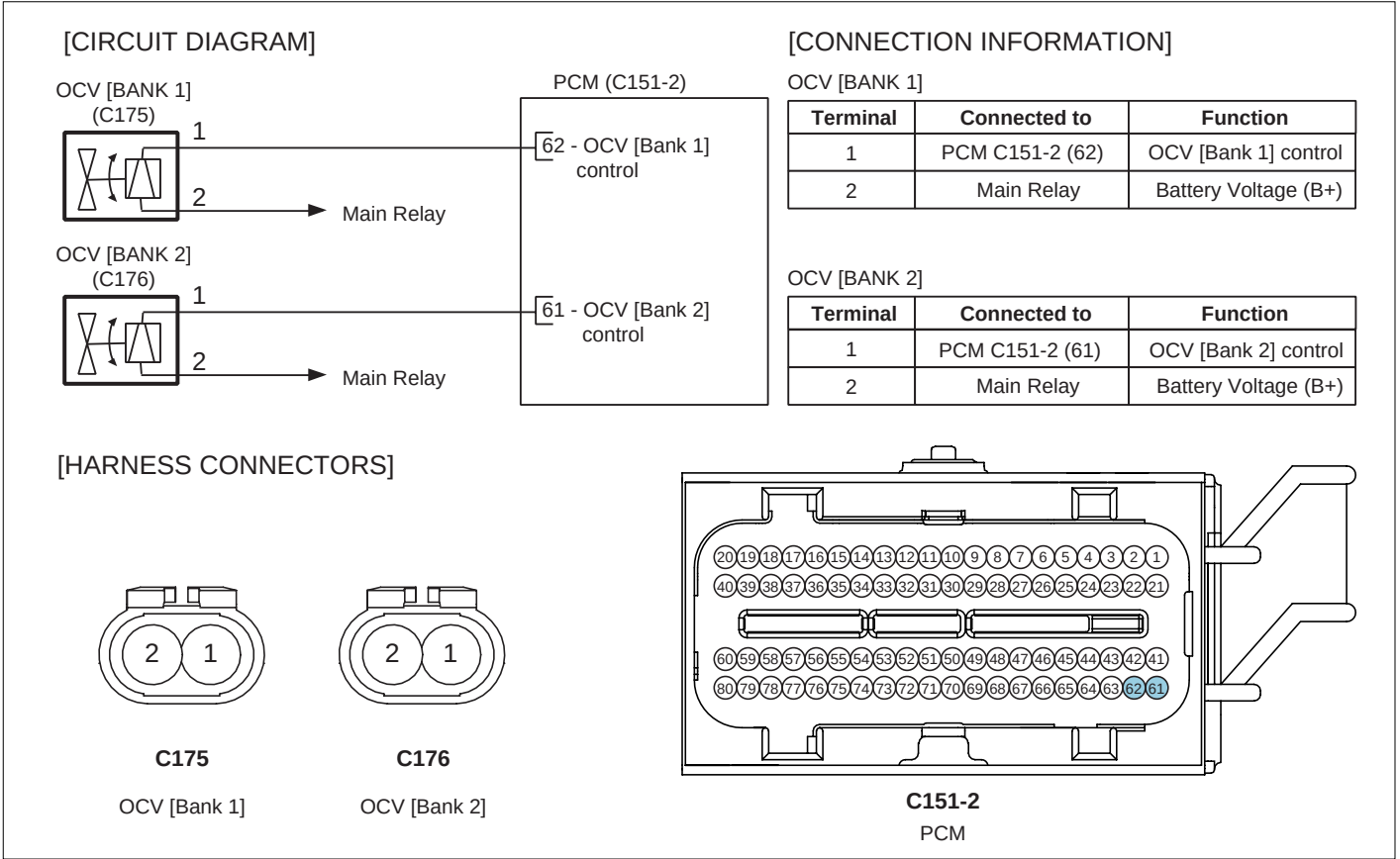
DTC DETECTING CONDITION E737CEC5

Item		Detecting Condition	Possible cause
DTC Strategy		Determines if oil control valve is stuck	- Oil Pressure Loss - OCV seizure
Enable Conditions		- Valve cleaning not in progress - CAM signal is normally generating	
Thresh old value	Case 1	Cam Actual Position > 50 CAD or Difference between CAM Actual Position and Desire Position > 20 CAD	
	Case 2	Cam Actual Position < 5 CAD or Difference between CAM Actual Position and Desire Position > 20 CAD	
Diagnosis Time		Continuous (Within 1min.)	
MIL On Condition		2 driving Cycle	

SPECIFICATION E8D9F224

Resistance (Ω)	6.7 ~ 7.7Ω [20℃(68°F)]

SCHEMATIC DIAGRAM E83D0BA2



SVQF16115L

SIGNAL WAVEFORM AND DATA E6E35DB1

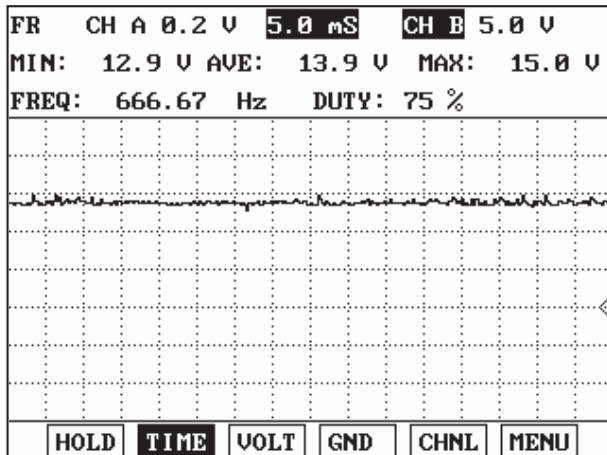


Fig. 1

Fig. 1 : Idle - normal Condition

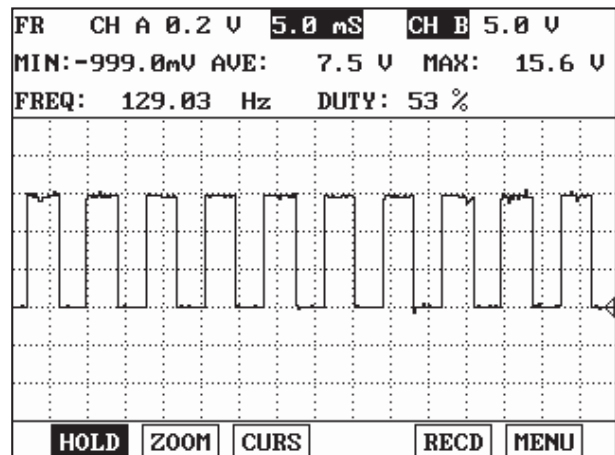


Fig. 2

Fig. 2 : Acceleration

EGRF600T

MONITOR DTC STATUS EAADDE1F

1. Check DTC Status

- 1) Connect scantool to Data Link Connector(DLC).
- 2) IG "ON".
- 3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F4(DTAL) to check DTC's information from the DTCs menu
- 4) Read "DTC Status" parameter.

1.1 DIAGNOSTIC TROUBLE CODES	
PXXXX	DTC TITLE
NUMBER OF DTC : 1 ITEMS	
PART	ERAS DTAL

PXXXX TITLE	
1.MIL STATUS:	ON/OFF
2.DTC STATUS:	PRESENT/HISTORY
3.DIAG.STATUS:	DIAGNOSIS FINISHED
DTC CAUSE TO SYSTEM ERROR : PXXXX	

SCMF16159L

5) Is parameter displayed "Present fault"?

YES

- ▶ Go to "Terminal and Connector inspection" procedure.

NO

- ▶ Fault is intermittent caused by PCM memory was not cleared after repair. Erase DTC and drive the vehicle to satisfy the enable condition then, go to " System Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION E5C05A43

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

- ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

- ▶ Go to " Power Circuit Inspection " as follow

POWER CIRCUIT INSPECTION EEA8DFAC

1. IG "OFF" and disconnect OCV connector.
2. IG "ON" & ENG "OFF".
3. Measure voltage between terminal 2 of OCV harness connector and chassis ground.



NOTE

Be careful not to change the connectors for B1 and B2

Specification : B+

4. Is the measured voltage within specification ?

YES

- ▶ Go to " Control Circuit Inspection " procedure.

NO

- ▶ Check that Fuse between Main Relay and OCV is open.
- ▶ Check open between main relay and OCV.
- ▶ Check short to ground between Main Relay and OCV.
- ▶ Repair or replace as necessary go to "Verification of Vehicle Repair " procedure.

CONTROL CIRCUIT INSPECTION E28BCFE0

1. IG "OFF" and disconnect OCV connector.
2. IG "ON" & ENG "OFF".

DTC TROUBLESHOOTING PROCEDURES

FLA -111

3. Measure voltage between terminal 1 of OCV harness connector and chassis ground.

Specification : Approx. below 1V

4. Is the measured voltage within specification ?

YES

- Go to "System Inspection" procedure.

NO

- Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

SYSTEM INSPECTION

E4EDBFCC

1. Visual Inspection

- 1) Check oil level is O.K.
- 2) Check oil is contaminated.
- 3) Check that any oil leakage is occurred around CVVT system.
- 4) Has a problem been found ?

YES

- Repair or replace as necessary and then, go to " Verification of Vehicle Repair" procedure.

NO

- Go to "Component Inspection" procedure

COMPONENT INSPECTION

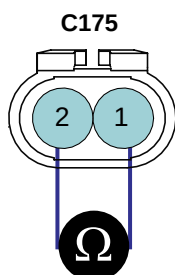
E3F590A1

1. OCV Inspection

- 1) IG "OFF" & Disconnect OCV connector.
- 2) Measure resistance between terminal 1 and 2 of OCV connector (Component Side)

SPECIFICATION :

Resistance (Ω)	6.7 ~ 7.7



1. OCV(B1) control
2. OCV(B1) power

3) Is the measured resistance within specification?

YES

► Go to "Check CAM PHASER with actuation test" as follow.

NO

► Substitute with a known - good OCV and check for proper operation. If the problem is corrected, replace OCV and go to "Verification of Vehicle Repair" procedure.

2. CAM PHASER with actuation test

- 1) Connect scantool and IG "ON".
- 2) Select "CAM PHASER INTAKE BANK 1" on the Actuation Test.
- 3) Select "OIL CONTROL VALVE" on the Actuation Test.
- 4) Activates "CAM PHASER INTAKE BANK 1" by pressing "STRT(F1)" key.
- 5) Activates "OIL CONTROL VALVE" by pressing "STRT(F1)" key.
- 6) Repeat this procedure 4 or 5 times to ensure CAM PHASER and intake valve control solenoid reliability.

1.4 ACTUATION TEST		24/29
CAM PHASER INTAKE BANK 1		
DURATION	UNTIL STOP KEY	
METHOD	ACTIVATION	
CONDITION	IG.KEY ON ENGINE RUNNING	
PRESS [STRT], IF YOU ARE READY ? SELECT TEST ITEM USING UP/DOWN KEY		
STRT STOP		

1.11 ACTUATION TEST		12/25
OIL CONTROL VALVE		
DURATION	UNTIL STOP KEY	
METHOD	ACTIVATION	
CONDITION	IG.KEY ON ENGINE OFF	
PRESS [STRT], IF YOU ARE READY ? SELECT TEST ITEM USING UP/DOWN KEY		
STRT STOP		

SVQF16601L

7) Has a problem been found ?

YES

► Substitute with a known - good CVVT or OCV and check for proper operation.
If the problem is corrected, replace CVVT or OCV and go to "Verification of Vehicle Repair" procedure.

NO

► Fault is intermittent. Drive the vehicle to meet the enable condition for the DTC. and Go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E0050497

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.

DTC TROUBLESHOOTING PROCEDURES

FLA -113

2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

- ▶ System performing to specification at this time. Clear the DTC.

NO

- ▶ Go to the applicable troubleshooting procedure.

FLA -114

FUEL SYSTEM

DTC P0028 INTAKE VALVE CONTROL SOLENOID CIRCUIT RANGE/PERFORMANCE (BANK 2)

COMPONENT LOCATION E90A0CA6

Refer to DTC P0026.

GENERAL DESCRIPTION E13FC5C5

Refer to DTC P0026.

DTC DESCRIPTION EA7FA854

PCM monitors OCV stuck while cam sinal is normally generating and Valve cleaning is not in progress. If the CAM Acutal Position is too high or low and Difference between Cam Actual Position and Desire Position is higher than 20° PCM determines that a fault exists and a DTC is stored.

DTC DETECTING CONDITION E4754CB1

Item		Detecting Condition	Possible cause
DTC Strategy		Determines if oil control valve is stuck	- Oil Pressure Loss - OCV seizure
Enable Conditions		- Valve cleaning not in progress - CAM signal is normally generating	
Thresh old value	Case 1	Cam Actual Position > 50 CAD or Difference between CAM Actual Position and Desire Position > 20 CAD	
	Case 2	Cam Actual Position < 5 CAD or Difference between CAM Actual Position and Desire Position > 20 CAD	
Diagnosis Time		Continuous (Within 1min.)	
MIL On Condition		2 driving Cycle	

SPECIFICATION E72EC069

Resistance (Ω)	6.7 ~ 7.7 Ω [20°C(68°F)]

SCHEMATIC DIAGRAM EF561D2B

Refer to DTC P0026.

SIGNAL WAVEFORM AND DATA E77C538A

Refer to DTC P0026.

MONITOR DTC STATUS E9DD3AE4

Refer to DTC P0026.

DTC TROUBLESHOOTING PROCEDURES

FLA -115

TERMINAL AND CONNECTOR INSPECTION EF0852AC

Refer to DTC P0026.

POWER CIRCUIT INSPECTION EDFBC67D

1. IG "OFF" and disconnect OCV connector.
2. IG "ON" & ENG "OFF".
3. Measure voltage between terminal 2 of OCV harness connector and chassis ground.



NOTE

Be careful not to change the connectors for B1 and B2

Specification : B+

4. Is the measured voltage within specification ?

YES

- ▶ Go to " Control Circuit Inspection " procedure.

NO

- ▶ Check that Fuse between Main Relay and OCV is open.
- ▶ Check open between main relay and OCV.
- ▶ Check short to ground between Main Relay and OCV.
- ▶ Repair or replace as necessary go to "Verification of Vehicle Repair " procedure.

CONTROL CIRCUIT INSPECTION EDE2EAE7

1. IG "OFF" and disconnect OCV connector.
2. IG "ON" & ENG "OFF".
3. Measure voltage between terminal 1 of OCV harness connector and chassis ground.

Specification : Approx. below 1V

4. Is the measured voltage within specification ?

YES

- ▶ Go to "System Inspection" procedure.

NO

- ▶ Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

SYSTEM INSPECTION E7BEFDB5

1. Visual Inspection
 - 1) Check oil level is O.K.

- 2) Check oil is contaminated.
- 3) Check that any oil leakage is occurred around CVVT system.
- 4) Has a problem been found ?

YES

► Repair or replace as necessary and then, go to " Verification of Vehicle Repair" procedure.

NO

► Go to "Component Inspection" procedure

COMPONENT INSPECTION

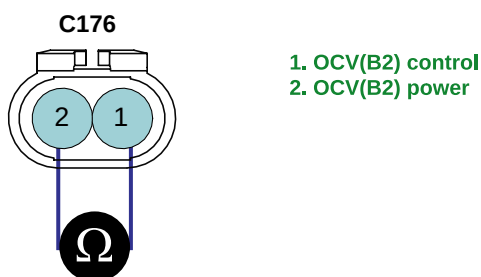
EAB07D60

1. OCV Inspection

- 1) IG "OFF" & Disconnect OCV connector.
- 2) Measure resistance between terminal 1 and 2 of OCV connector (Component Side)

SPECIFICATION :

Resistance (Ω)	6.7 ~ 7.7



SVQF16157L

- 3) Is the measured resistance within specification ?

YES

► Go to "Check CAM PHASER with actuation test" as follows.

NO

► Substitute with a known - good OCV and check for proper operation.
If the problem is corrected, replace OCV and go to "Verification of Vehicle Repair" procedure.

2. Check CAM PHASER with actuation test

- 1) Connect scantool and IG "ON".
- 2) Select "CAM PHASER INTAKE BANK 2" on the Actuation Test.
- 3) Select "OIL CONTROL VALVE" on the Actuation Test.
- 4) Activates "CAM PHASER INTAKE BANK 2" by pressing "STRT(F1)" key.
- 5) Activates "OIL CONTROL VALVE" by pressing "STRT(F1)" key.

DTC TROUBLESHOOTING PROCEDURES

FLA -117

- 6) Repeat this procedure 4 or 5 times to ensure CAM PHASER and intake valve control solenoid reliability.

1.4 ACTUATION TEST		24/29
CAM PHASER INTAKE BANK 2		
DURATION	UNTIL STOP KEY	
METHOD	ACTIVATION	
CONDITION	IG.KEY ON ENGINE RUNNING	
PRESS [STRT], IF YOU ARE READY ? SELECT TEST ITEM USING UP/DOWN KEY		
STRT STOP		

1.11 ACTUATION TEST		12/25
OIL CONTROL VALVE		
DURATION	UNTIL STOP KEY	
METHOD	ACTIVATION	
CONDITION	IG.KEY ON ENGINE OFF	
PRESS [STRT], IF YOU ARE READY ? SELECT TEST ITEM USING UP/DOWN KEY		
STRT STOP		

SVQF16603L

- 7) Has a problem been found ?

YES

- Substitute with a known - good CVVT or OCV and check for proper operation.
If the problem is corrected, replace CVVT or OCV and go to "Verification of Vehicle Repair" procedure.

NO

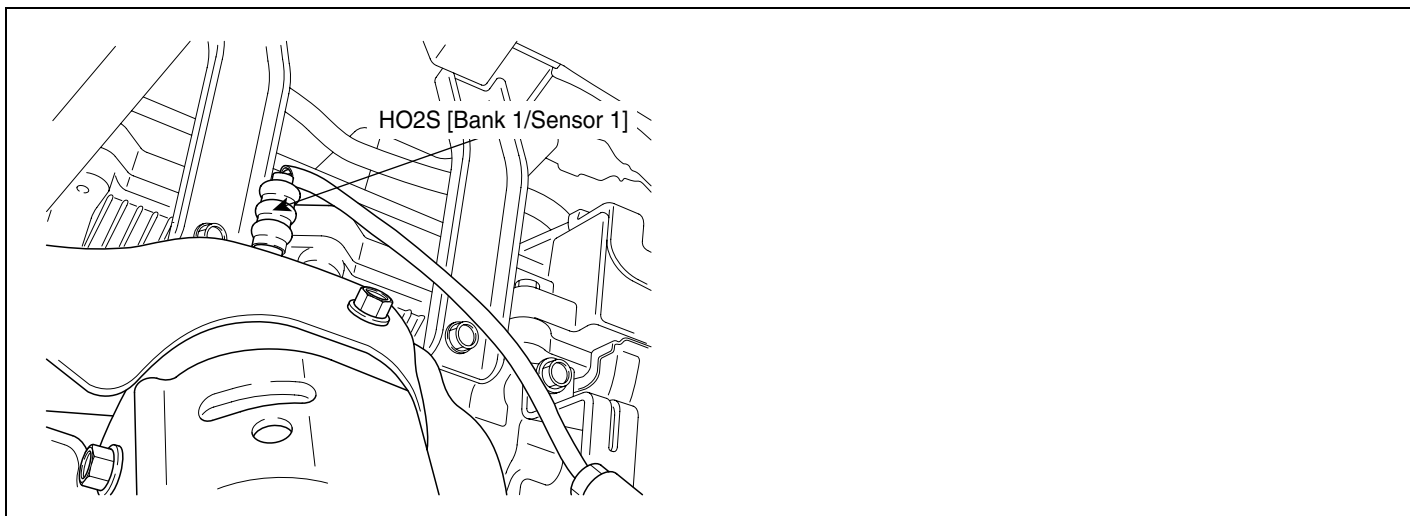
- Fault is intermittent. Drive the vehicle to meet the enable condition for the DTC. and Go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EB1FC64E

Refer to DTC P0026.

DTC P0030 HO2S HEATER CONTROL CIRCUIT (BANK 1 / SENSOR 1)

COMPONENT LOCATION E889F8BF



LGLG504A

GENERAL DESCRIPTION E7D9053E

The normal operating temperature of the HO2S(Heated Oxygen Sensor) ranges from 350 to 850°C(662 to 1562°F). The HO2S heater greatly decreases the amount of time required for fuel control to become active. The ECM provides a pulse width modulated control circuit to adjust current through the heater. When the HO2S is cold, the value of the resistance is low and the current in the circuit is high. On the contrary, if the temperature in the resistor of the sensor rises, the current drops gradually.

DTC DESCRIPTION E55501AD

Checking current from HO2S under detecting condition,if the heater current is below a certain threshold for more than predeterminate time, PCM sets P0030. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E1805512

Item	Detecting Condition	Possible cause
DTC Strategy	Monitor the current through the heater	- Poor Connection - HO2S(B1/S1) - PCM
Enable Conditions	- Engine Running > 60 sec. - Heater Duty Cycle > 40% - Max. Duty Cycle - Min. Duty Cycle < 5%	
Threshold value	Filtered Heater Current < threshold value	
Diagnosis Time	Continuous (More than 2.5 second failure for every 5 second test)	
MIL On Condition	2 Driving Cycles	

DTC TROUBLESHOOTING PROCEDURES

FLA -119

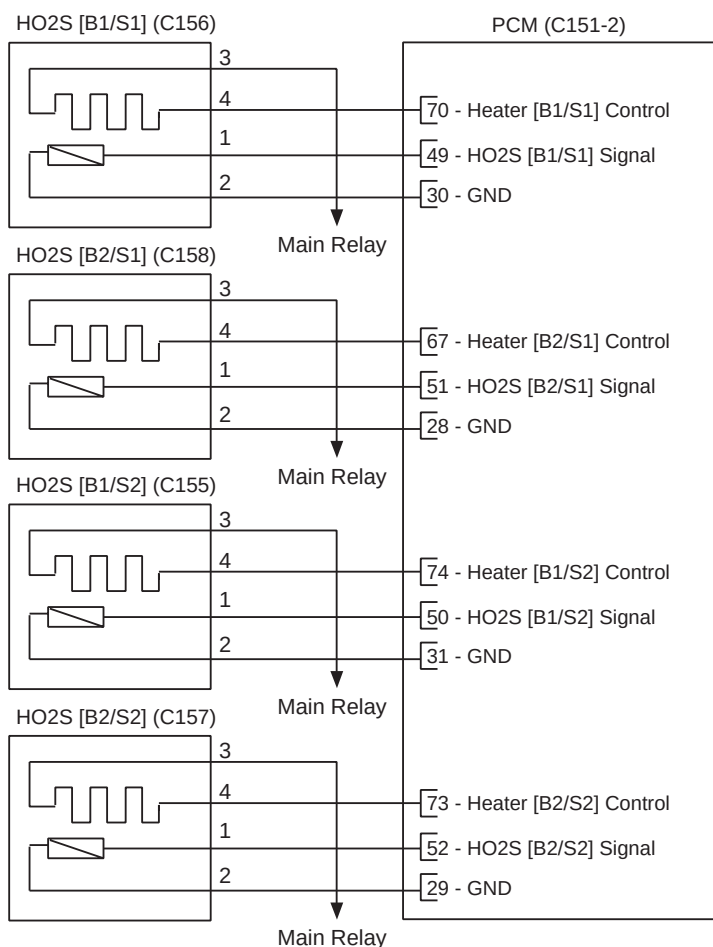
SPECIFICATION E50E2A42

(REFERENCE ONLY)

Condition	Current(A)
Heater Current at 13.5V, 450°C (842°F) Exhaust	0.52 ± 0.1

SCHEMATIC DIAGRAM ECB89579

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	PCM C151-2 (49)	HO2S [B1/S1] Signal
2	PCM C151-2 (30)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C151-2 (70)	Heater [B1/S1] Control

HO2S [B2/S1]

Terminal	Connected to	Function
1	PCM C151-2 (51)	HO2S [B2/S1] Signal
2	PCM C151-2 (28)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C151-2 (67)	Heater [B2/S1] Control

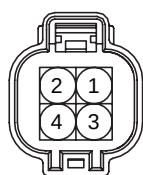
HO2S [B1/S2]

Terminal	Connected to	Function
1	PCM C151-2(50)	HO2S [B1/S2] Signal
2	PCM C151-2 (31)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C151-2 (74)	Heater [B1/S2] Control

HO2S [B2/S2]

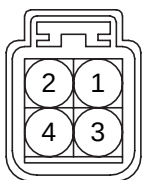
Terminal	Connected to	Function
1	PCM C151-2 (52)	HO2S [B2/S2] Signal
2	PCM C151-2 (29)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C151-2 (73)	Heater [B2/S2] Control

[HARNESS CONNECTORS]



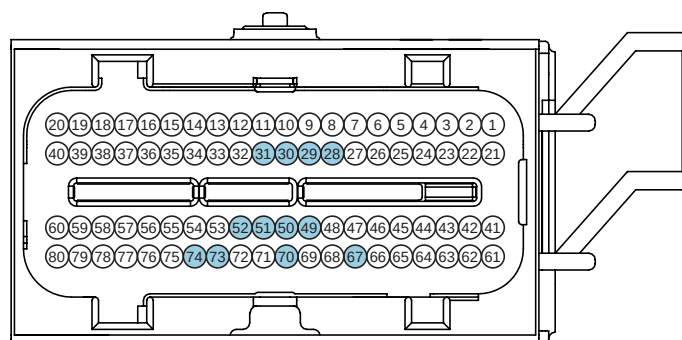
C156, C158

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]



C155, C157

HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]



C151-2
PCM

SVQF16110L

SIGNAL WAVEFORM AND DATA

E80309D1

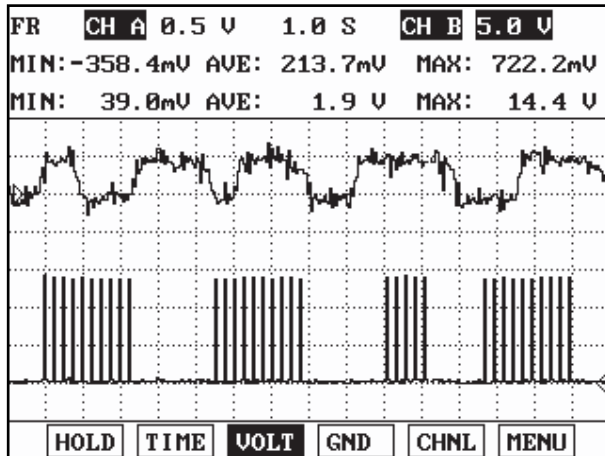


Fig. 1

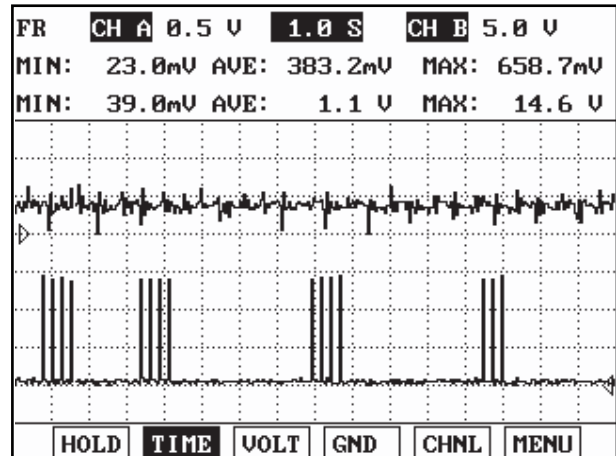


Fig. 2

Fig1) The signal waveforms of front HO2S(the upper) and heater(the lower) at idle

Fig2) The signal waveforms of rear HO2S(the upper) and heater(the lower) at idle

SCMF16158L

The HO2S requires a minimum temperature to provide a closed loop fuel control system. So the HO2S contains a heater element to reduce its warm-up time and ensure its performance during all driving conditions. The PCM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the PCM provides a ground circuit for activating the heater.

MONITOR DTC STATUS

EF54E3EB

1. Check DTC Status

- 1) Connect scantool to Data Link Connector(DLC).
- 2) IG "ON".
- 3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F4(DTAL) to check DTC's information from the DTCs menu
- 4) Read "DTC Status" parameter.

1.1 DIAGNOSTIC TROUBLE CODES	
PXXXX	DTC TITLE
NUMBER OF DTC : 1 ITEMS	
PART	ERAS DTAL

PXXXX TITLE	
1.MIL STATUS:	ON/OFF
2.DTC STATUS:	PRESENT/HISTORY
3.DIAG.STATUS:	DIAGNOSIS FINISHED
DTC CAUSE TO SYSTEM ERROR : PXXXX	

SCMF16159L

DTC TROUBLESHOOTING PROCEDURES

FLA -121

- 5) Is parameter displayed "Present fault"?

YES

- Go to "Terminal and connector inspection" procedure.

NO

- Fault is intermittent caused by poor contact in the sensor' s and/or PCM' s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

TERMINAL AND CONNECTOR INSPECTION EB00C1F9

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

- Repair as necessary and go to "Verification of Vehicle Repair" procedure

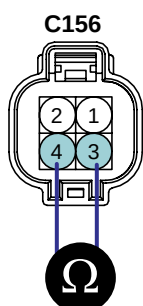
NO

- Go to " Component Inspection " procedure.

COMPONENT INSPECTION E55A281F

1. Check HO2S(B1/S1) Heater resistance
 - 1) IG "OFF" and disconnect HO2S(B1/S1) connector
 - 2) Measure resistance between terminal 3 and 4 of HO2S(B1/S1)(Component Side)

Specification : 3.0 ~ 4.0Ω [21℃ (69.8°F)]



1. HO2S [B1/S1] Signal
2. Sensor ground
3. Battery Voltage (B+)
4. Heater [B1/S1] Control

SVQF16227L

- 3) Is the measured resistance within specification ?

YES

- ▶ Substitute with a known - good PCM and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

NO

- ▶ Substitute with a known - good HO2S(B1/S1) and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E96ADDF1

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

- ▶ System performing to specification at this time. Clear the DTC.

NO

- ▶ Go to the applicable troubleshooting procedure.

DTC TROUBLESHOOTING PROCEDURES

FLA -123

DTC P0031 HO2S HEATER CIRCUIT LOW (BANK 1 / SENSOR 1)

COMPONENT LOCATION E5C4139A

Refer to DTC P0030.

GENERAL DESCRIPTION EE8AA40E

Refer to DTC P0030.

DTC DESCRIPTION ECB1D247

If the PCM detects short to ground or open in heater under detecting conditions, PCM sets P0031. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E809EBA1

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects a short to ground or open	• Poor Connection • Open in Power Circuit • Open or short to ground in control circuit • HO2S(B1/S1) • PCM
Enable Conditions	• No disabling Faults • Engine Running • $11V \leq \text{Battery Voltage} \leq 16V$	
Threshold value	• Short to ground or open circuit	
Diagnosis Time	• Continuous (More than 5 seconds failure for every 10 seconds test)	
MIL On Condition	• 2 Driving Cycles	

SPECIFICATION E96D15EC

Heater	
Resistance (Ω)	3.0 ~ 4.0 Ω [21℃ (69.8°F)]

SCHEMATIC DIAGRAM E2CB83CC

Refer to DTC P0030.

SIGNAL WAVEFORM AND DATA E16B27DA

Refer to DTC P0030.

MONITOR DTC STATUS E1583243

Refer to DTC P0030.

TERMINAL AND CONNECTOR INSPECTION E56AA16C

Refer to DTC P0030.

POWER CIRCUIT INSPECTION

E647A962

1. IG "OFF" & Disconnect HO2S(B1/S1) connector.
2. IG "ON" & ENG "OFF".
3. Measure voltage between terminal 3 of HO2S(B1/S1) harness connector and chassis ground.

Specification : B+

4. Is the measured voltage within specification ?

YES

- Go to "Control Circuit Inspection" procedure.

NO

- Repair open or short to ground in HO2S(B1/S1) Heater power circuit then, go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

EC89450E

1. Check short to ground in harness.
 - 1) IG "OFF" and disconnect HO2S(B1/S1) connector.
 - 2) Measure resistance between terminal 4 of HO2S(B1/S1) harness connector and chassis ground.

Specification : Infinite

- 3) Is the measured resistance within specification ?

YES

- Go to "Check Open in harness" as follows.

NO

- Repair short to ground in HO2S (B1/S1) heater control circuit and go to "Verification of Vehicle Repair" procedure.

2. Check open in harness
 - 1) IG "OFF" and disconnect HO2S(B1/S1) and PCM connector.
 - 2) Measure resistance between terminal 4 of HO2S(B1/S1) harness connector and terminal 70 of PCM harness connector.

Specification : Approx. below 1Ω

- 3) Is the measured resistance within specification ?

YES

- Go to "Component Inspection" procedure.

DTC TROUBLESHOOTING PROCEDURES

FLA -125

NO

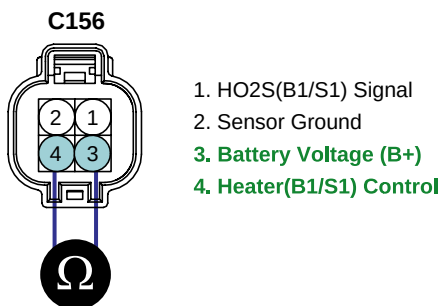
- Repair open in HO2S(B1/S1) heater control circuit and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EBB5CE11

1. Check HO2S(B1/S1) Heater resistance.
 - 1) IG "OFF" and disconnect HO2S(B1/S1) connector.
 - 2) Measure resistance between terminal 3 and 4 of HO2S(B1/S1)connector (Component Side)

SPECIFICATION :

Heater	
Resistance (Ω)	3.0 ~ 4.0 Ω [21℃ (69.8°F)]



SVQF16163L

- 3) Is the measured resistance within specification ?

YES

- Substitute with a known - good PCM and check for proper operation.
If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.

Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

NO

- Substitute with a known - good HO2S(B1/S1) and check for proper operation.
If the problem is corrected, replace HO2S(B1/S1) and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EBD805B8

Refer to DTC P0030.

FLA -126

FUEL SYSTEM

DTC P0032 HO2S HEATER CIRCUIT HIGH (BANK 1 / SENSOR 1)

COMPONENT LOCATION EFE79781

Refer to DTC P0030.

GENERAL DESCRIPTION E79B51DC

Refer to DTC P0030.

DTC DESCRIPTION E1669157

If the PCM detects short to battery in heater under detecting conditions, PCM sets P0032. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION EE656AA3

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects a short to battery	• Poor Connection • short to battery in control circuit • HO2S(B1/S1) • PCM
Enable Conditions	• No disabling Faults Present • Engine Running • $11V \leq \text{Battery Voltage} \leq 16V$	
Threshold value	• short to battery	
Diagnosis Time	• Continuous (More than 5 seconds failure for every 10 seconds test)	
MIL On Condition	• 2 Driving Cycles	

SPECIFICATION EB8FE3AB

Heater	
Resistance (Ω)	3.0 ~ 4.0 Ω [21 °C (69.8 °F)]

SCHEMATIC DIAGRAM E08966A6

Refer to DTC P0030.

SIGNAL WAVEFORM AND DATA E4237B7E

Refer to DTC P0030.

MONITOR DTC STATUS E420D820

Refer to DTC P0030.

TERMINAL AND CONNECTOR INSPECTION E80CA6DA

Refer to DTC P0030.

DTC TROUBLESHOOTING PROCEDURES

FLA -127

CONTROL CIRCUIT INSPECTION E2F69A02

1. IG "OFF" & disconnect HO2S(B1/S1) connector.
2. IG "ON" & ENG "OFF".
3. Measure voltage between terminal 4 of HO2S(B1/S1) harness connector and chassis ground.

Specification : Approx. 0 V

4. Is the measured voltage within specification ?

YES

- Go to "Component Inspection" procedure.

NO

- Repair short to battery in HO2S(B1/S1) Heater control circuit and go to "Verification of Vehicle Repair" procedure.

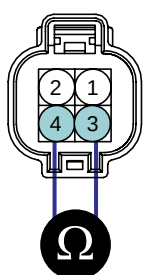
COMPONENT INSPECTION E2CB890D

1. Check HO2S(B1/S1) Heater resistance.
 - 1) IG "OFF" and disconnect HO2S(B1/S1) connector.
 - 2) Measure resistance between terminal 4 and 3 of HO2S(B1/S1)connector (Component Side)

SPECIFICATION :

Heater	
Resistance (Ω)	3.0 ~ 4.0 Ω [21°C (69.8°F)]

C156



1. HO2S(B1/S1) Signal
2. Sensor Ground
3. Battery Voltage (B+)
4. Heater(B1/S1) Control

SVQF16163L

- 3) Is the measured resistance within specification ?

YES

- Substitute with a known - good PCM and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.

Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

NO

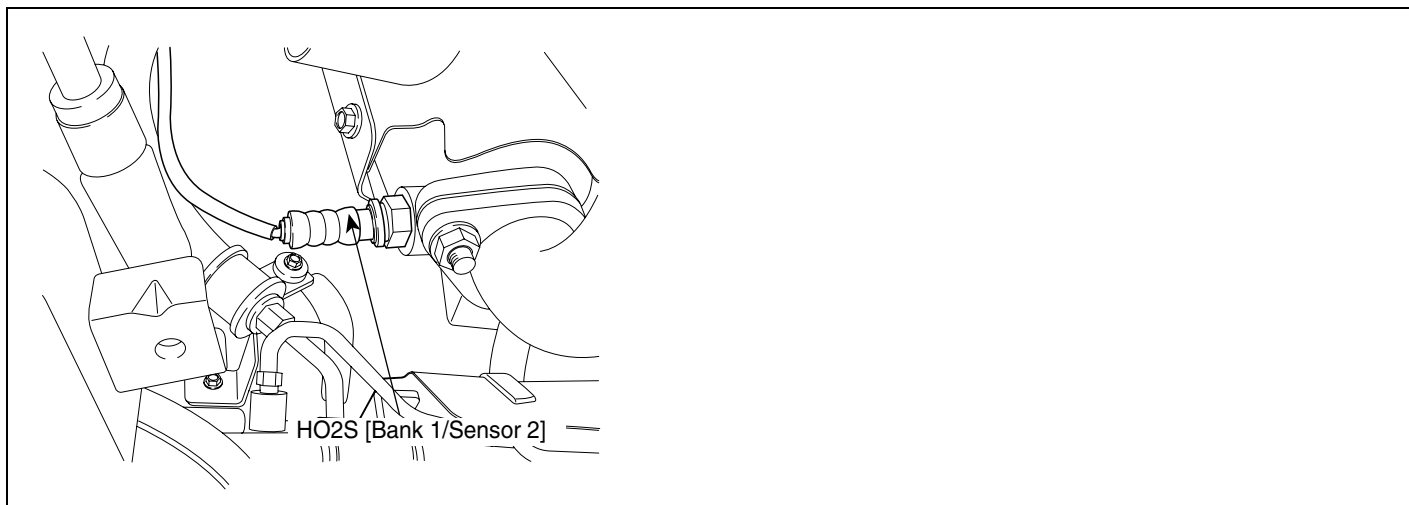
- Substitute with a known - good HO2S(B1/S1) and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E1B49251

Refer to DTC P0030.

DTC P0036 HO2S HEATER CONTROL CIRCUIT (BANK 1 / SENSOR 2)

COMPONENT LOCATION EC54BBBD



LGLG505A

GENERAL DESCRIPTION E910D173

The normal operating temperature of the HO2S(Heated Oxygen Sensor) ranges from 350 to 850°C(662 to 1562°F). The HO2S heater greatly decreases the amount of time required for fuel control to become active. The ECM provides a pulse width modulated control circuit to adjust current through the heater. When the HO2S is cold, the value of the resistance is low and the current in the circuit is high. On the contrary, if the temperature in the resistor of the sensor rises, the current drops gradually.

DTC DESCRIPTION EC6D53A3

Checking current from HO2S under detecting condition,if the heater current is below a certain threshold for more than predeterminate time, PCM sets P0036. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION EA44BBFC

Item	Detecting Condition	Possible cause
DTC Strategy	Monitor the current through the heater	- Poor Connection - HO2S(B1/S2) - PCM
Enable Conditions	- Engine Running > 60 sec. - Heater Duty Cycle > 18% - Max. Duty Cycle - Min. Duty Cycle < 5%.	
Threshold value	Filtered Heater Current < threshold value	
Diagnosis Time	Continuous (More than 2.5 second failure for every 5 second test)	
MIL On Condition	2 Driving Cycles	

SPECIFICATION

E337F0B9

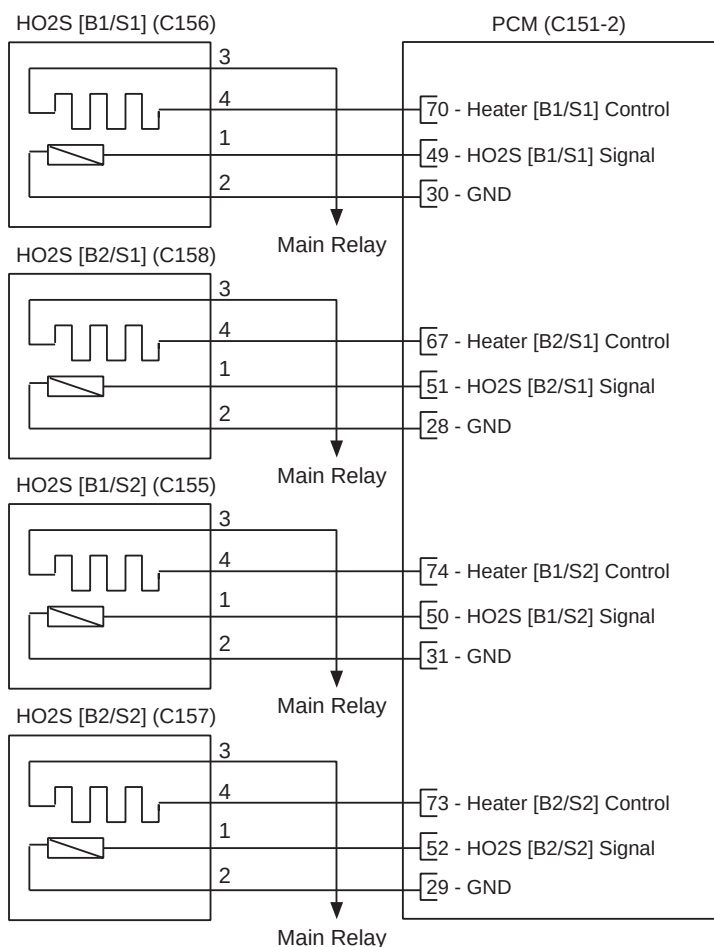
(REFERENCE ONLY)

Condition	Current(A)
Heater Current at 13.5V, 450℃ (842°F) Exhaust	0.52 ± 0.1

SCHEMATIC DIAGRAM

EEEE0FE0F

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

HO2S [B1/S1]

Terminal	Connected to	Function
1	PCM C151-2 (49)	HO2S [B1/S1] Signal
2	PCM C151-2 (30)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C151-2 (70)	Heater [B1/S1] Control

HO2S [B2/S1]

Terminal	Connected to	Function
1	PCM C151-2 (51)	HO2S [B2/S1] Signal
2	PCM C151-2 (28)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C151-2 (67)	Heater [B2/S1] Control

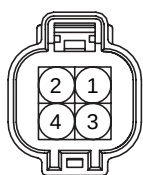
HO2S [B1/S2]

Terminal	Connected to	Function
1	PCM C151-2(50)	HO2S [B1/S2] Signal
2	PCM C151-2 (31)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C151-2 (74)	Heater [B1/S2] Control

HO2S [B2/S2]

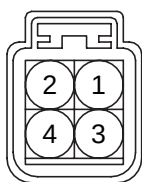
Terminal	Connected to	Function
1	PCM C151-2 (52)	HO2S [B2/S2] Signal
2	PCM C151-2 (29)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C151-2 (73)	Heater [B2/S2] Control

[HARNESS CONNECTORS]



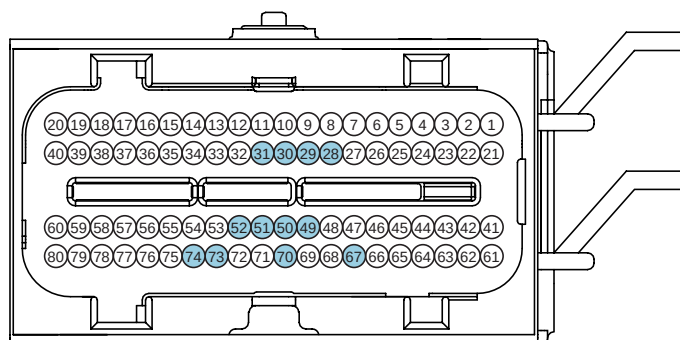
C156, C158

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]



C155, C157

HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]



C151-2

PCM

SIGNAL WAVEFORM AND DATA EF4B0BDB

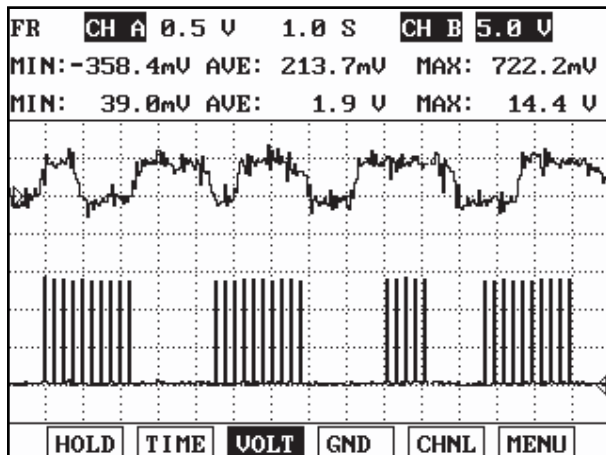


Fig. 1

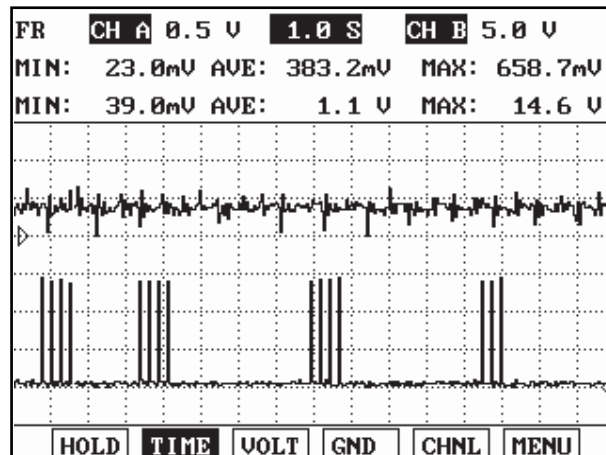


Fig. 2

Fig1) The signal waveforms of front HO2S(the upper) and heater(the lower) at idle

Fig2) The signal waveforms of rear HO2S(the upper) and heater(the lower) at idle

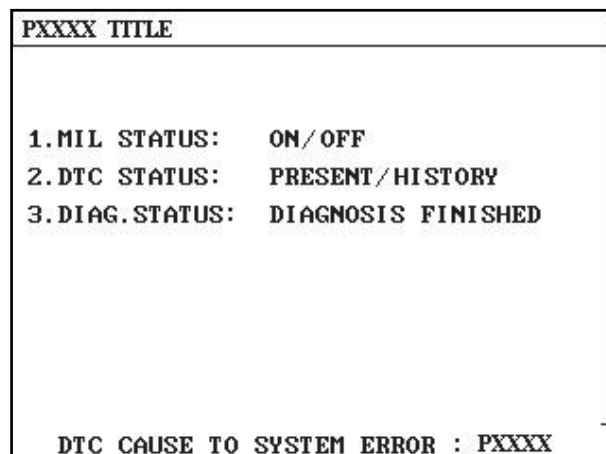
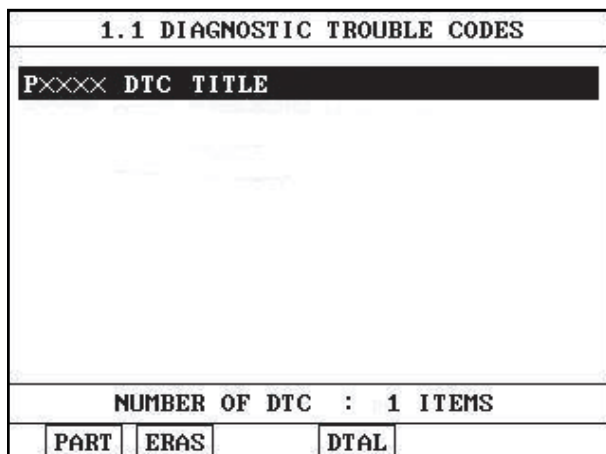
SCMF16158L

The HO2S requires a minimum temperature to provide a closed loop fuel control system. So the HO2S contains a heater element to reduce its warm-up time and ensure its performance during all driving conditions. The PCM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the PCM provides a ground circuit for activating the heater.

MONITOR DTC STATUS E34A309F

1. Check DTC Status

- 1) Connect scantool to Data Link Connector(DLC).
- 2) IG "ON".
- 3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F4(DTAL) to check DTC's information from the DTCs menu
- 4) Read "DTC Status" parameter.



SCMF16159L

5) Is parameter displayed "Present fault"?

YES

► Go to "Terminal and connector inspection" procedure.

NO

► Fault is intermittent caused by poor contact in the sensor' s and/or PCM' s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

TERMINAL AND CONNECTOR INSPECTION E1293BD8

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

► Repair as necessary and go to "Verification of Vehicle Repair" procedure

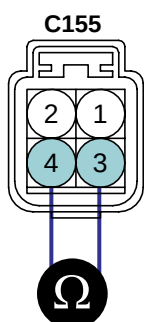
NO

► Go to " Component Inspection " procedure.

COMPONENT INSPECTION EA730770

1. Check HO2S(B1/S2) Heater resistance
 - 1) IG "OFF" and disconnect HO2S(B1/S2) connector
 - 2) Measure resistance between terminal 3 and 4 of HO2S(B1/S2)(Component Side)

Specification : 3.0 ~ 4.0Ω [21℃ (69.8°F)]



1. HO2S(B1/S2) Signal
2. Sensor Ground
3. Battery Voltage (B+)
4. Heater(B1/S2) Control

SVQF16232L

3) Is the measured resistance within specification ?

YES

- ▶ Substitute with a known - good PCM and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

- ▶ Substitute with a known - good HO2S(B1/S2) and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

E6E28F0E

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

- ▶ System performing to specification at this time. Clear the DTC.

NO

- ▶ Go to the applicable troubleshooting procedure.

FLA -134

FUEL SYSTEM

DTC P0037 HO2S HEATER CIRCUIT LOW (BANK 1 / SENSOR 2)

COMPONENT LOCATION ED71BF6C

Refer to DTC P0036.

GENERAL DESCRIPTION E90D395B

Refer to DTC P0036.

DTC DESCRIPTION EC23A286

If the PCM detects short to ground or open in heater under detecting conditions, PCM sets P0037. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E382D1D3

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects a short to ground or open	• Poor Connection • Open in Power Circuit • Open or short to ground in control circuit • HO2S(B1/S2) • PCM
Enable Conditions	• No disabling Faults Present • Engine Running • $11V \leq \text{Battery Voltage} \leq 16V$	
Threshold value	• short to ground or open circuit	
Diagnosis Time	• Continuous (More than 5 seconds failure for every 10 seconds test)	
MIL On Condition	• 2 Driving Cycles	

SPECIFICATION EE1EF805

Heater	
Resistance (Ω)	3.0 ~ 4.0 Ω [21 °C (69.8 °F)]

SCHEMATIC DIAGRAM E78EA1CB

Refer to DTC P0036.

SIGNAL WAVEFORM AND DATA E3963534

Refer to DTC P0036.

MONITOR DTC STATUS E92EBECC

Refer to DTC P0036.

TERMINAL AND CONNECTOR INSPECTION E7779CB6

Refer to DTC P0036.

DTC TROUBLESHOOTING PROCEDURES

FLA -135

POWER CIRCUIT INSPECTION E4F406C9

1. IG "OFF" & Disconnect HO2S(B1/S2) connector.
2. IG "ON" & ENG "OFF".
3. Measure voltage between terminal 3 of HO2S(B1/S2) harness connector and chassis ground.

Specification : B+

4. Is the measured voltage within specification ?

YES

- Go to "Control Circuit Inspection" procedure.

NO

- Repair open or short to ground in HO2S(B1/S2) Heater power circuit then, go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION EF0AC0A7

1. Check short to ground in harness.
 - 1) IG "OFF" and disconnect HO2S(B1/S2) connector.
 - 2) Measure resistance between terminal 4 of HO2S(B1/S2) harness connector and chassis ground.

Specification : Infinite

- 3) Is the measured resistance within specification ?

YES

- Go to "Check Open in harness" as follows.

NO

- Repair short to ground in HO2S (B1/S2) heater control circuit and go to "Verification of Vehicle Repair" procedure.

2. Check open in harness
 - 1) IG "OFF" and disconnect HO2S(B1/S2) and PCM connector.
 - 2) Measure resistance between terminal 4 of HO2S(B1/S2) harness connector and terminal 74 of PCM harness connector.

Specification : Approx. below 1Ω

- 3) Is the measured resistance within specification ?

YES

- Go to "Component Inspection" procedure.

NO

► Repair open in HO2S(B1/S2) heater control circuit and go to "Verification of Vehicle Repair" procedure.

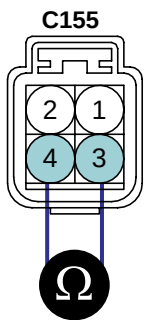
COMPONENT INSPECTION E3364B45

1. Check HO2S(B1/S2) Heater resistance

- 1) IG "OFF" and disconnect HO2S(B1/S2) connector
- 2) Measure resistance between terminal 3 and 4 of HO2S(B1/S2)(Component Side)

SPECIFICATION :

Heater	
Resistance (Ω)	3.0 ~ 4.0 Ω [21 °C (69.8 °F)]



1. HO2S(B1/S2) Signal
2. Sensor Ground
3. Battery Voltage (B+)
4. Heater(B1/S2) Control

SVQF16169L

3) Is the measured resistance within specification ?

YES

► Substitute with a known - good PCM and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.

Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

NO

► Substitute with a known - good HO2S(B1/S2) and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E112D008

Refer to DTC P0036.

DTC TROUBLESHOOTING PROCEDURES

FLA -137

DTC P0038 HO2S HEATER CIRCUIT HIGH (BANK 1 / SENSOR 2)

COMPONENT LOCATION EB6C74B6

Refer to DTC P0036.

GENERAL DESCRIPTION EB7DD26F

Refer to DTC P0036.

DTC DESCRIPTION ECA58DC4

If the PCM detects short to battery in heater under detecting conditions, PCM sets P0038. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION EB9C76A0

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects a short to battery	• Poor Connection • short to battery in control circuit • HO2S(B1/S2) • PCM
Enable Conditions	• No disabling Faults Present • Engine Running • $11V \leq \text{Battery Voltage} \leq 16V$	
Threshold value	• short to battery	
Diagnosis Time	• Continuous (More than 5 seconds failure for every 10 seconds test)	
MIL On Condition	• 2 Driving Cycles	

SPECIFICATION EEFFC06F

Heater	
Resistance (Ω)	3.0 ~ 4.0 Ω [21℃ (69.8°F)]

SCHEMATIC DIAGRAM EE3BACB2

Refer to DTC P0036.

SIGNAL WAVEFORM AND DATA EF09793A

Refer to DTC P0036.

MONITOR DTC STATUS E7B82B16

Refer to DTC P0036.

TERMINAL AND CONNECTOR INSPECTION E15C4596

Refer to DTC P0036.

CONTROL CIRCUIT INSPECTION

E24CC29E

1. IG "OFF" & disconnect HO2S(B1/S2) connector.
2. IG "ON" & ENG "OFF".
3. Measure voltage between terminal 4 of HO2S(B1/S2) harness connector and chassis ground.

Specification : Approx. 0 V

4. Is the measured voltage within specification ?

YES

- ▶ Go to HO2S(B1/S2) "Component Inspection" procedure.

NO

- ▶ Repair short to battery in HO2S (B1/S2) heater control circuit and go to "Verification of Vehicle Repair" procedure.

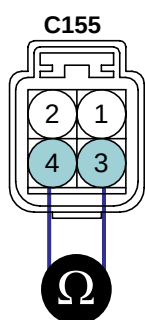
COMPONENT INSPECTION

E0BA325D

1. Check HO2S(B1/S2) Heater resistance
 - 1) IG "OFF" and disconnect HO2S(B1/S2) connector
 - 2) Measure resistance between terminal 3 and 4 of HO2S(B1/S2)(Component Side)

SPECIFICATION :

Heater	
Resistance (Ω)	3.0 ~ 4.0 Ω [21℃ (69.8°F)]



1. HO2S(B1/S2) Signal
2. Sensor Ground
3. Battery Voltage (B+)
4. Heater(B1/S2) Control

SVQF16169L

- 3) Is the measured resistance within specification ?

YES

- ▶ Substitute with a known - good PCM and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.

DTC TROUBLESHOOTING PROCEDURES

FLA -139

Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

NO

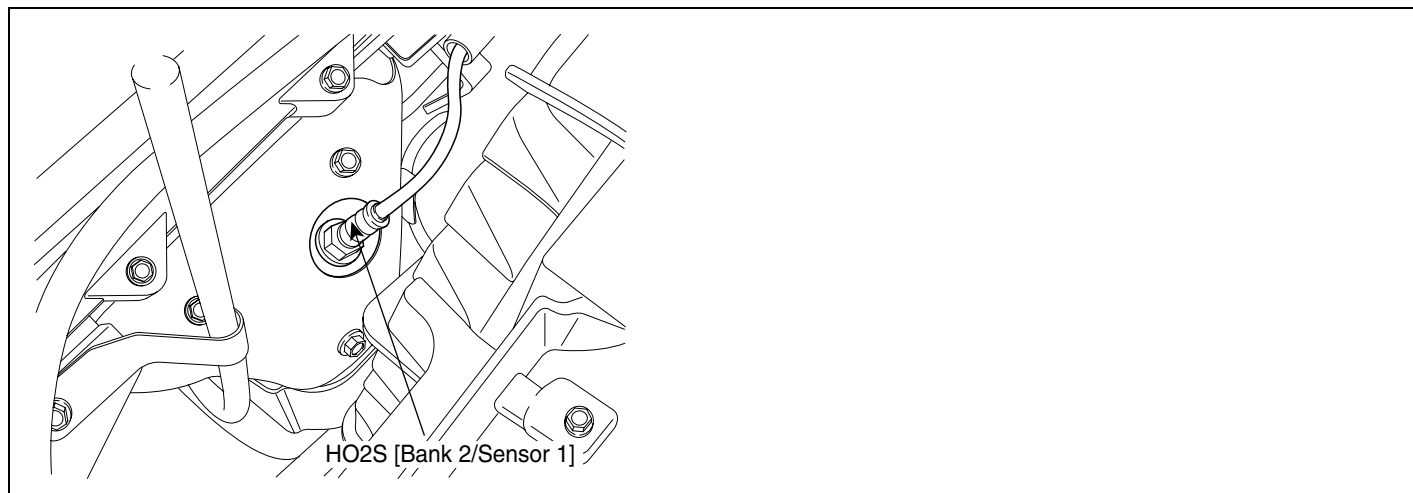
- ▶ Substitute with a known - good HO2S(B1/S2) and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E8682525

Refer to DTC P0036.

DTC P0050 HO2S HEATER CONTROL CIRCUIT (BANK 2 / SENSOR 1)

COMPONENT LOCATION E52FEA52



LGLG506A

GENERAL DESCRIPTION E396D5EE

The normal operating temperature of the HO2S(Heated Oxygen Sensor) ranges from 350 to 850°C(662 to 1562°F). The HO2S heater greatly decreases the amount of time required for fuel control to become active. The ECM provides a pulse width modulated control circuit to adjust current through the heater. When the HO2S is cold, the value of the resistance is low and the current in the circuit is high. On the contrary, if the temperature in the resistor of the sensor rises, the current drops gradually.

DTC DESCRIPTION EC4910CB

Checking current from HO2S under detecting condition,if the heater current is below a certain threshold for more than predeterminate time, PCM sets P0050. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E470B0D8

Item	Detecting Condition	Possible cause
DTC Strategy	Monitor the current through the heater	- Poor Connection - HO2S(B2/S1) - PCM
Enable Conditions	- Engine Running > 60 sec. - Heater Duty Cycle > 40% - Max. Duty Cycle - Min. Duty Cycle < 5%	
Threshold value	Filtered O2 Heater Current < threshold value	
Diagnosis Time	Continuous (More than 2.5 second failure for every 5 second test)	
MIL On Condition	2 Driving Cycles	

DTC TROUBLESHOOTING PROCEDURES

FLA -141

SPECIFICATION

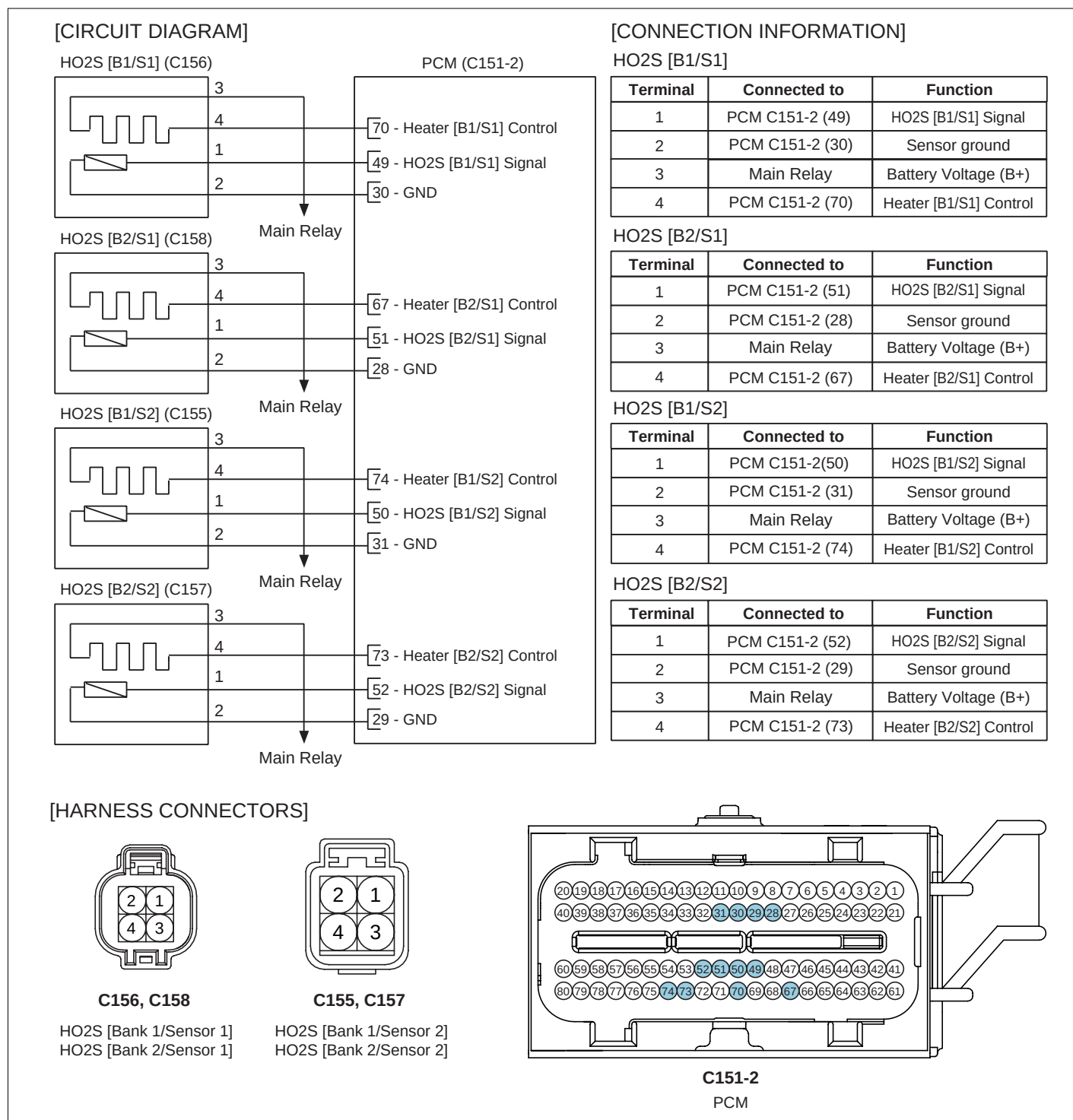
E323CB65

(REFERENCE ONLY)

Condition	Current(A)
Heater Current at 13.5V, 450 °C (842°F) Exhaust	0.52 ± 0.1

SCHEMATIC DIAGRAM

E698EE52



SVQF16110L

SIGNAL WAVEFORM AND DATA

E8CA1A5D

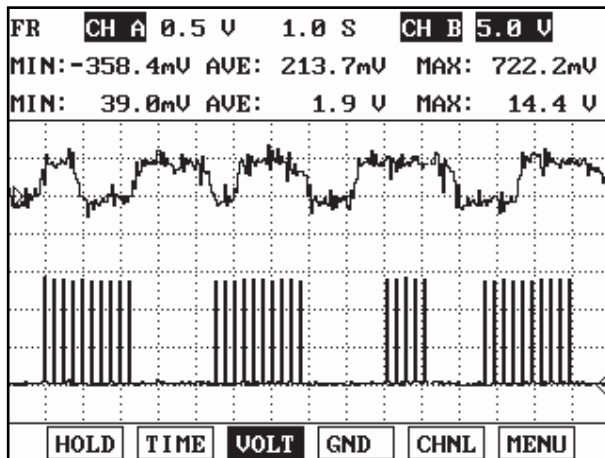


Fig. 1

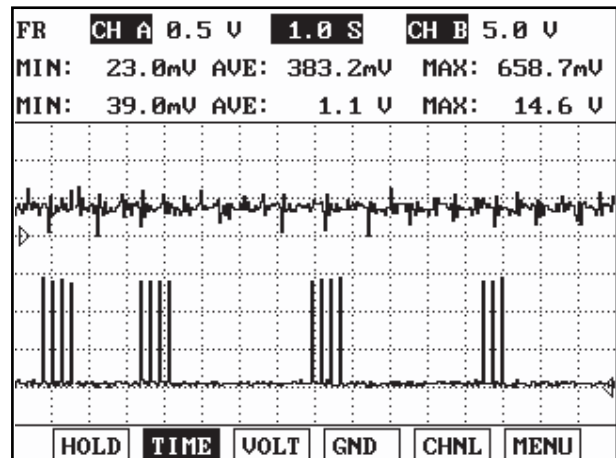


Fig. 2

Fig1) The signal waveforms of front HO2S(the upper) and heater(the lower) at idle

Fig2) The signal waveforms of rear HO2S(the upper) and heater(the lower) at idle

SCMF16158L

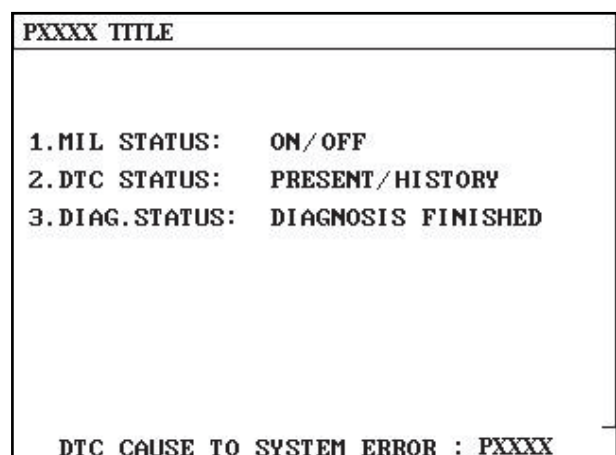
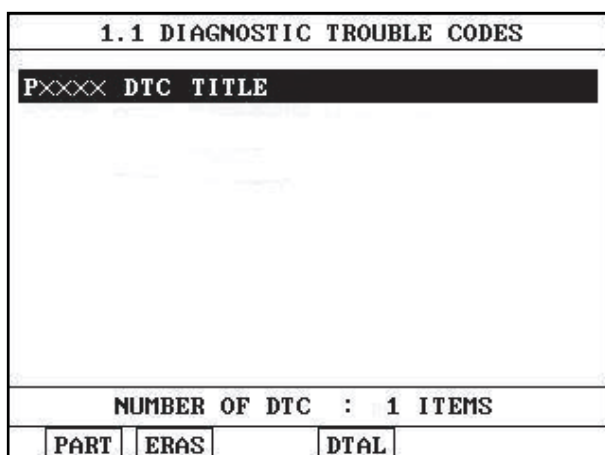
The HO2S requires a minimum temperature to provide a closed loop fuel control system. So the HO2S contains a heater element to reduce its warm-up time and ensure its performance during all driving conditions. The PCM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the PCM provides a ground circuit for activating the heater.

MONITOR DTC STATUS

EA87FFAE

1. Check DTC Status

- 1) Connect scantool to Data Link Connector(DLC).
- 2) IG "ON".
- 3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F4(DTAL) to check DTC's information from the DTCs menu
- 4) Read "DTC Status" parameter.



SCMF16159L

DTC TROUBLESHOOTING PROCEDURES

FLA -143

- 5) Is parameter displayed "Present fault"?

YES

- Go to "Terminal and connector inspection" procedure.

NO

- Fault is intermittent caused by poor contact in the sensor' s and/or PCM' s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

TERMINAL AND CONNECTOR INSPECTION E039415D

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

- Repair as necessary and go to "Verification of Vehicle Repair" procedure

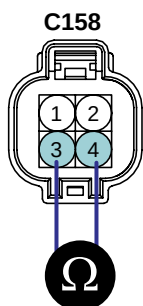
NO

- Go to "Component Inspection" procedure.

COMPONENT INSPECTION ECD12C61

1. Check HO2S(B2/S1) Heater resistance
 - 1) IG "OFF" and disconnect HO2S(B2/S1) connector
 - 2) Measure resistance between terminal 3 and 4 of HO2S(B2/S1)(Component Side)

Specification : 3.0 ~ 4.0 Ω at 21°C (69.8°F)



1. HO2S(B2/S1) Signal
2. Sensor Ground
3. Battery Voltage (B+)
4. Heater(B2/S1) Control

SVQF16233L

- 3) Is the measured resistance within specification ?

YES

- ▶ Substitute with a known - good PCM and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

- ▶ Substitute with a known - good HO2S(B2/S1) and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

E726D4B8

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

- ▶ System performing to specification at this time. Clear the DTC.

NO

- ▶ Go to the applicable troubleshooting procedure.

DTC TROUBLESHOOTING PROCEDURES

FLA -145

DTC P0051 HO2S HEATER CIRCUIT LOW (BANK 2 / SENSOR 1)

COMPONENT LOCATION E4992107

Refer to DTC P0050.

GENERAL DESCRIPTION E535D4BE

Refer to DTC P0050.

DTC DESCRIPTION E6923814

If the PCM detects short to ground or open in heater under detecting conditions, PCM sets P0051. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E394EBCE

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects a short to ground or open	• Poor Connection • Open in Power Circuit • Open or short to ground in control circuit • HO2S(B2/S1) • PCM
Enable Conditions	• No disabling Faults • Engine Running • $11V \leq \text{Battery Voltage} \leq 16V$	
Threshold value	• short to ground or open circuit	
Diagnosis Time	• Continuous (More than 5 seconds failure for every 10 seconds test)	
MIL On Condition	• 2 Driving Cycles	

SPECIFICATION E6E87FC9

Heater	
Resistance (Ω)	3.0 ~ 4.0 Ω [21℃ (69.8°F)]

SCHEMATIC DIAGRAM E501720E

Refer to DTC P0050.

SIGNAL WAVEFORM AND DATA ECAD7DFA

Refer to DTC P0050.

MONITOR DTC STATUS EFF5CF05

Refer to DTC P0050.

TERMINAL AND CONNECTOR INSPECTION EF2EFE36

Refer to DTC P0050.

POWER CIRCUIT INSPECTION

E9385DF1

1. IG "OFF" & Disconnect HO2S(B2/S1) connector.
2. IG "ON" & ENG "OFF".
3. Measure voltage between terminal 3 of HO2S(B2/S1) harness connector and chassis ground.

Specification : B+

4. Is the measured voltage within specification ?

YES

- Go to "Control Circuit Inspection" procedure.

NO

- Repair open or short to ground in HO2S(B2/S1) Heater power circuit then, go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

EBFE5349

1. Check short to ground in harness.
 - 1) IG "OFF" and disconnect HO2S(B2/S1) connector.
 - 2) Measure resistance between terminal 4 of HO2S(B2/S1) harness connector and chassis ground.

Specification : Infinite

- 3) Is the measured resistance within specification ?

YES

- Go to "Check Open in harness" as follows.

NO

- Repair short to ground in HO2S (B2/S1) heater control circuit and go to "Verification of Vehicle Repair" procedure.

2. Check open in harness
 - 1) IG "OFF" and disconnect HO2S(B2/S1) and PCM connector.
 - 2) Measure resistance between terminal 4 of HO2S(B2/S1) harness connector and terminal 67 of PCM harness connector.

Specification : Approx. below 1Ω

- 3) Is the measured resistance within specification ?

YES

- Go to "Component Inspection" procedure.

DTC TROUBLESHOOTING PROCEDURES

FLA -147

NO

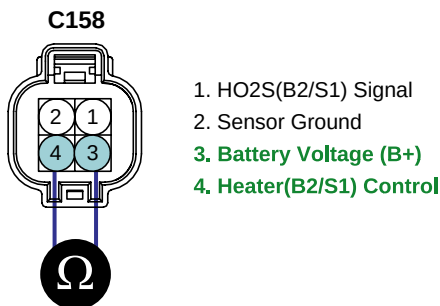
- Repair open in HO2S(B2/S1) heater control circuit and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E3ED50EA

1. Check HO2S(B2/S1) Heater resistance
 - 1) IG "OFF" and disconnect HO2S(B2/S1) connector
 - 2) Measure resistance between terminal 1 and 2 of HO2S(B2/S1)(Component Side)

SPECIFICATION :

Heater	
Resistance (Ω)	3.0 ~ 4.0 Ω [21°C (69.8°F)]



SVQF16174L

- 3) Is the measured resistance within specification ?

YES

- Substitute with a known - good PCM and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.

Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

NO

- Substitute with a known - good HO2S(B2/S1) and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E0F55148

Refer to DTC P0050.

FLA -148

FUEL SYSTEM

DTC P0052 HO2S HEATER CIRCUIT HIGH (BANK 2 / SENSOR 1)

COMPONENT LOCATION E91F4CFC

Refer to DTC P0050.

GENERAL DESCRIPTION E2AC4FB7

Refer to DTC P0050.

DTC DESCRIPTION EE86C43C

If the PCM detects short to battery in heater under detecting conditions, PCM sets P0052. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION EF44CFAB

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects a short to battery	• Poor Connection • Short to battery in control circuit • HO2S(B2/S1) • PCM
Enable Conditions	• No disabling Faults • Engine Running • $11V \leq \text{Battery Voltage} \leq 16V$	
Threshold value	• Short to battery	
Diagnosis Time	• Continuous (More than 5 seconds failure for every 10 seconds test)	
MIL On Condition	• 2 Driving Cycles	

SPECIFICATION E9CF71E6

Heater	
Resistance (Ω)	3.0 ~ 4.0 Ω [21 °C (69.8 °F)]

SCHEMATIC DIAGRAM E7A3435D

Refer to DTC P0050.

SIGNAL WAVEFORM AND DATA E6595DDC

Refer to DTC P0050.

MONITOR DTC STATUS E73C5F88

Refer to DTC P0050.

TERMINAL AND CONNECTOR INSPECTION E4364E96

Refer to DTC P0050.

DTC TROUBLESHOOTING PROCEDURES

FLA -149

CONTROL CIRCUIT INSPECTION

EA6A8A29

1. IG "OFF" & disconnect HO2S(B2/S1) connector.
2. IG "ON" & ENG "OFF".
3. Measure voltage between terminal 4 of HO2S(B2/S1) harness connector and chassis ground.

Specification : Approx. 0 V

4. Is the measured voltage within specification ?

YES

► Go to "Component Inspection" procedure.

NO

► Repair short to battery in HO2S(B2/S1) Heater control circuit and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

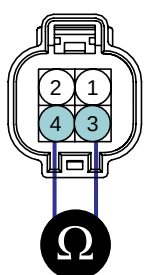
E7B3B30E

1. Check HO2S(B2/S1) Heater resistance
 - 1) IG "OFF" and disconnect HO2S(B2/S1) connector
 - 2) Measure resistance between terminal 3 and 4 of HO2S(B2/S1)(Component Side)

SPECIFICATION :

Heater	
Resistance (Ω)	3.0 ~ 4.0 Ω [21°C (69.8°F)]

C158



1. HO2S(B2/S1) Signal
2. Sensor Ground
3. Battery Voltage (B+)
4. Heater(B2/S1) Control

SVQF16174L

- 3) Is the measured resistance within specification ?

YES

► Substitute with a known - good PCM and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.

Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

NO

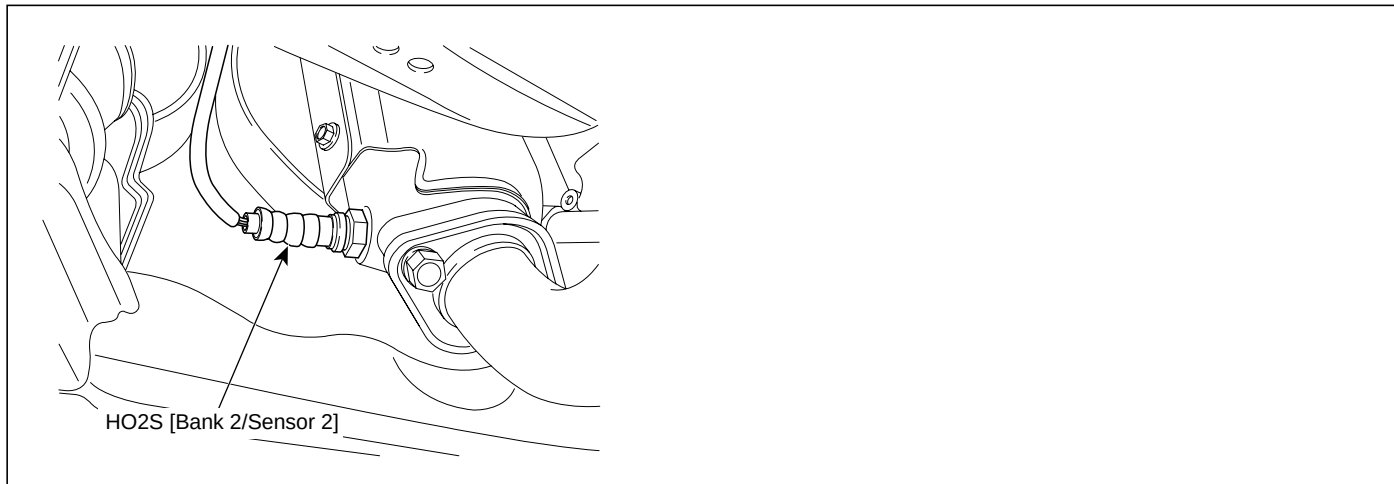
- Substitute with a known - good HO2S(B2/S1) and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EBC231F8

Refer to DTC P0050.

DTC P0056 HO2S HEATER CONTROL CIRCUIT (BANK 2 / SENSOR 2)

COMPONENT LOCATION EBCB2426



SCMF16176L

GENERAL DESCRIPTION EE20DCF2

The normal operating temperature of the HO2S(Heated Oxygen Sensor) ranges from 350 to 850°C(662 to 1562°F). The HO2S heater greatly decreases the amount of time required for fuel control to become active. The ECM provides a pulse width modulated control circuit to adjust current through the heater. When the HO2S is cold, the value of the resistance is low and the current in the circuit is high. On the contrary, if the temperature in the resistor of the sensor rises, the current drops gradually.

DTC DESCRIPTION E95D0768

Checking current from HO2S under detecting condition,if the heater current is below a certain threshold for more than predeterminate time, PCM sets P0056. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E8E45268

Item	Detecting Condition	Possible cause
DTC Strategy	Monitor the current through the heater	- Poor connection - HO2S(B2/S2) - PCM
Enable Conditions	- Engine Running > 60 sec. - Heater Duty Cycle > 18% - Max. Duty Cycle - Min. Duty Cycle < 5%	
Threshold value	Filtered Heater Current < threshold value	
Diagnosis Time	Continuous (More than 2.5 second failure for every 5 second test)	
MIL On Condition	2 Driving Cycles	

SPECIFICATION

E28FDF13

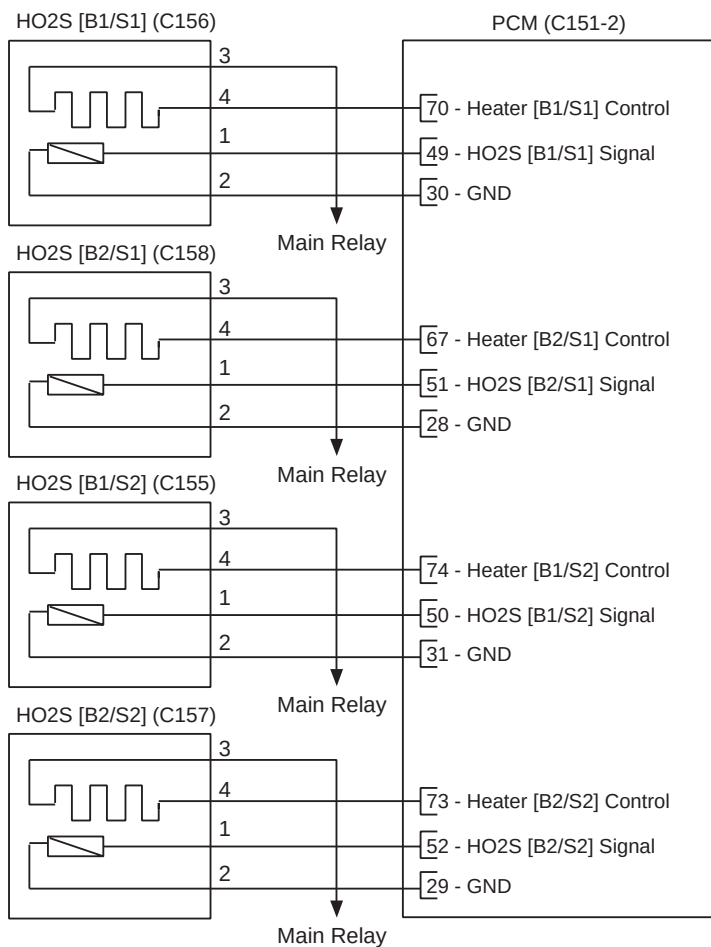
(REFERENCE ONLY)

Condition	Current(A)
Heater Current at 13.5V, 450 °C (842°F) Exhaust	0.52 ± 0.1

SCHEMATIC DIAGRAM

E14CB6D5

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

HO2S [B1/S1]

Terminal	Connected to	Function
1	PCM C151-2 (49)	HO2S [B1/S1] Signal
2	PCM C151-2 (30)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C151-2 (70)	Heater [B1/S1] Control

HO2S [B2/S1]

Terminal	Connected to	Function
1	PCM C151-2 (51)	HO2S [B2/S1] Signal
2	PCM C151-2 (28)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C151-2 (67)	Heater [B2/S1] Control

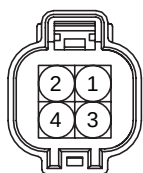
HO2S [B1/S2]

Terminal	Connected to	Function
1	PCM C151-2(50)	HO2S [B1/S2] Signal
2	PCM C151-2 (31)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C151-2 (74)	Heater [B1/S2] Control

HO2S [B2/S2]

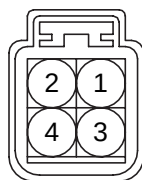
Terminal	Connected to	Function
1	PCM C151-2 (52)	HO2S [B2/S2] Signal
2	PCM C151-2 (29)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C151-2 (73)	Heater [B2/S2] Control

[HARNESS CONNECTORS]



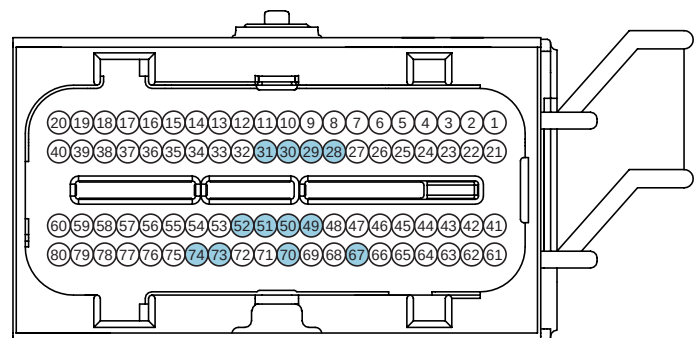
C156, C158

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]



C155, C157

HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]



C151-2
PCM

SIGNAL WAVEFORM AND DATA E0BCDEF2

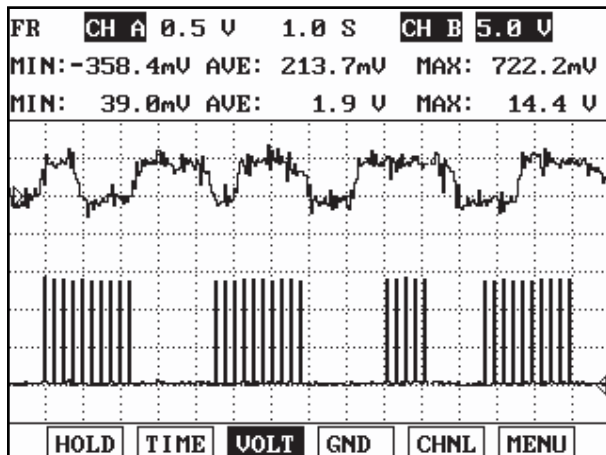


Fig. 1

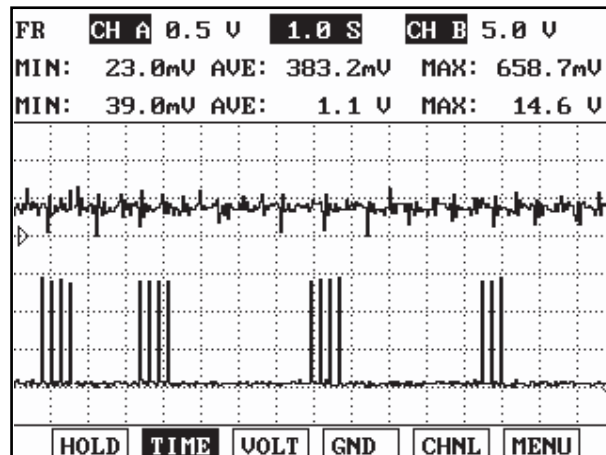


Fig. 2

Fig1) The signal waveforms of front HO2S(the upper) and heater(the lower) at idle

Fig2) The signal waveforms of rear HO2S(the upper) and heater(the lower) at idle

SCMF16158L

The HO2S requires a minimum temperature to provide a closed loop fuel control system. So the HO2S contains a heater element to reduce its warm-up time and ensure its performance during all driving conditions. The PCM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the PCM provides a ground circuit for activating the heater.

MONITOR DTC STATUS E22844FA

1. Check DTC Status

- 1) Connect scantool to Data Link Connector(DLC).
- 2) IG "ON".
- 3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F4(DTAL) to check DTC's information from the DTCs menu
- 4) Read "DTC Status" parameter.

1.1 DIAGNOSTIC TROUBLE CODES		
PXXXX DTC TITLE		
NUMBER OF DTC : 1 ITEMS		
PART	ERAS	DTAL

PXXXX TITLE	
1.MIL STATUS:	ON/OFF
2.DTC STATUS:	PRESENT/HISTORY
3.DIAG.STATUS:	DIAGNOSIS FINISHED
DTC CAUSE TO SYSTEM ERROR : PXXXX	

SCMF16159L

- 5) Is parameter displayed "Present fault"?

YES

- Go to "Terminal and connector inspection" procedure.

NO

- Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

TERMINAL AND CONNECTOR INSPECTION ED0B2600

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

- Repair as necessary and go to "Verification of Vehicle Repair" procedure

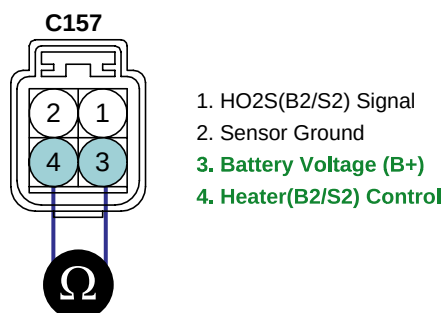
NO

- Go to "Component Inspection" procedure.

COMPONENT INSPECTION E806FF18

1. Check HO2S(B2/S2) Heater resistance
 - 1) IG "OFF" and disconnect HO2S(B2/S2) connector
 - 2) Measure resistance between terminal 3 and 4 of HO2S(B2/S2)(Component Side)

Specification : 3.0 ~ 4.0Ω [21℃ (69.8°F)]



SVQF16180L

2. Is the measured resistance within specification ?

YES

- ▶ Substitute with a known - good PCM and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.

 NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

- ▶ Substitute with a known - good HO2S(B2/S2) and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E63568BB

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

- ▶ System performing to specification at this time. Clear the DTC.

NO

- ▶ Go to the applicable troubleshooting procedure.

FLA -156

FUEL SYSTEM

DTC P0057 HO2S HEATER CIRCUIT LOW (BANK 2 / SENSOR 2)

COMPONENT LOCATION ED7330BE

Refer to DTC P0056.

GENERAL DESCRIPTION EFE22A4A

Refer to DTC P0056.

DTC DESCRIPTION E9551803

If the PCM detects short to ground or open in heater under detecting conditions, PCM sets P0057. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION EE2A5032

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects a short to ground or open	• Poor Connection • Open in Power Circuit • Open or short to ground in control circuit • HO2S(B2/S2) • PCM
Enable Conditions	• No disabling Faults • Engine Running • $11V \leq \text{Battery Voltage} \leq 16V$	
Threshold value	• short to ground or open circuit	
Diagnosis Time	• Continuous (More than 5 seconds failure for every 10 seconds test)	
MIL On Condition	• 2 Driving Cycles	

SPECIFICATION ED43F551

Heater	
Resistance (Ω)	3.0 ~ 4.0 Ω [21 °C (69.8 °F)]

SCHEMATIC DIAGRAM E7BE250F

Refer to DTC P0056.

SIGNAL WAVEFORM AND DATA E27F14FA

Refer to DTC P0056.

MONITOR DTC STATUS E63177D2

Refer to DTC P0056.

TERMINAL AND CONNECTOR INSPECTION ED10E4DC

Refer to DTC P0056.

DTC TROUBLESHOOTING PROCEDURES

FLA -157

POWER CIRCUIT INSPECTION EC78498B

1. IG "OFF" & Disconnect HO2S(B2/S2) connector.
2. IG "ON" & ENG "OFF".
3. Measure voltage between terminal 3 of HO2S(B2/S2) harness connector and chassis ground.

Specification : B+

4. Is the measured voltage within specification ?

YES

- Go to "Control Circuit Inspection" procedure.

NO

- Repair open or short to ground in HO2S(B2/S2) Heater power circuit then, go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION EA808408

1. Check short to ground in harness.
 - 1) IG "OFF" and disconnect HO2S(B2/S2) connector.
 - 2) Measure resistance between terminal 4 of HO2S(B2/S2) harness connector and chassis ground.

Specification : Infinite

- 3) Is the measured resistance within specification ?

YES

- Go to "Check Open in harness" as follows.

NO

- Repair short to ground in HO2S (B2/S2) heater control circuit and go to "Verification of Vehicle Repair" procedure.

2. Check open in harness
 - 1) IG "OFF" and disconnect HO2S(B2/S2) and PCM connector.
 - 2) Measure resistance between terminal 4 of HO2S(B2/S2) harness connector and terminal 73 of PCM harness connector.

Specification : Approx. below 1Ω

- 3) Is the measured resistance within specification ?

YES

- Go to "Component Inspection" procedure.

NO

► Repair open in HO2S(B2/S2) heater control circuit and go to "Verification of Vehicle Repair" procedure.

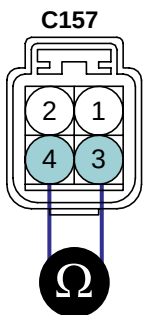
COMPONENT INSPECTION E31E12EC

1. Check HO2S(B2/S2) Heater resistance

- 1) IG "OFF" and disconnect HO2S(B2/S2) connector
- 2) Measure resistance between terminal 3 and 4 of HO2S(B2/S2)(Component Side)

SPECIFICATION :

Heater	
Resistance (Ω)	3.0 ~ 4.0 Ω [21 °C (69.8 °F)]



1. HO2S(B2/S2) Signal
2. Sensor Ground
3. Battery Voltage (B+)
4. Heater(B2/S2) Control

SVQF16180L

3) Is the measured resistance within specification ?

YES

► Substitute with a known - good PCM and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.

Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

NO

► Substitute with a known - good HO2S(B2/S2) and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR ED007C94

Refer to DTC P0056.

DTC TROUBLESHOOTING PROCEDURES

FLA -159

DTC P0058 HO2S HEATER CIRCUIT HIGH (BANK 2 / SENSOR 2)

COMPONENT LOCATION E8EECFBE

Refer to DTC P0056.

GENERAL DESCRIPTION EBFDC1AC

Refer to DTC P0056.

DTC DESCRIPTION E1B31BA2

If the PCM detects short to battery in heater under detecting conditions, PCM sets P0058. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E95AA488

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects a short to battery	• Poor Connection • Short to battery in control circuit • HO2S(B2/S2) • PCM
Enable Conditions	• No disabling Faults • Engine Running • $11V \leq \text{Battery Voltage} \leq 16V$	
Threshold value	• Short to battery	
Diagnosis Time	• Continuous (More than 5 seconds failure for every 10 seconds test)	
MIL On Condition	• 2 Driving Cycles	

SPECIFICATION E72F6E7E

Heater	
Resistance (Ω)	3.0 ~ 4.0 Ω [21℃ (69.8°F)]

SCHEMATIC DIAGRAM EDAC9D24

Refer to DTC P0056.

SIGNAL WAVEFORM AND DATA EA7786A6

Refer to DTC P0056.

MONITOR DTC STATUS E0E1DEC1

Refer to DTC P0056.

TERMINAL AND CONNECTOR INSPECTION EBFA41CB

Refer to DTC P0056.

CONTROL CIRCUIT INSPECTION

EBF34ABE

1. IG "OFF" & disconnect HO2S(B2/S2) connector.
2. IG "ON" & ENG "OFF".
3. Measure voltage between terminal 4 of HO2S(B2/S2) harness connector and chassis ground.

Specification : Approx. 0 V

4. Is the measured voltage within specification ?

YES

- ▶ Go to "Component Inspection" procedure.

NO

- ▶ Repair short to battery in HO2S (B2/S2) heater control circuit and go to "Verification of Vehicle Repair" procedure.

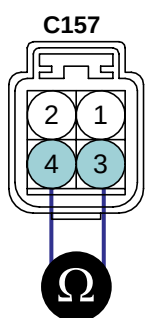
COMPONENT INSPECTION

E516F026

1. Check HO2S(B2/S2) Heater resistance
 - 1) IG "OFF" and disconnect HO2S(B2/S2) connector
 - 2) Measure resistance between terminal 1 and 2 of HO2S(B2/S2)(Component Side)

SPECIFICATION :

Heater	
Resistance (Ω)	3.0 ~ 4.0 Ω [21 $^{\circ}$ C (69.8 $^{\circ}$ F)]



1. HO2S(B2/S2) Signal
2. Sensor Ground
3. Battery Voltage (B+)
4. Heater(B2/S2) Control

SVQF16180L

- 3) Is the measured resistance within specification ?

YES

- ▶ Substitute with a known - good PCM and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.

DTC TROUBLESHOOTING PROCEDURES

FLA -161

Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

NO

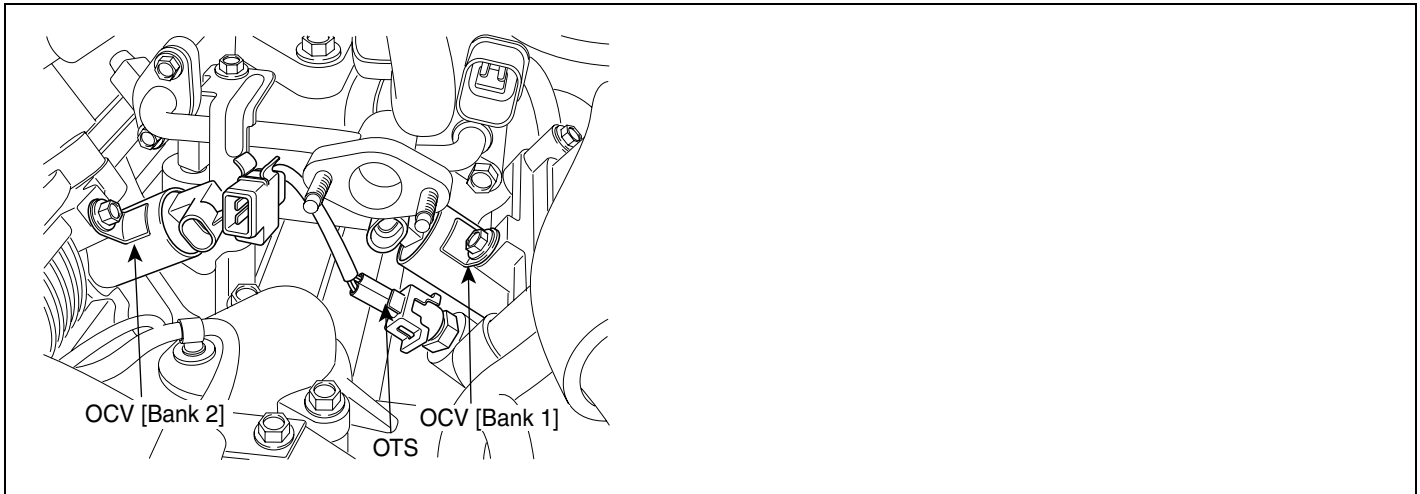
- ▶ Substitute with a known - good HO2S(B2/S2) and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E3725F3E

Refer to DTC P0056.

DTC P0076 INTAKE VALVE CONTROL SOLENOID CIRCUIT LOW (BANK 1)

COMPONENT LOCATION EC804154



LGLG500A

GENERAL DESCRIPTION EC183A40

The CVVT (Continuously Variable Valve Timing) system is installed to the chain sprocket of the intake camshaft. This system controls the intake camshaft to provide the optimal valve timing for every driving condition. The ECM controls the Oil Control Valve(OCV), based on the signals output from mass air flow, throttle position and engine coolant temperature. The CVVT controller regulates the intake camshaft angle using oil pressure through the OCV. As result, the relative position between the camshaft and the crankshaft becomes optimal, and the engine torque improves, fuel economy improves, exhaust emissions decrease under overall driving conditions.

DTC DESCRIPTION E095E210

When the enable condition is satisfied, the PCM checks that OCV outputs (Voltage level) are observed when OCVs are commanded. When a OCV output failure is detected, the appropriate fail counter is incremented. If the failure threshold is exceeded 5 seconds during one diagnostic test(10second), the test is failed and DTC is stored. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E0F366C7

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects a short to ground or open	• Poor Connection • Open in Power Circuit • Open or short to ground in control circuit • OCV • PCM
Enable Conditions	• No disabling Faults Present • Engine Running • $11V \leq \text{Ignition Voltage} \leq 16V$	
Threshold value	• Short to ground or open circuit	
Diagnosis Time	• Continuous (More than 5 seconds failure for every 10 seconds test)	
MIL On Condition	• 2 Driving Cycles	

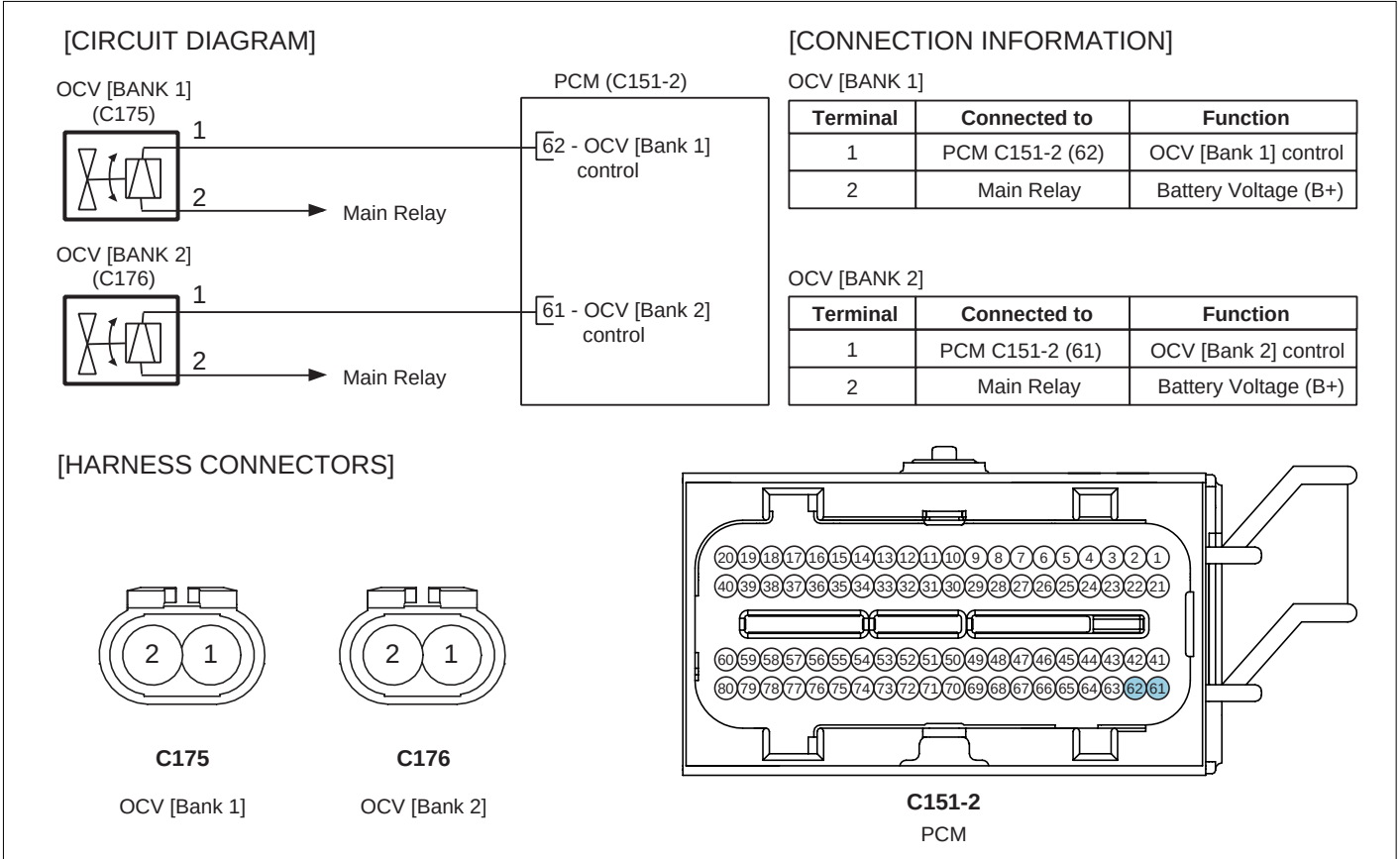
DTC TROUBLESHOOTING PROCEDURES

FLA -163

SPECIFICATION EF9008C7

Resistance (Ω)	6.7 ~ 7.7 Ω [20°C (68°F)]

SCHEMATIC DIAGRAM E6F09AA7



SVQF16115L

SIGNAL WAVEFORM AND DATA E64712E4

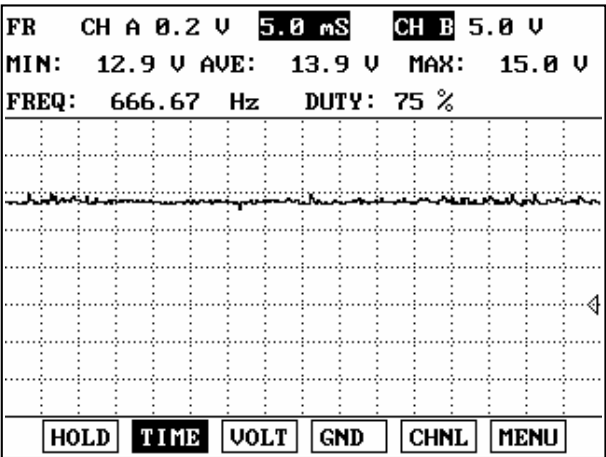


Fig. 1

Fig. 1 : Idle

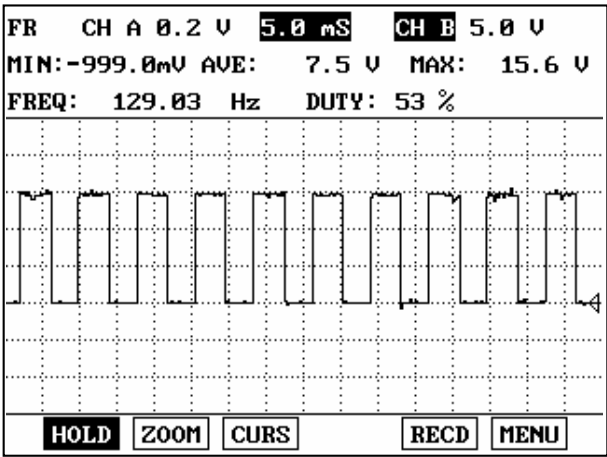


Fig. 2

Fig. 2 : Accelleration

EGRF602G

YES

- ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

- ▶ Go to " Power Circuit Inspection " procedure

POWER CIRCUIT INSPECTION EB17C5EC

1. IG "OFF" & Disconnect OCV(B1) connector.
2. IG "ON" & ENG "OFF".
3. Measure voltage between terminal 2 of OCV(B1) harness connector and chassis ground.

Specification : B+

4. Is the measured voltage within specification ?

YES

- ▶ Go to "Control Circuit Inspection" procedure.

NO

- ▶ Check fuse between Main Relay and OCV is open or not installed.
- ▶ Check open in power circuit between Main Relay and OCV power circuit.
- ▶ Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION E49A77A9

1. Check short to ground in harness.
 - 1) IG "OFF" and disconnect OCV connector.
 - 2) IG "ON" & ENG "OFF".
 - 3) Measure resistance between terminal 1 of OCV harness connector and chassis ground.

Specification : Infinite

- 4) Is the measured resistance within specification ?

YES

- ▶ Go to "Check open in harness" as follows

NO

- ▶ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check open in harness
 - 1) IG "OFF" and disconnect OCV and PCM connector.
 - 2) Measure resistance between terminal 1 of OCV harness connector and terminal 62 of PCM harness connector.

Specification : Approx. below 1Ω

3) Is the measured resistance within specification ?

YES

► Go to "Component Inspection" procedure.

NO

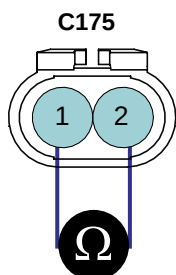
► Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EEFE7202

1. Check OCV

- 1) IG "OFF" and disconnect OCV connector.
- 2) Measure resistance between terminal 1 and 2 of OCV. (Component Side)

Specification : $6.7 \sim 7.7 \Omega$ at 20°C (68°F)



1. OCV(B1) control
2. OCV(B1) power

SVQF16433L

3) Is the measured resistance within specification ?

YES

► Go to "OCV Actuation Test" as follows.

NO

► Substitute with a known - good OCV and check for proper operation. If the problem is corrected, replace OCV and go to "Verification of Vehicle Repair" procedure.

2. OCV Actuation Test

- 1) Connect scantool and IG "ON".
- 2) Select "OCV" on the Actuation Test.
- 3) Activate "OCV" by pressing "STRT(F1)" key.
(should hear a faint click from Oil Control solenoid Valve)
- 4) Repeat this procedure 4 or 5 times to ensure reliability

1.11 ACTUATION TEST		12/25
OIL CONTROL VALVE		
DURATION	UNTIL STOP KEY	
METHOD	ACTIVATION	
CONDITION	IG.KEY ON ENGINE OFF	
PRESS [STRT], IF YOU ARE READY ! SELECT TEST ITEM USING UP/DOWN KEY		
STRT STOP		

EGRF602M

5) Does OCV generate click sound during acutation test ?

YES

► Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.

Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

► Substitute with a known - good OCV and check for proper operation. If the problem is corrected, replace OCV and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

E68A0D99

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

► System performing to specification at this time. Clear the DTC.

NO

► Go to the applicable troubleshooting procedure.

FLA -168

FUEL SYSTEM

DTC P0077 INTAKE VALVE CONTROL SOLENOID CIRCUIT HIGH (BANK 1)

COMPONENT LOCATION EBE4B7B4

Refer to DTC P0076.

GENERAL DESCRIPTION E3EE6112

Refer to DTC P0076.

DTC DESCRIPTION E6C94604

When the enable condition is satisfied, the PCM checks that OCV outputs (Voltage level) are observed when OCVs are commanded. When a OCV output failure is detected, the appropriate fail counter is incremented. If the failure threshold is exceeded 5 seconds during one diagnostic test(10second),the test is failed and DTC is stored. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E5241C91

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects a short to battery	• Poor Connection • Short to battery in Control Circuit • OCV • PCM
Enable Conditions	• No disabling Faults Present • Engine Running • $11V \leq \text{Ignition Voltage} \leq 16V$	
Threshold value	• Short to battery	
Diagnosis Time	• Continuous (More than 5 seconds failure for every 10 seconds test)	
MIL On Condition	• 2 Driving Cycles	

SPECIFICATION EBE87B33

Resistance (Ω)	6.7 ~ 7.7 Ω [20℃(68°F)]

SCHEMATIC DIAGRAM ED688252

Refer to DTC P0076.

SIGNAL WAVEFORM AND DATA E2078BE7

Refer to DTC P0076.

MONITOR DTC STATUS E5EBE25E

Refer to DTC P0076.

TERMINAL AND CONNECTOR INSPECTION E57DBE3C

Refer to DTC P0076.

DTC TROUBLESHOOTING PROCEDURES

FLA -169

CONTROL CIRCUIT INSPECTION E6D7EE7A

1. IG "OFF" and Disconnect OCV connector.
2. Measure resistance between terminal 1 and 2 of OCV harness connector.

Specification : Infinite

3. Is the measured resistance within specification ?

YES

- Go to "Component Inspection" procedure.

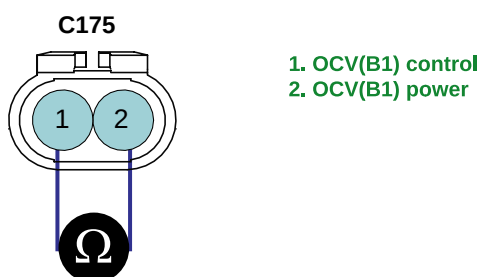
NO

- Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EFD05898

1. Check OCV
 - 1) IG "OFF" and disconnect OCV connector.
 - 2) Measure resistance between terminal 1 and 2 of OCV. (Component Side)

Specification : 6.7 ~ 7.7 Ω at 20°C (68°F)



SVQF16433L

- 3) Is the measured resistance within specification ?

YES

- Go to "OCV Actuation Test" as follows.

NO

- Substitute with a known - good OCV and check for proper operation. If the problem is corrected, replace OCV and go to "Verification of Vehicle Repair" procedure.

2. OCV Actuation Test

- 1) Connect scantool and IG "ON".
- 2) Select "OCV" on the Actuation Test.
- 3) Activate "OCV" by pressing "STRT(F1)" key.
(should hear a faint click from Oil Control solenoid Valve)

- 4) Repeat this procedure 4 or 5 times to ensure reliability

1.11 ACTUATION TEST		12/25
OIL CONTROL VALVE		
DURATION	UNTIL STOP KEY	
METHOD	ACTIVATION	
CONDITION	IG.KEY ON ENGINE OFF	
PRESS [STRT], IF YOU ARE READY ! SELECT TEST ITEM USING UP/DOWN KEY		
STRT STOP		

EGRF602M

- 5) Does OCV generate click sound during acutation test ?

YES

► Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.

Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

► Substitute with a known - good OCV and check for proper operation. If the problem is corrected, replace OCV and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

E240091F

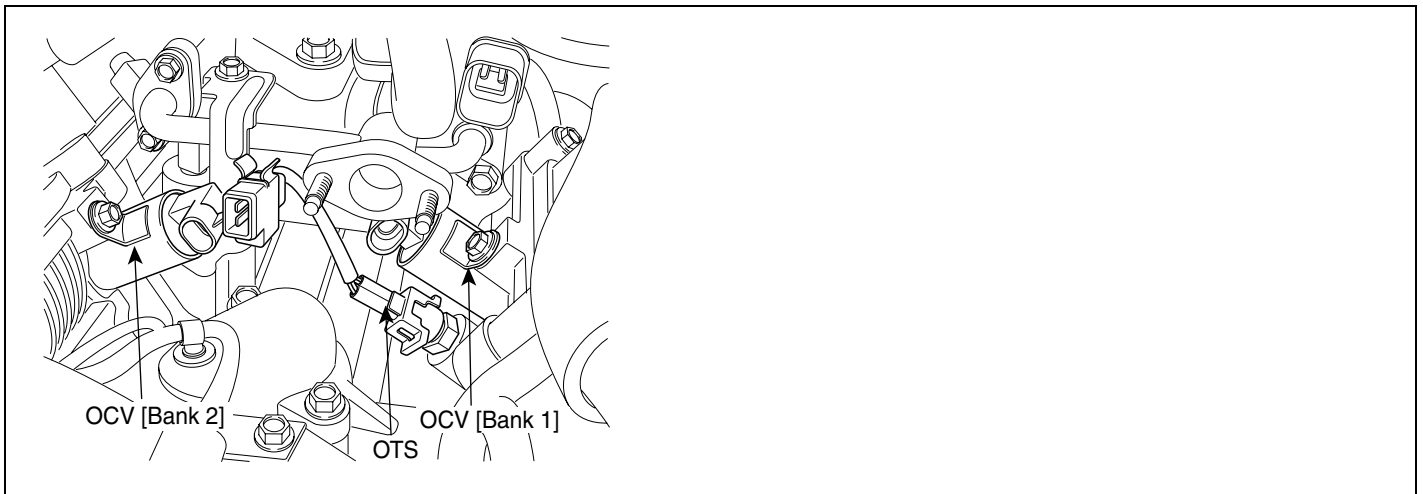
Refer to DTC P0076.

DTC TROUBLESHOOTING PROCEDURES

FLA -171

DTC P0082 INTAKE VALVE CONTROL SOLENOID CIRCUIT LOW (BANK 2)

COMPONENT LOCATION EDA8A772



LGLG500A

GENERAL DESCRIPTION E93DB789

The CVVT (Continuously Variable Valve Timing) system is installed to the chain sprocket of the intake camshaft. This system controls the intake camshaft to provide the optimal valve timing for every driving condition. The ECM controls the Oil Control Valve(OCV), based on the signals output from mass air flow, throttle position and engine coolant temperature. The CVVT controller regulates the intake camshaft angle using oil pressure through the OCV. As result, the relative position between the camshaft and the crankshaft becomes optimal, and the engine torque improves, fuel economy improves, exhaust emissions decrease under overall driving conditions.

DTC DESCRIPTION EC8DA8F5

When the enable condition is satisfied, the PCM checks that OCV outputs (Voltage level) are observed when OCVs are commanded. When a OCV output failure is detected, the appropriate fail counter is incremented. If the failure threshold is exceeded 5 seconds during one diagnostic test(10second), the test is failed and DTC is stored. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

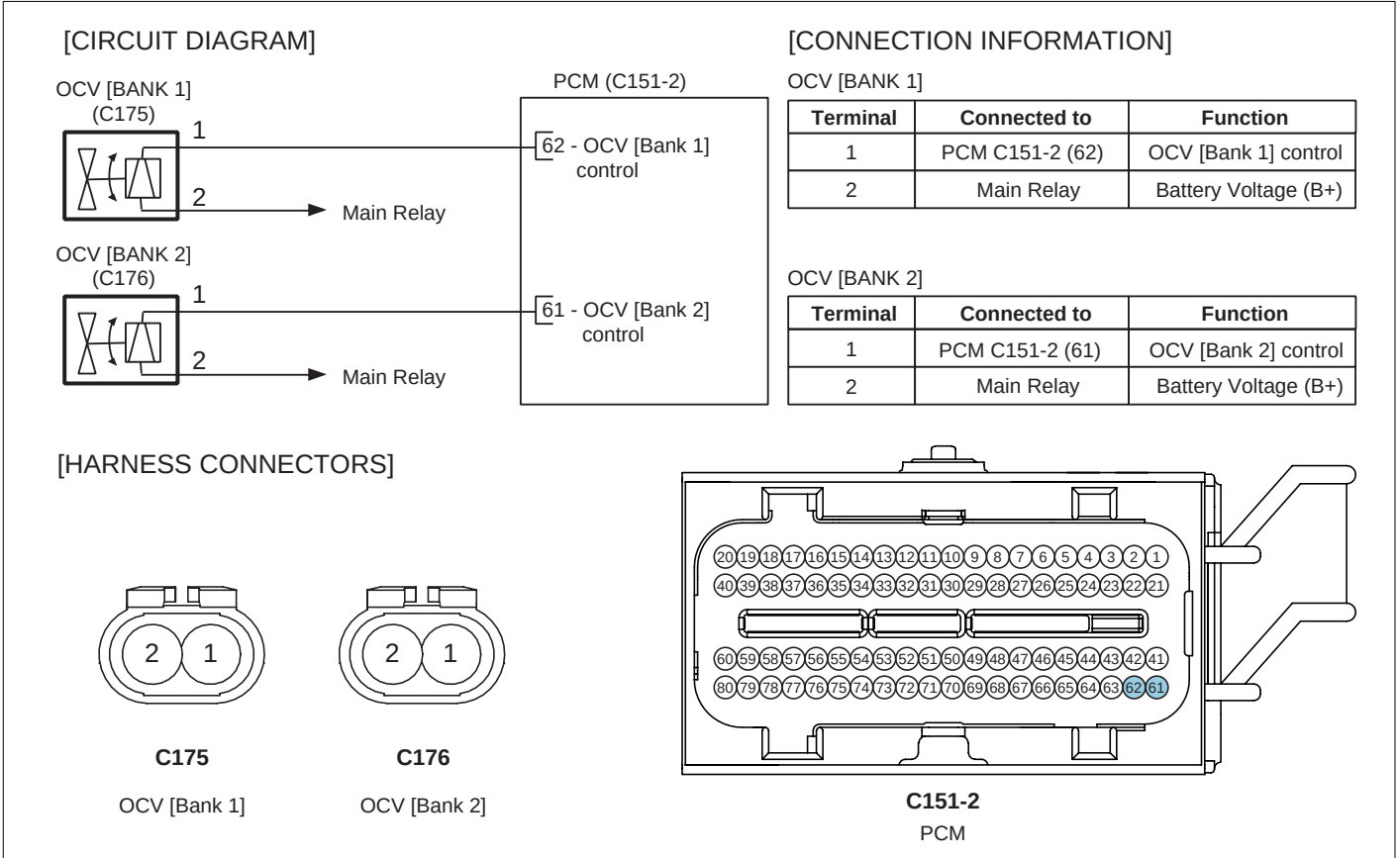
DTC DETECTING CONDITION EE5E97EC

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects a short to ground or open	• Poor Connection • Open in Power circuit • Open or short to ground in Control Circuit • OCV • PCM
Enable Conditions	• No disabling Faults Present • Engine Running • $11V \leq \text{Ignition Voltage} \leq 16V$	
Threshold value	• Short to ground or open circuit	
Diagnosis Time	• Continuous (More than 5 seconds failure for every 10 seconds test)	
MIL On Condition	• 2 Driving Cycles	

SPECIFICATION ECB21020

Resistance (Ω)	6.7 ~ 7.7 Ω [20°C (68°F)]

SCHEMATIC DIAGRAM E59A18F6



SVQF16115L

SIGNAL WAVEFORM AND DATA EE778E2

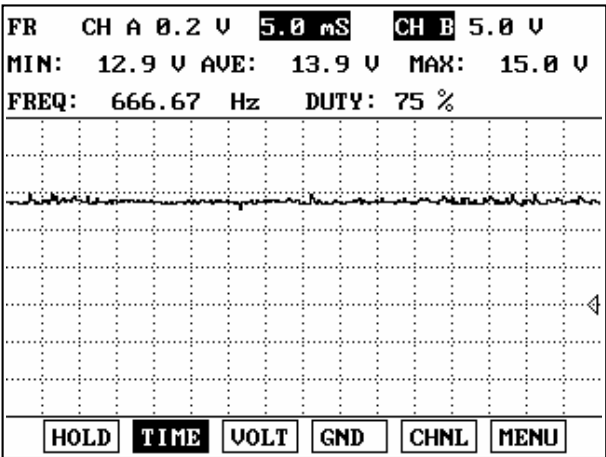


Fig. 1

Fig. 1 : Idle
Fig. 2 : Accelleration

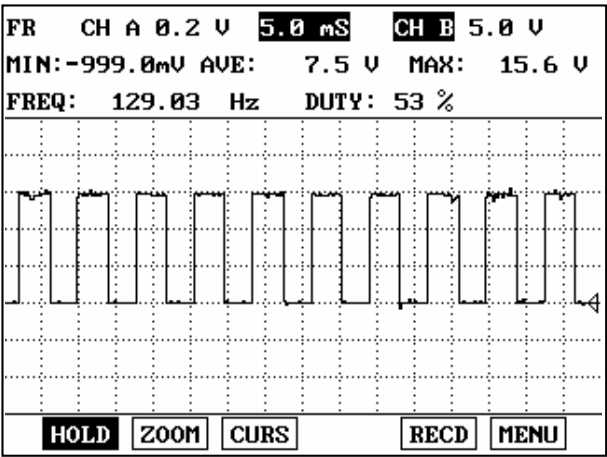


Fig. 2

EGRF602G

DTC TROUBLESHOOTING PROCEDURES

FLA -173

The oil control valve is commanded by a pulse-width-modulated signal from the engine control unit. A duty cycle of zero commands the cam phaser to its default position. A duty cycle of 100% commands the phaser to its maximum phased position. When the phaser must be controlled to an intermediate position, the duty cycle is maintained in the region of the 'hold position'. This is a medium duty cycle, usually between 35% and 65%, depending on temperature and voltage conditions.

MONITOR DTC STATUS EEFE6523

1. Check DTC Status
 - 1) Connect scantool to Data Link Connector(DLC).
 - 2) IG "ON".
 - 3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F4(DTAL) to check DTC's information from the DTCs menu
 - 4) Read "DTC Status" parameter.

1.1 DIAGNOSTIC TROUBLE CODES		
PXXXX DTC TITLE		
NUMBER OF DTC : 1 ITEMS		
PART	ERAS	DTAL

PXXXX TITLE	
1.MIL STATUS:	ON/OFF
2.DTC STATUS:	PRESENT/HISTORY
3.DIAG.STATUS:	DIAGNOSIS FINISHED
DTC CAUSE TO SYSTEM ERROR : PXXXX	

SCMF16159L

- 5) Is parameter displayed "Present fault"?

YES

- Go to "Terminal and connector inspection" procedure.

NO

- Fault is intermittent caused by poor contact in the sensor' s and/or PCM' s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

TERMINAL AND CONNECTOR INSPECTION EBBB7718

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

- ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

- ▶ Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION E27C56B6

1. IG "OFF" & Disconnect OCV(B2) connector.
2. IG "ON" & ENG "OFF".
3. Measure voltage between terminal 2 of OCV(B2) harness connector and chassis ground.

Specification : B+

4. Is the measured voltage within specification ?

YES

- ▶ Go to "Control Circuit Inspection " procedure.

NO

- ▶ Check fuse between Main Relay and OCV is open or not installed.
- ▶ Check open in power circuit between Main Relay and OCV power circuit.
- ▶ Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION E0DED8B5

1. Check short to ground in harness
 - 1) IG "OFF" and disconnect OCV connector.
 - 2) IG "ON" & ENG "OFF".
 - 3) Measure resistance between terminal 1 of OCV harness connector and chassis ground.

Specification : Infinite

- 4) Is the measured resistance within specification ?

YES

- ▶ Go to "Check open in harness" as follows

NO

- ▶ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check open in harness

- 1) IG "OFF" and disconnect OCV and PCM connector.
- 2) Measure resistance between terminal 1 of OCV harness connector and terminal 61 of PCM harness connector.

DTC TROUBLESHOOTING PROCEDURES

FLA -175

Specification : Approx. below 1Ω

3) Is the measured resistance within specification ?

YES

► Go to "Component Inspection" procedure.

NO

► Repair or replace as necessary and then go to " Verification of Vehicle Repair" procedure.

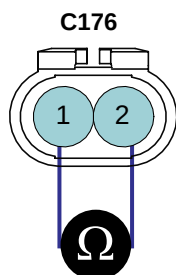
COMPONENT INSPECTION

E53E3F6C

1. Check OCV

- 1) IG "OFF" and disconnect OCV connector.
- 2) Measure resistance between terminal 1 and 2 of OCV. (Component Side)

pecification : $6.7 \sim 7.7 \Omega$ at 20°C (68°F)



1. OCV(B2) control
2. OCV(B2) power

SVQF16434L

3) Is the measured resistance within specification ?

YES

4) ► Go to "OCV Actuation Test" as follows.

NO

► Substitute with a known - good OCV and check for proper operation. If the problem is corrected, replace OCV and go to "Verification of Vehicle Repair" procedure.

2. OCV Actuation Test

- 1) Connect scantool and IG "ON"
- 2) Select "OCV" on the Actuation Test
- 3) Activate "OCV" by pressing "STRT(F1)" key
(should hear a faint click from Oil Control solenoid Valve)
- 4) Repeat this procedure 4 or 5 times to ensure reliability

1.11 ACTUATION TEST		12/25
OIL CONTROL VALVE		
DURATION	UNTIL STOP KEY	
METHOD	ACTIVATION	
CONDITION	IG.KEY ON ENGINE OFF	
PRESS [STRT], IF YOU ARE READY ! SELECT TEST ITEM USING UP/DOWN KEY		
STRT STOP		

EGRF602W

- 5) Does OCV generate click sound during acutation test ?

YES

► Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

► Substitute with a known - good OCV and check for proper operation. If the problem is corrected, replace OCV and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

E4C6AD68

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

► System performing to specification at this time. Clear the DTC.

NO

► Go to the applicable troubleshooting procedure.

DTC TROUBLESHOOTING PROCEDURES

FLA -177

DTC P0083 INTAKE VALVE CONTROL SOLENOID CIRCUIT HIGH (BANK 2)

COMPONENT LOCATION E9FCFBA3

Refer to DTC P0082.

GENERAL DESCRIPTION E05AB0C3

Refer to DTC P0082.

DTC DESCRIPTION EA792A37

When the enable condition is satisfied, the PCM checks that OCV outputs (Voltage level) are observed when OCVs are commanded. When a OCV output failure is detected, the appropriate fail counter is incremented. If the failure threshold is exceeded 5 seconds during one diagnostic test(10second), the test is failed and DTC is stored. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E2916CDC

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects a short to battery	• Poor Connection • Short to battery in Control Circuit • OCV • PCM
Enable Conditions	• No disabling Faults Present • Engine Running • $11V \leq \text{Ignition Voltage} \leq 16V$	
Threshold value	• Short to battery	
Diagnosis Time	• Continuous (More than 5 seconds failure for every 10 seconds test)	
MIL On Condition	• 2 Driving Cycles	

SPECIFICATION E8BF5279

Resistance (Ω)	6.7 ~ 7.7 Ω [20°C(68°F)]

SCHEMATIC DIAGRAM E147C633

Refer to DTC P0082.

SIGNAL WAVEFORM AND DATA E697B9B4

Refer to DTC P0082.

MONITOR DTC STATUS E5FDB812

Refer to DTC P0082.

TERMINAL AND CONNECTOR INSPECTION E15DD3E5

Refer to DTC P0082.

CONTROL CIRCUIT INSPECTION

EEFEE337

1. IG "OFF" and Disconnect OCV connector.
2. Measure resistance between terminal 1 and 2 of OCV harness connector.

Specification : Infinite

3. Is the measured resistance within specification ?

YES

- Go to "Component Inspection" procedure.

NO

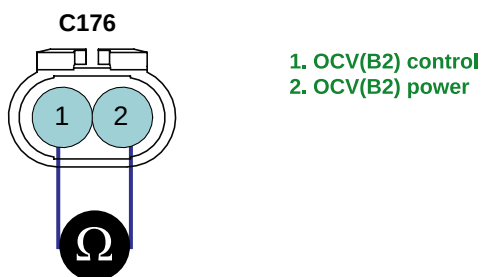
- Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

EDC54B78

1. Check OCV
 - 1) IG "OFF" and disconnect OCV connector.
 - 2) Measure resistance between terminal 1 and 2 of OCV. (Component Side)

Specification : 6.7 ~ 7.7 Ω at 20°C (68°F)



SVQF16434L

- 3) Is the measured resistance within specification ?

YES

- 4) ► Go to "OCV Actuation Test" as follows.

NO

- Substitute with a known - good OCV and check for proper operation. If the problem is corrected, replace OCV and go to "Verification of Vehicle Repair" procedure.

2. OCV Actuation Test

- 1) Connect scantool and IG "ON"
- 2) Select "OCV" on the Actuation Test
- 3) Activate "OCV" by pressing "STRT(F1)" key
(should hear a faint click from Oil Control solenoid Valve)

DTC TROUBLESHOOTING PROCEDURES

FLA -179

- 4) Repeat this procedure 4 or 5 times to ensure reliability

1.11 ACTUATION TEST		12/25
OIL CONTROL VALVE		
DURATION	UNTIL STOP KEY	
METHOD	ACTIVATION	
CONDITION	IG.KEY ON ENGINE OFF	
PRESS [STRT], IF YOU ARE READY ! SELECT TEST ITEM USING UP/DOWN KEY		
STRT STOP		

EGRF602W

- 5) Does OCV generate click sound during acutation test ?

YES

- Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

- Substitute with a known - good OCV and check for proper operation. If the problem is corrected, replace OCV and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

E4C265F7

Refer to DTC P0082.

DTC P0101 MASS OR VOLUME AIR FLOW CIRCUIT RANGE/PERFORMANCE

COMPONENT LOCATION E45377FC



SCMF16185L

GENERAL DESCRIPTION E1F15262

The Mass Air Flow Sensor (MAFS) is located between the air cleaner assembly and the throttle body. The MAFS uses a hot film type sensing element to measure the mass of intake air entering the engine. This hot film type air flow sensor consists of a hot film sensor, housing and metering ducts. Mass air flow rate is measured by detection of heat transfer from a hot film probe. The change in air flow rate causes change in the amount of heat being transferred from the hot film probe surface to the air. A large amount of intake air represents acceleration or high load conditions while a small amount of intake air represents deceleration or idle. The mass of intake air should increase at acceleration and be stable during constant engine speed. The ECM uses this information to determine the injection duration and ignition timing for the desired air/fuel ratio.

DTC DESCRIPTION E06B8990

The difference between values coming from the MAF Sensor and those are calculated is analyzed. This difference, or error, is then compared to high and low limit calibration values, which are functions of engine speed. PCM compares the difference between MAFS output and calculated flow rate value while enable condition is met.

If the actual air flow is higher or lower than calculated value(threshold) for more than 2min.

PCM determines that a fault exists and a DTC is stored.

MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC TROUBLESHOOTING PROCEDURES

FLA -181

DTC DETECTING CONDITION

E930E251

Item	Detecting Condition	Possible cause
DTC Strategy	The MAF Rationality Diagnostic compares the difference between MAF Sensor output and calculated flow rate value to a calibration value	- Clogged air cleaner - MAFS
Enable Conditions	- Engine Coolant Temperature $\geq 60^{\circ}\text{C}$ (Fully Warmed up state) 600rpm < Engine Speed < 3000rpm	
Thresh old value	Acutal Air Mass Value is higher or lower than calculated value	
Diagnosis Time	Continuous (2 min.)	
MIL On Condition	2 driving cycles	

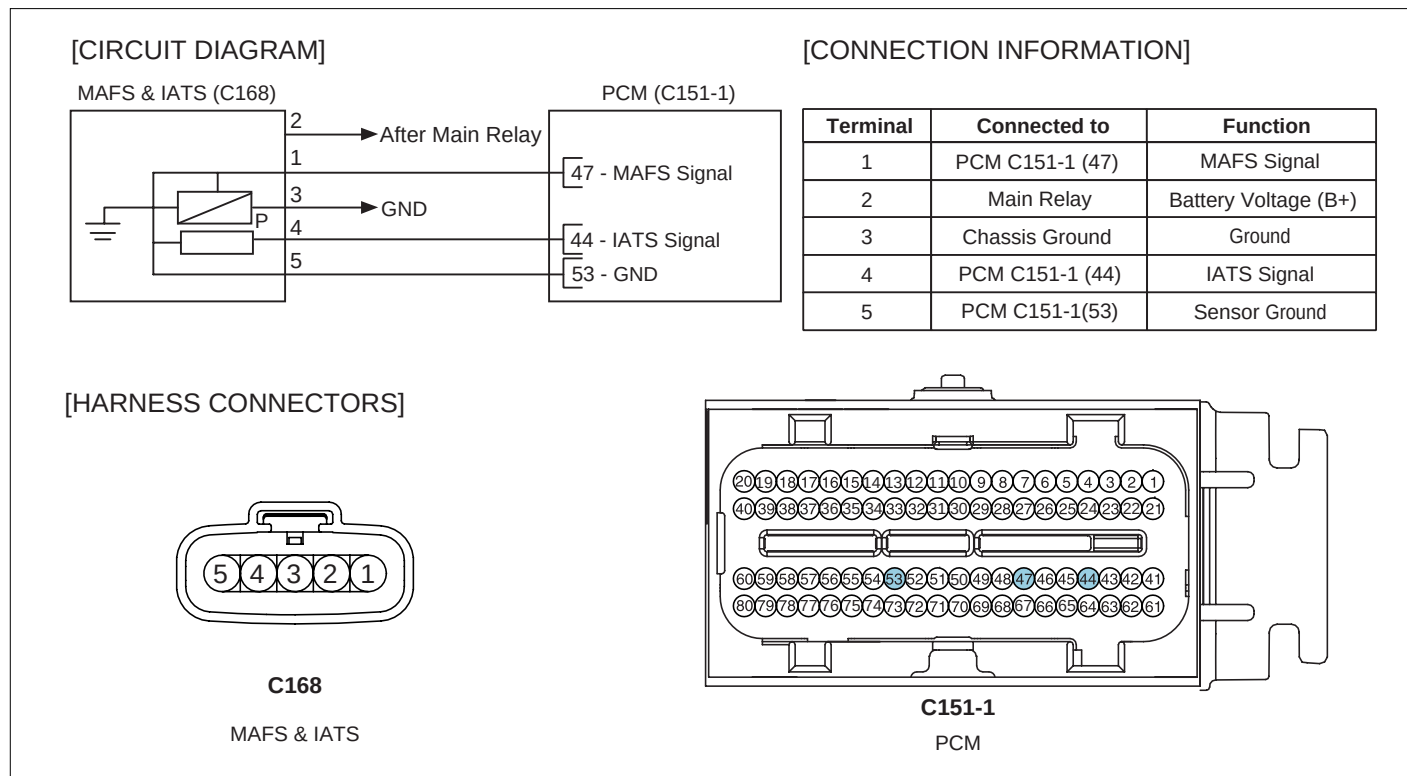
SPECIFICATION

EFBE022F

Air Flow (kg/h)	Frequency (Hz)
12.6 kg/h	2,617Hz
18.0 kg/h	2,958Hz
23.4 kg/h	3,241Hz
32.4 kg/h	3,653Hz
43.2 kg/h	4,024Hz
57.6 kg/h	4,399Hz
72.0 kg/h	4,704Hz
108.0 kg/h	5,329Hz
144.0 kg/h	5,897Hz
198.0 kg/h	6,553Hz
270.0 kg/h	7,240Hz
360.0 kg/h	7,957Hz
486.0 kg/h	8,738Hz
666.0 kg/h	9,644Hz
900.0 kg/h	10,590Hz

SCHEMATIC DIAGRAM

E99FB490



SVQF16104L

MONITOR DTC STATUS

EBC98EAC

1. Check DTC Status

- 1) Connect scantool to Data Link Connector(DLC).
- 2) IG "ON".
- 3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F4(DTAL) to check DTC's information from the DTCs menu
- 4) Read "DTC Status" parameter.

1.1 DIAGNOSTIC TROUBLE CODES

PXXXX DTC TITLE

NUMBER OF DTC : 1 ITEMS

PART
ERAS
DTAL

PXXXX TITLE

1.MIL STATUS: ON/OFF

2.DTC STATUS: PRESENT/HISTORY

3.DIAG.STATUS: DIAGNOSIS FINISHED

DTC CAUSE TO SYSTEM ERROR : PXXXX

SCMF16159L

DTC TROUBLESHOOTING PROCEDURES

FLA -183

- 5) Is parameter displayed "Present fault"?

YES

- ▶ Go to "Component Inspection" procedure.

NO

- ▶ Fault is intermittent caused by PCM memory was not cleared after repair. Erase DTC and drive the vehicle to satisfy the enable condition then, go to "Component Inspection" procedure.

COMPONENT INSPECTION

E6A7DABE

1. Visual Inspection

- 1) Check that MAFS is damaged, contaminated or deformed
- 2) Check that air cleaner is clogged.
- 3) Has a problem been found ?

YES

- ▶ Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

- ▶ Go to "Check MAFS" as follows

2. Check MAFS

- 1) IG "OFF" and install a scantool
- 2) ENG "ON" and monitor "MAFS" data on the service data.
- 3) Monitor signal waveform at terminal 1 of MAFS with scantool.

Specification :Signal waveform will be displayed as follows. (Be aware that the signal of MAFS is not voltage display but frequency display.)

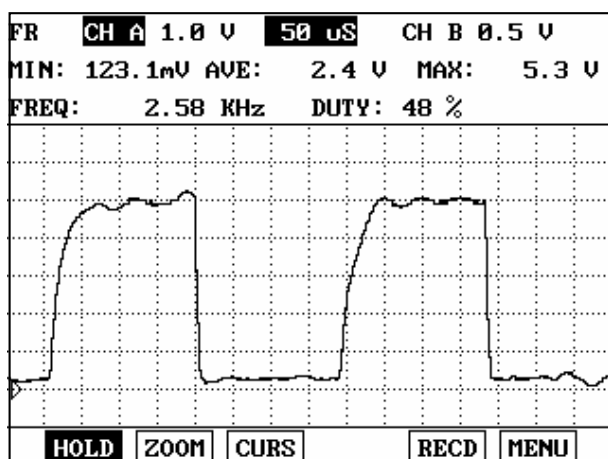


Fig. 1

Fig. 1 : Idle

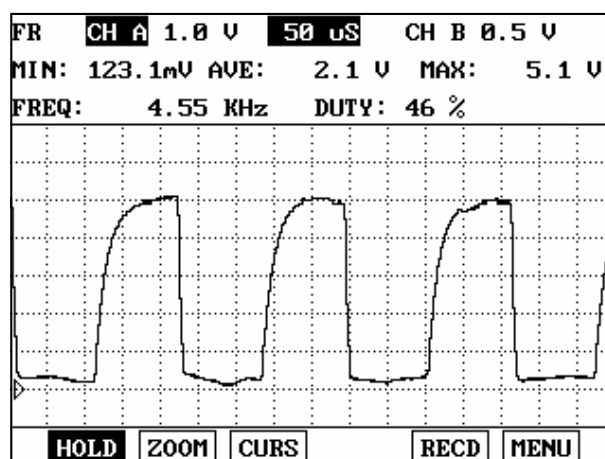


Fig. 2

Fig. 2 : Acceleration

EGRF603D

4) Are both service data and signalwave form displayed correctly ?

YES

► Go to "Verification of Vehicle Repair" procedure.

NO

► Substitute with a known - good MAFS and check for proper operation. If the problem is corrected, replace MAFS and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

E1B5FE68

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

► System performing to specification at this time. Clear the DTC.

NO

► Go to the applicable troubleshooting procedure.

DTC TROUBLESHOOTING PROCEDURES

FLA -185

DTC P0102 MASS OR VOLUME AIR FLOW CIRCUIT LOW INPUT

COMPONENT LOCATION EA92D299

Refer to DTC P0101.

GENERAL DESCRIPTION ECAA2EB9

Refer to DTC P0101.

DTC DESCRIPTION E4654CDA

If PCM detects that frequency signal of MAFS is lower than 1000 Hz for more than 75 second during one diagnostic test (125 second) while enable condition is met, PCM determines that a fault exists and a DTC is stored. MIL (Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION EF0585E2

Item	Detecting Condition	Possible cause
DTC Strategy	Compares the airmeter input frequency to a low limit	- Poor Connection - Open or short in harness - MAFS - PCM
Enable Conditions	- Engine Speed $\geq$ 500 rpm - Engine Running Time $\geq$ 5 second - Ignition Voltage $\geq$ 11V - Conditions met delay time $\geq$ 1 second	
Threshold value	MAF frequency signal $<$ 1000Hz	
Diagnosis Time	Continuous (More than 75 second failure for every 125 second tests)	
MIL On Condition	2 Driving Cycles	

SPECIFICATION E68C1575

Refer to DTC P0101.

SCHEMATIC DIAGRAM EA1D4DF0

Refer to DTC P0101.

MONITOR DTC STATUS E9A71DE1

Refer to DTC P0101.

TERMINAL AND CONNECTOR INSPECTION E72B5CFD

Refer to DTC P0101.

POWER CIRCUIT INSPECTION E01EFF96

1. IG "OFF" and Disconnect MAFS connector.

2. IG "ON" & ENG "OFF"
3. Measure voltage between terminal 2 of MAFS harness connector and chassis ground

Specification : B+

4. Is the measured voltage within specification ?

YES

- ▶ Go to "Signal Circuit Inspection" Procedure.

NO

- ▶ Check fuse between MAFS and main relay is open or not installed.
- ▶ Repair open in power harness between MAFS and main relay and go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

EDB71EDC

1. Check voltage
 - 1) IG "OFF" and disconnect MAFS connector.
 - 2) IG "ON" & ENG "OFF".
 - 3) Measure voltage between terminal 1 of MAFS harness connector and chassis ground.

Specification : Approx. 5V

- 4) Is the measured voltage within specification ?

YES

- ▶ Go to "Ground circuit inspection" procedure.

NO

- ▶ If the measured voltage is "0", go to "Check open in harness" as follows. If the measured voltage is over "5V", go to "Check short to battery in harness" as follows.

2. Check short to battery in harness
 - 1) IG "OFF" and disconnect MAFS and PCM connector.
 - 2) Measure resistance between terminal 1 and 2 of MAFS harness connector.
 - 3) Measure resistance between terminal 1 and 4 of MAFS harness connector.

Specification : Infinite

- 4) Is the measured resistance within specification ?

YES

- ▶ Go to "Check short to ground in harness" as follows.

NO

DTC TROUBLESHOOTING PROCEDURES

FLA -187

► Repair short to battery in harness and go to "Verification of Vehicle Repair" procedure.

3. Check short to ground in harness

- 1) IG "OFF" and disconnect MAFS and PCM connector.
- 2) Measure resistance between terminal 1 of MAFS harness connector and chassis ground.

Specification : Infinite

3) Is the measured resistance within specification ?

YES

► Go to "Check open in harness" as follows.

NO

► Repair short to ground in harness and go to "Verification of Vehicle Repair" procedure.

4. Check open in harness

- 1) IG "OFF" and disconnect MAFS and PCM connector.
- 2) Measure resistance between terminal 1 of MAFS harness connector and terminal 47 of PCM harness connector.

Specification : Approx. below 1Ω .

3) Is the measured resistance within specification ?

YES

► Go to "Ground circuit Inspection" procedure.

NO

► Repair open in harness and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION E0C934B8

1. IG "OFF" and disconnect MAFS connector.
2. Measure voltage between terminal 1 of MAFS harness connector and chassis ground.
3. Measure voltage between terminal 1 and 3 of MAFS harness connector.

Specification : Voltage difference between Measurement "A" and "B" is below 200mV.

4. Is the measured voltage within specification ?

YES

► Go to "Component Inspection" procedure.

NO

► Repair contact resistance or open in harness and then go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

EB5DFEB3

1. Visual Inspection

- 1) Check that MAFS is damaged, contaminated or deformed.
- 2) Has a problem been found ?

YES

► Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Check MAFS" as follows

2. Check MAFS

- 1) IG "OFF" and install a scantool
- 2) ENG "ON" and monitor "MAFS" data on the service data.
- 3) Monitor signal waveform at terminal 1 of MAFS with scantool.

Specification :Signal waveform will be displayed as follows. (Be aware that the signal of MAFS is not voltage display but frequency display.)

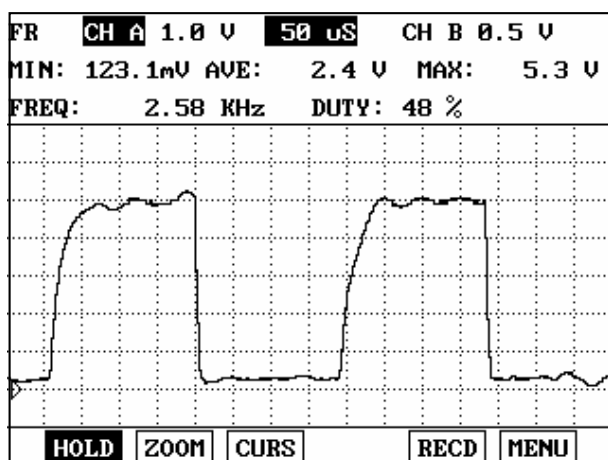


Fig. 1

Fig. 1 : Idle

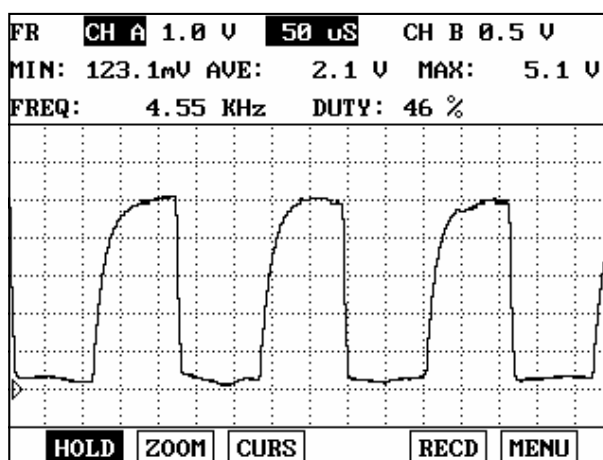


Fig. 2

Fig. 2 : Acceleration

EGRF603D

- 4) Are both service data and signalwave form displayed correctly ?

YES

► Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.

DTC TROUBLESHOOTING PROCEDURES

FLA -189

Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

- ▶ Substitute with a known - good MAFS and check for proper operation. If the problem is corrected, replace MAFS and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

EBBF5268

Refer to DTC P0101.

FLA -190

FUEL SYSTEM

DTC P0103 MASS OR VOLUME AIR FLOW CIRCUIT HIGH INPUT

COMPONENT LOCATION E9D056EB

Refer to DTC P0101.

GENERAL DESCRIPTION EC05A3D3

Refer to DTC P0101.

DTC DESCRIPTION E9038980

The PCM compares the airmeter input frequency to low and high limits.

If PCM detects that frequency signal of MAFS is higher than 11900Hz for more than 75 second failure during 125 second diagnostic test while enable condition is met, PCM determines that a fault exists and a DTC is stored. MIL (Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E7DFA25A

Item	Detecting Condition	Possible cause
DTC Strategy	Compares the airmeter input frequency to a high limit	- Noise - MAFS - PCM
Enable Conditions	- Engine Speed $\geq$ 500 rpm - Engine Running Time $\geq$ 5 second - Ignition Voltage $\geq$ 11V - Conditions met delay time $\geq$ 1 second	
Threshold value	MAF frequency signal $>$ 11900Hz	
Diagnosis Time	Continuous (More than 75 second failure for every 125 second tests)	
MIL On Condition	2 Driving Cycles	

SPECIFICATION E751A027

Refer to DTC P0101.

SCHEMATIC DIAGRAM E2026F7A

Refer to DTC P0101.

MONITOR DTC STATUS EBFDBB23

Refer to DTC P0101.

TERMINAL AND CONNECTOR INSPECTION EEE097C3

Refer to DTC P0101.

GROUND CIRCUIT INSPECTION E04A4C53

1. IG "OFF"

DTC TROUBLESHOOTING PROCEDURES

FLA -191

2. Disconnect MAFS connector.
3. Measure the voltage between terminal 1 of MAFS harness connector.
4. Measure the voltage between terminal 1 and 3 of MAFS harness connector.

Specification : Voltage difference and "A" and B" is below 200mV

5. Is the measured voltage within the specification?

YES

- Go to "Component Inspection".

NO

- After repairing or replacing contact resistance in ground circuit and open in the MAFS circuit, go to "Verification and Vehicle Repair".

COMPONENT INSPECTION E6DE5338

1. Visual Inspection

- 1) Check that MAFS is damaged, contaminated or deformed.
- 2) Has a problem been found ?

YES

- Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

- Go to "Check MAFS" as follows

2. Check MAFS

- 1) IG "OFF" and install a scantool
- 2) ENG "ON" and monitor "MAFS" data on the service data.
- 3) Monitor signal waveform at terminal 1 of MAFS with scantool.

Specification : Signal waveform will be displayed as follows. (Be aware that the signal of MAFS is not voltage display but frequency display.)

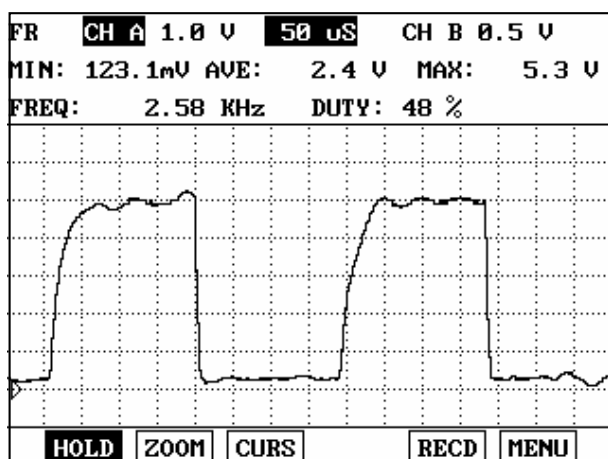


Fig. 1

Fig. 1 : Idle

Fig. 2 : Acceleration

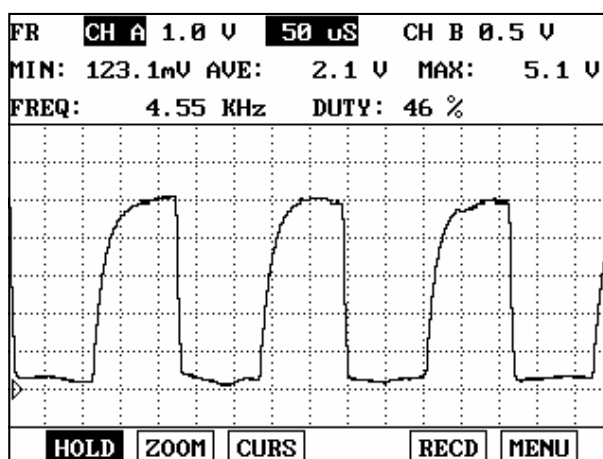


Fig. 2

EGRF603D

4) Are both service data and signalwave form dispayed correctly ?

YES

► Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.

Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

► Substitute with a known - good MAFS and check for proper operation. If the problem is corrected, replace MAFS and go to "Verification of Vehicle Repair" procedure.

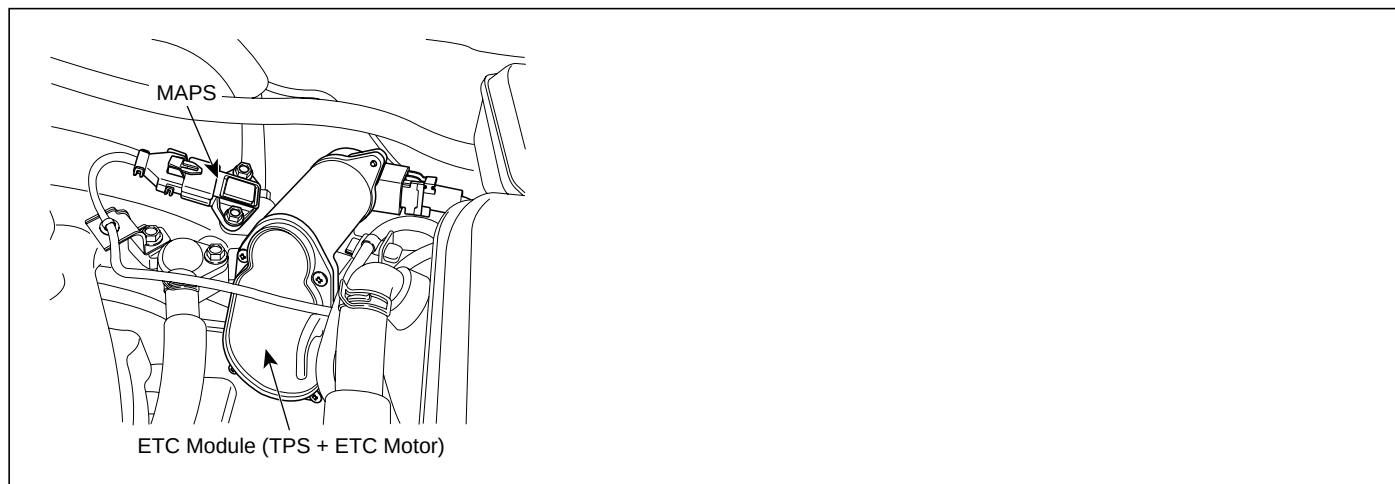
VERIFICATION OF VEHICLE REPAIR

ECC266EC

Refer to DTC P0101.

DTC P0106 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT RANGE/PERFORMANCE

COMPONENT LOCATION ED009E33



SCMF16192L

GENERAL DESCRIPTION EFA5C66C

The amount of intake air flow must be inputted to PCM in order to determine the fuel injection quantity. MAPS(Manifold Absolute Pressure) calculates the amount of air indirectly as measuring the pressure inside of intake manifold. This mechanism is also called Speed-Density Type.

MAPS transfers analog output signal which is proportional to the change of intake manifold pressure, then, with this signal and RPM, PCM calculates the amount of intake air flow.

MAPS is mounted on surge tank to measure the pressure inside of intake manifold, and it consists of a piezo electric element and hybrid IC which amplifies output signal from the element. A piezo electric element is a sort of a diaphragm using piezo electric effect. One side of the diaphragm is surrounded with vacuum chamber while intake pressure is applied to the other side. Thus, signals are outputted by the transformation of diaphragm according to the change of pressure inside of intake manifold.

DTC DESCRIPTION E377698C

PCM compares the difference between MAPS output and calculated MAPS value while enable condition is met. If the actual MAP value or lower than calculated(threshold) value for 2 min failure during tip in-out driving, PCM determines that a fault exists and a DTC is stored.

MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

E0A4A66A

Item		Detecting Condition	Possible cause
DTC Strategy		The MAP reading is compared to expected MAP high and low limits based on engine speed & Throttle Position	- Faulty TPS - Faulty MAPS
Enable		- Engine Coolant Temperature $\geq 60^{\circ}\text{C}$ (Fully Warmed up state) 600rpm < Engine Speed < 3000rpm	
Thresh- old	Case 1	Power Test - Altitude compensated MAP < Calculated min. MAP data - Altitude compensated MAP > Calculated max. MAP data	
	Case 2	Deceleration Test Altitude compensated MAP < Calculated MAP data	
Diagnosis Time		Continuous (For 2min. in mild tip in - out Driving)	
MIL On Condition		2 Driving Cycles	

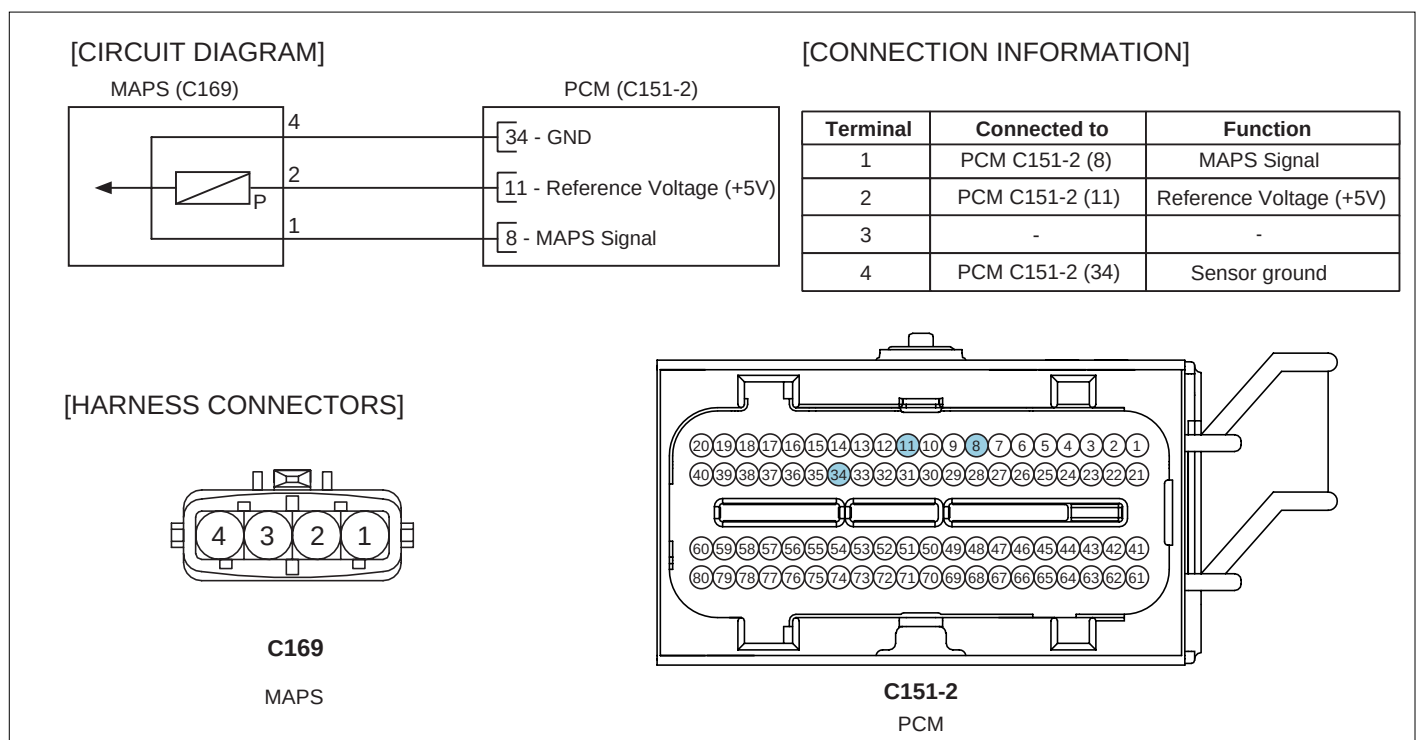
SPECIFICATION

EF4AF42F3

Pressure (kPa)	20	35	60	95	101.32
Voltage (V)	0.789	1.382	2.369	3.75	4
Tolerance (V)	± 0.045				

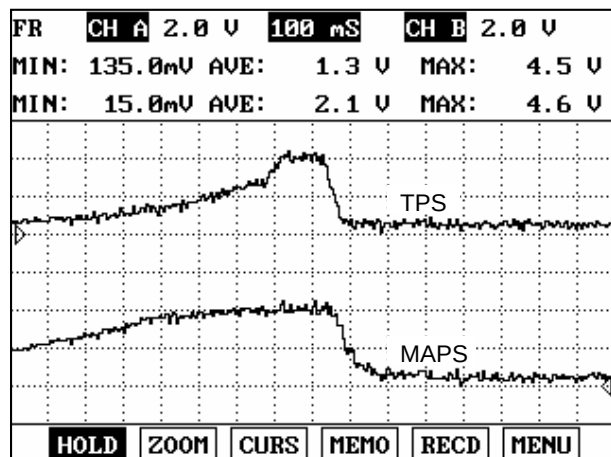
SCHEMATIC DIAGRAM

E596AE25



SVQF16105L

SIGNAL WAVEFORM AND DATA E8C9C339



EGRF6030

It is necessary that MAPS should be checked along with TPS. Because The MAP/TPS Rationality Diagnostic is comprised of two tests. A deceleration test is performed to provide a robust method for detection of an altitude compensated MAP value that is too high for the deceleration condition. The second test compares the altitude compensated MAP value to both high and low limits, dependent upon throttle position and engine speed. When the MAP value is out of the threshold range, the MAP/TPS system is determined to be failed.

MONITOR DTC STATUS EEBDFC81

1. Check DTC Status
 - 1) Connect scantool to Data Link Connector(DLC).
 - 2) IG "ON".
 - 3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F4(DTAL) to check DTC's information from the DTCs menu
 - 4) Read "DTC Status" parameter.

1.1 DIAGNOSTIC TROUBLE CODES	
PXXXX	DTC TITLE
NUMBER OF DTC : 1 ITEMS	
PART	ERAS DTAL

PXXXX TITLE	
1.MIL STATUS:	ON/OFF
2.DTC STATUS:	PRESENT/HISTORY
3.DIAG.STATUS:	DIAGNOSIS FINISHED
DTC CAUSE TO SYSTEM ERROR : PXXXX	

SCMF16159L

- 5) Is parameter displayed "Present fault"?

YES

- Go to "Component Inspection" procedure.

NO

- Fault is intermittent caused by PCM memory was not cleared after repair. Erase DTC and drive the vehicle to satisfy the enable condition then, go to "Component Inspection" procedure.

COMPONENT INSPECTION EADD83A9

1. Check TPS

- 1) Visually check that TPS is contaminated by foreign materials, deformed, or damaged
- 2) Has a problem been found ?

YES

- Go to "Check MAPS Performance" as follows.

NO

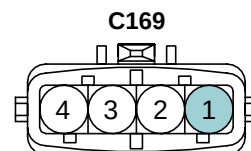
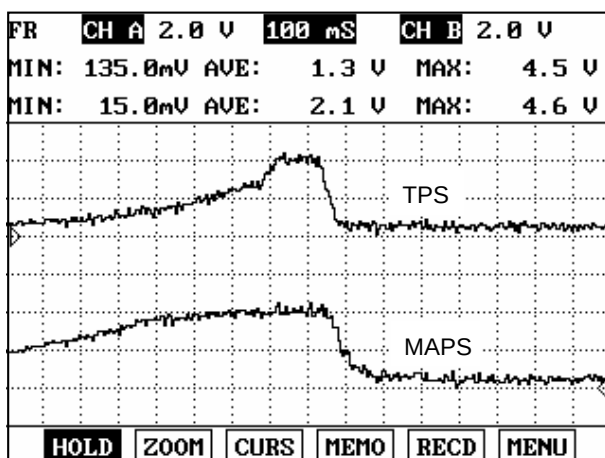
- Substitute with a known - good TPS and check for proper operation. If the problem is corrected, replace TPS and go to "Verification of Vehicle Repair" procedure.

2. Check MAPS Performance

- 1) IG "OFF" and install scatool.
- 2) Connect probe to MAPS and TPS to check signal waveform by using oscilloscope function.
- 3) ENG "ON" and monitor signal waveform during acceleration and deceleration.

SPECIFICATON :

Pressure (kPa)	20	35	60	95	101.32
Voltage (V)	0.789	1.382	2.369	3.75	4
Tolerance (V)	± 0.045				



1. MAPS Signal
2. MAPS Power
3. -
4. MAPS Ground

SVQF16197L

- 4) Is the measured signal waveform (MAP/TPS Rationality) O.K ?

YES

DTC TROUBLESHOOTING PROCEDURES

FLA -197

- ▶ Go to "Verification of Vehicle Repair" procedure.

NO

- ▶ Substitute with a known - good MAPS and check for proper operation. If the problem is corrected, replace MAPS and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E72837AD

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

- ▶ System performing to specification at this time. Clear the DTC.

NO

- ▶ Go to the applicable troubleshooting procedure.

FLA -198

FUEL SYSTEM

DTC P0107 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT LOW INPUT

COMPONENT LOCATION E6BC03D5

Refer to DTC P0106.

GENERAL DESCRIPTION E98C4468

Refer to DTC P0106.

DTC DESCRIPTION EE077925

Checking output signals of MAPS every 5 sec. under detecting condition, if an output signal is below 0.25V for more than 2.5 sec., PCM sets P0107. MIL(Malfuction Indication Lamp) turns on when the malfunction lasts till continuous 2 driving cycle.

DTC DETECTING CONDITION EC82B062

Item		Detecting Condition	Possible cause
DTC Strategy		This code detects a continuous short to low or open in either the signal circuit or the MAP	- Connecting condition - Open or short to ground in power circuit - Open or short to ground in signal circuit - MAPS - PCM
Enable Conditions	Case 1	- No TPS Active Fault Present - Ignition Voltage $\geq 11V$ - Engine Speed $\leq 1000rpm$ - Throttle Position $\geq 0\%$	
	Case 2	- No TPS Active Fault Present - Ignition Voltage $\geq 11V$ - Engine Speed $> 1000rpm$ - Throttle Position $\geq 30\%$	
Threshold value		MAP Signal $< 0.25V$	
Diagnosis Time		Continuous (More than 2.5 seconds failure for every 5 seconds test)	
MIL On Condition		2 Driving Cycle	

SPECIFICATION ED30BA2C

Pressure (kPa)	20	35	60	95	101.32
Voltage (V)	0.789	1.382	2.369	3.75	4
Tolerance (V)	± 0.045				

SCHEMATIC DIAGRAM E4E6E1E6

Refer to DTC P0106.

SIGNAL WAVEFORM AND DATA EB4EC3FE

Refer to DTC P0106.

DTC TROUBLESHOOTING PROCEDURES

FLA -199

MONITOR DTC STATUS E4465B0E

Refer to DTC P0106.

TERMINAL AND CONNECTOR INSPECTION E7BD305E

Refer to DTC P0106.

POWER CIRCUIT INSPECTION E6A16B22

1. IG "OFF"
2. Disconnect MAPS connector.
3. IG "ON"
4. Measure the voltage between terminal 2 of MAPS harness connector and ground.

Specification : Approx. 5V

5. Is the measured voltage within specification ?

YES

- Go to "Signal Circuit Inspection" of MAPS.

NO

- After repairing open or short to ground in circuits and go to "Verification of Vehicle Repair"

SIGNAL CIRCUIT INSPECTION E3918D36

1. Check short to ground in harness.
 - 1) IG "OFF"
 - 2) Disconnect MAPS and PCM connector.
 - 3) Measure the resistance between terminal 1 of MAPS harness connector and ground.

Specification : Infinite

- 4) Is the measured resistance within the specification?

YES

- Go to "Check open in the harness" procedure.

NO

- After repairing short to ground in harness and go to "Verification of Vehicle Repair"

2. Check open in the harness

- 1) IG "OFF"
- 2) Disconnect MAPS and PCM connector.

- 3) Measure the resistance between terminal 1 of MAPS harness connector and terminal 8 of PCM harness connector

Specification : Approx. below 1 Ω

- 4) Is the measured resistance within the specification?

YES

► Go to "Component Inspection" procedure.

NO

► Repair open in the harness and go to "Verification of Vehicle Repair".

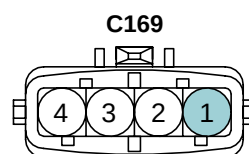
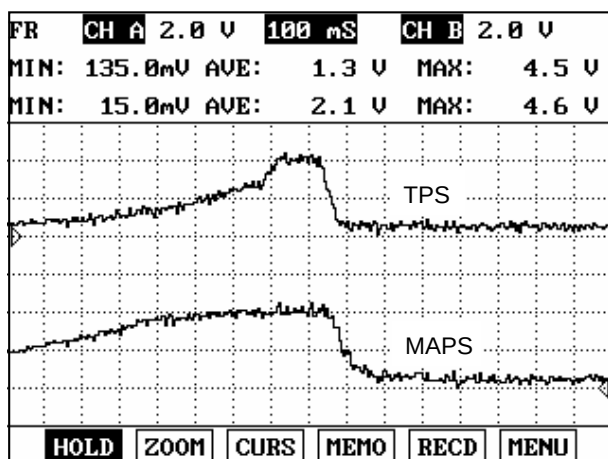
COMPONENT INSPECTION E8D15C53

1. MAPS performance test

- 1) IG "OFF"
- 2) Connect scantool to Data Link Connector(DLC) and select "Oscilloscope" then, connect probes to output signal lines of MAPS and TPS.
- 3) Start engine and monitor the waveforms during accelerating and decelerating.

SPECIFICATON :

Pressure (kPa)	20	35	60	95	101.32
Voltage (V)	0.789	1.382	2.369	3.75	4
Tolerance (V)	± 0.045				



1. MAPS Signal
2. MAPS Power
3. -
4. MAPS Ground

SVQF16197L

- 4) Is the waveform displayed correctly?(Compare the response time of TPS and MAPS)

YES

► Go to "Check PCM".

NO

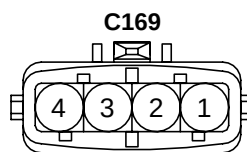
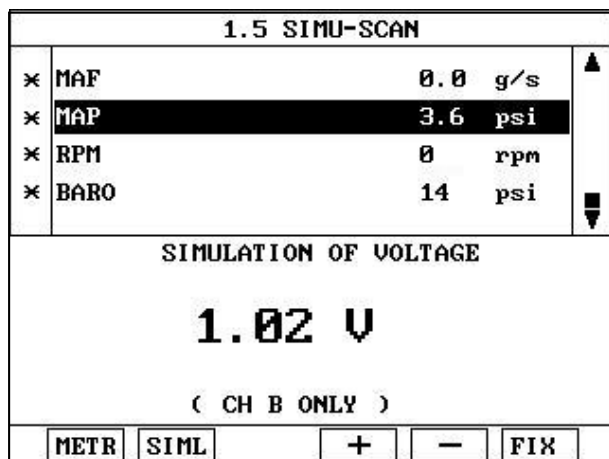
DTC TROUBLESHOOTING PROCEDURES

FLA -201

► After replacing MAPS with new one, if it operates normally, replace MAPS and go to "Verification of Vehicle Repair".

2. Check PCM

- 1) IG "OFF" disconnect MAPS connector
- 2) Connect Scantool and IG "ON" & ENG "OFF"
- 3) Select simulation function on scantool.
- 4) Simulate voltage at terminal 1 of MAPS harness connector.



1. MAPS Signal
2. MAPS Power
3. -
4. MAPS Ground

SVQF16198L

- 5) Does the output voltage response to the change of signal by simulation?

YES

► Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace if necessary and go to "Verification of Vehicle Repair" procedure

NO

► Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

E9C5B29D

Refer to DTC P0106.

FLA -202

FUEL SYSTEM

DTC P0108 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT HIGH INPUT

COMPONENT LOCATION E6C6809E

Refer to DTC P0106.

GENERAL DESCRIPTION EC7E4A76

Refer to DTC P0106.

DTC DESCRIPTION E7F708B4

Checking output signals of MAPS every 5 sec. under detecting condition, if an output signal is above 4.5V for more than 2.5 sec., PCM sets P0108. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E4CDE73D

Item		Detecting Condition	Possible cause
DTC Strategy		This code detects a continuous short to high in either the signal circuit or the MAP sensor	- Connecting condition - Short to battery in Signal Circuit - Open in Ground Circuit - Faulty MAPS - Faulty PCM
Enable Conditions	Case 1	- No TPS Active Fault Present - Engine Running Time > 10sec. - Engine Speed ≤ 2500rpm - Throttle Position ≤ 30%	
	Case 2	- No TPS Active Fault Present - Engine Running Time > 10sec. - Engine Speed > 2500rpm - Throttle Position ≤ 40%	
Threshold value		MAP Signal > 4.5V	
Diagnosis Time		Continuous (More than 2.5 seconds failure for every 5 seconds test)	
MIL On Condition		2 Driving Cycle	

SPECIFICATION EA6ABE01

Pressure (kPa)	20	35	60	95	101.32
Voltage (V)	0.789	1.382	2.369	3.75	4
Tolerance (V)	± 0.045				

SCHEMATIC DIAGRAM EC026FEC

Refer to DTC P0106.

SIGNAL WAVEFORM AND DATA E311481A

Refer to DTC P0106.

DTC TROUBLESHOOTING PROCEDURES

FLA -203

MONITOR DTC STATUS EEDDA889

Refer to DTC P0106.

TERMINAL AND CONNECTOR INSPECTION E6706E2D

Refer to DTC P0106.

POWER CIRCUIT INSPECTION EFB51A55

1. IG "OFF"
2. Disconnect MAPS connector
3. IG "ON"
4. Measure the voltage between terminal 2 of MAPS harness connector and ground.

Specification : Approx. 5V

5. Is the measured voltage within specification ?

YES

- ▶ Go to "Ground Circuit Inspection" procedure.

NO

- ▶ If the voltage is over 5.1V, check short to battery in harness.
- ▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION E66AA21D

1. IG "OFF".
2. Disconnect MAPS connector.
3. IG "ON" & ENG "OFF"
4. Measure the voltage between terminal 2 of MAPS harness connector and chassis ground.
5. Measure the voltage between terminal 2 and 4 of MAPS harness connector.

Specification : "A" - "B" = : Approx. below 200mV

6. Is the measured voltage within specification ?

YES

- ▶ Go to "Signal Circuit Inspection" procedure.

NO

- ▶ Repair contact resistance or open in harness and then go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

E772F55B

1. IG "OFF"
2. Disconnect MAPS and PCM connector.
3. Measure resistance between terminal 1 and 2 of MAPS harness connector.

Specification : Infinite

4. Is the measured resistance within specification ?

YES

- Go to "Component Inspection" procedure.

NO

- Repair short to battery in harness and then go to "Verification of Vehicle Repair" procedure.

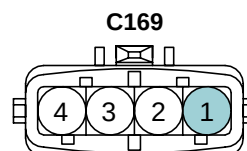
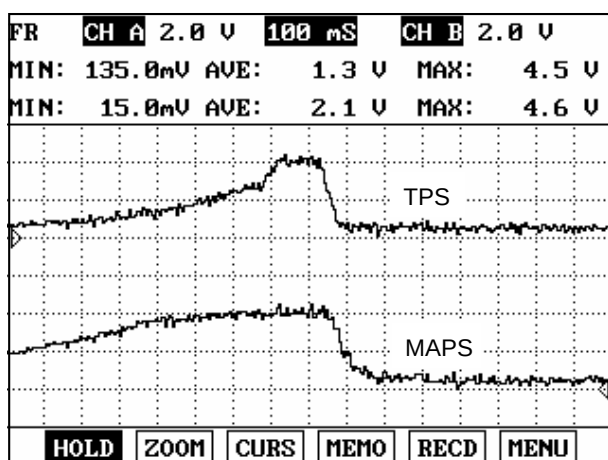
COMPONENT INSPECTION

E7F6EABB

1. MAPS performance test
 - 1) IG "OFF"
 - 2) Connect scantool to Data Link Connector(DLC) and select "Oscilloscope" then, connect probes to output signal lines of MAPS and TPS.
 - 3) Start engine and monitor the waveforms during accelerating and decelerating.

SPECIFICATON :

Pressure (kPa)	20	35	60	95	101.32
Voltage (V)	0.789	1.382	2.369	3.75	4
Tolerance (V)	± 0.045				



1. MAPS Signal
2. MAPS Power
3. -
4. MAPS Ground

SVQF16197L

- 4) Is the waveform displayed correctly?(Compare the response time of TPS and MAPS)

YES

DTC TROUBLESHOOTING PROCEDURES

FLA -205

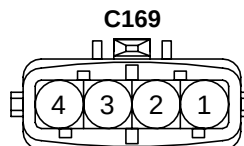
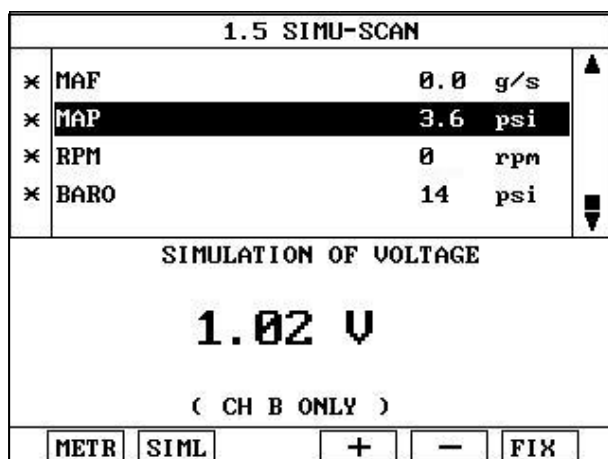
► Go to "Check PCM".

NO

► After replacing MAPS with new one, if it operates normally, replace MAPS and go to "Verification of Vehicle Repair".

2. Check PCM

- 1) IG "OFF" disconnect MAPS connector
- 2) Connect Scantool and IG "ON" & amp; amp; amp; amp; amp; ENG "OFF"
- 3) Select simulation function on scantool.
- 4) Simulate voltage at terminal 1 of MAPS harness connector.



1. MAPS Signal
2. MAPS Power
3. -
4. MAPS Ground

SVQF16198L

- 5) Does the output voltage response to the change of signal by simulation?

YES

► Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace if necessary and go to "Verification of Vehicle Repair" procedure

NO

► Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

E359DA4A

Refer to DTC P0106.

DTC P0110 INTAKE AIR TEMPERATURE SENSOR1 CIRCUIT

COMPONENT LOCATION E2939C87



SCMF16185L

GENERAL DESCRIPTION E9DAB32E

The Intake Air Temperature Sensor (IATS) is installed into the Mass Air Flow Sensor (MAFS). The IATS uses a thermistor whose resistance changes with the temperature. The electrical resistance of the IATS decreases as the temperature increases, and increases as the temperature decreases. The 5 V power source in the ECM is supplied to the IATS via a resistor in the ECM. That is, the resistor in the ECM and the thermistor in the IATS are connected in series. When the resistance value of the thermistor in IATS changes according to the intake air temperature, the signal voltage also changes. Using this signal, the information of the intake air temperature, the ECM corrects basic fuel injection duration and ignition timing.

DTC DESCRIPTION EACF4291

PCM monitors temperature difference between MAX. and MIN IATS in order to detect movement in IATS not only Start Test but Drive Test while enable condition is met. If PCM detects intake air temperature changes less than 3°C (5.4 °F) PCM determines that a fault exists and a DTC is stored. MIL (Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC TROUBLESHOOTING PROCEDURES

FLA -207

DTC DETECTING CONDITION

E7D8BB2A

Item		Detecting Condition	Possible cause
DTC Strategy	Case 1	Start Test: Monitors the difference between max and min IAT in order to detect movement in IAT for a certain time.	Faulty IATS
	Case 2	Drive test: Performs the max and min delta check while driving under load for a length of time followed by an idle for a certain time.	
Enable Conditions		- Engine soaked time > 360min - Engine Running State - No fault present - IAT stored previous trip - No IAT Tests pending	
Thresh old value	Case 1	Max IAT - Min IAT $\leq 3^{\circ}\text{C}$ (5.4 $^{\circ}\text{F}$)	
	Case 2	Continuous (10 min.)	
MIL On Condition		2 driving Cycles	

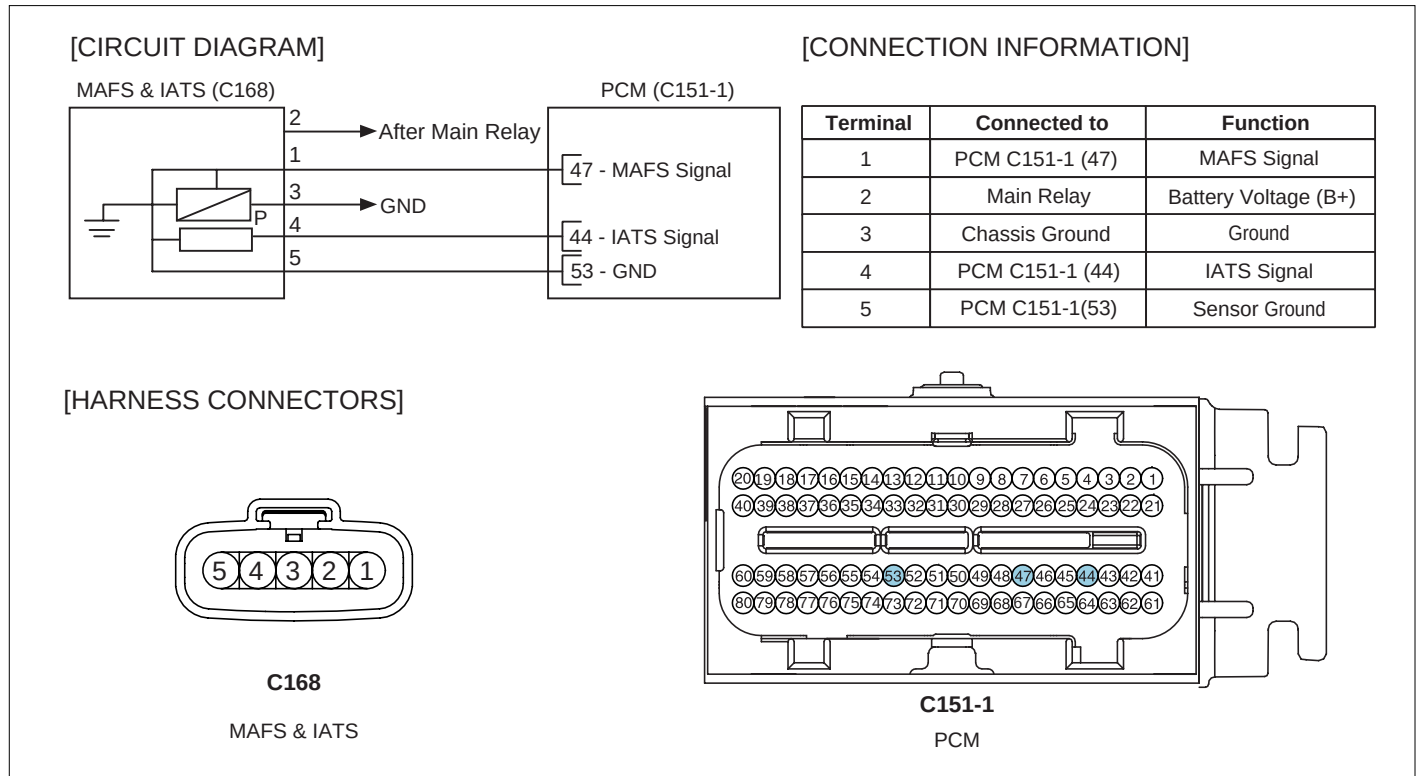
SPECIFICATION

E11F4E69

Temp. ($^{\circ}\text{C}/^{\circ}\text{F}$)	Resistance ($\text{k}\Omega$)	Temp. ($^{\circ}\text{C}/^{\circ}\text{F}$)	Resistance ($\text{k}\Omega$)
-40(-40)	95.95 ~ 105.78	20(68)	3.42 ~ 3.61
-20(-4)	27.4 ~ 29.77	40(104)	1.43 ~ 1.5
0(32)	9.08 ~ 9.72	60(140)	0.66 ~ 0.69
10(50)	5.49 ~ 5.83	80(176)	0.33 ~ 0.34

SCHEMATIC DIAGRAM

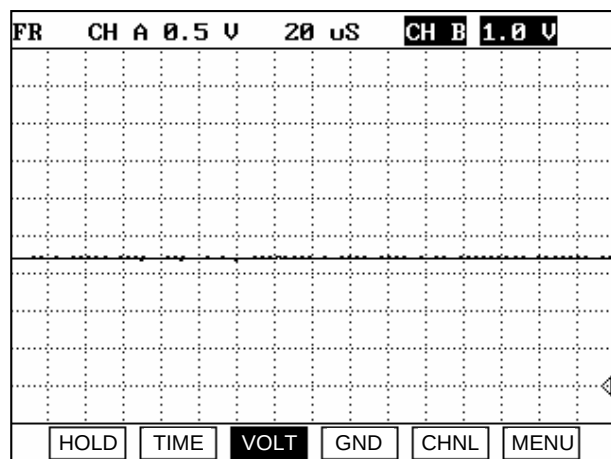
E383B48B



SVQF16104L

SIGNAL WAVEFORM AND DATA

E74A022E



EGRF604E

The output signals of IATS & ECTS change smoothly without any rapid changes. Those have almost same characteristic signal during the early period after start. It means that the temperatures of intake air and engine coolant are depended on the temperature of atmosphere. Meanwhile, during the warming up, the output signal of ECTS is going up increasingly. but, the output signal of IATS changes a little bit. even it may not change almost. It means that the heat of engine does not affect on the temperature of intake air.

MONITOR DTC STATUS

EAE59C54

1. Check DTC Status

- 1) Connect scantool to Data Link Connector(DLC).

DTC TROUBLESHOOTING PROCEDURES

FLA -209

- 2) IG "ON".
- 3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F4(DTAL) to check DTC's information from the DTCs menu
- 4) Read "DTC Status" parameter.

1.1 DIAGNOSTIC TROUBLE CODES			
PXXXX DTC TITLE			
NUMBER OF DTC : 1 ITEMS			
PART	ERAS	DTAL	

PXXXX TITLE	
1.MIL STATUS:	ON/OFF
2.DTC STATUS:	PRESENT/HISTORY
3.DIAG.STATUS:	DIAGNOSIS FINISHED
DTC CAUSE TO SYSTEM ERROR : PXXXX	

SCMF16159L

- 5) Is parameter displayed "Present fault"?

YES

- ▶ Go to "Component Inspection" procedure.

NO

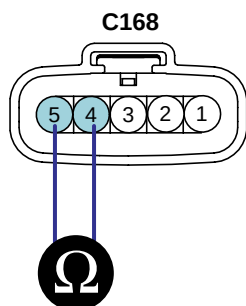
- ▶ Fault is intermittent caused by PCM memory was not cleared after repair. Erase DTC and drive the vehicle to satisfy the enable codition then, go to " Component Inspection" procedure.

COMPONENT INSPECTION EF987E04

1. Check resistance of IATS
 - 1) IG "OFF" and disconnect IATS connector.
 - 2) Measure resistance between terminal 4 and 5 of IATS connector.(Component Side) after checking out the temperature of IAT with scantool

SPECIFICATON :

Temp. (°C/°F)	Resistance (kΩ)	Temp. (°C/°F)	Resistance (kΩ)
-40(-40)	95.95 ~ 105.78	20(68)	3.42 ~ 3.61
-20(-4)	27.4 ~ 29.77	40(104)	1.43 ~ 1.5
0(32)	9.08 ~ 9.72	60(140)	0.66 ~ 0.69
10(50)	5.49 ~ 5.83	80(176)	0.33 ~ 0.34



1. MAFS Signal
2. MAFS Power
3. MAFS Ground
4. IATS Signal
5. IATS Ground

1.2 CURRENT DATA		07/79
* BATTERY VOLTAGE	12.4 V	▲
* COOLANT TEMP. SNSR	194.0°F	■
* MASS AIR FLOW	16.0 g/s	
* INT. AIR TEMP. SNSR	95.0 °F	
* MAP SENSOR	14.5 psi	
* ENGINE SPEED	0 rpm	
* ETC THROTTLE POSITION	16.92%	
OIL TEMPERATURE	195.8°F	▼
FIX		SCRN
FULL		PART
GRPH		HELP

SVQF16204L

3) Is the measured resistance within specification ?

YES

► Go to "Verification of Vehicle Repair" procedure.

NO

► Substitute with a known - good IATS and check for proper operation. If the problem is corrected, replace IATS and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EA2B60BB

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

► System performing to specification at this time. Clear the DTC.

NO

► Go to the applicable troubleshooting procedure.

DTC TROUBLESHOOTING PROCEDURES

FLA -211

DTC P0111 INTAKE AIR TEMPERATURE SENSOR1 CIRCUIT RANGE/PERFORMANCE

COMPONENT LOCATION EE5B6B5D

Refer to DTC P0110.

GENERAL DESCRIPTION E2159E6C

Refer to DTC P0110.

DTC DESCRIPTION EEA95955

PCM monitors temperature changes resulting from soaking the vehicle. Therefore, Coolant temperature and Intake temperature should be changed. If PCM detects intake air temperature correlated to coolant temperature does not change PCM determines that a fault exists and a DTC is stored. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E88201A7

Item		Detection condition	Possible cause
DTC Strategy	Case 1	Monitors the difference between the startup coolant and IAT values	IATS
	Case 2	Monitors the difference between the startup IAT and coolant values	
Enable Conditions	Case 1	- Engine soaked time $\geq$ 360min - Engine running state - No faults present - IAT stored previous trip - Startup Coolant Temperature $>$ -20°C - Airflow $>$ 15 g/s - Vehicle speed $>$ 40kph	
	Case 2	- Engine soaked time $\geq$ 360min - Engine running state - No faults present - IAT stored previous trip - Airflow $>$ 15 g/s - Vehicle speed $>$ 40kph	
Thresh old value	Case 1	Startup Coolant - Startup IAT $\geq$ 30°C	
	Case 2	Startup IAT - Startup Coolant $\geq$ 20°C	
Diagnosis Time		Continuous (More than 1.25 second failure)	
MIL On Condition		2 Driving Cycles	

SPECIFICATION

E59D6FB6

Temp. (°C/°F)	Resistance (kΩ)	Temp. (°C/°F)	Resistance (kΩ)
-40(-40)	95.95 ~ 105.78	20(68)	3.42 ~ 3.61
-20(-4)	27.4 ~ 29.77	40(104)	1.43 ~ 1.5
0(32)	9.08 ~ 9.72	60(140)	0.66 ~ 0.69
10(50)	5.49 ~ 5.83	80(176)	0.33 ~ 0.34

SCHEMATIC DIAGRAM

E0C08B0E

Refer to DTC P0110.

SIGNAL WAVEFORM AND DATA

EEB56960

Refer to DTC P0110.

MONITOR DTC STATUS

EBDF8E0D

Refer to DTC P0110.

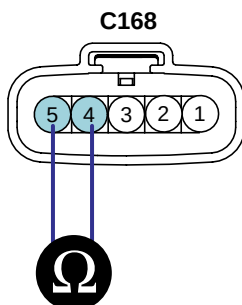
COMPONENT INSPECTION

E44DDF98

- Check resistance of IATS
 - IG "OFF" and disconnect IATS connector.
 - Measure resistance between terminal 4 and 5 of IATS connector.(Component Side) after checking out the temperature of IAT with scantool

SPECIFICATON :

Temp. (°C/°F)	Resistance (kΩ)	Temp. (°C/°F)	Resistance (kΩ)
-40(-40)	95.95 ~ 105.78	20(68)	3.42 ~ 3.61
-20(-4)	27.4 ~ 29.77	40(104)	1.43 ~ 1.5
0(32)	9.08 ~ 9.72	60(140)	0.66 ~ 0.69
10(50)	5.49 ~ 5.83	80(176)	0.33 ~ 0.34



- MAFS Signal
- MAFS Power
- MAFS Ground
- IATS Signal
- IATS Ground

1.2 CURRENT DATA		07/79
× BATTERY VOLTAGE	12.4 V	▲
× COOLANT TEMP. SNSR	194.0°F	■
× MASS AIR FLOW	16.0 g/s	
× INT. AIR TEMP. SNSR	95.0 °F	
× MAP SENSOR	14.5 psi	
× ENGINE SPEED	0 rpm	
× ETC THROTTLE POSITION	16.92%	
OIL TEMPERATURE	195.8°F	▼
FIX		SCRN
FULL		PART
GRPH		HELP

DTC TROUBLESHOOTING PROCEDURES

FLA -213

- 3) Is the measured resistance within specification ?

YES

- Go to "Verification of Vehicle Repair" procedure.

NO

- Substitute with a known - good IATS and check for proper operation. If the problem is corrected, replace IATS and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EFA6A207

Refer to DTC P0110.

FLA -214

FUEL SYSTEM

DTC P0112 INTAKE AIR TEMPERATURE SENSOR1 CIRCUIT LOW INPUT

COMPONENT LOCATION EC387A43

Refer to DTC P0110.

GENERAL DESCRIPTION EA0589DC

Refer to DTC P0110.

DTC DESCRIPTION E3FD8660

Checking output signals of IATS every 20 sec. under detecting condition, if an output signal is below 0.1V for more than 10 sec., PCM sets P0112. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E698C5D0

Item		Detecting Condition	Possible Cause
DTC Strategy		This code detects a continuous short to ground in either the signal circuit or the sensor	- Poor connection - Short to ground in harness - IATS - PCM
Enable Conditions	Case 1	- Engine running state - No Vehicle speed sensor fault - Vehicle speed > 50kph(30mph)	
	Case 2	Engine running time > 120 sec. or Time from IG "OFF" to IG "ON" > 360 min.	
Threshold value		Intake air temperature sensor's voltage < 0.1V	
Diagnosis Time		Continuous (More than 10 seconds failure for every 20 seconds test)	
MIL On Condition		2 Driving Cycles	

SPECIFICATION EAFF2A60

Temp. (°C/°F)	Resistance (kΩ)	Temp. (°C/°F)	Resistance (kΩ)
-40(-40)	95.95 ~ 105.78	20(68)	3.42 ~ 3.61
-20(-4)	27.4 ~ 29.77	40(104)	1.43 ~ 1.5
0(32)	9.08 ~ 9.72	60(140)	0.66 ~ 0.69
10(50)	5.49 ~ 5.83	80(176)	0.33 ~ 0.34

SCHEMATIC DIAGRAM E2EA293C

Refer to DTC P0110.

SIGNAL WAVEFORM AND DATA E05C8192

Refer to DTC P0110.

DTC TROUBLESHOOTING PROCEDURES

FLA -215

MONITOR DTC STATUS E72AC1B9

Refer to DTC P0110.

TERMINAL AND CONNECTOR INSPECTION E056E9B4

Refer to DTC P0110.

SIGNAL CIRCUIT INSPECTION E66614F6

1. Check voltage

- 1) IG "OFF" and disconnect IATS connector.
- 2) IG "ON" and ENG "OFF"
- 3) Measure voltage between terminal 4 of IATS harness connector and chassis ground.

Specification : Approx. 5V

- 4) Is the measured voltage within specification ?

YES

- Go to "Component Inspection" procedure.

NO

- Go to " Check short to ground in harness" procedure.

2. Check short to ground in harness

- 1) IG "OFF" and disconnect IATS connector and PCM connector.
- 2) Measure resistance between terminal 4 of IATS harness connector and chassis ground.
- 3) Measure resistance between terminals 4 and 5 of IATS harness connector.
- 4) Measure resistance between terminals 4 and 3 of IATS harness connector.

Specification : Infinite

- 5) Is the measured resistance within specification?

YES

- Go to "Component inspection" procedure.

NO

- Repair short to ground in harness and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E421DC2E

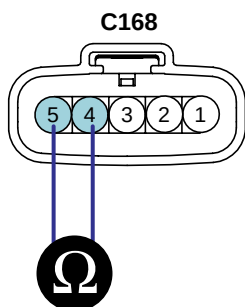
1. Check IATS

- 1) IG "OFF" and disconnect IATS connector.

- 2) Measure resistance between terminals 4 and 5 of IATS connector.(Component side)

SPECIFICATON :

Temp. (°C/°F)	Resistance (k Ω)	Temp. (°C/°F)	Resistance (k Ω)
-40(-40)	95.95 ~ 105.78	20(68)	3.42 ~ 3.61
-20(-4)	27.4 ~ 29.77	40(104)	1.43 ~ 1.5
0(32)	9.08 ~ 9.72	60(140)	0.66 ~ 0.69
10(50)	5.49 ~ 5.83	80(176)	0.33 ~ 0.34



1. MAFS Signal
2. MAFS Power
3. MAFS Ground
4. IATS Signal
5. IATS Ground

SVQF16607L

- 3) Is the measured resistance within specification ?

YES

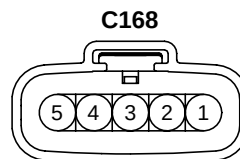
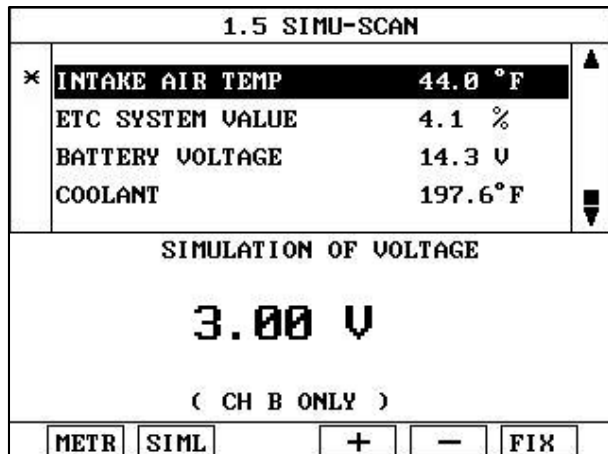
- Go to "Check PCM" as follows.

NO

- Substitute with a known - good IATS and check for proper operation. If the problem is corrected, replace IATS and go to "Verification of Vehicle Repair" procedure.

2. Check PCM

- 1) IG "OFF" and connect scantool.
- 2) Disconnect IATS connector and connect probe to terminal 4 of IATS harness connector.
- 3) IG "ON" and ENG "OFF" and simulation Function on scantool.
- 4) Simulate voltage at terminal 4 of IATS harness connector.



1. MAFS Signal
2. MAFS Power
3. MAFS Ground
4. IATS Signal
5. IATS Ground

SVQF16205L

5) Does the signal value of IAT sensor change according to simulation voltage ?

YES

► Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

► Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR

E876B71E

Refer to DTC P0110.

FLA -218

FUEL SYSTEM

DTC P0113 INTAKE AIR TEMPERATURE SENSOR1 CIRCUIT HIGH INPUT

COMPONENT LOCATION E3BEBEF2

Refer to DTC P0110.

GENERAL DESCRIPTION E577857C

Refer to DTC P0110.

DTC DESCRIPTION ECA49F73

Checking output signals of IATS every 20 sec. under detecting condition, if an output signal is over 4.9V for more than 10 sec., PCM sets P0113. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E3A9AE8F

Item	Detecting Condition	Possible cause
DTC Strategy	This code detects a continuous short to high in either the signal circuit or the sensor	- Poor connection - Open or short to battery in harness - Open in ground harness - IATS - PCM
Enable Conditions	- No vehicle speed sensor fault - No ECTS fault - No MAFS fault - Vehicle speed < 25 kph (9.3 mph) - Intake airflow < 15 g/s 50°C (122°F) and Engine running time > 120 s or Time from IG "OFF" to IG "ON" > 360 min and ECT > -10°C (14°F) - Engine running state	
Threshold value	Intake air temperature sensor's voltage > 4.9V	
Diagnosis Time	Continuous (More than 10 seconds failure for every 20 seconds test)	
MIL On Condition	2 Driving Cycles	

SPECIFICATION EDD6F718

Temp. (°C/°F)	Resistance (kΩ)	Temp. (°C/°F)	Resistance (kΩ)
-40(-40)	95.95 ~ 105.78	20(68)	3.42 ~ 3.61
-20(-4)	27.4 ~ 29.77	40(104)	1.43 ~ 1.5
0(32)	9.08 ~ 9.72	60(140)	0.66 ~ 0.69
10(50)	5.49 ~ 5.83	80(176)	0.33 ~ 0.34

SCHEMATIC DIAGRAM E41DAC06

Refer to DTC P0110.

DTC TROUBLESHOOTING PROCEDURES

FLA -219

SIGNAL WAVEFORM AND DATA E83E665B

Refer to DTC P0110.

MONITOR DTC STATUS EFCD2818

Refer to DTC P0110.

TERMINAL AND CONNECTOR INSPECTION E570B72D

Refer to DTC P0110.

SIGNAL CIRCUIT INSPECTION E1D80CD4

1. Check voltage

- 1) IG "OFF" and disconnect IATS connector.
- 2) IG "ON" and ENG "OFF"
- 3) Measure voltage between terminal 4 of IATS harness connector and chassis ground.

Specification : Approx. 5V

- 4) Is the measured voltage within specification ?

YES

► Go to "Ground Circuit Inspection" procedure.

NO

► If the voltage is 0V, go to "Check open in harness" as follows. If the voltage is more than 5.1V, go to "Check short to battery in harness" as follows.

2. Check short to battery in harness

- 1) IG "OFF" and disconnect IATS connector and PCM connector.
- 2) Measure resistance between terminals 2 and 4 of IATS harness connector.
- 3) Measure resistance between terminals 1 and 4 of IATS harness connector.

Specification : Infinite

- 4) Is the measured resistance within specification?

YES

► Go to "Component Inspection" procedure.

NO

► Repair short to battery in harness and go to "Verification of Vehicle Repair" procedure.

3. Check open in harness

FLA -220

FUEL SYSTEM

- 1) IG "OFF" and disconnect IATS connector and PCM connector.
- 2) Measure resistance between terminal 4 of IATS harness connector and 44 of PCM harness connector.

Specification : below 1Ω

- 3) Is the measured resistance within specification?

YES

► Go to "Ground Circuit Inspection" procedure.

NO

► Repair open in harness and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

E9C2613F

1. IG "OFF" and disconnect IATS connector.
2. Measure voltage between terminal 4 of IATS harness connector and chassis ground.
3. Measure voltage between terminals 4 and 5 of IATS harness connector.

Specification : Voltage difference between measurement "A" and "B" is below 200mV.

4. Is the measured voltage within specification ?

YES

► Go to "Component Inspection" procedure.

NO

► Repair contact resistance or open in harness and go to "Verification of Vehicle Repair" procedure.

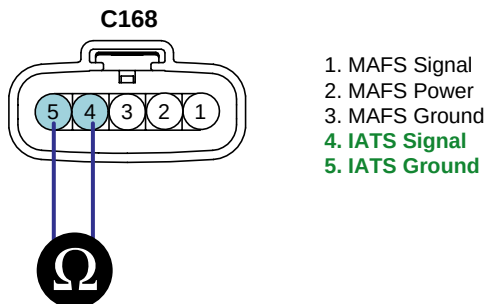
COMPONENT INSPECTION

E544C3E7

1. Check IATS
 - 1) IG "OFF" and disconnect IATS connector.
 - 2) Measure resistance between terminals 4 and 5 of IATS connector.(Component side)

SPECIFICATON :

Temp. ($^{\circ}\text{C}/^{\circ}\text{F}$)	Resistance ($\text{k}\Omega$)	Temp. ($^{\circ}\text{C}/^{\circ}\text{F}$)	Resistance ($\text{k}\Omega$)
-40(-40)	95.95 ~ 105.78	20(68)	3.42 ~ 3.61
-20(-4)	27.4 ~ 29.77	40(104)	1.43 ~ 1.5
0(32)	9.08 ~ 9.72	60(140)	0.66 ~ 0.69
10(50)	5.49 ~ 5.83	80(176)	0.33 ~ 0.34



SVQF16607L

3) Is the measured resistance within specification ?

YES

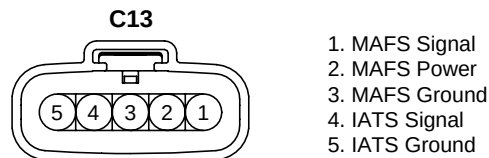
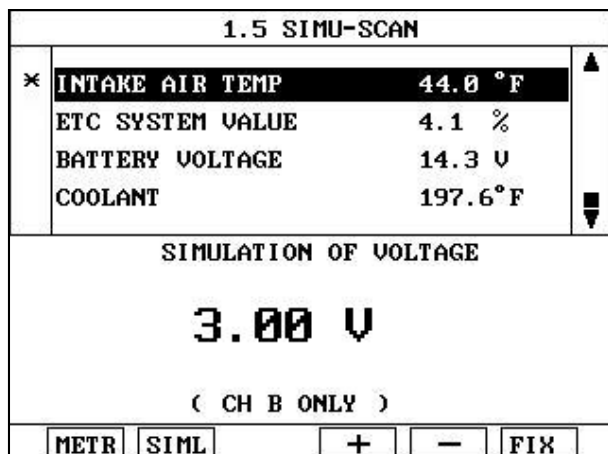
► Go to "Check PCM" as follows.

NO

► Substitute with a known - good IATS and check for proper operation. If the problem is corrected, replace IATS and go to "Verification of Vehicle Repair" procedure.

2. Check PCM

- 1) IG "OFF" and connect scantool.
- 2) Disconnect IATS connector and connect probe to terminal 4 of IATS harness connector.
- 3) IG "ON" and ENG "OFF" and simulation Function on scantool.
- 4) Simulate voltage at terminal 4 of IATS harness connector.



SCMF16205L

5) Does the signal value of IAT sensor change according to simulation voltage ?

YES

► Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

► Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

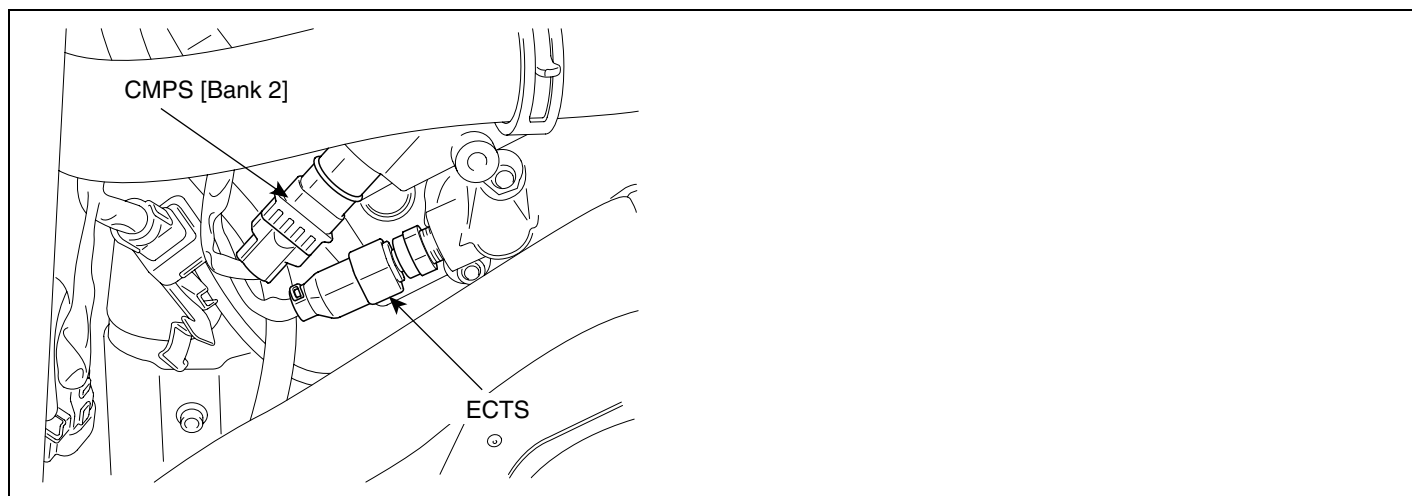
VERIFICATION OF VEHICLE REPAIR

E1AFF304

Refer to DTC P0110.

DTC P0117 ENGINE COOLANT TEMPERATURE CIRCUIT LOW INPUT

COMPONENT LOCATION E8BA96C1



LGLG510A

GENERAL DESCRIPTION EE2E48C5

The Engine Coolant Temperature Sensor (ECTS) is located in the engine coolant passage of the cylinder head for detecting the engine coolant temperature. The ECTS uses a thermistor whose resistance changes with the temperature. The electrical resistance of the ECTS decreases as the temperature increases, and increases as the temperature decreases. The reference 5 V in the ECM is supplied to the ECTS via a resistor in the ECM. That is, the resistor in the ECM and the thermistor in the ECTS are connected in series. When the resistance value of the thermistor in the ECTS changes according to the engine coolant temperature, the output voltage also changes. During cold engine operation the ECM increases the fuel injection duration and controls the ignition timing using the information of engine coolant temperature to avoid engine stalling and improve drivability.

DTC DESCRIPTION EAAEF50E

Checking output signals from ECTS every 80 sec. under detecting condition, if an output signal is below 0.1V for more than 40 sec., PCM sets P0117. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E268CE7B

Item		Detecting Condition	Possible cause
DTC Strategy		• Signal low	• Poor connection • Short to ground in harness • ECTS • PCM
Enable Conditions	Case 1	• Time after start-up > 120 sec.	
	Case 2	• Time from IG "OFF" to IG "ON" > 360 min. • Engine running state	
Threshold value		• Engine coolant temperature sensor's voltage < 0.1V	
Diagnosis Time		• Continuous (More than 40 seconds failure for every 80 second test)	
MIL On Condition		• 2 Driving Cycle	

FLA -224

FUEL SYSTEM

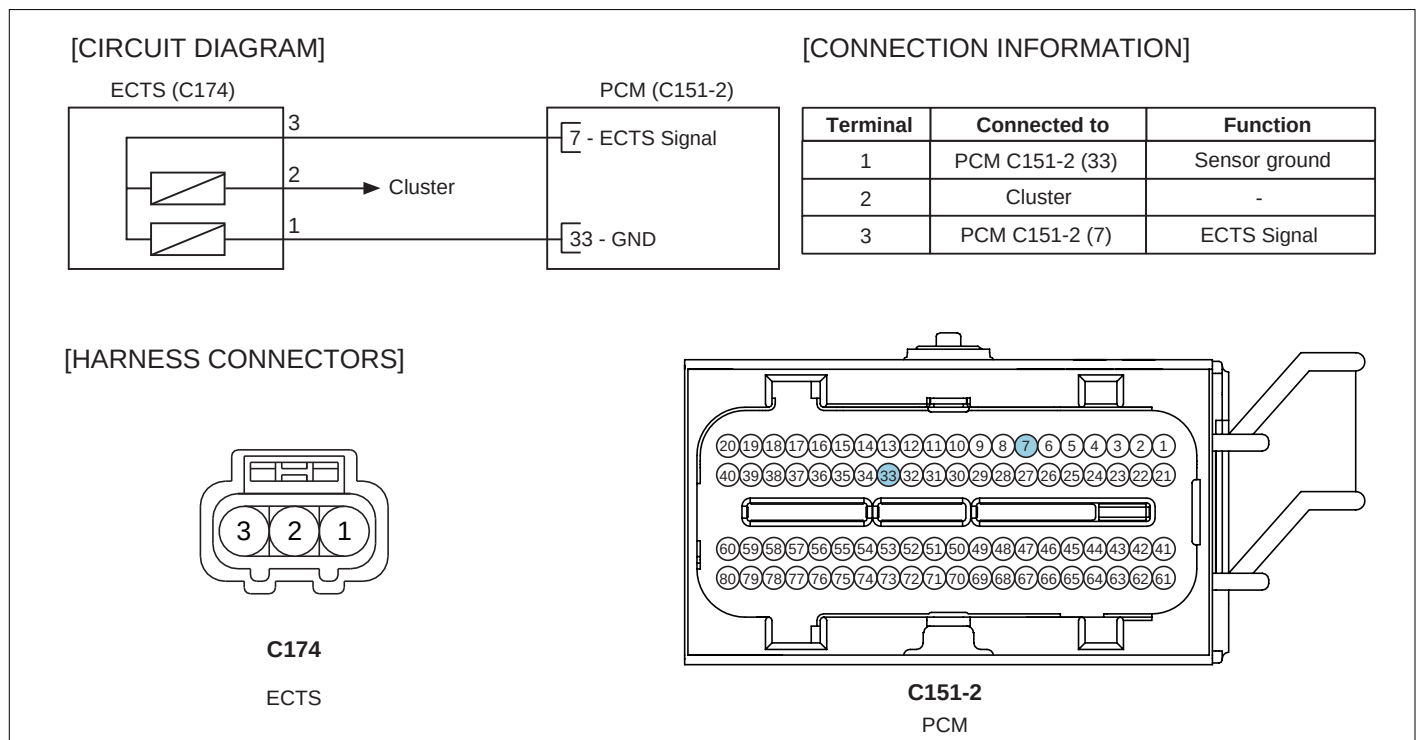
SPECIFICATION

E073B461

Temp. (°C/°F)	Resistance (kΩ)	Temp. (°C/°F)	Resistance (kΩ)
-40(-40)	48.14	40(104)	1.15
-20(-4)	14.13 ~ 16.83	60(140)	0.59
0(32)	5.79	80(176)	0.32
20(68)	2.31 ~ 2.59		

SCHEMATIC DIAGRAM

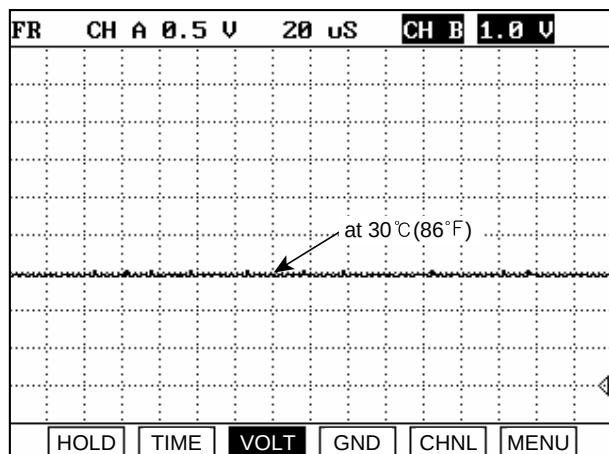
EE348B41



SVQF16106L

SIGNAL WAVEFORM AND DATA

EBAD21D7



EGRF604P

The output signals of IATS & ECTS change smoothly without any rapid changes. Those have almost same characteristic signal during the early period after start. It means that the temperatures of intake air and engine coolant are depended on

DTC TROUBLESHOOTING PROCEDURES

FLA -225

the temperature of atmosphere. Meanwhile, during the warming up, the output signal of ECTS is going up increasingly. but, the output signal of IATS changes a little bit. even it may not change almost. It means that the heat of engine does not affect on the temperature of intake air.

MONITOR DTC STATUS EBEC7FB1

1. Check DTC Status

- 1) Connect scantool to Data Link Connector(DLC).
- 2) IG "ON".
- 3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F4(DTAL) to check DTC's information from the DTCs menu
- 4) Read "DTC Status" parameter.

1.1 DIAGNOSTIC TROUBLE CODES		
PXXXX DTC TITLE		
NUMBER OF DTC : 1 ITEMS		
PART	ERAS	DTAL

PXXXX TITLE	
1.MIL STATUS:	ON/OFF
2.DTC STATUS:	PRESENT/HISTORY
3.DIAG.STATUS:	DIAGNOSIS FINISHED
DTC CAUSE TO SYSTEM ERROR : PXXXX	

SCMF16159L

5) Is parameter displayed "Present fault"?

YES

- Go to "Terminal and connector inspection" procedure.

NO

- Fault is intermittent caused by poor contact in the sensor' s and/or PCM' s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

TERMINAL AND CONNECTOR INSPECTION E7DD93A9

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

- ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

- ▶ Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION E7A87D49

1. Check voltage

- 1) IG "OFF" and disconnect ECTS connector.
- 2) IG "ON" and ENG "OFF"
- 3) Measure voltage between terminal 3 of ECTS harness connector and chassis ground.

Specification : Approx. 5V

- 4) Is the measured voltage within specification ?

YES

- ▶ Go to "Component Inspection" procedure.

NO

- ▶ Go to "Check short to ground in harness" as follows.

2. Check short to ground in harness

- 1) IG "OFF" and disconnect ECTS connector and PCM connector.
- 2) Measure resistance between terminal 3 of ECTS harness connector and chassis ground.
- 3) Measure resistance between terminals 1 and 3 of ECTS harness connector.

Specification : Infinite

- 4) Is the measured resistance within specification?

YES

- ▶ Go to "Component Inspection" procedure.

NO

- ▶ Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E5A14E1D

1. Check ECTS

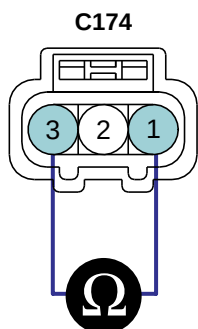
- 1) IG "OFF" and disconnect ECTS connector.
- 2) Measure resistance between terminals 1 and 3 of ECTS connector.(Component side)

DTC TROUBLESHOOTING PROCEDURES

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SPECIFICATION :

Temp. (°C/°F)	Resistance (kΩ)	Temp. (°C/°F)	Resistance (kΩ)
-40(-40)	48.14	40(104)	1.15
-20(-4)	14.13 ~ 16.83	60(140)	0.59
0(32)	5.79	80(176)	0.32
20(68)	2.31 ~ 2.59		



1. ECTS Ground
2. To Gauge
3. ECTS Signal

SVQF16211L

3) Is the measured resistance within specification?

YES

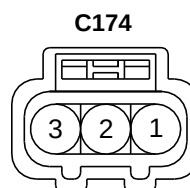
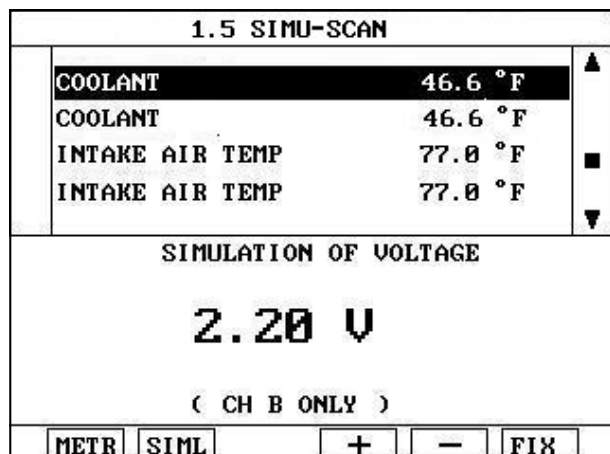
► Go to "Check PCM" as follows.

NO

► Substitute with a known - good ECTS and check for proper operation. If the problem is corrected, replace ECTS and go to "Verification of Vehicle Repair" procedure.

2. Check PCM

- 1) IG "OFF" and connect scantool.
- 2) Connect probe to terminal 3 of ECTS harness connector.
- 3) IG "ON" and ENG "OFF" and simulation Function on scantool.
- 4) Simulate voltage at terminal 3 of ECTS harness connector.



1. ECTS Ground
2. To Gauge
3. ECTS Signal

SVQF16212L

5) Does the signal value of ECT sensor change according to simulation voltage ?

YES

► Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

► Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR

E1A96D6E

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

► System performing to specification at this time. Clear the DTC.

NO

► Go to the applicable troubleshooting procedure.

DTC TROUBLESHOOTING PROCEDURES

FLA -229

DTC P0118 ENGINE COOLANT TEMPERATURE CIRCUIT HIGH INPUT

COMPONENT LOCATION E39FB981

Refer to DTC P0117.

GENERAL DESCRIPTION E69DC80F

Refer to DTC P0117.

DTC DESCRIPTION EBA41CAA

Checking output signals from ECTS every 80 sec. under detecting condition, if an output signal is above 4.9V for more than 40 sec., PCM sets P0118. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E3D5A198

Item		Detecting Condition	Possible cause
DTC Strategy		• Open, Signal high	• Poor connection • Open or short to battery in signal harness • Open in ground harness • ECTS • PCM
Enable Conditions	Case 1	• Time after start-up > 120 sec.	
	Case 2	• Time from IG "OFF" to IG "ON" > 360 min. • Intake air temperature $\geq -10^{\circ}\text{C}(14^{\circ}\text{F})$ • Engine running state	
Threshold value		• Engine coolant temperature sensor's voltage > 4.9V	
Diagnosis Time		• Continuous (More than 40 sec. failure for every 80 sec. test)	
MIL On Condition		• 2 Driving Cycle	

SPECIFICATION E813F79D

Temp. ($^{\circ}\text{C}/^{\circ}\text{F}$)	Resistance ($\text{k}\Omega$)	Temp. ($^{\circ}\text{C}/^{\circ}\text{F}$)	Resistance ($\text{k}\Omega$)
-40(-40)	48.14	40(104)	1.15
-20(-4)	14.13 ~ 16.83	60(140)	0.59
0(32)	5.79	80(176)	0.32
20(68)	2.31 ~ 2.59		

SCHEMATIC DIAGRAM ED53CE9E

Refer to DTC P0117.

SIGNAL WAVEFORM AND DATA E36568DB

Refer to DTC P0117.

MONITOR DTC STATUS EB1CC283

Refer to DTC P0117.

TERMINAL AND CONNECTOR INSPECTION E42A0DDA

Refer to DTC P0117.

SIGNAL CIRCUIT INSPECTION EF57F5F5

1. Check voltage

- 1) IG "OFF" and disconnect ECTS connector.
- 2) IG "ON" and ENG "OFF"
- 3) Measure voltage between terminal 3 of ECTS harness connector and chassis ground.

Specification : Approx. 5V

- 4) Is the measured voltage within specification ?

YES

► Go to "Ground Circuit Inspection" procedure.

NO

► If voltage is 0V, go to "Check open in harness" as follows. If it is more than 5.1V, go to "Check short to battery in harness" as follows

2. Check short to battery in harness

- 1) IG "OFF" and disconnect ECTS connector and PCM connector.
- 2) Measure resistance between terminals 2 and 3 of ECTS harness connector.

Specification : Infinite

- 3) Is the measured resistance within specification?

YES

► Go to "Component Inspection" procedure.

NO

► Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

3. Check open in harness

- 1) IG "OFF" and disconnect ECTS connector and PCM connector.
- 2) Measure resistance between terminal 3 of ECTS harness connector and terminal 7 of PCM harness connector.

Specification : Below 1Ω

DTC TROUBLESHOOTING PROCEDURES

FLA -231

- 3) Is the measured resistance within specification?

YES

- Go to "Ground Circuit Inspection" procedure.

NO

- Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION ED915B6F

1. IG "OFF" and disconnect ECTS connector.
2. Measure voltage between terminal 3 of ECTS harness connector and chassis ground.
3. Measure voltage between terminals 1 and 3 of ECTS harness connector.

Specification : Voltage difference between measurement "A" and "B" is below 200mV.

4. Is the measured voltage within specification?

YES

- Go to "Component Inspection" procedure.

NO

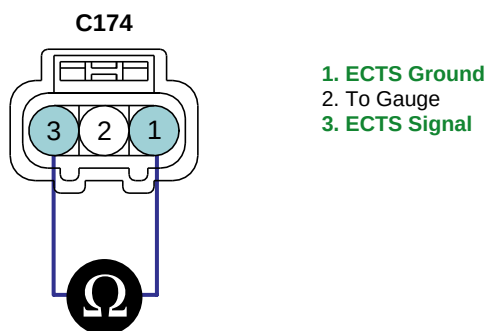
- Repair open or contact resistance in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E86B0A34

1. Check ECTS
 - 1) IG "OFF" and disconnect ECTS connector.
 - 2) Measure resistance between terminals 1 and 3 of ECTS connector.(Component side)

SPECIFICATON :

Temp. (°C/°F)	Resistance (kΩ)	Temp. (°C/°F)	Resistance (kΩ)
-40(-40)	48.14	40(104)	1.15
-20(-4)	14.13 ~ 16.83	60(140)	0.59
0(32)	5.79	80(176)	0.32
20(68)	2.31 ~ 2.59		



SVQF16211L

3) Is the measured resistance within specification?

YES

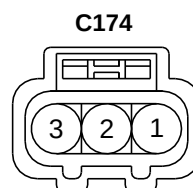
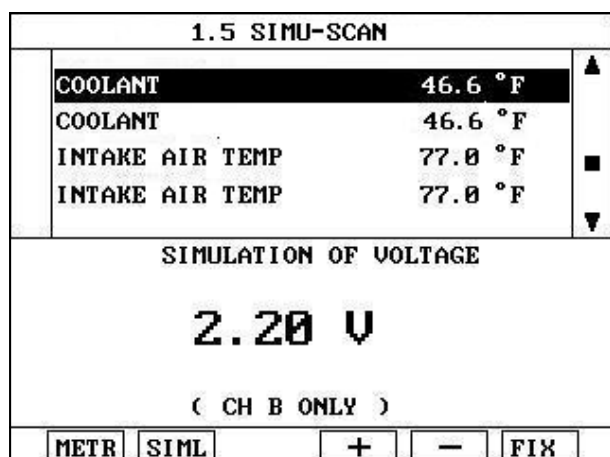
► Go to "Check PCM" as follows.

NO

► Substitute with a known - good ECTS and check for proper operation. If the problem is corrected, replace ECTS and go to "Verification of Vehicle Repair" procedure.

2. Check PCM

- 1) IG "OFF" and connect scantool.
- 2) Connect probe to terminal 3 of ECTS harness connector.
- 3) IG "ON" and ENG "OFF" and simulation Function on scantool.
- 4) Simulate voltage at terminal 3 of ECTS harness connector.



1. ECTS Ground
2. To Gauge
3. ECTS Signal

SVQF16212L

5) Does the signal value of ECT sensor change according to simulation voltage ?

YES

► Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

DTC TROUBLESHOOTING PROCEDURES

FLA -233

- ▶ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR

E39E2BF2

Refer to DTC P0117.

DTC P0122 THROTTLE/PEDAL POSITION SENSOR/SWITCH "A" CIRCUIT LOW INPUT

COMPONENT LOCATION E99DDCBA



LGLG509A

GENERAL DESCRIPTION EA17E0B5

The Electronic Throttle Control(ETC) system is made of the components throttle body, Throttle Position Sensor(TPS)1 & 2 and Accelerator Position Sensor(APS) 1 & 2. TPS1 & 2 are sharing the same source voltage and ground.The throttle valve opening is control by throttle motor which is controlled by Engine Control Module(ECM).The opposite position indicator shows inverted signal characteristics.TPS1 output voltage increases smoothly in proportion with the throttle valve opening angle after starting. TPS2 output voltage decreases in inverse proportion with the throttle valve opening angle after starting. TPS provides feedback to the ECM to control the throttle motor in order to control the throttle valve opening angle properly in response to the driving condition.

DTC DESCRIPTION ECD19B0F

Checking output signals from TPS1 every 8.5 sec. under detecting condition, if an output signal is below 0.25V for more than 0.1 sec., PCM sets P0122. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E9D5EB68

Item	Detecting Condition	Possible Cause
DTC Strategy	• signal low	• Poor connection • Open or short to ground in power harness • Short to ground in signal harness • TPS • PCM
Enable condition	• IG "ON	
threshold value	• The voltage of TPS < 0.25V	
diagnosis time	• Continuous (more than 0.1 sec. failure for every 8.5 sec.test)	
MIL ON condition	• 2 driving cycles	

DTC TROUBLESHOOTING PROCEDURES

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SPECIFICATION EB32305D

Throttle opening (°)	Output voltage(V) [Vref=5.0]	
	TPS1	TPS2
0°	0.0V	5.0V
10°	0.5V	4.5V
20°	0.9V	4.1V
30°	1.4V	3.6V
40°	1.8V	3.2V
50°	2.3V	2.7V
60°	2.7V	2.3V
70°	3.2V	1.8V
80°	3.6V	1.4V
90°	4.1V	0.9V
100°	4.5V	0.5V
110°	5.0V	0.0V

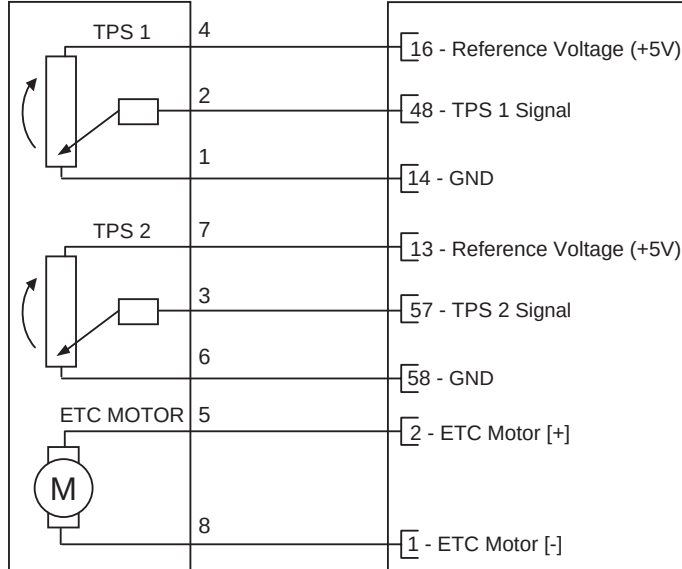
SCHEMATIC DIAGRAM

EB8A3F43

[CIRCUIT DIAGRAM]

ETC Module (C159)

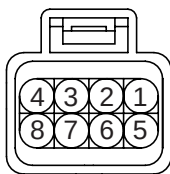
PCM (C151-2)



[CONNECTION INFORMATION]

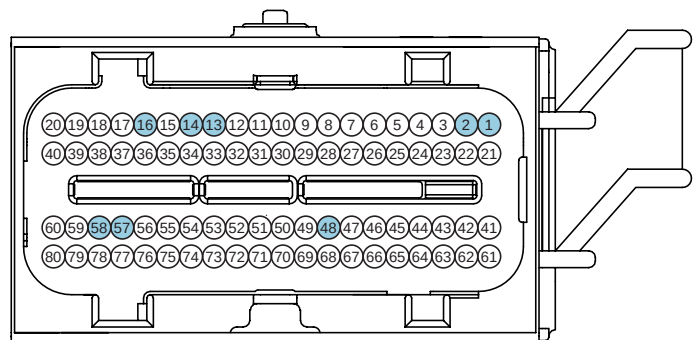
Terminal	Connected to	Function
1	PCM C151-2 (14)	TPS 1 Ground
2	PCM C151-2 (48)	TPS 1 Signal
3	PCM C151-2 (57)	TPS 2 Signal
4	PCM C151-2 (16)	TPS 1 Reference Voltage (+5V)
5	PCM C151-2 (2)	ETC Motor [+] Control
6	PCM C151-2 (58)	TPS 2 Ground
7	PCM C151-2 (13)	TPS 2 Reference Voltage (+5V)
8	PCM C151-2 (1)	ETC Motor [-] Control

[HARNESS CONNECTORS]



C159

ETC MODULE



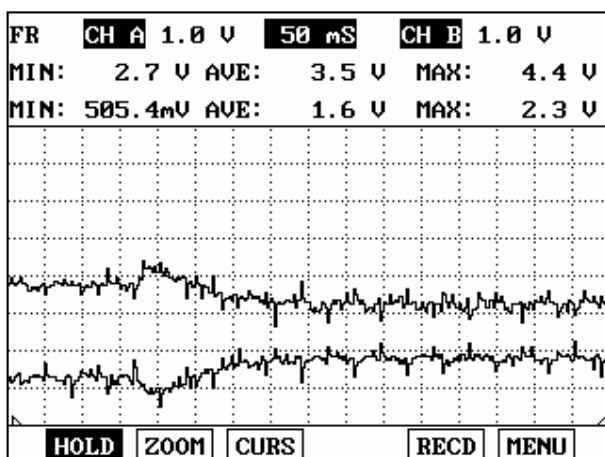
C151-2

PCM

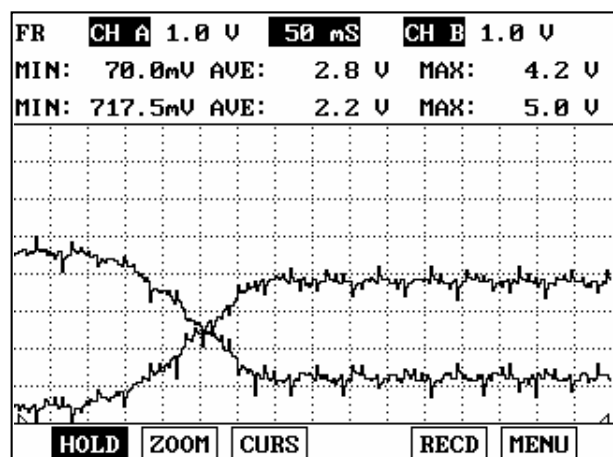
SVQF16101L

SIGNAL WAVEFORM AND DATA

EA4AD1D5



Hit the accelerator at IG ON



Open the throttle valve by force at IG ON

EGRF604Z

DTC TROUBLESHOOTING PROCEDURES

FLA -237

MONITOR DTC STATUS E531A752

1. Check DTC Status
 - 1) Connect scantool to Data Link Connector(DLC).
 - 2) IG "ON".
 - 3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F4(DTAL) to check DTC's information from the DTCs menu
 - 4) Read "DTC Status" parameter.

1.1 DIAGNOSTIC TROUBLE CODES			
PXXXX DTC TITLE			
NUMBER OF DTC : 1 ITEMS			
PART	ERAS	DTAL	

PXXXX TITLE	
1.MIL STATUS:	ON/OFF
2.DTC STATUS:	PRESENT/HISTORY
3.DIAG.STATUS:	DIAGNOSIS FINISHED
DTC CAUSE TO SYSTEM ERROR : PXXXX	

SCMF16159L

- 5) Is parameter displayed "Present fault"?

YES

- Go to "Terminal and connector inspection" procedure.

NO

- Fault is intermittent caused by poor contact in the sensor' s and/or PCM' s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

TERMINAL AND CONNECTOR INSPECTION ED208D6D

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

- Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

- ▶ Go to "Power Circuit Inspection" procedure.

POWER CIRCUIT INSPECTION EFEB7E

1. IG "OFF" and disconnect TPS connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 4 of TPS harness connector and chassis ground.

Specification : Approx. 5V

4. Is the measured voltage within specification ?

YES

- ▶ Go to "Signal circuit inspection" procedure.

NO

- ▶ Repair open or short to ground in power harness, and go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION EE62AB39

1. Check short to ground in harness
 - 1) IG "OFF" and disconnect TPS connector and PCM connector.
 - 2) Measure resistance between terminal 2 of TPS harness connector and chassis ground.
 - 3) Measure resistance between terminals 2 and 6(1) of TPS harness connector.

Specification : Infinite

- 4) Is the measured resistance within specification?

YES

- ▶ Go to "Component Inspection" procedure.

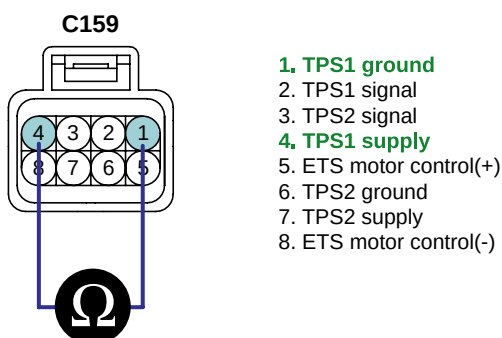
NO

- ▶ Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EA894B1C

1. Check TPS
 - 1) IG "OFF" and disconnect TPS connector.
 - 2) Measure resistance between terminals 4 and 1 of TPS connector.(component side)

Specifacaton : 4 ~ 6kΩ



SVQF16218L

3) Is the measured resistance within specification?

YES

► Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

► Substitute with a known - good ECT motor & TPS and check for proper operation. If the problem is corrected, replace ECT motor & TPS and go to "Verification of Vehicle Repair" procedure.

CAUTION

Procedure of ETS Initialization

1. **Erase the trouble codes on PCM**
2. **Turn the ignition key off and keep this condition until the main relay is turned off.(It will takes 10sec.)**
3. **Turn ignition key on more than 1second to record the throttle motor position on the EEPROM**

VERIFICATION OF VEHICLE REPAIR EE0ABC4F

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

► System performing to specification at this time. Clear the DTC.

NO

► Go to the applicable troubleshooting procedure.

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FUEL SYSTEM

DTC P0123 THROTTLE/PEDAL POSITION SENSOR/SWITCH "A" CIRCUIT HIGH INPUT

COMPONENT LOCATION E34BDD3C

Refer to DTC P0122.

GENERAL DESCRIPTION EC220AC2

Refer to DTC P0122.

DTC DESCRIPTION ED5835FD

Checking output signals from TPS1 every 8.5 sec. under detecting condition, if an output signal is above 4.75V for more than 0.1 sec., PCM sets P0123. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E4B633B0

Item	Detecting Condition	Possible Cause
DTC Strategy	• signal high	• Poor connection • Open or short to battery in signal harness • Open in ground harness • TPS • PCM
Enable condition	• IG "ON	
threshold value	• The voltage of TPS > 4.75V	
diagnosis time	• Continuous (more than 0.1 sec. failure for every 8.5 sec.test)	
MIL ON condition	• 2 driving cycles	

SPECIFICATION E8877DEC

Refer to DTC P0122.

SCHEMATIC DIAGRAM EAE92A53

Refer to DTC P0122.

SIGNAL WAVEFORM AND DATA E4E9A992

Refer to DTC P0122.

MONITOR DTC STATUS E50CACAF

Refer to DTC P0122.

TERMINAL AND CONNECTOR INSPECTION EC2C6DE2

Refer to DTC P0122.

DTC TROUBLESHOOTING PROCEDURES

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SIGNAL CIRCUIT INSPECTION E3E9DEDF

1. Check voltage
 - 1) IG "OFF" and disconnect TPS connector.
 - 2) IG "ON" and ENG "OFF"
 - 3) Measure voltage between terminal 2 of TPS harness connector and chassis ground.

Specification : Approx. 5V

- 4) Is the measured voltage within specification?

YES

- ▶ Go to "Check short to battery in harness" as follows.

NO

- ▶ Go to "Check open in harness" as follows.

2. Check open in harness

- 1) IG "OFF" and disconnect TPS connector and PCM connector.
- 2) Measure resistance between terminal 2 of TPS harness connector and terminal 48 of PCM harness connector.

Specification : Below 1Ω

- 3) Is the measured resistance within specification?

YES

- ▶ Go to "Ground Circuit Inspection" procedure.

NO

- ▶ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

3. Check short to battery in harness

- 1) IG "OFF" and disconnect TPS connector and PCM connector.
- 2) Measure resistance between terminals 4 and 2 of TPS harness connector.
- 3) Measure resistance between terminals 7 and 2 of TPS harness connector.
- 4) Measure resistance between terminals 5 and 2 of TPS harness connector.
- 5) Measure resistance between terminals 8 and 2 of TPS harness connector.

Specification : Infinite

- 6) Is the measured resistance within specification?

YES

- ▶ Go to "Ground circuit inspection " procedure.

NO

- ▶ Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION E0E47490

1. IG "OFF" and disconnect TPS connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 4 of TPS harness connector and chassis ground.
4. Measure voltage between terminals 4 and 1 of TPS harness connector.

Specification : Voltage difference between measurement "A" and "B" is below 200mV.

5. Is the measured voltage within specification?

YES

- ▶ Go to "Component inspection" procedure.

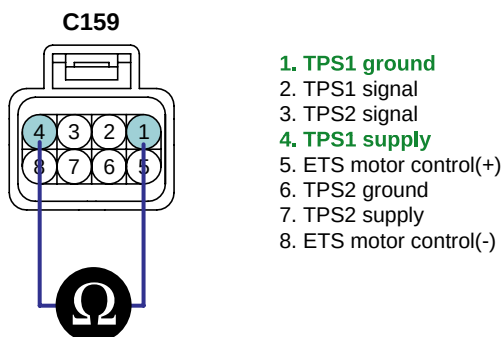
NO

- ▶ Repair open or contact resistance in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EE1B17BA

1. Check TPS
 - 1) IG "OFF" and disconnect TPS connector.
 - 2) Measure resistance between terminals 4 and 1 of TPS connector.(component side)

Specifcaton : 4 ~ 6k Ω



SVQF16218L

- 3) Is the measured resistance within specification?

YES

- ▶ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

► Substitute with a known - good ECT motor & TPS and check for proper operation. If the problem is corrected, replace ECT motor & TPS and go to "Verification of Vehicle Repair" procedure.



CAUTION

Procedure of ETS Initialization

1. **Erase the trouble codes on PCM**
2. **Turn the ignition key off and keep this condition until the main relay is turned off.(It will takes 10sec.)**
3. **Turn ignition key on more than 1second to record the throttle motor position on the EEPROM**

VERIFICATION OF VEHICLE REPAIR

E2A3F96D

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

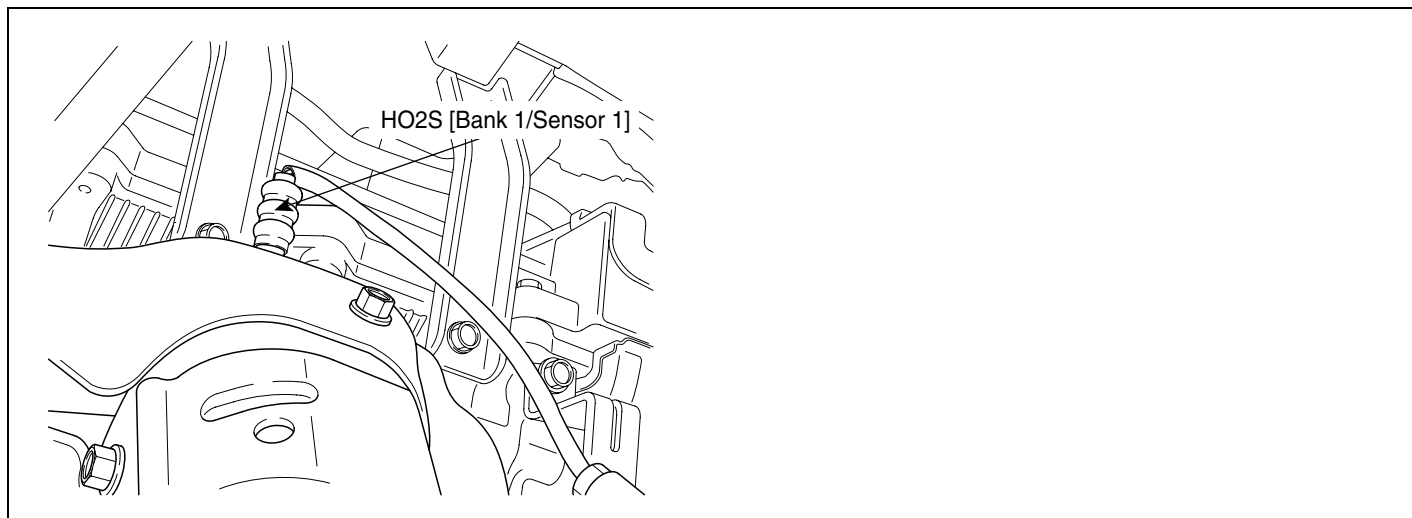
► System performing to specification at this time. Clear the DTC.

NO

► Go to the applicable troubleshooting procedure.

DTC P0131 HO2S CIRCUIT LOW VOLTAGE (BANK 1 / SENSOR 1)

COMPONENT LOCATION E5E16663



LGLG504A

GENERAL DESCRIPTION E9CECC3F

In order to control emissions of the CO, HC and NOx components of the exhaust gas, heated oxygen sensor (HO2S), mounted on the front side and rear side of catalytic converter, detects the oxygen content in the exhaust gas. The front HO2S signal is used to control air/fuel ratio (closed loop fuel control) and the rear HO2S signal is used to monitor front HO2S and catalyst for proper operation. The HO2S requires a minimum temperature to operate properly and provide a closed loop fuel control system. The HO2S contains the heater element to reduce its warming-up time and ensure its performance during all driving conditions. The oxygen sensor generates a voltage that indicates the difference between the oxygen content of the exhaust stream and the oxygen content of ambient air. When the exhaust stream is “ rich,” there is more oxygen in the ambient air than in the exhaust stream, so the voltage will be higher.

DTC DESCRIPTION E8D2EB10

Checking output signals from HO2S under detecting condition, if an output signal is below 0.04V for more than predetermine time, PCM sets P0131. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E2DEFF6E

Item	Detecting Condition	Possible cause
DTC Strategy	• Monitor signal voltage	• Poor Connection • Short to ground in harness • HO2S(B1/S1) • PCM
Enable Conditions	• Battery voltage $\geq 10V$ • Engine running ≥ 60 sec. • Engine warm-up state	
Threshold value	• The voltage of HO2S(B1/S1) $< 0.04V$	
Diagnosis Time	• Continuous (more than 12.5 sec. failure for every 15 sec.test)	
MIL On Condition	• 2 Driving Cycles	

DTC TROUBLESHOOTING PROCEDURES

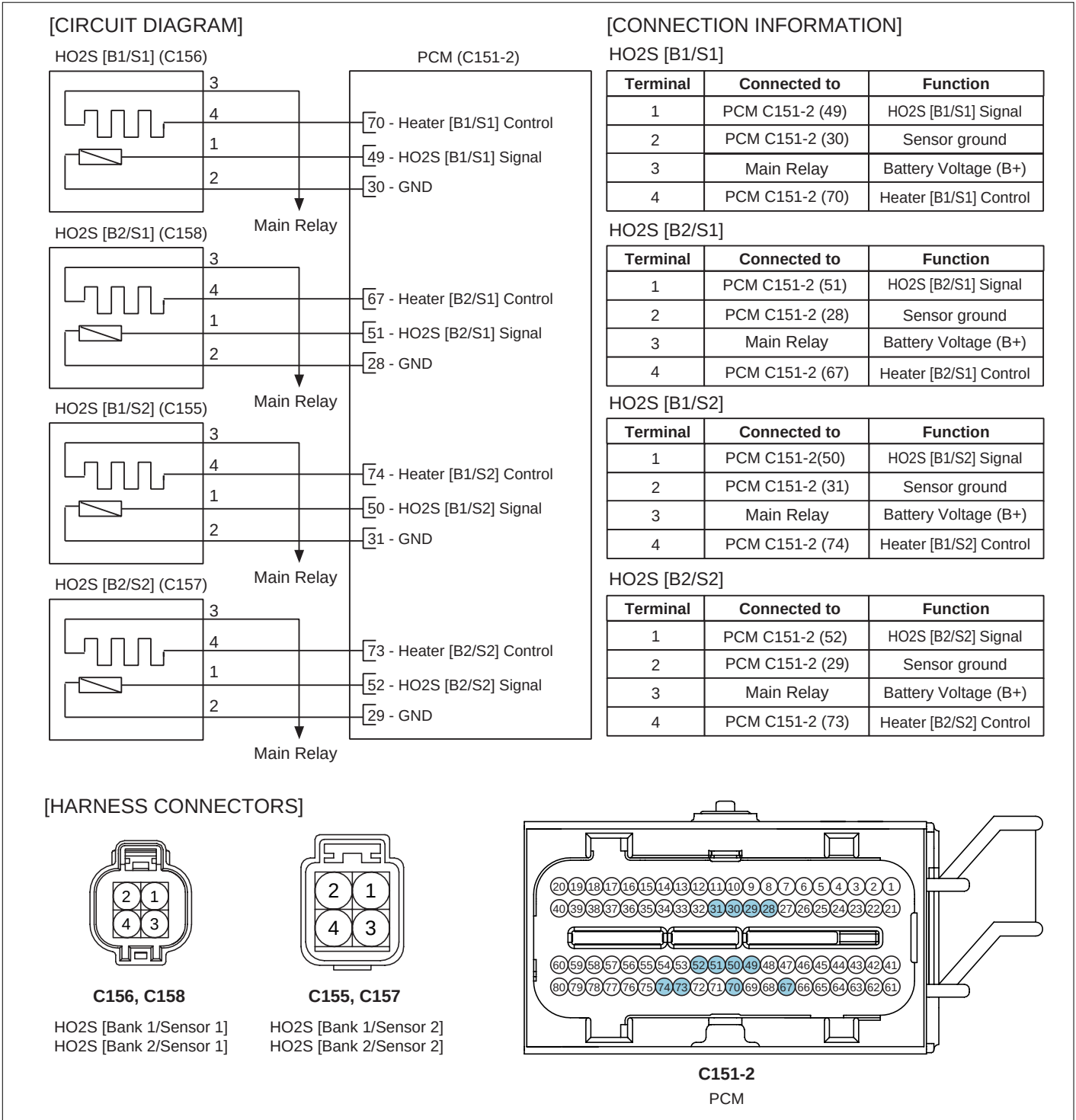
FLA -245

SPECIFICATION EB86DDBC

(REFERENCE ONLY)

Test Condition	HO2S Voltage(Sensor1)	HO2S Voltage(Sensor2)
HO2S Signal at idle after warm-up	Signal is commonly switching from rich to lean more than 3 times in 10 sec.	Signal is commonly above 0.6V.
HO2S signal at open circuit (Pumping current OFF)	Approx. 0.45V	
HO2S signal at open circuit (Pumping current ON)	Approx. 3.5V	

SCHEMATIC DIAGRAM E57946F9



SIGNAL WAVEFORM AND DATA E59FF425

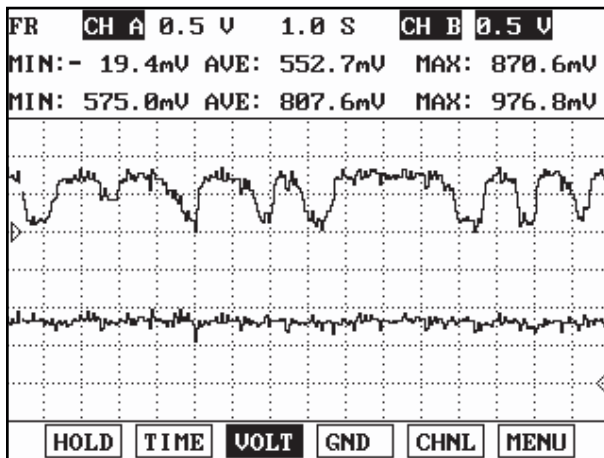


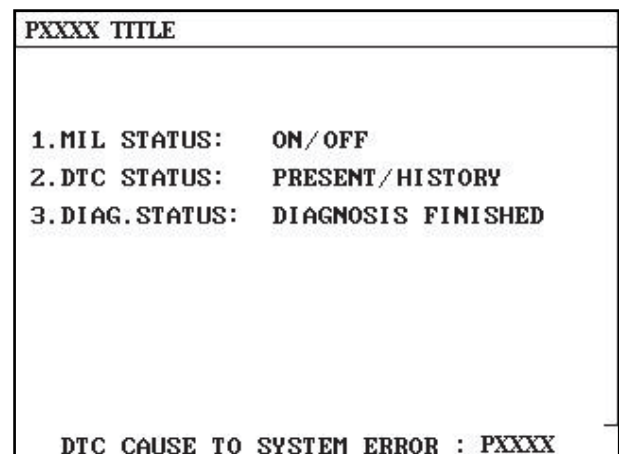
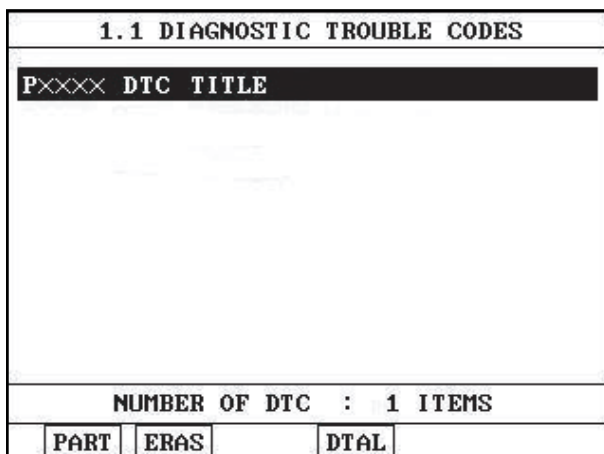
Fig) Signal waveforms of front HO2S(the upper) and rear HO2S(the lower)

SCMF16223L

After warming-up, if accelerator pedal is released suddenly around 4000rpm, the HO2S signal reading will be lower than 200mV resulting from Fuel cut-off for the moment. Conversely, if suddenly accelerator pedal is depressed, HO2S signal reading will be around 0.6V ~1.0V. At idle, Normally HO2S signal will switch from lean to rich with 3 Hz. And as racing, Its frequency rises.

MONITOR DTC STATUS EFA6B287

1. Check DTC Status
 - 1) Connect scantool to Data Link Connector(DLC).
 - 2) IG "ON".
 - 3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F4(DTAL) to check DTC's information from the DTCs menu
 - 4) Read "DTC Status" parameter.



SCMF16159L

- 5) Is parameter displayed "Present fault"?

YES

- Go to "Terminal and connector inspection" procedure.

NO

- Fault is intermittent caused by poor contact in the sensor' s and/or PCM' s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

TERMINAL AND CONNECTOR INSPECTION E95CE0B0

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

- Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

- Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION ECA7A130

1. IG "OFF" and disconnect HO2S(B1/S1) connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 1 of HO2S(B1/S1) harness connector and chassis ground.

Specification : Approx. 3.5V - when pumping current is ON
Approx. 0.45V - when pumping current is OFF

4. Is the measured voltage within specification?

YES

- Go to "Component Inspection" procedure.

NO

- Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EA7C37B2

1. Check the Signal waveform of HO2S
 - 1) IG "OFF" and connect HO2S connector.
 - 2) Engine start.

- 3) After warming-up, monitor signal waveform of HO2S with scantool.?

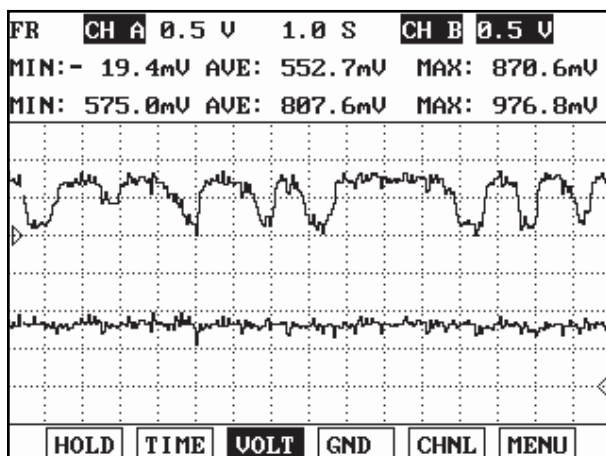


Fig) Signal waveform of front(the upper) and rear(the lower) HO2S at idle

SCMF16225L

- 4) Is the sensor switching properly?

YES

- Go to "Check HO2S" as below.

NO

- Substitute with a known - good HO2S and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.

2. Check HO2S

- 1) IG "OFF" and disconnect HO2S connector.
- 2) Check that the HO2S is securely installed.
- 3) Check the HO2S for contamination or damage
- 4) Is the sensor normal?

YES

- Substitute with a known - good PCM and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.

NO

- Substitute with a known - good HO2S and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR EC73FB01

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

- ▶ System performing to specification at this time. Clear the DTC.

NO

- ▶ Go to the applicable troubleshooting procedure.

DTC TROUBLESHOOTING PROCEDURES

FLA -251

DTC P0132 HO2S CIRCUIT HIGH VOLTAGE (BANK 1 / SENSOR 1)

COMPONENT LOCATION E34D7E43

Refer to DTC P0131.

GENERAL DESCRIPTION E8459360

Refer to DTC P0131.

DTC DESCRIPTION E74110AE

Checking output signals from HO2S under detecting condition, if an output signal is above 1.3V for more than predetermine time, PCM sets P0132. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E0C6706A

Item	Detecting Condition	Possible cause
DTC Strategy	Monitor signal voltage	- Poor Connection - Short to battery in harness - HO2S(B1/S1) - PCM
Enable Conditions	- Battery voltage $\geq 10V$ - Engine running ≥ 60 sec. - Engine warm-up state	
Threshold value	The voltage of HO2S(B1/S1) $> 1.3V$	
Diagnosis Time	Continuous (more than 12.5 sec.failure for every 15 sec.test)	
MIL On Condition	2 Driving Cycles	

SPECIFICATION E8E22996

(REFERENCE ONLY)

Test Condition	HO2S Voltage(Sensor1)	HO2S Voltage(Sensor2)
HO2S Signal at idle after warm-up	Signal is commonly switching from rich to lean more than 3 times in 10 sec.	Signal is commonly above 0.6V.
HO2S signal at open circuit (Pumping current OFF)	Approx. 0.45V	
HO2S signal at open circuit (Pumping current ON)	Approx. 3.5V	

SCHEMATIC DIAGRAM E2838EC3

Refer to DTC P0131.

SIGNAL WAVEFORM AND DATA EC655E30

Refer to DTC P0131.

MONITOR DTC STATUS EB5D5CFA

Refer to DTC P0131.

TERMINAL AND CONNECTOR INSPECTION E340BB9F

Refer to DTC P0131.

SIGNAL CIRCUIT INSPECTION E702180A

1. IG "OFF" and disconnect HO2S(B1/S1) connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 1 of HO2S(B1/S1) harness connector and chassis ground.

Specification : Approx. 3.5V - when pumping current is ON
Approx. 0.45V - when pumping current is OFF

4. Is the measured voltage within specification?

YES

► Go to "Component Inspection" procedure.

NO

► Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EBFB56A3

1. Check the Signal waveform of HO2S
 - 1) IG "OFF" and connect HO2S connector.
 - 2) Engine start.
 - 3) After warming-up, monitor signal waveform of HO2S with scantool.?

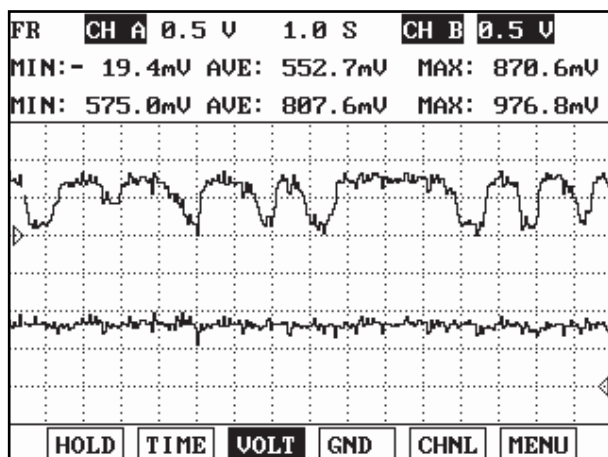


Fig) Signal waveform of front(the upper) and rear(the lower) HO2S at idle

DTC TROUBLESHOOTING PROCEDURES

FLA -253

- 4) Is the sensor switching properly?

YES

► Go to "Check HO2S" as below.

NO

► Substitute with a known - good HO2S and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.

2. Check HO2S

- 1) IG "OFF" and disconnect HO2S connector.
- 2) Check that the HO2S is securely installed.
- 3) Check the HO2S for contamination or damage
- 4) Is the sensor normal?

YES

► Substitute with a known - good PCM and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.

NO

► Substitute with a known - good HO2S and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR

E57C1154

Refer to DTC P0131.

DTC P0133 HO2S CIRCUIT SLOW RESPONSE (BANK 1 / SENSOR 1)

COMPONENT LOCATION E7CE00FE

Refer to DTC P0131.

GENERAL DESCRIPTION E2028FB5

Refer to DTC P0131.

DTC DESCRIPTION E6CF7AD6

Checking output signals from HO2S under detecting condition, if PCM judges it's signals too slow, PCM sets P0133. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION EB2A1D25

Item	Detecting Condition	Possible cause
DTC Strategy	Monitor HO2S's response rate	- Poor connection - Faulty HO2S - Faulty PCM
Enable Conditions	- Engine warm-up sufficiently - Engine run time > 60sec - Drive at a steady speed between 45-55 mph(72-88 km/h) - Engine Coolant > 70℃(158 °F) - No disabling faults	
Threshold value	The calculated response rate is too slow (out of threshold in PCM)	
Diagnosis Time	Continuous	
MIL On Condition	2 Driving Cycles	

SPECIFICATION EE815218

(REFERENCE ONLY)

Test Condition	HO2S Voltage(Sensor1)	HO2S Voltage(Sensor2)
HO2S Signal at idle after warm-up	Signal is commonly switching from rich to lean more than 3 times in 10 sec.	Signal is commonly above 0.6V.
HO2S signal at open circuit (Pumping current OFF)	Approx. 0.45V	
HO2S signal at open circuit (Pumping current ON)	Approx. 3.5V	

SCHEMATIC DIAGRAM E191554F

Refer to DTC P0131.

SIGNAL WAVEFORM AND DATA EC985B21

Refer to DTC P0131.

DTC TROUBLESHOOTING PROCEDURES

FLA -255

MONITOR DTC STATUS E9343755

Refer to DTC P0131.

COMPONENT INSPECTION E419B061

1. Replace the HO2S.
2. Clear DTC with scantool.
3. Start the engine and warm it up until the radiator fan comes on(more than at least 10 minutes).
4. Drive at a steady speed between 45-55 mph(72-88 km/h) for 120 sec.
5. Stop and then maintain idle state.
6. Check if O2 sensor monitoring readiness is complete.
7. Does the scan tool show DTC P0133?

YES

► Substitute with a known - good PCM and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.

NO

► Troubleshooting is finished.

VERIFICATION OF VEHICLE REPAIR EC3749F2

Refer to DTC P0131.

DTC P0134 HO2S CIRCUIT NO ACTIVITY DETECTED (BANK 1 / SENSOR 1)

COMPONENT LOCATION EC04207D

Refer to DTC P0131.

GENERAL DESCRIPTION E000B34D

Refer to DTC P0131.

DTC DESCRIPTION EBB9E980

Checking output signals from HO2S under detecting condition, if an output voltage is approx.0.45V or 3.5V for more than predetermine time, PCM sets P0134. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E768B6A1

Item		Detecting Condition	Possible cause
DTC Strategy		• Monitor signal voltage	• Poor connection • Open in harness • HO2S(B1/S1) • PCM
Enable Conditions		• Battery voltage $\geq 10V$ • Engine running ≥ 60 sec. • Engine warm-up state • No disable faults	
Thresh old value	Case 1	• $1.2V \leq \text{Voltage of HO2S} \leq 3.9V$ (at pumping current ON)	
	Case 2	• $0.415V \leq \text{Voltage of HO2S} \leq 0.515V$ (at pumping current OFF)	
Diagnosis Time		• Continuous (more than 76.5 sec.failure for every 90 sec.test)	
MIL On Condition		• 2 Driving Cycles	

SPECIFICATION E61464A0

(REFERENCE ONLY)

Test Condition	HO2S Voltage(Sensor1)	HO2S Voltage(Sensor2)
HO2S Signal at idle after warm-up	Signal is commonly switching from rich to lean more than 3 times in 10 sec.	Signal is commonly above 0.6V.
HO2S signal at open circuit (Pumping current OFF)	Approx. 0.45V	
HO2S signal at open circuit (Pumping current ON)	Approx. 3.5V	

※ In case of open circuit, voltage is set to 0.45V(Pumping current OFF) or 3.5V(Pumping current ON)

DTC TROUBLESHOOTING PROCEDURES

FLA -257

SCHEMATIC DIAGRAM E4E20A98

Refer to DTC P0131.

SIGNAL WAVEFORM AND DATA E4D090D2

Refer to DTC P0131.

MONITOR DTC STATUS EDFACD48

Refer to DTC P0131.

TERMINAL AND CONNECTOR INSPECTION E0773217

Refer to DTC P0131.

SIGNAL CIRCUIT INSPECTION EB3A1908

1. IG "OFF" and disconnect HO2S(B1/S1) connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 1 of HO2S(B1/S1) harness connector and chassis ground.

Specification : Approx. 3.5V - when pumping current is ON
Approx. 0.45V - when pumping current is OFF

4. Is the measured voltage within specification?

YES

► Go to "Ground circuit inspection" procedure.

NO

► Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION E9B8BED9

1. IG "ON" and disconnect HO2S(B1/S1) connector.
2. Measure voltage between terminal 1 of HO2S(B1/S1) harness connector and chassis ground.
3. Measure voltage between terminals 1 and 2 of HO2S(B1/S1) harness connector.

Specification : Voltage difference between measurement "A" and "B" is below 200mV.

4. Is the measured voltage within specification?

YES

► Go to "Component inspection" procedure.

NO

- Repair open or contact resistance in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EA53DB05

1. Check the Signal waveform of HO2S

- 1) IG "OFF" and connect HO2S connector.
- 2) Engine start.
- 3) After warming-up, monitor signal waveform of HO2S with scantool.?

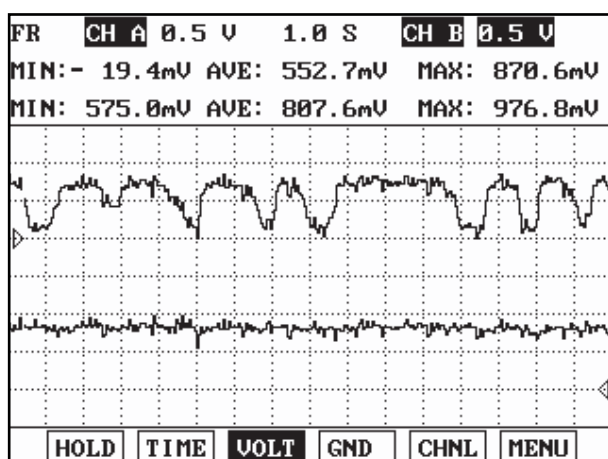


Fig) Signal waveform of front(the upper) and rear(the lower) HO2S at idle

SCMF16225L

4) Is the sensor switching properly?

YES

- Go to "Check HO2S" as below.

NO

- Substitute with a known - good HO2S and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.

2. Check HO2S

- 1) IG "OFF" and disconnect HO2S connector.
- 2) Check that the HO2S is securely installed.
- 3) Check the HO2S for contamination or damage
- 4) Is the sensor normal?

YES

- Substitute with a known - good PCM and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.

NO

DTC TROUBLESHOOTING PROCEDURES

FLA -259

- ▶ Substitute with a known - good HO2S and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

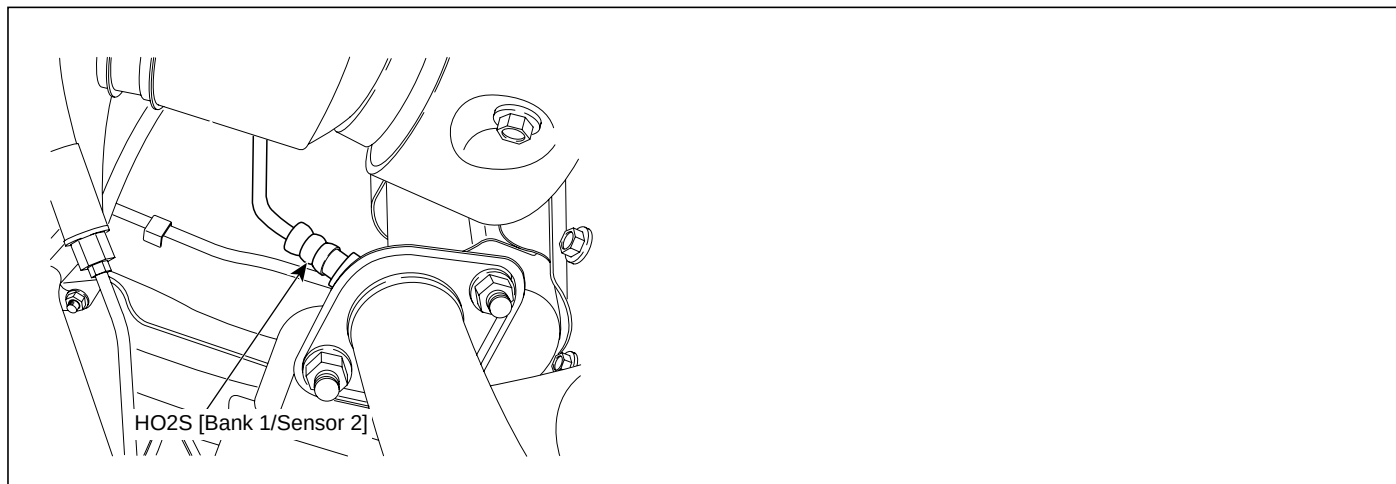
VERIFICATION OF VEHICLE REPAIR

E39CB705

Refer to DTC P0131.

DTC P0137 HO2S CIRCUIT LOW VOLTAGE (BANK 1 / SENSOR 2)

COMPONENT LOCATION EA538A1A



SCMF16165L

GENERAL DESCRIPTION E8446B63

The rear heated oxygen sensor is mounted on the rear side of the Catalytic Converter (warm-up catalytic converter) or in the rear exhaust pipe, which is able to detect catalyst efficiency. The rear heated oxygen sensor (HO2S) produces a voltage between 0V and 1V. This rear heated oxygen sensor is used to estimate the oxygen storage capability. If a catalyst has good conversion properties, the oxygen fluctuations are smoothed by the oxygen storage capacity of the catalyst. If the conversion provided by the catalyst is low due to aging, poisoning or misfiring, then the oxygen fluctuations are similar to signals from the front oxygen sensor.

DTC DESCRIPTION E79D0981

Checking output signals from HO2S under detecting condition, if an output signal is below 0.04V for more than predetermine time, PCM sets P0137. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION EE412DD5

Item	Detecting Condition	Possible cause
DTC Strategy	Monitor signal voltage	- Poor Connection - Short to ground in harness - HO2S(B1/S2) - PCM
Enable Conditions	- Battery voltage $\geq 10V$ - Engine running ≥ 60 sec. - Engine warm-up state	
Threshold value	The voltage of HO2S(B1/S2) $< 0.04V$	
Diagnosis Time	Continuous (more than 12.5 sec. failure for every 15 sec.test)	
MIL On Condition	2 Driving Cycles	

DTC TROUBLESHOOTING PROCEDURES

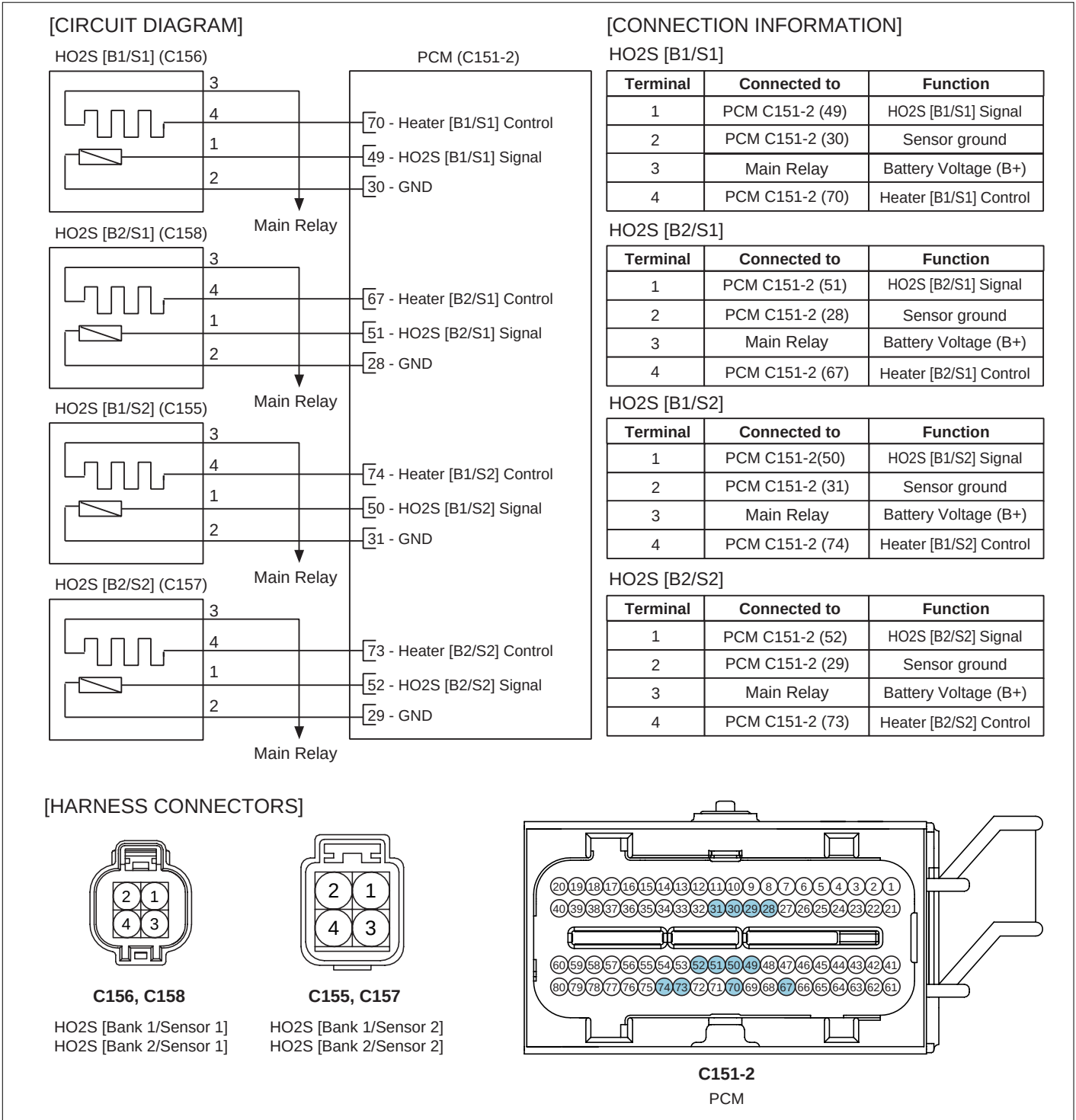
FLA -261

SPECIFICATION EFA42C60

(REFERENCE ONLY)

Test Condition	HO2S Voltage(Sensor1)	HO2S Voltage(Sensor2)
HO2S Signal at idle after warm-up	Signal is commonly switching from rich to lean more than 3 times in 10 sec.	Signal is commonly above 0.6V.
HO2S signal at open circuit (Pumping current OFF)	Approx. 0.45V	
HO2S signal at open circuit (Pumping current ON)	Approx. 3.5V	

SCHEMATIC DIAGRAM EDFB2BD8



SVQF16110L

SIGNAL WAVEFORM AND DATA E00C0EDC

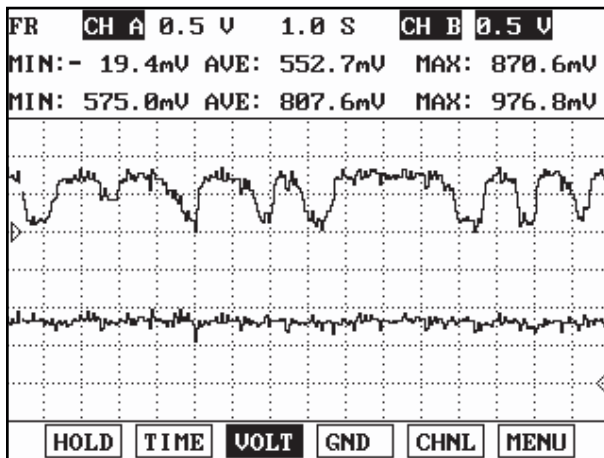


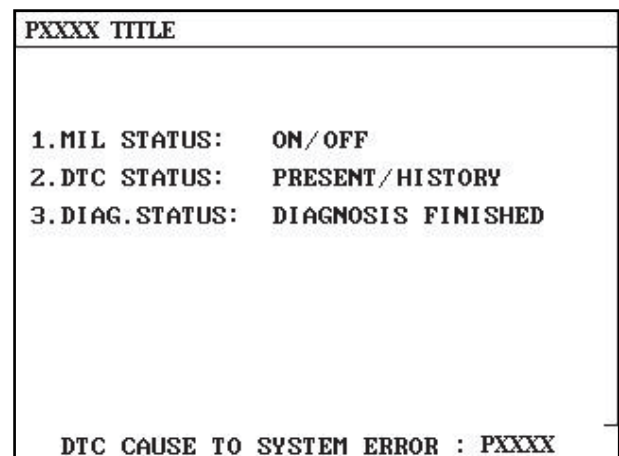
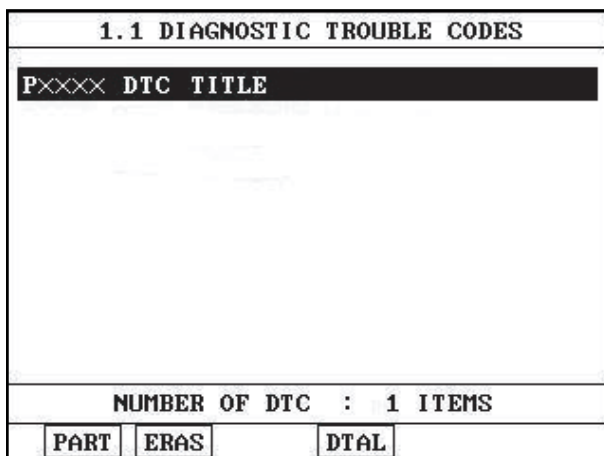
Fig) Signal waveforms of front HO2S(the upper) and rear HO2S(the lower)

SCMF16223L

After warming-up, if accelerator pedal is released suddenly around 4000rpm, the HO2S signal reading will be lower than 200mV resulting from Fuel cut-off for the moment. Conversely, if suddenly accelerator pedal is depressed, HO2S signal reading will be around 0.6V ~1.0V. At idle, Normally HO2S signal will switch from lean to rich with 3 Hz. And as racing, Its frequency rises.

MONITOR DTC STATUS E0480FCB

1. Check DTC Status
 - 1) Connect scantool to Data Link Connector(DLC).
 - 2) IG "ON".
 - 3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F4(DTAL) to check DTC's information from the DTCs menu
 - 4) Read "DTC Status" parameter.



SCMF16159L

- 5) Is parameter displayed "Present fault"?

YES

- Go to "Terminal and connector inspection" procedure.

NO

- Fault is intermittent caused by poor contact in the sensor' s and/or PCM' s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

TERMINAL AND CONNECTOR INSPECTION E4CC3E07

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

- Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

- Go to " Signal Circuit Inspection " procedure.

SIGNAL CIRCUIT INSPECTION E46755BD

1. IG "OFF" and disconnect HO2S(B1/S2)
2. IG "ON"
3. Measure voltage between terminal 1 of HO2S(B1/S2) harness connector and chassis ground.

Specification : Approx. 3.5V - when pumping current is ON
Approx. 0.45V - when pumping current is OFF

4. Is the measured voltage within specification?

YES

- Go to "Component Inspection" procedure.

NO

- Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E9A07236

1. Check the Signal waveform of HO2S
 - 1) IG "OFF" and connect HO2S connector.
 - 2) Engine start.

- 3) After warming-up, monitor signal waveform of HO2S with scantool.?

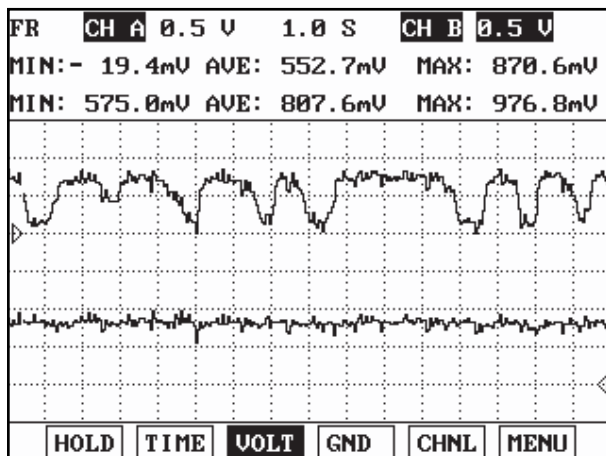


Fig) Signal waveform of front(the upper) and rear(the lower) HO2S at idle

SCMF16225L

- 4) Is the sensor switching properly?

YES

- Go to "Check HO2S" as below.

NO

- Substitute with a known - good HO2S and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.

2. Check HO2S

- 1) IG "OFF" and disconnect HO2S connector.
- 2) Check that the HO2S is securely installed.
- 3) Check the HO2S for contamination or damage
- 4) Is the sensor normal?

YES

- Substitute with a known - good PCM and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.

NO

- Substitute with a known - good HO2S and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR

E8544C8A

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

- ▶ System performing to specification at this time. Clear the DTC.

NO

- ▶ Go to the applicable troubleshooting procedure.

DTC TROUBLESHOOTING PROCEDURES

FLA -267

DTC P0138 HO2S CIRCUIT HIGH VOLTAGE (BANK 1 / SENSOR 2)

COMPONENT LOCATION E47EE366

Refer to DTC P0137.

GENERAL DESCRIPTION EDFEEB95

Refer to DTC P0137.

DTC DESCRIPTION E1CC9CD2

Checking output signals from HO2S under detecting condition, if an output signal is above 1.3V for more than predetermine time, PCM sets P0138. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E5E6FDFA

Item	Detecting Condition	Possible cause
DTC Strategy	Monitor signal voltage	- Poor connection - Short to battery in harness - HO2S(B1/S2) - PCM
Enable Conditions	- Battery voltage $\geq 10V$ - Engine running ≥ 60 sec - Engine warm-up state	
Threshold value	The voltage of HO2S(B1/S2) $> 1.3V$	
Diagnosis Time	Continuous (more than 12.5 sec.failure for every 15 sec.test)	
MIL On Condition	2 Driving Cycles	

SPECIFICATION E5165F35

(REFERENCE ONLY)

Test Condition	HO2S Voltage(Sensor1)	HO2S Voltage(Sensor2)
HO2S Signal at idle after warm-up	Signal is commonly switching from rich to lean more than 3 times in 10 sec.	Signal is commonly above 0.6V.
HO2S signal at open circuit (Pumping current OFF)	Approx. 0.45V	
HO2S signal at open circuit (Pumping current ON)	Approx. 3.5V	

SCHEMATIC DIAGRAM E0F689E6

Refer to DTC P0137.

SIGNAL WAVEFORM AND DATA E3809D65

Refer to DTC P0137.

MONITOR DTC STATUS EB4B82C9

Refer to DTC P0137.

TERMINAL AND CONNECTOR INSPECTION EF5D7B77

Refer to DTC P0137.

SIGNAL CIRCUIT INSPECTION E63979A1

1. IG "OFF" and disconnect HO2S(B1/S2) connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 1 of HO2S(B1/S2) harness connector and chassis ground.

Specification : Approx. 3.5V - when pumping current is ON
Approx. 0.45V - when pumping current is OFF

4. Is the measured voltage within specification?

YES

► Go to "Component Inspection" procedure.

NO

► Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E7837436

1. Check the Signal waveform of HO2S
 - 1) IG "OFF" and connect HO2S connector.
 - 2) Engine start.
 - 3) After warming-up, monitor signal waveform of HO2S with scantool.?

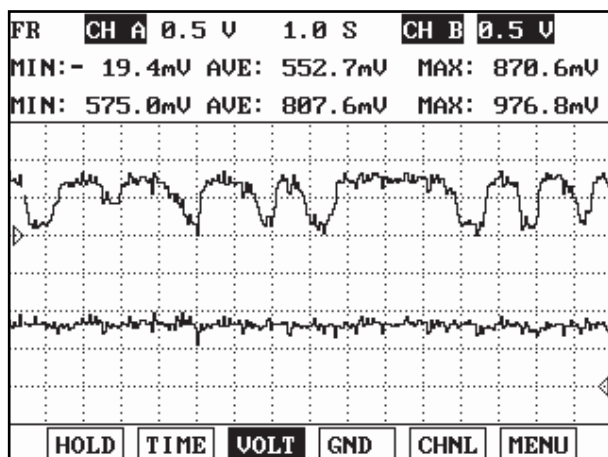


Fig) Signal waveform of front(the upper) and rear(the lower) HO2S at idle

DTC TROUBLESHOOTING PROCEDURES

FLA -269

- 4) Is the sensor switching properly?

YES

► Go to "Check HO2S" as below.

NO

► Substitute with a known - good HO2S and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.

2. Check HO2S

- 1) IG "OFF" and disconnect HO2S connector.
- 2) Check that the HO2S is securely installed.
- 3) Check the HO2S for contamination or damage
- 4) Is the sensor normal?

YES

► Substitute with a known - good PCM and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.

NO

► Substitute with a known - good HO2S and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR

EC5462E1

Refer to DTC P0137.

FLA -270

FUEL SYSTEM

DTC P0140 HO2S CIRCUIT NO ACTIVITY DETECTED (BANK 1 / SENSOR 2)

COMPONENT LOCATION EEBC2F3C

Refer to DTC P0137.

GENERAL DESCRIPTION ECB75069

Refer to DTC P0137.

DTC DESCRIPTION EF2F1633

Checking output signals from HO2S under detecting condition, if an output voltage is approx.0.45V or 3.5V for more than predetermine time, PCM sets P0140. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION EFF97065

Item		Detecting Condition	Possible cause
DTC Strategy		• Monitor signal voltage	• Poor Connection • Open in harness • HO2S(B1/S2) • PCM
Enable Conditions		• Battery voltage $\geq 10V$ • Engine running ≥ 60 sec. • Engine warm-up state • No disable faults	
Thresh- old value	Case 1	• $1.2V \leq \text{Voltage of HO2S} \leq 3.9V$ (at pumping current ON)	
	Case 2	• $0.415V \leq \text{Voltage of HO2S} \leq 0.515V$ (at pumping current OFF)	
Diagnosis Time		• Continuous (more than 76.5 sec.failure for every 90 sec.test)	
MIL On Condition		• 2 driving cycles	

SPECIFICATION E0BF53DA

(REFERENCE ONLY)

Test Condition	HO2S Voltage(Sensor1)	HO2S Voltage(Sensor2)
HO2S Signal at idle after warm-up	Signal is commonly switching from rich to lean more than 3 times in 10 sec.	Signal is commonly above 0.6V.
HO2S signal at open circuit (Pumping current OFF)	Approx. 0.45V	
HO2S signal at open circuit (Pumping current ON)	Approx. 3.5V	

SCHEMATIC DIAGRAM E35BC6DB

Refer to DTC P0137.

DTC TROUBLESHOOTING PROCEDURES

FLA -271

SIGNAL WAVEFORM AND DATA E4AE5538

Refer to DTC P0137.

MONITOR DTC STATUS EB63EA5F

Refer to DTC P0137.

TERMINAL AND CONNECTOR INSPECTION E6400FE2

Refer to DTC P0137.

SIGNAL CIRCUIT INSPECTION E7FA65CA

1. IG "OFF" and disconnect HO2S(B1/S2) connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 1 of HO2S(B1/S2) harness connector and chassis ground.

Specification : Approx. 3.5V - when pumping current is ON
Approx. 0.45V - when pumping current is OFF

4. Is the measured voltage within specification?

YES

- ▶ Go to "Ground Circuit Inspection" procedure.

NO

- ▶ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION E909D35D

1. IG "ON" and disconnect HO2S(B1/S2) connector.
2. Measure voltage between terminal 1 of HO2S(B1/S2) harness connector and chassis ground.
3. Measure voltage between terminals 1 and 2 of HO2S(B1/S2) harness connector.

Specification : Voltage difference between measurement "A" and "B" is below 200mV.

4. Is the measured voltage within specification?

YES

- ▶ Go to "Component inspection" procedure.

NO

- ▶ Repair open or contact resistance in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

EE664101

1. Check the Signal waveform of HO2S

- 1) IG "OFF" and connect HO2S connector.
- 2) Engine start.
- 3) After warming-up, monitor signal waveform of HO2S with scantool.?

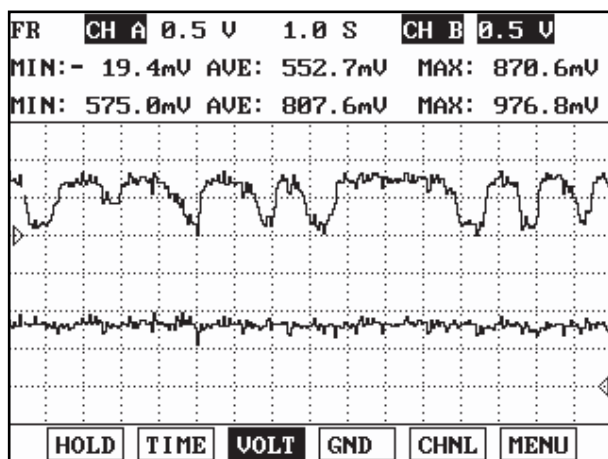


Fig) Signal waveform of front(the upper) and rear(the lower) HO2S at idle

SCMF16225L

4) Is the sensor switching properly?

YES

- Go to "Check HO2S" as below.

NO

- Substitute with a known - good HO2S and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.

2. Check HO2S

- 1) IG "OFF" and disconnect HO2S connector.
- 2) Check that the HO2S is securely installed.
- 3) Check the HO2S for contamination or damage
- 4) Is the sensor normal?

YES

- Substitute with a known - good PCM and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.

NO

- Substitute with a known - good HO2S and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

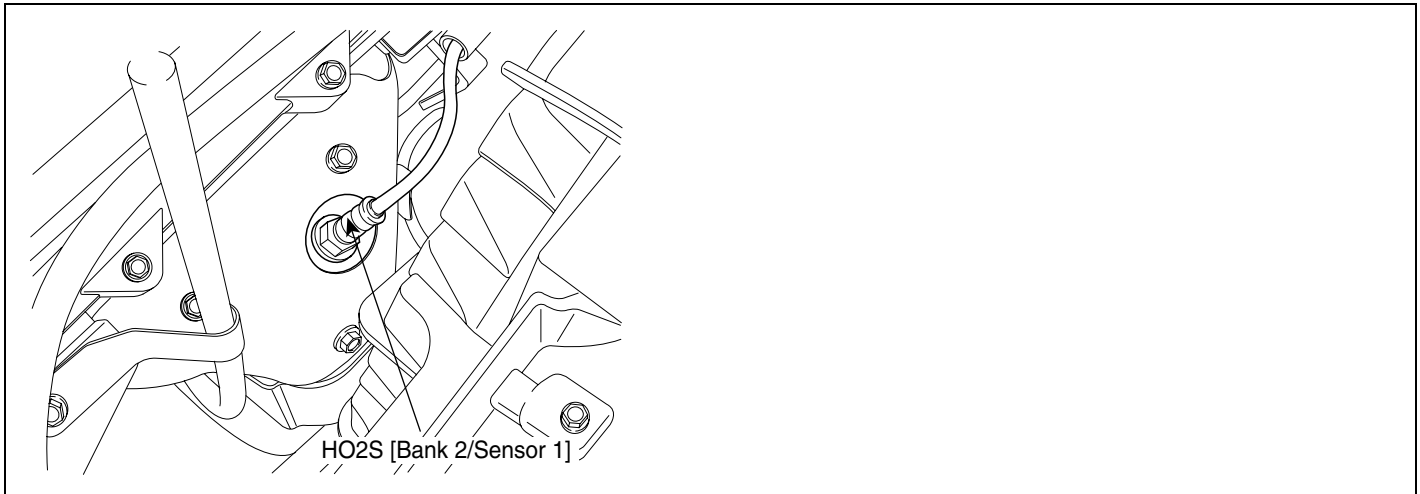
VERIFICATION OF VEHICLE REPAIR

EF632C17

Refer to DTC P0137.

DTC P0151 HO2S CIRCUIT LOW VOLTAGE (BANK 2 / SENSOR 1)

COMPONENT LOCATION ED40F14F



LGLG506A

GENERAL DESCRIPTION E6FB2D8C

In order to control emissions of the CO, HC and NOx components of the exhaust gas, heated oxygen sensor (HO2S), mounted on the front side and rear side of catalytic converter, detects the oxygen content in the exhaust gas. The front HO2S signal is used to control air/fuel ratio (closed loop fuel control) and the rear HO2S signal is used to monitor front HO2S and catalyst for proper operation. The HO2S requires a minimum temperature to operate properly and provide a closed loop fuel control system. The HO2S contains the heater element to reduce its warming-up time and ensure its performance during all driving conditions. The oxygen sensor generates a voltage that indicates the difference between the oxygen content of the exhaust stream and the oxygen content of ambient air. When the exhaust stream is “ rich,” there is more oxygen in the ambient air than in the exhaust stream, so the voltage will be higher.

DTC DESCRIPTION E2B9F456

Checking output signals from HO2S under detecting condition, if an output signal is below 0.04V for more than predetermine time, PCM sets P0151. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E2E6D8F9

Item	Detecting Condition	Possible cause
DTC Strategy	• Monitor signal voltage	• Poor connection • Short to ground in harness • HO2S(B2/S1) • PCM
Enable Conditions	• Battery voltage $\geq 10V$ • Engine running ≥ 60 sec. • Engine warm-up state	
Threshold value	• The voltage of HO2S(B2/S1) $< 0.04V$	
Diagnosis Time	• Continuous (more than 12.5 sec. failure for every 15 sec.test)	
MIL On Condition	• 2 Driving Cycles	

DTC TROUBLESHOOTING PROCEDURES

FLA -275

SPECIFICATION EFE431CF

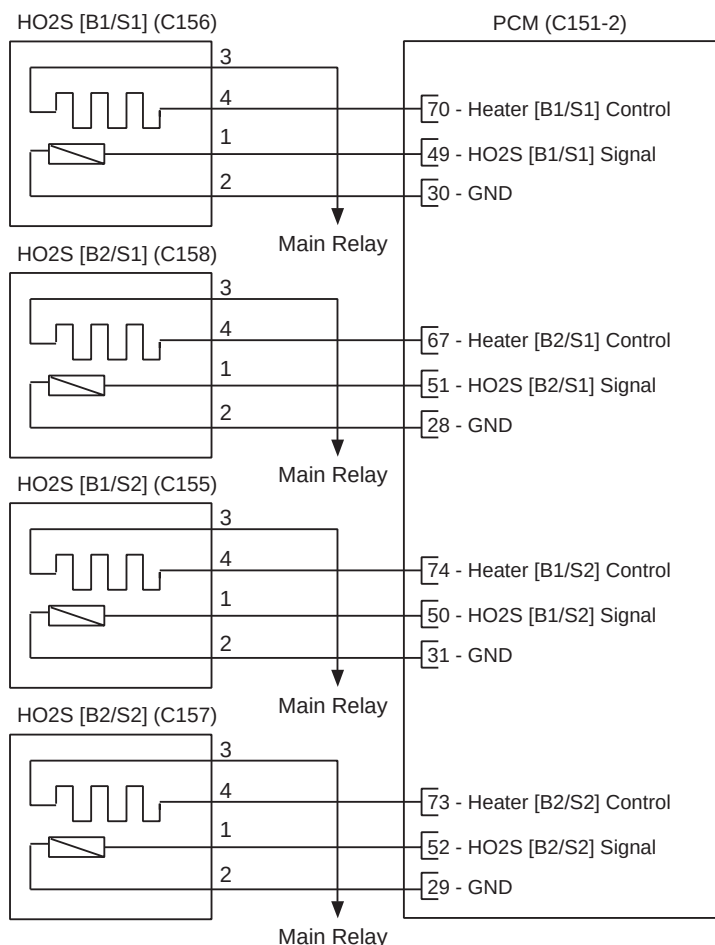
(REFERENCE ONLY)

Test Condition	HO2S Voltage(Sensor1)	HO2S Voltage(Sensor2)
HO2S Signal at idle after warm-up	Signal is commonly switching from rich to lean more than 3 times in 10 sec.	Signal is commonly above 0.6V.
HO2S signal at open circuit (Pumping current OFF)	Approx. 0.45V	
HO2S signal at open circuit (Pumping current ON)	Approx. 3.5V	

SCHEMATIC DIAGRAM

E719BBFC

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

HO2S [B1/S1]

Terminal	Connected to	Function
1	PCM C151-2 (49)	HO2S [B1/S1] Signal
2	PCM C151-2 (30)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C151-2 (70)	Heater [B1/S1] Control

HO2S [B2/S1]

Terminal	Connected to	Function
1	PCM C151-2 (51)	HO2S [B2/S1] Signal
2	PCM C151-2 (28)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C151-2 (67)	Heater [B2/S1] Control

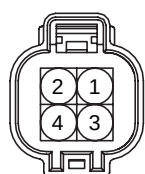
HO2S [B1/S2]

Terminal	Connected to	Function
1	PCM C151-2(50)	HO2S [B1/S2] Signal
2	PCM C151-2 (31)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C151-2 (74)	Heater [B1/S2] Control

HO2S [B2/S2]

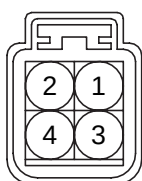
Terminal	Connected to	Function
1	PCM C151-2 (52)	HO2S [B2/S2] Signal
2	PCM C151-2 (29)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C151-2 (73)	Heater [B2/S2] Control

[HARNESS CONNECTORS]



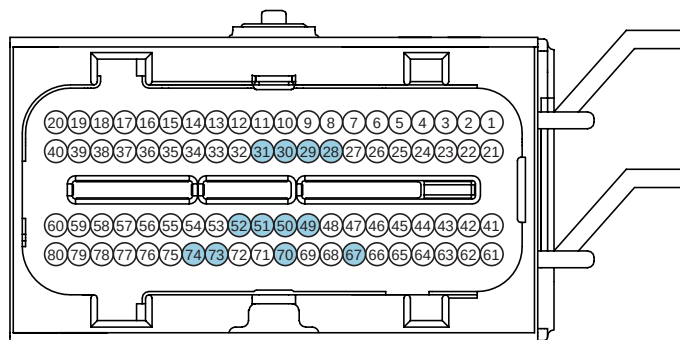
C156, C158

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]



C155, C157

HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]



C151-2
PCM

SVQF16110L

SIGNAL WAVEFORM AND DATA EAF4A1D8

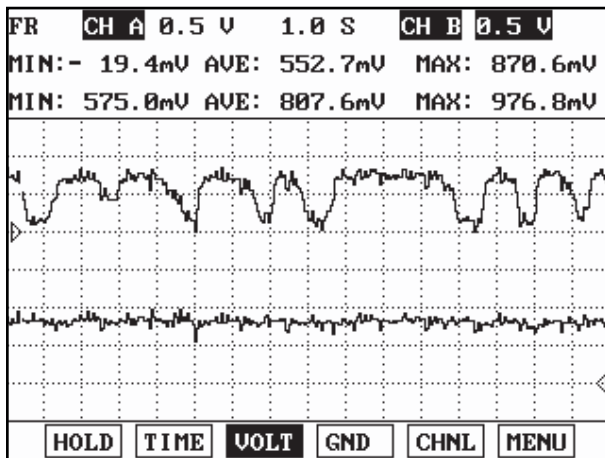


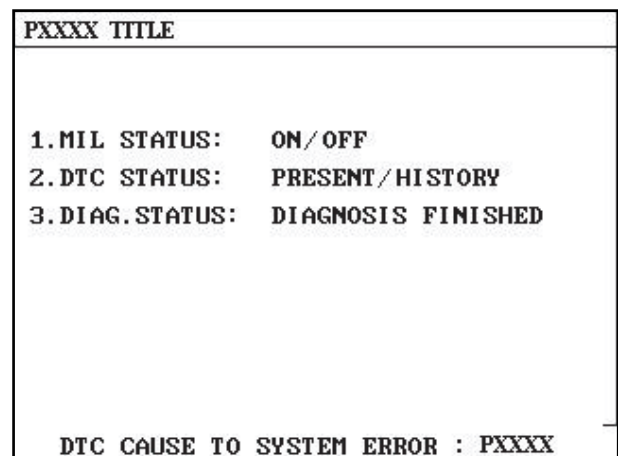
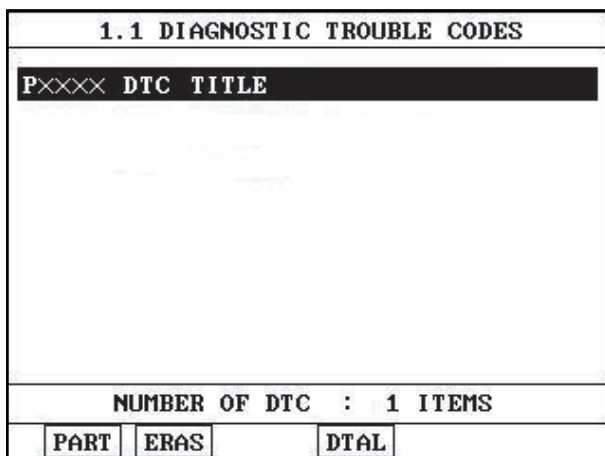
Fig) Signal waveforms of front HO2S(the upper) and rear HO2S(the lower)

SCMF16223L

After warming-up, if accelerator pedal is released suddenly around 4000rpm, the HO2S signal reading will be lower than 200mV resulting from Fuel cut-off for the moment. Conversely, if suddenly accelerator pedal is depressed, HO2S signal reading will be around 0.6V ~1.0V. At idle, Normally HO2S signal will switch from lean to rich with 3 Hz. And as racing, Its frequency rises.

MONITOR DTC STATUS ECF25ABB

1. Check DTC Status
 - 1) Connect scantool to Data Link Connector(DLC).
 - 2) IG "ON".
 - 3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F4(DTAL) to check DTC's information from the DTCs menu
 - 4) Read "DTC Status" parameter.



SCMF16159L

- 5) Is parameter displayed "Present fault"?

YES

- Go to "Terminal and connector inspection" procedure.

NO

- Fault is intermittent caused by poor contact in the sensor' s and/or PCM' s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

TERMINAL AND CONNECTOR INSPECTION E8A43B9B

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found ?

YES

- Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

- Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION E785105E

1. IG "OFF" and disconnect HO2S(B2/S1) connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 1 of HO2S(B2/S1) harness connector and chassis ground.

Specification :

Approx. 3.5V - when pumping current is ON

Approx. 0.45V - when pumping current is OFF

4. Is the measured voltage within specification?

YES

- Go to "Component Inspection" procedure.

NO

- Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E6F6E618

1. Check the Signal waveform of HO2S
 - 1) IG "OFF" and connect HO2S connector.

- 2) Engine start.
- 3) After warming-up, monitor signal waveform of HO2S with scantool.?

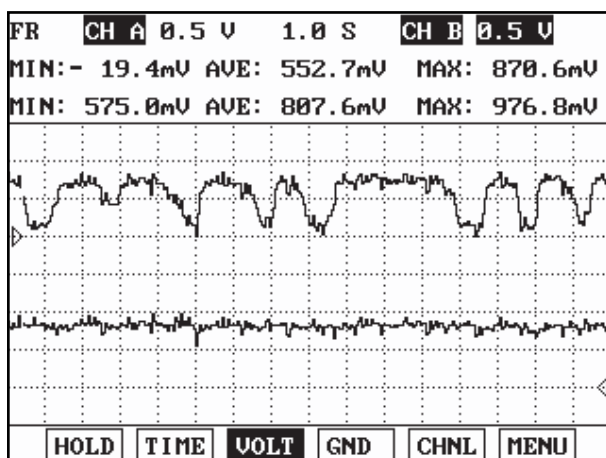


Fig) Signal waveform of front(the upper) and rear(the lower) HO2S at idle

SCMF16225L

- 4) Is the sensor switching properly?

YES

- ▶ Go to "Check HO2S" as below.

NO

- ▶ Substitute with a known - good HO2S and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.

2. Check HO2S

- 1) IG "OFF" and disconnect HO2S connector.
- 2) Check that the HO2S is securely installed.
- 3) Check the HO2S for contamination or damage
- 4) Is the sensor normal?

YES

- ▶ Substitute with a known - good PCM and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.

NO

- ▶ Substitute with a known - good HO2S and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR EF0DAD4D

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

- ▶ System performing to specification at this time. Clear the DTC.

NO

- ▶ Go to the applicable troubleshooting procedure.

DTC TROUBLESHOOTING PROCEDURES

FLA -281

DTC P0152 HO2S CIRCUIT HIGH VOLTAGE (BANK 2 / SENSOR 1)

COMPONENT LOCATION E73AFB1C

Refer to DTC P0151.

GENERAL DESCRIPTION EFF8EE63

Refer to DTC P0151.

DTC DESCRIPTION E92FC465

Checking output signals from HO2S under detecting condition, if an output signal is above 1.3V for more than predetermine time, PCM sets P0152. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E504302B

Item	Detecting Condition	Possible cause
DTC Strategy	Monitor signal voltage	- Poor connection - Short to battery in harness - HO2S(B2/S1) - PCM
Enable Conditions	- attery voltage $\geq$ 10V - Engine running $\geq$ 60 sec. - Engine warm-up state	
Threshold value	The voltage of HO2S(B2/S1) $>$ 1.3V	
Diagnosis Time	Continuous (more than 12.5 sec.failure for every 15 sec.test)	
MIL On Condition	2 Driving Cycles	

SPECIFICATION E64EEB11

(REFERENCE ONLY)

Test Condition	HO2S Voltage(Sensor1)	HO2S Voltage(Sensor2)
HO2S Signal at idle after warm-up	Signal is commonly switching from rich to lean more than 3 times in 10 sec.	Signal is commonly above 0.6V.
HO2S signal at open circuit (Pumping current OFF)	Approx. 0.45V	
HO2S signal at open circuit (Pumping current ON)	Approx. 3.5V	

SCHEMATIC DIAGRAM EC852741

Refer to DTC P0151.

SIGNAL WAVEFORM AND DATA E7BF889E

Refer to DTC P0151.

MONITOR DTC STATUS E632FE80

Refer to DTC P0151.

TERMINAL AND CONNECTOR INSPECTION EDA7B9B8

Refer to DTC P0151.

SIGNAL CIRCUIT INSPECTION E724643F

1. IG "OFF" and disconnect HO2S(B2/S1) connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 1 of HO2S(B2/S1) harness connector and chassis ground.

Specification :

Approx. 3.5V - when pumping current is ON

Approx. 0.45V - when pumping current is OFF

4. Is the measured voltage within specification?

YES

- Go to "Component Inspection" procedure.

NO

- Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EFE36D91

1. Check the Signal waveform of HO2S
 - 1) IG "OFF" and connect HO2S connector.
 - 2) Engine start.
 - 3) After warming-up, monitor signal waveform of HO2S with scantool.?

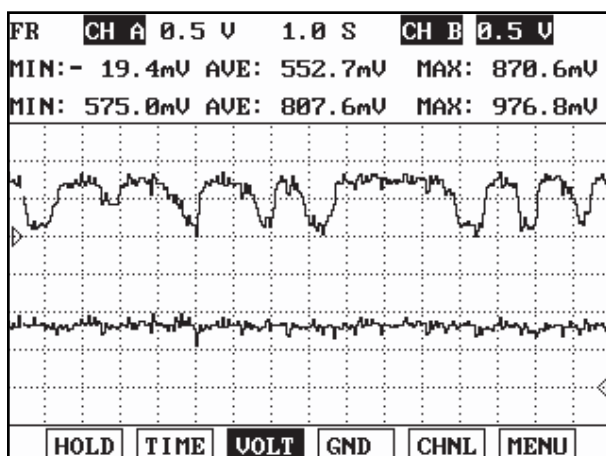


Fig) Signal waveform of front(the upper) and rear(the lower) HO2S at idle

SCMF16225L

- 4) Is the sensor switching properly?

YES

► Go to "Check HO2S" as below.

NO

► Substitute with a known - good HO2S and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.

2. Check HO2S

- 1) IG "OFF" and disconnect HO2S connector.
- 2) Check that the HO2S is securely installed.
- 3) Check the HO2S for contamination or damage
- 4) Is the sensor normal?

YES

► Substitute with a known - good PCM and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.

NO

► Substitute with a known - good HO2S and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR

EF53775E

Refer to DTC P0151.

FLA -284

FUEL SYSTEM

DTC P0153 HO2S CIRCUIT SLOW RESPONSE (BANK 2 / SENSOR 1)

COMPONENT LOCATION E5394BE4

Refer to DTC P0151.

GENERAL DESCRIPTION E352B807

Refer to DTC P0151.

DTC DESCRIPTION EAD91003

Checking output signals from HO2S under detecting condition, if PCM judges it's signals too slow, PCM sets P0153. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION EC1F151B

Item	Detecting Condition	Possible cause
DTC Strategy	Monitor HO2S's response rate	- Poor connection - Faulty HO2S - Faulty PCM
Enable Conditions	- Engine warm-up sufficiently - Engine run time > 60sec - Drive at a steady speed between 45-55 mph(72-88 km/h) - Engine Coolant > 70°C (158 °F) - No disabling faults	
Threshold value	The calculated response rate is too slow (out of threshold in PCM)	
Diagnosis Time	Continuous	
MIL On Condition	2 Driving Cycles	

SPECIFICATION E40CCCA6

(REFERENCE ONLY)

Test Condition	HO2S Voltage(Sensor1)	HO2S Voltage(Sensor2)
HO2S Signal at idle after warm-up	Signal is commonly switching from rich to lean more than 3 times in 10 sec.	Signal is commonly above 0.6V.
HO2S signal at open circuit (Pumping current OFF)	Approx. 0.45V	
HO2S signal at open circuit (Pumping current ON)	Approx. 3.5V	

SCHEMATIC DIAGRAM E00FE44D

Refer to DTC P0151.

SIGNAL WAVEFORM AND DATA E30C4E04

Refer to DTC P0151.

DTC TROUBLESHOOTING PROCEDURES

FLA -285

MONITOR DTC STATUS E7045E97

Refer to DTC P0151.

COMPONENT INSPECTION EEA2F864

1. Replace the HO2S.
2. Clear DTC with scantool.
3. Start the engine and warm it up until the radiator fan comes on(more than at least 10 minutes).
4. Drive at a steady speed between 45-55 mph(72-88 km/h) for 120 sec.
5. Stop and then maintain idle state.
6. Check if O2 sensor monitoring readiness is complete.
7. Does the scan tool show DTC P0153?

YES

► Substitute with a known - good PCM and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.

NO

► Troubleshooting is finished.

VERIFICATION OF VEHICLE REPAIR EC659C03

Refer to DTC P0151.

DTC P0154 HO2S CIRCUIT NO ACTIVITY DETECTED (BANK 2 / SENSOR 1)

COMPONENT LOCATION E927328A

Refer to DTC P0151.

GENERAL DESCRIPTION E6703041

Refer to DTC P0151.

DTC DESCRIPTION E6CCAE2

Checking output signals from HO2S under detecting condition, if an output voltage is approx.0.45V or 3.5V for more than predetermine time, PCM sets P0154. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION EEBE7B45

Item		Detecting Condition	Possible cause
DTC Strategy		• Monitor signal voltage	• Poor connection • Open in harness • HO2S(B2/S1) • PCM
Enable Conditions		• Battery voltage $\geq 10V$ • Engine running ≥ 60 sec. • Engine warm-up state • No disable faults	
Thresh- old value	Case 1	• $1.2V \leq \text{Voltage of HO2S} \leq 3.9V$ (at pumping current ON)	
	Case 2	• $0.415V \leq \text{Voltage of HO2S} \leq 0.515V$ (at pumping current OFF)	
Diagnosis Time		• Continuous (more than 76.5 sec.failure for every 90 sec.test)	
MIL On Condition		• 2 driving cycles	

SPECIFICATION E3400454

(REFERENCE ONLY)

Test Condition	HO2S Voltage(Sensor1)	HO2S Voltage(Sensor2)
HO2S Signal at idle after warm-up	Signal is commonly switching from rich to lean more than 3 times in 10 sec.	Signal is commonly above 0.6V.
HO2S signal at open circuit (Pumping current OFF)	Approx. 0.45V	
HO2S signal at open circuit (Pumping current ON)	Approx. 3.5V	

SCHEMATIC DIAGRAM E529691E

Refer to DTC P0151.

DTC TROUBLESHOOTING PROCEDURES

FLA -287

SIGNAL WAVEFORM AND DATA E3453427

Refer to DTC P0151.

MONITOR DTC STATUS E5E864C4

Refer to DTC P0151.

TERMINAL AND CONNECTOR INSPECTION EEA2C5E9

Refer to DTC P0151.

SIGNAL CIRCUIT INSPECTION E2E9407E

1. IG "OFF" and disconnect HO2S(B2/S1) connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 1 of HO2S(B2/S1) harness connector and chassis ground.

Specification :

Approx. 3.5V - when pumping current is ON

Approx. 0.45V - when pumping current is OFF

4. Is the measured voltage within specification?

YES

- Go to "Ground circuit inspection" procedure.

NO

- Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION ED75DEA6

1. IG "ON" and disconnect HO2S(B2/S1) connector.
2. Measure voltage between terminal 1 of HO2S(B2/S1) harness connector and chassis ground.
3. Measure voltage between terminals 1 and 2 of HO2S(B2/S1) harness connector.

Specification : Voltage difference between measurement "A" and "B" is below 200mV.

4. Is the measured voltage within specification?

YES

- Go to "Component inspection" procedure.

NO

- Repair open or contact resistance in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

EFACB6A1

1. Check the Signal waveform of HO2S

- 1) IG "OFF" and connect HO2S connector.
- 2) Engine start.
- 3) After warming-up, monitor signal waveform of HO2S with scantool.?

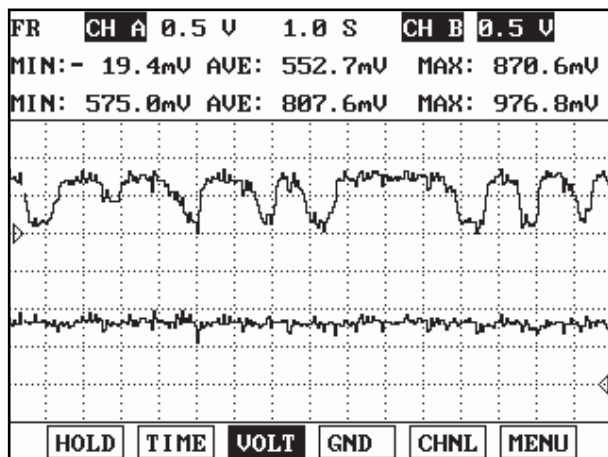


Fig) Signal waveform of front(the upper) and rear(the lower) HO2S at idle

SCMF16225L

4) Is the sensor switching properly?

YES

- Go to "Check HO2S" as below.

NO

- Substitute with a known - good HO2S and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.

2. Check HO2S

- 1) IG "OFF" and disconnect HO2S connector.
- 2) Check that the HO2S is securely installed.
- 3) Check the HO2S for contamination or damage
- 4) Is the sensor normal?

YES

- Substitute with a known - good PCM and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.

NO

- Substitute with a known - good HO2S and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

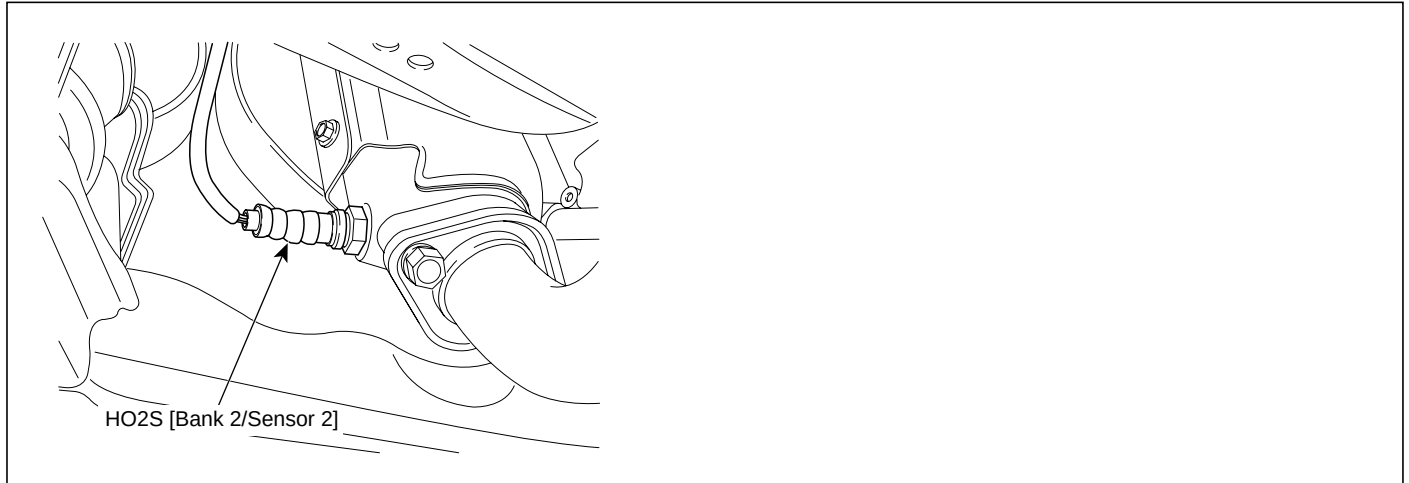
VERIFICATION OF VEHICLE REPAIR

EEA84363

Refer to DTC P0151.

DTC P0157 HO2S CIRCUIT LOW VOLTAGE (BANK 2 / SENSOR 2)

COMPONENT LOCATION EC466B58



SCMF16176L

GENERAL DESCRIPTION E68CCF51

The rear heated oxygen sensor is mounted on the rear side of the Catalytic Converter (warm-up catalytic converter) or in the rear exhaust pipe, which is able to detect catalyst efficiency. The rear heated oxygen sensor (HO2S) produces a voltage between 0V and 1V. This rear heated oxygen sensor is used to estimate the oxygen storage capability. If a catalyst has good conversion properties, the oxygen fluctuations are smoothed by the oxygen storage capacity of the catalyst. If the conversion provided by the catalyst is low due to aging, poisoning or misfiring, then the oxygen fluctuations are similar to signals from the front oxygen sensor.

DTC DESCRIPTION EE482644

Checking output signals from HO2S under detecting condition, if an output signal is below 0.04V for more than predetermine time, PCM sets P0157. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E814A11A

Item	Detecting Condition	Possible cause
DTC Strategy	Monitor signal voltage	- Poor connection - Short to ground in harness - HO2S(B2/S2) - PCM
Enable Conditions	- Battery voltage $\geq 10V$ - Engine running ≥ 60 sec. - Engine warm-up state	
Threshold value	The voltage of HO2S(B2/S2) $< 0.04V$	
Diagnosis Time	Continuous (more than 12.5 sec. failure for every 15 sec.test)	
MIL On Condition	2 Driving Cycles	

DTC TROUBLESHOOTING PROCEDURES

FLA -291

SPECIFICATION ECAFA1F6

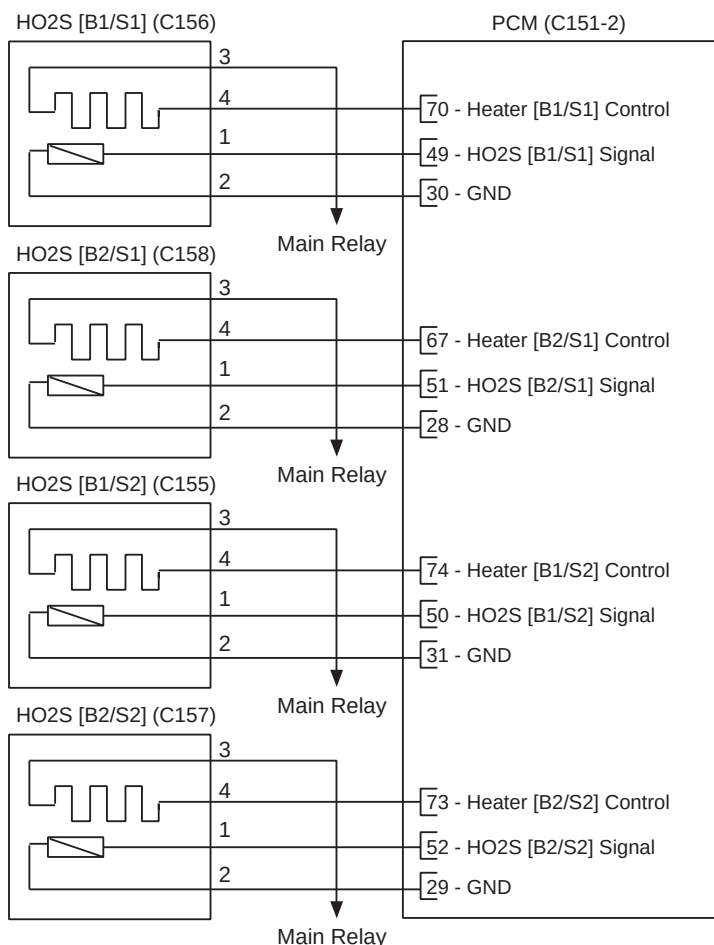
(REFERENCE ONLY)

Test Condition	HO2S Voltage(Sensor1)	HO2S Voltage(Sensor2)
HO2S Signal at idle after warm-up	Signal is commonly switching from rich to lean more than 3 times in 10 sec.	Signal is commonly above 0.6V.
HO2S signal at open circuit (Pumping current OFF)	Approx. 0.45V	
HO2S signal at open circuit (Pumping current ON)	Approx. 3.5V	

SCHEMATIC DIAGRAM

E9EEF01F

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

HO2S [B1/S1]

Terminal	Connected to	Function
1	PCM C151-2 (49)	HO2S [B1/S1] Signal
2	PCM C151-2 (30)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C151-2 (70)	Heater [B1/S1] Control

HO2S [B2/S1]

Terminal	Connected to	Function
1	PCM C151-2 (51)	HO2S [B2/S1] Signal
2	PCM C151-2 (28)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C151-2 (67)	Heater [B2/S1] Control

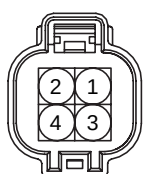
HO2S [B1/S2]

Terminal	Connected to	Function
1	PCM C151-2 (50)	HO2S [B1/S2] Signal
2	PCM C151-2 (31)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C151-2 (74)	Heater [B1/S2] Control

HO2S [B2/S2]

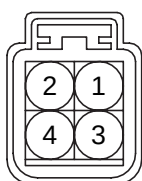
Terminal	Connected to	Function
1	PCM C151-2 (52)	HO2S [B2/S2] Signal
2	PCM C151-2 (29)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C151-2 (73)	Heater [B2/S2] Control

[HARNESS CONNECTORS]



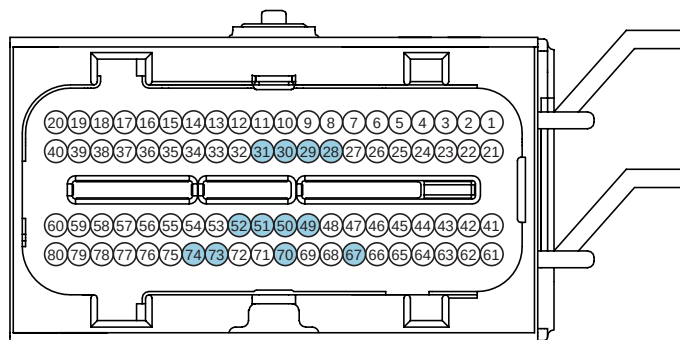
C156, C158

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]



C155, C157

HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]



C151-2
PCM

SVQF16110L

SIGNAL WAVEFORM AND DATA EBC8409A

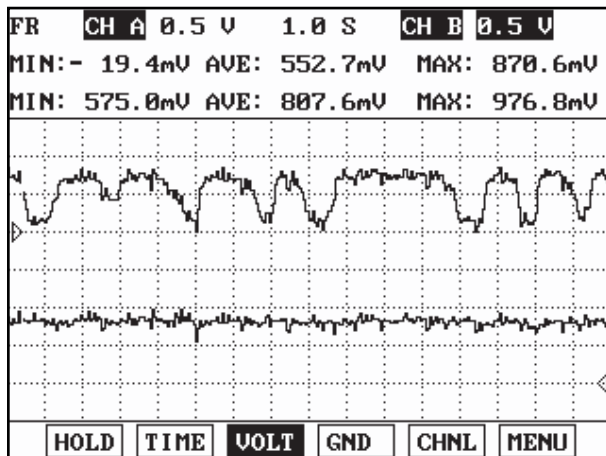


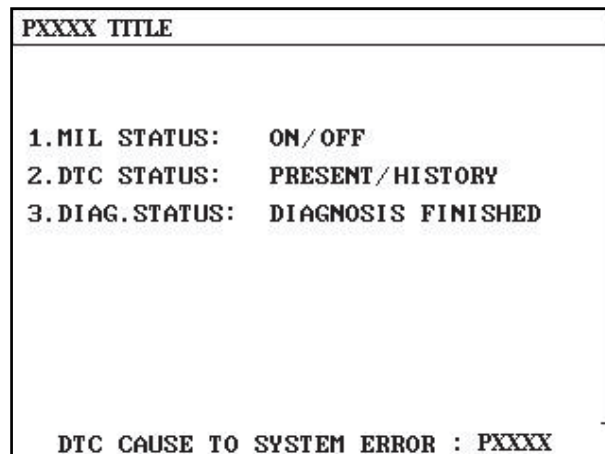
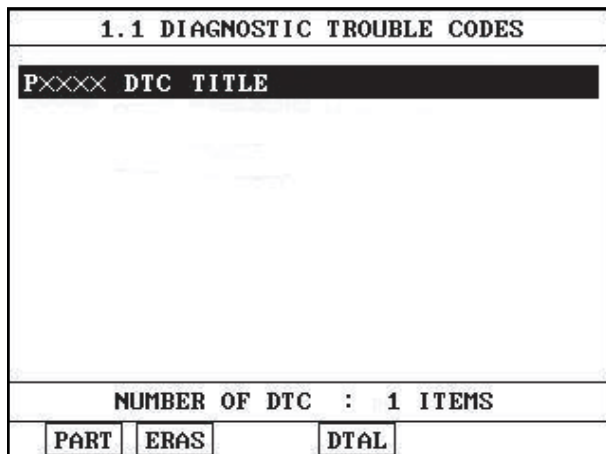
Fig) Signal waveforms of front HO2S(the upper) and rear HO2S(the lower)

SCMF16223L

After warming-up, if accelerator pedal is released suddenly around 4000rpm, the HO2S signal reading will be lower than 200mV resulting from Fuel cut-off for the moment. Conversely, if suddenly accelerator pedal is depressed, HO2S signal reading will be around 0.6V ~1.0V. At idle, Normally HO2S signal will switch from lean to rich with 3 Hz. And as racing, Its frequency rises.

MONITOR DTC STATUS EC7B4E32

1. Check DTC Status
 - 1) Connect scantool to Data Link Connector(DLC).
 - 2) IG "ON".
 - 3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F4(DTAL) to check DTC's information from the DTCs menu
 - 4) Read "DTC Status" parameter.



SCMF16159L

- 5) Is parameter displayed "Present fault"?

YES

- Go to "Terminal and connector inspection" procedure.

NO

- Fault is intermittent caused by poor contact in the sensor' s and/or PCM' s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

TERMINAL AND CONNECTOR INSPECTION EE7F7D7E

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

- Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

- Go to " Signal Circuit Inspection " procedure.

SIGNAL CIRCUIT INSPECTION E9A8FDF3

1. IG "OFF" and disconnect HO2S(B2/S2)
2. IG "ON"
3. Measure voltage between terminal 1 of HO2S(B2/S2) harness connector and chassis ground.

Specification : Approx. 3.5V - when pumping current is ON
Approx. 0.45V - when pumping current is OFF

4. Is the measured voltage within specification?

YES

- Go to "Component Inspection" procedure.

NO

- Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E45EBFF8

1. Check the Signal waveform of HO2S
 - 1) IG "OFF" and connect HO2S connector.
 - 2) Engine start.

- 3) After warming-up, monitor signal waveform of HO2S with scantool.?

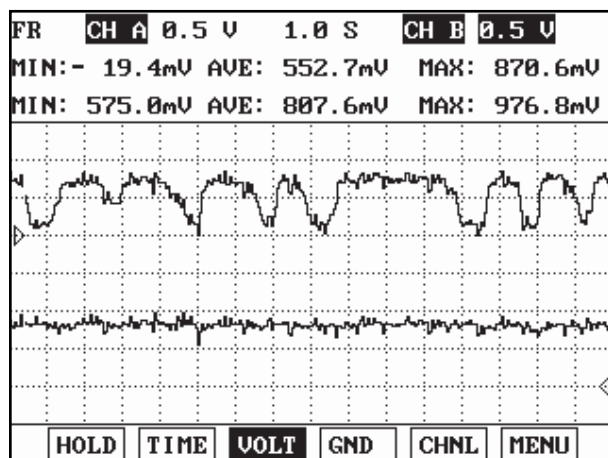


Fig) Signal waveform of front(the upper) and rear(the lower) HO2S at idle

SCMF16225L

- 4) Is the sensor switching properly?

YES

- Go to "Check HO2S" as below.

NO

- Substitute with a known - good HO2S and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.

2. Check HO2S

- 1) IG "OFF" and disconnect HO2S connector.
- 2) Check that the HO2S is securely installed.
- 3) Check the HO2S for contamination or damage
- 4) Is the sensor normal?

YES

- Substitute with a known - good PCM and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.

NO

- Substitute with a known - good HO2S and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR E16A8B88

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

- ▶ System performing to specification at this time. Clear the DTC.

NO

- ▶ Go to the applicable troubleshooting procedure.

DTC TROUBLESHOOTING PROCEDURES

FLA -297

DTC P0158 HO2S CIRCUIT HIGH VOLTAGE (BANK 2 / SENSOR 2)

COMPONENT LOCATION ED02A084

Refer to DTC P0157.

GENERAL DESCRIPTION E80B453F

Refer to DTC P0157.

DTC DESCRIPTION E20AA58E

Checking output signals from HO2S under detecting condition, if an output signal is above 1.3V for more than predetermine time, PCM sets P0158. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E08BFD99

Item	Detecting Condition	Possible cause
DTC Strategy	Monitor signal voltage	- Poor connection - Short to battery in harness - HO2S(B2/S2) - PCM
Enable Conditions	- Battery voltage $\geq 10V$ - Engine running ≥ 60 sec. - Engine warm-up state	
Threshold value	The voltage of HO2S(B2/S2) $> 1.3V$	
Diagnosis Time	Continuous (more than 12.5 sec. failure for every 15 sec.test)	
MIL On Condition	2 Driving Cycles	

SPECIFICATION EC808963

(REFERENCE ONLY)

Test Condition	HO2S Voltage(Sensor1)	HO2S Voltage(Sensor2)
HO2S Signal at idle after warm-up	Signal is commonly switching from rich to lean more than 3 times in 10 sec.	Signal is commonly above 0.6V.
HO2S signal at open circuit (Pumping current OFF)	Approx. 0.45V	
HO2S signal at open circuit (Pumping current ON)	Approx. 3.5V	

SCHEMATIC DIAGRAM E358095F

Refer to DTC P0157.

SIGNAL WAVEFORM AND DATA EBB7BB8A

Refer to DTC P0157.

MONITOR DTC STATUS E7193974

Refer to DTC P0157.

TERMINAL AND CONNECTOR INSPECTION EE41B826

Refer to DTC P0157.

SIGNAL CIRCUIT INSPECTION E9F3F25A

1. IG "OFF" and disconnect HO2S(B2/S2) connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 1 of HO2S(B2/S2) harness connector and chassis ground.

Specification :

Approx. 3.5V - when pumping current is ON

Approx. 0.45V - when pumping current is OFF

4. Is the measured voltage within specification?

YES

- Go to "Component Inspection" procedure.

NO

- Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E67626BE

1. Check the Signal waveform of HO2S
 - 1) IG "OFF" and connect HO2S connector.
 - 2) Engine start.
 - 3) After warming-up, monitor signal waveform of HO2S with scantool.?

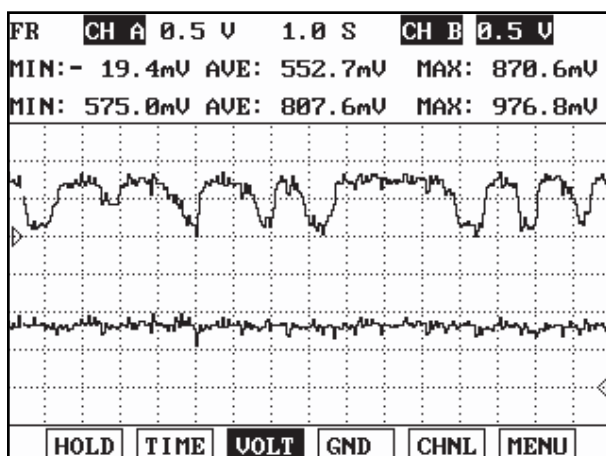


Fig) Signal waveform of front(the upper) and rear(the lower) HO2S at idle

SCMF16225L

- 4) Is the sensor switching properly?

YES

► Go to "Check HO2S" as below.

NO

► Substitute with a known - good HO2S and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.

2. Check HO2S

- 1) IG "OFF" and disconnect HO2S connector.
- 2) Check that the HO2S is securely installed.
- 3) Check the HO2S for contamination or damage
- 4) Is the sensor normal?

YES

► Substitute with a known - good PCM and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.

NO

► Substitute with a known - good HO2S and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR

E1B0F3D0

Refer to DTC P0157.

DTC P0160 HO2S CIRCUIT NO ACTIVITY DETECTED (BANK 2 / SENSOR 2)

COMPONENT LOCATION E7ECD0FE

Refer to DTC P0157.

GENERAL DESCRIPTION E40C3747

Refer to DTC P0157.

DTC DESCRIPTION EA1246BA

Checking output signals from HO2S under detecting condition, if an output voltage is approx.0.45V or 3.5V for more than predetermine time, PCM sets P0160. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E60838DA

Item		Detecting Condition	Possible cause
DTC Strategy		• Monitor signal voltage	• Poor connection • Open in harness • HO2S(B2/S2) • PCM
Enable Conditions		• Battery voltage $\geq 10V$ • Engine running ≥ 60 sec. • Engine warm-up state • No disable faults	
Thresh- old value	Case 1	• $1.2V \leq \text{Voltage of HO2S} \leq 3.9V$ (at pumping current ON)	
	Case 2	• $0.415V \leq \text{Voltage of HO2S} \leq 0.515V$ (at pumping current OFF)	
Diagnosis Time		• Continuous (more than 76.5 sec.failure for every 90 sec.test)	
MIL On Condition		• 2 Driving Cycles	

SPECIFICATION EF953B16

(REFERENCE ONLY)

Test Condition	HO2S Voltage(Sensor1)	HO2S Voltage(Sensor2)
HO2S Signal at idle after warm-up	Signal is commonly switching from rich to lean more than 3 times in 10 sec.	Signal is commonly above 0.6V.
HO2S signal at open circuit (Pumping current OFF)	Approx. 0.45V	
HO2S signal at open circuit (Pumping current ON)	Approx. 3.5V	

SCHEMATIC DIAGRAM E08EF8CF

Refer to DTC P0157.

DTC TROUBLESHOOTING PROCEDURES

FLA -301

SIGNAL WAVEFORM AND DATA EC950F42

Refer to DTC P0157.

MONITOR DTC STATUS E38A5341

Refer to DTC P0157.

TERMINAL AND CONNECTOR INSPECTION EA9C0DA4

Refer to DTC P0157.

SIGNAL CIRCUIT INSPECTION E4F75E95

1. IG "OFF" and disconnect HO2S(B2/S2) connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 1 of HO2S(B2/S2) harness connector and chassis ground.

Specification :

Approx. 3.5V - when pumping current is ON

Approx. 0.45V - when pumping current is OFF

4. Is the measured voltage within specification?

YES

- ▶ Go to "Ground Circuit Inspection" procedure.

NO

- ▶ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION E77D1325

1. IG "ON" and disconnect HO2S(B2/S2) connector.
2. Measure voltage between terminal 1 of HO2S(B2/S2) harness connector and chassis ground.
3. Measure voltage between terminals 1 and 2 of HO2S(B2/S2) harness connector.

Specification : Voltage difference between measurement "A" and "B" is below 200mV.

4. Is the measured voltage within specification?

YES

- ▶ Go to "Component Inspection" procedure.

NO

- ▶ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

E279C52A

1. Check the Signal waveform of HO2S

- 1) IG "OFF" and connect HO2S connector.
- 2) Engine start.
- 3) After warming-up, monitor signal waveform of HO2S with scantool.?

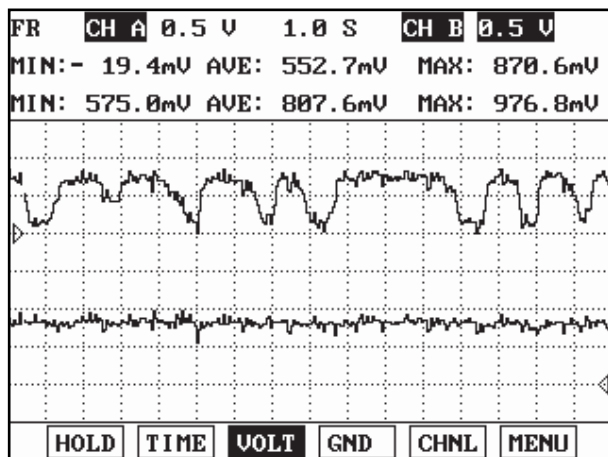


Fig) Signal waveform of front(the upper) and rear(the lower) HO2S at idle

SCMF16225L

4) Is the sensor switching properly?

YES

- ▶ Go to "Check HO2S" as below.

NO

- ▶ Substitute with a known - good HO2S and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.

2. Check HO2S

- 1) IG "OFF" and disconnect HO2S connector.
- 2) Check that the HO2S is securely installed.
- 3) Check the HO2S for contamination or damage
- 4) Is the sensor normal?

YES

- ▶ Substitute with a known - good PCM and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.

NO

- ▶ Substitute with a known - good HO2S and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR

EB601912

Refer to DTC P0157.

DTC P0171 SYSTEM TOO LEAN (BANK 1)

GENERAL DESCRIPTION E0E9D636

In order to provide the best possible combination of drivability, fuel economy and emission control, the ECM uses a closed loop air/fuel metering system. The ECM monitors the HO₂S signal voltage and adjusts fuel delivery based it in closed loop fuel control. Changes in fuel delivery will be indicated by the long-term and the short-term fuel trim values. The ideal fuel trim value is around 0%. The ECM will add fuel when the HO₂S signal is Indicating a lean condition. Additional fuel is indicated by fuel trim values that are above 0%. The ECM will reduce fuel when the HO₂S signal is Indicating a rich condition. Reduction in fuel is indicated by fuel trim values that are below 0%. The DTC relevant to fuel trim will be set when the amount reaches excessive levels because of a lean or rich condition.

DTC DESCRIPTION EB85DC59

Checking the fuel trime value under detecting condition, if its average exceeds the limit over certain period, PCM sets P0171. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E461125D

Item	Detecting Condition	Possible cause
DTC Strategy	Monitor the fuel trim value	- Air leakage - Improper fuel pressure - PCV valve stuck - Clogging of injector
Enable Conditions	- Engine warm-up sufficiently - Drive at a steady speed over 5 minutes (Vehicle speed ≤ 130km/h) 60°C(140°F) ≤ Engine coolant temperature ≤ 115°C(239°F) - No disabling faults (DTCs related to HO₂S, purge valve,catalyst)	
Threshold value	Average of short term fuel trim > 0.8 and Average of long term fuel trim > 1.2	
Diagnosis Time	Continuous	
MIL On Condition	2 Driving Cycles	

MONITOR DTC STATUS EA2D7ED9

- Monitor DTCs related to MAFS, MAPS, ECTS, Injector or CVVT items with scantool.
- Are there the DTCs above-mentioned?

YES

- ▶ Do all repairs associated with those codes before proceeding with this procedure.

NO

- ▶ Go to "System Inspection" procedure.

SYSTEM INSPECTION E77E6B06

- Check air leakage
 - 1) Visually/physically inspect the air leakage in intake/exhaust system for following items

DTC TROUBLESHOOTING PROCEDURES

FLA -305

- ▶ Vacuum hoses for splits, kinks and improper connections.
- ▶ Throttle body gasket
- ▶ Gasket between intake manifold and cylinder head
- ▶ Seals between intake manifold and fuel injectors
- ▶ Exhaust system between HO2S and three way catalyst for air leakage

2) Has a problem found in this procedure?

YES

- ▶ Repair or replace it which has a problem, and go to "Verification of Vehicle Repair" procedure.

NO

- ▶ Go to "Check the fuel line" as follows

2. Check the fuel line

1) Check the fuel line for following items

- ▶ Connector connection state
- ▶ Damage/ connection state for vacuum hoses connected to fuel line
- ▶ Bent/ pressed/ twisted fuel line or fuel leakage

2) Has a problem found in this procedure?

YES

- ▶ Repair or replace it which has a problem, and go to " Verification of Vehicle Repair" procedure.

NO

- ▶ Go to "Check fuel pressure" as follows

3. Check fuel pressure



NOTE

- Be cautious that Fuel is explosive and an empty fuel tank can still contain explosive gases. When working on fuel system make sure to supply adequate ventilation to the work area. Do not smoke, and keep sparks and open flames away.
- The fuel system remains under pressure when the engine is not running. Release fuel system pressure before disconnecting any fuel line to reduce the chance of personal injury or fire damage to vehicle components.

1) IG "OFF" and disconnect Fuel Pump Relay in Junction Box.

2) Start-up and wait until it stops itself.

3) IG "OFF" and connect Fuel Pump Relay.

4) Install the fuel pressure gauge to the delivery pipe with the fuel pressure gauge adaptor.

5) Activate the fuel pump, and with fuel pressure applied, check that there is no fuel leakage from the pressure gauge or connection part.

6) Measure the fuel pressure at idle.

Specification : 374.6 ~ 384.4 kPa(3.82 ~ 3.92 kg/cm², 54.3 ~ 55.8 psi)

7) Is the measured fuel pressure within specifications ?

YES

► Go to "Component Inspection" procedure.

NO

► Repair or replace according to the below table. And then, go to " Verification of Vehicle Repair"procedure.

Condition	Possible Cause
Fuel pressure too low	Fuel filter,fuel pressure regulator, in-tank fuel hose or the fuel pump
Fuel pressure too high	Fuel pressure regulator, hose or pipe

COMPONENT INSPECTION

E8FB3042

1. Check PCV

- 1) IG "OFF" and remove PCV valve from rocker cover.
- 2) Insert a thin stick into the PCV valve from the threaded side and verify that the plunger is moving.
- 3) Is the PCV valve normally moving?

YES

► Go to "Check injector" as follows.

NO

► Replace it, and go to "Verification of Vehicle Repair" procedure.

2. Check injector for normal operation

- 1) Start engine.
- 2) Check its RPM decrease when doing the injector's actuation test.
- 3) Is there any cylinder with no change in RPM or only a small change in RPM ?

YES

► Clear DTC and Test-drive under enable conditions above-mentioned. After the test, If this DTC is set, go to "Inspection & Repair" procedure. If not, troubleshooting is completed.

NO

► Replace injector, and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

ECCEB299

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.

DTC TROUBLESHOOTING PROCEDURES

FLA -307

3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

- ▶ System performing to specification at this time. Clear the DTC.

NO

- ▶ Go to the applicable troubleshooting procedure.

DTC P0172 SYSTEM TOO RICH (BANK 1)

GENERAL DESCRIPTION EE18D8D2

Refer to DTC P0171.

DTC DESCRIPTION E62A3E5F

Checking the fuel trime value under detecting condition, if its average exceeds the limit over certain period, PCM sets P0172. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E8FF59ED

Item	Detecting Condition	Possible cause
DTC Strategy	Monitor the fuel trim value	- Blocking of intake system - Fuel leakage in injector - Improper fuel pressure
Enable Conditions	- Engine warm-up sufficiently - Drive at a steady speed over 5 minutes (Vehicle speed $\leq$ 130km/h) 60°C(140°F) $\leq$ Engine coolant temperature $\leq$ 115°C(239°F) - No disabling faults (DTCs related to HO2S, purge valve,catalyst)	
Threshold value	Average of short term fuel trim < 1.2 and Average of long term fuel trim < 0.8	
Diagnosis Time	Continuous	
MIL On Condition	2 Driving Cycles	

MONITOR DTC STATUS EFA8AB09

Refer to DTC P0171.

SYSTEM INSPECTION EF26692D

1. Check blocking of intake system

- 1) Visually/physically inspect the blocking in intake system for following items
 - ▶ Throttle body gasket and damage
 - ▶ Blocking in intake manifold and injector caused by any foreign substance

2) Has a problem found?

YES

- ▶ Repair or replace it, and go to "Verification of Vehicle Repair" procedure.

NO

- ▶ Go to " Check fuel pressure" as follows.

2. Check fuel pressure



NOTE

- Be cautious that Fuel is explosive and an empty fuel tank can still contain explosive gases. When working on fuel system make sure to supply adequate ventilation to the work area. Do not smoke, and keep sparks and open flames away.
 - The fuel system remains under pressure when the engine is not running. Release fuel system pressure before disconnecting any fuel line to reduce the chance of personal injury or fire damage to vehicle components.
- 1) IG "OFF" and disconnect Fuel Pump Relay in Junction Box.
 - 2) Start-up and wait until it stops itself.
 - 3) IG "OFF" and connect Fuel Pump Relay.
 - 4) Install the fuel pressure gauge to the delivery pipe with the fuel pressure gauge adaptor.
 - 5) Activate the fuel pump, and with fuel pressure applied, check that there is no fuel leakage from the pressure gauge or connection part.
 - 6) Measure the fuel pressure at idle.

Specification : 374.6 ~ 384.4 kPa(3.82 ~ 3.92 kg/cm², 54.3 ~ 55.8 psi)

- 7) Is the measured fuel pressure within specifications ?

YES

- Go to "Check fuel leakage in injector" as follow.

NO

- Repair or replace according to the below table. And then, go to " Verification of Vehicle Repair"procedure.

Condition	Possible Cause
Fuel pressure too low	Fuel filter,fuel pressure regulator, in-tank fuel hose or the fuel pump
Fuel pressure too high	Fuel pressure regulator, hose or pipe

3. Check fuel leakage in injector

- 1) IG "OFF" after checking the fuel pressure test.
- 2) Stop engine and check for a change in the fuel pressure gauge reading for 5 minutes.

Specification : After engine stops, fuel gauge reading is maintained for 5 minutes.

- 3) Is the fuel gauge reading maintained ?

YES

- Clear DTC and Test-drive under enable conditions above-mentioned. After the test, If this DTC is set, go to "Inspection & Repair" procedure. If not, troubleshooting is completed.

NO

- There is a fuel leakage in injector. Replace it, and go to " Verification of Vehicle Repair" procedure.

FLA -310

FUEL SYSTEM

VERIFICATION OF VEHICLE REPAIR E3C739E0

Refer to DTC P0171.

DTC TROUBLESHOOTING PROCEDURES

FLA -311

DTC P0174 SYSTEM TOO LEAN (BANK 2)

GENERAL DESCRIPTION EC2BE40F

In order to provide the best possible combination of drivability, fuel economy and emission control, the ECM uses a closed loop air/fuel metering system. The ECM monitors the HO2S signal voltage and adjusts fuel delivery based it in closed loop fuel control. Changes in fuel delivery will be indicated by the long-term and the short-term fuel trim values. The ideal fuel trim value is around 0%. The ECM will add fuel when the HO2S signal is Indicating a lean condition. Additional fuel is indicated by fuel trim values that are above 0%. The ECM will reduce fuel when the HO2S signal is Indicating a rich condition. Reduction in fuel is indicated by fuel trim values that are below 0%. The DTC relevant to fuel trim will be set when the amount reaches excessive levels because of a lean or rich condition.

DTC DESCRIPTION E15AB387

Checking the fuel trime value under detecting condition, if its average exceeds the limit over certain period, PCM sets P0174. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION EE27398D

Item	Detecting Condition	Possible cause
DTC Strategy	Monitor the fuel trim value	- Air leakage - Improper fuel pressure - PCV valve stuck - Clogging of injector
Enable Conditions	- Engine warm-up sufficiently - Drive at a steady speed over 5 minutes (Vehicle speed $\leq$ 130km/h) 60°C(140°F) $\leq$ Engine coolant temperature $\leq$ 115°C(239°F) - No disabling faults (DTCs related to HO2S, purge valve,catalyst)	
Threshold value	Average of short term fuel trim $>$ 0.8 and Average of long term fuel trim $>$ 1.2	
Diagnosis Time	Continuous	
MIL On Condition	2 Driving Cycles	

MONITOR DTC STATUS E69684B5

- Monitor DTCs related to MAFS, MAPS, ECTS, Injector or CVVT items with scantool.
- Are there the DTCs above-mentioned?

YES

- Do all repairs associated with those codes before proceeding with this procedure.

NO

- Go to "System Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION E6495F7B

- Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

- ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

- ▶ Go to " System Inspection " procedure.

SYSTEM INSPECTION E78D0AAB

1. Check air leakage

- 1) Visually/physically inspect the air leakage in intake/exhaust system for following items
 - ▶ Vacuum hoses for splits, kinks and improper connections.
 - ▶ Throttle body gasket
 - ▶ Gasket between intake manifold and cylinder head
 - ▶ Seals between intake manifold and fuel injectors
 - ▶ Exhaust system between HO2S and three way catalyst for air leakage

- 2) Has a problem found in this procedure?

YES

- ▶ Repair or replace it which has a problem, and go to "Verification of Vehicle Repair" procedure.

NO

- ▶ Go to "Check the fuel line" as follows

2. Check the fuel line

- 1) Check the fuel line for following items
 - ▶ Connector connection state
 - ▶ Damage/ connection state for vacuum hoses connected to fuel line
 - ▶ Bent/ pressed/ twisted fuel line or fuel leakage

- 2) Has a problem found in this procedure?

YES

- ▶ Repair or replace it which has a problem, and go to " Verification of Vehicle Repair" procedure.

NO

- ▶ Go to "Check fuel pressure" as follows

3. Check fuel pressure



NOTE

- Be cautious that Fuel is explosive and an empty fuel tank can still contain explosive gases. When working on fuel system make sure to supply adequate ventilation to the work area. Do not smoke, and keep sparks and open flames away.

DTC TROUBLESHOOTING PROCEDURES

FLA -313

- The fuel system remains under pressure when the engine is not running. Release fuel system pressure before disconnecting any fuel line to reduce the chance of personal injury or fire damage to vehicle components.
- 1) IG "OFF" and disconnect Fuel Pump Relay in Junction Box.
- 2) Start-up and wait until it stops itself.
- 3) IG "OFF" and connect Fuel Pump Relay.
- 4) Install the fuel pressure gauge to the delivery pipe with the fuel pressure gauge adaptor.
- 5) Activate the fuel pump, and with fuel pressure applied, check that there is no fuel leakage from the pressure gauge or connection part.
- 6) Measure the fuel pressure at idle.

Specification : 374.6 ~ 384.4 kPa(3.82 ~ 3.92 kg/cm², 54.3 ~ 55.8 psi)

- 7) Is the measured fuel pressure within specifications ?

YES

- Go to "Component Inspection" procedure.

NO

- Repair or replace according to the below table. And then, go to "Verification of Vehicle Repair" procedure.

Condition	Possible Cause
Fuel pressure too low	Fuel filter, fuel pressure regulator, in-tank fuel hose or the fuel pump
Fuel pressure too high	Fuel pressure regulator, hose or pipe

COMPONENT INSPECTION ED741613

1. Check PCV

- 1) IG "OFF" and remove PCV valve from rocker cover.
- 2) Insert a thin stick into the PCV valve from the threaded side and verify that the plunger is moving.
- 3) Is the PCV valve normally moving?

YES

- Go to "Check injector" as follows.

NO

- Replace it, and go to "Verification of Vehicle Repair" procedure.

2. Check injector for normal operation

- 1) Start engine.
- 2) Check its RPM decrease when doing the injector's actuation test.

- 3) Is there any cylinder with no change in RPM or only a small change in RPM?

YES

► Clear DTC and Test-drive under enable conditions above-mentioned. After the test, If this DTC is set, go to "Inspection & Repair" procedure. If not, troubleshooting is completed.

NO

► Replace injector, and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E5F1EB2D

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

► System performing to specification at this time. Clear the DTC.

NO

► Go to the applicable troubleshooting procedure.

DTC TROUBLESHOOTING PROCEDURES

FLA -315

DTC P0175 SYSTEM TOO RICH (BANK 2)

GENERAL DESCRIPTION E5695521

Refer to DTC P0174.

DTC DESCRIPTION EDAEAA98

Checking the fuel trime value under detecting condition, if its average exceeds the limit over certain period, PCM sets P0175. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E4BA108A

Item	Detecting Condition	Possible cause
DTC Strategy	Monitor the fuel trim value	- Blocking of intake system - Fuel leakage in injector - Improper fuel pressure
Enable Conditions	- Engine warm-up sufficiently - Drive at a steady speed over 5 minutes (Vehicle speed $\leq$ 130km/h) 60°C(140°F) $\leq$ Engine coolant temperature $\leq$ 115°C(239°F) - No disabling faults (DTCs related to HO2S, purge valve,catalyst)	
Threshold value	Average of short term fuel trim < 1.2 and Average of long term fuel trim < 0.8	
Diagnosis Time	Continuous	
MIL On Condition	2 Driving Cycles	

MONITOR DTC STATUS ED66A85A

Refer to DTC P0174.

SYSTEM INSPECTION E130A67A

1. Check blocking of intake system

- 1) Visually/physically inspect the blocking in intake system for following items
 - ▶ Throttle body gasket and damage
 - ▶ Blocking in intake manifold and injector caused by any foreign substance

2) Has a problem found?

YES

- ▶ Repair or replace it, and go to "Verification of Vehicle Repair" procedure.

NO

- ▶ Go to " Check fuel pressure" as follows.

2. Check fuel pressure



NOTE

- Be cautious that Fuel is explosive and an empty fuel tank can still contain explosive gases. When working on fuel system make sure to supply adequate ventilation to the work area. Do not smoke, and keep sparks and open flames away.
 - The fuel system remains under pressure when the engine is not running. Release fuel system pressure before disconnecting any fuel line to reduce the chance of personal injury or fire damage to vehicle components.
- 1) IG "OFF" and disconnect Fuel Pump Relay in Junction Box.
 - 2) Start-up and wait until it stops itself.
 - 3) IG "OFF" and connect Fuel Pump Relay.
 - 4) Install the fuel pressure gauge to the delivery pipe with the fuel pressure gauge adaptor.
 - 5) Activate the fuel pump, and with fuel pressure applied, check that there is no fuel leakage from the pressure gauge or connection part.
 - 6) Measure the fuel pressure at idle.

Specification : 374.6 ~ 384.4 kPa(3.82 ~ 3.92 kg/cm², 54.3 ~ 55.8 psi)

- 7) Is the measured fuel pressure within specifications ?

YES

- Go to "Check fuel leakage in injector" as follow.

NO

- Repair or replace according to the below table. And then, go to " Verification of Vehicle Repair"procedure.

Condition	Possible Cause
Fuel pressure too low	Fuel filter,fuel pressure regulator, in-tank fuel hose or the fuel pump
Fuel pressure too high	Fuel pressure regulator, hose or pipe

3. Check fuel leakage in injector

- 1) IG "OFF" after checking the fuel pressure test.
- 2) Stop engine and check for a change in the fuel pressure gauge reading for 5 minutes.

Specification : After engine stops, fuel gauge reading is maintained for 5 minutes.

- 3) Is the fuel gauge reading maintained ?

YES

- Clear DTC and Test-drive under enable conditions above-mentioned. After the test, If this DTC is set, go to "Inspection & Repair" procedure. If not, troubleshooting is completed.

NO

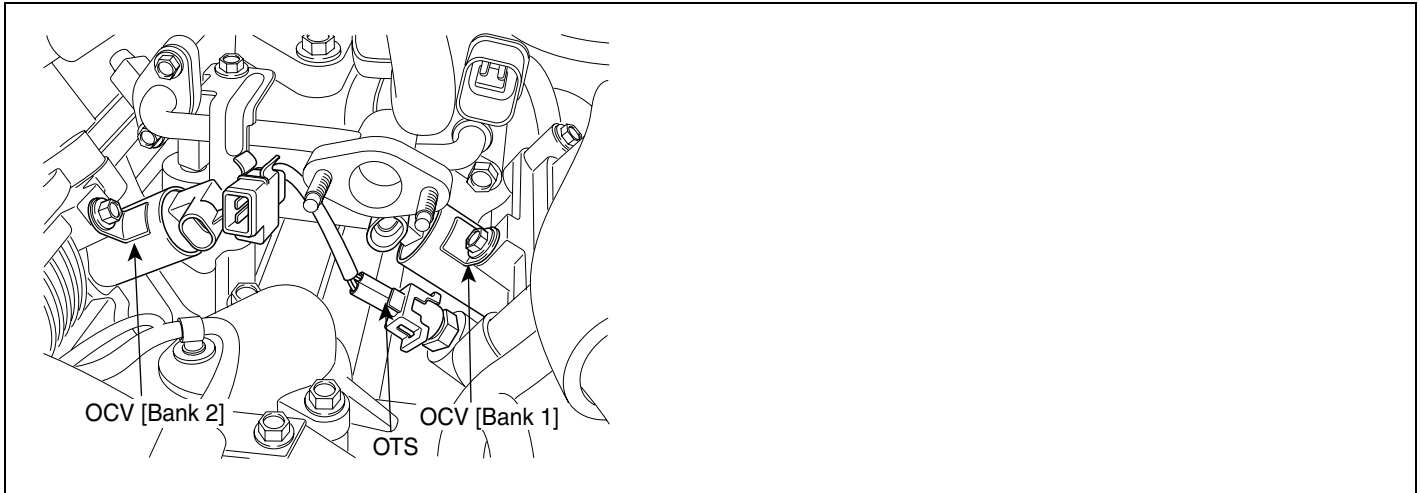
- There is a fuel leakage in injector. Replace it, and go to " Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EE19BC36

Refer to DTC P0174.

DTC P0197 ENGINE OIL TEMP. SENSOR LOW INPUT

COMPONENT LOCATION E8C526BB



LGLG500A

GENERAL DESCRIPTION E2BA831A

The fluid of the CVVT is the engine oil and its density changes according to the engine oil temperature. At this time the Oil Temperature Sensor (OTS) helps compensation against the temperature differences. The Oil Temperature Sensor measures the engine oil temperature before the engine oil comes into the Oil-flow Control Valve (OCV). According to the measured temperature, the Engine Control Module (ECM) compensates the oil-flow control valve operation time.

DTC DESCRIPTION EF5561C5

Checking output signals from oil temperature sensor every 15 sec. under detecting condition, if an signal is low for more than 12.5 sec., PCM sets P0197. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E7D73AB2

Item		Detecting Condition	Possible cause
DTC Strategy		Signal low	- Poor connection - Short to ground in harness - Oil temp.sensor - PCM
Enable Conditions	Case 1	- Engine running state > 60 sec - Coolant temperature < 110 °C (230°F)	
	Case 2	Engine running state > 90 sec.	
Thresh old value		Oil temperature sensor's signal < 0.1V	
Diagnosis Time		Continuous (More than 12.5 sec.failure for every 15 sec.test)	
MIL On Condition		2 Driving Cycles	

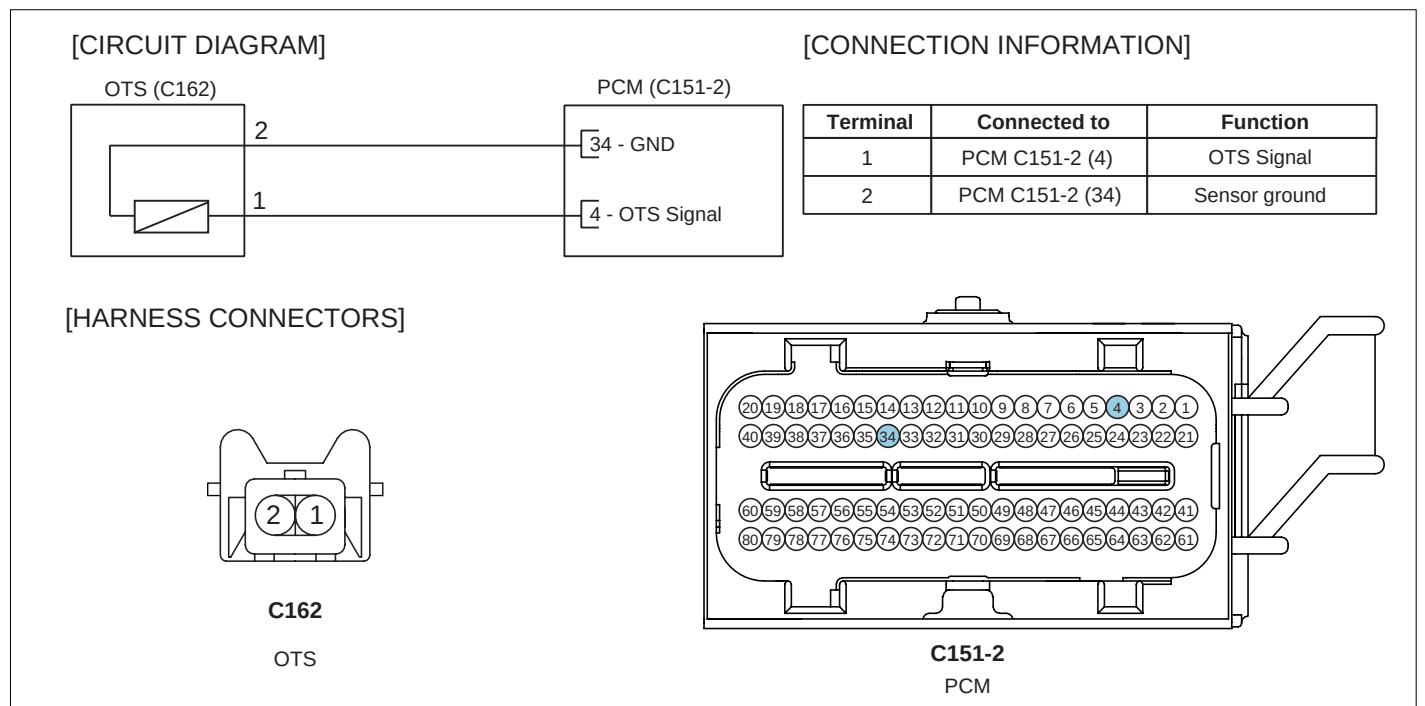
DTC TROUBLESHOOTING PROCEDURES

FLA -319

SPECIFICATION E3F3FD1B

Temperature(°C/°F)	Resistance(kΩ)
-20°C/ -4°F	16.52kΩ
20°C/ 68°F	2.45kΩ
80°C/ 176°F	0.29kΩ

SCHEMATIC DIAGRAM EA8CF7F5



SVQF16117L

MONITOR DTC STATUS E2E8A6EC

1. Check DTC Status
 - 1) Connect scantool to Data Link Connector(DLC).
 - 2) IG "ON".
 - 3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F4(DTAL) to check DTC's information from the DTCs menu
 - 4) Read "DTC Status" parameter.

1.1 DIAGNOSTIC TROUBLE CODES			
PXXXX DTC TITLE			
NUMBER OF DTC : 1 ITEMS			
PART	ERAS	DTAL	

PXXXX TITLE	
1.MIL STATUS:	ON/OFF
2.DTC STATUS:	PRESENT/HISTORY
3.DIAG.STATUS:	DIAGNOSIS FINISHED
DTC CAUSE TO SYSTEM ERROR : PXXXX	

SCMF16159L

5) Is parameter displayed "Present fault"?

YES

► Go to "Terminal and connector inspection" procedure.

NO

► Fault is intermittent caused by poor contact in the sensor' s and/or PCM' s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

TERMINAL AND CONNECTOR INSPECTION

EE8567D3

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

► Repair or replace if necessary and go to "Verification of Vehicle Repair" procedure

NO

► Go to "signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

E24C1B27

1. Check Voltage
 - 1) IG "OFF" & ENG "OFF"
 - 2) Disconnect OTS connector
 - 3) IG "ON" & ENG "OFF"

DTC TROUBLESHOOTING PROCEDURES

FLA -321

- 4) Measure voltage between harness terminal 1 of OTS and chassis ground.

Specification : Approx. 5V

- 5) Is the measured voltage within specification ?

YES

- Go to " Component Inspection" procedure.

NO

- Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

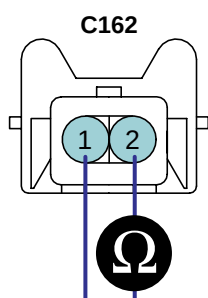
E0E32B66

1. Check resistance of OTS

- 1) IG "ON" & ENG "OFF"
- 2) Monitor Oil Temperature parameter on the scantool
- 3) IG "OFF" & ENG "OFF"
- 4) Disconnect OTS connector.
- 5) Measure resistance between terminal 1 and 2 of OTS connector(Component Side)

SPECIFICATION :

Temperature(°C/°F)	Resistance(kΩ)
-20°C/ -4°F	16.52kΩ
20°C/ 68°F	2.45kΩ
80°C/ 176°F	0.29kΩ



1. OTS Signal
2. OTS Ground

SVQF16241L

- 6) Is the measured resistance within specification ?

YES

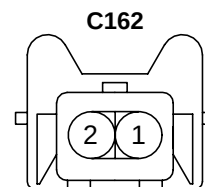
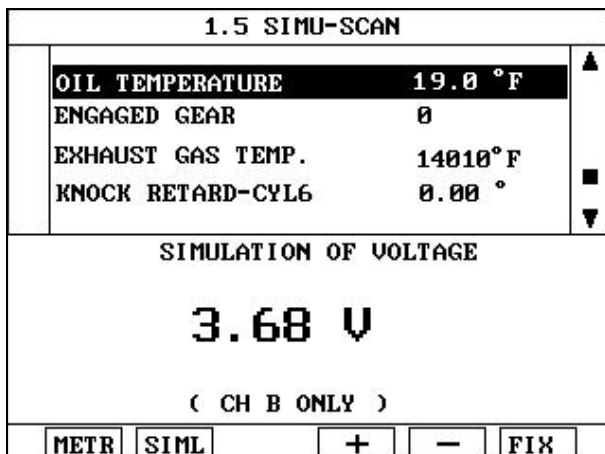
- Go to "Check PCM" as follows.

NO

► Substitute with a known - good OTS and check for proper operation. If the problem is corrected, replace OTS and go to "Verification of Vehicle Repair" procedure.

2. Check PCM

- 1) Ignition "OFF" and Connect Scantool
- 2) Ignition"ON " & Engine "OFF"
- 3) Select simulation function on scantool.
- 4) Simulate voltage at terminal "1" of OTS signal harness connector.



1. OTS Signal
2. OTS Ground

SVQF16242L

- 5) Does the OTS signal value changes according to simulation voltage ?

YES

► Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace if necessary and go to "Verification of Vehicle Repair" procedure

NO

► Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

EE96ADAA

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

- ▶ System performing to specification at this time. Clear the DTC.

NO

- ▶ Go to the applicable troubleshooting procedure.

FLA -324

FUEL SYSTEM

DTC P0198 ENGINE OIL TEMP. SENSOR HIGH INPUT

COMPONENT LOCATION E42E33E2

Refer to DTC P0197.

GENERAL DESCRIPTION E64334B1

Refer to DTC P0197.

DTC DESCRIPTION E4558250

Checking output signals from oil temperature sensor every 15 sec. under detecting condition, if an signal is high for more than 12.5 sec., PCM sets P0198. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION EE0B5425

Item		Detecting Condition	Possible cause
DTC Strategy		• Signal low	• Poor connection • Open or short to battery in signal harness • Open in ground harness • Oil temp.sensor • PCM
Enable Conditions	Case 1	• Engine running state > 60 sec • Coolant temperature < 110 °C(230°F)	
	Case 2	• Engine running state > 90 sec.	
Thresh old value		• Oil temperature sensor's signal > 4.9V	
Diagnosis Time		• Continuous (More than 12.5 sec.failure for every 15 sec.test)	
MIL On Condition		• 2 Driving Cycles	

SPECIFICATION E8CC49CD

Temperature(°C/°F)	Resistance(kΩ)
-20°C/ -4°F	16.52kΩ
20°C/ 68°F	2.45kΩ
80°C/ 176°F	0.29kΩ

SCHEMATIC DIAGRAM EAD51BEB

Refer to DTC P0197.

MONITOR DTC STATUS E6142301

Refer to DTC P0197.

TERMINAL AND CONNECTOR INSPECTION E23DAE00

Refer to DTC P0197.

DTC TROUBLESHOOTING PROCEDURES

FLA -325

SIGNAL CIRCUIT INSPECTION E3ECF421

1. Check Voltage

- 1) IG "OFF" & ENG "OFF"
- 2) Disconnect OTS connector
- 3) IG "ON" & ENG "OFF"
- 4) Measure voltage between harness terminal 1 of OTS and chassis ground.

Specification : Approx. 5V

- 5) Is the measured voltage within specification ?

YES

► Go to "Ground Circuit Inspection" procedure.

NO

► Go to "Check open in harness" as follow.

2. Check open in harness

- 1) IG "OFF" & ENG "OFF"
- 2) Disconnect OTS and PCM connector.
- 3) Measure resistance between terminal 1 of OTS harness connector and terminal 4 of PCM harness connector.

Specification : Approx. below 1Ω

- 4) Is the measured resistance within specification ?

YES

► Go to "Ground Circuit Inspection" procedure.

NO

► Repair or replace open in harness, and then go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION E9529310

1. IG "OFF" & ENG "OFF"
2. Disconnect OTS connector
3. Measure voltage between terminal 1 of OTS harness connector and chassis ground.
4. Measure voltage between terminals 1 and 2 of OTS harness connector.

Specification : Measurement "A" - Measurement 'B' = Approx. below 200mV

5. Is the measured voltage within specification ?

YES

- Go to "Component Inspection" procedure

NO

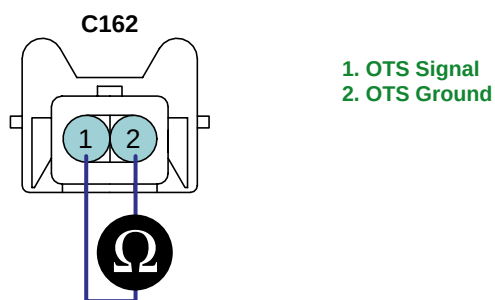
- Repair or replace contact resistance or open in harness and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E406B793

1. Check resistance of OTS
 - 1) IG "ON" & ENG "OFF"
 - 2) Monitor Oil Temperature parameter on the scantool
 - 3) IG "OFF" & ENG "OFF"
 - 4) Disconnect OTS connector.
 - 5) Measure resistance between terminal 1 and 2 of OTS connector(Component Side)

SPECIFICATION :

Temperature(°C/°F)	Resistance(kΩ)
-20°C/ -4°F	16.52kΩ
20°C/ 68°F	2.45kΩ
80°C/ 176°F	0.29kΩ



SVQF16241L

- 6) Is the measured resistance within specification ?

YES

- Go to "Check PCM" as follows.

NO

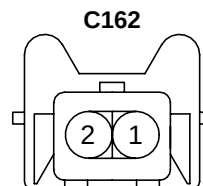
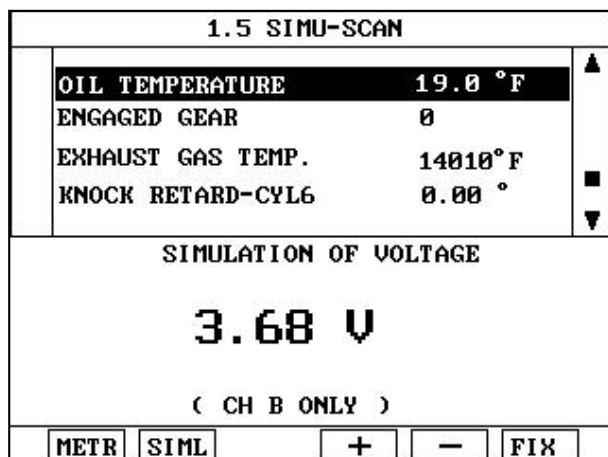
- Substitute with a known - good OTS and check for proper operation. If the problem is corrected, replace OTS and go to "Verification of Vehicle Repair" procedure.

2. Check PCM

DTC TROUBLESHOOTING PROCEDURES

FLA -327

- 1) Ignition "OFF" and Connect Scantool
- 2) Ignition"ON " & Engine "OFF"
- 3) Select simulation function on scantool.
- 4) Simulate voltage at terminal "1" of OTS signal harness connector.



1. OTS Signal
2. OTS Ground

SVQF16242L

- 5) Does the OTS signal value changes according to simulation voltage ?

YES

► Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace if necessary and go to "Verification of Vehicle Repair" procedure

NO

► Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

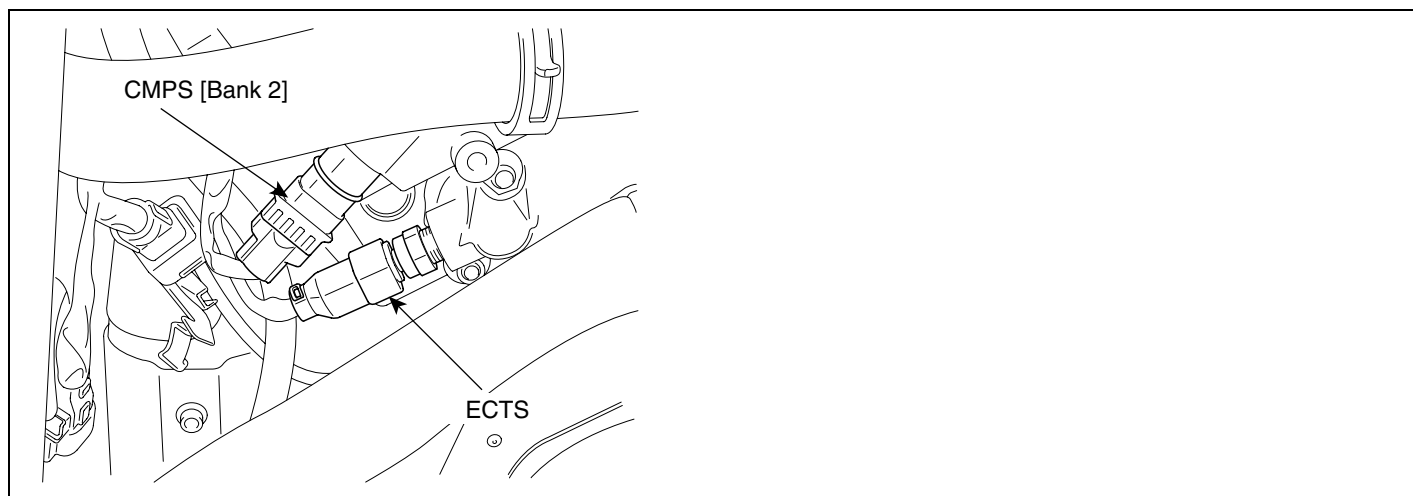
VERIFICATION OF VEHICLE REPAIR

E344162C

Refer to DTC P0197.

DTC P0217 ENGINE COOLANT OVER TEMPERATURE CONDITION

COMPONENT LOCATION E72AF219



LGLG510A

GENERAL DESCRIPTION E8DE49EF

The Engine Coolant Temperature Sensor (ECTS) is located in the engine coolant passage of the cylinder head for detecting the engine coolant temperature. The ECTS uses a thermistor whose resistance changes with the temperature. The electrical resistance of the ECTS decreases as the temperature increases, and increases as the temperature decreases. The reference 5 V in the ECM is supplied to the ECTS via a resistor in the ECM. That is, the resistor in the ECM and the thermistor in the ECTS are connected in series. When the resistance value of the thermistor in the ECTS changes according to the engine coolant temperature, the output voltage also changes. During cold engine operation the ECM increases the fuel injection duration and controls the ignition timing using the information of engine coolant temperature to avoid engine stalling and improve drivability.

DTC DESCRIPTION E351C025

Checking the coolant temperature under detecting condition, if the coolant temperature exceeds the threshold temperature under normal operation loads, PCM sets P0217. MIL (Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC TROUBLESHOOTING PROCEDURES

FLA -329

DTC DETECTING CONDITION

EF2AA66C

Item	Detecting Condition	Possible cause
DTC Strategy	Monitor the coolant temperature	ECTS
Enable Conditions	- Coolant sensor is normal - No disabling faults present(DTCs related to MAFS/MAPS, catalyst, fuel system or engine oil temperature sensor) - Coolant Temperature at startup < 45°C (113 °F) - Engine running state - Coolant temperature > 50°C (122 °F) - Intake air temperature < 35°C (95 °F)	
Thresh old value	Coolant temperature ≥ 110°C (230 °F) (Average airflow < 30 g/sec and filtered airflow < 50 g/sec)	
Diagnosis Time	Once per driving cycle (about 2 minutes)	
MIL On Condition	2 driving cycles	

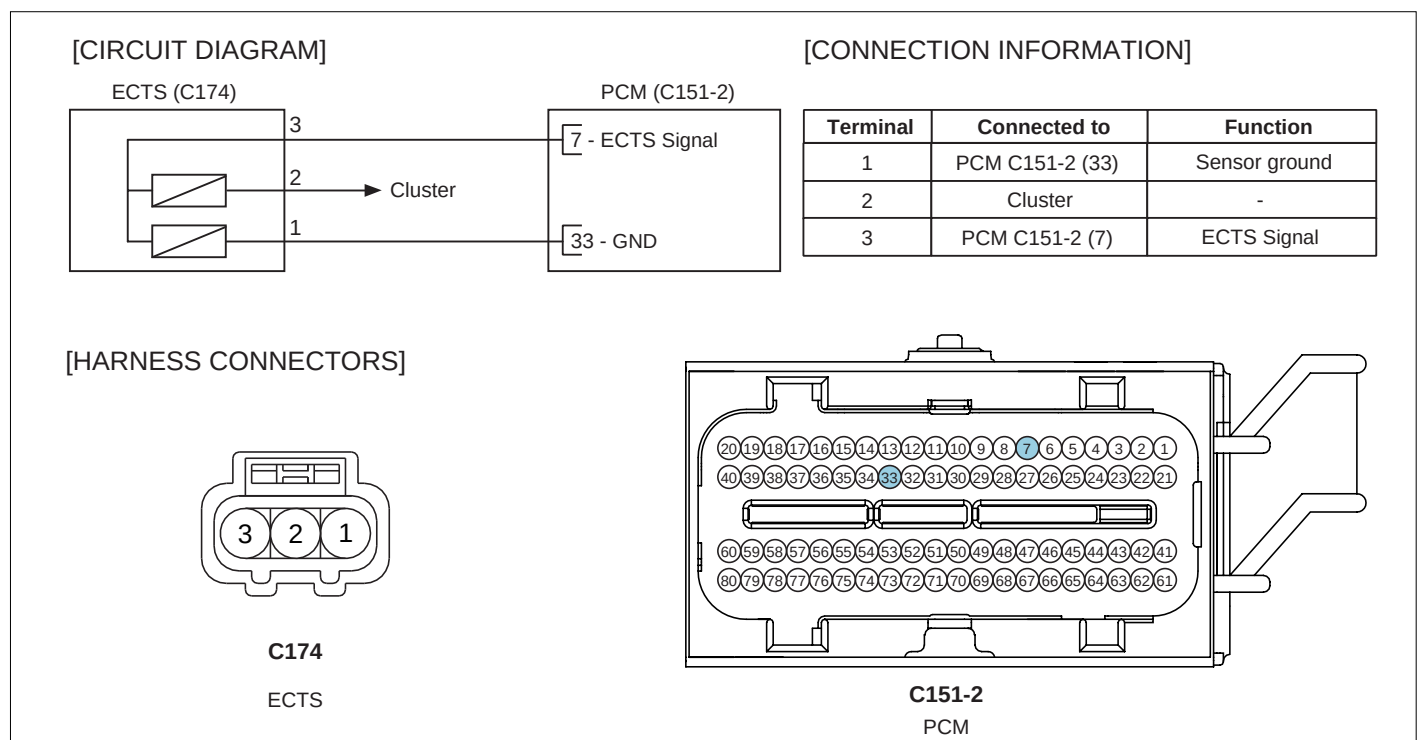
SPECIFICATION

E32110CD

Temp. (°C/°F)	Resistance (kΩ)	Temp. (°C/°F)	Resistance (kΩ)
-40(-40)	48.14	40(104)	1.15
-20(-4)	14.13 ~ 16.83	60(140)	0.59
0(32)	5.79	80(176)	0.32
20(68)	2.31 ~ 2.59		

SCHEMATIC DIAGRAM

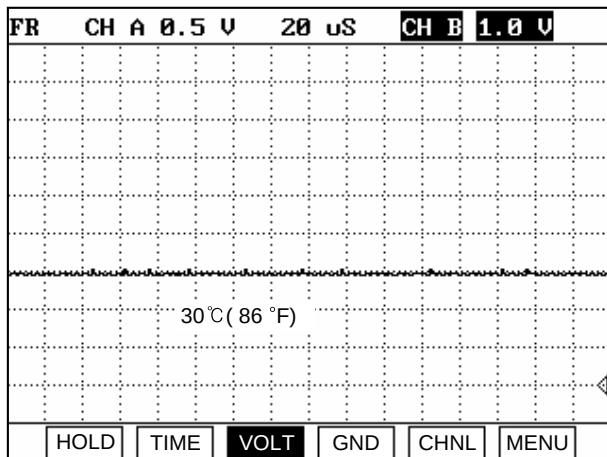
E2AF1CCA



SVQF16106L

SIGNAL WAVEFORM AND DATA

EBCA080D



EGRF700B

The output signals of IATS & ECTS change smoothly without any rapid changes. Those have almost same characteristic signal during the early period after start. It means that the temperatures of intake air and engine coolant are depended on the temperature of atmosphere. Meanwhile, during the warming up, the output signal of ECTS is going up increasingly. but, the output signal of IATS changes a little bit. even it may not change almost. It means that the heat of engine does not affect on the temperature of intake air.

MONITOR DTC STATUS

E7EB0ABB

1. Check DTC Status

- 1) Connect scantool to Data Link Connector(DLC).
- 2) IG "ON".
- 3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F4(DTAL) to check DTC's information from the DTCs menu
- 4) Read "DTC Status" parameter.

1.1 DIAGNOSTIC TROUBLE CODES	
PXXXX	DTC TITLE
NUMBER OF DTC : 1 ITEMS	
PART	ERAS
DTAL	

PXXXX TITLE	
1.MIL STATUS:	ON/OFF
2.DTC STATUS:	PRESENT/HISTORY
3.DIAG.STATUS:	DIAGNOSIS FINISHED
DTC CAUSE TO SYSTEM ERROR : PXXXX	

SCMF16159L

- 5) Is parameter displayed "Present fault"?

YES

DTC TROUBLESHOOTING PROCEDURES

FLA -331

- Go to "Component Inspection" procedure.

NO

- Fault is intermittent, go to "Verification of vehicle Repair" procedure.

COMPONENT INSPECTION

EB452CFD

1. IG "OFF" and disconnect ECTS connector.
2. Remove it.
3. Measure resistance between terminals 1 and 3 of ECTS connector as the temperature rises.

SPECIFICATION :

Temp. (°C/°F)	Resistance (kΩ)	Temp. (°C/°F)	Resistance (kΩ)
-40(-40)	48.14	40(104)	1.15
-20(-4)	14.13 ~ 16.83	60(140)	0.59
0(32)	5.79	80(176)	0.32
20(68)	2.31 ~ 2.59		

4. Are the measured resistance within specification?

YES

- Clear DTC and Test-drive under enable conditions above-mentioned. After the test, If this DTC is set, recheck it thoroughly. If not, it is intermittent fault, go to "Verification of vehicle Repair" procedure.

NO

- Substitute with a known - good ECTS and check for proper operation. If the problem is corrected, Go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

E61CE6CB

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

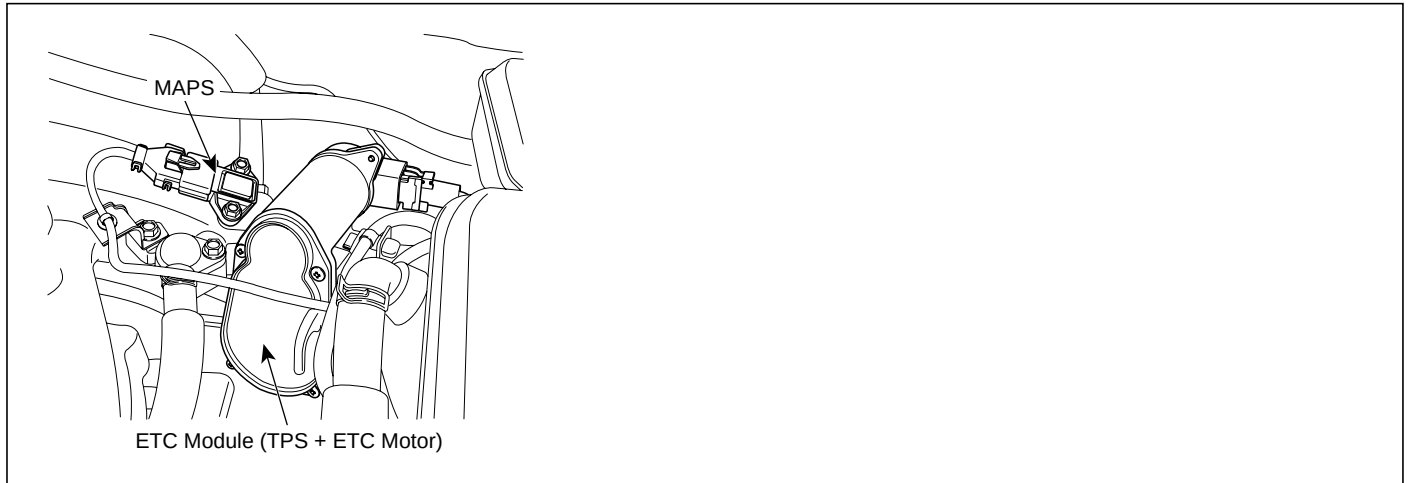
- System performing to specification at this time. Clear the DTC.

NO

- Go to the applicable troubleshooting procedure.

DTC P0222 THROTTLE/PEDAL POSITION SENSOR/SWITCH "B" CIRCUIT LOW INPUT

COMPONENT LOCATION E6D96587



SCMF16192L

GENERAL DESCRIPTION E89080A0

The Electronic Throttle Control(ETC) system is made of the components throttle body, Throttle Position Sensor(TPS)1 & 2 and Accelerator Position Sensor(APS) 1 & 2. TPS1 & 2 are sharing the same source voltage and ground.The throttle valve opening is control by throttle motor which is controlled by Engine Control Module(ECM).The opposite position indicator shows inverted signal characteristics.TPS1 output voltage increases smoothly in proportion with the throttle valve opening angle after starting. TPS2 output voltage decreases in inverse proportion with the throttle valve opening angle after starting. TPS provides feedback to the ECM to control the throttle motor in order to control the throttle valve opening angle properly in response to the driving condition.

DTC DESCRIPTION EC64320B

Checking output signals from TPS2 every 8.5 sec. under detecting condition, if an output signal is below 0.25V for more than 0.1 sec, PCM sets P0222. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E1FB6E8A

Item	Detecting Condition	Possible Cause
DTC Strategy	• signal low	• Poor connection • Open or short to ground in power harness • Open or short to ground in signal harness • TPS • PCM
Enable condition	• IG "ON"	
threshold value	• The signal voltage of TPS < 0.25V	
diagnosis time	• Continuous (more than 0.1 sec. failure for every 8.5 sec.test)	
MIL ON condition	• 2 driving cycles	

DTC TROUBLESHOOTING PROCEDURES

FLA -333

SPECIFICATION E70D3209

Throttle opening (°)	Output voltage(V) [Vref=5.0]	
	TPS1	TPS2
0°	0.0V	5.0V
10°	0.5V	4.5V
20°	0.9V	4.1V
30°	1.4V	3.6V
40°	1.8V	3.2V
50°	2.3V	2.7V
60°	2.7V	2.3V
70°	3.2V	1.8V
80°	3.6V	1.4V
90°	4.1V	0.9V
100°	4.5V	0.5V
110°	5.0V	0.0V

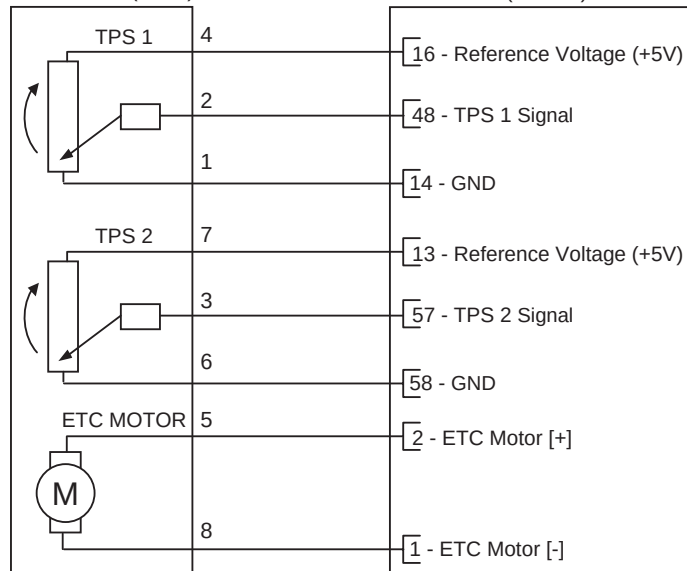
SCHEMATIC DIAGRAM

EF39B8B3

[CIRCUIT DIAGRAM]

ETC Module (C159)

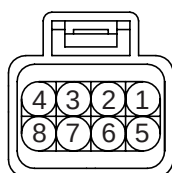
PCM (C151-2)



[CONNECTION INFORMATION]

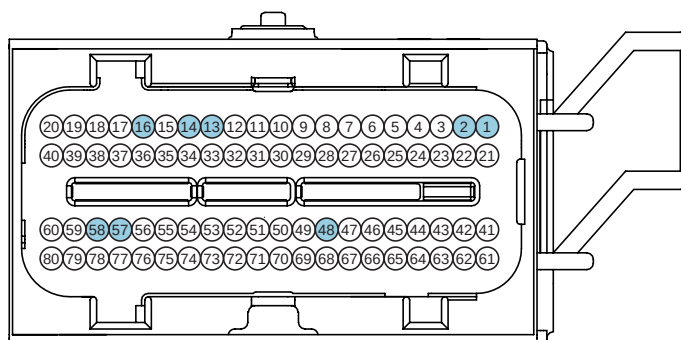
Terminal	Connected to	Function
1	PCM C151-2 (14)	TPS 1 Ground
2	PCM C151-2 (48)	TPS 1 Signal
3	PCM C151-2 (57)	TPS 2 Signal
4	PCM C151-2 (16)	TPS 1 Reference Voltage (+5V)
5	PCM C151-2 (2)	ETC Motor [+] Control
6	PCM C151-2 (58)	TPS 2 Ground
7	PCM C151-2 (13)	TPS 2 Reference Voltage (+5V)
8	PCM C151-2 (1)	ETC Motor [-] Control

[HARNESS CONNECTORS]



C159

ETC MODULE



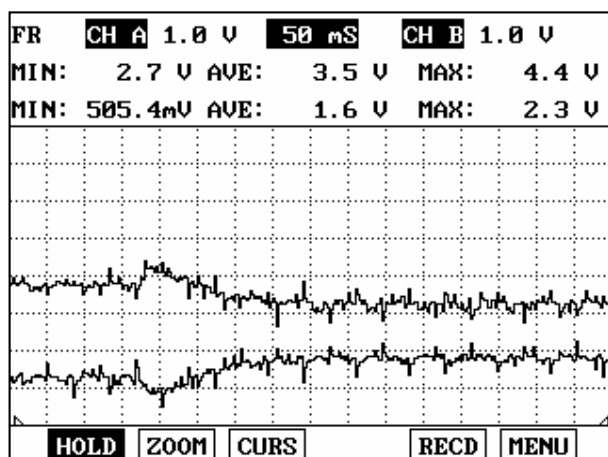
C151-2

PCM

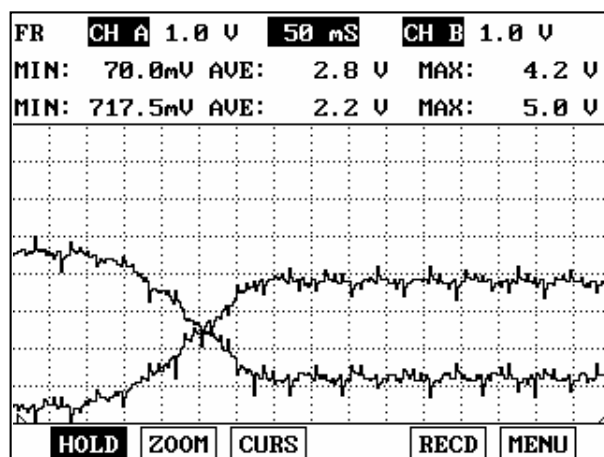
SVQF16101L

SIGNAL WAVEFORM AND DATA

E24A5BA6



Hit the accelerator at IG ON



Open the throttle valve by force at IG ON

EGRF604Z

DTC TROUBLESHOOTING PROCEDURES

FLA -335

MONITOR DTC STATUS E7C113D0

1. Check DTC Status
 - 1) Connect scantool to Data Link Connector(DLC).
 - 2) IG "ON".
 - 3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F4(DTAL) to check DTC's information from the DTCs menu
 - 4) Read "DTC Status" parameter.

1.1 DIAGNOSTIC TROUBLE CODES			
PXXXX DTC TITLE			
NUMBER OF DTC : 1 ITEMS			
PART	ERAS	DTAL	

PXXXX TITLE	
1.MIL STATUS:	ON/OFF
2.DTC STATUS:	PRESENT/HISTORY
3.DIAG.STATUS:	DIAGNOSIS FINISHED
DTC CAUSE TO SYSTEM ERROR : PXXXX	

SCMF16159L

- 5) Is parameter displayed "Present fault"?

YES

- Go to "Terminal and connector inspection" procedure.

NO

- Fault is intermittent caused by poor contact in the sensor' s and/or PCM' s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

TERMINAL AND CONNECTOR INSPECTION EBF4C90A

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

- Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

- ▶ Go to "Power Circuit Inspection" procedure.

POWER CIRCUIT INSPECTION E9ED0C51

1. IG "OFF" and disconnect TPS connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 7 of TPS harness connector and chassis ground.

Specification : Approx. 5V

4. Is the measured voltage within specification ?

YES

- ▶ Go to "Signal circuit inspection" procedure.

NO

- ▶ Repair open or short to ground in power harness, and go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION E2A4F904

1. Check short to ground in harness
 - 1) IG "OFF" and disconnect TPS connector and PCM connector.
 - 2) Measure resistance between terminal 3 of TPS harness connector and chassis ground.
 - 3) Measure resistance between terminals 3 and 6(1) of TPS harness connector.

Specification : Infinite

- 4) Is the measured resistance within specification?

YES

- ▶ Go to "Check open in harness" as follows

NO

- ▶ Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

2. Check open in harness

- 1) IG "OFF" and disconnect TPS connector and PCM connector.
 - 2) Measure resistance between terminal 3 of TPS harness connector and terminal 57 of PCM harness connector.

Specification : Below 1Ω

- 3) Is the measured resistance within specification?

YES

- ▶ Go to "Component Inspection" procedure.

DTC TROUBLESHOOTING PROCEDURES

FLA -337

NO

- Repair open in harness, and go to "Verification of Repair" procedure.

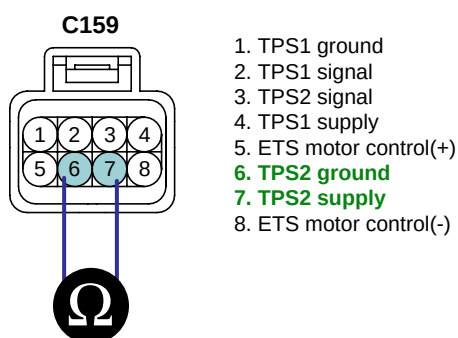
COMPONENT INSPECTION

EADB26DA

1. Check TPS

- 1) IG "OFF" and disconnect TPS connector.
- 2) Measure resistance between terminals 7 and 6 of TPS connector.(Component side)

Specification : 2.7 ~ 4.1k Ω



SVQF16250L

- 3) Is the measured resistance within specification?

YES

- Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

- Substitute with a known - good TPS and check for proper operation. If the problem is corrected, replace TPS and go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others



CAUTION

Procedure of ETS Initialization

1. Erase the trouble codes on PCM
2. Turn the ignition key off and keep this condition until the main relay is turned off.(It will takes 10sec.)
3. Turn ignition key on more than 1second to record the throttle motor position on the EEPROM

VERIFICATION OF VEHICLE REPAIR

ECE0E273

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.

FLA -338

FUEL SYSTEM

2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

- ▶ System performing to specification at this time. Clear the DTC.

NO

- ▶ Go to the applicable troubleshooting procedure.

DTC TROUBLESHOOTING PROCEDURES

FLA -339

DTC P0223 THROTTLE/PEDAL POSITION SENSOR/SWITCH "B" CIRCUIT HIGH INPUT

COMPONENT LOCATION E2DDF6EC

Refer to DTC P0222.

GENERAL DESCRIPTION E1F46B90

The Electronic Throttle Control(ETC) system is made of the components throttle body, Throttle Position Sensor(TPS)1 & 2 and Accelerator Position Sensor(APS) 1 & 2. TPS1 & 2 are sharing the same source voltage and ground. The throttle valve opening is control by throttle motor which is controlled by Engine Control Module(ECM). The opposite position indicator shows inverted signal characteristics. TPS1 output voltage increases smoothly in proportion with the throttle valve opening angle after starting. TPS2 output voltage decreases in inverse proportion with the throttle valve opening angle after starting. TPS provides feedback to the ECM to control the throttle motor in order to control the throttle valve opening angle properly in response to the driving condition.

DTC DESCRIPTION E99F7095

Checking output signals from TPS2 every 8.5 sec. under detecting condition, if an output signal is above 4.75V for more than 0.1 sec., PCM sets P0223. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E0998B07

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal High	• Poor connection • Short to battery in signal harness • Open in ground harness • TPS • PCM
Enable condition	• IG "ON"	
threshold value	• The signal voltage of TPS > 4.75V	
diagnosis time	• Continuous (more than 0.1 sec. failure for every 8.5 sec.test)	
MIL ON condition	• 2 driving cycles	

SPECIFICATION EF1158C6

Refer to DTC P0222.

SCHEMATIC DIAGRAM EB52B2D8

Refer to DTC P0222.

SIGNAL WAVEFORM AND DATA EDE87B15

Refer to DTC P0222.

MONITOR DTC STATUS EFD FE57A

Refer to DTC P0222.

TERMINAL AND CONNECTOR INSPECTION ED7A94AD

Refer to DTC P0222.

SIGNAL CIRCUIT INSPECTION E2452337

1. Check voltage
 - 1) IG "OFF" and disconnect TPS connector.
 - 2) IG "ON and ENG "OFF"
 - 3) Measure voltage between terminal 3 of TPS harness connector and chassis ground.

Specification : Approx. 0V

- 4) Is the measured voltage within specification?

YES

► Go to "Ground Circuit Inspection" procedure.

NO

► Go to "Check short to battery in harness" as follows.

2. Check short to battery in harness
 - 1) IG "OFF" and disconnect TPS connector and PCM connector.
 - 2) Measure resistance between terminals 7 and 3 of TPS harness connector.
 - 3) Measure resistance between terminals 4 and 3 of TPS harness connector.
 - 4) Measure resistance between terminals 5 and 3 of TPS harness connector.
 - 5) Measure resistance between terminals 8 and 3 of TPS harness connector.

Specification : Infinite

- 6) Is the measured resistance within specification?

YES

► Go to "Ground Circuit Inspection" procedure.

NO

► Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION E060618D

1. IG "OFF" and disconnect TPS connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 7 of TPS harness connector and chassis ground.

DTC TROUBLESHOOTING PROCEDURES

FLA -341

4. Measure voltage between terminals 7 and 6 of TPS harness connector.

Specification : Measurement "A" - Measurement 'B' = Approx. below 200mV

5. Is the measured voltage within specification?

YES

- Go to "Component Inspection" procedure.

NO

- Repair open or contact resistance in harness, and go to "Verification of Vehicle Repair" procedure.

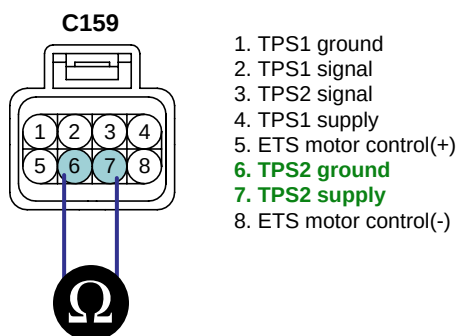
COMPONENT INSPECTION

E2BE8CB7

1. Check TPS

- 1) IG "OFF" and disconnect TPS connector.
- 2) Measure resistance between terminals 7 and 6 of TPS connector.(Component side)

Specification : 2.7 ~ 4.1kΩ



SVQF16250L

- 3) Is the measured resistance within specification?

YES

- Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

- Substitute with a known - good TPS and check for proper operation. If the problem is corrected, replace TPS and go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

CAUTION

Procedure of ETS Initialization

1. *Erase the trouble codes on PCM*
2. *Turn the ignition key off and keep this condition until the main relay is turned off.(It will takes 10sec.)*
3. *Turn ignition key on more than 1second to record the throttle motor position on the EEPROM*

VERIFICATION OF VEHICLE REPAIR

E2F56A35

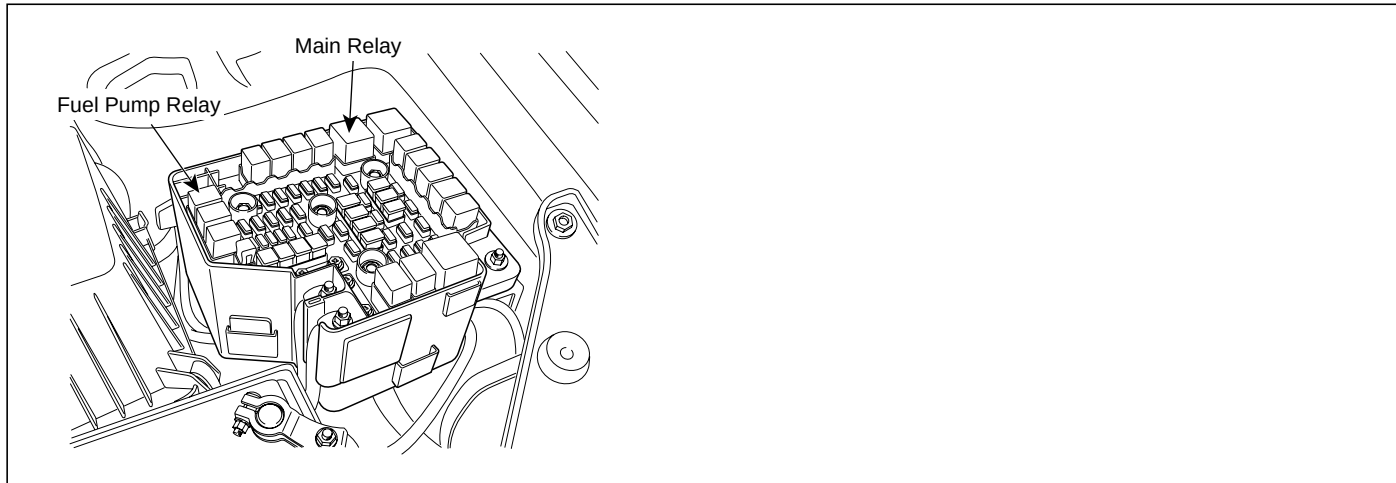
Refer to DTC P0222.

DTC TROUBLESHOOTING PROCEDURES

FLA -343

DTC P0230 FUEL PUMP PRIMARY CIRCUIT

COMPONENT LOCATION ECC8A902



SCMF16254L

GENERAL DESCRIPTION E6E9EF13

The ECM provides ground to one side of the coil in the fuel pump relay to control the fuel pump relay. The other side of the fuel pump relay coil is connected to fuel pump relay, which activates when the ignition switch is ON. The ECM monitors the control circuit between the fuel pump relay and the ECM. When the ignition switch is turned ON, the ECM energizes the fuel pump relay, which sends power to the fuel pump.

DTC DESCRIPTION E614D1F8

Checking fuel pump relay circuit continuously under detecting condition, if open or short in the circuit is detected, PCM sets P0230. In addition, Take note that open circuit in Main Relay may cause this P0230 code.

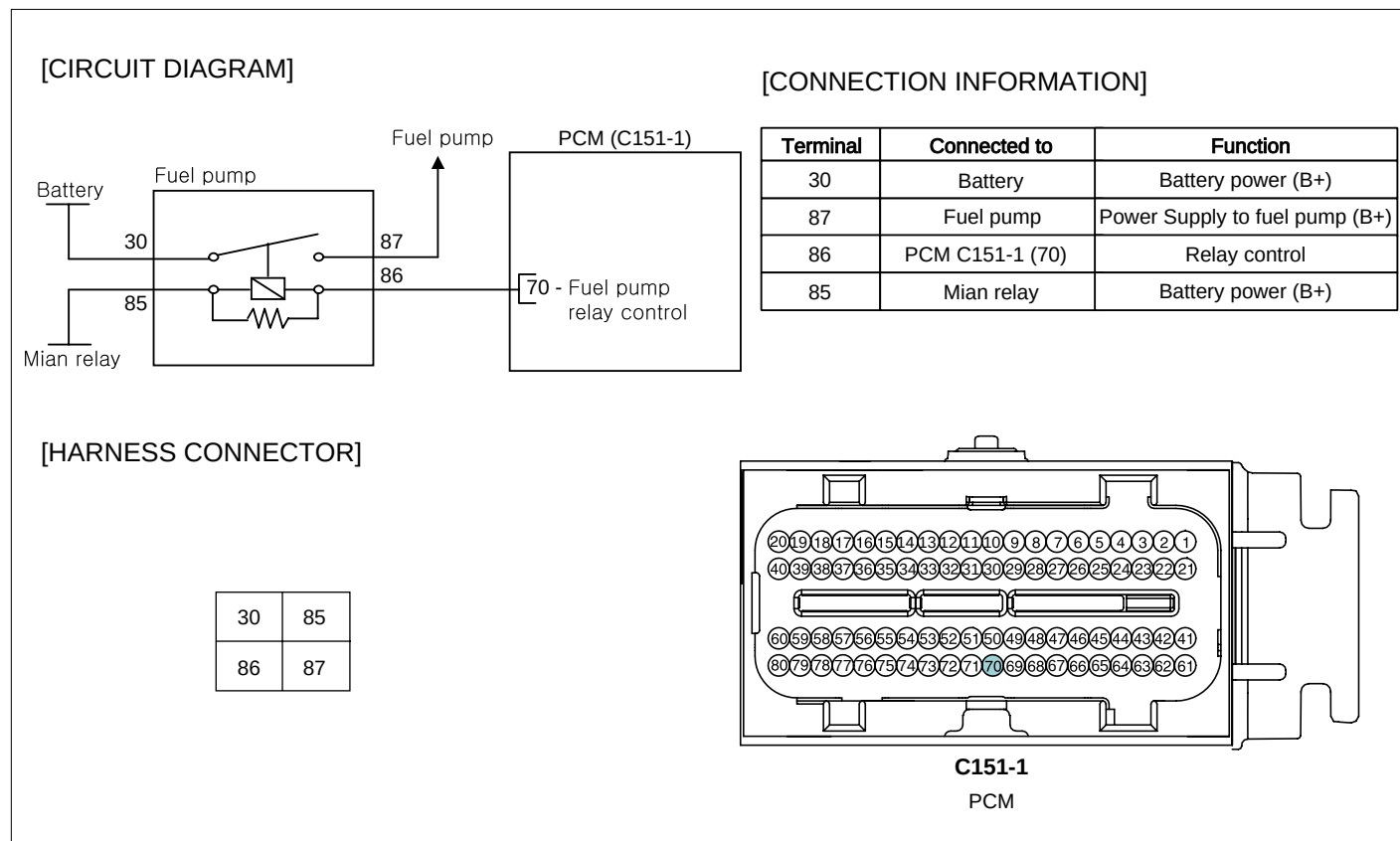
※ In addition, Take note that open circuit in Main Relay may cause this P0230 code.

DTC DETECTING CONDITION EBBFCD8E

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal Low or High	• Poor connection • Open or short in fuel pump relay circuit • Open in Main Relay circuit • Fuel Pump Relay • PCM
Enable condition	• $11V \leq \text{Battery Voltage} \leq 16V$	
threshold value	• Open or short	
diagnosis time	• Continuous	
MIL ON condition	• NO MIL ON(DTC only)	

SCHEMATIC DIAGRAM

E60A2C29



SVQF16255L

MONITOR DTC STATUS

EE0FF7EC

1. Check DTC Status

- 1) Connect scantool to Data Link Connector(DLC).
- 2) IG "ON".
- 3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F4(DTAL) to check DTC's information from the DTCs menu
- 4) Read "DTC Status" parameter.

1.1 DIAGNOSTIC TROUBLE CODES			
PXXXX DTC TITLE			
NUMBER OF DTC : 1 ITEMS			
PART	ERAS	DTAL	

PXXXX TITLE	
1.MIL STATUS:	ON/OFF
2.DTC STATUS:	PRESENT/HISTORY
3.DIAG.STATUS:	DIAGNOSIS FINISHED
DTC CAUSE TO SYSTEM ERROR : PXXXX	

SCMF16159L

5) Is parameter displayed "Present fault"?

YES

► Go to "Terminal and connector inspection" procedure.

NO

► Fault is intermittent caused by poor contact in the sensor' s and/or PCM' s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

TERMINAL AND CONNECTOR INSPECTION

E4D51B0A

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

► Repair or replace if necessary and go to "Verification of Vehicle Repair" procedure

NO

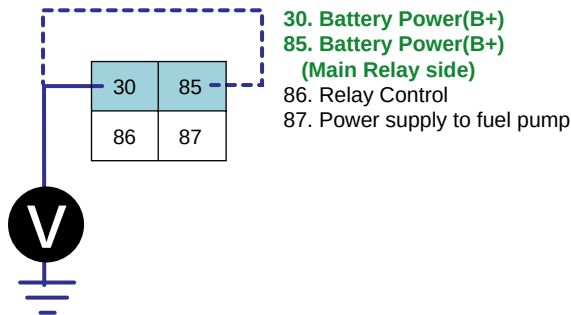
► Go to "Power Circuit Inspection" procedure.

POWER CIRCUIT INSPECTION

EB120C99

1. IG "OFF" & ENG "OFF"
2. Disconnect fuel pump relay.
3. IG "ON" & ENG "OFF"
4. Measure voltage between harness terminal 30(85) of chassis ground.

Specification : B+



SVQF16608L

5. Is the measured voltage within specification ?

YES

► Go to "Control Circuit Inspection" procedure.

NO

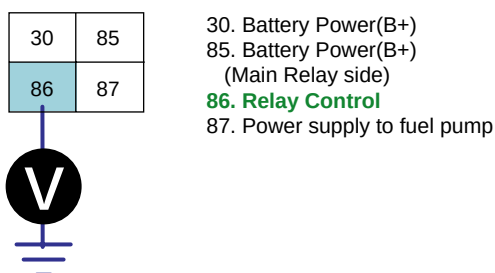
- Check "Fuse" between fuel pump relay and main relay is not installed or blown off
- Check "Fuse" between fuel pump relay and battery is not installed or blown off
- Especially, if battery voltage at terminal 85 is not detected, replace the Main Relay.
- Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

E800A71E

1. IG "OFF"
2. Disconnect fuel pump relay.
3. IG "ON" & ENG "OFF"
4. Measure voltage between harness terminal 86 and chassis ground.

Specification : Approx. 2.5V



SVQF16609L

5. Is the measured voltage within specification ?

YES

DTC TROUBLESHOOTING PROCEDURES

FLA -347

- Go to "Component Inspection" procedure.

NO

- Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

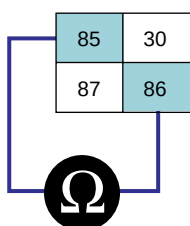
COMPONENT INSPECTION

E6D72E04

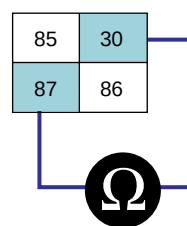
1. Check fuel pump relay
 - 1) IG "OFF"
 - 2) Disconnect Fuel Pump Relay
 - 3) Measure resistance between terminal 30 and 87 of Fuel Pump Relay
 - 4) Measure resistance between terminal 85 and 86 of Fuel Pump Relay

SPECIFICATION :

Terminal	continuity
30 ~ 87	NO
85 ~ 86	YES (Approx. 70Ω ~ 120Ω)



30. Battery Power(B+)
85. Battery Power(B+)
(Main Relay side)
86. Relay Control
87. Power supply to fuel pump



SVQF16610L

- 5) Is the measured resistance within specification ?

YES

- Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

- Substitute with a known - good Fuel Pump Relay and check for proper operation. If the problem is corrected, replace Fuel Pump Relay and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

EE7C6F22

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

- ▶ System performing to specification at this time. Clear the DTC.

NO

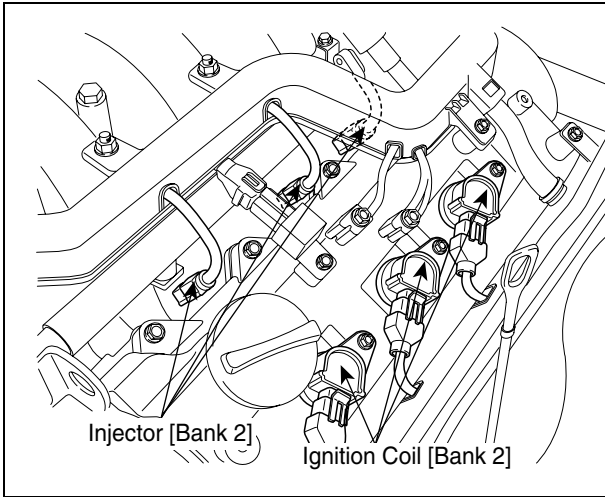
- ▶ Go to the applicable troubleshooting procedure.

DTC TROUBLESHOOTING PROCEDURES

FLA -349

DTC P0261 CYLINDER 1-INJECTOR CIRCUIT LOW

COMPONENT LOCATION EA07F81A



LGLG512A

GENERAL DESCRIPTION EBE9969F

Based on information from various sensors, the ECM measures the fuel injection amount. The fuel injector is a solenoid-operated valve and the fuel injection amount is controlled by length of time the fuel injector is held open. The ECM controls each injector by grounding the control circuit. When the ECM energizes the injector by grounding the control circuit, the circuit voltage should be low (theoretically 0V) and the fuel is injected. When the ECM de-energizes the injector by opening the control circuit, the fuel injector is closed and circuit voltage should momentarily peak.

DTC DESCRIPTION E0829D7F

Checking output signals from injectors. Under detecting condition, if an output signal is low, PCM sets P0261. MIL (Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION EFE811AE

Item	Detecting Condition	Possible Cause
DTC Strategy	Signal Low	- Poor connection - Open or short to ground in power harness - Open or short to ground in control harness - Injector - PCM
Enable condition	- Engine running state $11V \leq \text{Battery voltage} \leq 16V$ - Above conditions are met $> 0.5\text{sec.}$ - No disabling faults present	
threshold value	Open or short to ground	
diagnosis time	Continuous	
MIL ON condition	2 driving cycles	

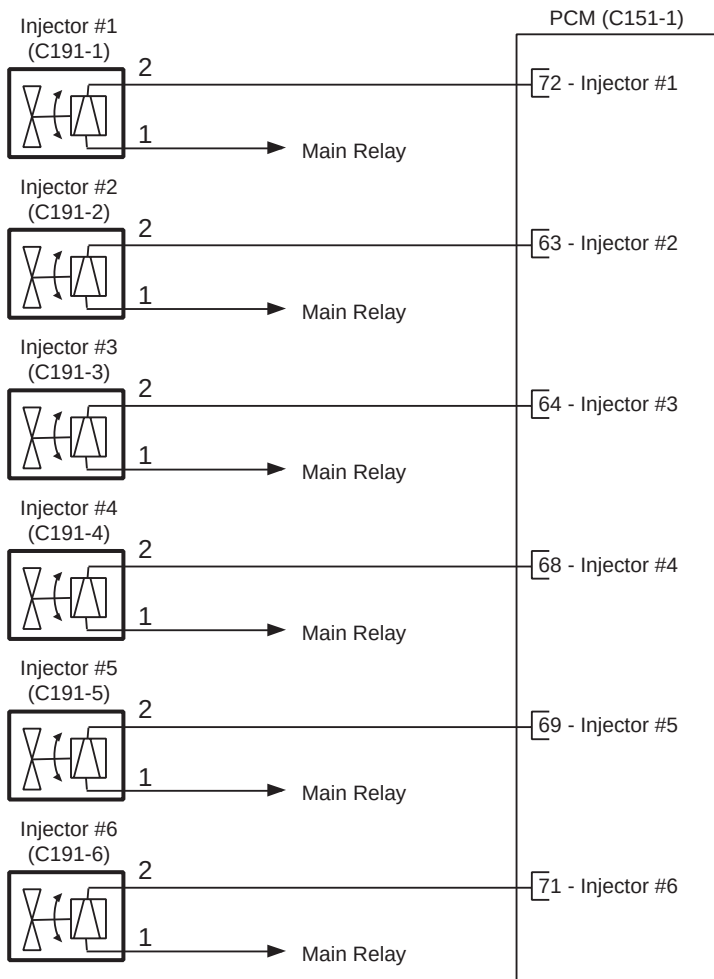
SPECIFICATION ECC7150B

Item	Coil resistance(Ω)
Injector	$13.8 \sim 15.2\Omega$ [20°C (68°F)]

SCHEMATIC DIAGRAM

E6B67638

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Injector #1

Terminal	Connected to	Function
1	PCM C151-1 (72)	Injector #1 control
2	Main Relay	Battery Voltage (B+)

Injector #2

Terminal	Connected to	Function
1	PCM C151-1 (63)	Injector #2 control
2	Main Relay	Battery Voltage (B+)

Injector #3

Terminal	Connected to	Function
1	PCM C151-1 (64)	Injector #3 control
2	Main Relay	Battery Voltage (B+)

Injector #4

Terminal	Connected to	Function
1	PCM C151-1 (68)	Injector #4 control
2	Main Relay	Battery Voltage (B+)

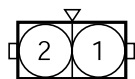
Injector #5

Terminal	Connected to	Function
1	PCM C151-1 (69)	Injector #5 control
2	Main Relay	Battery Voltage (B+)

Injector #6

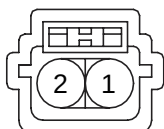
Terminal	Connected to	Function
1	PCM C151-1 (71)	Injector #6 control
2	Main Relay	Battery Voltage (B+)

[HARNESS CONNECTORS]



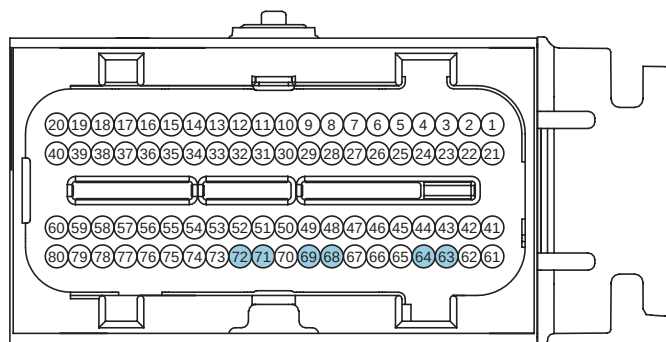
C191-1,3,5

Injector #1,3,5



C191-2,4,6

Injector #2,4,6



C151-1

PCM

SVQF16113L

F16CB445



E4BE54AA

PXXXX TITLE	
1.MIL STATUS:	ON/OFF
2.DTC STATUS:	PRESENT/HISTORY
3.DIAG.STATUS:	DIAGNOSIS FINISHED
DTC CAUSE TO SYSTEM ERROR : PXXXX	

SCMF16159L

- YES**

- <https://autolibrary.ir>***

NO

► Fault is intermittent caused by poor contact in the sensor' s and/or PCM' s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

TERMINAL AND CONNECTOR INSPECTION ECB23331

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

► Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

► Go to "Power Circuit Inspection" procedure.

POWER CIRCUIT INSPECTION E37F10FF

1. IG "ON" and disconnect injector connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 1 of injector harness connector and chassis ground.

Specification : B+

4. Is the measured voltage within specification?

YES

► Go to "Control Circuit Inspection" procedure.

NO

- Check open or connection of the fuse connected to injector power supply.
- Repair open or short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION EDC281C2

1. Check short to ground in harness
 - 1) IG "OFF" and disconnect injector connector and PCM connector.
 - 2) Measure resistance between terminal 2 of injector harness connector and chassis ground.

Specification : Infinite

DTC TROUBLESHOOTING PROCEDURES

FLA -353

3) Is the measured resistance within specification?

YES

► Go to "Check open in harness" as follows.

NO

► Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

2. Check open in harness

1) IG "OFF" and disconnect injector connector and PCM connector.

2) Measure resistance between terminal 2 of injector harness connector and 72 of PCM harness connector.

Specification : Below 1Ω

3) Is the measured resistance within specification?

YES

► Go to "Component Inspection" procedure.

NO

► Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

E36E5AB0

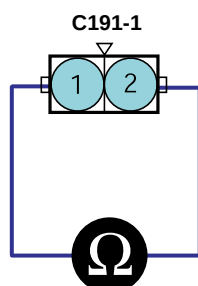
1. Check injector

1) IG "OFF" and disconnect injector connector.

2) Measure resistance between terminals 1 and 2 of injector connector.(Component side)

SPECIFICATION :

Item	Coil resistance(Ω)
Injector	13.8 ~ 15.2 Ω [20°C (68°F)]



1. Battery voltage
2. Injector #1 control

SVQF16260L

3) Is the measured resistance within specification?

YES

► Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

► Substitute with a known - good injector and check for proper operation. If the problem is corrected, replace injector and go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR EEE753BC

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

► System performing to specification at this time. Clear the DTC.

NO

► Go to the applicable troubleshooting procedure.

DTC TROUBLESHOOTING PROCEDURES

FLA -355

DTC P0262 CYLINDER 1-INJECTOR CIRCUIT HIGH

COMPONENT LOCATION E150E0E6

Refer to DTC P0261.

GENERAL DESCRIPTION EEF3FBEA

Refer to DTC P0261.

DTC DESCRIPTION E8A8A39D

Checking output signals from injectors. Under detecting condition, if an output signal is high, PCM sets P0262. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E1EF623E

Item	Detecting Condition	Possible Cause
DTC Strategy	Signal High	- Poor connection - Short to battery in harness - Injector - PCM
Enable condition	- Engine running state $11V \leq \text{Battery voltage} \leq 16V$ - Above conditions are met $> 0.5\text{sec.}$ - No disabling faults present	
threshold value	Short to battery	
diagnosis time	Continuous	
MIL ON condition	2 driving cycles	

SPECIFICATION E7E796A6

Item	Coil resistance(Ω)
Injector	$13.8 \sim 15.2\Omega$ [20°C (68°F)]

SCHEMATIC DIAGRAM ECE17432

Refer to DTC P0261.

SIGNAL WAVEFROM AND DATA E1FF3458

Refer to DTC P0261.

MONITOR DTC STATUS E59DA212

Refer to DTC P0261.

TERMINAL AND CONNECTOR INSPECTION EA245884

Refer to DTC P0261.

CONTROL CIRCUIT INSPECTION

E76F012F

1. Check voltage

- 1) IG "OFF" and disconnect injector connector.
- 2) IG "ON" and ENG "OFF"
- 3) Measure voltage between terminal 2 of injector harness connector and chassis ground.

Specification : Approx. 0V

- 4) Is the measured voltage within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Go to "Check short to battery in harness" as follows.

2. Check short to battery in harness

- 1) IG "OFF" and disconnect injector connector and PCM connector.
- 2) Measure resistance between terminals 1 and 2 of injector harness connector.

Specification : Infinite

- 3) Is the measured resistance within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

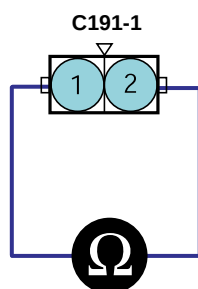
E2DB98CB

1. Check injector

- 1) IG "OFF" and disconnect injector connector.
- 2) Measure resistance between terminals 1 and 2 of injector connector.(Component side)

SPECIFICATION :

Item	Coil resistance(Ω)
Injector	13.8 ~ 15.2 Ω [20°C (68°F)]



1. Battery voltage
2. Injector #1 control

SVQF16260L

3) Is the measured resistance within specification?

YES

► Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

► Substitute with a known - good injector and check for proper operation. If the problem is corrected, replace injector and go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

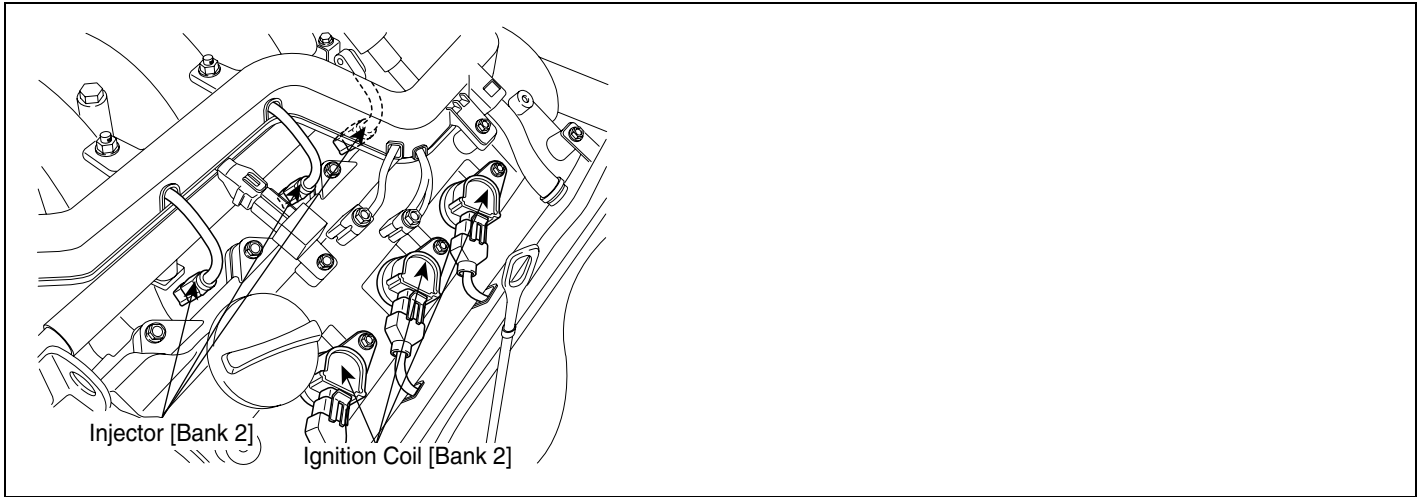
VERIFICATION OF VEHICLE REPAIR

E12658ED

Refer to DTC P0261.

DTC P0264 CYLINDER 2-INJECTOR CIRCUIT LOW

COMPONENT LOCATION ED34E79D



LGLG512A

GENERAL DESCRIPTION E8EDE704

Based on information from various sensors, the ECM measures the fuel injection amount. The fuel injector is a solenoid-operated valve and the fuel injection amount is controlled by length of time the fuel injector is held open. The ECM controls each injector by grounding the control circuit. When the ECM energizes the injector by grounding the control circuit, the circuit voltage should be low (theoretically 0V) and the fuel is injected. When the ECM de-energizes the injector by opening the control circuit, the fuel injector is closed and circuit voltage should momentarily peak.

DTC DESCRIPTION ECDD9FE7

Checking output signals from injectors. Under detecting condition, if an output signal is low, PCM sets P0264. MIL (Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E884B16F

Item	Detecting Condition	Possible Cause
DTC Strategy	Signal Low	- Poor connection - Open or short to ground in power harness - Open or short to ground in control harness - Injector - PCM
Enable condition	- Engine running state $11V \leq \text{Battery voltage} \leq 16V$ - Above conditions are met $> 0.5\text{sec.}$ - No disabling faults present	
threshold value	Open or short to ground	
diagnosis time	Continuous	
MIL ON condition	2 driving cycles	

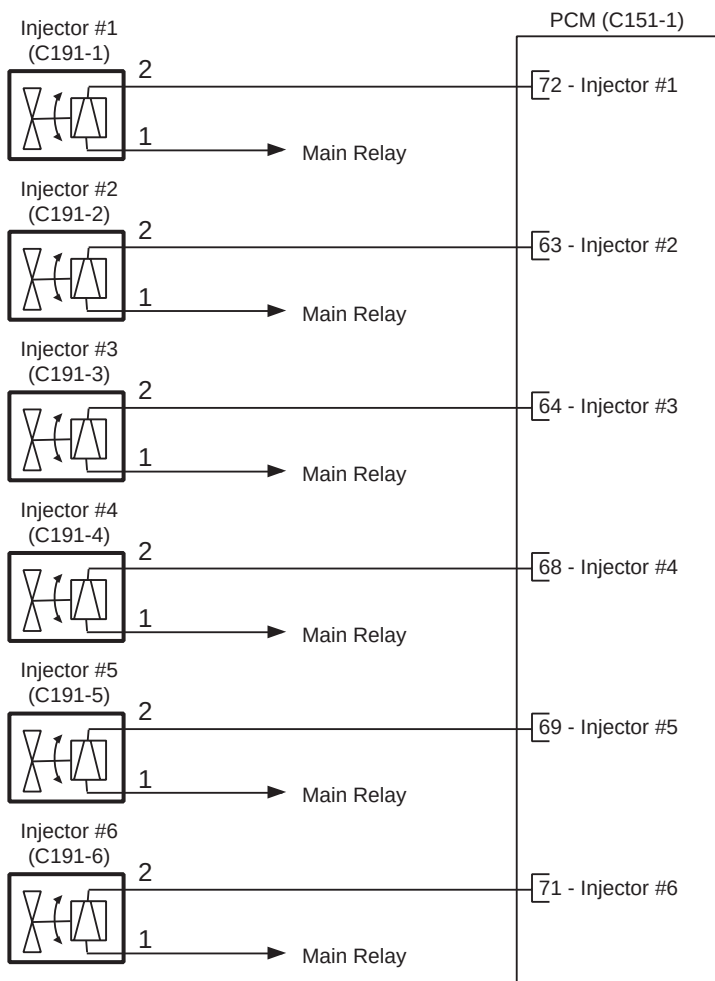
SPECIFICATION E3AE383C

Item	Coil resistance(Ω)
Injector	$13.8 \sim 15.2\Omega$ [20°C (68°F)]

SCHEMATIC DIAGRAM

EEAE8634

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Injector #1

Terminal	Connected to	Function
1	PCM C151-1 (72)	Injector #1 control
2	Main Relay	Battery Voltage (B+)

Injector #2

Terminal	Connected to	Function
1	PCM C151-1 (63)	Injector #2 control
2	Main Relay	Battery Voltage (B+)

Injector #3

Terminal	Connected to	Function
1	PCM C151-1 (64)	Injector #3 control
2	Main Relay	Battery Voltage (B+)

Injector #4

Terminal	Connected to	Function
1	PCM C151-1 (68)	Injector #4 control
2	Main Relay	Battery Voltage (B+)

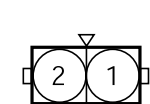
Injector #5

Terminal	Connected to	Function
1	PCM C151-1 (69)	Injector #5 control
2	Main Relay	Battery Voltage (B+)

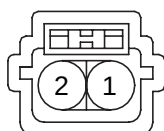
Injector #6

Terminal	Connected to	Function
1	PCM C151-1 (71)	Injector #6 control
2	Main Relay	Battery Voltage (B+)

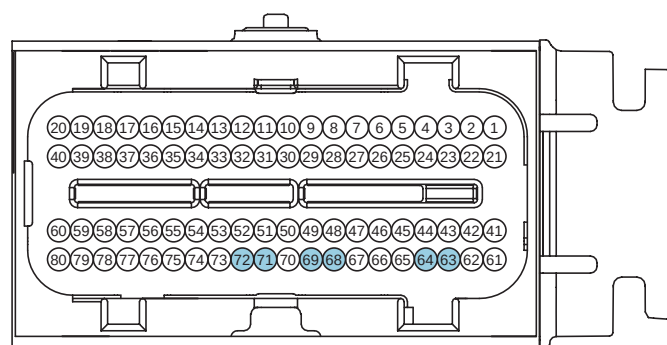
[HARNESS CONNECTORS]



C191-1,3,5
Injector #1,3,5



C191-2,4,6
Injector #2,4,6

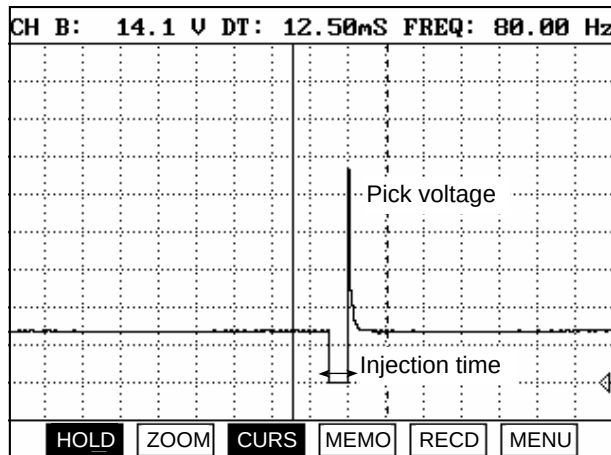


C151-1
PCM

SVQF16113L

SIGNAL WAVEFORM AND DATE

E42BD784



EGRF607S

When the PCM energizes the injector by grounding control circuit, the circuit voltage should be low (theoretically 0V) and the fuel is injected. When the PCM de-energizes the injector by opening control circuit, the fuel injector is closed and circuit voltage should be peak at a moment.

MONITOR DTC STATUS

E6BD0D3C

1. Check DTC Status

- 1) Connect scantool to Data Link Connector(DLC).
- 2) IG "ON".
- 3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F4(DTAL) to check DTC's information from the DTCs menu
- 4) Read "DTC Status" parameter.

1.1 DIAGNOSTIC TROUBLE CODES	
PXXXX	DTC TITLE
NUMBER OF DTC : 1 ITEMS	
PART	ERAS
DTAL	

PXXXX TITLE	
1.MIL STATUS:	ON/OFF
2.DTC STATUS:	PRESENT/HISTORY
3.DIAG.STATUS:	DIAGNOSIS FINISHED
DTC CAUSE TO SYSTEM ERROR : PXXXX	

SCMF16159L

5) Is parameter displayed "Present fault"?

YES

- Go to "Terminal and connector inspection" procedure.

DTC TROUBLESHOOTING PROCEDURES

FLA -361

NO

► Fault is intermittent caused by poor contact in the sensor' s and/or PCM' s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

TERMINAL AND CONNECTOR INSPECTION E8BE694E

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

► Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

► Go to "Power Circuit Inspection" procedure.

POWER CIRCUIT INSPECTION E9784FC2

1. IG "ON" and disconnect injector connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 1 of injector harness connector and chassis ground.

Specification : B+

4. Is the measured voltage within specification?

YES

► Go to "Control Circuit Inspection" procedure.

NO

- Check open or connection of the fuse connected to injector power supply.
- Repair open or short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION EACF7F2E

1. Check short to ground in harness
 - 1) IG "OFF" and disconnect injector connector and PCM connector.
 - 2) Measure resistance between terminal 2 of injector harness connector and chassis ground.

Specification : Infinite

3) Is the measured resistance within specification?

YES

► Go to "Check open in harness" as follows.

NO

► Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

2. Check open in harness

1) IG "OFF" and disconnect injector connector and PCM connector.

2) Measure resistance between terminal 2 of injector harness connector and 63 of PCM harness connector.

Specification : Below 1Ω

3) Is the measured resistance within specification?

YES

► Go to "Component Inspection" procedure.

NO

► Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EACEEF5C

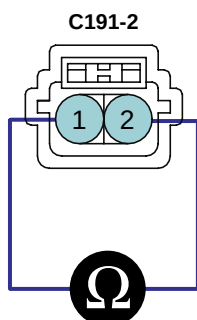
1. Check injector

1) IG "OFF" and disconnect injector connector.

2) Measure resistance between terminals 1 and 2 of injector connector.(Component side)

SPECIFICATION :

Item	Coil resistance(Ω)
Injector	13.8 ~ 15.2 Ω [20°C (68°F)]



- 1. Battery voltage
- 2. Injector #2 control

SVQF16291L

3) Is the measured resistance within specification?

YES

DTC TROUBLESHOOTING PROCEDURES

FLA -363

- ▶ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

- ▶ Substitute with a known - good injector and check for proper operation. If the problem is corrected, replace injector and go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

EFDB5D51

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

- ▶ System performing to specification at this time. Clear the DTC.

NO

- ▶ Go to the applicable troubleshooting procedure.

FLA -364

FUEL SYSTEM

DTC P0265 CYLINDER 2-INJECTOR CIRCUIT HIGH

COMPONENT LOCATION EF94DCB4

Refer to DTC P0264.

GENERAL DESCRIPTION E7E501E2

Refer to DTC P0264.

DTC DESCRIPTION EC01C04C

Checking output signals from injectors. Under detecting condition, if an output signal is high, PCM sets P0265. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E7FE5F4C

Item	Detecting Condition	Possible Cause
DTC Strategy	Signal High	- Poor connection - Short to battery in harness - Injector - PCM
Enable condition	- Engine running state $11V \leq \text{Battery voltage} \leq 16V$ - Above conditions are met $> 0.5\text{sec.}$ - No disabling faults present	
threshold value	Short to battery	
diagnosis time	Continuous	
MIL ON condition	2 driving cycles	

SPECIFICATION ED3291DC

Item	Coil resistance(Ω)
Injector	13.8 ~ 15.2 Ω [20°C (68°F)]

SCHEMATIC DIAGRAM E0C3AC69

Refer to DTC P0264.

SIGNAL WAVEFROM AND DATA ECB4E06A

Refer to DTC P0264.

MONITOR DTC STATUS EFDCEC1D

Refer to DTC P0264.

TERMINAL AND CONNECTOR INSPECTION E10164B2

Refer to DTC P0264.

DTC TROUBLESHOOTING PROCEDURES

FLA -365

CONTROL CIRCUIT INSPECTION E9DAD1EB

1. Check voltage

- 1) IG "OFF" and disconnect injector connector.
- 2) IG "ON" and ENG "OFF"
- 3) Measure voltage between terminal 2 of injector harness connector and chassis ground.

Specification : Approx. 0V

- 4) Is the measured voltage within specification?

YES

- Go to "Component Inspection" procedure.

NO

- Go to "Check short to battery in harness" as follows.

2. Check short to battery in harness

- 1) IG "OFF" and disconnect injector connector and PCM connector.
- 2) Measure resistance between terminals 1 and 2 of injector harness connector.

Specification : Infinite

- 3) Is the measured resistance within specification?

YES

- Go to "Component Inspection" procedure.

NO

- Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

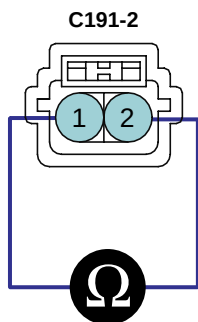
COMPONENT INSPECTION EC817EA8

1. Check injector

- 1) IG "OFF" and disconnect injector connector.
- 2) Measure resistance between terminals 1 and 2 of injector connector.(Component side)

SPECIFICATION :

Item	Coil resistance(Ω)
Injector	13.8 ~ 15.2 Ω [20°C (68°F)]



1. Battery voltage
2. Injector #2 control

SVQF16291L

3) Is the measured resistance within specification?

YES

► Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

► Substitute with a known - good injector and check for proper operation. If the problem is corrected, replace injector and go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

EB88867F

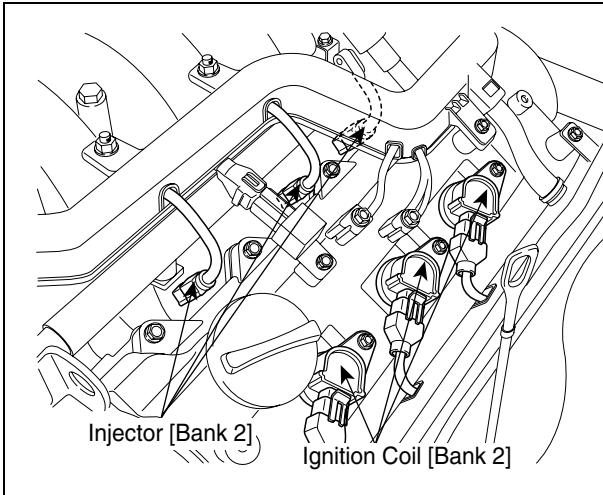
Refer to DTC P0264.

DTC TROUBLESHOOTING PROCEDURES

FLA -367

DTC P0267 CYLINDER 3-INJECTOR CIRCUIT LOW

COMPONENT LOCATION E9B077D1



LGLG512A

GENERAL DESCRIPTION E871AEE6

Based on information from various sensors, the ECM measures the fuel injection amount. The fuel injector is a solenoid-operated valve and the fuel injection amount is controlled by length of time the fuel injector is held open. The ECM controls each injector by grounding the control circuit. When the ECM energizes the injector by grounding the control circuit, the circuit voltage should be low (theoretically 0V) and the fuel is injected. When the ECM de-energizes the injector by opening the control circuit, the fuel injector is closed and circuit voltage should momentarily peak.

DTC DESCRIPTION EFC9531D

Checking output signals from injectors. Under detecting condition, if an output signal is low, PCM sets P0267. MIL (Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION EAADD816

Item	Detecting Condition	Possible Cause
DTC Strategy	Signal Low	- Poor connection - Open or short to ground in power harness - Open or short to ground in control harness - Injector - PCM
Enable condition	- Engine running state $11V \leq \text{Battery voltage} \leq 16V$ - Above conditions are met $> 0.5\text{sec.}$ - No disabling faults present	
threshold value	Open or short to ground	
diagnosis time	Continuous	
MIL ON condition	2 driving cycles	

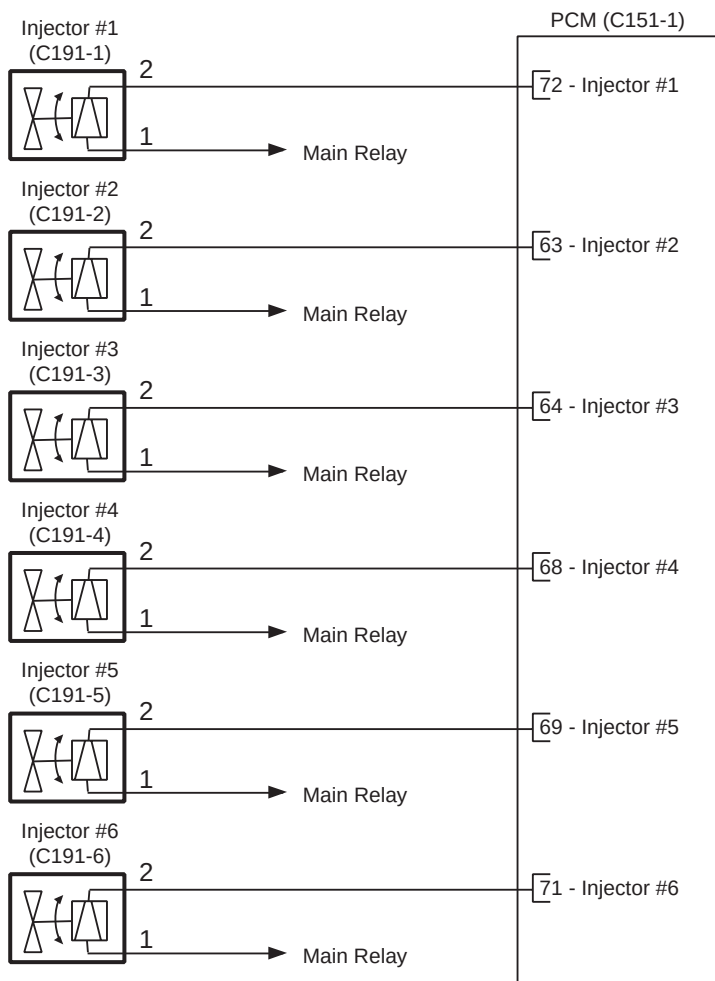
SPECIFICATION ED05ED1A

Item	Coil resistance(Ω)
Injector	$13.8 \sim 15.2\Omega$ [20°C (68°F)]

SCHEMATIC DIAGRAM

E7C0EB82

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Injector #1

Terminal	Connected to	Function
1	PCM C151-1 (72)	Injector #1 control
2	Main Relay	Battery Voltage (B+)

Injector #2

Terminal	Connected to	Function
1	PCM C151-1 (63)	Injector #2 control
2	Main Relay	Battery Voltage (B+)

Injector #3

Terminal	Connected to	Function
1	PCM C151-1 (64)	Injector #3 control
2	Main Relay	Battery Voltage (B+)

Injector #4

Terminal	Connected to	Function
1	PCM C151-1 (68)	Injector #4 control
2	Main Relay	Battery Voltage (B+)

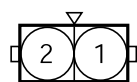
Injector #5

Terminal	Connected to	Function
1	PCM C151-1 (69)	Injector #5 control
2	Main Relay	Battery Voltage (B+)

Injector #6

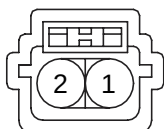
Terminal	Connected to	Function
1	PCM C151-1 (71)	Injector #6 control
2	Main Relay	Battery Voltage (B+)

[HARNESS CONNECTORS]



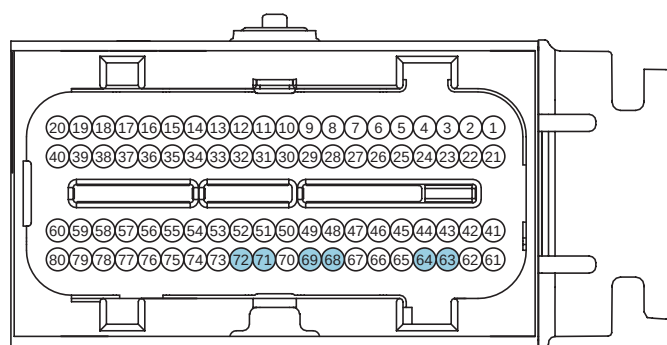
C191-1,3,5

Injector #1,3,5



C191-2,4,6

Injector #2,4,6

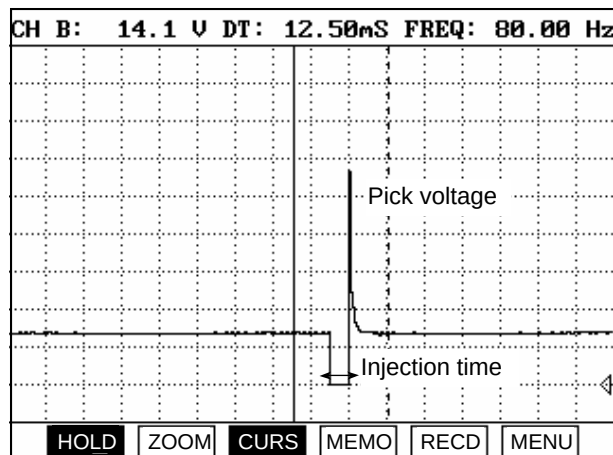


C151-1

PCM

SVQF16113L

SIGNAL WAVEFORM AND DATE E695CAE8



EGRF607S

When the PCM energizes the injector by grounding control circuit, the circuit voltage should be low (theoretically 0V) and the fuel is injected. When the PCM de-energizes the injector by opening control circuit, the fuel injector is closed and circuit voltage should be peak at a moment.

MONITOR DTC STATUS E490BF1B

1. Check DTC Status
 - 1) Connect scantool to Data Link Connector(DLC).
 - 2) IG "ON".
 - 3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F4(DTAL) to check DTC's information from the DTCs menu
 - 4) Read "DTC Status" parameter.

1.1 DIAGNOSTIC TROUBLE CODES	
PXXXX	DTC TITLE
NUMBER OF DTC : 1 ITEMS	
PART	ERAS DTAL

PXXXX TITLE	
1.MIL STATUS:	ON/OFF
2.DTC STATUS:	PRESENT/HISTORY
3.DIAG.STATUS:	DIAGNOSIS FINISHED
DTC CAUSE TO SYSTEM ERROR : PXXXX	

SCMF16159L

- 5) Is parameter displayed "Present fault"?

YES

- Go to "Terminal and connector inspection" procedure.

NO

► Fault is intermittent caused by poor contact in the sensor' s and/or PCM' s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

TERMINAL AND CONNECTOR INSPECTION E25B665F

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

► Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

► Go to "Power Circuit Inspection" procedure.

POWER CIRCUIT INSPECTION E94C0FBB

1. IG "ON" and disconnect injector connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 1 of injector harness connector and chassis ground.

Specification : B+

4. Is the measured voltage within specification?

YES

► Go to "Control Circuit Inspection" procedure.

NO

- Check open or connection of the fuse connected to injector power supply.
- Repair open or short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION E407029B

1. Check short to ground in harness
 - 1) IG "OFF" and disconnect injector connector and PCM connector.
 - 2) Measure resistance between terminal 2 of injector harness connector and chassis ground.

Specification : Infinite

DTC TROUBLESHOOTING PROCEDURES

FLA -371

3) Is the measured resistance within specification?

YES

► Go to "Check open in harness" as follows.

NO

► Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

2. Check open in harness

1) IG "OFF" and disconnect injector connector and PCM connector.

2) Measure resistance between terminal 2 of injector harness connector and 64 of PCM harness connector.

Specification : Below 1Ω

3) Is the measured resistance within specification?

YES

► Go to "Component Inspection" procedure.

NO

► Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

EB87292A

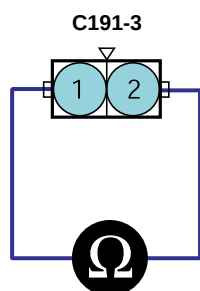
1. Check injector

1) IG "OFF" and disconnect injector connector.

2) Measure resistance between terminals 1 and 2 of injector connector.(Component side)

SPECIFICATION :

Item	Coil resistance(Ω)
Injector	13.8 ~ 15.2 Ω [20°C (68°F)]



1. Battery voltage
2. Injector #3 control

SVQF16273L

3) Is the measured resistance within specification?

YES

► Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

► Substitute with a known - good injector and check for proper operation. If the problem is corrected, replace injector and go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

E26CF43F

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

► System performing to specification at this time. Clear the DTC.

NO

► Go to the applicable troubleshooting procedure.

DTC TROUBLESHOOTING PROCEDURES

FLA -373

DTC P0268 CYLINDER 3-INJECTOR CIRCUIT HIGH

COMPONENT LOCATION EDACC98A

Refer to DTC P0267.

GENERAL DESCRIPTION E61CF410

Refer to DTC P0267.

DTC DESCRIPTION EABB7108

Checking output signals from injectors. Under detecting condition, if an output signal is high, PCM sets P0268. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till continuous 2 driving cycle.

DTC DETECTING CONDITION ED8CA155

Item	Detecting Condition	Possible Cause
DTC Strategy	Signal High	- Poor connection - Short to battery in harness - Injector - PCM
Enable condition	- Engine running state $11V \leq \text{Battery voltage} \leq 16V$ - Above conditions are met $> 0.5\text{sec.}$ - No disabling faults present	
threshold value	Short to battery	
diagnosis time	Continuous	
MIL ON condition	2 driving cycles	

SPECIFICATION EF910403

Item	Coil resistance(Ω)
Injector	$13.8 \sim 15.2\Omega$ [20°C (68°F)]

SCHEMATIC DIAGRAM EEBCA29E

Refer to DTC P0267.

SIGNAL WAVEFROM AND DATA ED47BC4B

Refer to DTC P0267.

MONITOR DTC STATUS EC8E05D8

Refer to DTC P0267.

TERMINAL AND CONNECTOR INSPECTION E94E7E65

Refer to DTC P0267.

CONTROL CIRCUIT INSPECTION

EC4193F2

1. Check voltage

- 1) IG "OFF" and disconnect injector connector.
- 2) IG "ON" and ENG "OFF"
- 3) Measure voltage between terminal 2 of injector harness connector and chassis ground.

Specification : Approx. 0V

- 4) Is the measured voltage within specification?

YES

► Go to "Component Inspection" procedure.

NO

► Go to "Check short to battery in harness" as follows.

2. Check short to battery in harness

- 1) IG "OFF" and disconnect injector connector and PCM connector.
- 2) Measure resistance between terminals 1 and 2 of injector harness connector.

Specification : Below 1Ω

- 3) Is the measured resistance within specification?

YES

► Go to "Component Inspection" procedure.

NO

► Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

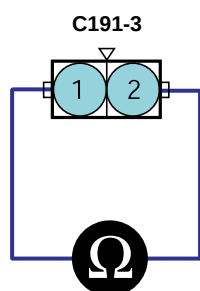
EF90E1D4

1. Check injector

- 1) IG "OFF" and disconnect injector connector.
- 2) Measure resistance between terminals 1 and 2 of injector connector.(Component side)

SPECIFICATION :

Item	Coil resistance(Ω)
Injector	13.8 ~ 15.2Ω [20℃(68°F)]



1. Battery voltage
2. Injector #3 control

SVQF16273L

3) Is the measured resistance within specification?

YES

► Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

► Substitute with a known - good injector and check for proper operation. If the problem is corrected, replace injector and go to "Verification of Vehicle Repair" procedure.



NOTE

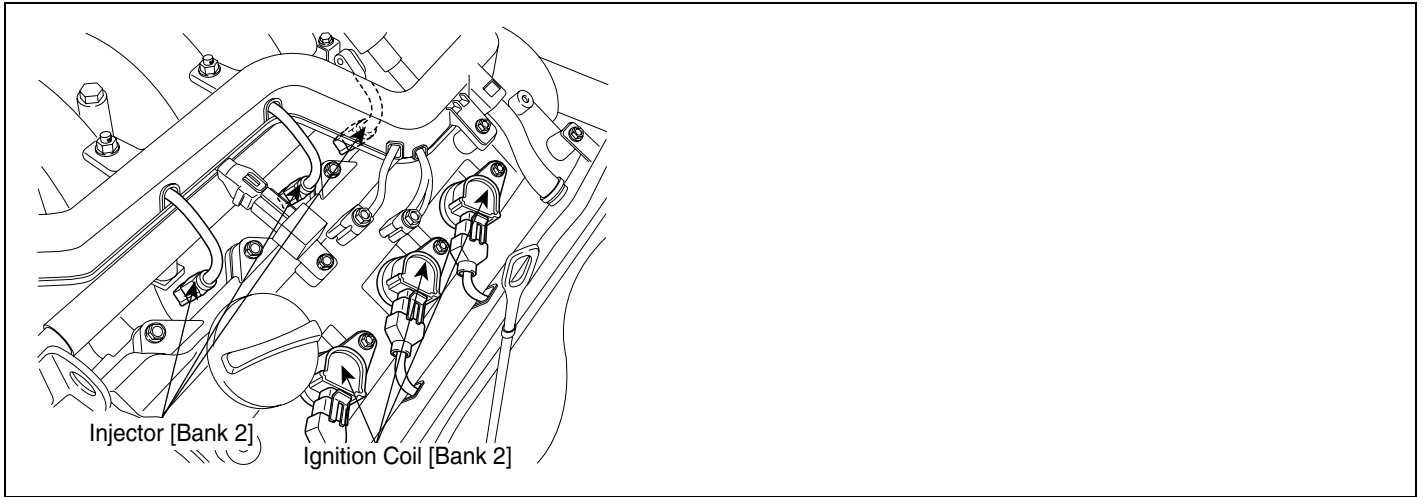
There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR EC1D28C2

Refer to DTC P0267.

DTC P0270 CYLINDER 4-INJECTOR CIRCUIT LOW

COMPONENT LOCATION E722FB9A



LGLG512A

GENERAL DESCRIPTION E540DEA2

Based on information from various sensors, the ECM measures the fuel injection amount. The fuel injector is a solenoid-operated valve and the fuel injection amount is controlled by length of time the fuel injector is held open. The ECM controls each injector by grounding the control circuit. When the ECM energizes the injector by grounding the control circuit, the circuit voltage should be low (theoretically 0V) and the fuel is injected. When the ECM de-energizes the injector by opening the control circuit, the fuel injector is closed and circuit voltage should momentarily peak.

DTC DESCRIPTION ED6A35CF

Checking output signals from injectors Under detecting condition, if an output signal is low, PCM sets P0270. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E4E1E308

Item	Detecting Condition	Possible Cause
DTC Strategy	Signal Low	- Poor connection - Open or short to ground in power harness - Open or short to ground in control harness - Injector - PCM
Enable condition	- Engine running state $11V \leq \text{Battery voltage} \leq 16V$ - Above conditions are met $> 0.5\text{sec.}$ - No disabling faults present	
threshold value	Open or short to ground	
diagnosis time	Continuous	
MIL ON condition	2 driving cycles	

SPECIFICATION E9667075

Item	Coil resistance(Ω)
Injector	$13.8 \sim 15.2\Omega$ [20°C (68°F)]

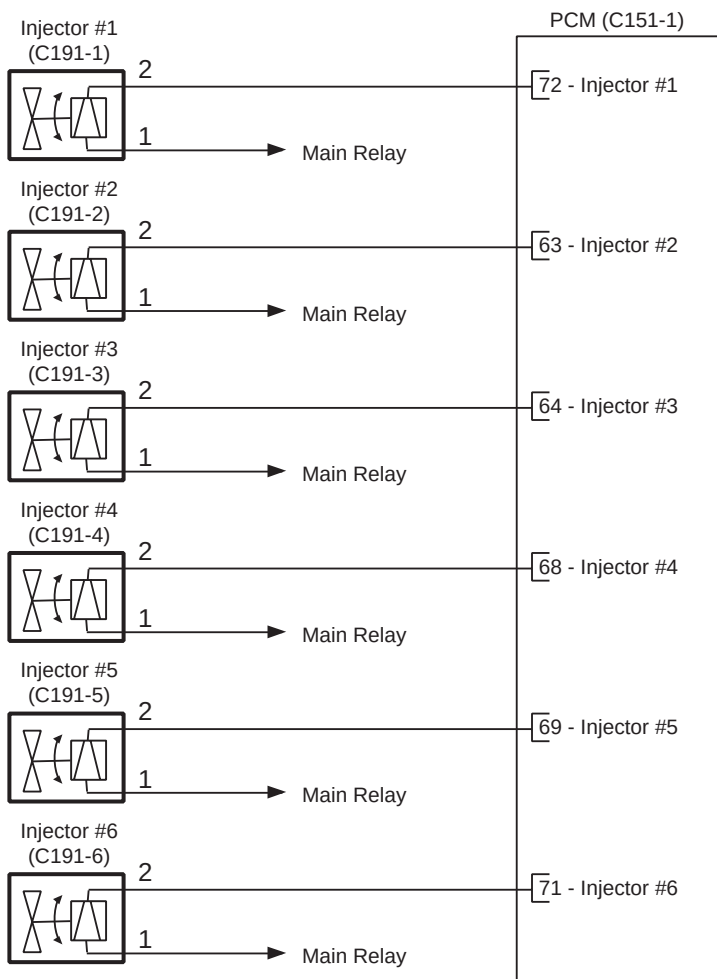
DTC TROUBLESHOOTING PROCEDURES

FLA -377

SCHEMATIC DIAGRAM

E04E5202

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Injector #1

Terminal	Connected to	Function
1	PCM C151-1 (72)	Injector #1 control
2	Main Relay	Battery Voltage (B+)

Injector #2

Terminal	Connected to	Function
1	PCM C151-1 (63)	Injector #2 control
2	Main Relay	Battery Voltage (B+)

Injector #3

Terminal	Connected to	Function
1	PCM C151-1 (64)	Injector #3 control
2	Main Relay	Battery Voltage (B+)

Injector #4

Terminal	Connected to	Function
1	PCM C151-1 (68)	Injector #4 control
2	Main Relay	Battery Voltage (B+)

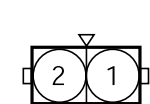
Injector #5

Terminal	Connected to	Function
1	PCM C151-1 (69)	Injector #5 control
2	Main Relay	Battery Voltage (B+)

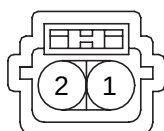
Injector #6

Terminal	Connected to	Function
1	PCM C151-1 (71)	Injector #6 control
2	Main Relay	Battery Voltage (B+)

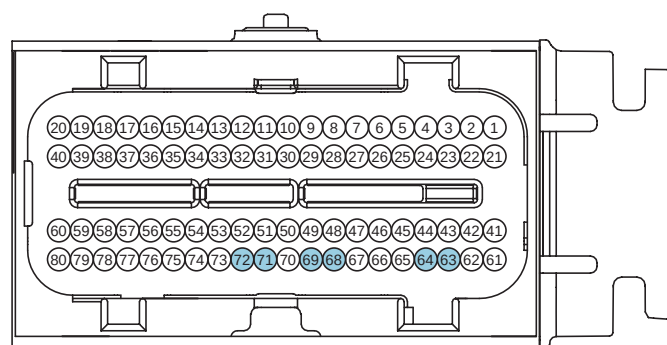
[HARNESS CONNECTORS]



C191-1,3,5
Injector #1,3,5



C191-2,4,6
Injector #2,4,6

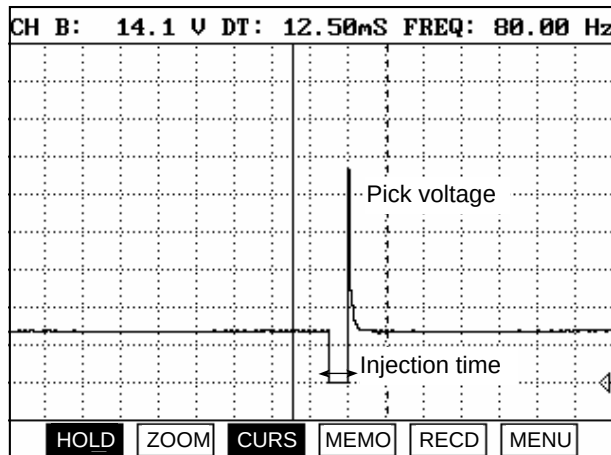


C151-1
PCM

SVQF16113L

SIGNAL WAVEFORM AND DATE

EB5A5CB7



EGRF607S

When the PCM energizes the injector by grounding control circuit, the circuit voltage should be low (theoretically 0V) and the fuel is injected. When the PCM de-energizes the injector by opening control circuit, the fuel injector is closed and circuit voltage should be peak at a moment.

MONITOR DTC STATUS

E7A7CBD5

1. Check DTC Status

- 1) Connect scantool to Data Link Connector(DLC).
- 2) IG "ON".
- 3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F4(DTAL) to check DTC's information from the DTCs menu
- 4) Read "DTC Status" parameter.

1.1 DIAGNOSTIC TROUBLE CODES	
PXXXX	DTC TITLE
NUMBER OF DTC : 1 ITEMS	
PART	ERAS
DTAL	

PXXXX TITLE	
1.MIL STATUS:	ON/OFF
2.DTC STATUS:	PRESENT/HISTORY
3.DIAG.STATUS:	DIAGNOSIS FINISHED
DTC CAUSE TO SYSTEM ERROR : PXXXX	

SCMF16159L

5) Is parameter displayed "Present fault"?

YES

- Go to "Terminal and connector inspection" procedure.

DTC TROUBLESHOOTING PROCEDURES

FLA -379

NO

► Fault is intermittent caused by poor contact in the sensor' s and/or PCM' s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

TERMINAL AND CONNECTOR INSPECTION E9124D60

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

► Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

► Go to "Terminal and connector inspection" procedure.

POWER CIRCUIT INSPECTION EE9EB174

1. IG "ON" and disconnect injector connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 1 of injector harness connector and chassis ground.

Specification : B+

4. Is the measured voltage within specification?

YES

► Go to "Control Circuit Inspection" procedure.

NO

- Check open or connection of the fuse connected to injector power supply.
- Repair open or short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION E200D553

1. Check short to ground in harness
 - 1) IG "OFF" and disconnect injector connector and PCM connector.
 - 2) Measure resistance between terminal 2 of injector harness connector and chassis ground.

Specification : Infinite

3) Is the measured resistance within specification?

YES

► Go to "Check open in harness" as follows.

NO

► Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

2. Check open in harness

1) IG "OFF" and disconnect injector connector and PCM connector.

2) Measure resistance between terminal 2 of injector harness connector and 68 of PCM harness connector.

Specification : Below 1Ω

3) Is the measured resistance within specification?

YES

► Go to "Component Inspection" procedure.

NO

► Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EA5E27F5

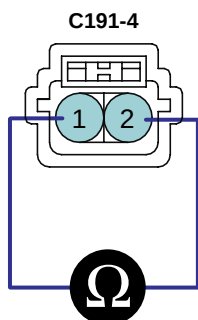
1. Check injector

1) IG "OFF" and disconnect injector connector.

2) Measure resistance between terminals 1 and 2 of injector connector.(Component side)

SPECIFICATION :

Item	Coil resistance(Ω)
Injector	13.8 ~ 15.2Ω [20℃ (68°F)]



- 1. Battery voltage
- 2. Injector #4 control

SVQF16279L

3) Is the measured resistance within specification?

YES

DTC TROUBLESHOOTING PROCEDURES

FLA -381

- ▶ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

- ▶ Substitute with a known - good injector and check for proper operation. If the problem is corrected, replace injector and go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

EA0FAD0F

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

- ▶ System performing to specification at this time. Clear the DTC.

NO

- ▶ Go to the applicable troubleshooting procedure.

FLA -382

FUEL SYSTEM

DTC P0271 CYLINDER 4-INJECTOR CIRCUIT HIGH

COMPONENT LOCATION E3FCF841

Refer to DTC P0270.

GENERAL DESCRIPTION EA5E24B6

Refer to DTC P0270.

DTC DESCRIPTION E1E8D339

Checking output signals from injectors. Under detecting condition, if an output signal is high, PCM sets P0271. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E8BA2742

Item	Detecting Condition	Possible Cause
DTC Strategy	Signal High	- Poor connection - Short to battery in harness - Injector - PCM
Enable condition	- Engine running state $11V \leq \text{Battery voltage} \leq 16V$ - Above conditions are met $> 0.5\text{sec.}$ - No disabling faults present	
Threshold value	Short to battery	
Diagnosis time	Continuous	
MIL ON condition	2 driving cycles	

SPECIFICATION E4D60688

Item	Coil resistance(Ω)
Injector	$13.8 \sim 15.2\Omega$ [20°C (68°F)]

SCHEMATIC DIAGRAM EF1C0184

Refer to DTC P0270.

SIGNAL WAVEFROM AND DATA E7825C89

Refer to DTC P0270.

MONITOR DTC STATUS E8BC99AA

Refer to DTC P0270.

TERMINAL AND CONNECTOR INSPECTION E1A7643C

Refer to DTC P0270.

DTC TROUBLESHOOTING PROCEDURES

FLA -383

CONTROL CIRCUIT INSPECTION E275D851

1. Check voltage

- 1) IG "OFF" and disconnect injector connector.
- 2) IG "ON" and ENG "OFF"
- 3) Measure voltage between terminal 2 of injector harness connector and chassis ground.

Specification : Approx. 0V

- 4) Is the measured voltage within specification?

YES

- Go to "Component Inspection" procedure.

NO

- Go to "Check short to battery in harness" as follows.

2. Check short to battery in harness

- 1) IG "OFF" and disconnect injector connector and PCM connector.
- 2) Measure resistance between terminals 1 and 2 of injector harness connector.

Specification : Infinite

- 3) Is the measured resistance within specification?

YES

- Go to "Component Inspection" procedure.

NO

- Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

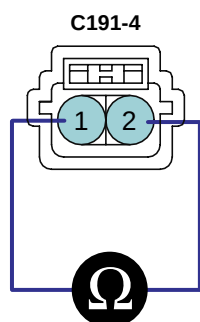
COMPONENT INSPECTION E02BDA85

1. Check injector

- 1) IG "OFF" and disconnect injector connector.
- 2) Measure resistance between terminals 1 and 2 of injector connector.(Component side)

SPECIFICATION :

Item	Coil resistance(Ω)
Injector	13.8 ~ 15.2 Ω [20°C (68°F)]



1. Battery voltage
2. Injector #4 control

SVQF16279L

3) Is the measured resistance within specification?

YES

► Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

► Substitute with a known - good injector and check for proper operation. If the problem is corrected, replace injector and go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

EAD2931A

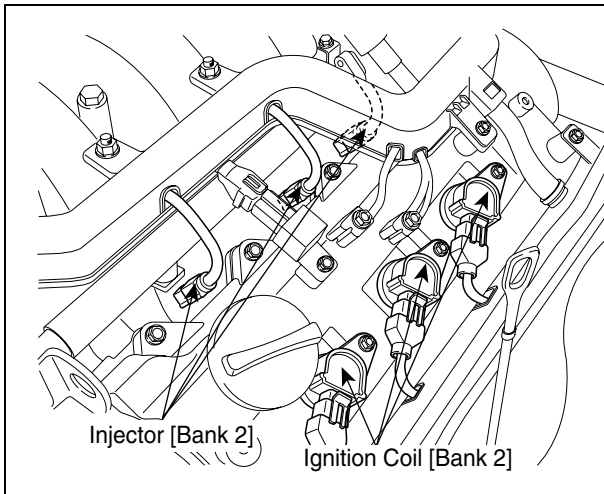
Refer to DTC P0270.

DTC TROUBLESHOOTING PROCEDURES

FLA -385

DTC P0273 CYLINDER 5-INJECTOR CIRCUIT LOW

COMPONENT LOCATION EB6A906E



LGLG512A

GENERAL DESCRIPTION EF9F89B9

Based on information from various sensors, the ECM measures the fuel injection amount. The fuel injector is a solenoid-operated valve and the fuel injection amount is controlled by length of time the fuel injector is held open. The ECM controls each injector by grounding the control circuit. When the ECM energizes the injector by grounding the control circuit, the circuit voltage should be low (theoretically 0V) and the fuel is injected. When the ECM de-energizes the injector by opening the control circuit, the fuel injector is closed and circuit voltage should momentarily peak.

DTC DESCRIPTION E1A785DC

Checking output signals from injectors. Under detecting condition, if an output signal is low, PCM sets P0273. MIL (Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E8F4C0EC

Item	Detecting Condition	Possible Cause
DTC Strategy	Signal Low	- Poor connection - Open or short to ground in power harness - Open or short to ground in control harness - Injector - PCM
Enable condition	- Engine running state $11V \leq \text{Battery voltage} \leq 16V$ - Above conditions are met $> 0.5\text{sec.}$ - No disabling faults present	
Threshold value	Open or short to ground	
Diagnosis time	Continuous	
MIL ON condition	2 driving cycles	

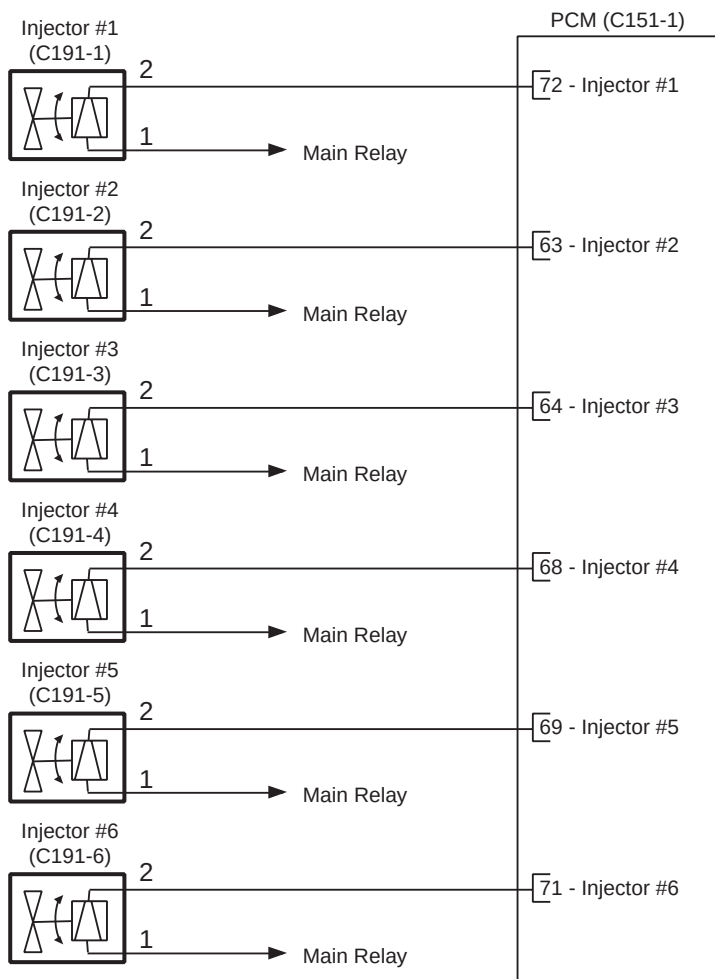
SPECIFICATION E2CBD4D1

Item	Coil resistance(Ω)
Injector	$13.8 \sim 15.2\Omega$ [20°C (68°F)]

SCHEMATIC DIAGRAM

E2771905

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Injector #1

Terminal	Connected to	Function
1	PCM C151-1 (72)	Injector #1 control
2	Main Relay	Battery Voltage (B+)

Injector #2

Terminal	Connected to	Function
1	PCM C151-1 (63)	Injector #2 control
2	Main Relay	Battery Voltage (B+)

Injector #3

Terminal	Connected to	Function
1	PCM C151-1 (64)	Injector #3 control
2	Main Relay	Battery Voltage (B+)

Injector #4

Terminal	Connected to	Function
1	PCM C151-1 (68)	Injector #4 control
2	Main Relay	Battery Voltage (B+)

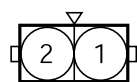
Injector #5

Terminal	Connected to	Function
1	PCM C151-1 (69)	Injector #5 control
2	Main Relay	Battery Voltage (B+)

Injector #6

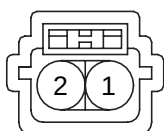
Terminal	Connected to	Function
1	PCM C151-1 (71)	Injector #6 control
2	Main Relay	Battery Voltage (B+)

[HARNESS CONNECTORS]



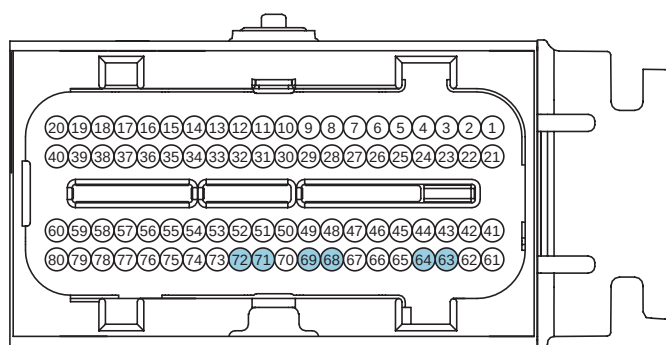
C191-1,3,5

Injector #1,3,5



C191-2,4,6

Injector #2,4,6

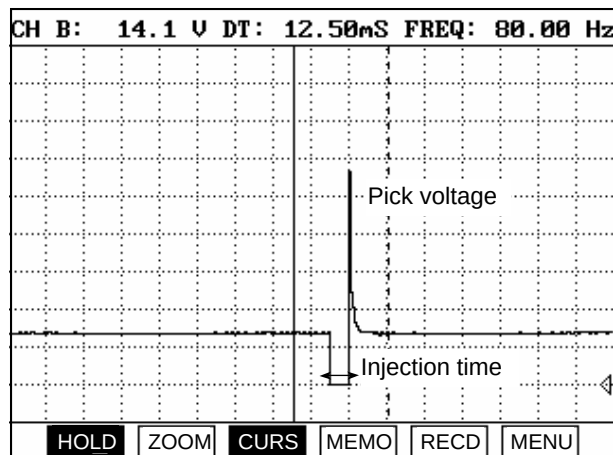


C151-1

PCM

SVQF16113L

SIGNAL WAVEFORM AND DATE E3A32CA3



EGRF607S

When the PCM energizes the injector by grounding control circuit, the circuit voltage should be low (theoretically 0V) and the fuel is injected. When the PCM de-energizes the injector by opening control circuit, the fuel injector is closed and circuit voltage should be peak at a moment.

MONITOR DTC STATUS E32EF024

1. Check DTC Status
 - 1) Connect scantool to Data Link Connector(DLC).
 - 2) IG "ON".
 - 3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F4(DTAL) to check DTC's information from the DTCs menu
 - 4) Read "DTC Status" parameter.

1.1 DIAGNOSTIC TROUBLE CODES	
PXXXX	DTC TITLE
NUMBER OF DTC : 1 ITEMS	
PART	ERAS DTAL

PXXXX TITLE	
1.MIL STATUS:	ON/OFF
2.DTC STATUS:	PRESENT/HISTORY
3.DIAG.STATUS:	DIAGNOSIS FINISHED
DTC CAUSE TO SYSTEM ERROR : PXXXX	

SCMF16159L

- 5) Is parameter displayed "Present fault"?

YES

- Go to "Terminal and connector inspection" procedure.

NO

► Fault is intermittent caused by poor contact in the sensor' s and/or PCM' s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

TERMINAL AND CONNECTOR INSPECTION E5B46B2F

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

► Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

► Go to "Power Circuit Inspection" procedure.

POWER CIRCUIT INSPECTION E75633F8

1. IG "ON" and disconnect injector connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 1 of injector harness connector and chassis ground.

Specification : B+

4. Is the measured voltage within specification?

YES

► Go to "Control Circuit Inspection" procedure.

NO

- Check open or connection of the fuse connected to injector power supply.
- Repair open or short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION E6618A31

1. Check short to ground in harness
 - 1) IG "OFF" and disconnect injector connector and PCM connector.
 - 2) Measure resistance between terminal 2 of injector harness connector and chassis ground.

Specification : Infinite

DTC TROUBLESHOOTING PROCEDURES

FLA -389

3) Is the measured resistance within specification?

YES

► Go to "Check open in harness" as follows.

NO

► Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

2. Check open in harness

1) IG "OFF" and disconnect injector connector and PCM connector.

2) Measure resistance between terminal 2 of injector harness connector and 69 of PCM harness connector.

Specification : Below 1Ω

3) Is the measured resistance within specification?

YES

► Go to "Component Inspection" procedure.

NO

► Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

EDDDFD3E

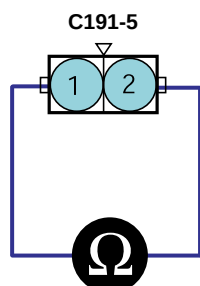
1. Check injector

1) IG "OFF" and disconnect injector connector.

2) Measure resistance between terminals 1 and 2 of injector connector.(Component side)

SPECIFICATION :

Item	Coil resistance(Ω)
Injector	13.8 ~ 15.2 Ω [20°C (68°F)]



- 1. Battery voltage
- 2. Injector #5 control

SVQF16285L

3) Is the measured resistance within specification?

YES

► Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

► Substitute with a known - good injector and check for proper operation. If the problem is corrected, replace injector and go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

E2B7AB31

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

► System performing to specification at this time. Clear the DTC.

NO

► Go to the applicable troubleshooting procedure.

DTC TROUBLESHOOTING PROCEDURES

FLA -391

DTC P0274 CYLINDER 5-INJECTOR CIRCUIT HIGH

COMPONENT LOCATION EF6D5E45

Refer to DTC P0273.

GENERAL DESCRIPTION E8B4CA19

Refer to DTC P0273.

DTC DESCRIPTION EAE9CADF

Checking output signals from injectors. Under detecting condition, if an output signal is high, PCM sets P0274. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION EBA15E96

Item	Detecting Condition	Possible Cause
DTC Strategy	Signal High	- Poor connection - Short to battery in harness - Injector - PCM
Enable condition	- Engine running state $11V \leq \text{Battery voltage} \leq 16V$ - Above conditions are met $> 0.5\text{sec.}$ - No disabling faults present	
Threshold value	Short to battery	
Diagnosis time	Continuous	
MIL ON condition	2 driving cycles	

SPECIFICATION EB1252A8

Item	Coil resistance(Ω)
Injector	13.8 ~ 15.2 Ω [20°C (68°F)]

SCHEMATIC DIAGRAM EB2D23D1

Refer to DTC P0273.

SIGNAL WAVEFROM AND DATA E533A40B

Refer to DTC P0273.

MONITOR DTC STATUS E57C53BC

Refer to DTC P0273.

TERMINAL AND CONNECTOR INSPECTION E1E66DD2

Refer to DTC P0273.

CONTROL CIRCUIT INSPECTION

EDB71B58

1. Check voltage

- 1) IG "OFF" and disconnect injector connector.
- 2) IG "ON" and ENG "OFF"
- 3) Measure voltage between terminal 2 of injector harness connector and chassis ground.

Specification : Approx. 0V

- 4) Is the measured voltage within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Go to "Check short to battery in harness" as follows.

2. Check short to battery in harness

- 1) IG "OFF" and disconnect injector connector and PCM connector.
- 2) Measure resistance between terminals 1 and 2 of injector harness connector.

Specification : Infinite

- 3) Is the measured resistance within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

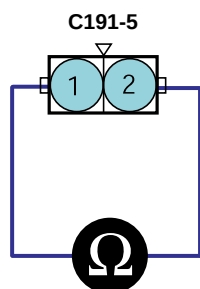
EC69575B

1. Check injector

- 1) IG "OFF" and disconnect injector connector.
- 2) Measure resistance between terminals 1 and 2 of injector connector.(Component side)

SPECIFICATION :

Item	Coil resistance(Ω)
Injector	13.8 ~ 15.2 Ω [20°C (68°F)]



- 1. Battery voltage
- 2. Injector #5 control

SVQF16285L

3) Is the measured resistance within specification?

YES

► Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

► Substitute with a known - good injector and check for proper operation. If the problem is corrected, replace injector and go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

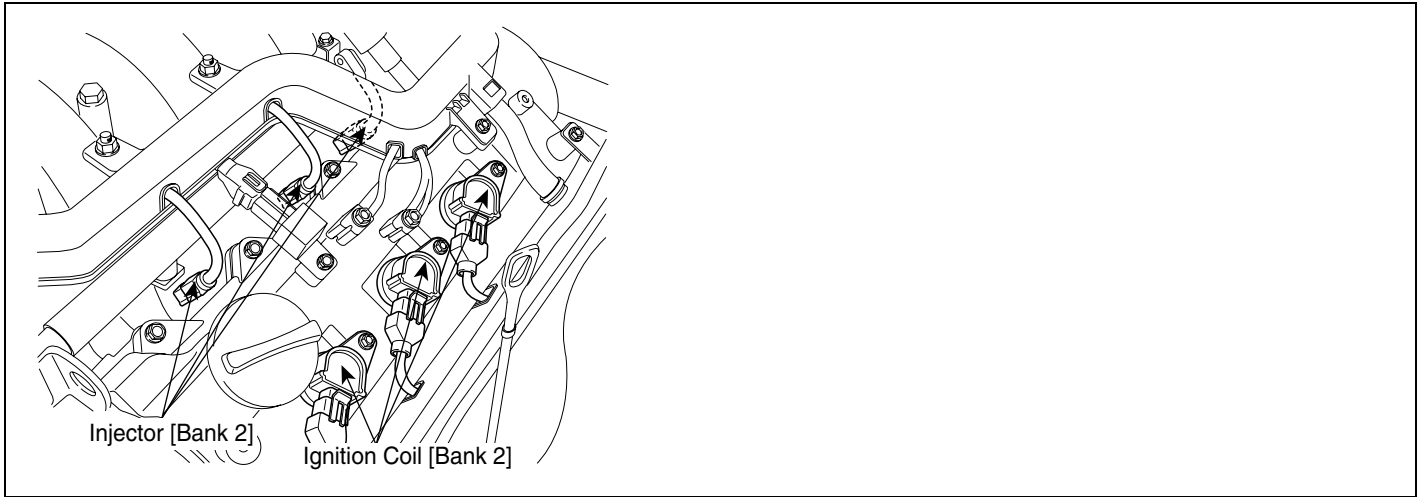
VERIFICATION OF VEHICLE REPAIR

ED23F0AD

Refer to DTC P0273.

DTC P0276 CYLINDER 6-INJECTOR CIRCUIT LOW

COMPONENT LOCATION E75C30BE



LGLG512A

GENERAL DESCRIPTION EFBFD3E1

Based on information from various sensors, the ECM measures the fuel injection amount. The fuel injector is a solenoid-operated valve and the fuel injection amount is controlled by length of time the fuel injector is held open. The ECM controls each injector by grounding the control circuit. When the ECM energizes the injector by grounding the control circuit, the circuit voltage should be low (theoretically 0V) and the fuel is injected. When the ECM de-energizes the injector by opening the control circuit, the fuel injector is closed and circuit voltage should momentarily peak.

DTC DESCRIPTION E85EBF75

Checking output signals from injectors. Under detecting condition, if an output signal is low, PCM sets P0276. MIL (Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E5FE2579

Item	Detecting Condition	Possible Cause
DTC Strategy	Signal Low	- Poor connection - Open or short to ground in power harness - Open or short to ground in control harness - Injector - PCM
Enable condition	- Engine running state $11V \leq \text{Battery voltage} \leq 16V$ - Above conditions are met $> 0.5\text{sec.}$ - No disabling faults present	
Threshold value	Open or short to ground	
Diagnosis time	Continuous	
MIL ON condition	2 driving cycles	

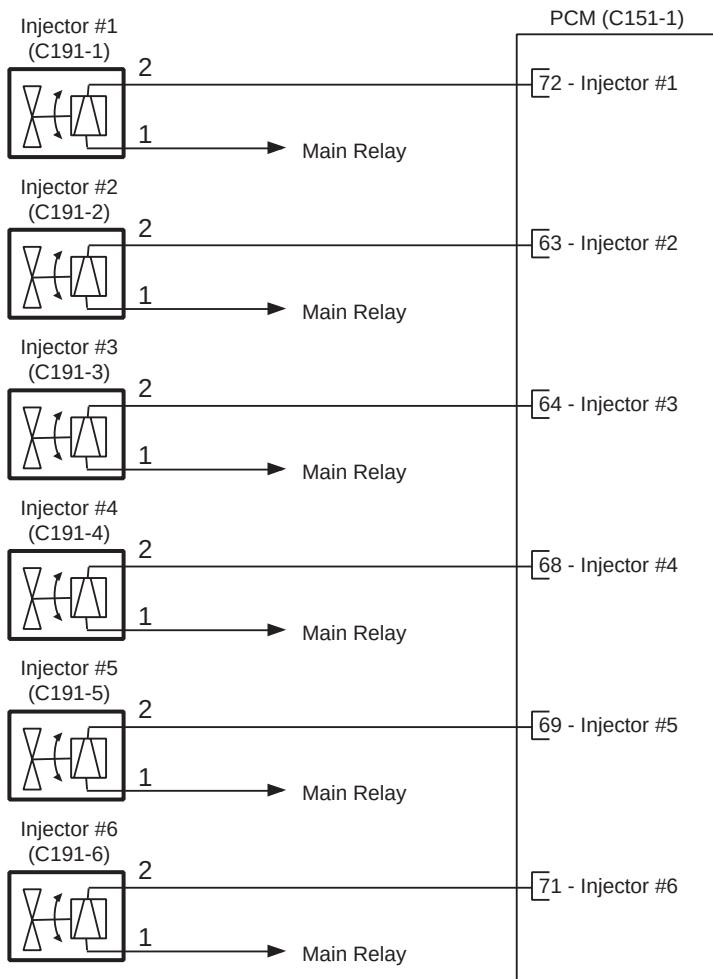
SPECIFICATION E7C3CCDD

Item	Coil resistance(Ω)
Injector	$13.8 \sim 15.2\Omega$ [20°C (68°F)]

SCHEMATIC DIAGRAM

EB7BA016

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Injector #1

Terminal	Connected to	Function
1	PCM C151-1 (72)	Injector #1 control
2	Main Relay	Battery Voltage (B+)

Injector #2

Terminal	Connected to	Function
1	PCM C151-1 (63)	Injector #2 control
2	Main Relay	Battery Voltage (B+)

Injector #3

Terminal	Connected to	Function
1	PCM C151-1 (64)	Injector #3 control
2	Main Relay	Battery Voltage (B+)

Injector #4

Terminal	Connected to	Function
1	PCM C151-1 (68)	Injector #4 control
2	Main Relay	Battery Voltage (B+)

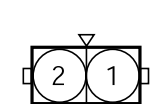
Injector #5

Terminal	Connected to	Function
1	PCM C151-1 (69)	Injector #5 control
2	Main Relay	Battery Voltage (B+)

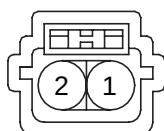
Injector #6

Terminal	Connected to	Function
1	PCM C151-1 (71)	Injector #6 control
2	Main Relay	Battery Voltage (B+)

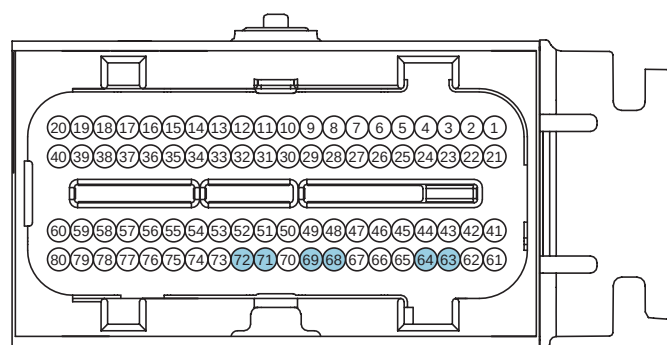
[HARNESS CONNECTORS]



C191-1,3,5
Injector #1,3,5



C191-2,4,6
Injector #2,4,6

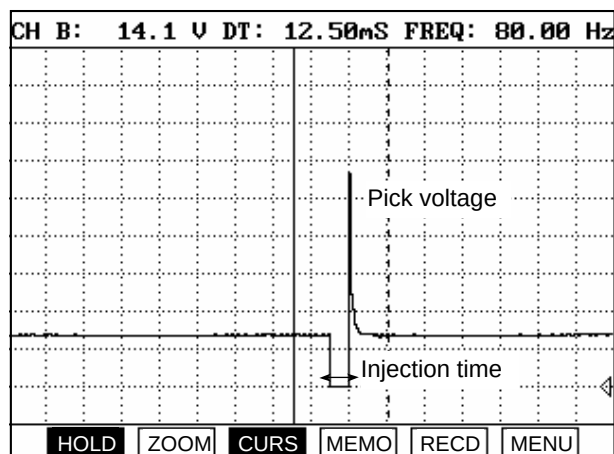


C151-1
PCM

SVQF16113L

SIGNAL WAVEFROM AND DATE

F6DB7A94



EGRE607S

When the PCM energizes the injector by grounding control circuit, the circuit voltage should be low (theoretically 0V) and the fuel is injected. When the PCM de-energizes the injector by opening control circuit, the fuel injector is closed and circuit voltage should be peak at a moment.

MONITOR DTC STATUS

E976DD77

1. Check DTC Status
 - 1) Connect scantool to Data Link Connector(DLC).
 - 2) IG "ON".
 - 3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F4(DTAL) to check DTC's information from the DTCs menu
 - 4) Read "DTC Status" parameter.

1.1 DIAGNOSTIC TROUBLE CODES					
P×××× DTC TITLE					
NUMBER OF DTC : 1 ITEMS					
PART	ERAS		DTAL		

PXXXX TITLE	
1.MIL STATUS:	ON/OFF
2.DTC STATUS:	PRESENT/HISTORY
3.DIAG.STATUS:	DIAGNOSIS FINISHED
DTC CAUSE TO SYSTEM ERROR : PXXXX	

SCMF16159L

- 5) Is parameter displayed "Present fault"?

YES

- Go to "Terminal and connector inspection" procedure.

DTC TROUBLESHOOTING PROCEDURES

FLA -397

NO

► Fault is intermittent caused by poor contact in the sensor' s and/or PCM' s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

TERMINAL AND CONNECTOR INSPECTION EAC50C0B

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

► Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

► Go to "Power Circuit Inspection" procedure.

POWER CIRCUIT INSPECTION E4F0986F

1. IG "ON" and disconnect injector connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 1 of injector harness connector and chassis ground.

Specification : B+

4. Is the measured voltage within specification?

YES

► Go to "Control Circuit Inspection" procedure.

NO

- Check open or connection of the fuse connected to injector power supply.
- Repair open or short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION E2CF92BD

1. Check short to ground in harness
 - 1) IG "OFF" and disconnect injector connector and PCM connector.
 - 2) Measure resistance between terminal 2 of injector harness connector and chassis ground.

Specification : Infinite

3) Is the measured resistance within specification?

YES

► Go to "Check open in harness" as follows.

NO

► Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

2. Check open in harness

1) IG "OFF" and disconnect injector connector and PCM connector.

2) Measure resistance between terminal 2 of injector harness connector and 71 of PCM harness connector.

Specification : Below 1Ω

3) Is the measured resistance within specification?

YES

► Go to "Component Inspection" procedure.

NO

► Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E7BD1B93

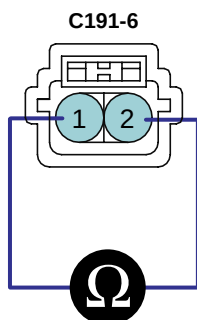
1. Check injector

1) IG "OFF" and disconnect injector connector.

2) Measure resistance between terminals 1 and 2 of injector connector.(Component side)

SPECIFICATION :

Item	Coil resistance(Ω)
Injector	13.8 ~ 15.2 Ω [20°C (68°F)]



- 1. Battery voltage
- 2. Injector #6 control

SVQF16266L

3) Is the measured resistance within specification?

YES

DTC TROUBLESHOOTING PROCEDURES

FLA -399

- ▶ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

- ▶ Substitute with a known - good injector and check for proper operation. If the problem is corrected, replace injector and go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

E62195B3

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

- ▶ System performing to specification at this time. Clear the DTC.

NO

- ▶ Go to the applicable troubleshooting procedure.

FLA -400

FUEL SYSTEM

DTC P0277 CYLINDER 6-INJECTOR CIRCUIT HIGH

COMPONENT LOCATION ED978EDB

Refer to DTC P0276.

GENERAL DESCRIPTION E2BD166F

Refer to DTC P0276.

DTC DESCRIPTION E3C614A2

Checking output signals from injectors. Under detecting condition, if an output signal is high, PCM sets P0277. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E79D04D3

Item	Detecting Condition	Possible Cause
DTC Strategy	Signal High	- Poor connection - Short to battery in harness - Injector - PCM
Enable condition	- Engine running state $11V \leq \text{Battery voltage} \leq 16V$ - Above conditions are met $> 0.5\text{sec.}$ - No disabling faults present	
Threshold value	Short to battery	
Diagnosis time	Continuous	
MIL ON condition	2 driving cycles	

SPECIFICATION EF27C928

Item	Coil resistance(Ω)
Injector	$13.8 \sim 15.2\Omega$ [20°C (68°F)]

SCHEMATIC DIAGRAM E052E7E7

Refer to DTC P0276.

SIGNAL WAVEFROM AND DATA E4CEF177

Refer to DTC P0276.

MONITOR DTC STATUS EAA7AEE3

Refer to DTC P0276.

TERMINAL AND CONNECTOR INSPECTION E9FC3E9A

Refer to DTC P0276.

DTC TROUBLESHOOTING PROCEDURES

FLA -401

CONTROL CIRCUIT INSPECTION E289BD99

1. Check voltage

- 1) IG "OFF" and disconnect injector connector.
- 2) IG "ON" and ENG "OFF"
- 3) Measure voltage between terminal 2 of injector harness connector and chassis ground.

Specification : Approx. 0V

- 4) Is the measured voltage within specification?

YES

- ▶ Go to "Component Inspection" procedure.

NO

- ▶ Go to "Check short to battery in harness" as follows.

2. Check short to battery in harness

- 1) IG "OFF" and disconnect injector connector and PCM connector.
- 2) Measure resistance between terminals 1 and 2 of injector harness connector.

Specification : Infinite

- 3) Is the measured resistance within specification?

YES

- ▶ Go to "Component Inspection" procedure.

NO

- ▶ Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

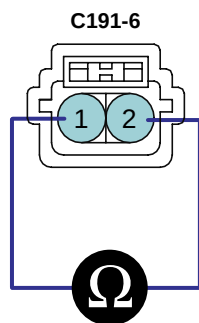
COMPONENT INSPECTION E3899277

1. Check injector

- 1) IG "OFF" and disconnect injector connector.
- 2) Measure resistance between terminals 1 and 2 of injector connector.(Component side)

SPECIFICATION :

Item	Coil resistance(Ω)
Injector	13.8 ~ 15.2 Ω [20°C (68°F)]



1. Battery voltage
2. Injector #6 control

SVQF16268L

3) Is the measured resistance within specification?

YES

► Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

► Substitute with a known - good injector and check for proper operation. If the problem is corrected, replace injector and go to "Verification of Vehicle Repair" procedure.



NOTE

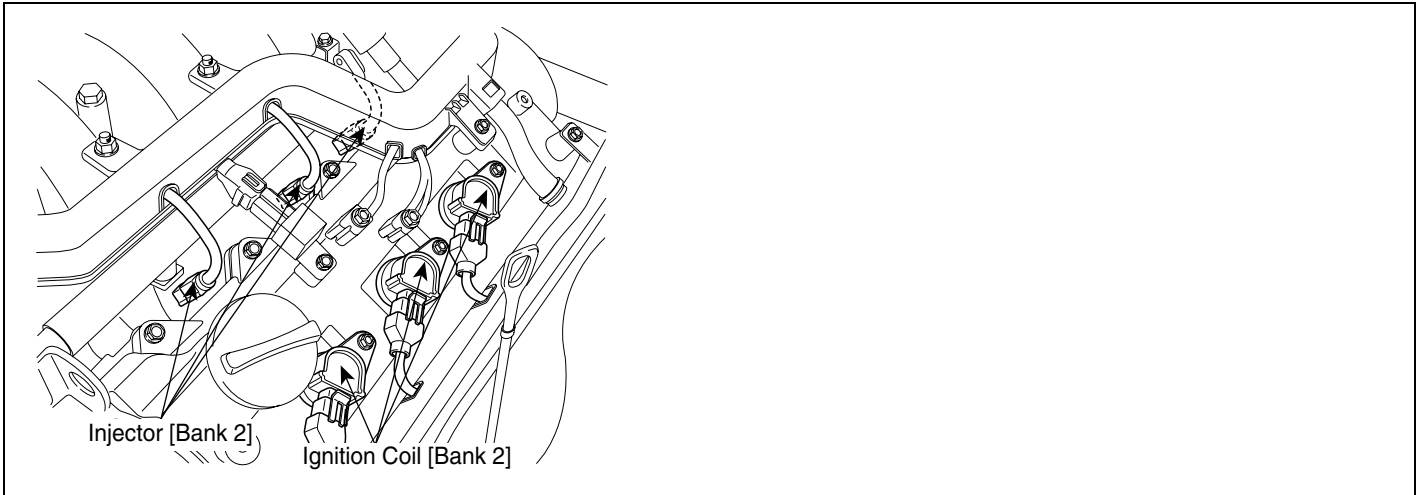
There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR E7FC0DFA

Refer to DTC P0276.

DTC P0300 RANDOM/MULTIPLE CYLINDER MISFIRE DETECTED

COMPONENT LOCATION E595915F



LGLG512A

GENERAL DESCRIPTION E8981F68

The Misfire monitor diagnostic is based on crankshaft rotation velocity variation. The ECM determines crankshaft rotational velocity using the crankshaft position sensor and camshaft position sensor. When a cylinder misfires the crankshaft slows down momentarily. By monitoring the crankshaft and camshaft position sensor signals, the ECM can calculate when a misfire occurs. For a non-catalyst damaging misfire, the diagnostic will be required to report a misfire present within 1000-3200 engine revolutions. For catalyst damaging misfire, the diagnostic will respond to monitor 200 engine revolutions. Rough roads may cause false misfire detection. The rough road (acceleration) sensor consists of a piezoelectric vibration pick up which detects vertical acceleration of the vehicle. The sensor signal is used by the ECM to determine the degree of vertical movement of the car, for example, on a bumpy road. Since this may also cause uneven engine running, the ECM uses the signal to distinguish the phenomenon from actual misfiring.

DTC DESCRIPTION E8D0ED27

The misfire diagnostic measures reference event times and calculates the positive and negative acceleration of the crank wheel to determine whether a misfire has occurred.

When the rate of misfire exceeds a threshold where the catalyst reaches a temperature where permanent damage can occur, to the point that tail pipe emissions reach 1.5 times the tailpipe standard or where a cylinder misfire causes a loss of torque produced from that cylinder. PCM sets this DTC. In case that misfire affects Catalyst damage, MIL (Malfunction Indication Lamp) will be illuminating and blinking at 1HZ frequency. However, in case of individual and emission damaging misfire, MIL will be turned on when the malfunction is detected.

Especially, if injector connector / Ignition coil is disconnected for more than 46 sec., PCM sets DTC relating to misfire and conducts the fuel-cut to protect the catalyst.

DTC DETECTING CONDITION

E554E741

Item		Detecting Condition	Possible Cause
DTC Strategy		etermine if a multiple cylinder misfire or a cylinder specific misfire is occurring by monitoring crankshaft acceleration.	- Faulty Spark plugs - Faulty Spark plug cables - Air Leakage - Belt deflection and Air gap of CKPS - Incorrect timing - Faulty injector - Improper fuel pressure - Improper engine compression
Enable condition		no disabling faults present / no disabling Active Faults - P0340 / P0341 / P0118 / P0117 / P0115 / P0336 / P0335 / P1295 / P0103 / P0102 / 0108 / P0107 / P0106 / P0501 - Engine speed between 550 and 5800 RPM - System voltage between 9 and 18 volts - The ECT indicates an engine temperature between -6°C(20°F) and 120°C(248°F)	
Thresh old value	Case 1	Individual cylinder misfire detection	
	Case 2	Emissions damaging - 18 times in 600 ignitions (In case that the misfire affects more than 1.5 times than FTP emissions)	
	Case 3	Catalyst damaging - 95 times in 600 ignitions at idle (It is going to be changeable according to the load or the temperature which is not in the range where it does not melt catalyst)	
Diagnosis time		Continuous	
MIL ON condition		2 driving cycles	

MONITOR DTC STATUS

EAAAD21E

1. Check DTC Status

- 1) Connect scantool to Data Link Connector(DLC).
- 2) IG "ON".
- 3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F4(DTAL) to check DTC's information from the DTCs menu
- 4) Read "DTC Status" parameter.

1.1 DIAGNOSTIC TROUBLE CODES			
PXXXX DTC TITLE			
NUMBER OF DTC : 1 ITEMS			
PART	ERAS	DTAL	

PXXXX TITLE	
1.MIL STATUS:	ON/OFF
2.DTC STATUS:	PRESENT/HISTORY
3.DIAG.STATUS:	DIAGNOSIS FINISHED
DTC CAUSE TO SYSTEM ERROR : PXXXX	

DTC TROUBLESHOOTING PROCEDURES

FLA -405

- 5) Is parameter displayed "Present fault"?

YES

- Go to "System inspection" procedure.

NO

- Although the misfire does not occur when the vehicle is brought to workshop, misfire can be reproduced when the condition is met. Drive the vehicle according to the freeze frame data in order to satisfy the condition.

SYSTEM INSPECTION EB1FBE92

1. Check Spark Plug

- 1) Remove cylinder's spark plugs
- 2) Visually/physically inspect the following items:
 - Damaged insulation, Worn electrodes, Oil or fuel fouled, Loose terminals and cracks
 - Check for plug gap : 1.0 - 1.1 mm (0.039 - 0.043 in.)
 - Check if the spark plug for the relevant cylinder is lighter in color than the other plugs.
- 3) Has a problem been found in any of the above areas?

YES

- Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

- Go to "Check Air Leakage " as below

2. Check Air Leakage

- 1) Visually/physically inspect the air leakage in intake/exhaust system as following items,
 - Vacuum hoses for splits, kinks and improper connections.
 - Throttle body gasket
 - Gasket between intake manifold and cylinder head
 - Seals between intake manifold and fuel injectors
 - Exhaust system between HO2S and Three way catalyst for air leakage
- 2) Has a problem been found in any of the above areas?

YES

- Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

- Go to "Check for air leakage in Positive Crankcase Ventilation Valve(PCV)

3. Check for air leakage in Positive Crankcase Ventilation Valve(PCV)

- 1) Remove PCV valve from cylinder head cover by pulling ventilation hose
- 2) With engine idling block PCV valve opening
- 3) Verify that vacuum is felt

- 4) Remove PCV valve
- 5) Blow through valve from port "A" and verify that air comes out of port "B"
- 6) Blow through valve from port "B" and verify that no air comes out of port "A"
- 7) Has a problem been found ?

YES

► Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

► Go to "Check Compression pressure" as below

4. Check Compression pressure

- 1) Warm up the engine to normal operating temperature
- 2) Disconnect the spark plug cables and remove the spark plugs.
- 3) Crank the engine to remove any foreign material in the cylinders.
- 4) Put compression pressure gauge into spark plug hole
- 5) Crank the engine with widely open throttle valve and check compression pressure at each cylinder
- 6) Is compression pressure for each cylinder displayed within specifications ?

Specification : 1323kPa(13.5 kg/cm²,192 psi)

YES

► Go to "Check Timing " as below

NO

► Add a small amount of oil through the spark plug hole, and repeat above steps. If the addition of oil causes the compression to rise, the cause is a worn or damaged piston ring or cylinder inner surface.

► If the compression remains the same, the cause is a burnt or defective valve seat, or pressure is leaking from the gasket. Repair as necessary and go to "Verification of Vehicle Repair" procedure

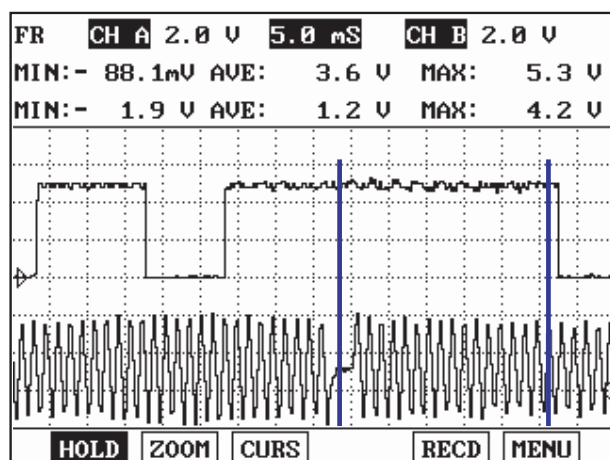
5. Check Timing

- 1) Ignition "OFF"
- 2) Monitor these signal waveforms from CAM and Crank shaft position Sensor are correctly aligned.

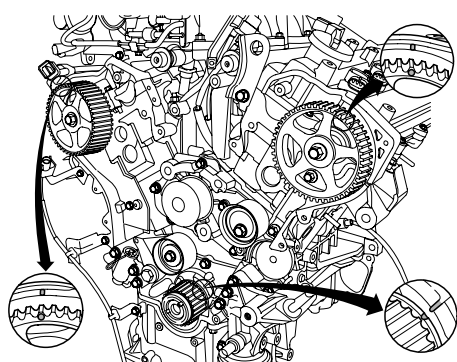
DTC TROUBLESHOOTING PROCEDURES

FLA -407

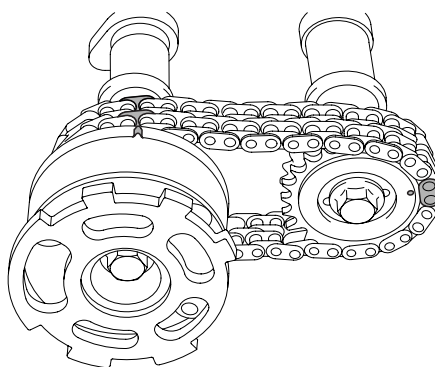
REFERENCE : THE 17TH OF CKP SIGNAL FROM MISSING TOOTH IS ALIGNED WITH HIGH OF CMP SIGNAL



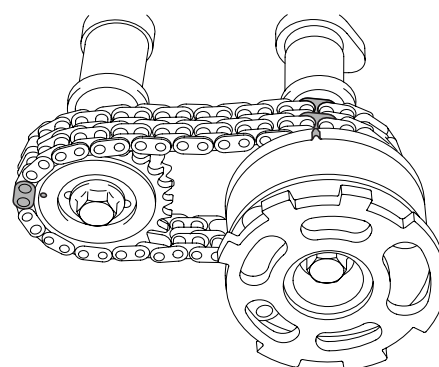
SVQF16611L



[Timing Belt]



[Cam (Bank 1)]



[Cam (Bank 2)]

LGLG502A

3) Are all timing marks aligned correctly ?

YES

► Go to "Check Fuel Pressure " as below

NO

► Check that Cam, Crank and Oil pump sprocket timing marks are correctly aligned. Repair or readjust as necessary and go to "Verification of Vehicle Repair" procedure

6. Check fuel pressure



NOTE

- Be cautious that Fuel is explosive and an empty fuel tank can still contain explosive gases. When working on fuel system make sure to supply adequate ventilation to the work area. Do not smoke, and keep sparks and open flames away.
- The fuel system remains under pressure when the engine is not running. Release fuel system pressure before disconnecting any fuel line to reduce the chance of personal injury or fire damage to vehicle components.

1) IG "OFF" and disconnect Fuel Pump Relay in Junction Box.

- 2) Start-up and wait until it stops itself.
- 3) IG "OFF" and connect Fuel Pump Relay.
- 4) Install the fuel pressure gauge to the delivery pipe with the fuel pressure gauge adaptor.
- 5) Activate the fuel pump, and with fuel pressure applied, check that there is no fuel leakage from the pressure gauge or connection part.
- 6) Measure the fuel pressure at idle.

Specification : 374.6 ~ 384.4 kPa(3.82 ~ 3.92 kg/cm², 54.3 ~ 55.8 psi)

- 7) Is the measured fuel pressure within specifications ?

YES

► Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

► Repair or replace according to the below table. And then, go to " Verification of Vehicle Repair"procedure.

Condition	Possible Cause
Fuel pressure too low	Fuel filter,fuel pressure regulator, in-tank fuel hose or the fuel pump
Fuel pressure too high	Fuel pressure regulator, hose or pipe

VERIFICATION OF VEHICLE REPAIR E8FA8100

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

► System performing to specification at this time. Clear the DTC.

NO

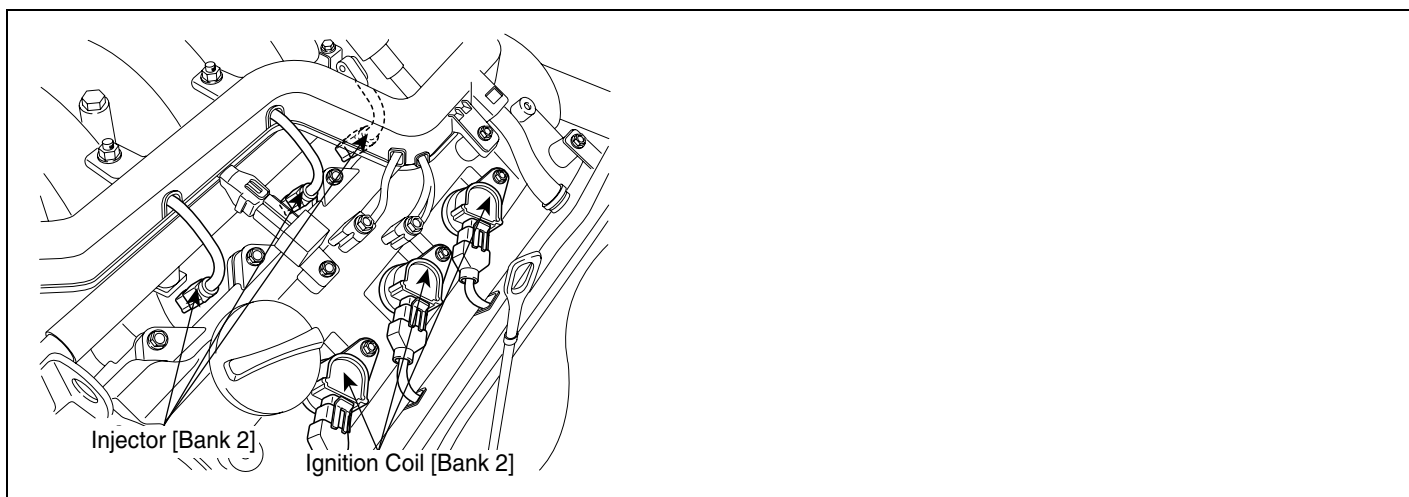
► Go to the applicable troubleshooting procedure.

DTC TROUBLESHOOTING PROCEDURES

FLA -409

DTC P0301	CYLINDER 1-MISFIRE DETECTED
DTC P0302	CYLINDER 2-MISFIRE DETECTED
DTC P0303	CYLINDER 3-MISFIRE DETECTED
DTC P0304	CYLINDER 4-MISFIRE DETECTED
DTC P0305	CYLINDER 5-MISFIRE DETECTED
DTC P0306	CYLINDER 6-MISFIRE DETECTED

COMPONENT LOCATION EBA2E4FE



LGLG512A

GENERAL DESCRIPTION EE5C133F

The Misfire monitor diagnostic is based on crankshaft rotation velocity variation. The ECM determines crankshaft rotational velocity using the crankshaft position sensor and camshaft position sensor. When a cylinder misfires the crankshaft slows down momentarily. By monitoring the crankshaft and camshaft position sensor signals, the ECM can calculate when a misfire occurs. For a non-catalyst damaging misfire, the diagnostic will be required to report a misfire present within 1000-3200 engine revolutions. For catalyst damaging misfire, the diagnostic will respond to monitor 200 engine revolutions. Rough roads may cause false misfire detection. The rough road (acceleration) sensor consists of a piezoelectric vibration pick up which detects vertical acceleration of the vehicle. The sensor signal is used by the ECM to determine the degree of vertical movement of the car, for example, on a bumpy road. Since this may also cause uneven engine running, the ECM uses the signal to distinguish the phenomenon from actual misfiring.

DTC DESCRIPTION E77058A1

The misfire diagnostic measures reference event times and calculates the positive and negative acceleration of the crank wheel to determine whether a misfire has occurred.

When the rate of misfire exceeds a threshold where the catalyst reaches a temperature where permanent damage can occur, to the point that tail pipe emissions reach 1.5 times the tailpipe standard or where a cylinder misfire causes a loss of torque produced from that cylinder. PCM sets this DTC. In case that misfire affects Catalyst damage, MIL (Malfunction Indication Lamp) will be illuminating and blinking at 1HZ frequency. However, in case of individual and emission damaging misfire, MIL will be turned on when the malfunction is detected.

Especially, if injector connector / Ignition coil is disconnected for more than 46 sec., PCM sets DTC relating to misfire and conducts the fuel-cut to protect the catalyst.

DTC DETECTING CONDITION

EACC26C4

Item		Detecting Condition	Possible Cause
DTC Strategy		etermine if a multiple cylinder misfire or a cylinder specific misfire is occurring by monitoring crankshaft acceleration.	- Faulty Spark plugs - Faulty Spark plug cables - Air Leakage - Belt deflection and Air gap of CKPS - Incorrect timing - Faulty injector - Improper fuel pressure - Improper engine compression
Enable condition		no disabling faults present / no disabling Active Faults - P0340 / P0341 / P0118 / P0117 / P0115 / P0336 / P0335 / P1295 / P0103 / P0102 / 0108 / P0107 / P0106 / P0501 - Engine speed between 550 and 5800 RPM - System voltage between 9 and 18 volts - The ECT indicates an engine temperature between -6°C(20°F) and 120°C(248°F)	
Thresh old value	Case 1	Individual cylinder misfire detection	
	Case 2	Emissions damaging - 18 times in 600 ignitions (In case that the misfire affects more than 1.5 times than FTP emissions)	
	Case 3	Catalyst damaging - 95 times in 600 ignitions at idle (It is going to be changeable according to the load or the temperature which is not in the range where it does not melt catalyst)	
Diagnosis time		Continuous	
MIL ON condition		2 driving cycles	

MONITOR DTC STATUS

EE15325E

1. Check DTC Status

- 1) Connect scantool to Data Link Connector(DLC).
- 2) IG "ON".
- 3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F4(DTAL) to check DTC's information from the DTCs menu
- 4) Read "DTC Status" parameter.

1.1 DIAGNOSTIC TROUBLE CODES			
PXXXX DTC TITLE			
NUMBER OF DTC : 1 ITEMS			
PART	ERAS	DTAL	

PXXXX TITLE	
1.MIL STATUS:	ON/OFF
2.DTC STATUS:	PRESENT/HISTORY
3.DIAG.STATUS:	DIAGNOSIS FINISHED
DTC CAUSE TO SYSTEM ERROR : PXXXX	

DTC TROUBLESHOOTING PROCEDURES

FLA -411

- 5) Is parameter displayed "Present fault"?

YES

- Go to "System inspection" procedure.

NO

- Although the misfire does not occur when the vehicle is brought to workshop, misfire can be reproduced when the condition is met. Drive the vehicle according to the freeze frame data in order to satisfy the condition.

SYSTEM INSPECTION E99603F0

1. Check Spark Plug

- 1) Remove cylinder's spark plugs
- 2) Visually/physically inspect the following items:
 - Damaged insulation, Worn electrodes, Oil or fuel fouled, Loose terminals and cracks
 - Check for plug gap : 1.0 - 1.1 mm (0.039 - 0.043 in.)
 - Check if the spark plug for the relevant cylinder is lighter in color than the other plugs.
- 3) Has a problem been found in any of the above areas?

YES

- Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

- Go to "Check Air Leakage " as below

2. Check Air Leakage

- 1) Visually/physically inspect the air leakage in intake/exhaust system as following items,
 - Vacuum hoses for splits, kinks and improper connections.
 - Throttle body gasket
 - Gasket between intake manifold and cylinder head
 - Seals between intake manifold and fuel injectors
 - Exhaust system between HO2S and Three way catalyst for air leakage
- 2) Has a problem been found in any of the above areas?

YES

- Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

- Go to "Check for air leakage in Positive Crankcase Ventilation Valve(PCV)

3. Check for air leakage in Positive Crankcase Ventilation Valve(PCV)

- 1) Remove PCV valve from cylinder head cover by pulling ventilation hose
- 2) With engine idling block PCV valve opening
- 3) Verify that vacuum is felt

- 4) Remove PCV valve
- 5) Blow through valve from port "A" and verify that air comes out of port "B"
- 6) Blow through valve from port "B" and verify that no air comes out of port "A"
- 7) Has a problem been found ?

YES

► Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

► Go to "Check Compression pressure" as below

4. Check Compression pressure

- 1) Warm up the engine to normal operating temperature
- 2) Disconnect the spark plug cables and remove the spark plugs.
- 3) Crank the engine to remove any foreign material in the cylinders.
- 4) Put compression pressure gauge into spark plug hole
- 5) Crank the engine with widely open throttle valve and check compression pressure at each cylinder
- 6) Is compression pressure for each cylinder displayed within specifications ?

Specification : 1323kPa(13.5 kg/cm²,192 psi)

YES

► Go to "Check Timing " as below

NO

► Add a small amount of oil through the spark plug hole, and repeat above steps. If the addition of oil causes the compression to rise, the cause is a worn or damaged piston ring or cylinder inner surface.

► If the compression remains the same, the cause is a burnt or defective valve seat, or pressure is leaking from the gasket. Repair as necessary and go to "Verification of Vehicle Repair" procedure

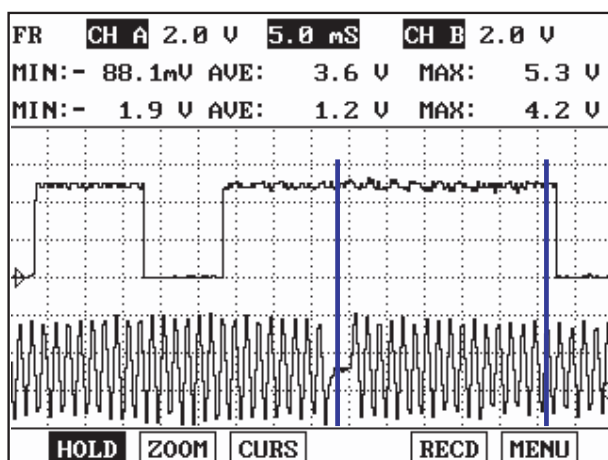
5. Check Timing

- 1) Ignition "OFF"
- 2) Monitor these signal waveforms from CAM and Crank shaft position Sensor are correctly aligned.

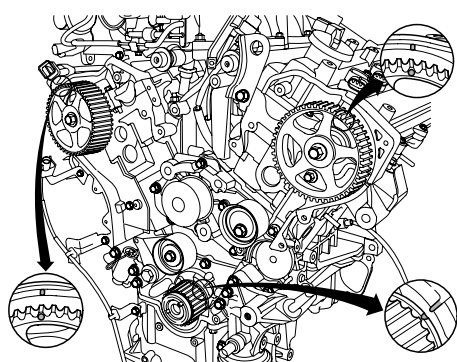
DTC TROUBLESHOOTING PROCEDURES

FLA -413

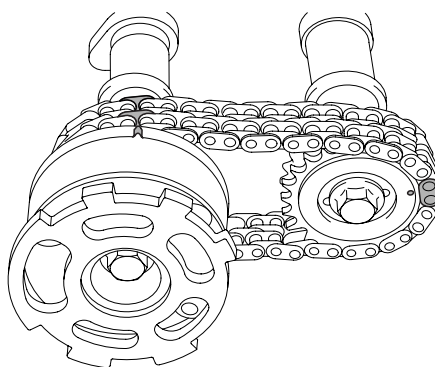
REFERENCE : THE 17TH OF CKP SIGNAL FROM MISSING TOOTH IS ALIGNED WITH HIGH OF CMP SIGNAL



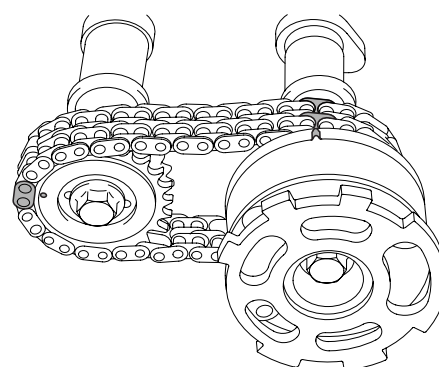
SVQF16611L



[Timing Belt]



[Cam (Bank 1)]



[Cam (Bank 2)]

LGLG502A

3) Are all timing marks aligned correctly ?

YES

► Go to "Check Fuel Pressure " as below

NO

► Check that Cam, Crank and Oil pump sprocket timing marks are correctly aligned. Repair or readjust as necessary and go to "Verification of Vehicle Repair" procedure

6. Check fuel pressure

NOTE

- Be cautious that Fuel is explosive and an empty fuel tank can still contain explosive gases. When working on fuel system make sure to supply adequate ventilation to the work area. Do not smoke, and keep sparks and open flames away.
- The fuel system remains under pressure when the engine is not running. Release fuel system pressure before disconnecting any fuel line to reduce the chance of personal injury or fire damage to vehicle components.

1) IG "OFF" and disconnect Fuel Pump Relay in Junction Box.

- 2) Start-up and wait until it stops itself.
- 3) IG "OFF" and connect Fuel Pump Relay.
- 4) Install the fuel pressure gauge to the delivery pipe with the fuel pressure gauge adaptor.
- 5) Activate the fuel pump, and with fuel pressure applied, check that there is no fuel leakage from the pressure gauge or connection part.
- 6) Measure the fuel pressure at idle.

Specification : 374.6 ~ 384.4 kPa(3.82 ~ 3.92 kg/cm², 54.3 ~ 55.8 psi)

- 7) Is the measured fuel pressure within specifications ?

YES

► Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

► Repair or replace according to the below table. And then, go to " Verification of Vehicle Repair"procedure.

Condition	Possible Cause
Fuel pressure too low	Fuel filter,fuel pressure regulator, in-tank fuel hose or the fuel pump
Fuel pressure too high	Fuel pressure regulator, hose or pipe

VERIFICATION OF VEHICLE REPAIR

EB7143B3

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

► System performing to specification at this time. Clear the DTC.

NO

► Go to the applicable troubleshooting procedure.

DTC TROUBLESHOOTING PROCEDURES

FLA -415

DTC P0315 SEGMENT TIME ACQUISITION INCORRECT

GENERAL DESCRIPTION E6DFE6D5

The Crankshaft Position Sensor (CKPS) is a magnetic field sensitive type sensor that generates voltage using a sensor and a target wheel mounted on the crankshaft; there are 58 slots in the target wheel where one is longer than the others. During one crankshaft rotation there are 58 rectangular signals and one longer signal. The ECM calculates engine RPM by using the sensor's signal and controls the injection duration and the ignition timing. Using the signal differences caused by the longer slot, the ECM identifies which cylinder is at top dead center.

DTC DESCRIPTION E90F99E4

Checking tooth error correction under detecting condition, if the TEC(Tooth Error Correction) is out of Threshold value, PCM sets P0315.

DTC DETECTING CONDITION E1D3BE8C

Item	Detecting Condition	Possible cause
DTC Strategy	This DTC indicates that crankwheel tooth error has not been learned.	- Loosened CKPS - Target wheel - PCM
Enable Conditions	$10\% \leq \text{Engine load} < 90\%$ $2000 \text{ rpm} \leq \text{engine speed} \leq 4000 \text{ rpm}$ - TEC(Tooth Error Correction) RPM stability timer $> 10\text{sec}$ $0^{\circ}\text{C}(32^{\circ}\text{F}) < \text{coolant temperature} < 110^{\circ}\text{C}(230^{\circ}\text{F})$ - Not active disabling faults	
Threshold value	- Distance driven without learning(during fuel cut off) tooth error $\geq 6500\text{km}(4038.91275 \text{ mile})$ - Actual Value is higher or lower than calibrated value	
Diagnosis Time	Continuous	
MIL On Condition	DTC only	

MONITOR DTC STATUS E2DFC14F

1. Check DTC Status

- 1) Connect scantool to Data Link Connector(DLC).
- 2) IG "ON".
- 3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F4(DTAL) to check DTC's information from the DTCs menu
- 4) Read "DTC Status" parameter.

1.1 DIAGNOSTIC TROUBLE CODES			
PXXXX DTC TITLE			
NUMBER OF DTC : 1 ITEMS			
PART	ERAS	DTAL	

PXXXX TITLE	
1.MIL STATUS:	ON/OFF
2.DTC STATUS:	PRESENT/HISTORY
3.DIAG.STATUS:	DIAGNOSIS FINISHED
DTC CAUSE TO SYSTEM ERROR : PXXXX	

SCMF16159L

- 5) Is parameter displayed "Present fault"?

YES

- Go to "Component Inspection" procedure.

NO

- Fault is intermittent caused by PCM memory was not cleared after repair. Erase DTC and drive the vehicle to satisfy the enable condition then, go to "Component Inspection" procedure.

COMPONENT INSPECTION E28BECE8

1. Visually check CKPS and target wheel

- 1) IG "OFF"
- 2) Visually check CKPS is loosened or target wheel is deformed or damaged.
- 3) Is the above items normal ?

YES

- Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

- Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E588DEEC

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.

DTC TROUBLESHOOTING PROCEDURES

FLA -417

4. Is parameter displayed "History(Not Present) fault"?

YES

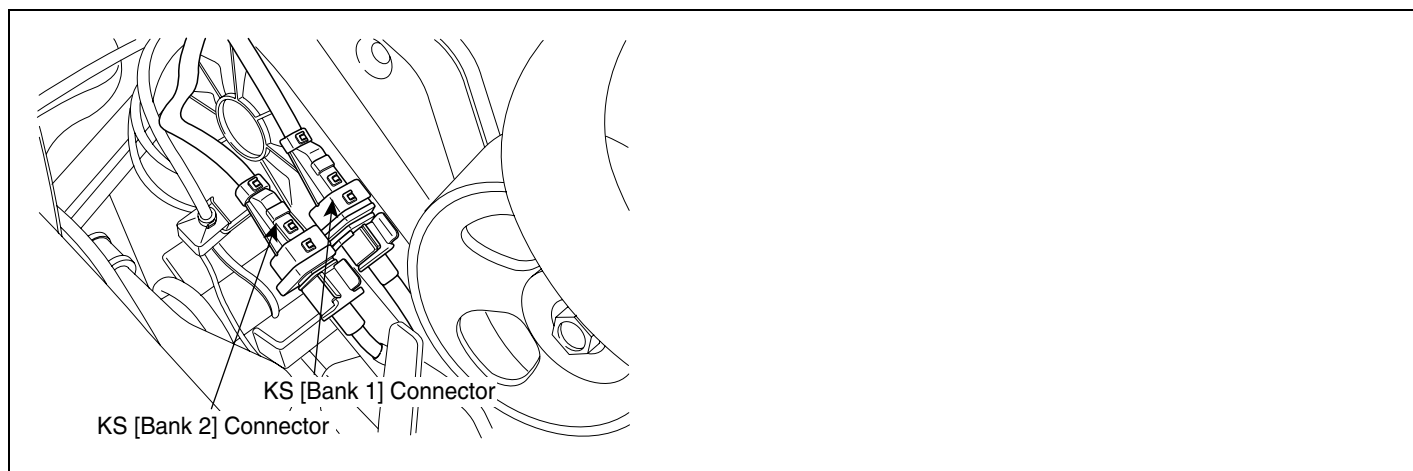
- ▶ System performing to specification at this time. Clear the DTC.

NO

- ▶ Go to the applicable troubleshooting procedure.

DTC P0325 KNOCK SENSOR 1 CIRCUIT

COMPONENT LOCATION E3047497



LGLG514A

GENERAL DESCRIPTION EDCF3B21

The knock sensor is attached to the cylinder block and senses engine knocking. The sensor contains a piezoelectric element that converts vibration (or noise) into voltage signal and sends this signal to ECM. With input signals from camshaft position and crankshaft position sensor, ECM can identify which cylinder is knocking. ECM filters vibrations and determines if the vibrations are knocking signal. The Engine Control Module (ECM) uses this signal to suppress knocking by retarding ignition timing. The ECM will set a code (Malfunction Indicator Lamp will Not turn on) if during two driving cycles the Knock sensor's output voltage falls below minimum threshold. This code indicates an unexpected vibration is being read by the Knock sensor or ECM under normal engine operation.

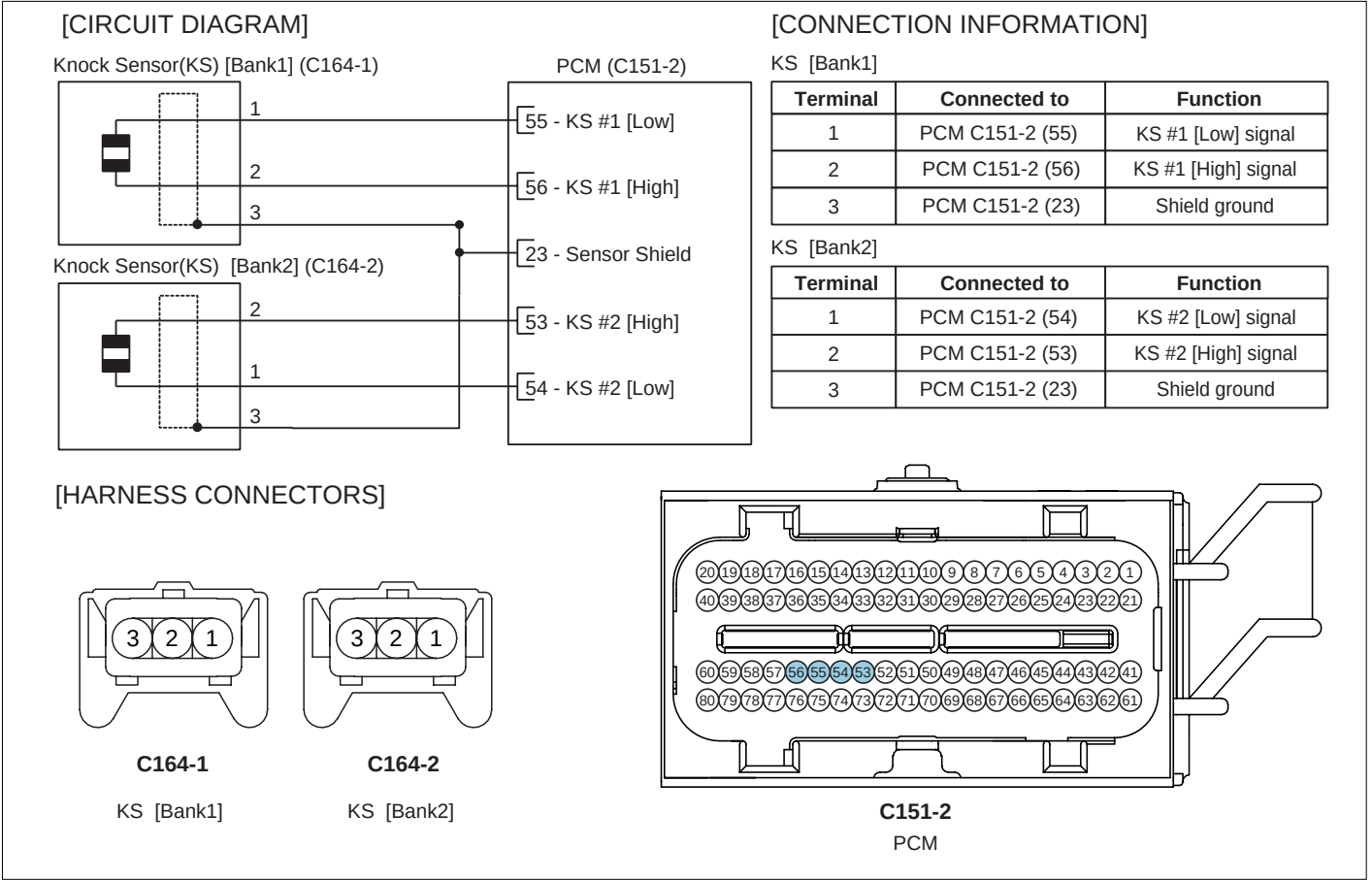
DTC DESCRIPTION E72F24F7

Checking the range of input signal with a knock sensor under detecting condition, PCM senses open in knock sensor circuit or malfunction of sensor. If a knock signal or noise level is inputted without the specified value during standard duration, PCM sets P0325.

DTC DETECTING CONDITION EF01E762

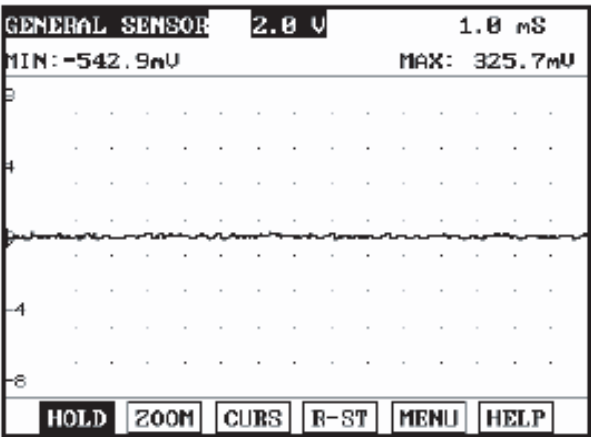
Item	Detecting Condition	Possible cause
DTC Strategy	Signal open	- Poor connection - Open in harness - Knock sensor - PCM
Enable Conditions	- Pressure in intake manifold is normal. - Engine speed $\geq$ 2200 rpm	
Threshold value	Filter coefficient $<$ 1.0	
Diagnosis Time	Continuous	
MIL On Condition	No MIL ON (DTC only)	

SCHEMATIC DIAGRAM EAFA3B05



SVQF16112L

SIGNAL WAVEFROM AND DATE E358942B



The knock sensor is installed at cycliner block to detect the vibration effectively during engine running. The above waveform shows the signal waveform of knock sensor when knock dosen't happen. Generally, knock signal has more noise than other sensor.

EGRF610B

MONITOR DTC STATUS EFC32C61

1. Check DTC Status

- 1) Connect scantool to Data Link Connector(DLC).
- 2) IG "ON".
- 3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F4(DTAL) to check DTC's information from the DTCs menu
- 4) Read "DTC Status" parameter.

1.1 DIAGNOSTIC TROUBLE CODES			
PXXXX DTC TITLE			
NUMBER OF DTC : 1 ITEMS			
PART	ERAS	DTAL	

PXXXX TITLE	
1.MIL STATUS:	ON/OFF
2.DTC STATUS:	PRESENT/HISTORY
3.DIAG.STATUS:	DIAGNOSIS FINISHED
DTC CAUSE TO SYSTEM ERROR : PXXXX	

SCMF16159L

5) Is parameter displayed "Present fault"?

YES

- Go to "Terminal and connector inspection" procedure.

NO

- Fault is intermittent caused by poor contact in the sensor' s and/or PCM' s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

TERMINAL AND CONNECTOR INSPECTION ED11003D

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

- Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

DTC TROUBLESHOOTING PROCEDURES

FLA -421

- Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION E115CF36

1. Check open in harness
 - 1) IG "OFF" and disconnect knock sensor connector and PCM connector.
 - 2) Measure resistance between terminal 1 of knock sensor harness connector and terminal 55 of PCM harness connector.
 - 3) Measure resistance between terminal 2 of knock sensor harness connector and terminal 56 of PCM harness connector.

Specification : Below 1Ω

- 4) Is the measured resistance within specification?

YES

► If the problem is corrected after substituting with a known - good knock sensor, replace it. If the problem is pending, check for proper operating after substituting with a known - good PCM. and then if the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

► Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR E280243E

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

► System performing to specification at this time. Clear the DTC.

NO

► Go to the applicable troubleshooting procedure.

FLA -422

FUEL SYSTEM

DTC P0326 KNOCK SENSOR 1 CIRCUIT RANGE/PERFORMANCE (BANK 1)

COMPONENT LOCATION E2355273

Refer to DTC P0325.

GENERAL DESCRIPTION E2072671

Refer to DTC P0325.

DTC DESCRIPTION EDCE93A8

Checking the range of input signal with a knock sensor under detecting condition, PCM senses short in knock sensor circuit or malfunction of sensor. If the average value of the knock signals is out of the threshold value during standard duration, PCM sets P0326.

DTC DETECTING CONDITION E259A1C9

Item	Detecting Condition	Possible cause
DTC Strategy	Signal short	- Poor connection - Short in harness - Knock sensor - PCM
Enable Conditions	- Pressure in intake manifold is normal. - Engine speed $\geq$ 2000 rpm	
Threshold value	Knock Filtered Value < 5 or > 65	
Diagnosis Time	Continuous	
MIL On Condition	No MIL ON (DTC only)	

SCHEMATIC DIAGRAM E21E4991

Refer to DTC P0325.

SIGNAL WAVEFROM AND DATE EA0EA640

Refer to DTC P0325.

MONITOR DTC STATUS E5BA4F02

Refer to DTC P0325.

TERMINAL AND CONNECTOR INSPECTION EC85DE4C

Refer to DTC P0325.

SIGNAL CIRCUIT INSPECTION E61F4E74

- Check short to battery in harness
 - IG "OFF" and disconnect knock sensor connector.
 - IG "ON" and ENG "OFF"

DTC TROUBLESHOOTING PROCEDURES

FLA -423

- 3) Measure voltage between terminal 1 of knock sensor harness connector and chassis ground.
- 4) Measure voltage between terminal 2 of knock sensor harness connector and chassis ground.

Specification : Approx. 1.5V

- 5) Is the measured voltage within specification?

YES

- ▶ Go to "Check short to ground in harness" as follows.

NO

- ▶ Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

2. Check short to ground in harness

- 1) IG "OFF" and disconnect knock sensor connector and PCM connector.
- 2) Measure resistance between terminal 1 of knock sensor harness connector and chassis ground.
- 3) Measure resistance between terminal 2 of knock sensor harness connector and chassis ground.
- 4) Measure resistance between terminal 1 and 3 of knock sensor harness connector.
- 5) Measure resistance between terminal 2 and 3 of knock sensor harness connector.

Specification : Infinite

- 6) Is the measured resistance within specification ?

YES

- ▶ If the problem is corrected after substituting with a known - good knock sensor, replace it. If the problem is pending, check for proper operating after substituting with a known - good PCM. and then if the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

- ▶ Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

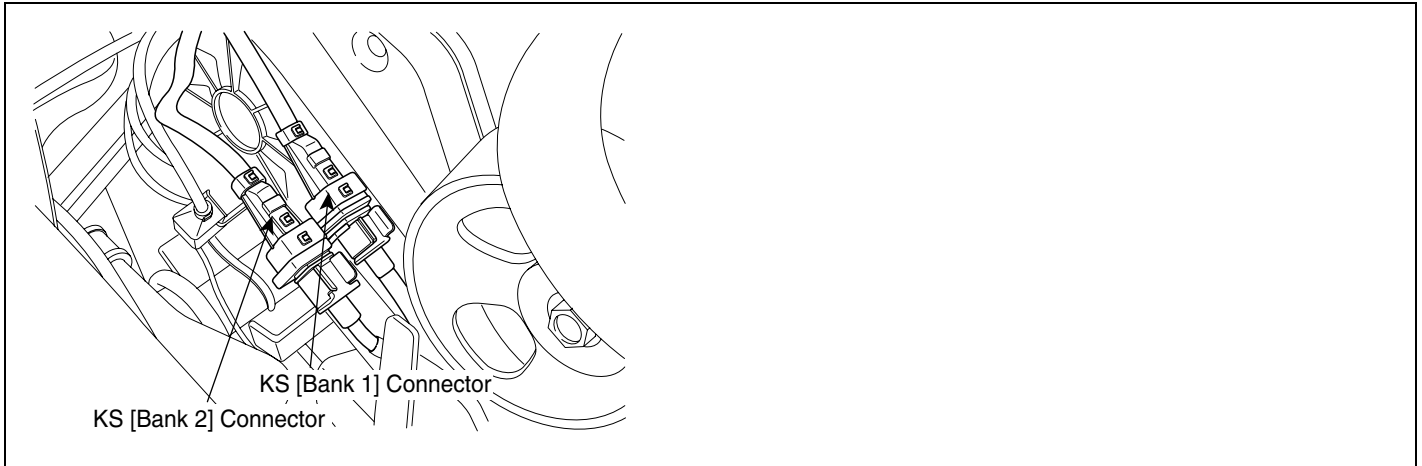
VERIFICATION OF VEHICLE REPAIR

E8B2B29F

Refer to DTC P0325.

DTC P0330 KNOCK SENSOR 2 CIRCUIT

COMPONENT LOCATION E0EE8921



LGLG514A

GENERAL DESCRIPTION ED3DE7AF

The knock sensor is attached to the cylinder block and senses engine knocking. The sensor contains a piezoelectric element that converts vibration (or noise) into voltage signal and sends this signal to ECM. With input signals from camshaft position and crankshaft position sensor, ECM can identify which cylinder is knocking. ECM filters vibrations and determines if the vibrations are knocking signal. The Engine Control Module (ECM) uses this signal to suppress knocking by retarding ignition timing. The ECM will set a code (Malfunction Indicator Lamp will Not turn on) if during two driving cycles the Knock sensor's output voltage falls below minimum threshold. This code indicates an unexpected vibration is being read by the Knock sensor or ECM under normal engine operation.

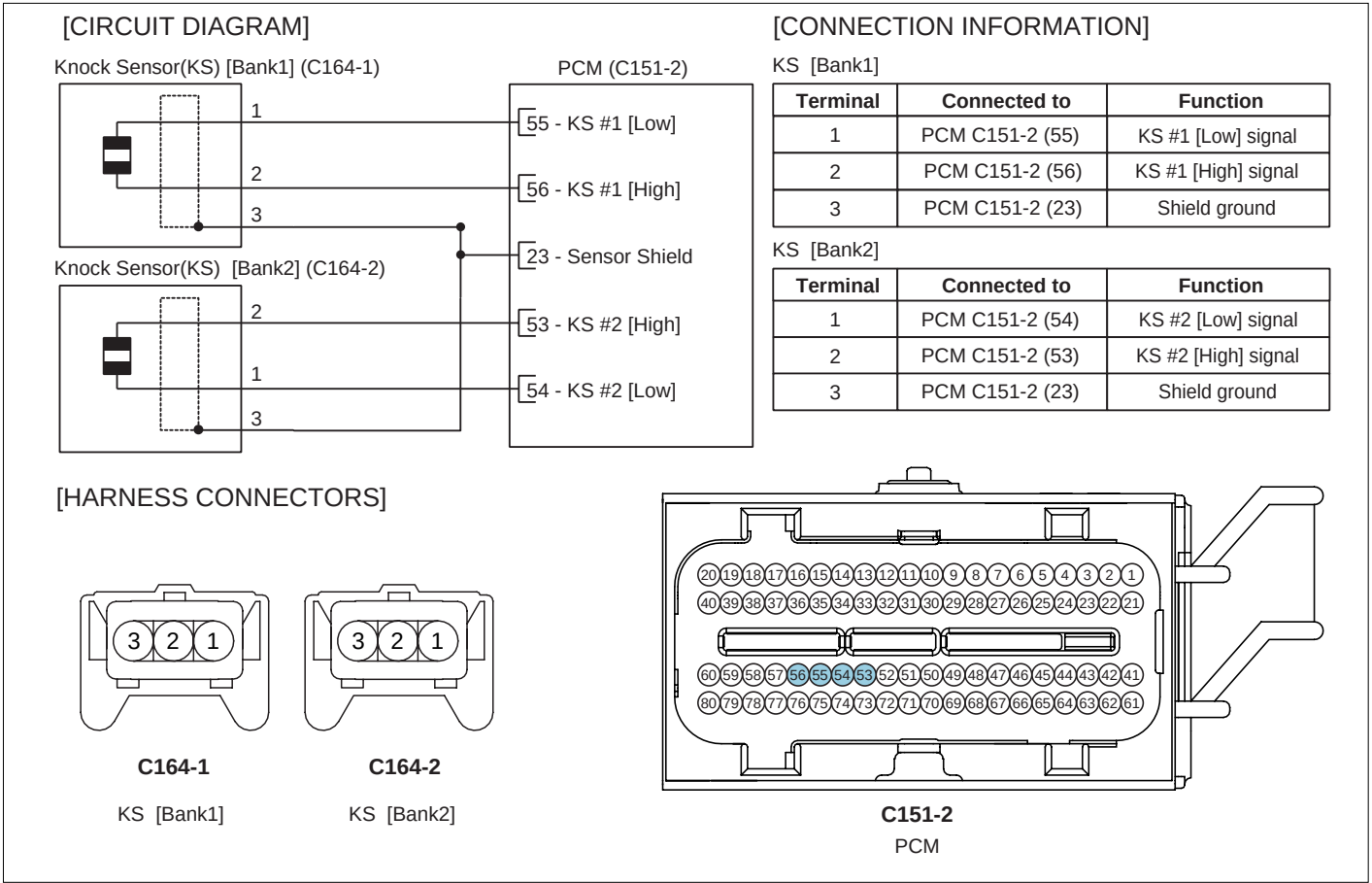
DTC DESCRIPTION E7DD6DC4

Checking the range of input signal with a knock sensor under detecting condition, PCM senses open in knock sensor circuit or malfunction of sensor. If a knock signal or noise level is inputted without the specified value during standard duration, PCM sets P0330.

DTC DETECTING CONDITION E6FBD4AC

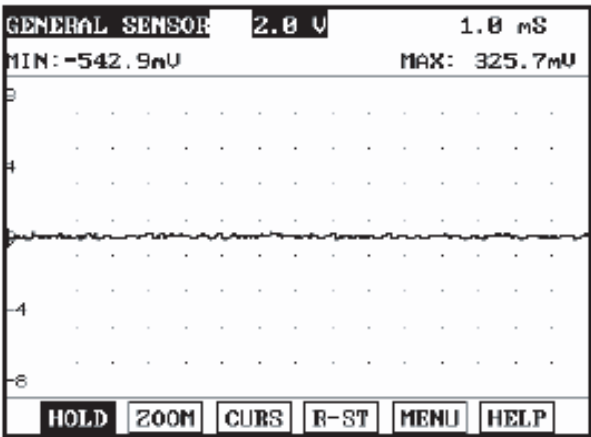
Item	Detecting Condition	Possible cause
DTC Strategy	Signal open	- Poor connection - Open in harness - Knock sensor - PCM
Enable Conditions	- Pressure in intake manifold is normal. - Engine speed ≥ 2000rpm	
Threshold value	Filter coefficient < 1.0	
Diagnosis Time	Continuous	
MIL On Condition	No MIL ON (DTC only)	

SCHEMATIC DIAGRAM E0FCDD97



SVQF16112L

SIGNAL WAVEFROM AND DATE E86BAB8E



The knock sensor is installed at cycliner block to detect the vibration effectively during engine running. The above waveform shows the signal waveform of knock sensor when knock dosen't happen. Generally, knock signal has more noise than other sensor.

EGRF610B

MONITOR DTC STATUS

E0C4799D

1. Check DTC Status

- 1) Connect scantool to Data Link Connector(DLC).
- 2) IG "ON".
- 3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F4(DTAL) to check DTC's information from the DTCs menu
- 4) Read "DTC Status" parameter.

1.1 DIAGNOSTIC TROUBLE CODES			
PXXXX DTC TITLE			
NUMBER OF DTC : 1 ITEMS			
PART	ERAS	DTAL	

PXXXX TITLE	
1.MIL STATUS:	ON/OFF
2.DTC STATUS:	PRESENT/HISTORY
3.DIAG.STATUS:	DIAGNOSIS FINISHED
DTC CAUSE TO SYSTEM ERROR : PXXXX	

SCMF16159L

5) Is parameter displayed "Present fault"?

YES

- Go to "Terminal and connector inspection" procedure.

NO

- Fault is intermittent caused by poor contact in the sensor' s and/or PCM' s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

TERMINAL AND CONNECTOR INSPECTION

E7C820BD

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

- Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

DTC TROUBLESHOOTING PROCEDURES

FLA -427

- ▶ Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION EA2CFD40

1. Check open in harness
 - 1) IG "OFF" and disconnect knock sensor connector and PCM connector.
 - 2) Measure resistance between terminal 1 of knock sensor harness connector and terminal 54 of PCM harness connector.
 - 3) Measure resistance between terminal 2 of knock sensor harness connector and terminal 53 of PCM harness connector.

Specification : Below 1Ω

- 4) Is the measured resistance within specification?

YES

▶ If the problem is corrected after substituting with a known - good knock sensor, replace it. If the problem is pending, check for proper operating after substituting with a known - good PCM. and then if the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▶ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR E44C2C07

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

▶ System performing to specification at this time. Clear the DTC.

NO

▶ Go to the applicable troubleshooting procedure.

FLA -428

FUEL SYSTEM

DTC P0331 KNOCK SENSOR 2 CIRCUIT RANGE/PERFORMANCE (BANK 2)

COMPONENT LOCATION E18EE9DD

Refer to DTC P0330.

GENERAL DESCRIPTION EEE1C293

Refer to DTC P0330.

DTC DESCRIPTION E6DC497A

Checking the range of input signal with a knock sensor under detecting condition, PCM senses short in knock sensor circuit or malfunction of sensor. If the average value of the knock signals is out of the threshold value during standard duration, PCM sets P0331.

DTC DETECTING CONDITION EC24661A

Item	Detecting Condition	Possible cause
DTC Strategy	Signal short	- Poor connection - Short in harness - Knock sensor - PCM
Enable Conditions	- Pressure in intake manifold is normal. - Engine speed $\geq$ 2000 rpm	
Threshold value	Knock Filtered Value < 5 or > 65	
Diagnosis Time	Continuous	
MIL On Condition	No MIL ON (DTC only)	

SCHEMATIC DIAGRAM E8CBE139

Refer to DTC P0330.

SIGNAL WAVEFROM AND DATE E0249FF3

Refer to DTC P0330.

MONITOR DTC STATUS EA416913

Refer to DTC P0330.

TERMINAL AND CONNECTOR INSPECTION EFB4E0B0

Refer to DTC P0330.

SIGNAL CIRCUIT INSPECTION E4888D9C

- Check short to battery in harness
 - IG "OFF" and disconnect knock sensor connector.
 - IG "ON" and ENG "OFF"

DTC TROUBLESHOOTING PROCEDURES

FLA -429

- 3) Measure voltage between terminal 1 of knock sensor harness connector and chassis ground
- 4) Measure voltage between terminal 2 of knock sensor harness connector and chassis ground.

Specification : Approx. 1.5V

- 5) Is the measured voltage within specification?

YES

- ▶ Go to "Check short to ground in harness" as follows.

NO

- ▶ Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

2. Check short to ground in harness

- 1) IG "OFF" and disconnect knock sensor connector and PCM connector.
- 2) Measure resistance between terminal 1 of knock sensor harness connector and chassis ground.
- 3) Measure resistance between terminal 2 of knock sensor harness connector and chassis ground.
- 4) Measure resistance between terminal 1 and 3 of knock sensor harness connector.
- 5) Measure resistance between terminal 2 and 3 of knock sensor harness connector.

Specification : Infinite

- 6) Is the measured resistance within specification?

YES

- ▶ If the problem is corrected after substituting with a known - good knock sensor, replace it. If the problem is pending, check for proper operating after substituting with a known - good PCM. and then if the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

- ▶ Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

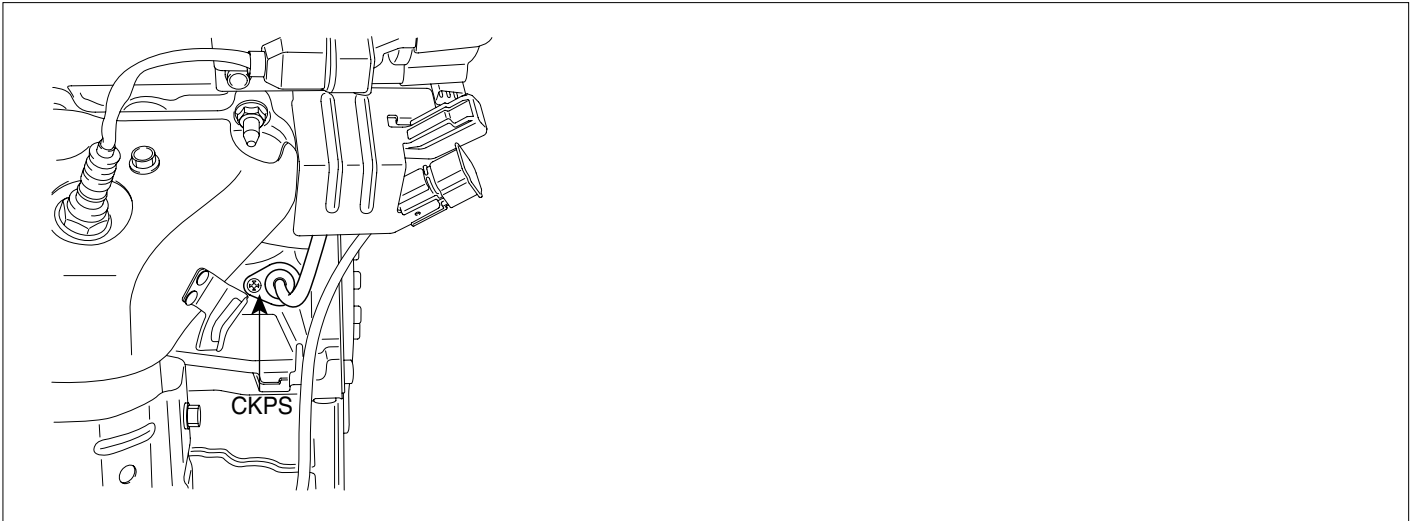
VERIFICATION OF VEHICLE REPAIR

EAC4A3B3

Refer to DTC P0330.

DTC P0335 CRANKSHAFT POSITION SENSOR A CIRCUIT

COMPONENT LOCATION EF1D1FC6



LGLG515A

GENERAL DESCRIPTION ECF67ABB

The Crankshaft Position Sensor (CKPS) is a magnetic field sensitive type sensor that generates voltage using a sensor and a target wheel mounted on the crankshaft; there are 58 slots in the target wheel where one is longer than the others. During one crankshaft rotation there are 58 rectangular signals and one longer signal. The ECM calculates engine RPM by using the sensor's signal and controls the injection duration and the ignition timing. Using the signal differences caused by the longer slot, the ECM identifies which cylinder is at top dead center.

DTC DESCRIPTION E2BEDA83

Checking reference signals from CKPS under detecting condition, if any signal is not detected for more than 0.15 sec., PCM sets P0335. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E8F43B64

Item	Detecting Condition	Possible cause
DTC Strategy	Check reference wave during cranking	- Poor connection - Open in harness - CKP sensor - PCM
Enable Conditions	- IG "ON", Cranking or engine-off during driving - No DTC related to CAM - Camshaft position sensor state change	
Threshold value	No reference signal over 0.15 sec.	
Diagnosis Time	0.15 sec.	
MIL On Condition	2 driving cycles	

SPECIFICATION E0F9ABBE

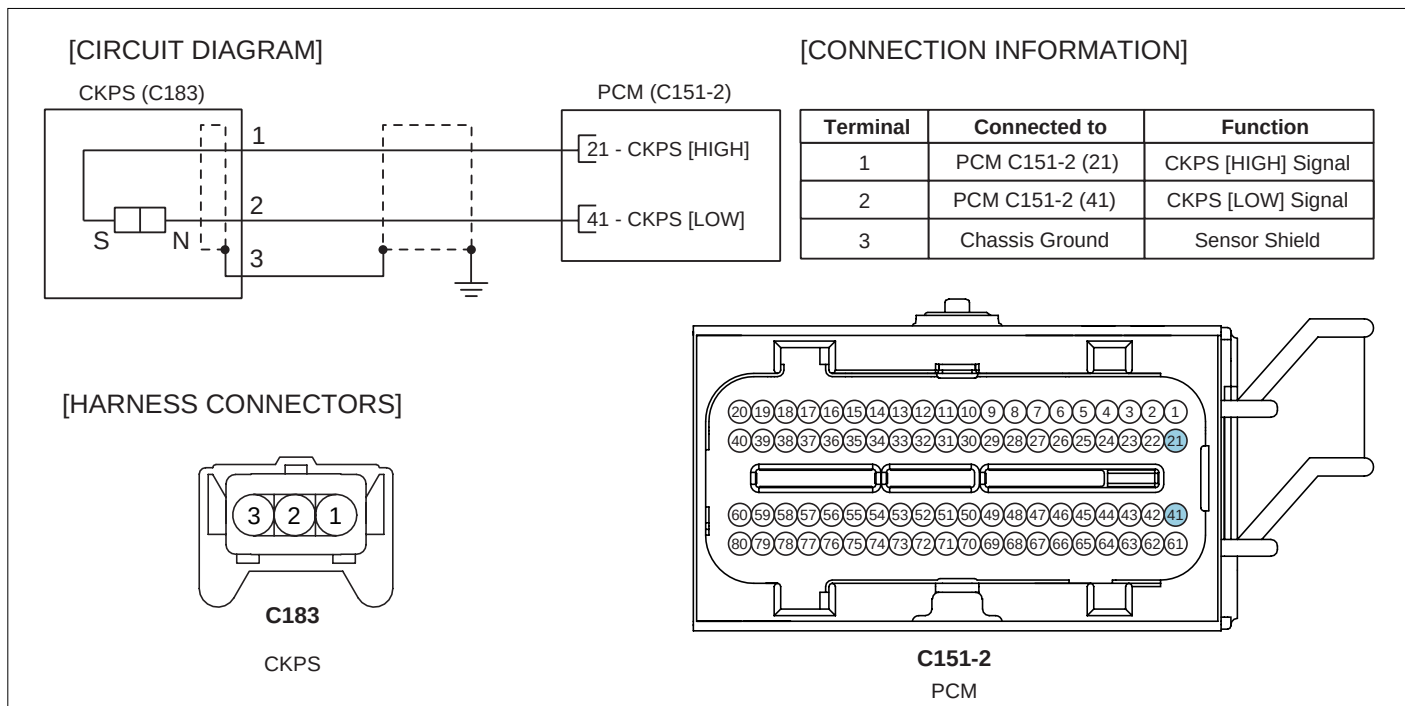
Resistance	825 ± 100Ω

DTC TROUBLESHOOTING PROCEDURES

FLA -431

SCHEMATIC DIAGRAM

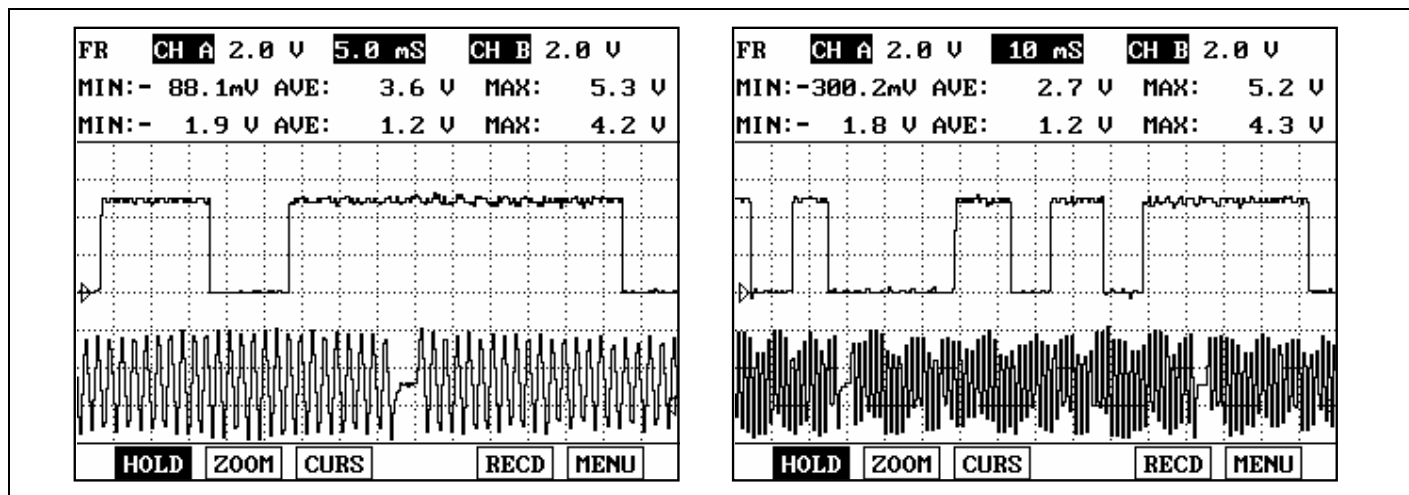
E5041BCF



SVQF16109L

SIGNAL WAVEFROM AND DATE

EB93BDD5



EGRF610K

MONITOR DTC STATUS

E152D6C1

1. Check DTC Status
 - 1) Connect scantool to Data Link Connector(DLC).
 - 2) IG "ON".
 - 3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F4(DTAL) to check DTC's information from the DTCs menu
 - 4) Read "DTC Status" parameter.

1.1 DIAGNOSTIC TROUBLE CODES			
PXXXX DTC TITLE			
NUMBER OF DTC : 1 ITEMS			
PART	ERAS	DTAL	

PXXXX TITLE	
1.MIL STATUS:	ON/OFF
2.DTC STATUS:	PRESENT/HISTORY
3.DIAG.STATUS:	DIAGNOSIS FINISHED
DTC CAUSE TO SYSTEM ERROR : PXXXX	

SCMF16159L

5) Is parameter displayed "Present fault"?

YES

► Go to "Terminal and connector inspection" procedure.

NO

► Fault is intermittent caused by poor contact in the sensor' s and/or PCM' s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

TERMINAL AND CONNECTOR INSPECTION

EB412486

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

► Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

► Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

ECDD9E7E

1. Check voltage
 - 1) IG "OFF" and disconnect CKPS connector.
 - 2) IG "ON" and ENG "OFF"
 - 3) Measure voltage between terminal 1 of CKPS harness connector and chassis ground.

DTC TROUBLESHOOTING PROCEDURES

FLA -433

- 4) Measure voltage between terminal 2 of CKPS harness connector and chassis ground.

Specification : Approx. 1.4V

- 5) Is the measured voltage within specification?

YES

- ▶ Go to "Component Inspection" procedure.

NO

- ▶ Go to "Check open in harness" as follows.

2. Check open in harness

- 1) IG "OFF" and disconnect CKPS connector and PCM connector.
- 2) Measure resistance between terminal 1 of CKPS harness connector and terminal 41 of PCM harness connector.
- 3) Measure resistance between terminal 2 of CKPS harness connector and terminal 21 of PCM harness connector.

Specification : Below 1Ω

- 4) Is the measured resistance within specification?

YES

- ▶ Go to "Component Inspection" procedure.

NO

- ▶ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

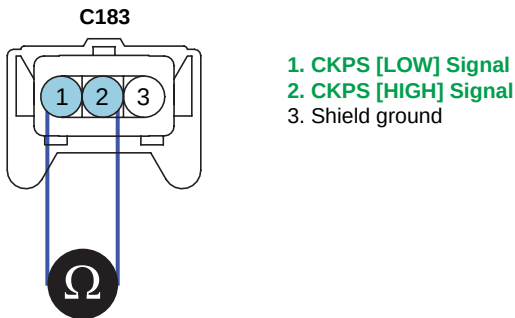
COMPONENT INSPECTION E67111F8

1. Check CKPS

- 1) IG "OFF" and disconnect CKPS connector.
- 2) Measure resistance between terminals 1 and 2 of CKPS connector.(Component side)

SPECIFICATION :

Resistance	825 ± 100Ω



SVQF16304L

3) Is the measured resistance within specification?

YES

► Go to "Check signal waveform of CKPS" as follows.

NO

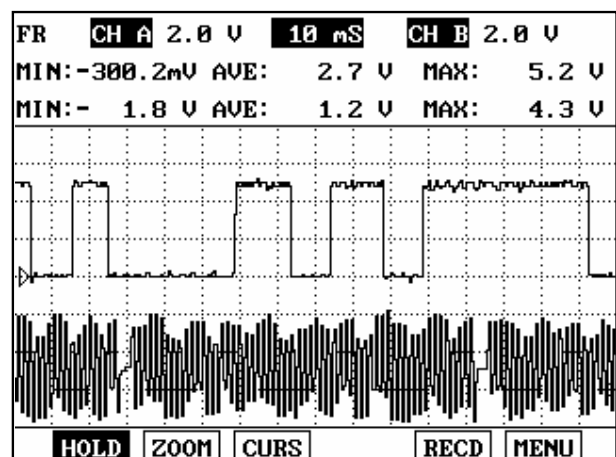
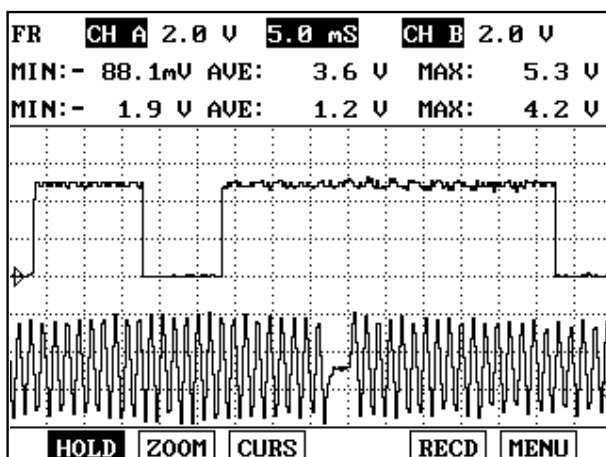
► Substitute with a known - good CKPS and check for proper operation. If the problem is corrected, replace CKPS and go to "Verification of Vehicle Repair" procedure.

2. Check signal waveform of CKPS

1) IG "OFF" and connect scantool.

2) ENG "ON" and Measure signal waveform at terminal 1 or 2 of CKPS.

REFERENCE SIGNAL WAVEFORM :



EGRF610K

3) Is the measured signal waveform normal?

YES

► Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary, and go to "Verification of Vehicle Repair" procedure.

NO

► Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

E6F57B93

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

► System performing to specification at this time. Clear the DTC.

NO

► Go to the applicable troubleshooting procedure.

FLA -436

FUEL SYSTEM

DTC P0336 CRANKSHAFT POSITION SENSOR A CIRCUIT RANGE/PERFORMANCE

COMPONENT LOCATION E841DF15

Refer to DTC P0335.

GENERAL DESCRIPTION EBDF7934

Refer to DTC P0335.

DTC DESCRIPTION ED49DB3E

Checking output signals from CKPS every 7.8 sec. under detecting condition, if an output signal is missing or redundant for more than 1.56 sec., PCM sets P0336. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION EA703496

Item	Detecting Condition	Possible cause
DTC Strategy	Detecting extra/missing pulses between consecutive 58X reference pulses	- Poor connection - Noise - Short in harness - Target wheel - PCM
Enable Conditions	Engine running state	
Threshold value	Extra/ missing pulses > 2 pulse	
Diagnosis Time	Continuous (More than 1.56 sec.failure for every 7.8 sec.test)	
MIL On Condition	2 driving cycles	

SPECIFICATION E2C1013E

Resistance	825 ± 100Ω

SCHEMATIC DIAGRAM E0DE8501

Refer to DTC P0335.

SIGNAL WAVEFROM AND DATA E6425136

Refer to DTC P0335.

MONITOR DTC STATUS EDF2DA1D

Refer to DTC P0335.

TERMINAL AND CONNECTOR INSPECTION E825C7C2

Refer to DTC P0335.

DTC TROUBLESHOOTING PROCEDURES

FLA -437

SIGNAL CIRCUIT INSPECTION EAFA6CC0

1. Check voltage

- 1) IG "OFF" and disconnect CKPS connector.
- 2) IG "ON" and ENG "OFF"
- 3) Measure voltage between terminal 1 of CKPS harness connector and chassis ground.
- 4) Measure voltage between terminal 2 of CKPS harness connector and chassis ground.

Specification : Approx. 1.4V

- 5) Is the measured voltage within specification?

YES

- ▶ Go to "Component Inspection" procedure.

NO

- ▶ Go to "Check short in harness" as follows.

2. Check short in harness

- 1) IG "OFF" and disconnect CKPS connector and PCM connector.
- 2) Measure resistance between terminal 1(2) of CKPS harness connector and chassis ground.
- 3) Measure resistance between terminals 1 and 2 of CKPS harness connector.
- 4) Measure resistance between terminals 1(2) and 3 of CKPS harness connector.

Specification : Infinite

- 5) Is the measured resistance within specification?

YES

- ▶ Go to "Component Inspection" procedure.

NO

- ▶ Repair short in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E7D8DBBA

1. Visually check CKPS and Target wheel

- 1) IG "OFF"
- 2) Check CKPS and target wheel for deformation or damage visually
- 3) Is the above items normal ?

YES

► Go to "Check CKPS resistance" as follows.

NO

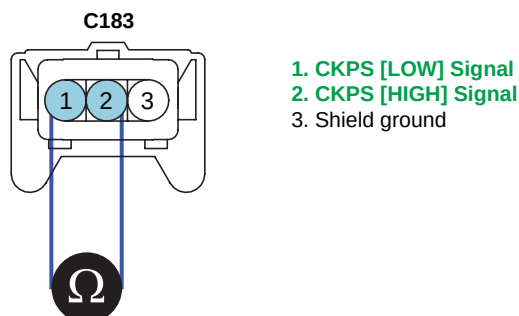
► Repair or replace it, and go to "Verification of Vehicle Repair" procedure.

2. Check CKPS resistance

- 1) IG "OFF" and disconnect CKPS connector.
- 2) Measure resistance between terminals 1 and 2 of CKPS connector. (Component side)

SPECIFICATION :

Resistance	$825 \pm 100\Omega$



SVQF16304L

3) Is the measured resistance within specification?

YES

► Go to "Check signal waveform of CKPS" as follows.

NO

► Substitute with a known - good CKPS and check for proper operation. If the problem is corrected, replace CKPS and go to "Verification of Vehicle Repair" procedure.

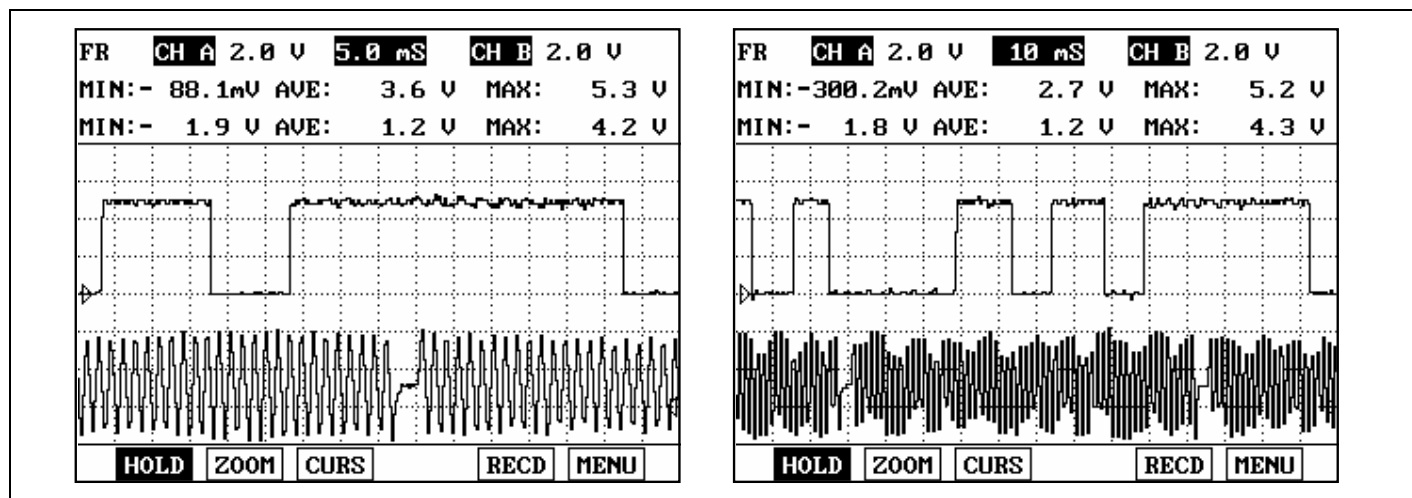
3. Check signal waveform of CKPS

- 1) IG "OFF" and connect scantool.
- 2) ENG "ON" and Measure signal waveform at terminal 1 or 2 of CKPS.

DTC TROUBLESHOOTING PROCEDURES

FLA -439

REFERENCE SIGNAL WAVEFORM :



EGRF610K

3) Is the measured signal waveform normal?

YES

► Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary, and go to "Verification of Vehicle Repair" procedure.

NO

► Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

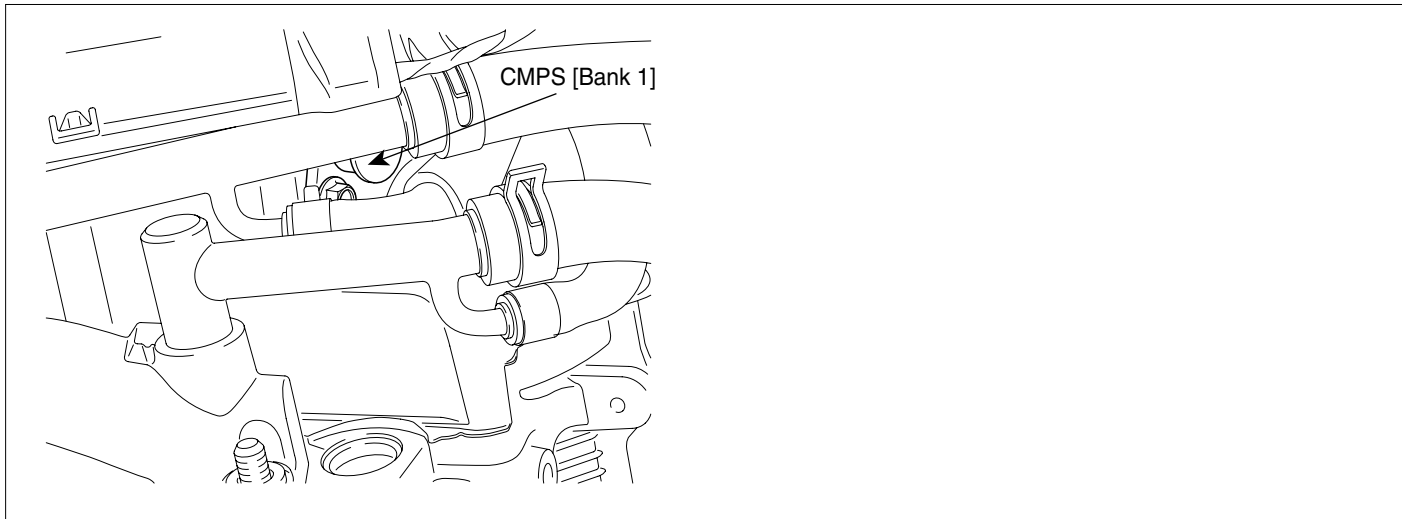
VERIFICATION OF VEHICLE REPAIR

EF39C360

Refer to DTC P0335.

DTC P0340 CAMSHAFT POSITION SENSOR A CIRCUIT MALFUNCTION (BANK 1 OR SINGLE SENSOR)

COMPONENT LOCATION EB1D0C8C



LGLG516A

GENERAL DESCRIPTION E64D42CB

The Camshaft Position Sensor (CMPS) is a sensor that detects the compression TDC of the NO. 1 cylinder. The CMPS consists of a hall type sensor and a target on the end of the intake camshaft. When the target triggers the sensor, the sensor voltage is 5V. If not, the sensor voltage is 0V. These CMPS signal is sent to the ECM and the ECM uses the CMPS signal for synchronizing the firing of sequential fuel injectors.

DTC DESCRIPTION EA360937

If PCM detects that cam event signal count is over 3 under detecting condition, PCM sets P0340. And MIL(Malfunction Indication Lamp) turns on.

DTC DETECTING CONDITION E7BF5DA1

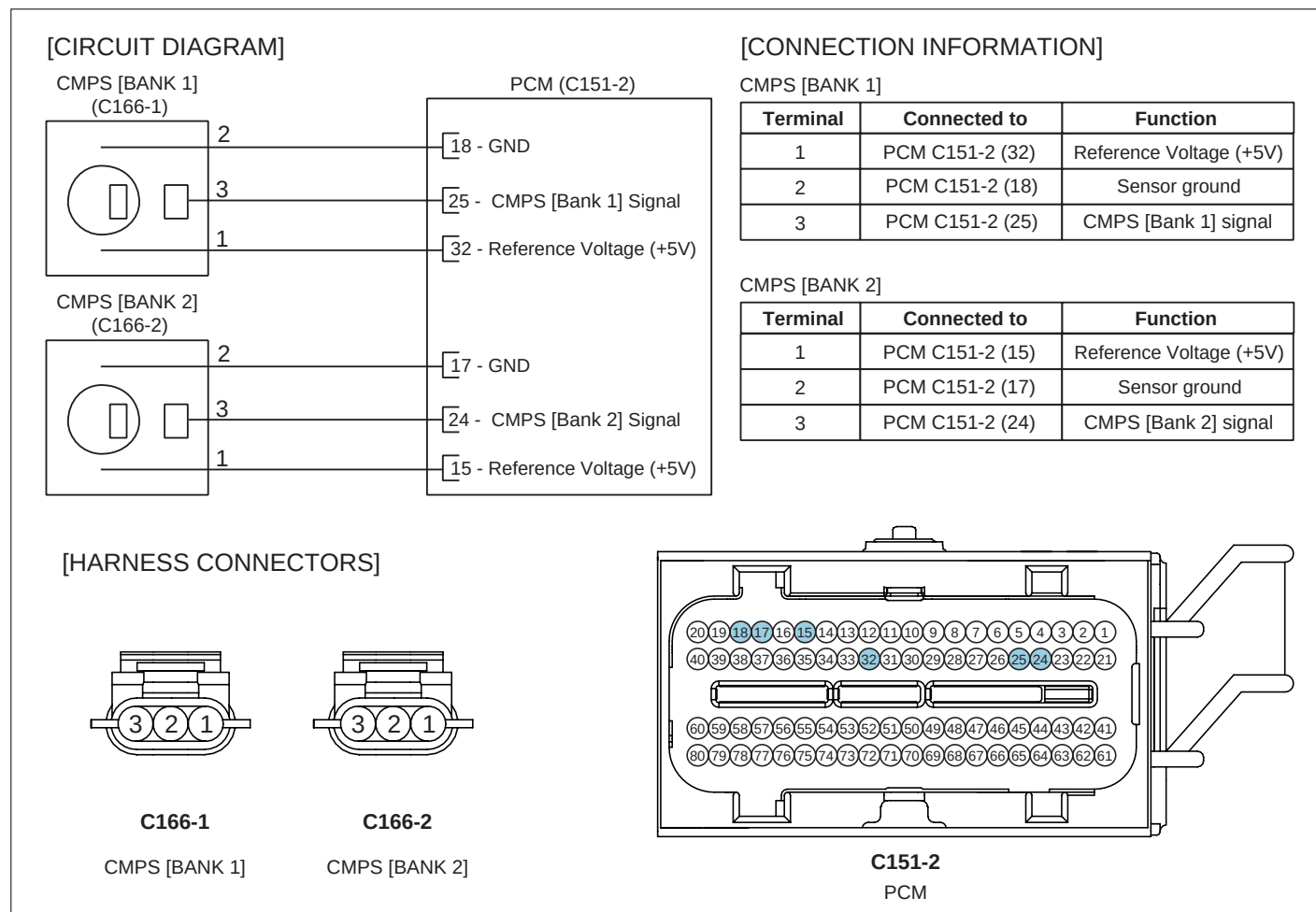
Item	Detecting Condition	Possible cause
DTC Strategy	Check if CAM sensor is synchronized correctly	- Poor connection - Open in harness - CMPS(Bank 1) - PCM
Enable Conditions	Engine running state	
Threshold value	CAM event signal count ≥ 3	
Diagnosis Time	Continuous	
MIL On Condition	1 driving cycles	

DTC TROUBLESHOOTING PROCEDURES

FLA -441

SCHEMATIC DIAGRAM

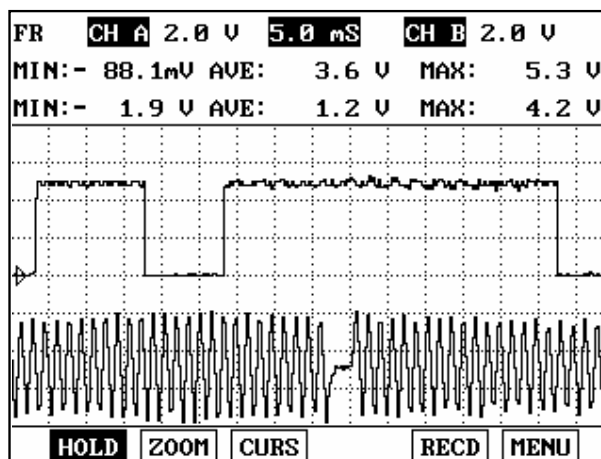
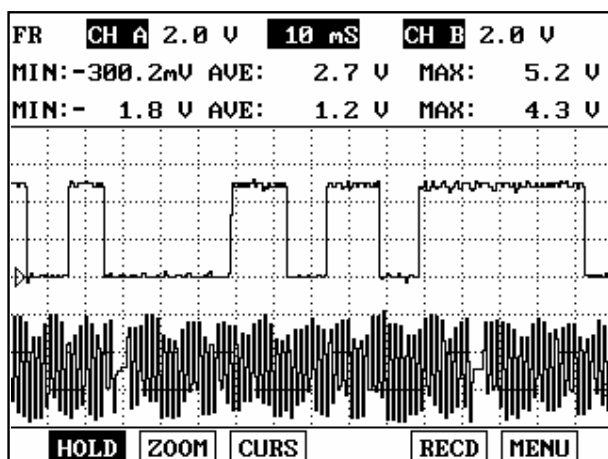
EB501374



SVQF16108L

SIGNAL WAVEFROM AND DATE

E3522305



This example shows a typical Crankshaft Position Sensor (CKPS) and Camshaft Position Sensor (CMPS) waveform at idle. The PCM controls the injection and ignition timing by using these signals. Generally CKPS signal is used to detect the piston's position and CMPS signal is used to detect the Top Dead Center of each cylinder.

EGRF610R

MONITOR DTC STATUS

E94F1D1C

1. Check DTC Status

- 1) Connect scantool to Data Link Connector(DLC).
- 2) IG "ON".
- 3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F4(DTAL) to check DTC's information from the DTCs menu
- 4) Read "DTC Status" parameter.

1.1 DIAGNOSTIC TROUBLE CODES			
PXXXX DTC TITLE			
NUMBER OF DTC : 1 ITEMS			
PART	ERAS	DTAL	

PXXXX TITLE	
1.MIL STATUS:	ON/OFF
2.DTC STATUS:	PRESENT/HISTORY
3.DIAG.STATUS:	DIAGNOSIS FINISHED
DTC CAUSE TO SYSTEM ERROR : PXXXX	

SCMF16159L

5) Is parameter displayed "Present fault"?

YES

- Go to "Terminal and connector inspection" procedure.

NO

- Fault is intermittent caused by poor contact in the sensor' s and/or PCM' s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

TERMINAL AND CONNECTOR INSPECTION

E84D9A8F

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

- Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

DTC TROUBLESHOOTING PROCEDURES

FLA -443

- ▶ Go to "Power Circuit Inspection" procedure.

POWER CIRCUIT INSPECTION E889698F

1. IG "OFF" and disconnect CMPS connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 1 of CMPS(B1) harness connector and chassis ground.

Specification : Approx. 5V

4. Is the measured voltage within specification?

YES

- ▶ Go to "Signal Circuit Inspection" procedure.

NO

- ▶ Repair open or short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION E6AE2417

1. Check voltage
 - 1) IG "OFF" and disconnect CMPS connector.
 - 2) IG "ON" and ENG "OFF"
 - 3) Measure voltage between terminal 3 of CMPS(B1) harness connector and chassis ground.

Specification : Approx. 5V

- 4) Is the measured voltage within specification?

YES

- ▶ Go to "Component Inspection" as follows.

NO

- ▶ Go to "Check open in harness" as follows.

2. Check open in harness

- 1) IG "OFF" and disconnect CMPS connector and PCM connector.
- 2) Measure resistance between terminal 3 of CMPS harness connector and terminal 25 of PCM harness connector.

Specification : Below 1Ω

- 3) Is the measured resistance within specification?

YES

- ▶ Go to "Ground Circuit Inspection" procedure.

NO

- Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION EA1D6745

1. IG "OFF" and disconnect CMPS connector.
2. Measure voltage between terminal 3 of CMPS harness connector and chassis ground.
3. Measure voltage between terminals 2 and 3 of CMPS harness connector.

Specification : Measurement "A" - Measurement 'B' = Approx. below 200mV

4. Is the measured voltage within specification?

YES

- Go to "Component Inspection" procedure.

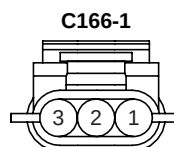
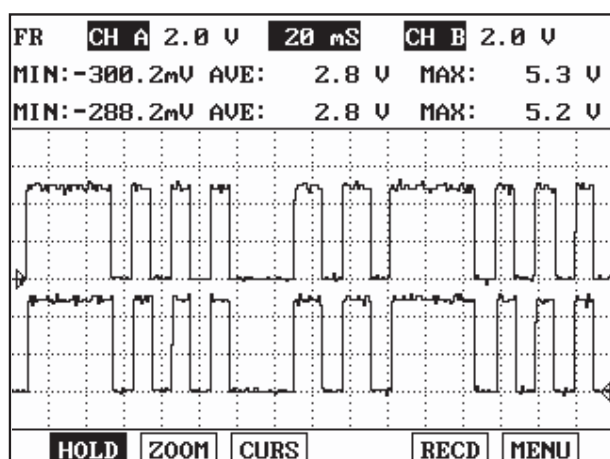
NO

- Repair open or contact resistance in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E94AD601

1. Check CMPS
 - 1) IG "OFF" and connect scantool.
 - 2) ENG "ON" and Measure signal waveform at terminal 3 of CMPS.

REFERENCE SIGNAL WAVEFORM :



1. Reference Voltage (+5V)
2. Sensor ground
3. CMPS [Bank 1] signal

SVQF16310L

- 3) Is the measured signal waveform normal?

YES

- Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

- ▶ Substitute with a known - good CMPS and check for proper operation. If the problem is corrected, replace CMPS and go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

E54AD5D6

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

- ▶ System performing to specification at this time. Clear the DTC.

NO

- ▶ Go to the applicable troubleshooting procedure.

FLA -446

FUEL SYSTEM

DTC P0341 CAMSHAFT POSITION SENSOR A CIRCUIT RANGE/PERFORMANCE (BANK 1 OR SINGLE SENSOR)

COMPONENT LOCATION E0B45A3C

Refer to DTC P0340.

GENERAL DESCRIPTION E840146B

Refer to DTC P0340.

DTC DESCRIPTION E0819699

Checking output signals from CMP during engine running, if the expected number of cam tooth count is not observed. PCM sets P0341. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION EACE8905

Item	Detecting Condition	Possible cause
DTC Strategy	• Check if CAM sensor is synchronized correctly	• Poor connection • Short in harness • electrical noise • Target wheel • CMPS • PCM
Enable Conditions	• Engine running state	
Threshold value	• Cam tooth count $\neq$ 6	
Diagnosis Time	• Continuous	
MIL On Condition	• 2 driving cycles	

SCHEMATIC DIAGRAM E2AE546B

Refer to DTC P0340.

SIGNAL WAVEFROM AND DATA E32A4B2F

Refer to DTC P0340.

MONITOR DTC STATUS E6D69B5E

Refer to DTC P0340.

TERMINAL AND CONNECTOR INSPECTION E176A700

Refer to DTC P0340.

POWER CIRCUIT INSPECTION E099D74C

1. IG "OFF" and disconnect CMPS connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 1 of CMPS(B1) harness connector and chassis ground.

Specification : Approx. 5V

DTC TROUBLESHOOTING PROCEDURES

FLA -447

4. Is the measured voltage within specification?

YES

- Go to "Signal Circuit Inspection" procedure.

NO

- Repair open or short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION E1FE1902

1. Check short in harness

- 1) IG "OFF" and disconnect CMPS connector.
- 2) Measure resistance between terminals 1 and 3 of CMPS(B1) harness connector.

Specification : Infinite

- 3) Is the measured resistance within specification?

YES

- Go to "Check short to ground in harness" as follows.

NO

- Repair short in harness, and go to "Verification of Vehicle Repair" procedure.

2. Check short to ground in harness

- 1) IG "OFF" and disconnect CMPS connector and PCM connector.
- 2) Measure resistance between terminal 3 of CMPS(B1) harness connector and chassis ground.

Specification : Infinite

- 3) Is the measured resistance within specification?

YES

- Go to "Component Inspection" procedure.

NO

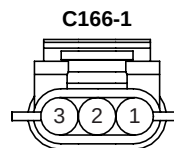
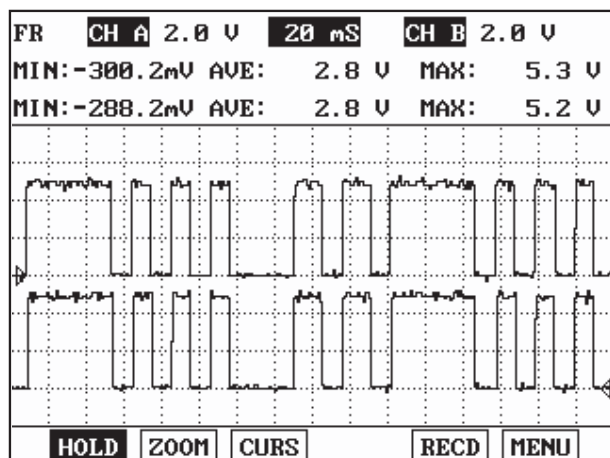
- Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E544CFDB

1. Check CMPS

- 1) IG "OFF" and connect scantool.
- 2) ENG "ON" and Measure signal waveform at terminal 3 of CMPS.

REFERENCE SIGNAL WAVEFORM :



1. Reference Voltage (+5V)
2. Sensor ground
3. CMPS [Bank 1] signal

SVQF16310L

3) Is the measured signal waveform normal?

YES

► Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

► Substitute with a known - good CMPS and check for proper operation. If the problem is corrected, replace CMPS and go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

EFE1E6C7

Refer to DTC P0340.

DTC TROUBLESHOOTING PROCEDURES

FLA -449

DTC P0346 CAMSHAFT POSITION SENSOR "A" CIRCUIT RANGE/PERFORMANCE (BANK 2)

COMPONENT LOCATION EE329BAD

Refer to DTC P0340.

GENERAL DESCRIPTION ECCCBCC7

Refer to DTC P0340.

DTC DESCRIPTION E7C4F9E2

Checking output signals from CMP during engine running, if the expected number of cam tooth count is not observed. PCM sets P0346. MIL (Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycles.

DTC DETECTING CONDITION E6BFC1A6

Item	Detecting Condition	Possible cause
DTC Strategy	• Check if CAM sensor is synchronized correctly	• Poor connection • Open or short in harness • electrical noise • Target wheel • CMPS • PCM
Enable Conditions	• Engine running state	
Threshold value	• Cam tooth count $\neq$ 6	
Diagnosis Time	• Continuous	
MIL On Condition	• 2 driving cycles	

SCHEMATIC DIAGRAM E43C80D5

Refer to DTC P0340.

SIGNAL WAVEFORM AND DATA E536A47E

Refer to DTC P0340.

MONITOR DTC STATUS EAA40E85

Refer to DTC P0340.

TERMINAL AND CONNECTOR INSPECTION ECCDDFC8

Refer to DTC P0340.

POWER CIRCUIT INSPECTION E53D0B80

1. IG "OFF" and disconnect CMPS connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 1 of CMPS(B2) harness connector and chassis ground.

Specification : Approx. 5V

4. Is the measured voltage within specification?

YES

► Go to "Signal Circuit Inspection" procedure.

NO

► Repair open or short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

E3ED19ED

1. Check voltage

- 1) IG "OFF" and disconnect CMPS connector.
- 2) IG "ON" and ENG "OFF"
- 3) Measure voltage between terminal 3 of CMPS(B2) harness connector and chassis ground.

Specification : Approx. 5V

4) Is the measured voltage within specification?

YES

► Go to "Check short in harness" as follows.

NO

► Go to "Check open in harness" as follows.

2. Check short in harness

- 1) IG "OFF" and disconnect CMPS connector.
- 2) Measure resistance between terminals 1 and 3 of CMPS(B2) harness connector.

Specification : Infinite

3) Is the measured resistance within specification?

YES

► Go to "Check short to ground in harness" as follows.

NO

► Repair short in harness, and go to "Verification of Vehicle Repair" procedure.

3. Check short to ground in harness

- 1) IG "OFF" and disconnect CMPS connector and PCM connector.
- 2) Measure resistance between terminal 3 of CMPS(B2) harness connector and chassis ground.

Specification : Infinite

DTC TROUBLESHOOTING PROCEDURES

FLA -451

- 3) Is the measured resistance within specification?

YES

- Go to "Ground Circuit Inspection" procedure.

NO

- Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

4. Check open in harness

- 1) IG "OFF" and disconnect CMPS connector and PCM connector.
- 2) Measure resistance between terminal 3 of CMPS harness connector and terminal 24 of PCM harness connector.

Specification : Below 1Ω

- 3) Is the measured resistance within specification?

YES

- Go to "Ground Circuit Inspection" procedure.

NO

- Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION E8222698

1. IG "OFF" and disconnect CMPS connector.
2. Measure voltage between terminal 3 of CMPS harness connector and chassis ground.
3. Measure voltage between terminals 2 and 3 of CMPS harness connector.

Specification : Measurement "A" - Measurement 'B' = Approx. below 200mV

4. Is the measured voltage within specification?

YES

- Go to "Component Inspection" procedure.

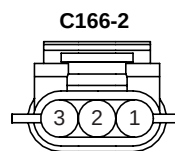
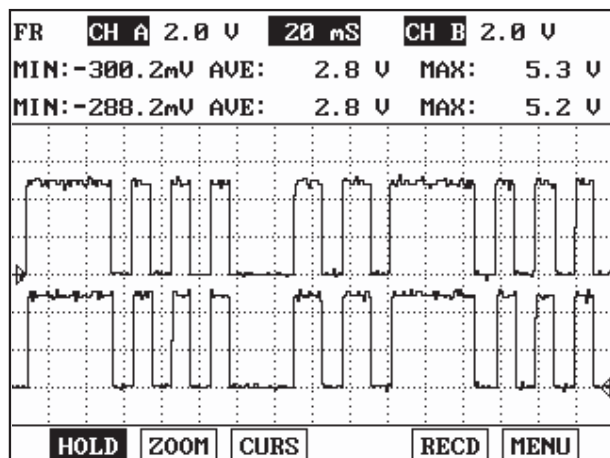
NO

- Repair open or contact resistance in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EEDE8846

1. Check CMPS
 - 1) IG "OFF" and connect scantool.
 - 2) ENG "ON" and Measure signal waveform at terminal 3 of CMPS.

REFERENCE SIGNAL WAVEFORM :



1. Reference Voltage (+5V)
2. Sensor ground
3. CMPS [Bank 2] signal

SVQF16319L

3) Is the measured signal waveform normal?

YES

► Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

► Check the electrical noise of signal waveform, and go to "Check target wheel of CAM shaft" as follows.

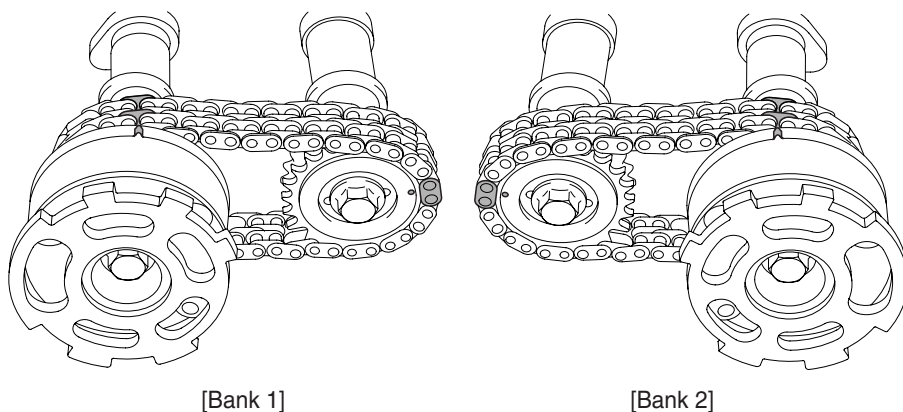


NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

2. Check target wheel of CAM shaft

- 1) IG "OFF"
- 2) Remove the cover of cylinder head and check target wheel state of bank 2.



LGLG517A

3) Is the target wheel state normal?

DTC TROUBLESHOOTING PROCEDURES

FLA -453

YES

- ▶ Substitute with a known - good CMPS and check for proper operation. If the problem is corrected, replace CMPS and go to "Verification of Vehicle Repair" procedure.

NO

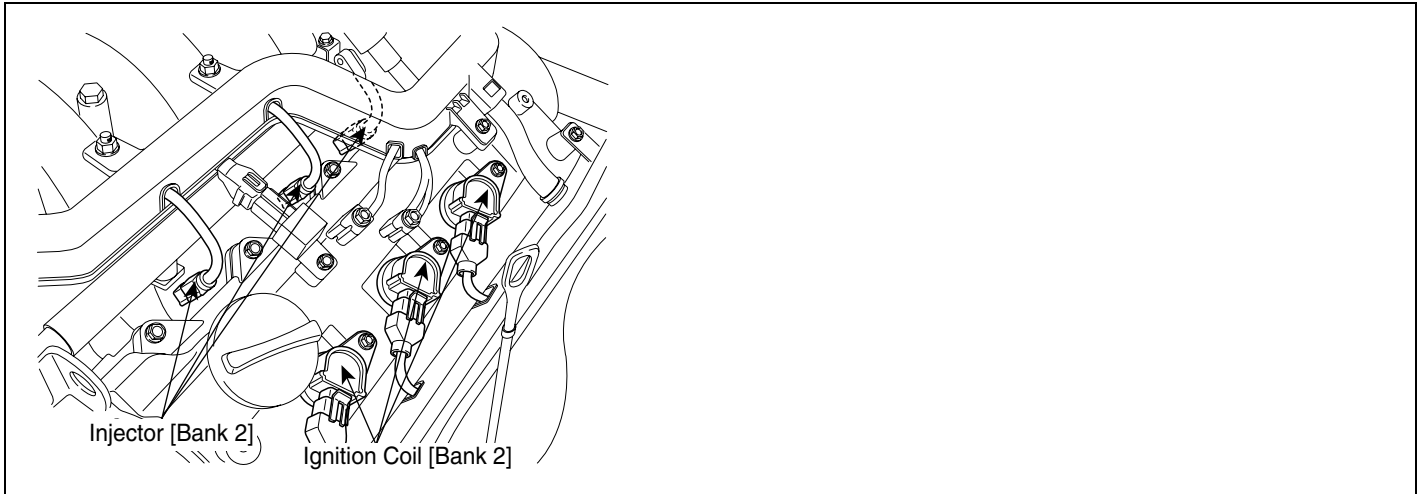
- ▶ Repair or replace it, and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E6B12409

Refer to DTC P0340.

DTC P0351	IGNITION COIL "A" PRIMARY / SECONDARY CIRCUIT
DTC P0352	IGNITION COIL "B" PRIMARY / SECONDARY CIRCUIT
DTC P0353	IGNITION COIL "C" PRIMARY / SECONDARY CIRCUIT
DTC P0354	IGNITION COIL "D" PRIMARY / SECONDARY CIRCUIT
DTC P0355	IGNITION COIL "E" PRIMARY / SECONDARY CIRCUIT
DTC P0356	IGNITION COIL "F" PRIMARY / SECONDARY CIRCUIT

COMPONENT LOCATION E166C0D7



LGLG512A

GENERAL DESCRIPTION EB407262

With the ignition switch in the ON or START position, voltage is applied to the ignition coil. Each ignition coil consists of two coils. High tension leads go to each cylinder from the ignition coils. The ignition coils fire two spark plugs on every power stroke (the cylinder under compression and the cylinder on the exhaust stroke). The Engine Control Module (ECM) provides a switching circuit to ground for energizing the primary ignition coils. The ECM uses the crankshaft position sensor and camshaft position sensor signal to time the energizing of the coil. When a primary ignition coil is energized and de-energized, the secondary coil produces a high voltage spike to the attached spark plugs.

DTC DESCRIPTION EF4C2929

Checking output signals from ignition coils every 10 sec. under detecting condition, if the signals Indicating open or short in the circuit are detected for more than 5 sec., PCM sets this DTC. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC TROUBLESHOOTING PROCEDURES

FLA -455

DTC DETECTING CONDITION

ED68F9E2

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects a short to ground, to battery or open circuit	• Poor connection • Open or short in harness • Ignition Coil • PCM
EnableConditions	• NO DTC related to this item • Engine running state • $11V \leq \text{Battery voltage} \leq 16V$ • The above conditions are met > 0.5 sec.	
Threshold value	• Open or short	
DiagnosisTime	• Continuous (More than 5 sec.failure for every 10 sec.test)	
MIL On Condition	• 2 driving cycles	

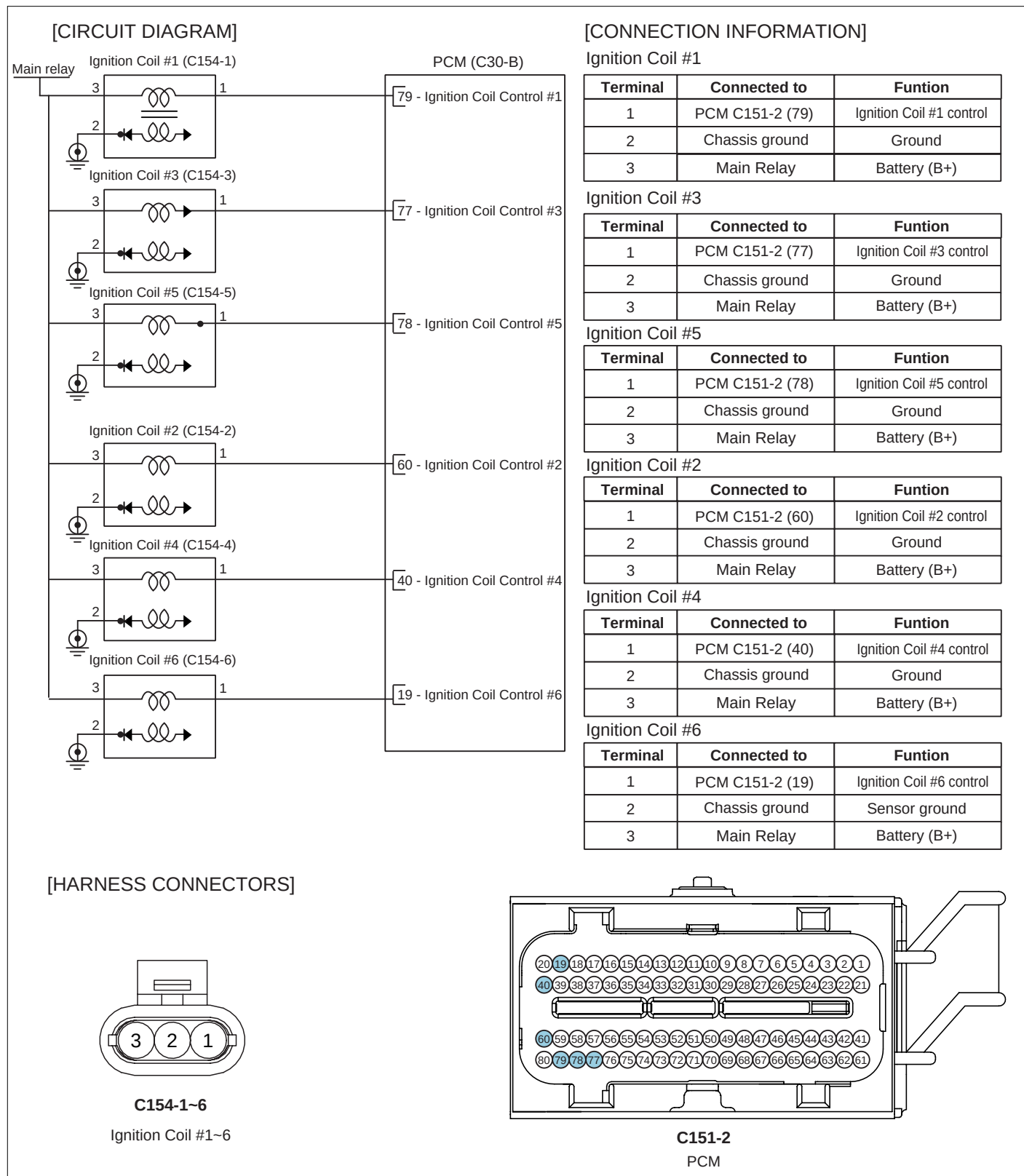
SPECIFICATION

E33EDA43

Resistance	Primary Coil	Secondary Coil
	$0.62\Omega \pm 10\% [20^{\circ}\text{C} (68^{\circ}\text{F})]$	$7.0k\Omega \pm 15\% [20^{\circ}\text{C} (68^{\circ}\text{F})]$

SCHEMATIC DIAGRAM

EC3E9EC0



SVQF16320L

MONITOR DTC STATUS

E8EA5E1F

1. Check DTC Status

DTC TROUBLESHOOTING PROCEDURES

FLA -457

- 1) Connect scantool to Data Link Connector(DLC).
- 2) IG "ON".
- 3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F4(DTAL) to check DTC's information from the DTCs menu
- 4) Read "DTC Status" parameter.

1.1 DIAGNOSTIC TROUBLE CODES		
PXXXX DTC TITLE		
NUMBER OF DTC : 1 ITEMS		
PART	ERAS	DTAL

PXXXX TITLE	
1.MIL STATUS:	ON/OFF
2.DTC STATUS:	PRESENT/HISTORY
3.DIAG.STATUS:	DIAGNOSIS FINISHED
DTC CAUSE TO SYSTEM ERROR : PXXXX	

SCMF16159L

- 5) Is parameter displayed "Present fault"?

YES

- Go to "Terminal and connector inspection" procedure.

NO

- Fault is intermittent caused by poor contact in the sensor' s and/or PCM' s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

TERMINAL AND CONNECTOR INSPECTION

EB4A8784

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

- Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

- Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSEPCTION

E79BA4AA

1. Check voltage

- 1) IG "OFF" and disconnect Ignition Coil connector.
- 2) IG "ON" and ENG "OFF"
- 3) Measure voltage between terminal 3 of ignition coil harness connector and chassis ground.

Specification : Approx. B+

4) Is the measured voltage within specification ?

YES

- Go to "Control Circuit Inspection" procedure.

NO

- Check fuse connected to ignition coil for open.
► Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

EF5F3B09

1. Check short to battery in harness.

- 1) IG "OFF" and disconnect ignitioncoil connector and PCM connector.
- 2) Measure resistance between terminals 1 and 3 of ignition coil harness connector.

Specification : Infinite

3) Is the measured resistance within specification?

YES

- Go to "Check short to ground in harness" as follows.

NO

- Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

2. Check short to ground in harness

- 1) IG "OFF" and disconnect ignition coil connector and PCM connector.
- 2) Measure resistance between terminal 1 of ignition coil harness connector and chassis ground.

Specification : Infinite

3) Is the measured resistance within specification?

YES

- Go to "Check open in harness" as follows.

DTC TROUBLESHOOTING PROCEDURES

FLA -459

NO

- Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

3. Check open in harness

- 1) IG "OFF" and disconnect Ignition Coil connector and PCM connector.
- 2) P0351) Measure resistance between terminal 1 of Ignition Coil harness connector and terminal 79 of PCM harness connector.
P0352) Measure resistance between terminal 1 of Ignition Coil harness connector and terminal 60 of PCM harness connector.
P0353) Measure resistance between terminal 1 of Ignition Coil harness connector and terminal 77 of PCM harness connector.
P0354) Measure resistance between terminal 1 of Ignition Coil harness connector and terminal 40 of PCM harness connector.
P0355) Measure resistance between terminal 1 of Ignition Coil harness connector and terminal 78 of PCM harness connector.
P0356) Measure resistance between terminal 1 of Ignition Coil harness connector and terminal 19 of PCM harness connector.

Specification : Below 1Ω

- 3) Is the measured resistance within specification?

YES

- Go to "Component Inspection" procedure.

NO

- Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

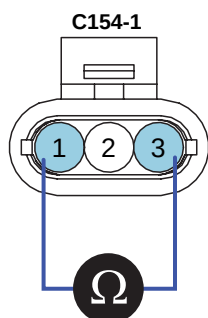
E401C34A

1. Check Ignition Coil

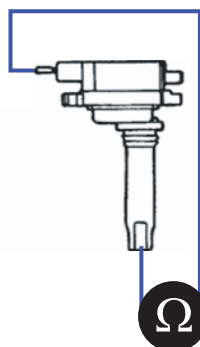
- 1) IG "OFF" and disconnect ignition coil connector.
- 2) Measure resistance between terminals 3 and 1 of ignition coil connector.(Component side)
- 3) Measure resistance between terminal 2 of ignition coil connector and out terminal of secondary ignition coil.

SPECIFICATION :

Resistance	Primary Coil	Secondary Coil
	$0.62\Omega \pm 10\% [20^{\circ}\text{C} (68^{\circ}\text{F})]$	$7.0\text{k}\Omega \pm 15\% [20^{\circ}\text{C} (68^{\circ}\text{F})]$



- 1. Ignition Coil control
- 2. Ground
- 3. Battery Voltage



SVQF16325L

4) Is the measured resistance within specification?

YES

- ▶ Substitute with a known - good PCM and check for proper operation
- ▶ If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

- ▶ Substitute with a known - good Ignition Coil and check for proper operation.
- ▶ If the problem is corrected, replace Ignition Coil and go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

ECD7629D

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

- ▶ System performing to specification at this time. Clear the DTC.

NO

- ▶ Go to the applicable troubleshooting procedure.

DTC TROUBLESHOOTING PROCEDURES

FLA -461

DTC P0420 CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD (BANK 1)

GENERAL DESCRIPTION EBD941FC

The ECM uses dual oxygen sensors to monitor the efficiency of the manifold catalytic converter (warm-up catalytic converter). By monitoring the oxygen storage capacity of a catalyst, its efficiency can be indirectly calculated. The upstream (front) HO₂S is used to detect the amount of oxygen in the exhaust gas before it enters the catalytic converter. A low voltage indicates high oxygen contents (lean air mixture). A high voltage indicates low oxygen contents (rich air mixture). When the catalyst efficiency drops, no chemical reaction takes place. This means the concentration of oxygen will be the same at the rear as it is at the front.

DTC DESCRIPTION ED6771A8

If the oxygen storage time for Bank 1 is lower than threshold, the PCM determines that a fault exists and a DTC is stored and MIL(Malfunction Indication Lamp) turns on.

DTC DETECTING CONDITION E28777BF

Item	Detecting Condition	Possible cause
DTC Strategy	Manipulates Airfuel and stores the times it takes for the pre and post converter oxygen sensors to switch.	Catalyst Converter
EnableConditions	- Engine Runtime $\geq$ 580 sec. - Purge Concentration Learned 3 g/s $\leq$ Airflow $\leq$ 10 g/s - Throttle closed $\leq$ 1.5% 70°C(158 °F) $\leq$ Coolant Temp. $\leq$ 120°C(248 °F) -7°C(19.4 °F) $\leq$ Ambient Temp. $\leq$ 105°C(221 °F) - Barometer $\geq$ 72 kPa - Max number of test attempts $\leq$ 12 - Closed Loop 250°C(482 °F) $\leq$ Catalyst Temp. $\leq$ 950°C(1742 °F) - Fuel learning completed - Vehicle speed $\leq$ 3 kph(1.8 mph) - Not airfuel ramping - Max idle time(about 60 sec.) not exceeded - No disabling faults present - No instrumentation slews active	
Threshold value	Oxygen Storage Time $\leq$ 3.25 sec.	
DiagnosisTime	15 sec.	
MIL On Condition	1 Driving cycle	

MONITOR SCANTOOL DATA E2E931EC

- Check DTC Status
 - Connect scantool to Data Link Connector(DLC).
 - IG "ON".
 - Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F4(DTAL) to check DTC's information from the DTCs menu

- 4) Read "DTC Status" parameter.

1.1 DIAGNOSTIC TROUBLE CODES			
PXXXX DTC TITLE			
NUMBER OF DTC : 1 ITEMS			
PART	ERAS	DTAL	

1.4 AMBIENT CONDITIONS	
1.MIL STATUS :	ON / OFF
2.DTC STATUS :	PRESENT / HISTORY
3.DTC READNESS FLAG :	COMPLETE

LGLG311A

- 5) Is parameter displayed "Present fault"?

YES

► Substitute with a known - good Catalyst Converter and check for proper operation. If the problem is corrected, Go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Component Inspection" procedure.

COMPONENT INSPECTION EC580A1F

1. Monitor the Catalyst Converter

- 1) Clear DTC.
- 2) Start the engine and warm it up until the radiator fan comes on(more than at least 10 minutes).
- 3) Drive at a steady speed between 45-55 mph(72-88 km/h) for 30 seconds.
- 4) Stop and then maintain idle state for 120 seconds in D-position.
- 5) Repeat step 3 once again.
- 6) Stop and then keep it in idle state(D-positon) for 120 seconds.
- 7) Repeat step 3 once again.
- 8) Stop and then maintain idle state for 120 seconds in D-position.
- 9) IG "OFF"
- 10) Repeat steps 3 through 9 three times.
- 11) Check if catalyst monitoring readiness is complete. so, if the readiness is incomplete, repeat steps 2 through 10.
- 12) Does the scan tool show DTC P0420?

YES

DTC TROUBLESHOOTING PROCEDURES

FLA -463

- ▶ Substitute with a known - good Catalyst Converter and check the signal waveform of HO2S for proper operation. If the problem is corrected, Go to "Verification of Vehicle Repair" procedure.

NO

- ▶ It was intermittent failure.

VERIFICATION OF VEHICLE REPAIR

E504AF4E

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

- ▶ System performing to specification at this time. Clear the DTC.

NO

- ▶ Go to the applicable troubleshooting procedure.

DTC P0430 CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD (BANK 2)

GENERAL DESCRIPTION E8F12E90

The ECM uses dual oxygen sensors to monitor the efficiency of the manifold catalytic converter (warm-up catalytic converter). By monitoring the oxygen storage capacity of a catalyst, its efficiency can be indirectly calculated. The upstream (front) HO₂S is used to detect the amount of oxygen in the exhaust gas before it enters the catalytic converter. A low voltage indicates high oxygen contents (lean air mixture). A high voltage indicates low oxygen contents (rich air mixture). When the catalyst efficiency drops, no chemical reaction takes place. This means the concentration of oxygen will be the same at the rear as it is at the front.

DTC DESCRIPTION E62446E1

If the oxygen storage time for Bank 2 is lower than threshold, the PCM determines that a fault exists and a DTC is stored and MIL(Malfunction Indication Lamp) turns on.

DTC DETECTING CONDITION E7917350

Item	Detecting Condition	Possible cause
DTC Strategy	Manipulates Airfuel and stores the times it takes for the pre and post converter oxygen sensors to switch.	Catalyst Converter
EnableConditions	- Engine Runtime $\geq$ 580 sec. - Purge Concentration Learned 3 g/s $\leq$ Airflow $\leq$ 10 g/s - Throttle closed $\leq$ 1.5% 70°C (158 °F) $\leq$ Coolant Temp. $\leq$ 120°C (248 °F) -7°C (19.4 °F) $\leq$ Ambient Temp. $\leq$ 105°C (221 °F) - Barometer $\geq$ 72 kPa - Max number of test attempts $\leq$ 12 - Closed Loop 250°C (482 °F) $\leq$ Catalyst Temp. $\leq$ 950°C (1742 °F) - Fuel learning completed - Vehicle speed $\leq$ 3 kph(1.8 mph) - Not airfuel ramping - Max idle time(about 60 sec.) not exceeded - No disabling faults present - No instrumentation slews active	
Threshold value	Oxygen Storage Time $<$ 2 sec.	
DiagnosisTime	15 sec.	
MIL On Condition	1 Driving cycle	

MONITOR SCANTOOL DATA E5FD71FC

- Check DTC Status
 - Connect scantool to Data Link Connector(DLC).
 - IG "ON".
 - Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F4(DTAL) to check DTC's information from the DTCs menu

DTC TROUBLESHOOTING PROCEDURES

FLA -465

- 4) Read "DTC Status" parameter.

1.1 DIAGNOSTIC TROUBLE CODES			
PXXXX DTC TITLE			
NUMBER OF DTC : 1 ITEMS			
PART	ERAS	DTAL	

1.4 AMBIENT CONDITIONS	
1.MIL STATUS :	ON / OFF
2.DTC STATUS :	PRESENT / HISTORY
3.DTC READNESS FLAG :	COMPLETE

LGLG311A

- 5) Is parameter displayed "Present fault"?

YES

► Substitute with a known - good Catalyst Converter and check for proper operation. If the problem is corrected, Go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Component Inspection" procedure.

COMPONENT INSPECTION

EA524FCD

1. Monitor the Catalyst Converter

- 1) Clear DTC.
- 2) Start the engine and warm it up until the radiator fan comes on(more than at least 10 minutes).
- 3) Drive at a steady speed between 45-55 mph(72-88 km/h) for 30 seconds.
- 4) Stop and then maintain idle state for 120 seconds in D-position.
- 5) Repeat step 3 once again.
- 6) Stop and then keep it in idle state(D-positon) for 120 seconds.
- 7) Repeat step 3 once again.
- 8) Stop and then maintain idle state for 120 seconds in D-position.
- 9) IG "OFF"
- 10) Repeat steps 3 through 9 three times.
- 11) Check if catalyst monitoring readiness is complete. so, if the readiness is incomplete, repeat steps 2 through 10.
- 12) Does the scan tool show DTC P0430?

YES

► Substitute with a known - good Catalyst Converter and check the signal waveform of HO2S for proper operation. If the problem is corrected, Go to "Verification of Vehicle Repair" procedure.

NO

► It was intermittent failure.

VERIFICATION OF VEHICLE REPAIR EB934998

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

► System performing to specification at this time. Clear the DTC.

NO

► Go to the applicable troubleshooting procedure.

DTC TROUBLESHOOTING PROCEDURES

FLA -467

DTC P0444 EVAP. EMISSION SYSTEM-PURGE CTRL. VALVE CIRCUIT OPEN

COMPONENT LOCATION E330C105



LGLG518A

GENERAL DESCRIPTION E9E8ED36

The evaporative emission control system prevents hydrocarbon (HC) vapors from the fuel tank from escaping into the atmosphere where they could form photochemical smog. Gasoline vapors are collected in the charcoal canister. The ECM controls the Purge Control Solenoid Valve (PCSV) to purge any collected vapors from the canister back to the engine for combustion. This valve is actuated by the purge control signal from the ECM and controls fuel vapor from the canister to the intake manifold.

DTC DESCRIPTION E1673907

Checking output signals from PCSV every 10 sec. under detecting condition, if signals Indicating open or short to ground in the circuit are detected for more than 5 sec., PCM sets P0444. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E6795A6C

Item	Detecting Condition	Possible cause
DTC Strategy	• Open, short to ground	• Poor connection • Open or short to ground in harness • PCSV • PCM
EnableConditions	• Engine running state • $11V \leq \text{Battery voltage} \leq 16V$ • Above enable conditions are met > 0.5 sec.	
Threshold value	• Open or short to ground	
DiagnosisTime	• Continuous (More than 5 sec.failure for every 10 sec.test)	
MIL On Condition	• 2 driving cycles	

FLA -468

FUEL SYSTEM

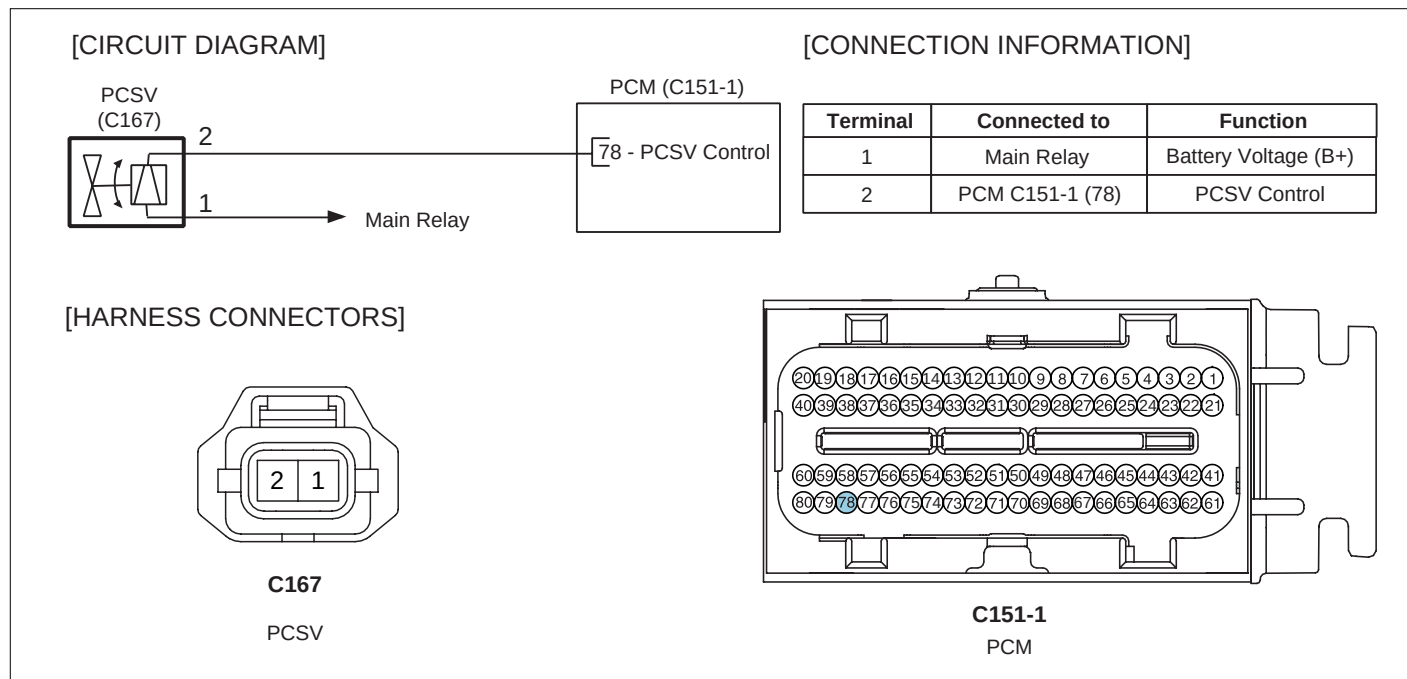
SPECIFICATION

E8F8828A

Item	Coil resistance(Ω)
PCSV	14.0 ~ 18.0 Ω [20°C (68°F)]

SCHEMATIC DIAGRAM

E4472935



SVQF16119L

SIGNAL WAVEFORM

EF5B67EC

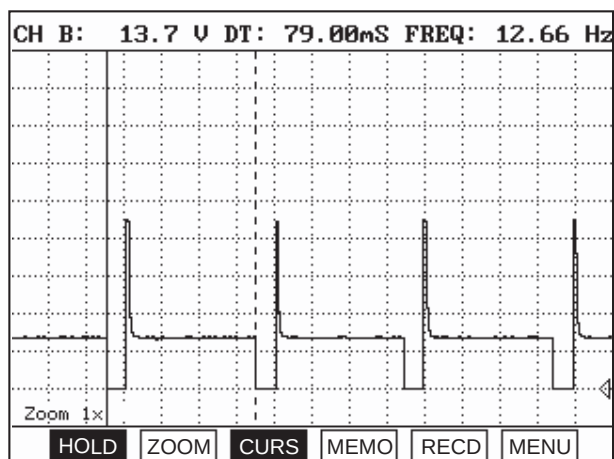


Fig. 1

The Purge Control Solenoid Valve(PCSV) is open or closed by PCM and vacuum of intake manifold. At opening, fuel vapor from canister enters into intake manifold. To prevent vacuum from forming inside canister, PCM controls to open it. This photo shows the signal waveform of PCSV operating normally.

EGRF848A

DTC TROUBLESHOOTING PROCEDURES

FLA -469

MONITOR DTC STATUS EB7ED820

1. Check DTC Status

- 1) Connect scantool to Data Link Connector(DLC).
- 2) IG "ON".
- 3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F4(DTAL) to check DTC's information from the DTCs menu
- 4) Read "DTC Status" parameter.

1.1 DIAGNOSTIC TROUBLE CODES			
PXXXX DTC TITLE			
NUMBER OF DTC : 1 ITEMS			
PART	ERAS	DTAL	

PXXXX TITLE	
1.MIL STATUS:	ON/OFF
2.DTC STATUS:	PRESENT/HISTORY
3.DIAG.STATUS:	DIAGNOSIS FINISHED
DTC CAUSE TO SYSTEM ERROR : PXXXX	

SCMF16159L

5) Is parameter displayed "Present fault"?

YES

- Go to "Terminal and connector inspection" procedure.

NO

- Fault is intermittent caused by poor contact in the sensor' s and/or PCM' s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

TERMINAL AND CONNECTOR INSPECTION E7A93020

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

- Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

- ▶ Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSEPCTION E823F06B

1. IG "OFF" and disconnect PCSV connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 1 of PCSV harness connector and chassis ground.

Specification : B+

4. Is the measured voltage within specification?

YES

- ▶ Go to "Control Circuit Inspection" procedure.

NO

- ▶ Repair open or short to ground in harness, and go to " Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION EF47BBB0

1. Check short to ground in harness.
 - 1) IG "OFF" and disconnect PCSV connector.
 - 2) IG "ON"
 - 3) Measure voltage between terminal 2 of PCSV harness connector and chassis ground.

Specification : Approx. 0.5V

- 4) Is the measured voltage within specification?

YES

- ▶ Go to "Check open in harness" as follows.

NO

- ▶ Repair short to ground in harness, and go to " Verification of Vehicle Repair" procedure.

2. Check open in harness.

- 1) IG "OFF" and disconnect PCSV connector and PCM connector.
- 2) Measure resistance between terminal 2 of PCSV harness connector and terminal 78 of PCM harness connector.

Specification : Below 1Ω

- 3) Is the measured resistance within specification?

YES

- ▶ Go to " Component Inspection" procedure.

DTC TROUBLESHOOTING PROCEDURES

FLA -471

NO

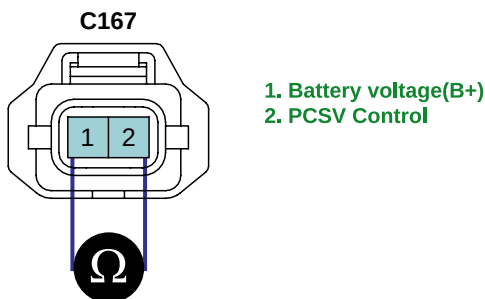
- ▶ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E3AE3F51

1. Check PCSV
 - 1) IG "OFF" and disconnect PCSV connector.
 - 2) Measure resistance between terminals 1 and 2 of PCSV connector.(Component side)

SPECIFICATION :

Item	Coil resistance(Ω)
PCSV	14.0 ~ 18.0 Ω [20℃ (68°F)]



SVQF16356L

- 3) Is the measured resistance within specification?

YES

- ▶ Substitute with a known - good PCM and check for proper operation.
- ▶ If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

- ▶ Substitute with a known - good PCSV and check for proper operation.
- ▶ If the problem is corrected, replace PCSV and go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR EEA6BD74

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.

4. Is parameter displayed "History(Not Present) fault"?

YES

- ▶ System performing to specification at this time. Clear the DTC.

NO

- ▶ Go to the applicable troubleshooting procedure.

DTC TROUBLESHOOTING PROCEDURES

FLA -473

DTC P0445 EVAP. EMISSION SYSTEM-PURGE CTRL. VALVE CIRCUIT SHORTED

COMPONENT LOCATION EA49A992

Refer to DTC P0444.

GENERAL DESCRIPTION E67CE4F2

Refer to DTC P0444.

DTC DESCRIPTION E00E371F

Checking output signals from PCSV every 10 sec. under detecting condition, if signals Indicating short to battery in the circuit are detected for more than 5 sec., PCM sets P0445. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E9146E29

Item	Detecting Condition	Possible cause
DTC Strategy	Short to battery	- Poor connection - Short to battery in harness - PCSV - PCM
EnableConditions	- Engine running state $11V \leq \text{Battery voltage} \leq 16V$ - Above enable conditions are met > 0.5 sec.	
Threshold value	Short to battery	
DiagnosisTime	Continuous (More than 5 sec.failure for every 10 sec.test)	
MIL On Condition	2 driving cycles	

SPECIFICATION EF7575BD

Item	Coil resistance(Ω)
PCSV	14.0 ~ 18.0 Ω [20°C (68°F)]

SCHEMATIC DIAGRAM E71171CC

Refer to DTC P0444.

SIGNAL WAVEFORM E219B974

Refer to DTC P0444.

MONITOR DTC STATUS ED8A58B2

Refer to DTC P0444.

TERMINAL AND CONNECTOR INSPECTION EF9207D3

Refer to DTC P0444.

CONTROL CIRCUIT INSPECTION

E96A7FBB

1. IG "OFF" and disconnect PCSV connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 2 of PCSV harness connector and chassis ground.

Specification : Approx. 0.5V

4. Is the measured voltage within specification?

YES

- ▶ Go to "Component Insepection" procedure.

NO

- ▶ Repair short to battery in harness, and go to " Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

E5DDBC8E

1. Check PCSV
 - 1) IG "OFF" and disconnect PCSV connector.
 - 2) Measure resistance between terminals 1 and 2 of PCSV connector.(Component side)

SPECIFICATION :

Item	Coil resistance(Ω)
PCSV	14.0 ~ 18.0 Ω [20°C (68°F)]

- 3) Is the measured resistance within specification?

YES

- ▶ Substitute with a known - good PCM and check for proper operation.
- ▶ If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

- ▶ Substitute with a known - good PCSV and check for proper operation.
- ▶ If the problem is corrected, replace PCSV and go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

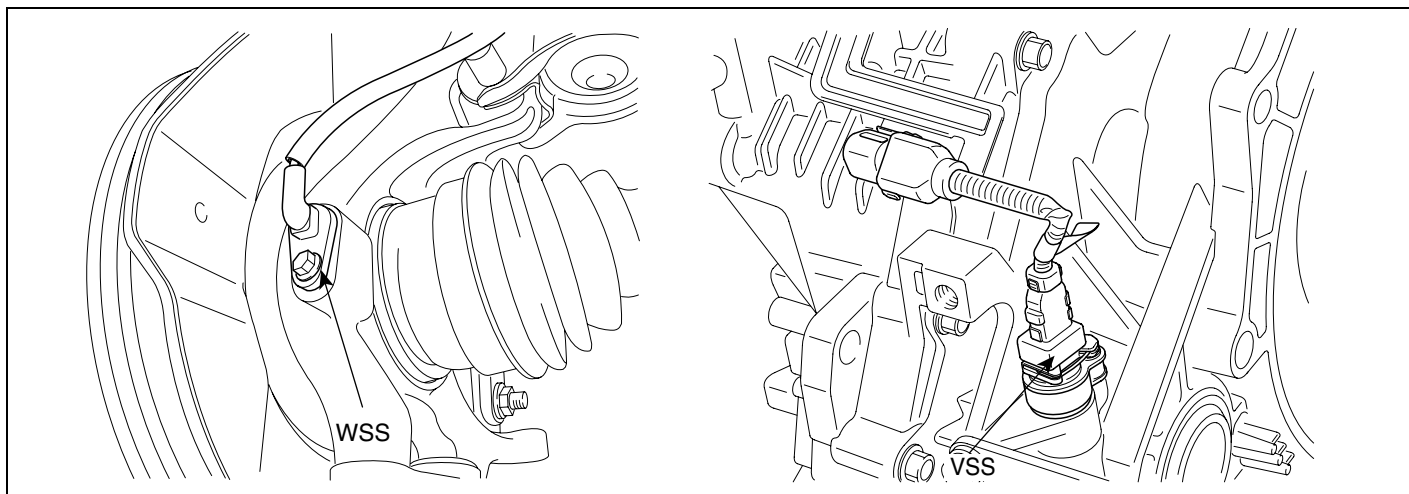
VERIFICATION OF VEHICLE REPAIR

E86F6EB7

Refer to DTC P0444.

DTC P0501 VEHICLE SPEED SENSOR A RANGE/PERFORMANCE

COMPONENT LOCATION EBF7FFDF



LGLG519A

GENERAL DESCRIPTION E30F80CC

The Wheel Speed Sensor (WSS) generates a waveform with a frequency proportional to the speed of the vehicle. The signal generated by the WSS informs the ECM not only if the vehicle speed is low or high but also if the vehicle is or is not moving. The ECM uses this signal to control the fuel injection, ignition timing, transaxle shift scheduling and torque converter clutch scheduling. The WSS signal is also used to detect rough road conditions.

DTC DESCRIPTION E24AFA68

Checking vehicle speed signal every from wheel speed sensor or ABS control every 30 sec. under detecting condition, if an signal is in the detecting condition for more than 20 sec., PCM sets P0501. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

E2265246

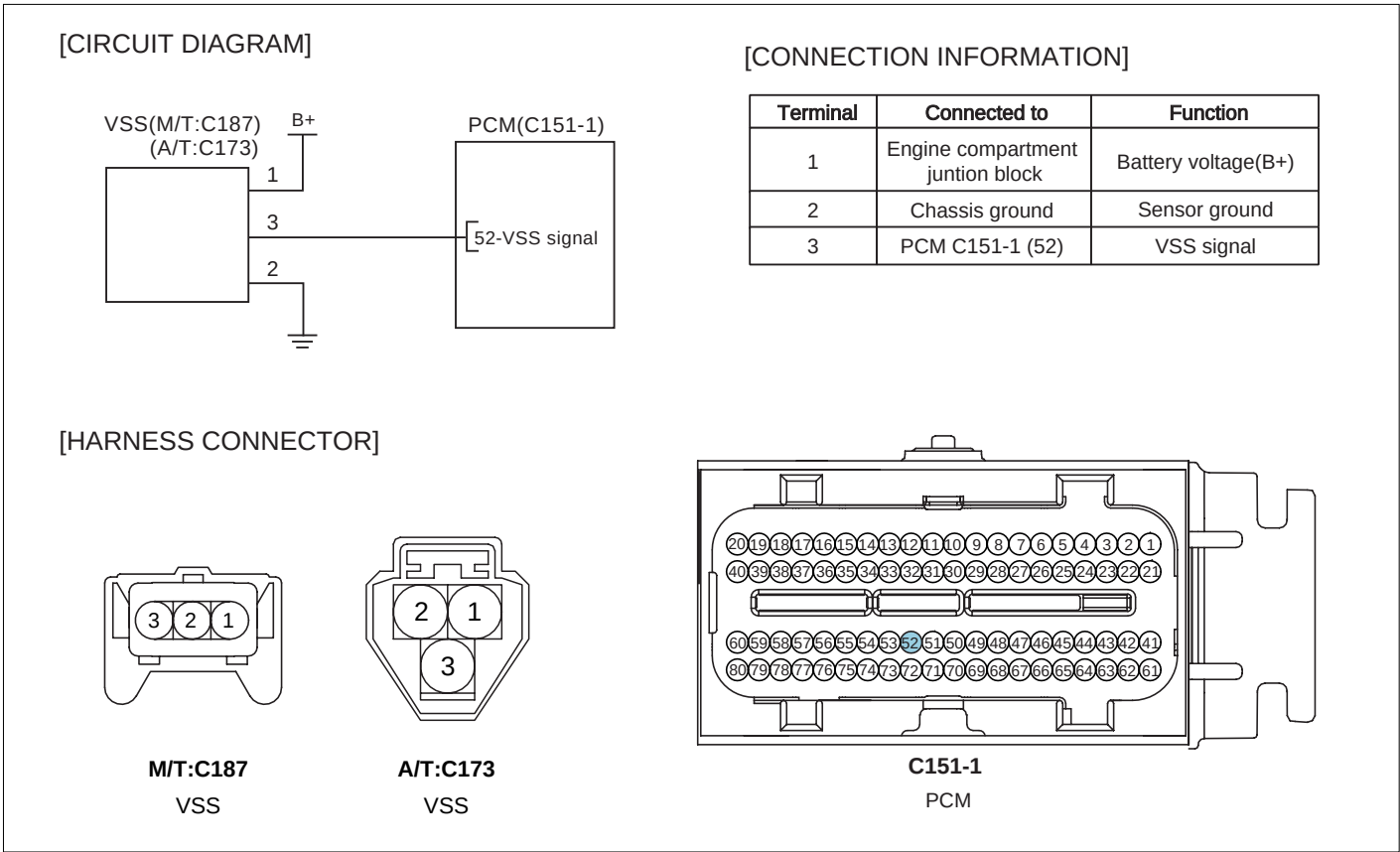
Item		Detecting Condition	Possible cause
DTC Strategy		Detects the lack of vehicle speed signal	- Poor connection - Open or short in harness - Wheel speed sensor(FR) - Vehicle speed sensor - ABS or ESP control unit - PCM
Enable Conditions	Case 1(Power)	- Engine Running - No VSS disabling malfunction present - No TPS fault present - No MAP fault present 11V < Ignition Voltage < 16V - Engine Coolant Temperature > 60°C (140°F) - MAP > 55kPa 25% ≤ TPS ≤ 60% 1200rpm ≤ Engine Speed ≤ 4000rpm - Vehicle Speed derived from transmission ≥ 10 kph (6.2 mph)	
	Case 2(Decel)	- Engine Running - No VSS disabling malfunction present - No TPS fault present - No MAP fault present 11V < Ignition Voltage < 16V - Engine Coolant Temperature > 60°C (140°F) - MAP < 32kPa - TPS < 1% 1800rpm ≤ Engine Speed ≤ 6000rpm - Transmission in gear	
Threshold value	Case 1(Power)	VSS Fault Vehicle Speed ≤ 10kph	
	Case 2(Decel)	- Vehicle Speed < 5kph - Delta Engine Speed ≥ 100rpm	
Diagnosis Time		Continuous (More than 20 seconds failure for every 30 seconds test)	
MIL On Condition		2 driving cycles	

DTC TROUBLESHOOTING PROCEDURES

FLA -477

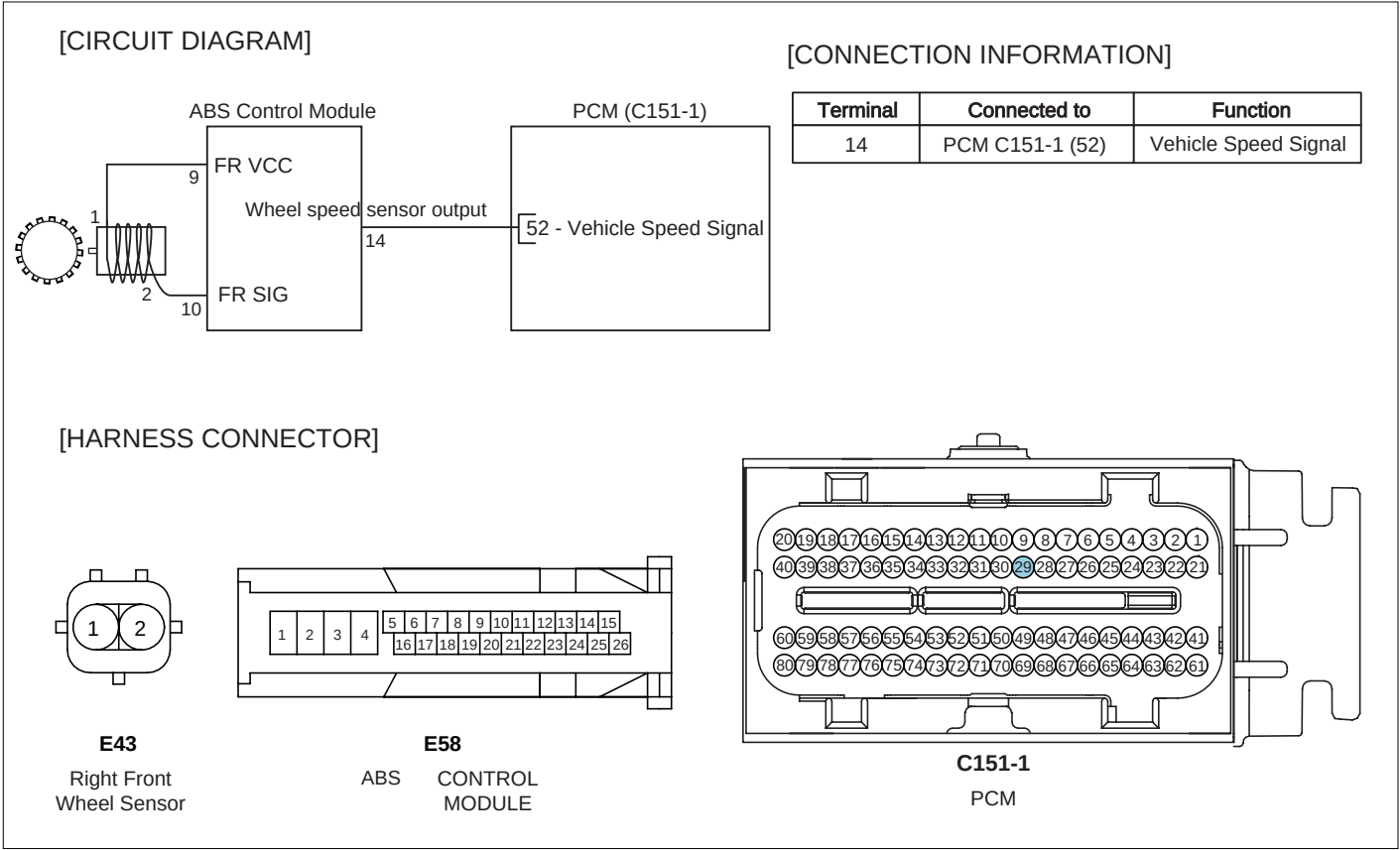
SCHEMATIC DIAGRAM EB698BAE

[EXCEPT EURO-III/IV]



SVQF16357L

[EURO-III/IV WITH ABS]



SVQF16358L

SIGNAL WAVEFROM AND DATA

E66D7EAA

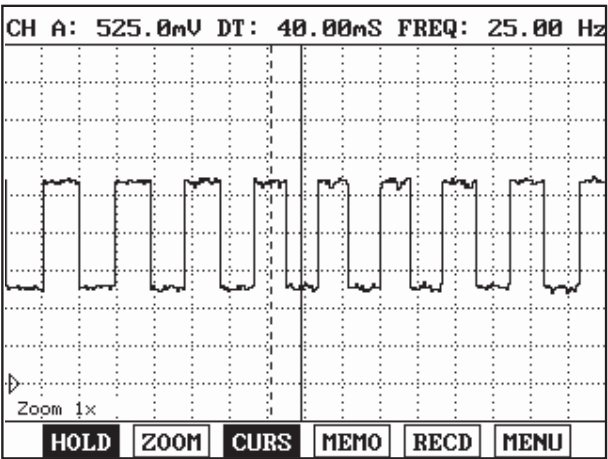


Fig. 1

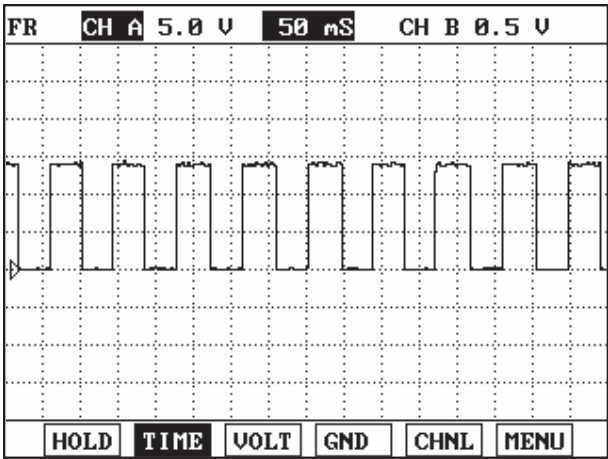


Fig. 2

Fig.1 : Signal waveform [EURO-III/IV]

Fig.2 : Signal waveform [Except EURO-III/IV]

LGLG437A

MONITOR DTC STATUS

E7EC0FD2

1. Check DTC Status

DTC TROUBLESHOOTING PROCEDURES

FLA -479

- 1) Connect scantool to Data Link Connector(DLC).
- 2) IG "ON".
- 3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F4(DTAL) to check DTC's information from the DTCs menu
- 4) Read "DTC Status" parameter.

1.1 DIAGNOSTIC TROUBLE CODES		
PXXXX DTC TITLE		
NUMBER OF DTC : 1 ITEMS		
PART	ERAS	DTAL

PXXXX TITLE	
1.MIL STATUS:	ON/OFF
2.DTC STATUS:	PRESENT/HISTORY
3.DIAG.STATUS:	DIAGNOSIS FINISHED
DTC CAUSE TO SYSTEM ERROR : PXXXX	

SCMF16159L

- 5) Is parameter displayed "Present fault"?

YES

- Go to "Terminal and connector inspection" procedure.

NO

- Fault is intermittent caused by poor contact in the sensor' s and/or PCM' s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

[EURO-III/IV] E91E55BF

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

- Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

- Go to " Signal Circuit Inspection " procedure.

SIGNAL CIRCUIT INSPECTION

EA61C2F8

⊗ WARNING

This procedure is applied to vehicle with ABS (or ESP). In case of no ABS(or ESP), refer to "C1203 Wheel speed sensor front-RH open/short".

1. Check short to ground in harness

- 1) IG "OFF"
- 2) Disconnect PCM connector and ABS or ESP control module connector.
- 3) Measure resistance between terminal 52 of PCM harness connector and chassis ground.

Specification : Infinite

4) Is the measured resistance within specifications?

YES

▶ Go to "Check open in harness" as follows.

NO

▶ Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

2. Check for open in harness

- 1) Ignition "OFF"
- 2) Disconnect PCM connector and ABS or ESP control module connector.
- 3) Measure resistance between terminal 52 of PCM harness connector and terminal "14(With ESP: terminal 40)" of ABS control module harness connector.

Specification : Approx. below 1Ω

📖 NOTE

Note: This picture is only applied to vehicle with ABS

4) Is the measured resistance within specifications?

YES

▶ Go to " Check wheel speed sensor " procedure.

NO

▶ Check open in harenss.

▶ Repair or replace as necessary and then, go to " Verification of Vehicle Repair" procedure.

3. Check wheel speed sensor

- 1) IG "OFF"
- 2) Check open or short in wheel speed sensor (Refer to "C1203 Wheel speed sensor front-RH open/short")
- 3) Is the wheel speed sensor normal?

DTC TROUBLESHOOTING PROCEDURES

FLA -481

YES

- ▶ Substitute with a known - good PCM/ ABS or ESP control unit and check for proper operation. If the problem is corrected, replace PCM/ ABS or ESP control unit and go to "Verification of Vehicle Repair" procedure.

NO

- ▶ Repair or replace it as necessary.
- ▶ And then go to " Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

[EXCEPT EURO-III/IV]

TERMINAL AND CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

- ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

- ▶ Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION

1. Check voltage
 - 1) IG "OFF"
 - 2) Disconnect vehicle speed sensor connector.
 - 3) IG "ON" and ENG "OFF"
 - 4) Measure voltage between terminal 1 of vehicle speed sensor harness connector and chassis ground.

Specification : Approx. 11.5 ~ 13V

- 5) Is the measured voltage within specifications?

YES

- ▶ Go to "Signal circuit inspection" procedure.

NO

- ▶ Repair open or short to ground in harness, and go to "Verification of Vehicle Repair" procedure. Especially Check the fuse related to Power for blown-off.

SIGNAL CIRCUIT INSPECTION

1. Check voltage from sensor side
 - 1) IG "OFF"
 - 2) Disconnect vehicle speed sensor connector.
 - 3) IG "ON" and ENG "OFF"
 - 4) Measure voltage between terminal 3 of vehicle speed sensor harness connector and chassis ground.

Specification : Approx. 8 ~ 11.5V

- 5) Is the measured voltage within specifications?

YES

▶ Go to "Check voltage from PCM side" as follows.

NO

▶ Repair open or short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

2. Check voltage from PCM side
 - 1) IG "OFF"
 - 2) Disconnect PCM connector and vehicle speed sensor connector.
 - 3) IG "ON" and ENG "OFF"
 - 4) Measure voltage between terminal "52" of PCM harness connector and chassis ground.

Specification : Approx. 8 ~ 11.5V

- 5) Is the measured voltage within specifications?

YES

▶ Go to "Ground circuit inspection" procedure.

NO

▶ Check open in harness.
▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

1. IG "OFF"
2. Disconnect vehicle speed sensor connector.
3. IG "ON" and ENG "OFF"
4. Measure voltage between terminal 1 of vehicle speed sensor harness connector and chassis ground.(Fig.A)
5. Measure voltage between terminals 1 and 2 of vehicle speed sensor harness connector.(Fig.B)

Specification : Measurement "A" - Measurement "B" = Approx. below 200mV

DTC TROUBLESHOOTING PROCEDURES

FLA -483

6. Is the measured voltage within specifications?

YES

► Substitute with a known - good vehicle speed sensor and check for proper operation. If the problem is not corrected, substitute with a known - good PCM and check for proper operation. And go to "Verification of Vehicle Repair" procedure.

NO

► Repair open or contact resistance in harness, and go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

EEFA2461

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

► System performing to specification at this time. Clear the DTC.

NO

► Go to the applicable troubleshooting procedure.

DTC P0504 BRAKE SWITCH "A"/"B" CORRELATION

GENERAL DESCRIPTION EB611534

The Stop lamp switch is used to judge whether the acceleration system is abnormal or not. The stop lamp switch has a duplex system(signals brake test or brake light) to memorize the abnormality when the signals of depressing and releasing the brake pedal are detected simultaneously.

DTC DESCRIPTION E8706E64

Checking output signals from both brake switch. when all of them are On or OFF simultaneously, if abnormal signal is detected for more than 0.5 sec., an error is recognized. And if this condition lasts for certain period, PCM sets P0504. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till cosecutive 2 driving cycle.

DTC DETECTING CONDITION E1833C1F

Item		Detecting Condition	Possible cause
DTC Strategy		Comparing 2 brake signals during driving	- Poor connection - Open or short in brake switch - Faulty Brake switch
Enable Conditions	Case 1	- Engine works - Vehicle Speed Sensor is abnormal.	
	Case 2	- Engine works - Vehicle Speed Sensor is normal and Vehicle Speed is over 20kph during 1sec or more.	
Threshold value		The one brake signal's change duration when another signal has been changed > 0.5 sec	
Diagnosis Time		Continuous	
MIL On Condition		2 driving cycles	

SPECIFICATION E1C5364F

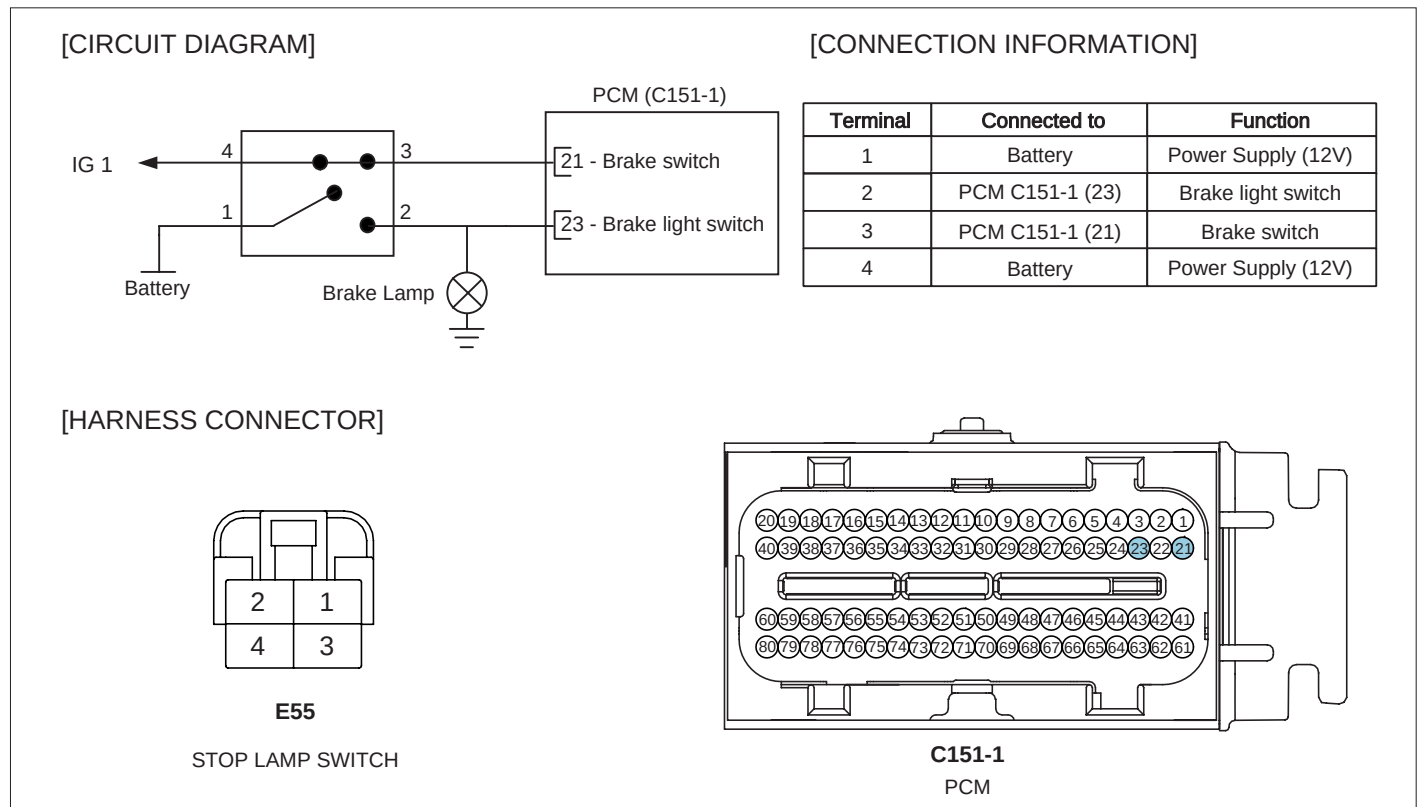
Item	During taking off the brake	During stepping on the brake
Brake Lamp Switch	0V	Battery voltage
Brake Switch	Battery voltage	0V

DTC TROUBLESHOOTING PROCEDURES

FLA -485

SCHEMATIC DIAGRAM

EE9EC90A



SVQF16365L

MONITOR DTC STATUS

E0862CEB

1. Check DTC Status

- 1) Connect scantool to Data Link Connector(DLC).
- 2) IG "ON".
- 3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F4(DTAL) to check DTC's information from the DTCs menu
- 4) Read "DTC Status" parameter.

1.1 DIAGNOSTIC TROUBLE CODES

PXXXX DTC TITLE

NUMBER OF DTC : 1 ITEMS

PART
ERAS
DTAL

PXXXX TITLE

1.MIL STATUS: ON/OFF

2.DTC STATUS: PRESENT/HISTORY

3.DIAG.STATUS: DIAGNOSIS FINISHED

DTC CAUSE TO SYSTEM ERROR : PXXXX

SCMF16159L

- 5) Is parameter displayed "Present fault"?

YES

► Go to "Terminal and connector inspection" procedure.

NO

► Fault is intermittent caused by poor contact in the sensor' s and/or PCM' s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

TERMINAL AND CONNECTOR INSPECTION EEADF250

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

► Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

► Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION E758E10E

1. Voltage check
 - 1) IG Key "OFF".
 - 2) Disconnect the PCM connector.
 - 3) IG Key "ON" and keep the brake taking off.
 - 4) Measure the voltage between terminal 21 of PCM harness connector and chassis ground.
 - 5) Measure the voltage between terminal 23 of PCM harness connector and chassis ground.
 - 6) Keep the brake stepping on.
 - 7) Measure the voltage between terminal 21 of PCM harness connector and chassis ground.
 - 8) Measure the voltage between terminal 23 of PCM harness connector and chassis ground.

SPECIFICATION :

Item	During taking off the brake	During stepping on the brake
Brake Lamp Switch	0V	Battery voltage
Brake Switch	Battery voltage	0V

- 9) Is the measured voltage within specification ?

YES

► Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Check open in harness" as follows.

2. Check open in harness

- 1) IG Key "OFF".
- 2) Disconnect the brake switch and PCM connector.
- 3) Measure the resistance between terminal 21 of PCM harness connector and terminal 3 of Brake switch harness side.
- 4) Measure the resistance between terminal 23 of PCM harness connector and terminal 2 of Brake switch harness side.

Specification : Approx. below 1Ω

- 5) Is the measured resistance within specification ?

YES

► Go to "Check voltage" procedure.

NO

► Repair open in circuit and go to "Verification of Vehicle Repair" procedure.

3. Check voltage

- 1) IG Key "OFF".
- 2) Disconnect the brake switch connector.
- 3) Measure the voltage between brake lamp switch terminal 1 and chassis ground.
- 4) Measure the voltage between brake switch terminal 4 and chassis ground.
- 5) IG Key "ON".
- 6) Measure the voltage between brake lamp switch terminal 1 and chassis ground.
- 7) Measure the voltage between brake switch terminal 4 and chassis ground.

SPECIFICATION :

Item	During taking off the brake	During stepping on the brake
Brake Lamp Switch	0V	Battery voltage
Brake Switch	Battery voltage	0V

- 8) Is the measured voltage within specification ?

YES

► Substitute with a known - good brake switch and check for proper operation. If the problem is corrected, replace brake switch and go to "Verification of Vehicle Repair" procedure.

NO

- Check the fuse between battery and brake switch.
- Repair open or short in power circuit of brake switch and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E8BE4E53

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

- System performing to specification at this time. Clear the DTC.

NO

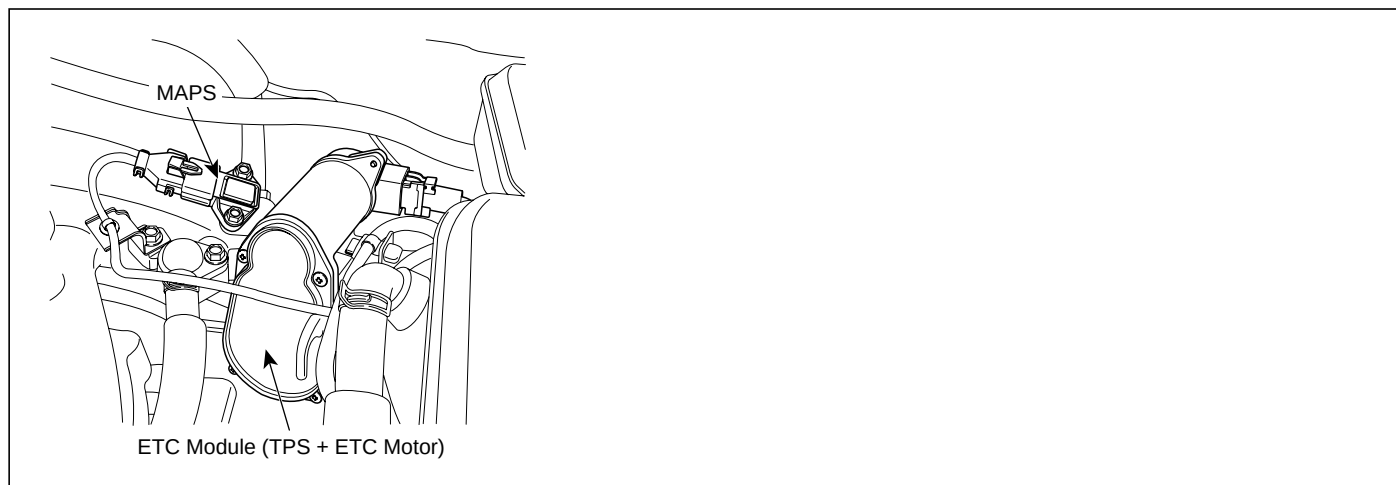
- Go to the applicable troubleshooting procedure.

DTC TROUBLESHOOTING PROCEDURES

FLA -489

DTC P0506 IDLE AIR CONTROL SYSTEM-RPM LOWER THAN EXPECTED

COMPONENT LOCATION EA62E8A4



SCMF16192L

GENERAL DESCRIPTION E4D4857B

The idle speed is controlled by the Electrical Throttle Control(ETC) System. ETC system is composed of the throttle motor to operate the throttle valve and the throttle position sensor to detect the opening angle of the throttle valve, the accelerator pedal position sensor to detect the accelerator pedal position and the one valve type throttle body. The ECM controls the throttle motor to provide the proper throttle valve opening angle for the target idle speed.

DTC DESCRIPTION E0E16B88

Checking idle RPM under detecting condition, if the real idle speed is lower than desired idle speed by 100 RPM over 10 sec., PCM sets P0506. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION EBD800A3

Item	Detecting Condition	Possible cause
DTC Strategy	• Monitor idle speed	• Intake system for blockage
Enable Conditions	• Normal idle conditions	
Thresh old value	• Real engine speed is lower than target engine speed by 100 RPM	
Diagnosis Time	• Continuous	
MIL On Condition	• 2 driving cycles	

MONITOR DTC STATUS E6751FA9

1. Monitor DTCs related to HO2S, MAFS, MAPS, ECTS, PCSV, Injector, CVVT items, ETC system, A/C system, or power steering system with Scantool.
2. Are there the DTCs above-mentioned?

YES

- ▶ Do all repairs associated with those codes before proceeding with this procedure.

NO

- ▶ Go to "System Inspection" procedure

SYSTEM INSPECTION ED2C157A

1. Check intake system for blockage

- 1) Visually/physically inspect the following items:
 - Air cleaner filter element for excessive dirt or for any foreign objects
 - Hoses of intake system for blockage
 - Throttle body inlet for damage or for any foreign objects
 - Throttle plate for carbon deposits

- 2) Has a problem been found in any of the above areas ?

YES

- ▶ Repair it and go to "Verification of Vehicle Repair" procedure

NO

- ▶ Clear DTC and Test-drive under enable conditions above-mentioned. After the test, If this DTC is set, go to "Inspection & Repair" procedure. If not, troubleshooting is completed.

VERIFICATION OF VEHICLE REPAIR E82333CC

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

- ▶ System performing to specification at this time. Clear the DTC.

NO

- ▶ Go to the applicable troubleshooting procedure.

DTC TROUBLESHOOTING PROCEDURES

FLA -491

DTC P0507 IDLE AIR CONTROL SYSTEM-RPM HIGHER THAN EXPECTED

COMPONENT LOCATION EECC48BE

Refer to DTC P0506.

GENERAL DESCRIPTION E1B8DE35

Refer to DTC P0506.

DTC DESCRIPTION EC7F26BC

Checking idle RPM under detecting condition, if if the real idle speed is higher than desired idle speed by 200 RPM over 10 sec., PCM sets P0507. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E4304A42

Item	Detecting Condition	Possible cause
DTC Strategy	• Monitor idle speed	• Intake system for air leakage
Enable Conditions	• Normal idle conditions	
Thresh old value	• Real engine speed is higher than target engine speed by 200 RPM	
Diagnosis Time	• Continuous	
MIL On Condition	• 2 driving cycles	

MONITOR DTC STATUS EB848DDC

1. Monitor DTCs related to HO2S, MAFS, MAPS, ECTS, PCSV, Injector, CVVT items, ETC system, A/C system, or power steering system with scantool.
2. Are there the DTCs above-mentioned?

YES

- ▶ Do all repairs associated with those codes before proceeding with this procedure.

NO

- ▶ Go to "System Inspection" procedure

SYSTEM INSPECTION E4DD892C

1. Check intake system/vapor hoses for air leakage or disconnection
 - 1) Visually/physically inspect the following items:
 - Intake system for air leakage
 - Vapor hoses for cracks or disconnection
 - 2) Has a problem been found in any of the above areas ?

YES

- ▶ Repair it and go to "Verification of Vehicle Repair" procedure

NO

- ▶ Clear DTC and Test-drive under enable conditions above-mentioned. After the test, If this DTC is set, go to "Inspection & Repair" procedure. If not, troubleshooting is completed.

VERIFICATION OF VEHICLE REPAIR E2D76F60

Refer to DTC P0506.

DTC TROUBLESHOOTING PROCEDURES

FLA -493

DTC P0532 A/C REFRIGERANT PRESSURE SENSOR "A" CIRCUIT LOW INPUT

COMPONENT LOCATION ECBA4F4B



SCMF16368L

GENERAL DESCRIPTION E092D000

The ECM(Engine Control Module) receives pressure signal in the A/C refrigerant high pressure side from the A/C refrigerant pressure sensor. This input indicates how much load the A/C compressor is putting on the engine and is one of the factors used by the ECM in order to determine the idle air control position for the idle speed. The circuits consist of a 5V reference and a ground, both provided by the ECM, and a signal from the sensor. The signal is a voltage which is proportional to the A/C pressure from 0 to 5V. Low pressure produces a low voltage signal and high pressure a high-voltage signal.

DTC DESCRIPTION EC914995

Checking output signals from A/C pressure sensor under detecting condition, if an signal below 0.25V lasts for more than 10 sec., PCM sets P0532.

DTC DETECTING CONDITION E858ED9E

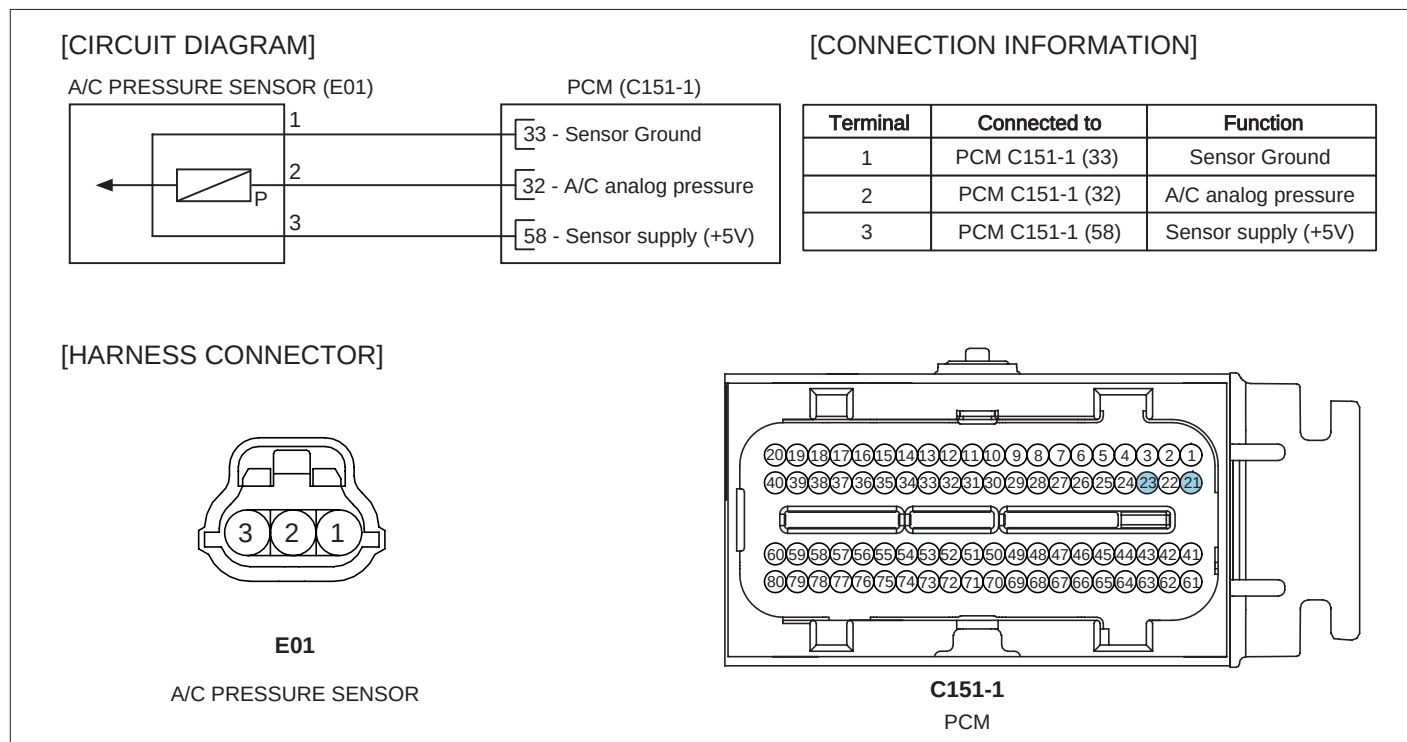
Item	Detecting Condition	Possible cause
DTC Strategy	• Detects sensor signal short to low voltage	• Poor connection • Open in power circuit • Open or short to ground in signal circuit • Faulty A/C pressure sensor • Faulty PCM
Enable Conditions	• Engine works	
Thresh old value	• Sensor output voltage < 0.25V	
Diagnosis Time	• Continuous (More than 10 seconds failure for every 20 seconds test)	
MIL On Condition	• DTC only (NO MIL ON)	

SPECIFICATION E428FF4C

Pressure(psi)	14.7	128.5	242.3	356.1	469.9
Voltage(V)	0.5	1.5	2.5	3.5	4.5

SCHEMATIC DIAGRAM

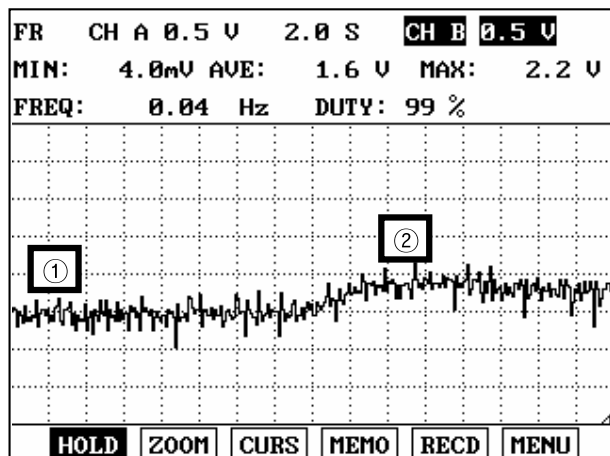
E445C178



SVQF16369L

SIGNAL WAVEFORM AND DATA

EB03F274



- ① - A/C OFF & idle state
- ② - A/C ON & idle state

EGRF884A

MONITOR DTC STATUS

EB6B770A

1. Check DTC Status

- 1) Connect scantool to Data Link Connector(DLC).
- 2) IG "ON".
- 3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F4(DTAL) to check DTC's information from the DTCs menu
- 4) Read "DTC Status" parameter.

1.1 DIAGNOSTIC TROUBLE CODES		
PXXXX DTC TITLE		
NUMBER OF DTC : 1 ITEMS		
PART	ERAS	DTAL

PXXXX TITLE	
1.MIL STATUS:	ON/OFF
2.DTC STATUS:	PRESENT/HISTORY
3.DIAG.STATUS:	DIAGNOSIS FINISHED
DTC CAUSE TO SYSTEM ERROR : PXXXX	

SCMF16159L

5) Is parameter displayed "Present fault"?

YES

► Go to "Terminal and connector inspection" procedure.

NO

► Fault is intermittent caused by poor contact in the sensor' s and/or PCM' s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

TERMINAL AND CONNECTOR INSPECTION

E243BD27

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

► Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

► Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION

EF2BA5DE

1. IG Key "OFF".
2. Disconnect the A/C pressure sensor connector.
3. IG Key "ON".
4. Measure the voltage between terminal 3 of A/C pressure sensor harness connector and chassis ground.

Specification : approx. 5V

5. Is the measured voltage within specification ?

YES

► Go to "Signal circuit inspection" procedure.

NO

► Repair Open or Short to ground in A/C pressure sensor power circuit and go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

E5715370

1. Check short to ground inspection

- 1) IG Key "OFF".
- 2) Disconnect A/C pressure sensor and PCM connector.
- 3) Measure the resistance between terminal 2 of A/C pressure sensor harness connector and chassis ground.

Specification : Infinite

4) Is the measured resistance within specification ?

YES

► Go to "Check open in harness" procedure.

NO

► Repair Short to ground in A/C pressure sensor signal circuit and go to "Verification of Vehicle Repair" procedure.

2. Check open in harness

- 1) IG Key "OFF".
- 2) Disconnect A/C pressure sensor and PCM connector.
- 3) Measure the resistance between terminal 2 of A/C pressure sensor harness connector and terminal 32 of PCM harness connector.

Specification : Approx. below 1Ω

4) Is the measured resistance within specification ?

YES

► Go to "Component inspection" procedure.

NO

► Repair Open in A/C pressure signal circuit and go to "Verification of Vehicle Repair" procedure.

DTC TROUBLESHOOTING PROCEDURES

FLA -497

COMPONENT INSPECTION

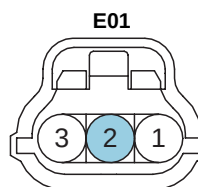
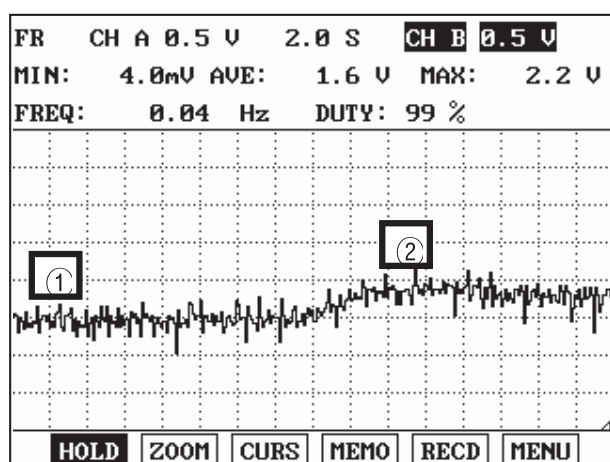
E4DCCBE8

1. A/C pressure sensor inspection

- 1) IG Key "OFF" and connect the scantool.
- 2) Connect the probe to A/C pressure sensor signal and select the oscilloscope in the menu.
- 3) Check the waveform with acceleration and deceleration after engine start.

SPECIFICATION :

Pressure(psi)	14.7	128.5	242.3	356.1	469.9
Voltage(V)	0.5	1.5	2.5	3.5	4.5



1. A/C pressure sensor ground
2. A/C pressure sensor signal
3. A/C pressure sensor power

- ① - A/C OFF & Idle
- ② - A/C ON & Idle

SVQF16373L

4) Is the measured waveform of A/C pressure sensor normal?

YES

► Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

► Substitute with a known - good A/C pressure sensor and check for proper operation. If the problem is corrected, replace A/C pressure sensor and go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

E2DAA8D6

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.

2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

- ▶ System performing to specification at this time. Clear the DTC.

NO

- ▶ Go to the applicable troubleshooting procedure.

DTC TROUBLESHOOTING PROCEDURES

FLA -499

DTC P0533 A/C REFRIGERANT PRESSURE SENSOR "A" CIRCUIT HIGH INPUT

COMPONENT LOCATION EA049922

Refer to DTC P0532.

GENERAL DESCRIPTION E2E00DD0

Refer to DTC P0532.

DTC DESCRIPTION EFD3B85E

Checking output signals from A/C pressure sensor under detecting condition, if an signal above 4.65V lasts for more than 10 sec., PCM sets P0533.

DTC DETECTING CONDITION EC676D4D

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects sensor signal short to high voltage	• Poor connection • Short to battery in signal circuit • Open in ground circuit • Faulty A/C pressure sensor • Faulty PCM
Enable Conditions	• Engine works	
Thresh old value	• Sensor output voltage > 4.65V	
Diagnosis Time	• Continuous (More than 10 seconds failure for every 20 seconds test)	
MIL On Condition	• DTC only (NO MIL ON)	

SPECIFICATION EF478CAD

Pressure(psi)	14.7	128.5	242.3	356.1	469.0
Voltage(V)	0.5	1.5	2.5	3.5	4.5

SCHEMATIC DIAGRAM E4925B57

Refer to DTC P0532.

SIGNAL WAVEFORM AND DATA E636CEEB

Refer to DTC P0532.

MONITOR DTC STATUS E263372C

Refer to DTC P0532.

TERMINAL AND CONNECTOR INSPECTION EECBB251

Refer to DTC P0532.

POWER CIRCUIT INSPECTION

E24F7E47

1. IG Key "OFF".
2. Disconnect the A/C pressure sensor connector.
3. IG Key "ON".
4. Measure the voltage between terminal 3 of A/C pressure sensor harness connector and chassis ground.

Specification : approx. 5V

5. Is the measured voltage within specification ?

YES

- Go to "Ground circuit inspection" procedure.

NO

- Repair Open in power circuit and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

EE3A1DF0

1. IG Key "OFF".
2. Disconnect the A/C pressure sensor connector.
3. IG Key "ON".
4. Measure the voltage between terminal 3 of A/C pressure sensor harness connector and chassis ground. (Fig A)
5. Measure the voltage between terminal 3 and terminal 1 of A/C pressure sensor harness connector. (Fig B)

Specification : The Difference between "A" and "B" is below 200mV.

6. Is the measured voltage within specification ?

YES

- Go to "Signal circuit inspection" procedure.

NO

- Repair as necessary and go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

EDC3237B

1. Voltage inspection
 - 1) IG Key "OFF".
 - 2) Disconnect the A/C pressure sensor connector.
 - 3) IG Key "ON".
 - 4) Measure the voltage between terminal 2 of A/C pressure sensor harness connector and chassis ground.

DTC TROUBLESHOOTING PROCEDURES

FLA -501

Specification : Approx. 0V

- 5) Is the measured voltage within specification ?

YES

- Go to "Component inspection" procedure.

NO

- Go to "Check short to battery in harness" procedure.

2. Check short to battery in harness

- 1) IG Key "OFF".
- 2) Disconnect A/C pressure sensor connector and PCM connector.
- 3) Measure the resistance between terminal 2 and terminal 3 of A/C pressure sensor harness connector.

Specification : Infinite

- 4) Is the measured resistance within specification ?

YES

- Go to "Component inspection" procedure.

NO

- Repair Short in signal circuit and go to "Verification of Vehicle Repair" procedure.

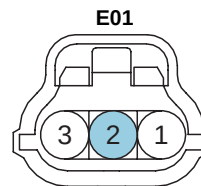
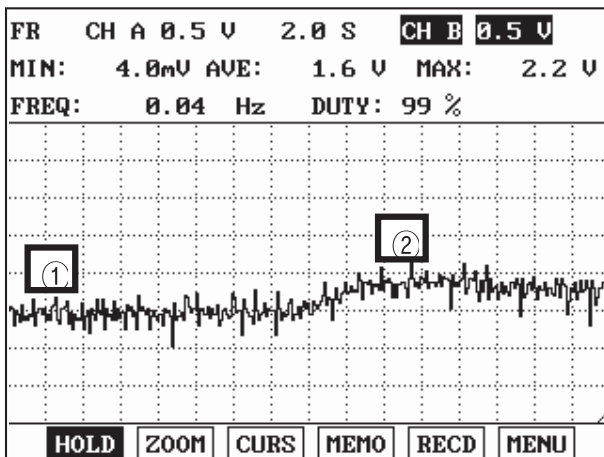
COMPONENT INSPECTION E5E87679

1. A/C pressure sensor inspection

- 1) IG Key "OFF" and connect the scantool.
- 2) Connect the probe to A/C pressure sensor signal and select the oscilloscope in the menu.
- 3) Check the waveform with acceleration and deceleration after engine start.

SPECIFICATION :

Pressure(psi)	14.7	128.5	242.3	356.1	469.0
Voltage(V)	0.5	1.5	2.5	3.5	4.5



1. A/C pressure sensor ground
2. A/C pressure sensor signal
3. A/C pressure sensor power

SVQF16373L

4) Is the measured waveform of A/C pressure sensor normal?

YES

► Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

► Substitute with a known - good A/C pressure sensor and check for proper operation. If the problem is corrected, replace A/C pressure sensor and go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

E04CD0ED

Refer to DTC P0532.

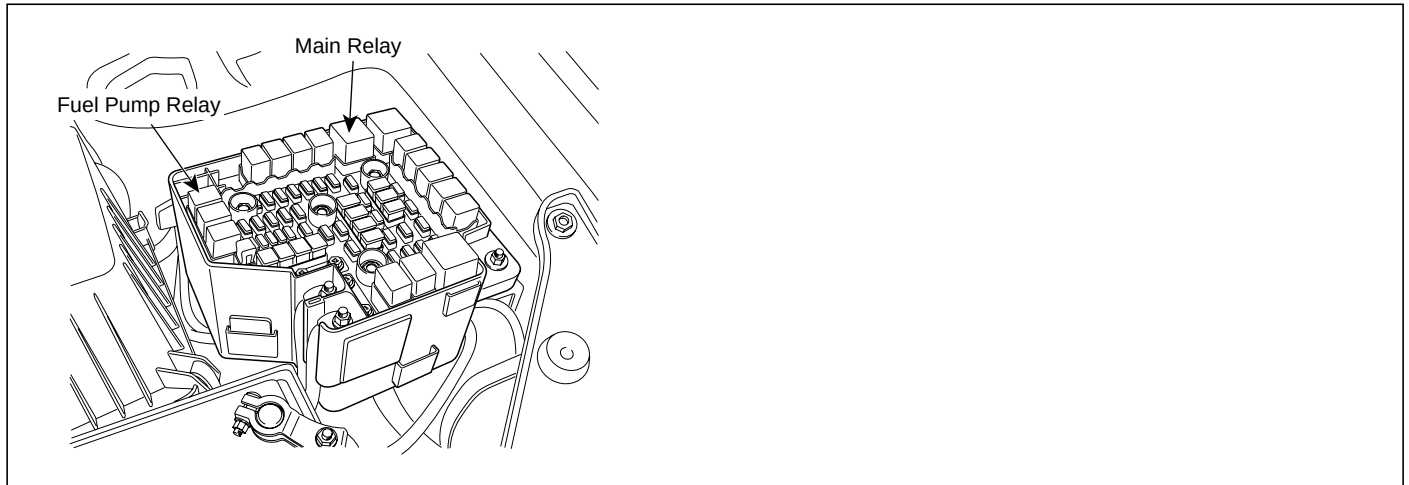
DTC TROUBLESHOOTING PROCEDURES

FLA -503

DTC P0562 SYSTEM VOLTAGE LOW

COMPONENT LOCATION

E4822353



SCMF16254L

GENERAL DESCRIPTION

EE0D9898

The ECM provides ground to one side of the coil of the main relay and the other side is connected to the battery. The ECM monitors battery voltage and the voltage after the main relay.

DTC DESCRIPTION

E745289C

During engine running, if system voltage is below 11V, PCM sets P0562. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION

ED806959

Item	Detecting Condition	Possible cause
DTC Strategy	Voltage too low	- Poor connection - Open in power circuit - Faulty charging system - Faulty main relay - Faulty PCM
Enable Conditions	- Engine works $11V \leq \text{Battery voltage} \leq 16V$	
Thresh old value	System voltage $< 11V$	
Diagnosis Time	Continuous	
MIL On Condition	2 driving cycles	

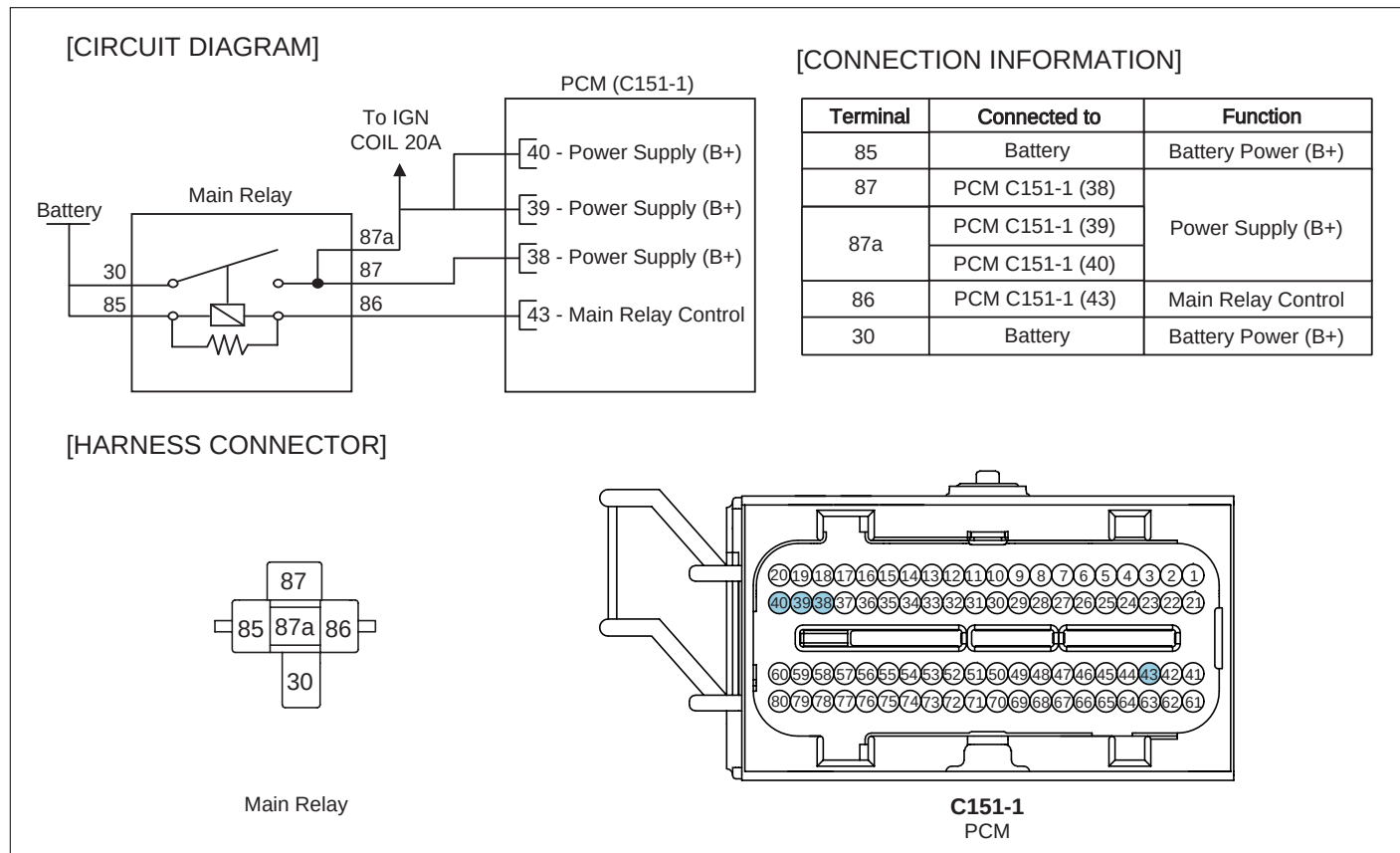
SPECIFICATION

EC9C973F

Coil Resistance	$70\Omega \sim 120\Omega$

SCHEMATIC DIAGRAM

EAED338F



SVQF16377L

MONITOR DTC STATUS

EADFFF7A

1. Check DTC Status

- 1) Connect scantool to Data Link Connector(DLC).
- 2) IG "ON".
- 3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F4(DTAL) to check DTC's information from the DTCs menu
- 4) Read "DTC Status" parameter.

1.1 DIAGNOSTIC TROUBLE CODES			
PXXXX DTC TITLE			
NUMBER OF DTC : 1 ITEMS			
PART	ERAS	DTAL	

PXXXX TITLE	
1.MIL STATUS:	ON/OFF
2.DTC STATUS:	PRESENT/HISTORY
3.DIAG.STATUS:	DIAGNOSIS FINISHED
DTC CAUSE TO SYSTEM ERROR : PXXXX	

SCMF16159L

5) Is parameter displayed "Present fault"?

YES

► Go to "Terminal and connector inspection" procedure.

NO

► Fault is intermittent caused by poor contact in the sensor' s and/or PCM' s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

TERMINAL AND CONNECTOR INSPECTION

EA71A57C

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

► Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

► Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION

EC50FD09

1. Check voltage.
 - 1) IG "OFF".
 - 2) Disconnect the main relay.
 - 3) IG "ON" and ENG "OFF"

FLA -506

FUEL SYSTEM

- 4) Measure the voltage between terminal 30 of main relay harness connector and chassis ground.
- 5) Measure the voltage between terminal 85 of main relay harness connector and chassis ground.

Specification : B+

- 6) Is the measured voltage within specification ?

YES

- Go to "Check open in harness" procedure.

NO

- Check the fuse between battery and main relay.
► Repair Open or Short to ground in power circuit and go to "Verification of Vehicle Repair" procedure

2. Check open in harness

- 1) IG "OFF".
- 2) Disconnect main relay and PCM connector.
- 3) Measure the resistance between terminal 87 of main relay harness connector and terminals 38 of PCM harness connector.
- 4) Measure the resistance between terminal 87a of main relay harness connector and terminals 39, 40 of PCM harness connector.

Specification : Approx. below 1Ω

- 5) Is the measured resistance within specification ?

YES

- Go to "Check short in harness" procedure.

NO

- Repair open in harness and go to "Verification of Vehicle Repair" procedure .

3. Check short in harness

- 1) IG "OFF".
- 2) Disconnect main relay and PCM connector.
- 3) Measure the resistance between terminal 87a of main relay harness connector and chassis ground.

Specification : Infinite

- 4) Is the measured resistance within specification ?

YES

- Go to "Control circuit inspection" procedure.

NO

DTC TROUBLESHOOTING PROCEDURES

FLA -507

- ▶ Repair short in harness and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION E8FBAF69

1. Check short in harness

- 1) IG "OFF".
- 2) Disconnect main relay and PCM connector.
- 3) Measure the resistance between terminal 86 of main relay harness connector and chassis ground.

Specification : Infinite

- 4) Is the measured resistance within specification ?

YES

- ▶ Go to "Check open in harness" procedure.

NO

- 5) ▶ Repair short in control harness and go to "Verification of Vehicle Repair" procedure.

2. Check open in harness

- 1) IG "OFF".
- 2) Disconnect main relay and PCM connector.
- 3) Measure the resistance between terminal 86 of main relay harness connector and terminal 43 of PCM harness connector.

Specification : Approx. below 1Ω

- 4) Is the measured resistance within specification ?

YES

- ▶ Go to "Ground circuit inspection" procedure.

NO

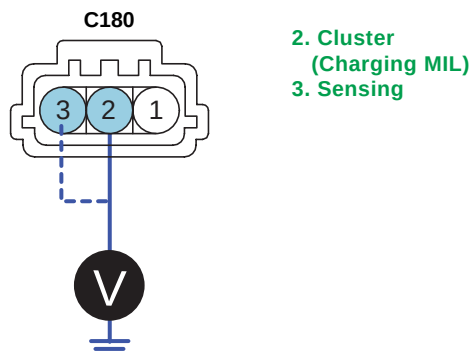
- ▶ Repair open in control harness and go to "Verification of Vehicle Repair" procedure.

SYSTEM INSPECTION EDF7965B

1. Check Alternator circuit

- 1) IG "OFF".
- 2) Disconnect alternator connector.
- 3) IG "ON" and ENG "OFF"
- 4) Measure the voltage between terminal 2 of alternator and chassis ground.
- 5) Measure the voltage between terminal 3 of alternator and chassis ground.

Specification : B+



SVQF16381L

6) Is the measured voltage within specification?

YES

► Go to "Component inspection" procedure.

NO

► In case terminal 2 : Repair MIL circuit, MIL resistor or Open in circuit and go to "Verification of Vehicle Repair" procedure.

► In case terminal 3 : Repair the fuse between battery and Ignition switch, the fuse between Ignition switch and alternator or Open in circuit and go to "Verification of Vehicle Repair" procedure.

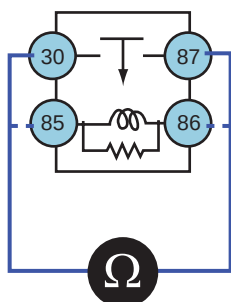
COMPONENT INSPECTION EDCC3570

1. Check Main relay

- 1) IG "OFF".
- 2) Disconnect the main relay.
- 3) Measure the resistance between terminal 30 and 87 of main relay.
- 4) Measure the resistance between terminal 85 and 86 of main relay.

Specification : 70 ~ 120Ω

Terminal	Power approval
30~87	NO
85~86	YES (Approx. 70Ω ~ 120Ω)



SVQF16912L

5) Is the measured resistance within specification ?

YES

► Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

► Substitute with a known - good Main relay and check for proper operation. If the problem is corrected, replace Main relay and go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

E558CCE6

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

► System performing to specification at this time. Clear the DTC.

NO

► Go to the applicable troubleshooting procedure.

FLA -510

FUEL SYSTEM

DTC P0563 SYSTEM VOLTAGE HIGH

COMPONENT LOCATION E0D02FB6

Refer to DTC P0562.

GENERAL DESCRIPTION E325E8A3

Refer to DTC P0562.

DTC DESCRIPTION EEB19291

During engine running, if system voltage is above 16V, PCM sets P0563. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E9F3B8D2

Item	Detecting Condition	Possible cause
DTC Strategy	Voltage too high	- Poor connection - Short in circuit - Faulty charging system - Faulty main relay - Faulty PCM
Enable Conditions	Engine works	
Thresh old value	System voltage > 16V	
Diagnosis Time	Continuous	
MIL On Condition	2 driving cycles	

SPECIFICATION EDE82ED2

Coil Resistance	70Ω ~ 120Ω

SCHEMATIC DIAGRAM E7F9ACF9

Refer to DTC P0562.

MONITOR DTC STATUS E3098E3B

Refer to DTC P0562.

TERMINAL AND CONNECTOR INSPECTION E7B7184C

Refer to DTC P0562.

POWER CIRCUIT INSPECTION E52F7AA5

- Check voltage
 - IG "OFF".
 - Disconnect the main relay.
 - IG "ON" and ENG "OFF"

DTC TROUBLESHOOTING PROCEDURES

FLA -511

- 4) Measure the voltage between terminal 30 of main relay harness connector and chassis ground.
- 5) Measure the voltage between terminal 85 of main relay harness connector and chassis ground.

Specification : B+

- 6) Is the measured voltage within specification ?

YES

- ▶ Go to "Check short in harness" procedure.

NO

- ▶ Repair Short in power harness and go to "Verification of Vehicle Repair" procedure.

2. Check short in harness

- 1) IG "ON".
- 2) Measure the voltage between terminal 38, 39, 40 of PCM harness terminal and chassis ground.

Specification : B+

- 3) Is the measured voltage within specification ?

YES

- ▶ Go to "System inspection" procedure.

NO

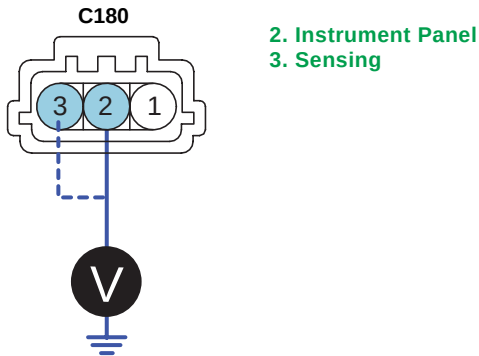
- ▶ Repair short in power harness and go to "Verification of Vehicle Repair" procedure .

SYSTEM INSPECTION ED02C2D0

1. Check Alternator circuit

- 1) IG "OFF".
- 2) Disconnect alternator connector
- 3) IG "ON" and ENG "OFF"
- 4) Measure the voltage between terminal 2 of alternator and chassis ground.
- 5) Measure the voltage between terminal 3 of alternator and chassis gound.

Specification : B+



SVQF16383L

6) Is the measured voltage within specification?

YES

► Go to "Component inspection" procedure.

NO

► Repair short in Sensing circuit or MIL circuit and go to "Verification of Vehicle Repair" procedure.

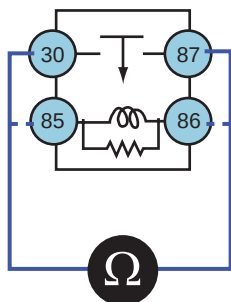
COMPONENT INSPECTION E2DE47BB

1. Check Main relay

- 1) IG "OFF".
- 2) Disconnect the main relay.
- 3) Measure the resistance between terminal 30 and 87 of main relay.
- 4) Measure the resistance between terminal 85 and 86 of main relay.

Specification : 70 ~ 120Ω

Terminal	Power approval
30~87	NO
85~86	YES (Approx. 70Ω ~ 120Ω)



SVQF16912L

5) Is the measured resistance within specification ?

YES

► Go to "Check Alternator" procedure.

NO

► Substitute with a known - good Main relay and check for proper operation. If the problem is corrected, replace Main relay and go to "Verification of Vehicle Repair" procedure.

2. Check Alternator

- 1) IG "OFF".
- 2) Check the tension of the belt.
- 3) Check Battery terminal and Alternator B+ terminal for looseness, corrosion or damage.
- 4) Engine "ON".
- 5) Operate electric equipments (Head lamp, Hot wire, etc).
- 6) accelerate engine to 2000 RPM and measure the battery voltage.

Specification : Approx. 12.5V ~ 14.5V

7) Is the measured voltage within specification ?

YES

► Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

► Substitute with a known - good Alternator and check for proper operation. If the problem is corrected, replace Alternator and go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR E12F704A

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

- ▶ System performing to specification at this time. Clear the DTC.

NO

- ▶ Go to the applicable troubleshooting procedure.

DTC TROUBLESHOOTING PROCEDURES

FLA -515

DTC P0571 BRAKE SWITCH "A" CIRCUIT

GENERAL DESCRIPTION E05F03C8

The Stop lamp switch is used to judge whether the acceleration system is abnormal or not. The stop lamp switch has a duplex system(signals brake test or brake light) to memorize the abnormality when the signals of depressing and releasing the brake pedal are detected simultaneously.

DTC DESCRIPTION E729BD31

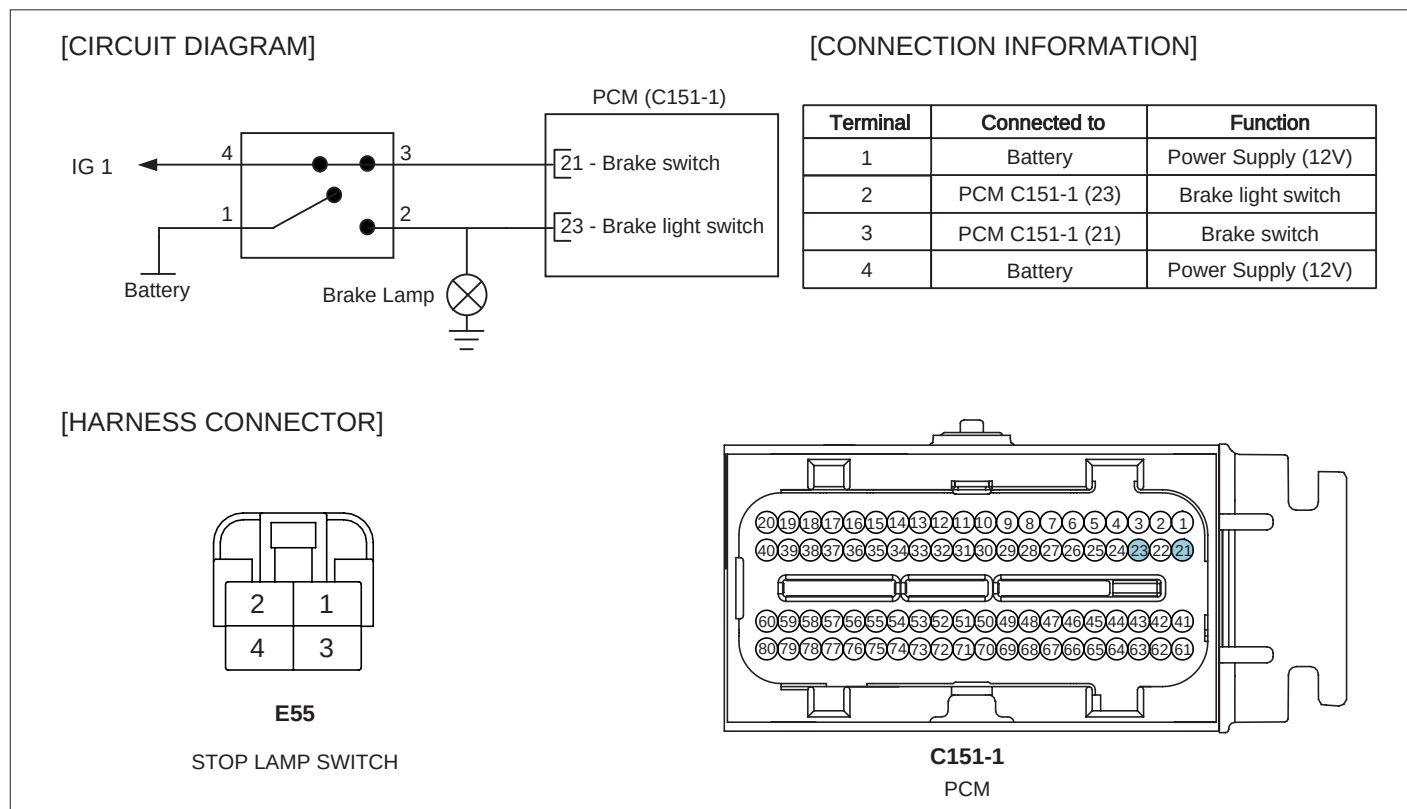
Checking input signals from brake lamp switch under detecting condition, if the operation state of brake lamp switch does not change for more than 3 sec., PCM sets P0571. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E26B2635

Item	Detecting Condition	Possible cause
DTC Strategy	PCM detects brake lamp input signal when vehicle stops.	- Poor connection - Open or short to ground in signal circuit - Faulty PCM
Enable Conditions	- Engine works - Vehicle speed signal is normal. - Vehicle speed > 20kph (during 1sec or more)	
Threshold value	- Vehicle speed < 3kph - Vehicle acceleration < -6kph/s - Brake lamp "OFF" and not changing of brake lamp signal for more 3 sec.	
Diagnosis Time	Continuous	
MIL On Condition	2 driving cycles	

SCHEMATIC DIAGRAM

E3311F66



SVQF16365L

MONITOR DTC STATUS

EDDDACD9

1. Check DTC Status

- 1) Connect scantool to Data Link Connector(DLC).
- 2) IG "ON".
- 3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F4(DTAL) to check DTC's information from the DTCs menu
- 4) Read "DTC Status" parameter.

1.1 DIAGNOSTIC TROUBLE CODES

PXXXX DTC TITLE

NUMBER OF DTC : 1 ITEMS

PART
ERAS
DTAL

PXXXX TITLE

1.MIL STATUS: ON/OFF

2.DTC STATUS: PRESENT/HISTORY

3.DIAG.STATUS: DIAGNOSIS FINISHED

DTC CAUSE TO SYSTEM ERROR : PXXXX

SCMF16159L

DTC TROUBLESHOOTING PROCEDURES

FLA -517

- 5) Is parameter displayed "Present fault"?

YES

- Go to "Terminal and connector inspection" procedure.

NO

- Fault is intermittent caused by poor contact in the sensor' s and/or PCM' s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

TERMINAL AND CONNECTOR INSPECTION EC369B30

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

- Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

- Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION E96451A9

1. Check voltage
 - 1) IG "OFF".
 - 2) Disconnect the PCM connector.
 - 3) IG "ON" and ENG "OFF"
 - 4) During taking off the brake : Measure the voltage between terminal 23 of PCM harness connector and chassis ground.
 - 5) During stepping on the brake : Measure the voltage between terminal 23 of PCM harness connector and chassis ground.

SPECIFICATION :

Item	During taking off the brake	During stepping on the brake
Brake Lamp Switch	0V	Battery voltage
Brake Switch	Battery voltage	0V

- 6) Is the measured voltage within specification ?

YES

► Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Check open in harness" as follows.

2. Check open in harness

- 1) IG "OFF".
- 2) Disconnect the brake switch and PCM connector.
- 3) Measure the resistance between terminal 23 of PCM harness connector and terminal 2 of Brake switch harness side.

Specification : Approx. below 1Ω

- 4) Is the measured resistance within specification ?

YES

► Go to "Check voltage" as follows.

NO

► Repair open in circuit and go to "Verification of Vehicle Repair" procedure.

3. Check voltage

- 1) IG Key "OFF".
- 2) Disconnect the brake switch connector.
- 3) Measure the voltage between brake lamp switch terminal 1 and chassis ground.
- 4) Measure the voltage between brake switch terminal 4 and chassis ground.
- 5) IG Key "ON".
- 6) Measure the voltage between brake lamp switch terminal 1 and chassis ground.
- 7) Measure the voltage between brake switch terminal 4 and chassis ground.

SPECIFICATION :

Item	During taking off the brake	During stepping on the brake
Brake Lamp Switch	Battery voltage	Battery voltage
Brake Switch	0V	Battery voltage

- 8) Is the measured voltage within specification ?

YES

► Substitute with a known - good brake switch and check for proper operation. If the problem is corrected, replace brake switch and go to "Verification of Vehicle Repair" procedure.

NO

DTC TROUBLESHOOTING PROCEDURES

FLA -519

- ▶ Check the fuse between battery and brake switch.
- ▶ Repair open or short in power circuit of brake switch and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E279FF74

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

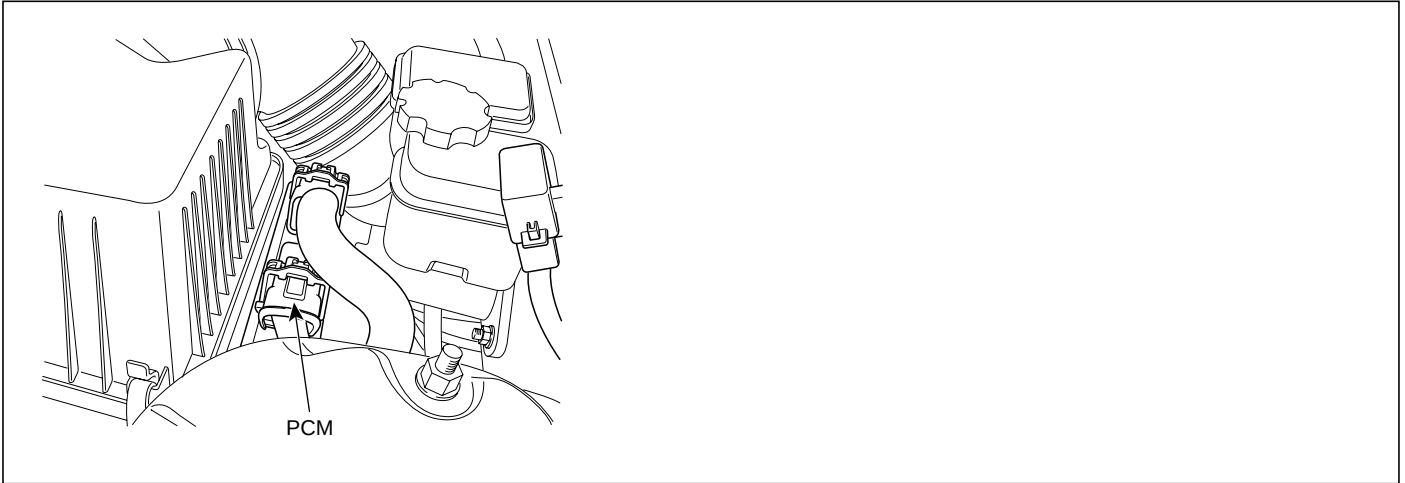
- ▶ System performing to specification at this time. Clear the DTC.

NO

- ▶ Go to the applicable troubleshooting procedure.

DTC P0601 EEPROM-CHECK SUM ERROR

COMPONENT LOCATION E229539F



SCMF16386L

GENERAL DESCRIPTION E87E4D85

A malfunction is detected by using a checksum technique for verifying data. The digital data is composed of zeros and ones. A checksum is the total of all ones in a string of data. By comparing the checksum value with a stored value, a malfunction can be detected.

DTC DESCRIPTION E65068E8

If real checksum does not accord with memory checksum, PCM sets P0601 and MIL(Malfunction Indication Lamp) turns on.

DTC DETECTING CONDITION E38A3627

Item	Detecting Condition	Possible cause
DTC Strategy	Checksum check	Faulty PCM
Enable Conditions	-	
Threshold value	Discordance between the real checksum and the memorized checksum	
Diagnosis Time	Continuous	
MIL On Condition	1 driving cycle	

MONITOR DTC STATUS E7BDFDA8

- Check DTC Status
 - Connect scantool to Data Link Connector(DLC).
 - IG "ON".
 - Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F4(DTAL) to check DTC's information from the DTCs menu

DTC TROUBLESHOOTING PROCEDURES

FLA -521

- 4) Read "DTC Status" parameter.

1.1 DIAGNOSTIC TROUBLE CODES		
PXXXX DTC TITLE		
NUMBER OF DTC : 1 ITEMS		
PART	ERAS	DTAL

PXXXX TITLE	
1.MIL STATUS:	ON/OFF
2.DTC STATUS:	PRESENT/HISTORY
3.DIAG.STATUS:	DIAGNOSIS FINISHED
DTC CAUSE TO SYSTEM ERROR : PXXXX	

SCMF16159L

- 5) Is parameter displayed "Present fault"?

YES

- Go to "Terminal and connector inspection" procedure.

NO

- Fault is intermittent caused by poor contact in the sensor' s and/or PCM' s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

TERMINAL AND CONNECTOR INSPECTION

E2E5805E

- Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
- Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
- Has a problem been found?

YES

- Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

- Substitute with a known-good PCM and check for proper operation. If the problem is corrected,replace PCM and then go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

EDF49698

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

- ▶ System performing to specification at this time. Clear the DTC.

NO

- ▶ Go to the applicable troubleshooting procedure.

DTC TROUBLESHOOTING PROCEDURES

FLA -523

DTC P0602 EEPROM-PROGRAMING ERROR

COMPONENT LOCATION E6E49C3C

Refer to DTC P0601.

GENERAL DESCRIPTION EECB64CE

Refer to DTC P0601.

DTC DESCRIPTION E0CE496F

If CPU software version dose not accord with main CPU, PCM sets P0602.

DTC DETECTING CONDITION E88A3072

Item	Detecting Condition	Possible cause
DTC Strategy	• Check internal CPU	• Faulty PCM
Enable Conditions	• -	
Threshold value	• The version discordance among PCU S/W or Calibration	
Diagnosis Time	• Continuous	
MIL On Condition	• 1 driving cycle	

MONITOR DTC STATUS ED153DB8

Refer to DTC P0601.

TERMINAL AND CONNECTOR INSPECTION EB336C96

Refer to DTC P0601.

VERIFICATION OF VEHICLE REPAIR E499B411

Refer to DTC P0601.

FLA -524

FUEL SYSTEM

DTC P0604 INTERNAL CONTROL MODULE RANDOM ACCESS MEMORY (RAM) ERROR

COMPONENT LOCATION ECDD00AC

Refer to DTC P0601.

GENERAL DESCRIPTION EC8E0935

Refer to DTC P0601.

DTC DESCRIPTION E7CA500D

If the RAM in PCM has errors, PCM sets P0604 and MIL(Malfunction Indication Lamp) turns on.

DTC DETECTING CONDITION E848AF67

Item	Detecting Condition	Possible cause
DTC Strategy	• Check internal CPU	• Faulty PCM
Enable Conditions	• -	
Threshold value	• RAM has errors	
Diagnosis Time	• Continuous	
MIL On Condition	• 1 driving cycle	

MONITOR DTC STATUS ECC7C404

Refer to DTC P0601.

TERMINAL AND CONNECTOR INSPECTION E6886EBD

Refer to DTC P0601.

VERIFICATION OF VEHICLE REPAIR EF1A07CB

Refer to DTC P0601.

DTC TROUBLESHOOTING PROCEDURES

FLA -525

DTC P0606 ECM/PCM PROCESSOR(ECM-SELF TEST FAILED)

COMPONENT LOCATION E6BA7101

Refer to DTC P0601.

GENERAL DESCRIPTION E8AE56A0

Refer to DTC P0601.

DTC DESCRIPTION E3F9D10A

Checking PCM under detecting condition, if internal error is detected, PCM sets P0606. And MIL(Malfunction Indication Lamp) turns on.

DTC DETECTING CONDITION EA082F6D

Item	Detecting Condition	Possible cause
DTC Strategy	• Check PCM internal error	• Faulty PCM
Enable Conditions	• 7V < Battery voltage < 20V	
Threshold value	• PCM internal error (A/D unit error)	
Diagnosis Time	• Continuous	
MIL On Condition	• 1 driving cycle	

MONITOR DTC STATUS EB03A742

Refer to DTC P0601.

TERMINAL AND CONNECTOR INSPECTION E4C51C74

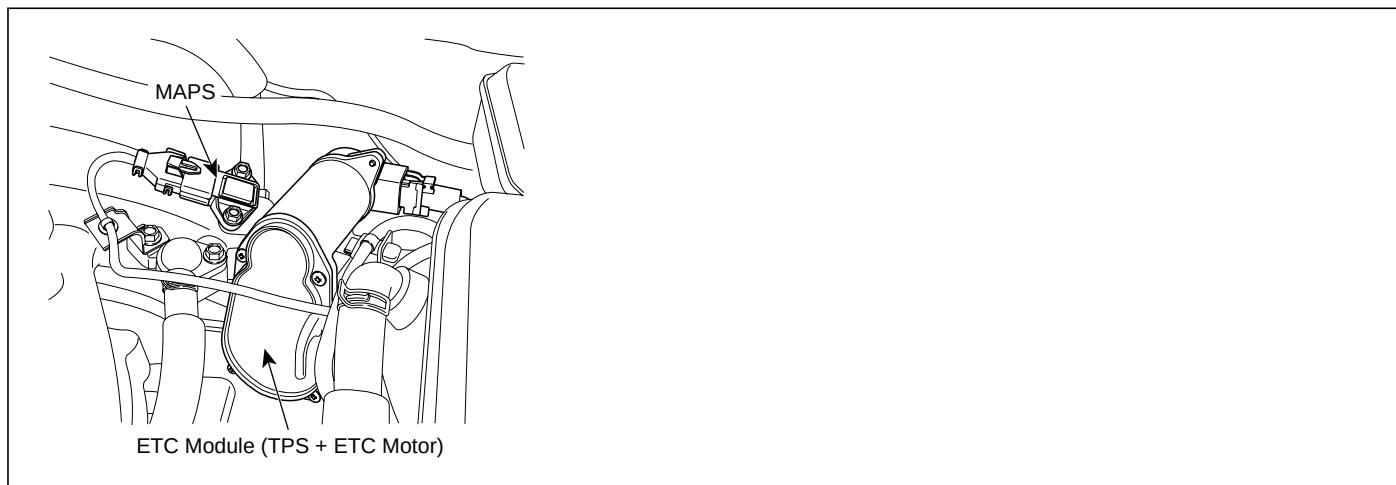
Refer to DTC P0601.

VERIFICATION OF VEHICLE REPAIR EB22E942

Refer to DTC P0601.

DTC P0638 THROTTLE ACTUATOR CONTROL RANGE/PERFORMANCE

COMPONENT LOCATION E39F0565



SCMF16192L

GENERAL DESCRIPTION EDD2D537

The Electronic Throttle Control(ETC) system is made of the components throttle body, Throttle Position Sensor(TPS)1 & 2 and Accelerator Position Sensor(APS) 1 & 2. The throttle body contains the actuator, the throttle plate and the throttle position sensor (potentiometer), which are integrated in one housing. The actuator consists of a DC motor with a two-stage gear. The opening angle of the throttle valve is detected by the throttle position sensor which is mounted on the throttle body. And it provides feedback to the ECM to control the throttle motor in order to control the throttle valve opening angle properly in response to the driving condition.

DTC DESCRIPTION EA375F92

Checking output signals from TPS under detecting condition, if the difference between real and target throttle position is above the specified value, PCM sets P0638 and then MIL(Malfunction Indication Lamp) turns on.

DTC DETECTING CONDITION E411BDA4

Item		Detecting Condition	Possible cause
DTC Strategy		Monitor the throttle position	- Throttle stuck - Open in motor circuit - Faulty motor - Faulty PCM
Enable Conditions		- Engine works - Battery voltage > 5V	
Thresh old value	Case1	The difference between the real ETS motor & TPS value and the target ETS motor & TPS value is over 4.5°.	
	Case2	When real Throttle position is below 36°, (the real throttle position - the target throttle position) < - 4.5°	
	Case3	(the real throttle position - the target throttle position) < - 18°	
Diagnosis Time		Continuous	
MIL On Condition		1 driving cycle	

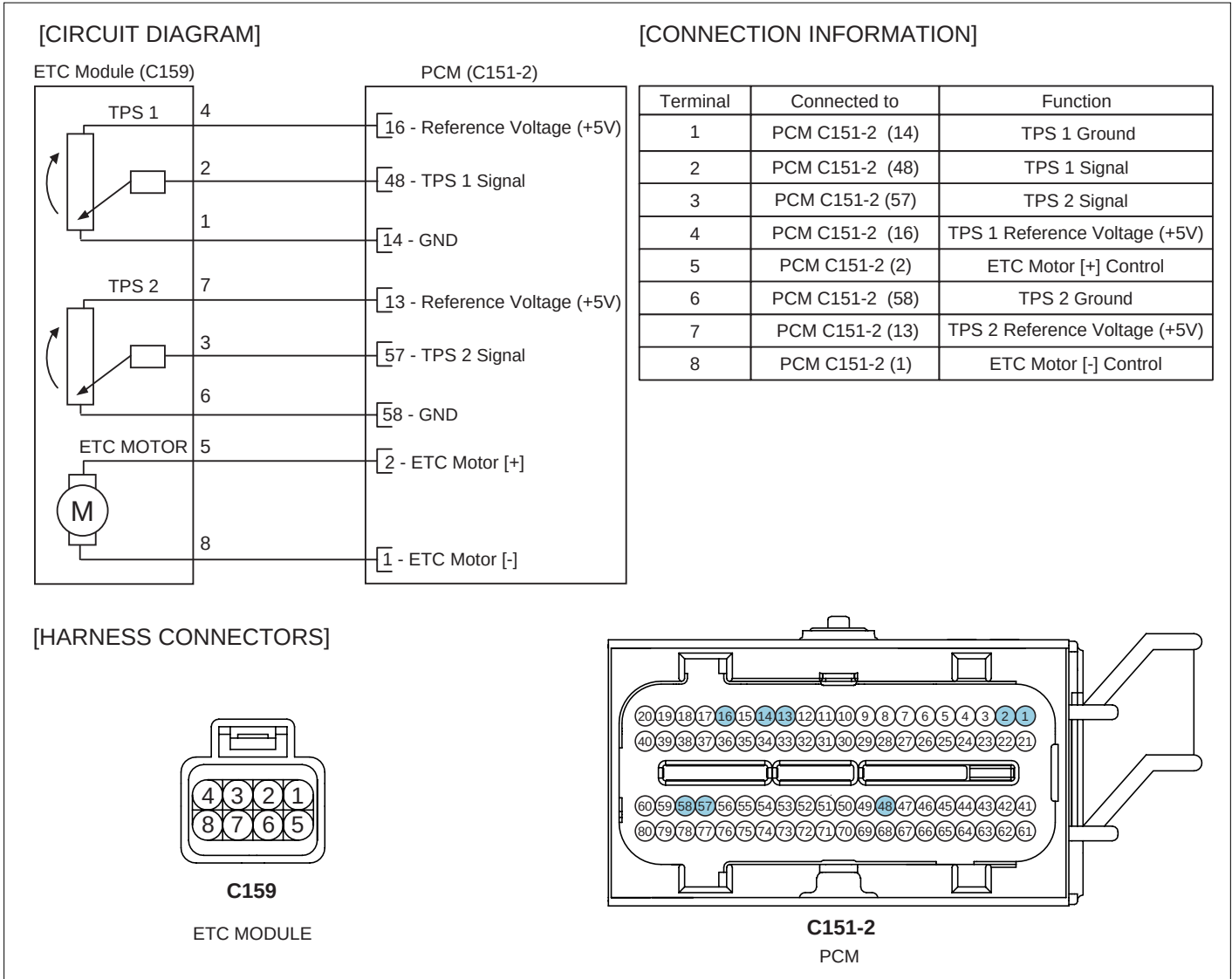
DTC TROUBLESHOOTING PROCEDURES

FLA -527

SPECIFICATION E58C81DC

Throttle opening (°)	Output voltage (V) [Verf = 5.0V]	
	TPS1	TPS2
0°	0.0V	5.0V
10°	0.5V	4.5V
20°	0.9V	4.1V
30°	1.4V	3.6V
40°	1.8V	3.2V
50°	2.3V	2.7V
60°	2.7V	2.3V
70°	3.2V	1.8V
80°	3.6V	1.4V
90°	4.1V	0.9V
100°	4.5V	0.5V
110°	5.0V	0.0V

SCHEMATIC DIAGRAM E32258ED



SIGNAL WAVEFORM

E48A6E0B

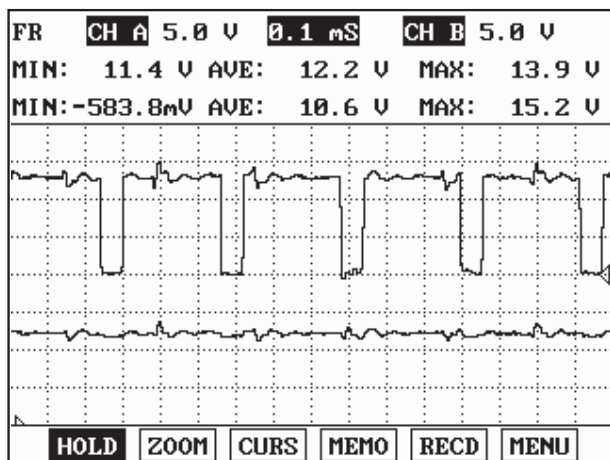


Fig. 1

Fig1) Signal waveform(+/-) instantly with accelerating

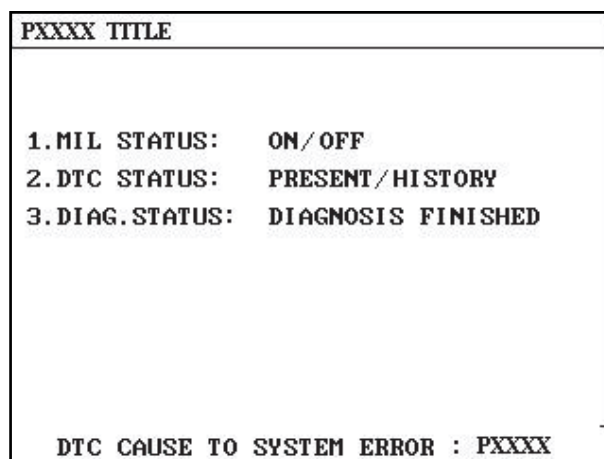
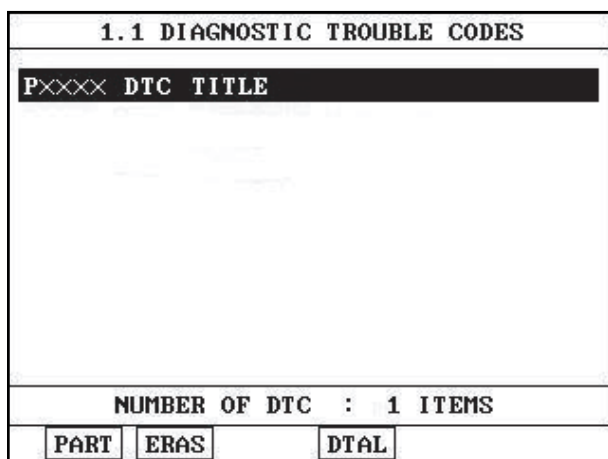
EGRF921A

MONITOR DTC STATUS

EBABB1E4

1. Check DTC Status

- 1) Connect scantool to Data Link Connector(DLC).
- 2) IG "ON".
- 3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F4(DTAL) to check DTC's information from the DTCs menu
- 4) Read "DTC Status" parameter.



SCMF16159L

5) Is parameter displayed "Present fault"?

YES

- Go to "Terminal and connector inspection" procedure.

NO

► Fault is intermittent caused by poor contact in the sensor' s and/or PCM' s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

TERMINAL AND CONNECTOR INSPECTION E49C836E

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

► Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

► Go to " Control Circuit Inspection " procedure.

CONTROL CIRCUIT INSPECTION E3BADF5F

1. Check voltage
 - 1) IG "OFF".
 - 2) Disconnect ETS motor & TPS connector.
 - 3) IG "ON" and ENG "OFF"
 - 4) Measure the voltage between terminal 5,8 of ETS motor & TPS harness connector and chassis ground.

Specification : Approx. 12V

- 5) Is the measured voltage within specification?

YES

► Go to "Component inspection" procedure.

NO

► Go to "Check open in harness" as follows.

2. Check open in harness
 - 1) IG "OFF"
 - 2) Disconnect ETS motor & TPS connector and PCM connector.
 - 3) Measure the resistance between terminal 5 of ETS motor & TPS harness connector and terminal 2 of PCM harness connector.

DTC TROUBLESHOOTING PROCEDURES

FLA -531

- 4) Measure the resistance between terminal 8 of ETS motor & TPS harness connector and terminal 1 of PCM harness connector.

Specification : Approx. below 1Ω

- 5) Is the measured resistance within specification ?

YES

- ▶ Go to "Component inspection" procedure.

NO

- ▶ Repair Open in motor harness and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

EC9FEB92

1. Check throttle valve for stuck

- 1) IG "OFF".
- 2) Disconnect the air hose between throttle body and air mass flow sensor.
- 3) Check stuck on throttle valve.
- 4) Is the throttle valve normal?

YES

- ▶ Go to check "ETS motor resistance" as follows.

NO

- ▶ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check ETS motor resistance

- 1) IG "OFF".
- 2) Disconnect ETS motor & TPS connector.
- 3) Measure the resistance between terminal 5 and 8 of ETS motor & TPS connector(component side).

Specification : Approx. $1.275 \sim 1.725\Omega$ @ 23°C (73.4°F)

- 4) Is the measured resistance within specification?

YES

- ▶ Go to "ETC motor actuation test" procedure.

NO

- ▶ Substitute with a known - good ETC motor and check for proper operation. If the problem is corrected, replace ETC motor and go to "Verification of Vehicle Repair" procedure.

※ Procedure of ETS Initialization

1. Erase the trouble codes on PCM
2. Turn the ignition key off and keep this condition until the main relay is turned off.(It will takes 10 second)
3. Turn ignition key on more than 1second to record the throttle motor position on the EEPROM

3. ETC motor actuation test

- 1) IG "OFF".
- 2) Connect ETS motor & TPS connector.
- 3) After IG "ON", execute the "ETC motor actuation test" by Scantool.

1.11 ACTUATION TEST 03/22	
ETC MOTOR	
DURATION	UNTIL STOP KEY
METHOD	ACTIVATION
CONDITION	IG.KEY ON ENGINE OFF
PRESS [STRT], IF YOU ARE READY ! SELECT TEST ITEM USING UP/DOWN KEY	
STRT	STOP

EGRF926A

- 4) Does the "ETC motor actuation test" execute normally?

YES

► Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

► Substitute with a known - good ETC motor and check for proper operation. If the problem is corrected, replace ETC motor and go to "Verification of Vehicle Repair" procedure.

※ Procedure of ETS Initialization

1. Erase the trouble codes on PCM
2. Turn the ignition key off and keep this condition until the main relay is turned off.(It will takes 10 second)
3. Turn ignition key on more than 1second to record the throttle motor position on the EEPROM

VERIFICATION OF VEHICLE REPAIR EEB6DD19

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

DTC TROUBLESHOOTING PROCEDURES

FLA -533

- ▶ System performing to specification at this time. Clear the DTC.

NO

- ▶ Go to the applicable troubleshooting procedure.

DTC P0641 SENSOR REFERENCE VOLTAGE "A" CIRCUIT OPEN

GENERAL DESCRIPTION E15F66A1

The ECM provides a 5volt reference voltage to Throttle Position Sensor 1(TPS1). The ECM monitors reference voltage deviation from the power supply circuit of the sensors.

DTC DESCRIPTION EF6A2456

Checking the voltage from sensor power supply every 1.87 sec. under detecting condition, if the value within detecting condition lasts for more than 0.2 sec., PCM sets P0641. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E7552101

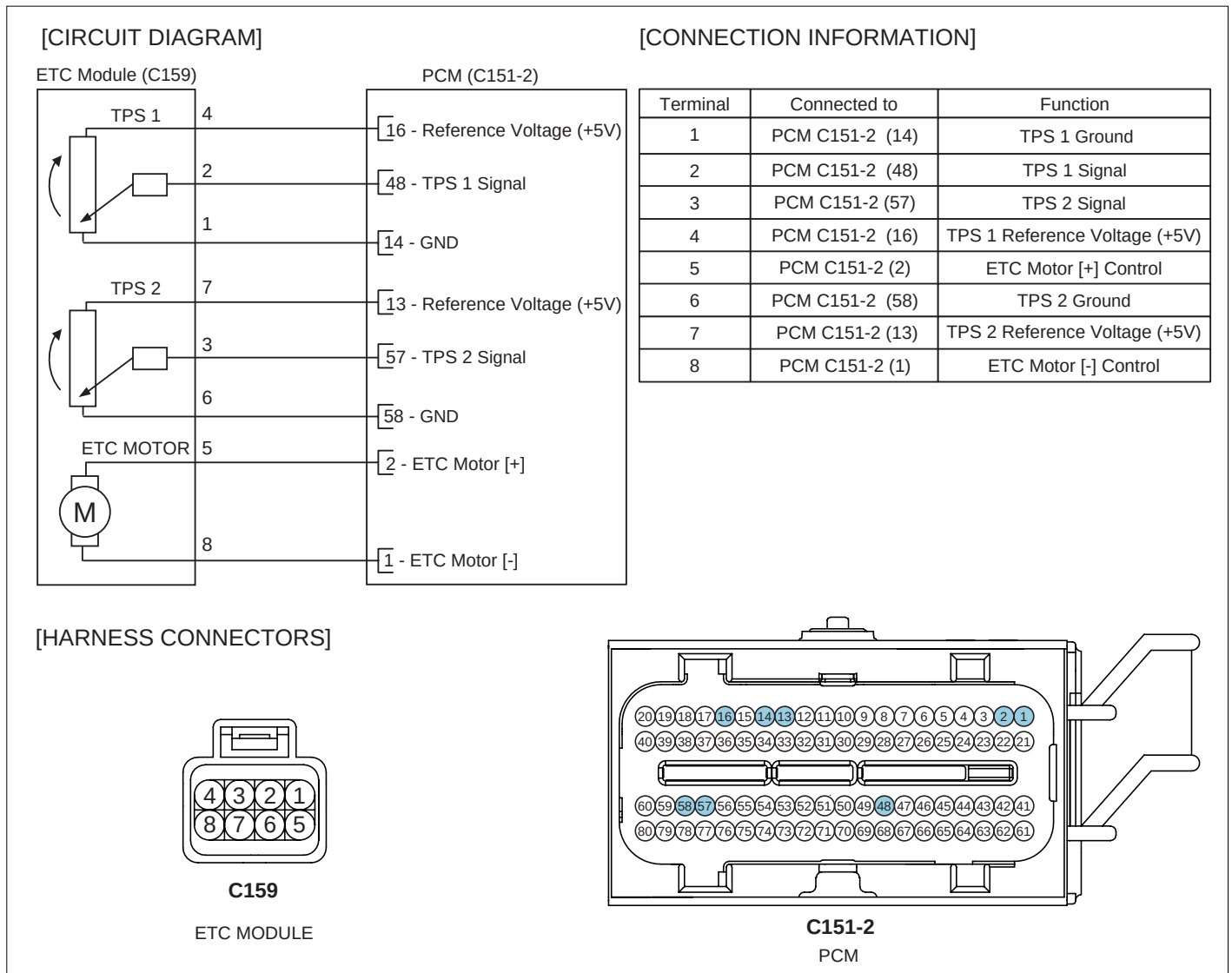
Item	Detecting Condition	Possible cause
DTC Strategy	• Sensor reference voltage check	• Short in sensor power supply line • Faulty PCM
Enable Conditions	• IG "ON"	
Threshold value	• Sensor supply power < 4.5V or > 5.5V	
Diagnosis Time	• Continuous (More than 0.2 seconds failure for every 1.87 seconds test)	
MIL On Condition	• 2 driving cycle	

DTC TROUBLESHOOTING PROCEDURES

FLA -535

SCHEMATIC DIAGRAM

EC1AC7D9



SVQF16101L

MONITOR DTC STATUS

EDB80F42

1. Check DTC Status
 - 1) Connect scantool to Data Link Connector(DLC).
 - 2) IG "ON".
 - 3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F4(DTAL) to check DTC's information from the DTCs menu
 - 4) Read "DTC Status" parameter.

1.1 DIAGNOSTIC TROUBLE CODES			
PXXXX DTC TITLE			
NUMBER OF DTC : 1 ITEMS			
PART	ERAS	DTAL	

PXXXX TITLE	
1.MIL STATUS:	ON/OFF
2.DTC STATUS:	PRESENT/HISTORY
3.DIAG.STATUS:	DIAGNOSIS FINISHED
DTC CAUSE TO SYSTEM ERROR : PXXXX	

SCMF16159L

5) Is parameter displayed "Present fault"?

YES

► Go to "Terminal and connector inspection" procedure.

NO

► Fault is intermittent caused by poor contact in the sensor' s and/or PCM' s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

TERMINAL AND CONNECTOR INSPECTION

EC1C2088

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

► Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

► Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION

E1B2DC07

1. Check voltage
 - 1) IG "OFF".
 - 2) Disconnect TPS connector.
 - 3) IG "ON" and ENG "OFF"

DTC TROUBLESHOOTING PROCEDURES

FLA -537

- 4) Measure the voltage between terminal 4 of TPS harness connector and chassis ground.

Specification : Approx. 5V

- 5) Is the measured voltage within specification ?

YES

▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Check short in power harness" as follows.

2. Check short in power harness

- 1) IG "OFF".
- 2) Disconnect TPS connector and PCM connector.
- 3) Measure the resistance between terminal 4 and 5 of TPS harness connector.
- 4) Measure the resistance between terminal 4 and 8 of TPS harness connector.
- 5) Measure the resistance between terminal 4 and 6 of TPS harness connector.
- 6) Measure the resistance between terminal 4 and 1 of TPS harness connector.

Specification : Infinite

- 7) Is the measured resistance within specification ?

YES

▶ Substitute with a known - good PCM and check for proper operation.
▶ If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▶ Repair Short in power circuit and go to "Verification of Vehicle Repair" procedure.

※ Procedure of ETS Initialization

1. Erase the trouble codes on PCM
2. Turn the ignition key off and keep this condition until the main relay is turned off.(It will takes 10 second)
3. Turn ignition key on more than 1second to record the throttle motor position on the EEPROM

VERIFICATION OF VEHICLE REPAIR

E34B8F1E

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.

4. Is parameter displayed "History(Not Present) fault"?

YES

- ▶ System performing to specification at this time. Clear the DTC.

NO

- ▶ Go to the applicable troubleshooting procedure.

DTC TROUBLESHOOTING PROCEDURES

FLA -539

DTC P0646 A/C CLUTCH RELAY CONTROL CIRCUIT LOW

GENERAL DESCRIPTION EDDD5D8D

The A/C clutch relay is activated if the A/C switch is operated while the blower is running and system operation is enabled by the ECM. When A/C is requested, the Engine Control Module(ECM) provides a ground path to the A/C clutch relay control circuit. When the relay circuit is grounded, the A/C clutch relay is energized. The ECM delays grounding the relay circuit for a short time, so the ECM can adjust the engine idle speed for the additional load. The ECM will temporarily de-energized the A/C clutch relay for one or more of the following conditions:

- Full acceleration when the throttle is at WOT.(Wide Open Throttle)
- Risk of overheating: Engine coolant temp. exceeds threshold value
- A/C system pressure exceeds threshold value
- Engine starting

DTC DESCRIPTION E104ED52

PCM monitors inputted voltage through A/C compressor relay. Checking voltage every 10 sec. under detecting condition, if the voltage lower than the specified value is detected for more than 5 sec., PCM sets P0646.

DTC DETECTING CONDITION EC2A54B9

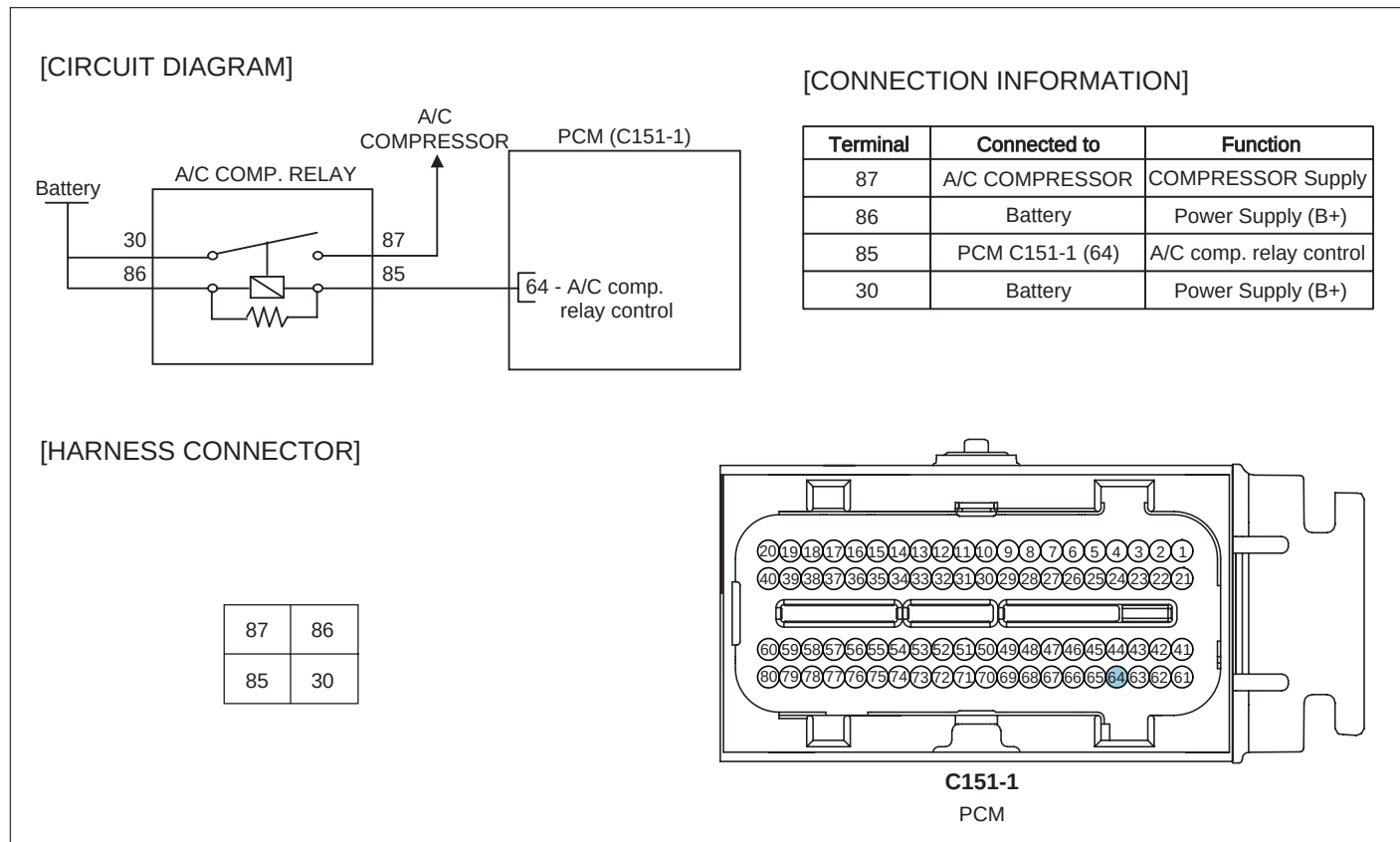
Item	Detecting Condition	Possible cause
DTC Strategy	• Detects circuit short to low voltage	• Poor connection • Open or short to ground in A/C relay circuit • Faulty A/C relay • Faulty PCM
Enable Conditions	• After 0.5 sec under conditions below • No DTC exists • Engine works • $11V \leq \text{Battery voltage} \leq 16V$	
Threshold value	• Open or short to ground	
Diagnosis Time	• Continuous (More than 5 seconds failure for every 10 seconds test)	
MIL On Condition	• DTC only (NO MIL ON)	

SPECIFICATION E4795868

Coil Resistance
$70\Omega \sim 120\Omega$

SCHEMATIC DIAGRAM

E7EB010D



SVQF16392L

MONITOR DTC STATUS

E94C88FB

1. Check DTC Status

- 1) Connect scantool to Data Link Connector(DLC).
- 2) IG "ON".
- 3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F4(DTAL) to check DTC's information from the DTCs menu
- 4) Read "DTC Status" parameter.

1.1 DIAGNOSTIC TROUBLE CODES			
PXXXX DTC TITLE			
NUMBER OF DTC : 1 ITEMS			
PART	ERAS	DTAL	

PXXXX TITLE	
1.MIL STATUS:	ON/OFF
2.DTC STATUS:	PRESENT/HISTORY
3.DIAG.STATUS:	DIAGNOSIS FINISHED
DTC CAUSE TO SYSTEM ERROR : PXXXX	

SCMF16159L

5) Is parameter displayed "Present fault"?

YES

► Go to "Terminal and connector inspection" procedure.

NO

► Fault is intermittent caused by poor contact in the sensor' s and/or PCM' s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

TERMINAL AND CONNECTOR INSPECTION

E6FB52BA

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

► Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

► Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION

E716BEFB

1. Check voltage
 - 1) IG "OFF".
 - 2) Disconnect A/C relay.
 - 3) IG "ON" and ENG "OFF"

- 4) Measure the voltage between terminal 86 of A/C relay harness connector and chassis ground.
- 5) Measure the voltage between terminal 30 of A/C relay harness connector and chassis ground.

Specification : B+

- 6) Is the measured voltage normal?

YES

- Go to "Control circuit inspection" procedure.

NO

- Check the fuse between Battery and A/C relay.
► Check Chassis ground for looseness.
► Repair Open or Short to ground in power circuit and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

E771FA95

1. Check short in harness

- 1) IG "OFF".
- 2) Disconnect A/C relay and PCM connector.
- 3) Measure the resistance between terminal 85 of A/C relay harness connector and chassis ground.

Specification : Infinite

- 4) Is the measured resistance within specification ?

YES

- Go to "Check open in harness" as follows.

NO

- Repair Short in Coil control harness and go to "Verification of Vehicle Repair" procedure.

2. Check open in harness

- 1) IG "OFF".
- 2) Disconnect A/C relay and PCM connector.
- 3) Measure the resistance between terminal 85 of A/C relay harness connector and terminal 64 of PCM harness connector.

Specification : Approx. below 1Ω

- 4) Is the measured resistance within specification ?

YES

- Go to "Component inspection" procedure.

DTC TROUBLESHOOTING PROCEDURES

FLA -543

NO

- Repair Open in Coil control harness and go to "Verification of Vehicle Repair" procedure.

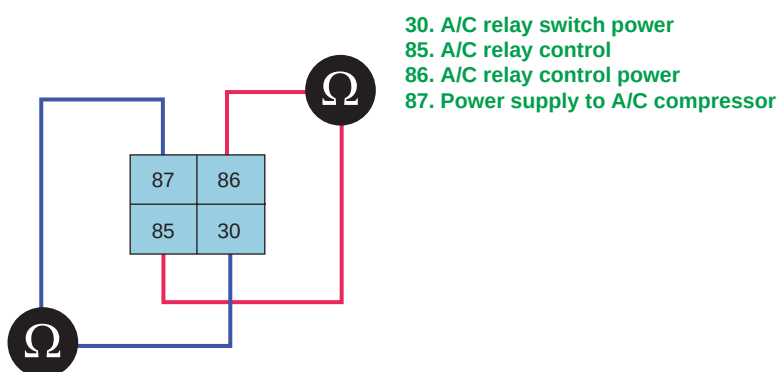
COMPONENT INSPECTION

E51102A9

1. Check A/C relay

- 1) IG "OFF".
- 2) Disconnect A/C relay.
- 3) Measure the resistance between terminal 85 and 86 of A/C relay.
- 4) Measure the resistance between terminal 30 and 87 of A/C relay.

Terminal	Power approval
30~87	NO
85~86	YES (70Ω ~ 120Ω)



SVQF16936L

5) Is the measured resistance within specification ?

YES

- Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

- Substitute with a known - good A/C relay and check for proper operation. If the problem is corrected, replace A/C relay and go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

E90B3F6D

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

- ▶ System performing to specification at this time. Clear the DTC.

NO

- ▶ Go to the applicable troubleshooting procedure.

DTC TROUBLESHOOTING PROCEDURES

FLA -545

DTC P0647 A/C CLUTCH RELAY CONTROL CIRCUIT HIGH

GENERAL DESCRIPTION E1B5EB25

Refer to DTC P0646.

DTC DESCRIPTION ECC5A729

PCM monitors inputted voltage through A/C compressor relay. Checking voltage every 10 sec. under detecting condition, if the voltage higher than the specified value is detected for more than 5 sec., PCM sets P0647.

DTC DETECTING CONDITION ECABD7EA

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects circuit short to high voltage	• Poor connection • Short to power in A/C relay circuit • Faulty A/C relay • Faulty PCM
Enable Conditions	• After 0.5 sec under conditions below • No DTC exists • Engine works • $11V \leq \text{Battery voltage} \leq 16V$	
Threshold value	• Short to power	
Diagnosis Time	• Continuous (More than 5 seconds failure for every 10 seconds test)	
MIL On Condition	• DTC only (NO MIL ON)	

SPECIFICATION E468E9AC

Coil Resistance
$70\Omega \sim 120\Omega$

SCHEMATIC DIAGRAM E034F9E5

Refer to DTC P0646.

MONITOR DTC STATUS EB070E3B

Refer to DTC P0646.

TERMINAL AND CONNECTOR INSPECTION E5D3822E

Refer to DTC P0646.

POWER CIRCUIT INSPECTION EEB7A706

1. Check voltage
 - 1) IG "OFF".
 - 2) Disconnect A/C relay.

- 3) IG "ON" and ENG "OFF"
- 4) Measure the voltage between terminal 30 of A/C relay harness connector and chassis ground.
- 5) Measure the voltage between terminal 86 of A/C relay harness connector and chassis ground.

Specification : B+

- 6) Is the measured voltage normal?

YES

- Go to "Control circuit inspection" procedure.

NO

- Check the fuse between Battery and A/C relay.
► Check Chassis ground 1 and 2 for looseness.
► Repair Open or Short to ground in power circuit and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

E1F331DD

1. Check short in harness

- 1) IG "ON".
- 2) Disconnect A/C relay.
- 3) Measure the voltage between terminal 85 of A/C relay harness connector and chassis ground.

Specification : Approx. 0V

- 4) Is the measured voltage within specification ?

YES

- Go to "Component inspection" procedure.

NO

- Repair Short in Coil control harness and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

E2F87DF4

1. Check A/C relay

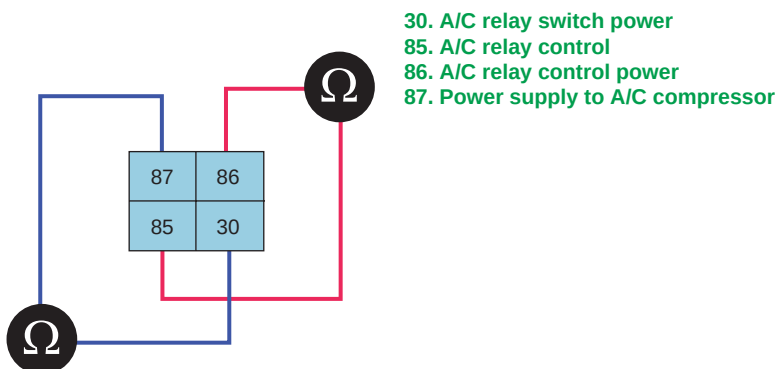
- 1) IG "OFF".
- 2) Disconnect A/C relay.
- 3) Measure the resistance between terminal 85 and 86 of A/C relay.
- 4) Measure the resistance between terminal 30 and 87 of A/C relay.

DTC TROUBLESHOOTING PROCEDURES

FLA -547

SPECIFICATION

Terminal	Power approval
30~87	NO
85~86	YES (APPROX. $70\Omega \sim 120\Omega$)



SVQF16936L

5) Is the measured resistance within specification ?

YES

► Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

► Substitute with a known - good A/C relay and check for proper operation. If the problem is corrected, replace A/C relay and go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

E1B4FDE5

Refer to DTC P0646.

DTC P0650 MALFUNCTION INDICATOR LAMP(MIL) CONTROL CIRCUIT

GENERAL DESCRIPTION E8471A68

The Malfunction Indicator Lamp (MIL), which is located in the instrument cluster, comes on to notify the driver that there may be a problem with the vehicle and that service is needed. Immediately after the ignition switch turns on, the malfunction indicator lamp is lit to indicate that the MIL operates normally and goes off after starting.

DTC DESCRIPTION E6FE14C0

Checking input signal of engine check lamp every 10 sec. under detecting condition, if open, or short to battery or ground is detected for more than 5 sec., PCM sets P0650.

DTC DETECTING CONDITION EC425377

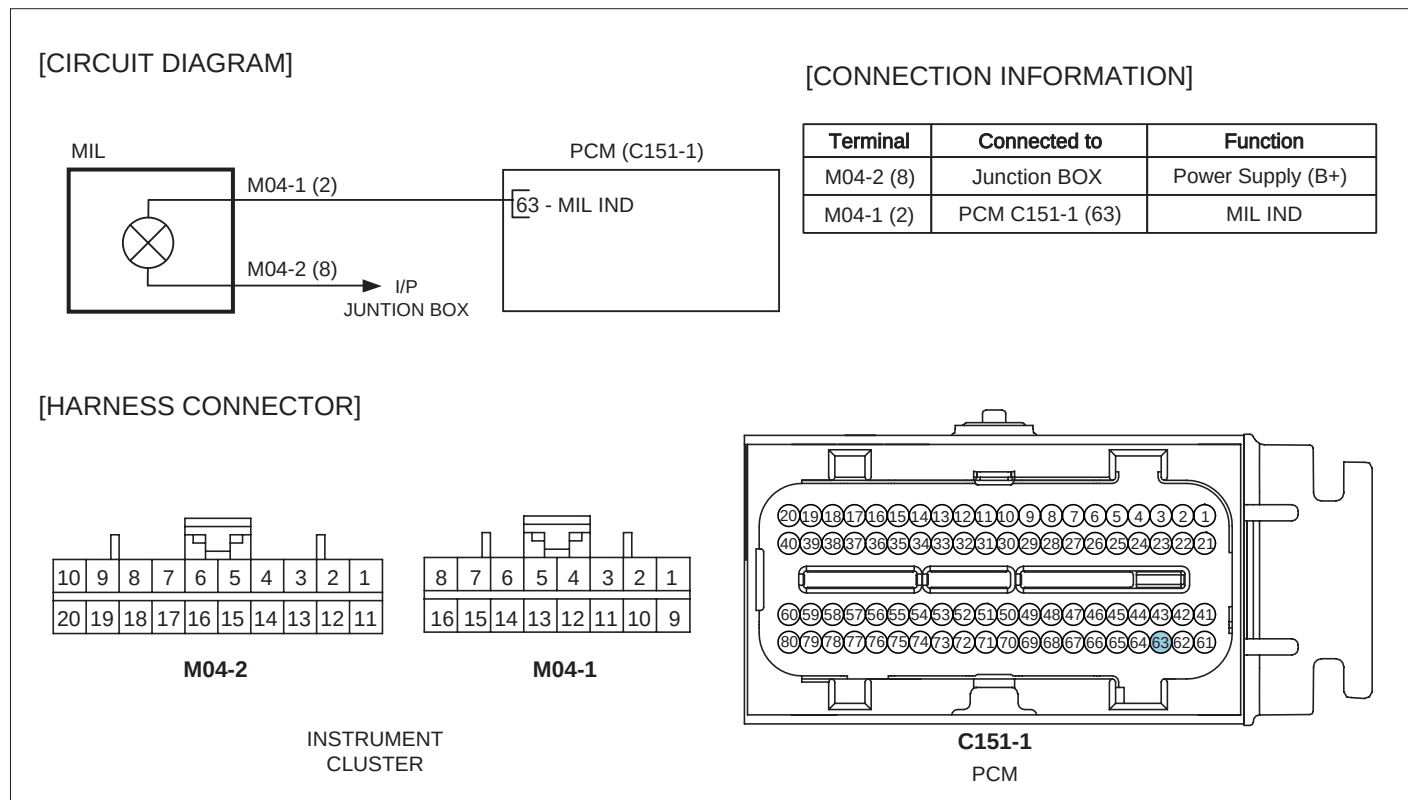
Item	Detecting Condition	Possible cause
DTC Strategy	Signal low, high	- Poor connection - Open or short in MIL circuit - Faulty MIL - Faulty PCM
Enable Conditions	- After 0.5 sec under conditions below - Engine works $11V \leq \text{Battery voltage} \leq 16V$	
Threshold value	Open or short	
Diagnosis Time	Continuous (More than 5 seconds failure for every 10 seconds test)	
MIL On Condition	DTC only (NO MIL ON)	

DTC TROUBLESHOOTING PROCEDURES

FLA -549

SCHEMATIC DIAGRAM

E50746B1



SVQF16394L

MONITOR DTC STATUS

E3BAD8B2

1. Check DTC Status

- 1) Connect scantool to Data Link Connector(DLC).
- 2) IG "ON".
- 3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F4(DTAL) to check DTC's information from the DTCs menu
- 4) Read "DTC Status" parameter.

1.1 DIAGNOSTIC TROUBLE CODES		
PXXXX DTC TITLE		
NUMBER OF DTC : 1 ITEMS		
PART	ERAS	DTAL

PXXXX TITLE	
1.MIL STATUS:	ON/OFF
2.DTC STATUS:	PRESENT/HISTORY
3.DIAG.STATUS:	DIAGNOSIS FINISHED
DTC CAUSE TO SYSTEM ERROR : PXXXX	

SCMF16159L

- 5) Is parameter displayed "Present fault"?

YES

- Go to "Terminal and connector inspection" procedure.

NO

- Fault is intermittent caused by poor contact in the sensor' s and/or PCM' s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

TERMINAL AND CONNECTOR INSPECTION E6FECEF1

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

- Repair as necessary and go to "Verification of Vehicle Repair" procedure

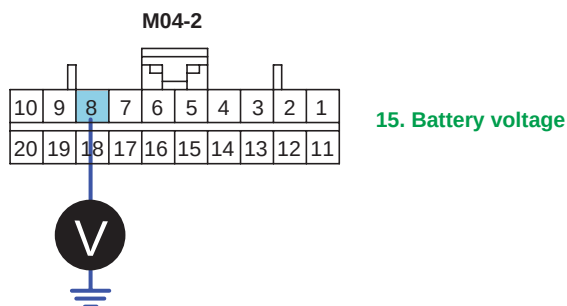
NO

- Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION E27E1DEF

1. IG "OFF" and disconnect Instrument cluster connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 8 of instrument cluster harness connector and chassis ground.

Specification : Approx. B+



SVQF16395L

4. Is the measured voltage within specification?

DTC TROUBLESHOOTING PROCEDURES

FLA -551

YES

- ▶ Go to "Control Circuit Inspection" procedure.

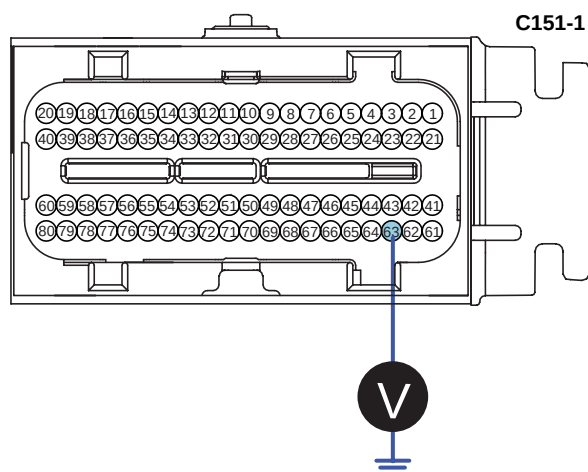
NO

- ▶ Check fuse between battery and instrument cluster for open or blown-off.
- ▶ Repair open or short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION E61B233E

1. IG "OFF" and disconnect PCM connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between 63 of PCM harness connector and chassis ground.

Specification : Approx. B+



SVQF16396L

4. Is the measured voltage within specification?

YES

- ▶ Go to "Component Inspection" procedure.

NO

- ▶ Check open in Engine warning lamp's filament.
- ▶ Repair open or short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E94A91A9

1. Check instrument cluster
 - 1) IG "OFF"
 - 2) Substitute with a known - good instrument cluster and check for proper operation.
 - 3) Does it normally operate after replacement?

YES

- ▶ Replace instrument cluster and go to "Verification of Vehicle Repair" procedure.

NO

- ▶ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

E19DDF35

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

- ▶ System performing to specification at this time. Clear the DTC.

NO

- ▶ Go to the applicable troubleshooting procedure.

DTC P0651 SENSOR REFERENCE VOLTAGE "B" CIRCUIT OPEN

GENERAL DESCRIPTION E90B3CC0

The ECM provides a 5volt reference voltage to Throttle Position Sensor 2(TPS2). The ECM monitors reference voltage deviation from the power supply circuit of the sensors.

DTC DESCRIPTION E5E773D1

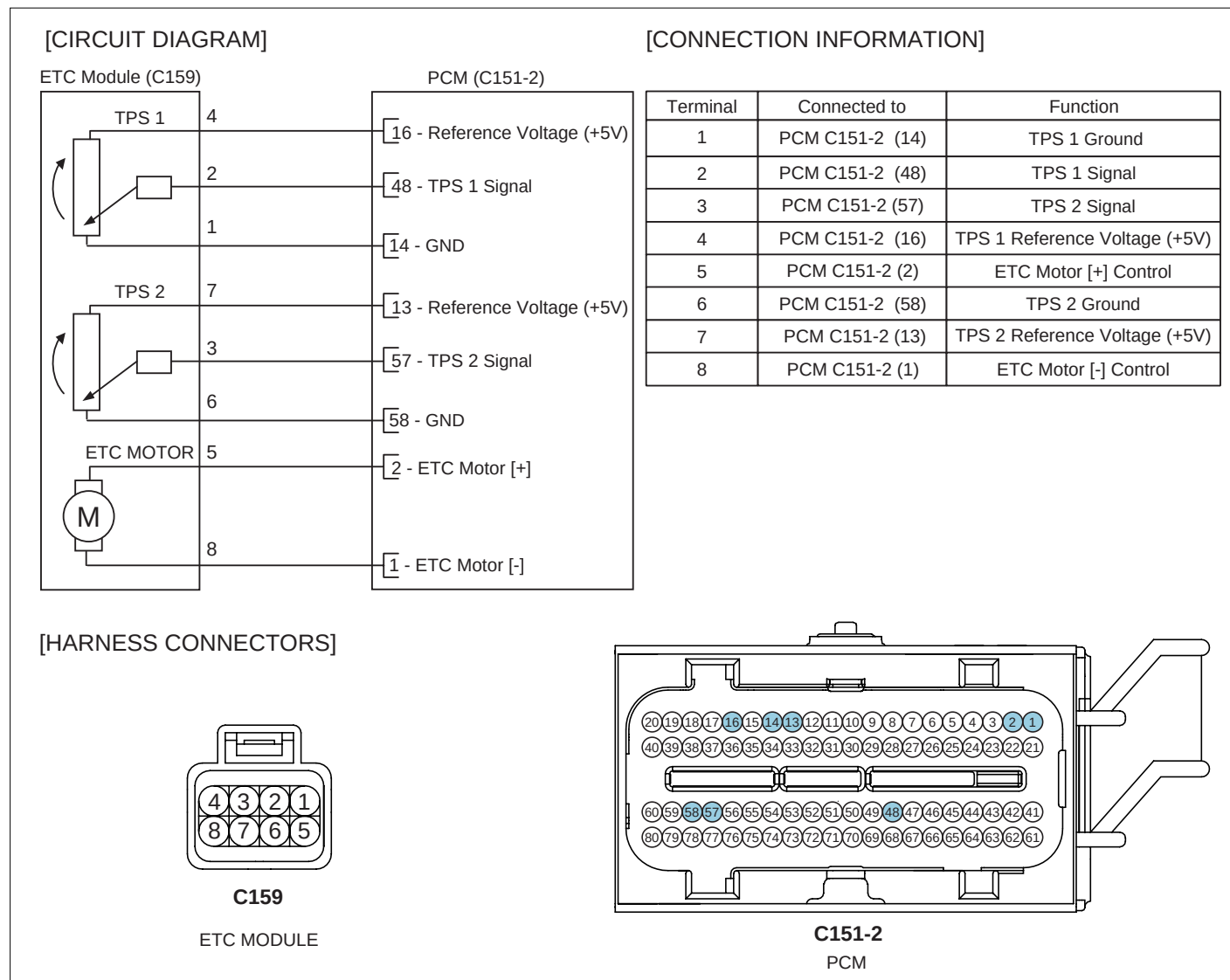
Checking the voltage from sensor power supply every 1.87 sec. under detecting condition, if the value within detecting condition lasts for more than 0.2 sec., PCM sets P0651. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E2B19B8E

Item	Detecting Condition	Possible Cause
DTC Strategy	• Sensor reference voltage check	• Short in sensor power supply line • Faulty PCM
Enable Conditions	• IG Key "ON"	
Threshold value	• Sensor supply power < 4.5V or > 5.5V	
Diagnosis time	• Continuous (More than 0.2 seconds failure for every 1.87 seconds test)	
MIL ON condition	• 2 driving cycles	

SCHEMATIC DIAGRAM

EDC1C559



SVQF16101L

MONITOR DTC STATUS

E62A3E7B

1. Check DTC Status

- 1) Connect scantool to Data Link Connector(DLC).
- 2) IG "ON".
- 3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F4(DTAL) to check DTC's information from the DTCs menu
- 4) Read "DTC Status" parameter.

1.1 DIAGNOSTIC TROUBLE CODES			
PXXXX DTC TITLE			
NUMBER OF DTC : 1 ITEMS			
PART	ERAS	DTAL	

PXXXX TITLE	
1.MIL STATUS:	ON/OFF
2.DTC STATUS:	PRESENT/HISTORY
3.DIAG.STATUS:	DIAGNOSIS FINISHED
DTC CAUSE TO SYSTEM ERROR : PXXXX	

SCMF16159L

5) Is parameter displayed "Present fault"?

YES

► Go to "Terminal and connector inspection" procedure.

NO

► Fault is intermittent caused by poor contact in the sensor' s and/or PCM' s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

TERMINAL AND CONNECTOR INSPECTION

ECD1D181

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

► Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

► Go to "Power Circuit Inspection" procedure.

POWER CIRCUIT INSPECTION

E00FDD8B

1. Check voltage
 - 1) IG "OFF".
 - 2) Disconnect TPS connector.
 - 3) IG "ON" and ENG "OFF"

- 4) Measure the voltage between terminal 7 of TPS harness connector and chassis ground.

Specification : Approx. 5V

- 5) Is the measured voltage within specification ?

YES

▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Check short in harness" as follows.

2. Check short in harness

- 1) IG "OFF".
- 2) Disconnect TPS connector and PCM connector.
- 3) Measure the resistance between terminal 7 and 5 of TPS harness connector.
- 4) Measure the resistance between terminal 7 and 8 of TPS harness connector.
- 5) Measure the resistance between terminal 7 and 6 of TPS harness connector.
- 6) Measure the resistance between terminal 7 and 1 of TPS harness connector.

Specification : Infinite

- 7) Is the measured resistance within specification ?

YES

▶ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▶ Repair Short in power harness and go to "Verification of Vehicle Repair" procedure.

※ Procedure of ETS Initialization

1. Erase the trouble codes on PCM
2. Turn the ignition key off and keep this condition until the main relay is turned off.(It will takes 10 second)
3. Turn ignition key on more than 1second to record the throttle motor position on the EEPROM

VERIFICATION OF VEHICLE REPAIR

E81DCD4F

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.

DTC TROUBLESHOOTING PROCEDURES

FLA -557

4. Is parameter displayed "History(Not Present) fault"?

YES

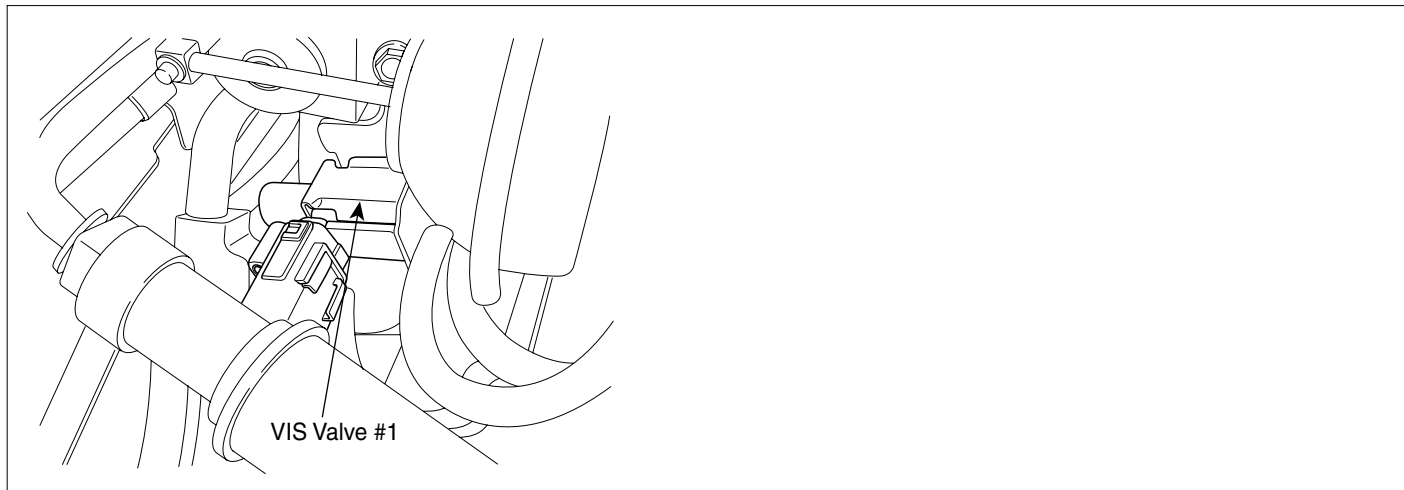
- ▶ System performing to specification at this time. Clear the DTC.

NO

- ▶ Go to the applicable troubleshooting procedure.

DTC P0660 INTAKE MANIFOLD TUNING VALVE CONTROL CIRCUIT/OPEN (BANK 1)

COMPONENT LOCATION ED18CA5D



LGLG522A

GENERAL DESCRIPTION E049CBFC

VIS(Variable intake system) is a device which varies the length of intake manifold to generate maximum power at certain RPM. VIS lengthens intake manifold to improve the torque at low RPM when vehicle speed is low while it shortens intake manifold to raise torque at high RPM when vehicle speed is high. PCM controls VIS using RPM signal.

DTC DESCRIPTION E8779C5F

Checking the output voltage from VIS #1 every 10 sec. under detecting condition, if the value within detecting condition lasts for more than 5 sec., PCM sets P0660. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E2A153B1

Item	Detecting Condition	Possible Cause
DTC Strategy	Signal low, high	- Poor connection - Open or short in VIS #1 circuit - Faulty VIS #1 - Faulty PCM
Enable condition	- After 0.5 sec under conditions below - Engine works $11V \leq \text{Battery voltage} \leq 16V$	
Threshold value	Open or short	
Diagnosis time	Continuous (More than 5 seconds failure for every 10 seconds test)	
MIL ON condition	2 driving cycles	

SPECIFICATION E73DA467

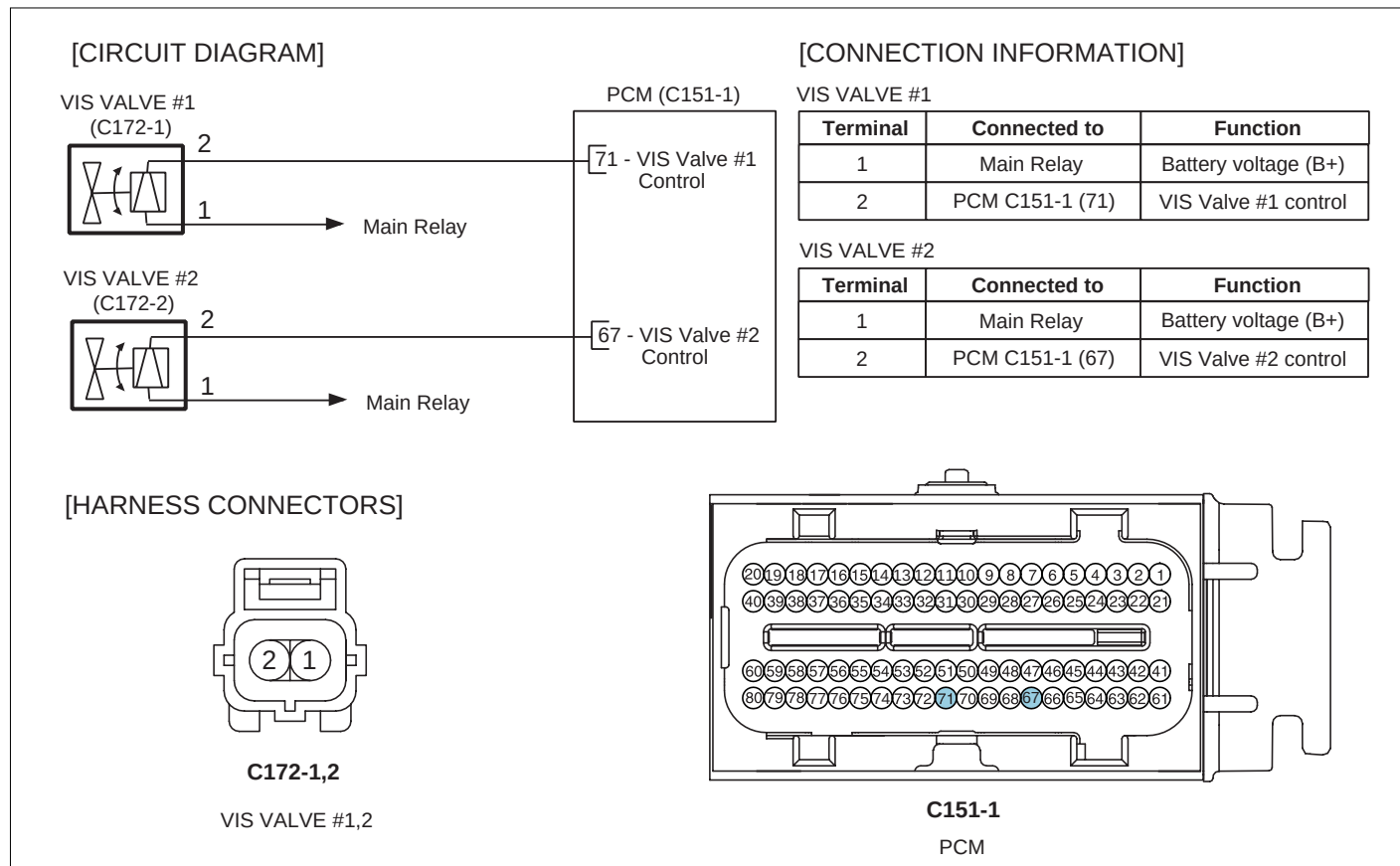
Item	Specification
Coil resistance	29 ~ 35 Ω at 22°C (71.6°F)

DTC TROUBLESHOOTING PROCEDURES

FLA -559

SCHEMATIC DIAGRAM

E219059A



SVQF16121L

MONITOR DTC STATUS

ED4CF13B

1. Check DTC Status

- 1) Connect scantool to Data Link Connector(DLC).
- 2) IG "ON".
- 3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F4(DTAL) to check DTC's information from the DTCs menu
- 4) Read "DTC Status" parameter.

1.1 DIAGNOSTIC TROUBLE CODES			
PXXXX DTC TITLE			
NUMBER OF DTC : 1 ITEMS			
PART	ERAS	DTAL	

PXXXX TITLE	
1.MIL STATUS:	ON/OFF
2.DTC STATUS:	PRESENT/HISTORY
3.DIAG.STATUS:	DIAGNOSIS FINISHED
DTC CAUSE TO SYSTEM ERROR : PXXXX	

SCMF16159L

5) Is parameter displayed "Present fault"?

YES

► Go to "Terminal and connector inspection" procedure.

NO

► Fault is intermittent caused by poor contact in the sensor' s and/or PCM' s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

TERMINAL AND CONNECTOR INSPECTION ED053940

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

► Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

► Go to "Power Circuit Inspection" procedure.

POWER CIRCUIT INSPECTION EDD22D0E

1. IG "OFF" and disconnect VIS #1 connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 1 of VIS #1 harness connector and chassis ground.

DTC TROUBLESHOOTING PROCEDURES

FLA -561

Specification : Approx. B+

4. Is the measured voltage within specification?

YES

- ▶ Go to "Control Circuit Inspection" procedure.

NO

- ▶ Check fuse connected to power of VIS #1 for open or blown-off.
▶ Repair open or short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION E742D31F

1. Check voltage

- 1) IG "OFF" and disconnect VIS #1 connector.
- 2) IG "ON" and ENG "OFF"
- 3) Measure voltage between terminal 2 of VIS #1 harness connector and chassis ground.

Specification : Approx. 2.5V

- 4) Is the measured voltage within specification?

YES

- ▶ Go to "Component Inspection" procedure.

NO

- ▶ Go to "Check short in harness" as follows.

2. Check short in harness

- 1) IG "OFF" and disconnect VIS #1 connector and PCM connector.
- 2) Measure resistance between terminal 2 of VIS #1 harness connector and chassis ground.
- 3) Measure resistance between terminals 1 and 2 of VIS #1 harness connector.

Specification : Infinite

- 4) Is the measured resistance within specification?

YES

- ▶ Go to "Check open in harness" as follows.

NO

- ▶ Repair short in harness, and go to "Verification of Vehicle Repair" procedure.

3. Check open in harness

FLA -562

FUEL SYSTEM

- 1) IG "OFF" and disconnect VIS #1 connector and PCM connector.
- 2) Measure resistance between terminal 2 of VIS #1 harness connector and terminal 71 of PCM harness connector.

Specification : Below 1Ω

- 3) Is the measured resistance within specification?

YES

► Go to "Component Inspection" procedure.

NO

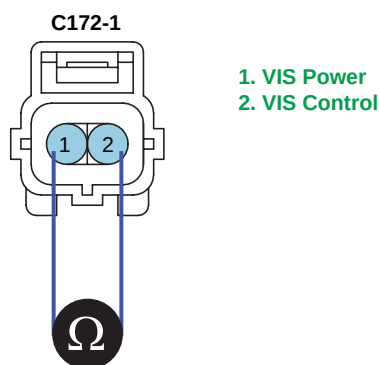
► Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E902D8C9

1. Check VIS #1

- 1) IG "OFF" and disconnect VIS #1 connector.
- 2) Measure resistance between terminals 1 and 2 of VIS #1 connector.(Component side)

Specification : $29 \sim 35 \Omega$ ($22^{\circ}\text{C}/71.6^{\circ}\text{F}$)



SVQF16403L

- 3) Is the measured resistance within specification?

YES

► Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

► Substitute with a known - good VIS #1 and check for proper operation. If the problem is corrected, replace VIS #1 and go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

E0A64B5A

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

- ▶ System performing to specification at this time. Clear the DTC.

NO

- ▶ Go to the applicable troubleshooting procedure.

DTC P0663 INTAKE MANIFOLD TUNING VALVE CONTROL CIRCUIT/OPEN (BANK 2)

COMPONENT LOCATION EFCAD4B7



LGLG523A

GENERAL DESCRIPTION ECB5E846

VIS(Variable intake system) is a device which varies the length of intake manifold to generate maximum power at certain RPM. VIS lengthens intake manifold to improve the torque at low RPM when vehicle speed is low while it shortens intake manifold to raise torque at high RPM when vehicle speed is high. PCM controls VIS using RPM signal.

DTC DESCRIPTION E3722C51

Checking the output voltage from VIS #2 every 10 sec. under detecting condition, if the value within detecting condition lasts for more than 5 sec., PCM sets P0663. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E9057D69

Item	Detecting Condition	Possible Cause
DTC Strategy	Signal low, high	- Poor connection - Open or short in VIS #2 circuit - Faulty VIS #2 - Faulty PCM
Enable condition	- After 0.5 sec under conditions below - Engine works $11V \leq \text{Battery voltage} \leq 16V$	
Threshold value	Open or short	
Diagnosis time	Continuous (More than 5 seconds failure for every 10 seconds test)	
MIL ON condition	2 driving cycles	

SPECIFICATION E8B478B3

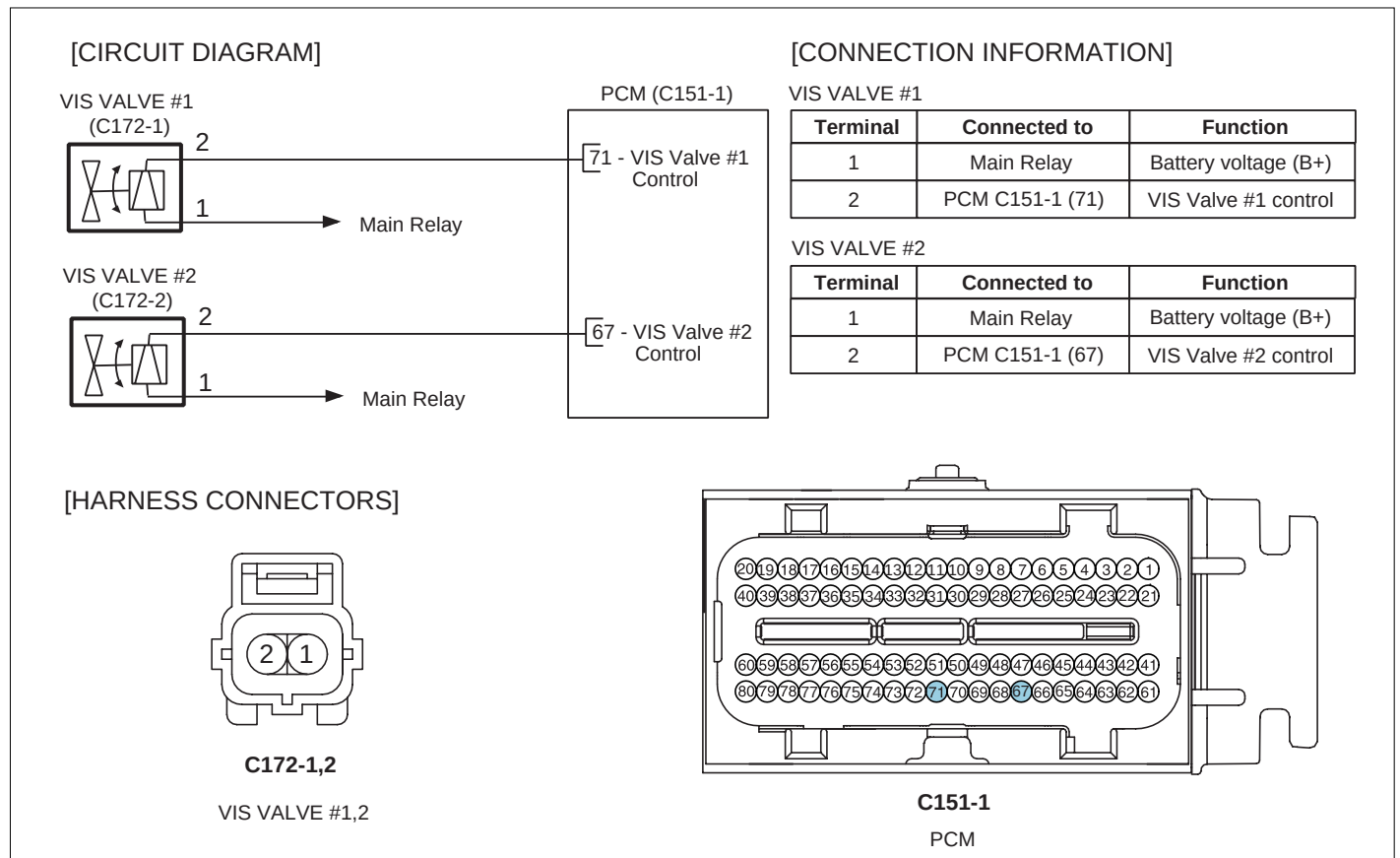
Item	Specification
Coil resistance	29 ~ 35 Ω at 22°C (71.6°F)

DTC TROUBLESHOOTING PROCEDURES

FLA -565

SCHEMATIC DIAGRAM

E2689279



SVQF16121L

MONITOR DTC STATUS

E46376D8

1. Check DTC Status

- 1) Connect scantool to Data Link Connector(DLC).
- 2) IG "ON".
- 3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F4(DTAL) to check DTC's information from the DTCs menu
- 4) Read "DTC Status" parameter.

1.1 DIAGNOSTIC TROUBLE CODES			
PXXXX DTC TITLE			
NUMBER OF DTC : 1 ITEMS			
PART	ERAS	DTAL	

PXXXX TITLE	
1.MIL STATUS:	ON/OFF
2.DTC STATUS:	PRESENT/HISTORY
3.DIAG.STATUS:	DIAGNOSIS FINISHED
DTC CAUSE TO SYSTEM ERROR : PXXXX	

SCMF16159L

5) Is parameter displayed "Present fault"?

YES

► Go to "Terminal and connector inspection" procedure.

NO

► Fault is intermittent caused by poor contact in the sensor' s and/or PCM' s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

TERMINAL AND CONNECTOR INSPECTION E25928CF

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

► Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

► Go to "Power Circuit Inspection" procedure.

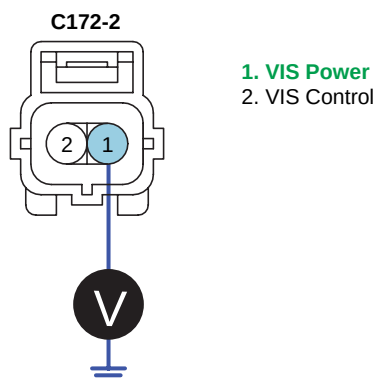
POWER CIRCUIT INSPECTION EE80590E

1. IG "OFF" and disconnect VIS #2 connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 1 of VIS #2 harness connector and chassis ground.

DTC TROUBLESHOOTING PROCEDURES

FLA -567

Specification : Approx. B+



SVQF16404L

4. Is the measured voltage within specification?

YES

► Go to "Control Circuit Inspection" procedure.

NO

- Check fuse connected to power of VIS #2 for open or blown-off.
- Repair open or short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION E0E6175D

1. Check voltage

- 1) IG "OFF" and disconnect VIS #2 connector.
- 2) IG "ON" and ENG "OFF"
- 3) Measure voltage between terminal 2 of VIS #2 harness connector and chassis ground.

Specification : Approx. 2.5V

4) Is the measured voltage within specification?

YES

► Go to "Component Inspection" procedure.

NO

► Go to "Check short in harness" as follows.

2. Check short in harness

- 1) IG "OFF" and disconnect VIS #2 connector and PCM connector.
- 2) Measure resistance between terminal 2 of VIS #2 harness connector and chassis ground.
- 3) Measure resistance between terminals 1 and 2 of VIS #2 harness connector.

FLA -568

FUEL SYSTEM

Specification : Infinite

- 4) Is the measured resistance within specification?

YES

► Go to "Check open in harness" as follows.

NO

► Repair short in harness, and go to "Verification of Vehicle Repair" procedure.

3. Check open in harness

- 1) IG "OFF" and disconnect VIS #2 connector and PCM connector.
- 2) Measure resistance between terminal 2 of VIS #2 harness connector and terminal 67 of PCM harness connector.

Specification : Below 1Ω

- 3) Is the measured resistance within specification?

YES

► Go to "Component Inspection" procedure.

NO

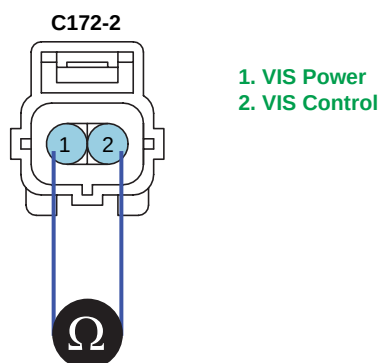
► Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EBB1C557

1. Check VIS #2

- 1) IG "OFF" and disconnect VIS #2 connector.
- 2) Measure resistance between terminals 1 and 2 of VIS #2 connector.(Component side)

Specification : 29 ~ 35 Ω (22℃/71.6°F)



DTC TROUBLESHOOTING PROCEDURES

FLA -569

- 3) Is the measured resistance within specification?

YES

► Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

► Substitute with a known - good VIS #2 and check for proper operation. If the problem is corrected, replace VIS #2 and go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

E121C656

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

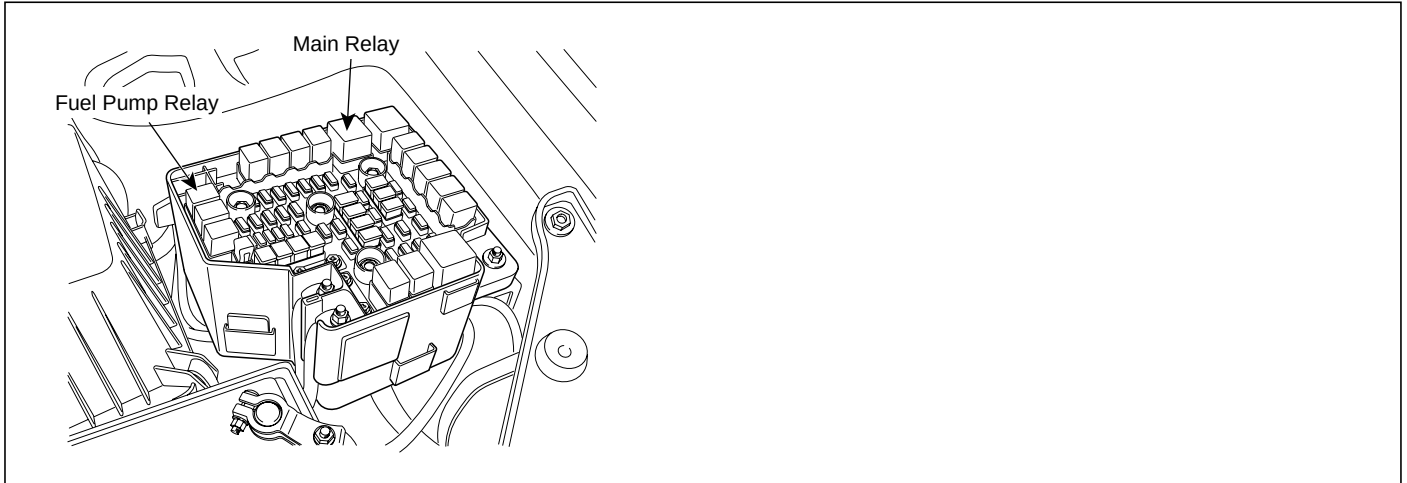
► System performing to specification at this time. Clear the DTC.

NO

► Go to the applicable troubleshooting procedure.

DTC P0685 ECM/PCM POWER RELAY CONTROL CIRCUIT /OPEN

COMPONENT LOCATION E032C31A



SCMF16254L

GENERAL DESCRIPTION E8B88C29

The ECM provides ground to one side of the coil of the main relay and the other side is connected to the battery. The ECM monitors battery voltage and the voltage after the main relay.

DTC DESCRIPTION E931EEBC

Checking the controlling state of main relay every 10 sec. under detecting condition, if open or short in the circuit is detected for more than 5 sec., PCM sets P0685.

DTC DETECTING CONDITION ED8CA705

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects a short to ground, to battery or open circuit on the main relay	• Poor Connection • Open or short in control circuit • Faulty Main Relay • Faulty PCM
EnableConditions	• Engine Running • $11V \leq \text{Ignition Voltage} \leq 16V$	
Threshold value	• Open or Short in circuit	
DiagnosisTime	• Continuous (More than 5sec. failure for every 10 sec. test)	
MIL On Condition	• DTC only (NO MIL ON)	

SPECIFICATION E9BBD35F

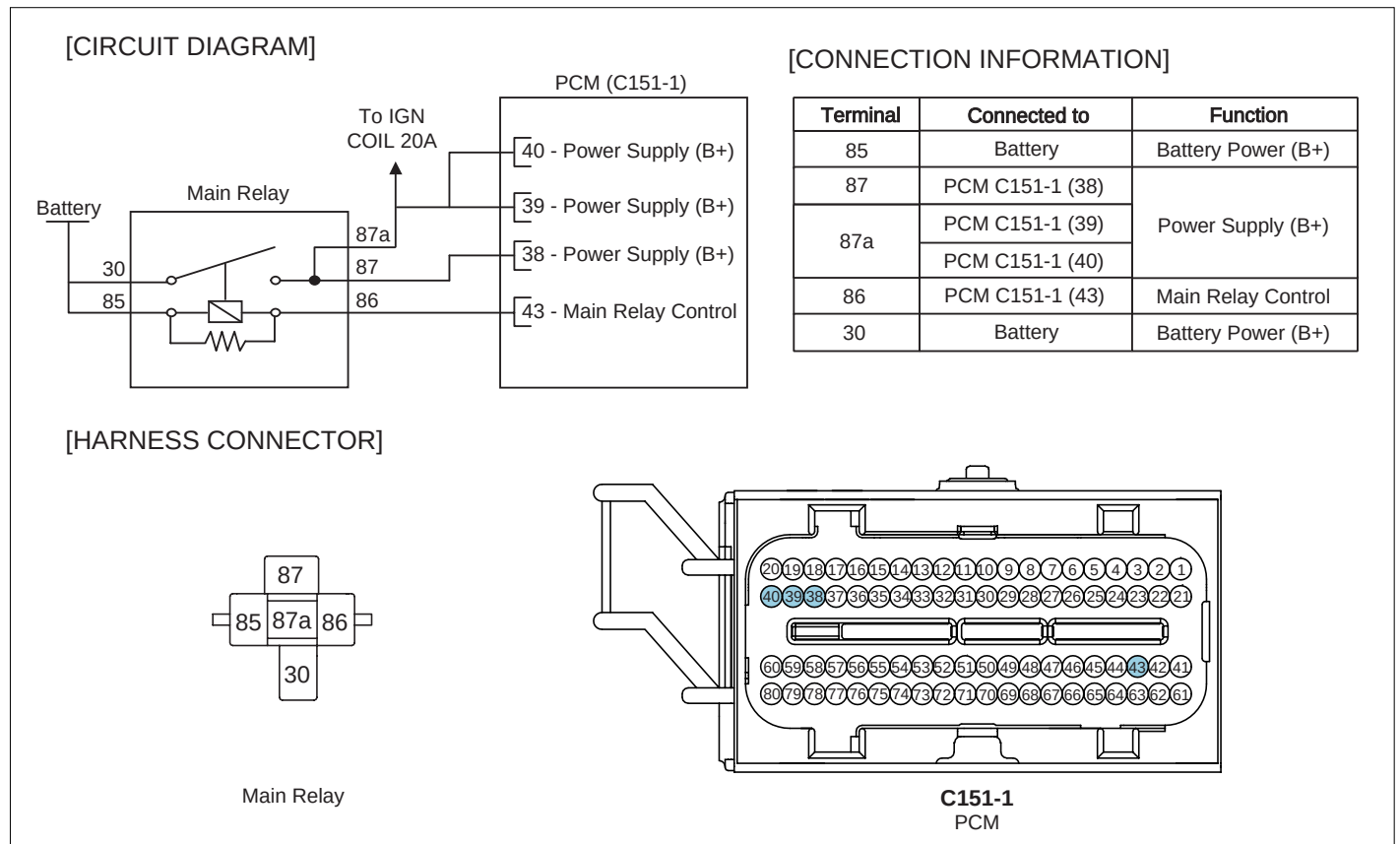
Coil Resistance
$70\Omega \sim 120\Omega$

DTC TROUBLESHOOTING PROCEDURES

FLA -571

SCHEMATIC DIAGRAM

EDE659D9



SVQF16377L

MONITOR DTC STATUS

EFABA80E

1. Check DTC Status

- 1) Connect scantool to Data Link Connector(DLC).
- 2) IG "ON".
- 3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F4(DTAL) to check DTC's information from the DTCs menu
- 4) Read "DTC Status" parameter.

1.1 DIAGNOSTIC TROUBLE CODES			
PXXXX DTC TITLE			
NUMBER OF DTC : 1 ITEMS			
PART	ERAS	DTAL	

PXXXX TITLE	
1.MIL STATUS:	ON/OFF
2.DTC STATUS:	PRESENT/HISTORY
3.DIAG.STATUS:	DIAGNOSIS FINISHED
DTC CAUSE TO SYSTEM ERROR : PXXXX	

SCMF16159L

5) Is parameter displayed "Present fault"?

YES

► Go to "Terminal and connector inspection" procedure.

NO

► Fault is intermittent caused by poor contact in the sensor' s and/or PCM' s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

TERMINAL AND CONNECTOR INSPECTION

E746E19E

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

► Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

► Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSEPCTION

EDD8F603

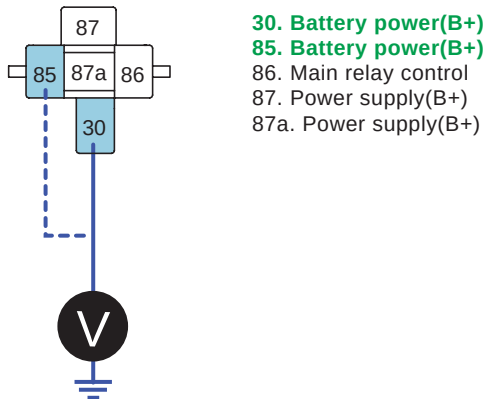
1. IG "OFF"
2. Disconnect Main Relay
3. IG "ON" & ENG "OFF".
4. Measure the voltage between terminal 30 of main relay harness connector and chassis ground.

DTC TROUBLESHOOTING PROCEDURES

FLA -573

5. Measure the voltage between terminal 85 of main relay harness connector and chassis ground.

Specification : B+



SVQF16905L

6. Is the measured voltage within specification ?

YES

- Go to "Control Circuit Inspection" procedure.

NO

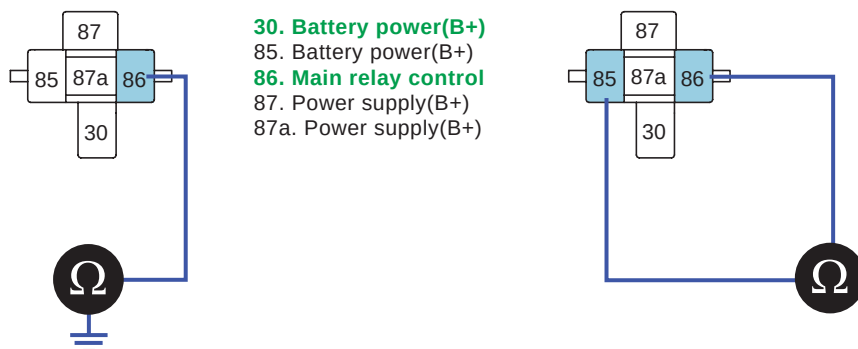
- Check fuse between battery and main relay is disconnected.
► Repair or replace open or short in harness and then go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION

EFF0D404

1. Check short in harness
 - 1) IG "OFF".
 - 2) Disconnect Main Relay and PCM connector.
 - 3) Measure resistance between terminal 86 of Main Relay and chassis ground.
 - 4) Measure resistance between terminals 86 and 85 of Main Relay.

Specification : Infinite



SVQF16988L

5) Is the measured resistance within specification ?

YES

► Go to "Check open in coil control" as follows.

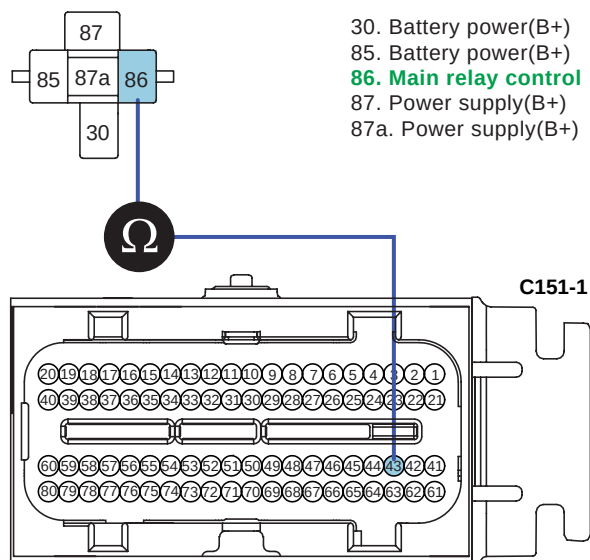
NO

► Repair or replace as necessary and then go to " Verification of Vehicle Repair" procedure.

2. Check open in harness

- 1) IG "OFF".
- 2) Disconnect Main Relay and PCM connector.
- 3) Measure resistance between harness terminal 86 of Main Relay and harness terminal 43 of PCM harness connector.

Specification : Approx. below 1Ω



SVQF16409L

DTC TROUBLESHOOTING PROCEDURES

FLA -575

- 4) Is the measured resistance within specifications ?

YES

► Go to "Component Inspection" procedure.

NO

► Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

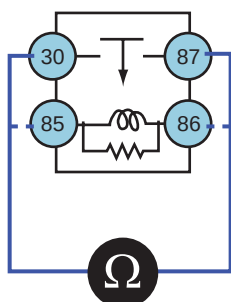
E3822814

1. Check Main Relay

- 1) IG "OFF".
- 2) Disconnect the main relay.
- 3) Measure the resistance between terminal 30 and 87 of main relay.
- 4) Measure the resistance between terminal 85 and 86 of main relay.

SPECIFICATION :

Terminal	continuity
30~87	NO
85~86	YES (Approx. $70\Omega \sim 120\Omega$)



SVQF16957L

- 5) Is the measured resistance within specification ?

YES

► Substitute with a known - good PCM and check for proper operation.
If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.

NO

- ▶ Substitute with a known - good Main Relay and check for proper operation.
If the problem is corrected, replace Main Relay and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EDA192E3

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

- ▶ System performing to specification at this time. Clear the DTC.

NO

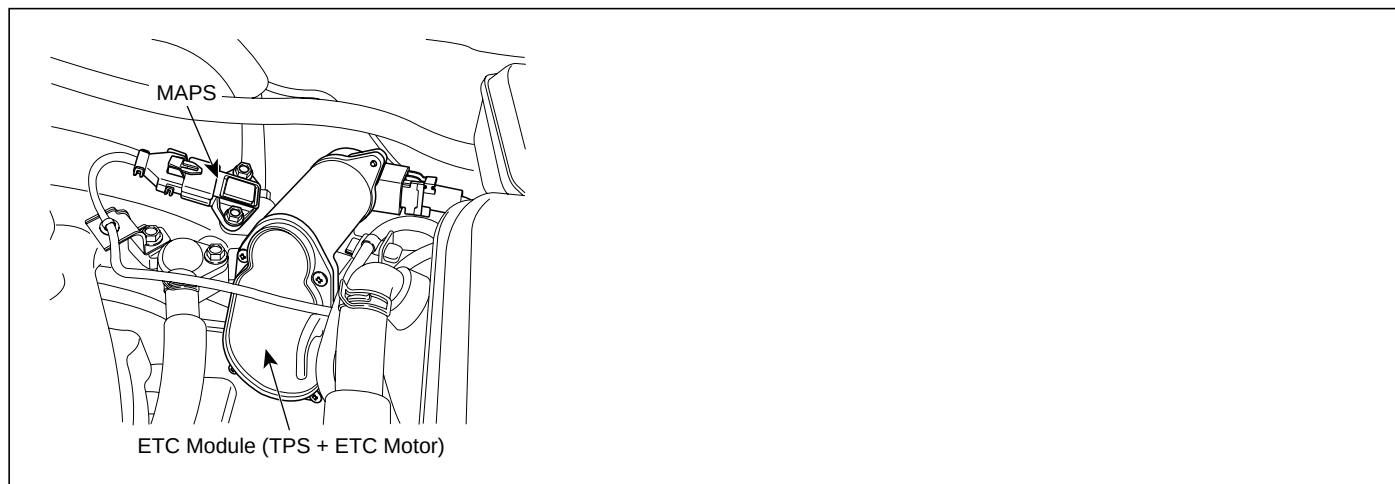
- ▶ Go to the applicable troubleshooting procedure.

DTC TROUBLESHOOTING PROCEDURES

FLA -577

DTC P1106 MANIFOLD ABSOLUTE PRESSURE SENSOR CIRCUIT SHORT - INTERMITTENT HIGH INPUT

COMPONENT LOCATION EA2D644F



SCMF16192L

GENERAL DESCRIPTION E944F092

The amount of intake air flow must be inputted to PCM in order to determine the fuel injection quantity. MAPS(Manifold Absolute Pressure) calculates the amount of air indirectly as measuring the pressure inside of intake manifold. This mechanism is also called Speed-Density Type.

MAPS transfers analog output signal which is proportional to the change of intake manifold pressure, then, with this signal and RPM, PCM calculates the amount of intake air flow.

MAPS is mounted on surge tank to measure the pressure inside of intake manifold, and it consists of a piezo electric element and hybrid IC which amplifies output signal from the element. A piezo electric element is a sort of a diaphragm using piezo electric effect. One side of the diaphragm is surrounded with vacuum chamber while intake pressure is applied to the other side. Thus, signals are outputted by the transformation of diaphragm according to the change of pressure inside of intake manifold.

DTC DESCRIPTION EDFAE6EB

Checking output signals of MAPS under detecting condition, if an output signal is intermittently above 4.5V ., PCM sets P1106.

FLA -578

FUEL SYSTEM

DTC DETECTING CONDITION

E75C117E

Item		Detecting Condition	Possible Cause
DTC Strategy		Monitor the signal of MAP sensor	- Poor Connecting - Short to battery in signal circuit - Open in ground circuit - Faulty MAPS - Faulty PCM
Enable Conditions	Case 1	- No TPS Active Fault Present - Engine Running Time > 10sec. - Engine Speed ≤ 2500rpm - Throttle Position ≤ 30%	
	Case 2	- No TPS Active Fault Present - Engine Running Time > 10sec. - Engine Speed > 2500rpm - Throttle Position ≤ 40%	
Threshold value		Intermittently MAP Signal > 4.5V	
Diagnosis Time		Continuous	
MIL On Condition		DTC only (NO MIL ON)	

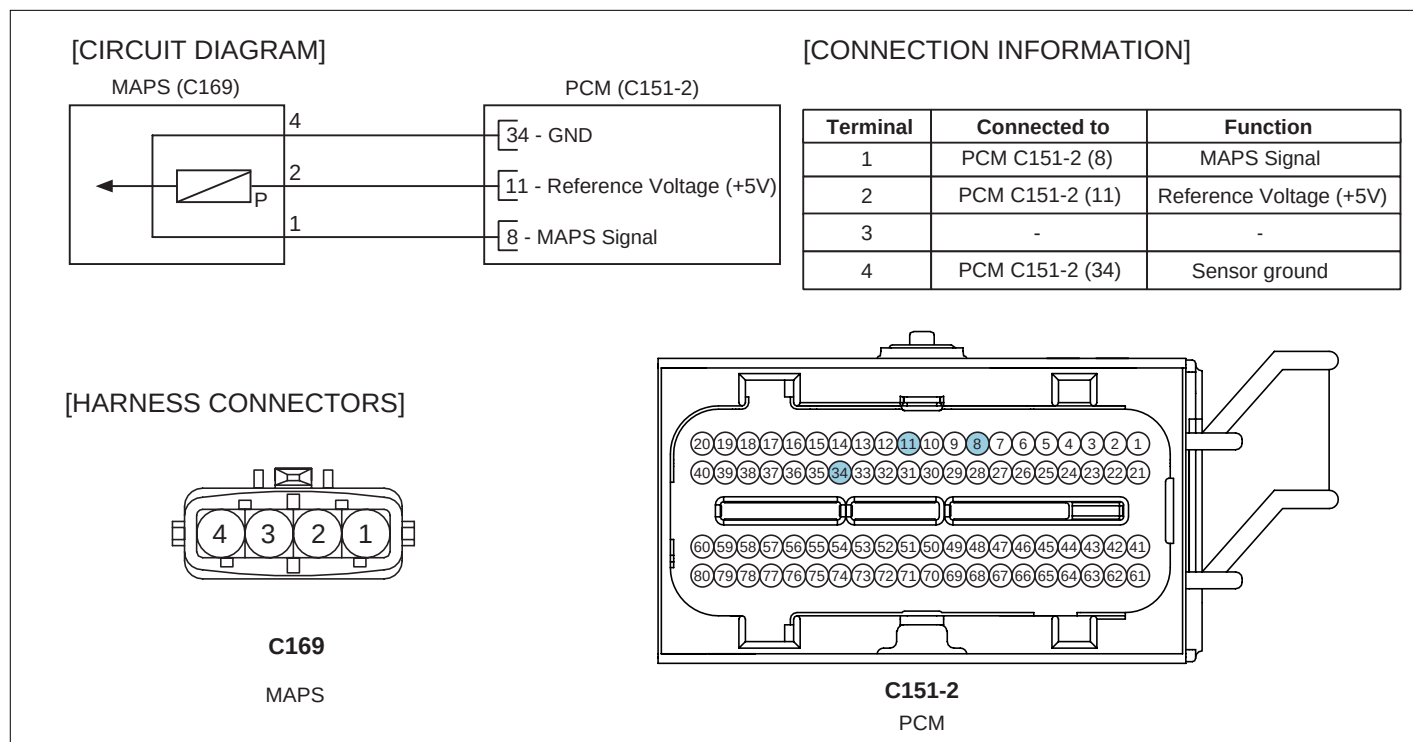
SPECIFICATION

E4530A26

Pressure(kPa)	20	35	60	95	101.32
Voltage(V)	0.789	1.382	2.369	3.75	4
Allowable error(V)	± 0.045				

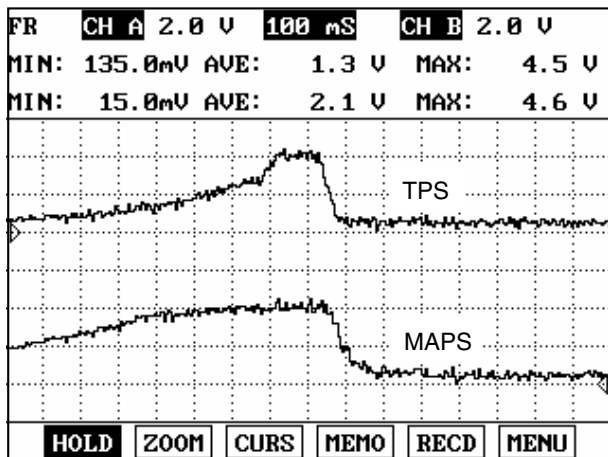
SCHEMATIC DIAGRAM

E75BE5E6



SVQF16105L

SIGNAL WAVEFORM AND DATA ED735DEE



EGRF603X

omparing MAPS and TPS, signals of MAPS and TPS increases and decrease simultaneously.

MONITOR DTC STATUS E9765A45

1. Check DTC Status
 - 1) Connect scantool to Data Link Connector(DLC).
 - 2) IG "ON".
 - 3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F4(DTAL) to check DTC's information from the DTCs menu
 - 4) Read "DTC Status" parameter.

1.1 DIAGNOSTIC TROUBLE CODES	
PXXXX DTC TITLE	
NUMBER OF DTC : 1 ITEMS	
PART	ERAS DTAL

PXXXX TITLE	
1.MIL STATUS:	ON/OFF
2.DTC STATUS:	PRESENT/HISTORY
3.DIAG.STATUS:	DIAGNOSIS FINISHED
DTC CAUSE TO SYSTEM ERROR : PXXXX	

SCMF16159L

- 5) Is parameter displayed "Present fault"?

YES

- Go to "Terminal and connector inspection" procedure.

NO

► Fault is intermittent caused by poor contact in the sensor' s and/or PCM' s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

TERMINAL AND CONNECTOR INSPECTION E76D2E43

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found ?

YES

► Repair or replace if necessary and go to "Verification of Vehicle Repair" procedure

NO

► Go to "Power Circuit Inspection" procedure.

POWER CIRCUIT INSPECTION ECD3BC60

1. IG "OFF"
2. Disconnect MAPS connector
3. IG "ON"
4. Measure the voltage between terminal 2 of MAPS harness connector and ground.

Specification : Approx. 5V

5. Is the measured voltage within specification ?

YES

► Go to "Ground Circuit Inspection" procedure.

NO

- If the voltage is over 5.1V, check short to battery in harness.
- Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION E0628D5D

1. IG "OFF".
2. Disconnect MAPS connector.
3. IG "ON" & ENG "OFF"
4. Measure the voltage between terminal 2 of MAPS harness connector and chassis ground.
5. Measure the voltage between terminal 2 and 4 of MAPS harness connector.

DTC TROUBLESHOOTING PROCEDURES

FLA -581

Specification : "A" - "B" = : Approx. below 200mV

6. Is the measured voltage within specification ?

YES

► Go to "Signal Circuit Inspection" procedure.

NO

► Repair contact resistance or open in harness and then go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION EF6F1F34

1. IG "OFF"

2. Disconnect MAPS and PCM connector.

3. Measure resistance between terminal 1 and 2 of MAPS harness connector.

Specification : Infinite

4. Is the measured resistance within specification ?

YES

► Go to "Component inspection" procedure.

NO

► Repair short to battery in harness and then go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E22196FB

1. MAPS performance test

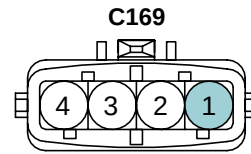
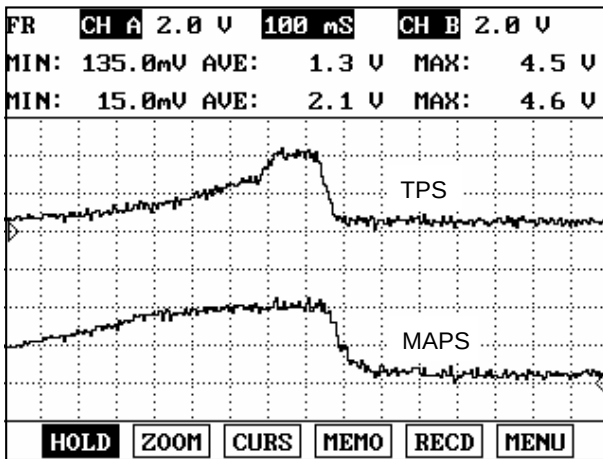
1) IG "OFF"

2) Connect scantool to Data Link Connector(DLC) and select "Oscilloscope" then, connect probes to output signal lines of MAPS and TPS.

3) Start engine and monitor the waveforms during accelerating and decelerating.

SPECIFICATION :

Pressure (kPa)	20	35	60	95	101.32
Voltage (V)	0.789	1.382	2.369	3.75	4
Tolerance (V)	± 0.045				



1. MAPS Signal
2. MAPS Power
3. -
4. MAPS Ground

SVQF16197L

4) Is the waveform displayed correctly?(Compare the response time of TPS and MAPS)

YES

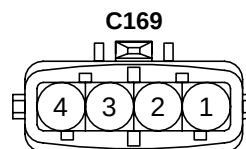
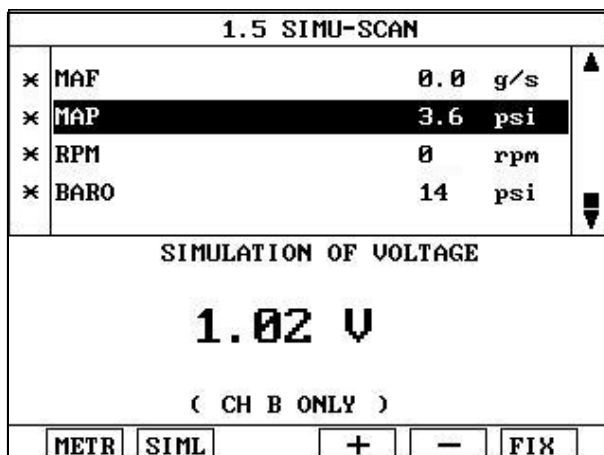
► Go to "Check PCM".

NO

► After replacing MAPS with new one, if it operates normally, replace MAPS and go to "Verification of Vehicle Repair".

2. Check PCM

- 1) IG "OFF" and disconnect MAPS connector.
- 2) Connect scantool and IG "ON" & ENG "OFF"
- 3) Select simulation function on scantool.
- 4) Simulate voltage at terminal 1 of MAPS harness connector.



1. MAPS Signal
2. MAPS Power
3. -
4. MAPS Ground

SVQF16198L

5) Does the output voltage response to the change of signal by simulation?

YES

DTC TROUBLESHOOTING PROCEDURES

FLA -583

- ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace if necessary and go to "Verification of Vehicle Repair" procedure

NO

- ▶ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

E2F62850

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

- ▶ System performing to specification at this time. Clear the DTC.

NO

- ▶ Go to the applicable troubleshooting procedure.

FLA -584

FUEL SYSTEM

DTC P1107 MANIFOLD ABSOLUTE PRESSURE SENSOR CIRCUIT SHORT - INTERMITTENT LOW INPUT

COMPONENT LOCATION E5265DAD

Refer to DTC P1106.

GENERAL DESCRIPTION E1649484

Refer to DTC P1106.

DTC DESCRIPTION EA745EA1

Checking output signals of MAPS under detecting condition, if an output signal is intermittently below 0.25V, PCM sets P1107.

DTC DETECTING CONDITION EBDC59F1

Item		Detecting Condition	Possible Cause
DTC Strategy		Monitor the signal of MAP sensor	- Poor Connecting - Open or short to ground in power circuit - Open or short to ground in signal circuit - Faulty MAPS - Faulty PCM
Enable Conditions	Case 1	- No TPS Active Fault Present - Ignition Voltage $\geq 11V$ - Engine Speed $\leq 1000rpm$ - Throttle Position $\geq 0\%$	
	Case 2	- No TPS Active Fault Present - Ignition Voltage $\geq 11V$ - Engine Speed $> 1000rpm$ - Throttle Position $\geq 30\%$	
Threshold value		Intermittently MAP Signal $< 0.25V$	
Diagnosis Time		Continuous	
MIL On Condition		DTC only (NO MIL ON)	

SPECIFICATION EB133088

Pressure(kPa)	20	35	60	95	101.32
Voltage(V)	0.789	1.382	2.369	3.75	4
Allowable error(V)	± 0.045				

SCHEMATIC DIAGRAM E4D4E2C8

Refer to DTC P1106.

SIGNAL WAVEFORM AND DATA EB5BF0EA

Refer to DTC P1106.

DTC TROUBLESHOOTING PROCEDURES

FLA -585

MONITOR DTC STATUS EE990409

Refer to DTC P1106.

TERMINAL AND CONNECTOR INSPECTION E1AD95A0

Refer to DTC P1106.

POWER CIRCUIT INSPECTION EC3C4E38

1. IG "OFF"
2. Disconnect MAPS connector.
3. IG "ON"
4. Measure the voltage between terminal 2 of MAPS harness connector and ground.

Specification : Approx. 5V

5. Is the measured voltage within specification ?

YES

- Go to "Signal Circuit Inspection" of MAPS.

NO

- After repairing open or short to ground in harness and go to "Verification of Vehicle Repair"

SIGNAL CIRCUIT INSPECTION E46CA26A

1. Check short to ground in harness
 - 1) IG "OFF"
 - 2) Disconnect MAPS and PCM connector.
 - 3) Measure the resistance between terminal 1 of MAPS harness connector and ground.

Specification : Infinite

- 4) Is the measured resistance within the specification?

YES

- Go to "Check open in the harness" of MAPS.

NO

- After repairing short to ground in circuits and go to "Verification of Vehicle Repair"

2. Check open in the harness

- 1) IG "OFF"
- 2) Disconnect MAPS and PCM connector.

- 3) Measure the resistance between terminal 1 of MAPS harness connector and terminal 8 of PCM harness connector

Specification : Approx. below 1 Ω

- 4) Is the measured resistance within the specification?

YES

► Go to "Component Inspection" of MAPS.

NO

► Repair open in the harness and go to "Verification of Vehicle Repair".

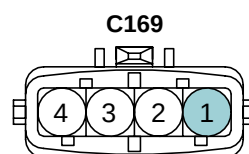
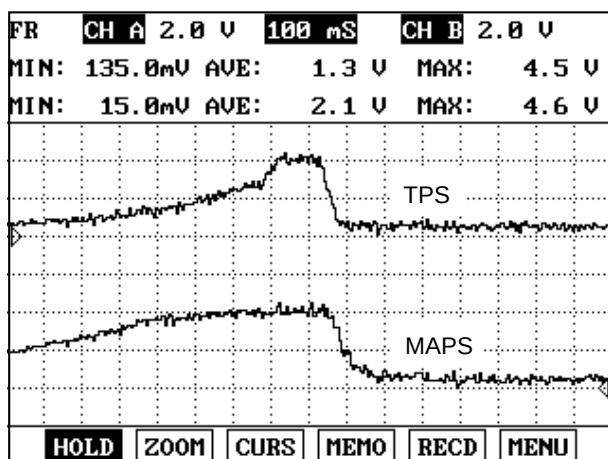
COMPONENT INSPECTION EFD44281

1. MAPS performance test

- 1) IG "OFF"
- 2) Connect scantool to Data Link Connector(DLC) and select "Oscilloscope" then, connect probes to output signal lines of MAPS and TPS.
- 3) Start engine and monitor the waveforms during accelerating and decelerating.

SPECIFICATON :

Pressure (kPa)	20	35	60	95	101.32
Voltage (V)	0.789	1.382	2.369	3.75	4
Tolerance (V)	± 0.045				



1. MAPS Signal
2. MAPS Power
3. -
4. MAPS Ground

SVQF16197L

- 4) Is the waveform displayed correctly?(Compare the response time of TPS and MAPS)

YES

► Go to "Check PCM".

NO

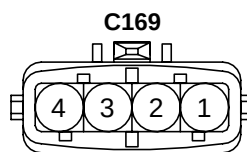
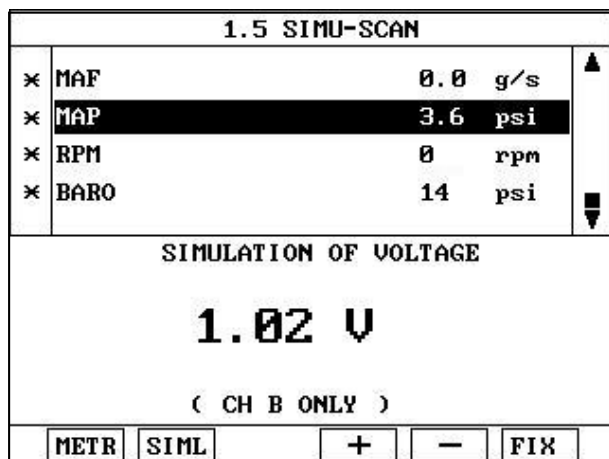
DTC TROUBLESHOOTING PROCEDURES

FLA -587

► After replacing MAPS with new one, if it operates normally, replace MAPS and go to "Verification of Vehicle Repair".

2. Check PCM

- 1) IG "OFF" disconnect MAPS connector
- 2) Connect Scantool and IG "ON" & ENG "OFF"
- 3) Select simulation function on scantool.
- 4) Simulate voltage at terminal 1 of MAPS harness connector.



1. MAPS Signal
2. MAPS Power
3. -
4. MAPS Ground

SVQF16198L

- 5) Does the output voltage response to the change of signal by simulation?

YES

► Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace if necessary and go to "Verification of Vehicle Repair" procedure

NO

► Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR

E478E394

Refer to DTC P1106.

DTC P1111 INTAKE AIR TEMPERATURE SENSOR CIRCUIT SHORT - INTERMITTENT HIGH INPUT

COMPONENT LOCATION EF01B093



SCMF16185L

GENERAL DESCRIPTION E0E1407B

The Intake Air Temperature Sensor (IATS) is installed into the Mass Air Flow Sensor (MAFS). The IATS uses a thermistor whose resistance changes with the temperature. The electrical resistance of the IATS decreases as the temperature increases, and increases as the temperature decreases. The 5 V power source in the ECM is supplied to the IATS via a resistor in the ECM. That is, the resistor in the ECM and the thermistor in the IATS are connected in series. When the resistance value of the thermistor in IATS changes according to the intake air temperature, the signal voltage also changes. Using this signal, the information of the intake air temperature, the ECM corrects basic fuel injection duration and ignition timing.

DTC DESCRIPTION E0F8336B

Checking output signals of IATS under detecting condition, if an output signal is intermittently over 4.9V, PCM sets P1111.

DTC DETECTING CONDITION E1AFC8CB

Item	Detecting Condition	Possible Cause
DTC Strategy	Monitor the signal of IAT sensor	- Poor Connection - Open or short in signal circuit - Open in ground circuit - Faulty IATS - Faulty PCM
Enable Conditions	- Engine running state - No Vehicle speed sensor fault - No ECTS fault - No MAFS fault - Intake airflow < 15 g/s - Vehicle speed < 25kph(9.3mph) - Engine coolant temperature > 50°C(122°F)	
Threshold value	Intake air temperature sensor's voltage > 4.9V	
Diagnosis Time	Continuous	
MIL On Condition	DTC only (NO MIL ON)	

DTC TROUBLESHOOTING PROCEDURES

FLA -589

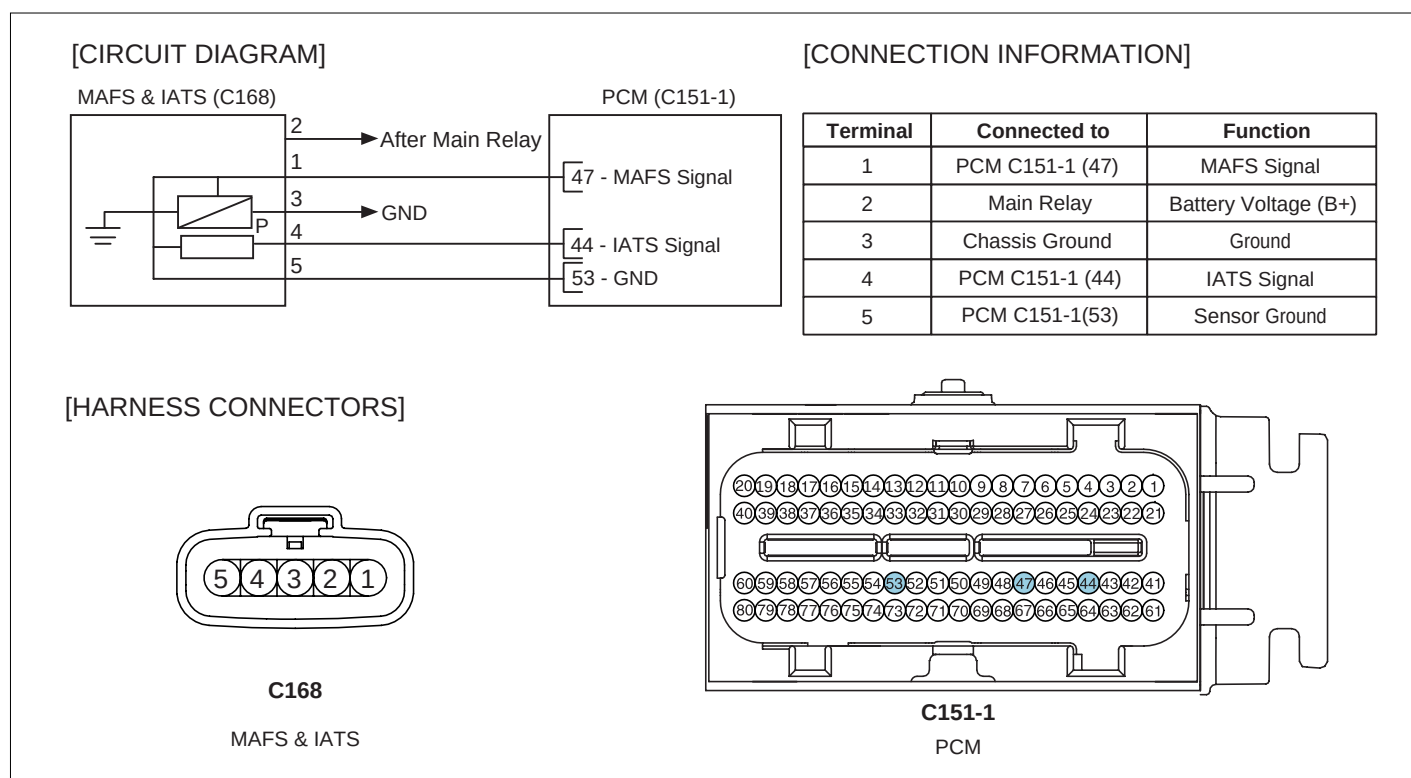
SPECIFICATION

ED73A718

Temp. (°C/°F)	Resistance (kΩ)	Temp. (°C/°F)	Resistance (kΩ)
-40(-40)	95.95 ~ 105.78	20(68)	3.42 ~ 3.61
-20(-4)	27.4 ~ 29.77	40(104)	1.43 ~ 1.5
0(32)	9.08 ~ 9.72	60(140)	0.66 ~ 0.69
10(50)	5.49 ~ 5.83	80(176)	0.33 ~ 0.34

SCHEMATIC DIAGRAM

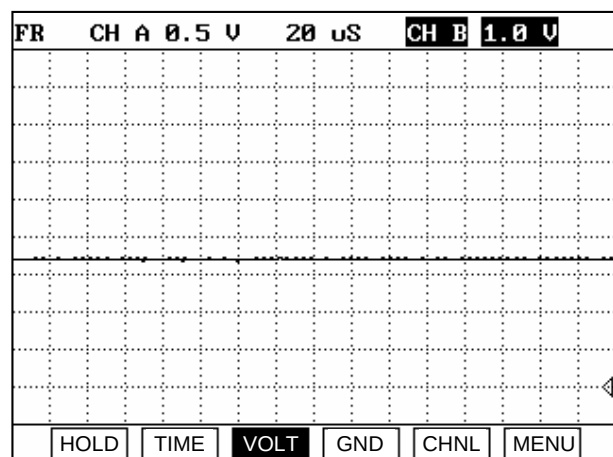
E43D15D8



SVQF16104L

SIGNAL WAVEFORM AND DATA

E1E6FAE0



EGRF604E

MONITOR DTC STATUS

1.1 DIAGNOSTIC TROUBLE CODES					
PXXXX DTC TITLE					
NUMBER OF DTC : 1 ITEMS					
PART	ERAS		DTAL		

SCME16159I

- YES**

- NO**

- ## TERMINAL AND CONNECTOR INSPECTION

- <https://autolibrary.ir>***

DTC TROUBLESHOOTING PROCEDURES

FLA -591

YES

- ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

- ▶ Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION EFB4B430

1. Check voltage

- 1) IG "OFF" and disconnect IATS connector.
- 2) IG "ON" and ENG "OFF"
- 3) Measure voltage between terminal 4 of IATS harness connector and chassis ground.

Specification : Approx. 5V

- 4) Is the measured voltage within specification ?

YES

- ▶ Go to "Ground Circuit Inspection" procedure.

NO

- ▶ If the voltage is 0V, go to "Check open in harness" as follows. If the voltage is more than 5.1V, go to "Check short to battery in harness" as follows.

2. Check short to battery in harness

- 1) IG "OFF" and disconnect IATS connector and PCM connector.
- 2) Measure resistance between terminals 2 and 4 of IATS harness connector.
- 3) Measure resistance between terminals 1 and 4 of IATS harness connector.

Specification : Infinite

- 4) Is the measured resistance within specification?

YES

- ▶ Go to "Component Inspection" procedure.

NO

- ▶ Repair short to battery in harness and go to "Verification of Vehicle Repair" procedure.

3. Check open in harness

- 1) IG "OFF" and disconnect IATS connector and PCM connector.
- 2) Measure resistance between terminal 4 of IATS harness connector and 44 of PCM harness connector.

Specification : below 1Ω

- 3) Is the measured resistance within specification?

YES

► Go to "Ground Circuit Inspection" procedure.

NO

► Repair open in harness and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION EBAC49D2

1. IG "OFF" and disconnect IATS connector.
2. Measure voltage between terminal 4 of IATS harness connector and chassis ground.
3. Measure voltage between terminals 4 and 5 of IATS harness connector.

Specification : Voltage difference between measurement "A" and "B" is below 200mV.

4. Is the measured voltage within specification ?

YES

► Go to "Component Inspection" procedure.

NO

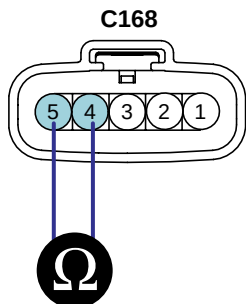
► Repair contact resistance or open in harness and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EABFAED3

1. Check IATS
 - 1) IG "OFF" and disconnect IATS connector.
 - 2) Measure resistance between terminals 4 and 5 of IATS connector.(Component side)

SPECIFICATION :

Temp. ($^{\circ}\text{C}/^{\circ}\text{F}$)	Resistance ($\text{k}\Omega$)	Temp. ($^{\circ}\text{C}/^{\circ}\text{F}$)	Resistance ($\text{k}\Omega$)
-40(-40)	95.95 ~ 105.78	20(68)	3.42 ~ 3.61
-20(-4)	27.4 ~ 29.77	40(104)	1.43 ~ 1.5
0(32)	9.08 ~ 9.72	60(140)	0.66 ~ 0.69
10(50)	5.49 ~ 5.83	80(176)	0.33 ~ 0.34



1. MAFS Signal
2. MAFS Power
3. MAFS Ground
4. IATS Signal
5. IATS Ground

SVQF16607L

3) Is the measured resistance within specification ?

YES

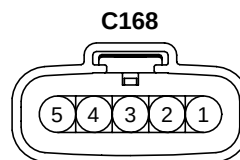
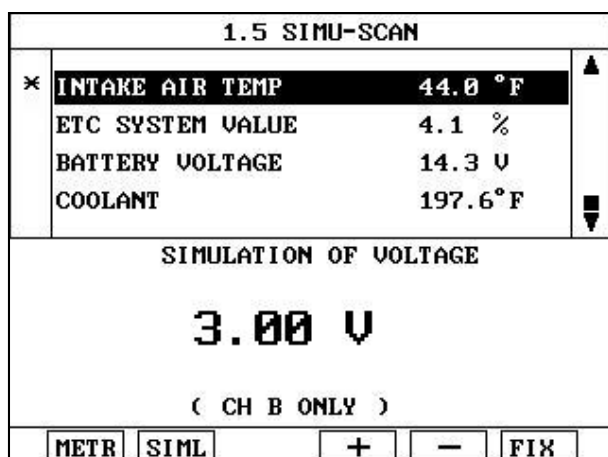
► Go to "Check PCM" as follows.

NO

► Substitute with a known - good IATS and check for proper operation. If the problem is corrected, replace IATS and go to "Verification of Vehicle Repair" procedure.

2. Check PCM

- 1) IG "OFF" and connect scantool.
- 2) Disconnect IATS connector and connect probe to terminal 4 of IATS harness connector.
- 3) IG "ON" and ENG "OFF" and simulation Function on scantool.
- 4) Simulate voltage at terminal 4 of IATS harness connector.



1. MAFS Signal
2. MAFS Power
3. MAFS Ground
4. IATS Signal
5. IATS Ground

SVQF16205L

5) Does the signal value of IAT sensor change according to simulation voltage ?

YES

► Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

► Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.

Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR

E33673FE

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

► System performing to specification at this time. Clear the DTC.

NO

► Go to the applicable troubleshooting procedure.

DTC TROUBLESHOOTING PROCEDURES

FLA -595

DTC P1112 INTAKE AIR TEMPERATURE SENSOR CIRCUIT SHORT - INTERMITTENT LOW INPUT

COMPONENT LOCATION EE64C5F4

Refer to DTC P1111.

GENERAL DESCRIPTION E1876C90

Refer to DTC P1111.

DTC DESCRIPTION E8A6F59D

Checking output signals of IATS under detecting condition, if an output signal is intermittently below 0.1V, PCM sets P1112.

DTC DETECTING CONDITION EB10DA7C

Item		Detecting Condition	Possible Cause
DTC Strategy		Monitor the signal of IAT sensor	- Poor connection - Short to ground in signal circuit - Faulty IATS - Faulty PCM
Enable Conditions	Case 1	- Engine running state - No Vehicle speed sensor fault - Vehicle speed > 50kph(30mph)	
	Case 2	- Engine running time > 120 sec. - Time from IG "OFF" to IG "ON" > 360 min.	
Threshold value		Intermittently Intake air temperature sensor's voltage < 0.1V	
Diagnosis Time		Continuous	
MIL On Condition		DTC only	

SPECIFICATION E8D6E9DC

Temp. (°C/°F)	Resistance (kΩ)	Temp. (°C/°F)	Resistance (kΩ)
-40(-40)	95.95 ~ 105.78	20(68)	3.42 ~ 3.61
-20(-4)	27.4 ~ 29.77	40(104)	1.43 ~ 1.5
0(32)	9.08 ~ 9.72	60(140)	0.66 ~ 0.69
10(50)	5.49 ~ 5.83	80(176)	0.33 ~ 0.34

SCHEMATIC DIAGRAM EF759E70

Refer to DTC P1111.

SIGNAL WAVEFORM AND DATA E01DD8F1

Refer to DTC P1111.

MONITOR DTC STATUS EF79ACC8

Refer to DTC P1111.

TERMINAL AND CONNECTOR INSPECTION E58ED658

Refer to DTC P1111.

SIGNAL CIRCUIT INSPECTION EF4CCDA1

1. Check voltage

- 1) IG "OFF" and disconnect IATS connector.
- 2) IG "ON" and ENG "OFF"
- 3) Measure voltage between terminal 4 of IATS harness connector and chassis ground.

Specification : Approx. 5V

- 4) Is the measured voltage within specification ?

YES

► Go to "Component Inspection" procedure.

NO

► Go to " Check short to ground in harness" procedure.

2. Check short to ground in harness

- 1) IG "OFF" and disconnect IATS connector and PCM connector.
- 2) Measure resistance between terminal 4 of IATS harness connector and chassis ground.
- 3) Measure resistance between terminals 4 and 5 of IATS harness connector.
- 4) Measure resistance between terminals 4 and 3 of IATS harness connector.

Specification : Infinite

- 5) Is the measured resistance within specification?

YES

► Go to "Component inspection" procedure.

NO

► Repair short to ground in harness and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E57797EC

1. Check IATS

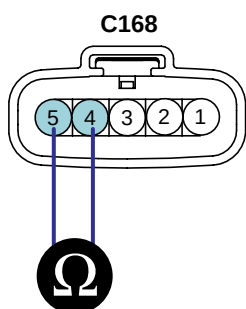
- 1) IG "OFF" and disconnect IATS connector.
- 2) Measure resistance between terminals 4 and 5 of IATS connector.(Component side)

DTC TROUBLESHOOTING PROCEDURES

FLA -597

SPECIFICATON :

Temp. (°C/°F)	Resistance (kΩ)	Temp. (°C/°F)	Resistance (kΩ)
-40(-40)	95.95 ~ 105.78	20(68)	3.42 ~ 3.61
-20(-4)	27.4 ~ 29.77	40(104)	1.43 ~ 1.5
0(32)	9.08 ~ 9.72	60(140)	0.66 ~ 0.69
10(50)	5.49 ~ 5.83	80(176)	0.33 ~ 0.34



1. MAFS Signal
2. MAFS Power
3. MAFS Ground
4. IATS Signal
5. IATS Ground

SVQF16607L

3) Is the measured resistance within specification ?

YES

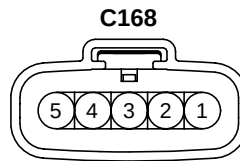
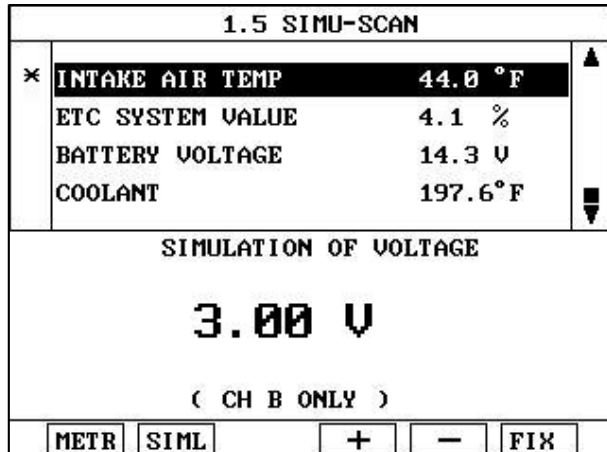
► Go to "Check PCM" as follows.

NO

► Substitute with a known - good IATS and check for proper operation. If the problem is corrected, replace IATS and go to "Verification of Vehicle Repair" procedure.

2. Check PCM

- 1) IG "OFF" and connect scantool.
- 2) Disconnect IATS connector and connect probe to terminal 4 of IATS harness connector.
- 3) IG "ON" and ENG "OFF" and simulation Function on scantool.
- 4) Simulate voltage at terminal 4 of IATS harness connector.



1. MAFS Signal
2. MAFS Power
3. MAFS Ground
4. IATS Signal
5. IATS Ground

SVQF16205L

5) Does the signal value of IAT sensor change according to simulation voltage ?

YES

► Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

► Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.

Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

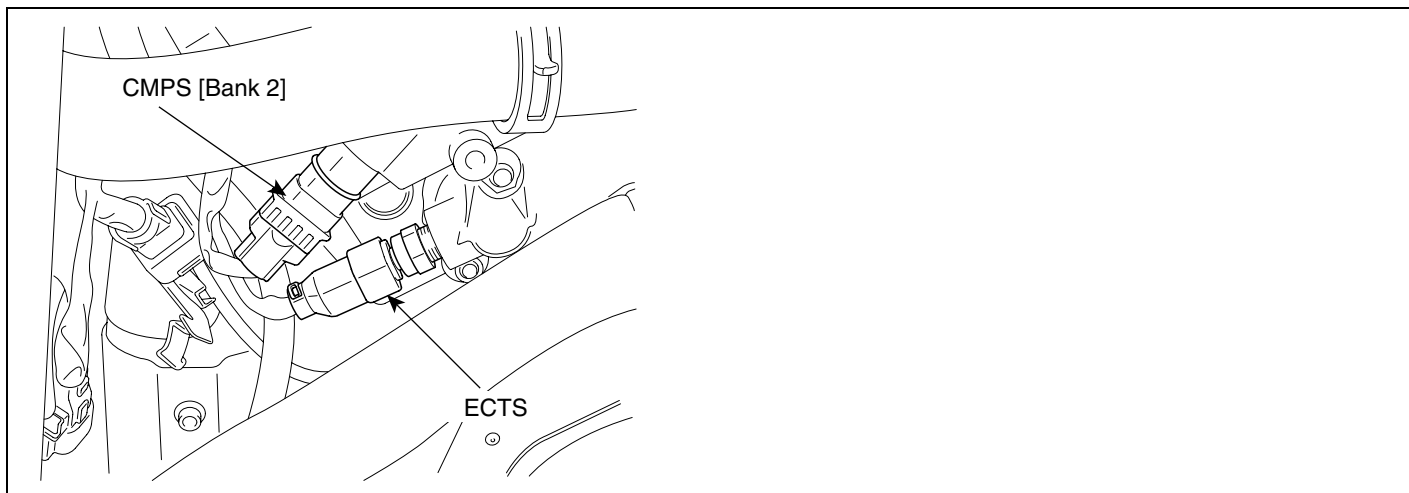
VERIFICATION OF VEHICLE REPAIR

EAB20578

Refer to DTC P1111.

DTC P1114 ENGINE COOLANT TEMPERATURE SENSOR CIRCUIT INTERMITTENT LOW INPUT

COMPONENT LOCATION E5C90ED0



LGLG510A

GENERAL DESCRIPTION ED9EA229

The Engine Coolant Temperature Sensor (ECTS) is located in the engine coolant passage of the cylinder head for detecting the engine coolant temperature. The ECTS uses a thermistor whose resistance changes with the temperature. The electrical resistance of the ECTS decreases as the temperature increases, and increases as the temperature decreases. The reference 5 V in the ECM is supplied to the ECTS via a resistor in the ECM. That is, the resistor in the ECM and the thermistor in the ECTS are connected in series. When the resistance value of the thermistor in the ECTS changes according to the engine coolant temperature, the output voltage also changes. During cold engine operation the ECM increases the fuel injection duration and controls the ignition timing using the information of engine coolant temperature to avoid engine stalling and improve drivability.

DTC DESCRIPTION E3E7E1FA

Checking output signals from ECTS under detecting condition, if an output signal is intermittently below 0.1V, PCM sets P1114.

DTC DETECTING CONDITION EB0C21F2

Item		Detecting Condition	Possible Cause
DTC Strategy		Monitor the signal of ECTS	- Poor connection - Short to ground in circuit - Faulty ECTS - Faulty PCM
Enable Conditions	Case 1	Time after start-up > 120 sec.	
	Case 2	- Time from IG "OFF" to IG "ON" > 360 min. - Engine running state	
Threshold value		Intermittently engine coolant temperature sensor's voltage < 0.1V	
Diagnosis Time		Continuous	
MIL On Condition		DTC only (NO MIL ON)	

FLA -600

FUEL SYSTEM

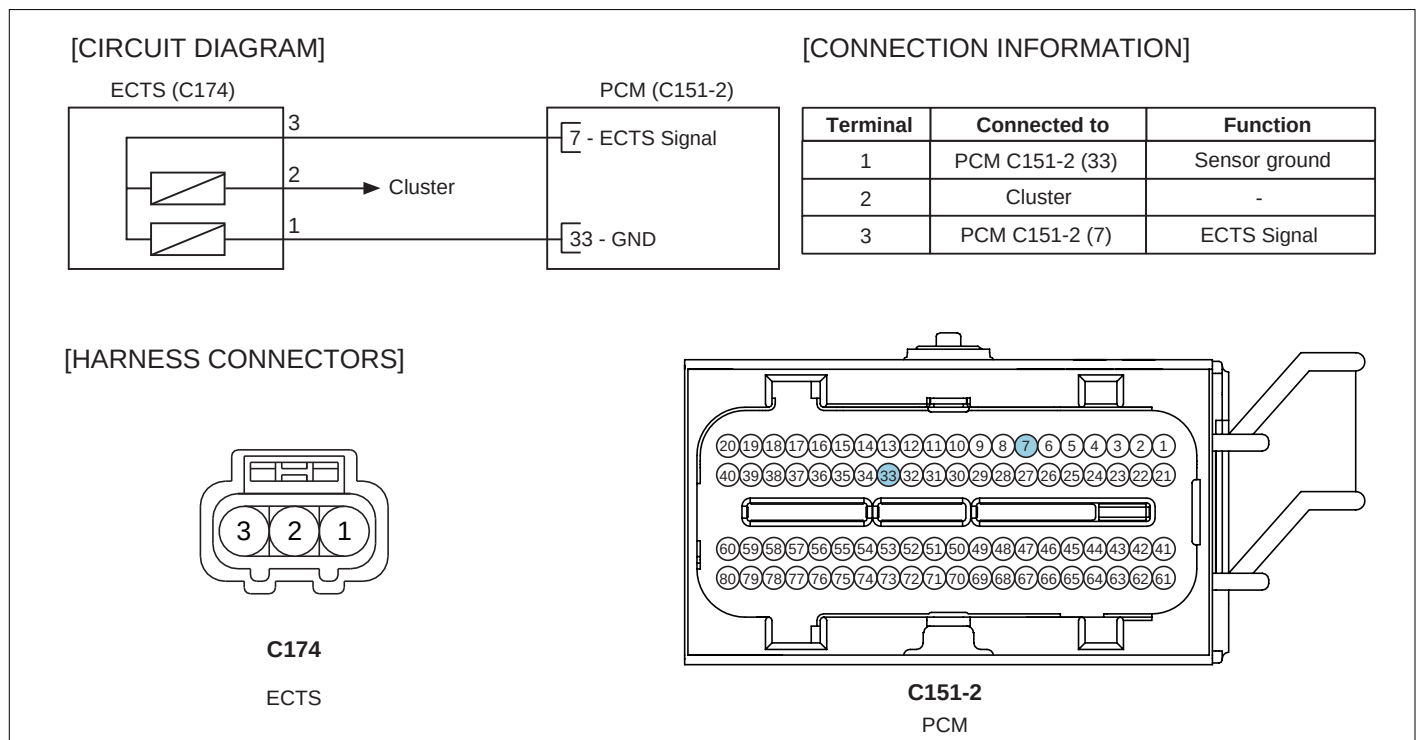
SPECIFICATION

E44D6B52

Temp. (°C/°F)	Resistance (kΩ)	Temp. (°C/°F)	Resistance (kΩ)
-40(-40)	48.14	40(104)	1.15
-20(-4)	14.13 ~ 16.83	60(140)	0.59
0(32)	5.79	80(176)	0.32
20(68)	2.31 ~ 2.59		

SCHEMATIC DIAGRAM

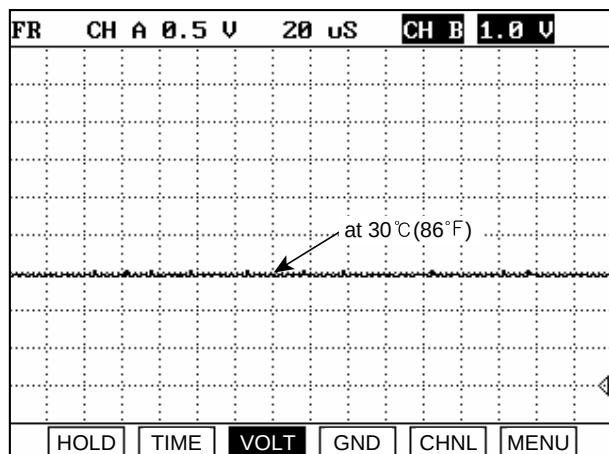
E3EDDA96



SVQF16106L

SIGNAL WAVEFORM AND DATA

E667E278



EGRF604P

The output signals of IATS & ECTS change smoothly without any rapid changes. Those have almost same characteristic signal during the early period after start. It means that the temperatures of intake air and engine coolant are depended on

DTC TROUBLESHOOTING PROCEDURES

FLA -601

the temperature of atmosphere. Meanwhile, during the warming up, the output signal of ECTS is going up increasingly. but, the output signal of IATS changes a little bit. even it may not change almost. It means that the heat of engine does not affect on the temperature of intake air.

MONITOR DTC STATUS EF86F17F

1. Check DTC Status

- 1) Connect scantool to Data Link Connector(DLC).
- 2) IG "ON".
- 3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F4(DTAL) to check DTC's information from the DTCs menu
- 4) Read "DTC Status" parameter.

1.1 DIAGNOSTIC TROUBLE CODES		
PXXXX DTC TITLE		
NUMBER OF DTC : 1 ITEMS		
PART	ERAS	DTAL

PXXXX TITLE	
1.MIL STATUS:	ON/OFF
2.DTC STATUS:	PRESENT/HISTORY
3.DIAG.STATUS:	DIAGNOSIS FINISHED
DTC CAUSE TO SYSTEM ERROR : PXXXX	

SCMF16159L

5) Is parameter displayed "Present fault"?

YES

- Go to "Terminal and connector inspection" procedure.

NO

- Fault is intermittent caused by poor contact in the sensor' s and/or PCM' s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

TERMINAL AND CONNECTOR INSPECTION E8321A87

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

- ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

- ▶ Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION E1B03909

1. Check voltage

- 1) IG "OFF" and disconnect ECTS connector.
- 2) IG "ON" and ENG "OFF"
- 3) Measure voltage between terminal 3 of ECTS harness connector and chassis ground.

Specification : Approx. 5V

- 4) Is the measured voltage within specification ?

YES

- ▶ Go to "Component Inspection" procedure.

NO

- ▶ Go to "Check short to ground in harness" as follows.

2. Check short to ground in harness

- 1) IG "OFF" and disconnect ECTS connector and PCM connector.
- 2) Measure resistance between terminal 3 of ECTS harness connector and chassis ground.
- 3) Measure resistance between terminals 1 and 3 of ECTS harness connector.

Specification : Infinite

- 4) Is the measured resistance within specification?

YES

- ▶ Go to "Component Inspection" procedure.

NO

- ▶ Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION ED03F372

1. Check ECTS

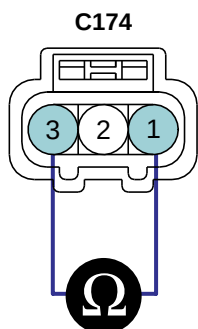
- 1) IG "OFF" and disconnect ECTS connector.
- 2) Measure resistance between terminals 1 and 3 of ECTS connector.(Component side)

DTC TROUBLESHOOTING PROCEDURES

FLA -603

SPECIFICATON :

Temp. (°C/°F)	Resistance (kΩ)	Temp. (°C/°F)	Resistance (kΩ)
-40(-40)	48.14	40(104)	1.15
-20(-4)	14.13 ~ 16.83	60(140)	0.59
0(32)	5.79	80(176)	0.32
20(68)	2.31 ~ 2.59		



1. ECTS Ground
2. To Gauge
3. ECTS Signal

SVQF16211L

3) Is the measured resistance within specification?

YES

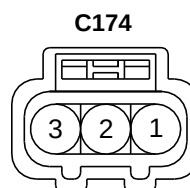
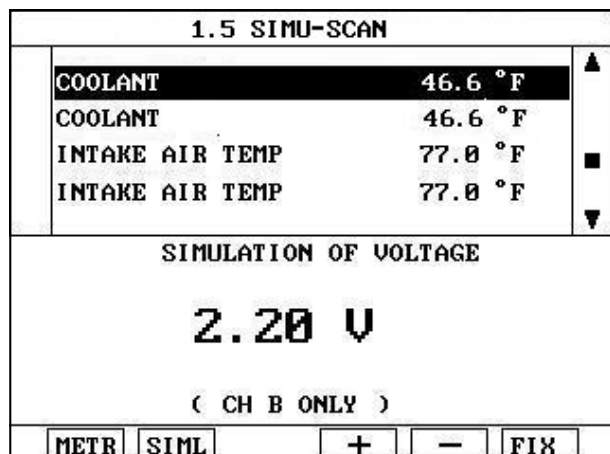
► Go to "Check PCM" as follows.

NO

► Substitute with a known - good ECTS and check for proper operation. If the problem is corrected, replace ECTS and go to "Verification of Vehicle Repair" procedure.

2. Check PCM

- 1) IG "OFF" and connect scantool.
- 2) Connect probe to terminal 3 of ECTS harness connector.
- 3) IG "ON" and ENG "OFF" and simulation Function on scantool.
- 4) Simulate voltage at terminal 3 of ECTS harness connector.



1. ECTS Ground
2. To Gauge
3. ECTS Signal

SVQF16212L

5) Does the signal value of ECT sensor change according to simulation voltage ?

YES

► Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

► Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.

Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR

EB43BBD0

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

► System performing to specification at this time. Clear the DTC.

NO

► Go to the applicable troubleshooting procedure.

DTC TROUBLESHOOTING PROCEDURES

FLA -605

DTC P1115 ENGINE COOLANT TEMPERATURE SENSOR CIRCUIT - INTERMITTENT HIGH INPUT

COMPONENT LOCATION E6E3F387

Refer to DTC P1114.

GENERAL DESCRIPTION ED21BC73

Refer to DTC P1114.

DTC DESCRIPTION EF56256D

Checking output signals from ECTS under detecting condition, if an output signal is intermittently above 4.9V, PCM sets P1115.

DTC DETECTING CONDITION EE0C1355

Item		Detecting Condition	Possible Cause
DTC Strategy		• Monitor the signal of ECTS	• Poor connection • Open or short to battery in signal circuit • Open in ground circuit • Faulty ECTS • Faulty PCM
Enable Conditions	Case 1	• Time after start-up > 120 sec.	
	Case 2	• Time from IG "OFF" to IG "ON" > 360 min. • Intake air temperature $\geq -10^{\circ}\text{C}(14^{\circ}\text{F})$ • Engine running state	
Threshold value		• Intermittently engine coolant temperature sensor's voltage > 4.9V	
Diagnosis Time		• Continuous	
MIL On Condition		• DTC only (NO MIL ON)	

SPECIFICATION E10F035E

Temp. ($^{\circ}\text{C}/^{\circ}\text{F}$)	Resistance ($\text{k}\Omega$)	Temp. ($^{\circ}\text{C}/^{\circ}\text{F}$)	Resistance ($\text{k}\Omega$)
-40(-40)	48.14	40(104)	1.15
-20(-4)	14.13 ~ 16.83	60(140)	0.59
0(32)	5.79	80(176)	0.32
20(68)	2.31 ~ 2.59		

SCHEMATIC DIAGRAM EDE41432

Refer to DTC P1114.

SIGNAL WAVEFORM AND DATA E9107FF0

Refer to DTC P1114.

MONITOR DTC STATUS EEDAEBB3

Refer to DTC P1114.

TERMINAL AND CONNECTOR INSPECTION E08DB827

Refer to DTC P1114.

SIGNAL CIRCUIT INSPECTION EB1410D1

1. Check voltage

- 1) IG "OFF" and disconnect ECTS connector.
- 2) IG "ON" and ENG "OFF"
- 3) Measure voltage between terminal 3 of ECTS harness connector and chassis ground.

Specification : Approx. 5V

- 4) Is the measured voltage within specification ?

YES

► Go to "Ground Circuit Inspection" procedure.

NO

► If voltage is 0V, go to "Check open in harness" as follows. If it is more than 5.1V, go to "Check short to battery in harness" as follows

2. Check short to battery in harness

- 1) IG "OFF" and disconnect ECTS connector and PCM connector.
- 2) Measure resistance between terminals 2 and 3 of ECTS harness connector.

Specification : Infinite

- 3) Is the measured resistance within specification?

YES

► Go to "Component Inspection" procedure.

NO

► Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

3. Check open in harness

- 1) IG "OFF" and disconnect ECTS connector and PCM connector.
- 2) Measure resistance between terminal 3 of ECTS harness connector and terminal 7 of PCM harness connector.

Specification : Below 1Ω

DTC TROUBLESHOOTING PROCEDURES

FLA -607

- 3) Is the measured resistance within specification?

YES

- Go to "Ground Circuit Inspection" procedure.

NO

- Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION EE4A2CDF

1. IG "OFF" and disconnect ECTS connector.
2. Measure voltage between terminal 3 of ECTS harness connector and chassis ground.
3. Measure voltage between terminals 1 and 3 of ECTS harness connector.

Specification : Voltage difference between measurement "A" and "B" is below 200mV.

4. Is the measured voltage within specification?

YES

- Go to "Component Inspection" procedure.

NO

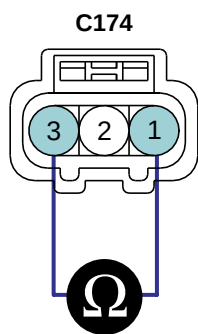
- Repair open or contact resistance in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E296506E

1. Check ECTS
 - 1) IG "OFF" and disconnect ECTS connector.
 - 2) Measure resistance between terminals 1 and 3 of ECTS connector.(Component side)

SPECIFICATON :

Temp. (°C/°F)	Resistance (kΩ)	Temp. (°C/°F)	Resistance (kΩ)
-40(-40)	48.14	40(104)	1.15
-20(-4)	14.13 ~ 16.83	60(140)	0.59
0(32)	5.79	80(176)	0.32
20(68)	2.31 ~ 2.59		



1. ECTS Ground
2. To Gauge
3. ECTS Signal

SVQF16211L

3) Is the measured resistance within specification?

YES

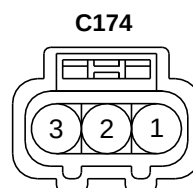
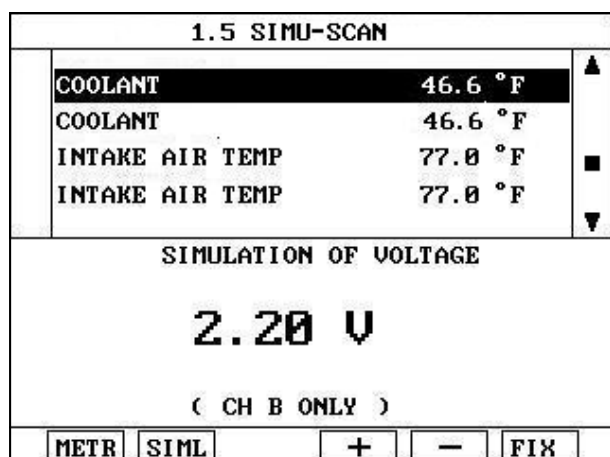
► Go to "Check PCM" as follows.

NO

► Substitute with a known - good ECTS and check for proper operation. If the problem is corrected, replace ECTS and go to "Verification of Vehicle Repair" procedure.

2. Check PCM

- 1) IG "OFF" and connect scantool.
- 2) Connect probe to terminal 3 of ECTS harness connector.
- 3) IG "ON" and ENG "OFF" and simulation Function on scantool.
- 4) Simulate voltage at terminal 3 of ECTS harness connector.



1. ECTS Ground
2. To Gauge
3. ECTS Signal

SVQF16212L

5) Does the signal value of ECT sensor change according to simulation voltage ?

YES

► Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

DTC TROUBLESHOOTING PROCEDURES

FLA -609

- ▶ Substitute with a known - good PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.

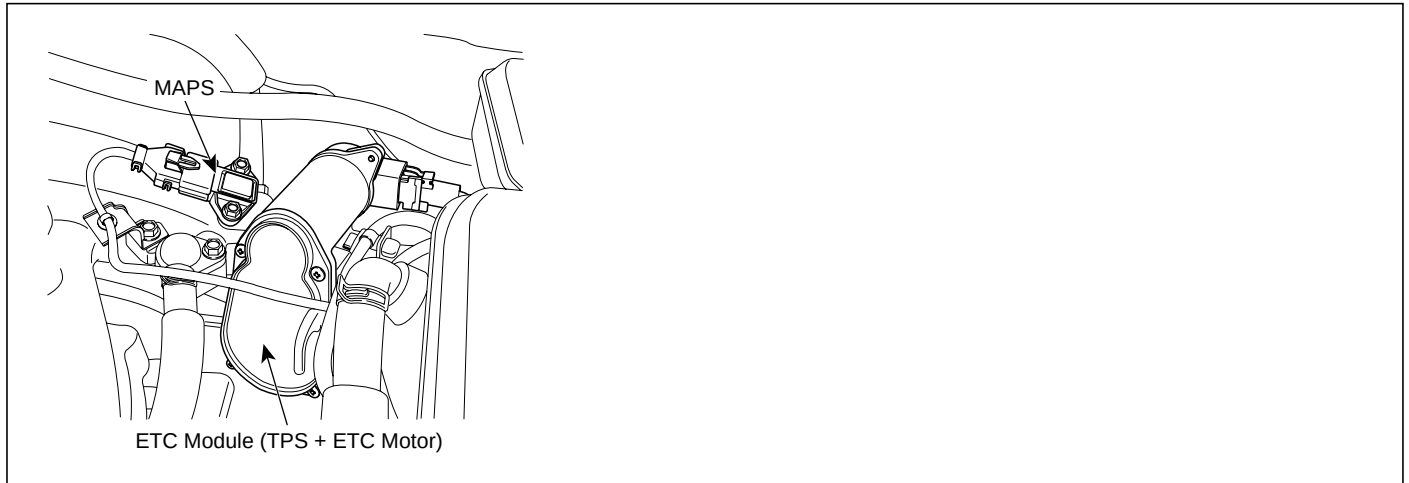
Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR EEAC6FF5

Refer to DTC P1114.

DTC P1295 ETC (ELECTRONIC THROTTLE CONTROL) SYSTEM MALFUNCTION - POWER MANAGEMENT

COMPONENT LOCATION E6E0C9FA



SCMF16192L

GENERAL DESCRIPTION EC81A79C

The Electronic Throttle Control(ETC) system is made of the components throttle body, Throttle Position Sensor(TPS)1 & 2 and Accelerator Position Sensor(APS) 1 & 2. The throttle body contains the actuator, the throttle plate and the throttle position sensor (potentiometer), which are integrated in one housing. The actuator consists of a DC motor with a two-stage gear. The opening angle of the throttle valve is detected by the throttle position sensor which is mounted on the throttle body. And it provides feedback to the ECM to control the throttle motor in order to control the throttle valve opening angle properly in response to the driving condition.

DTC DESCRIPTION E476FA42

If power management mode is recognized under detecting condition, PCM sets P1295. And MIL(Malfunction Indication Lamp) turns on.

DTC DETECTING CONDITION ED114BD2

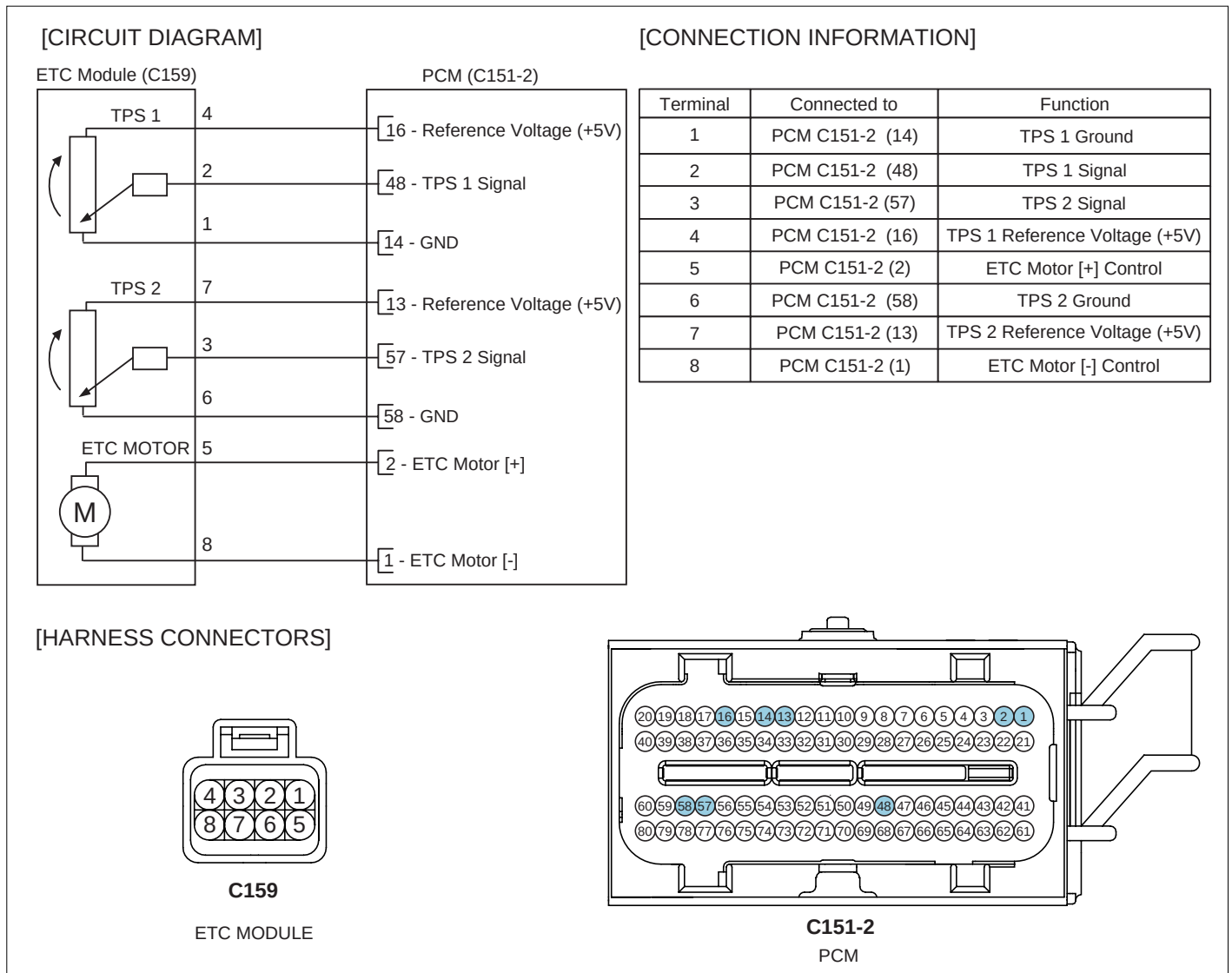
Item	Detecting Condition	Possible cause
DTC Strategy	This code detects if the system is in Power Management Mode	- TPS Malfunction - TPS Malfunction + MAFSMalfunction - MAP Malfunction + TPSPMalfunction - Faulty PCM
EnableConditions	Ignition On	
Threshold value	Power Management Mode is active	
DiagnosisTime	-	
MIL On Condition	1 Driving Cycle	

DTC TROUBLESHOOTING PROCEDURES

FLA -611

SCHEMATIC DIAGRAM

EF168216



SVQF16101L

MONITOR SCANTOOL DATA

EFA59658

1. Connect scantool to DLC(Data Link Connector)
2. IG "ON" & Monitor that any different DTC(Diagnostic Trouble Code) is existed.
(There will be at least one more DTC which causes this DTC P1295 to retrieve)
3. Repair the DTCs cause DTC P1295 first according to the designated trouble shooting guide.
(After repairing the DTCs cause DTC P1295, don't forget to do "ETC Initialization" as follows.)
4. Is the same DTC occurred ?

YES

► Substitute with a known-good PCM and check for proper operation. If the problem is corrected,replace PCM and then go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the other.

NO

► Go to "Verification of Vehicle Repair" procedure.

※ Procedure of ETS Initialization

- 1) Erase the trouble codes on PCM
- 2) Turn the ignition key off and keep this condition until the main relay is turned off. (It will take 10sec.)
- 3) Turn ignition key on more than 1second to record the throttle motor position on the EEPROM

VERIFICATION OF VEHICLE REPAIR E003F048

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

► System performing to specification at this time. Clear the DTC.

NO

► Go to the applicable troubleshooting procedure.

DTC TROUBLESHOOTING PROCEDURES

FLA -613

DTC P1523 ETC (ELECTRONIC THROTTLE CONTROL) SYSTEM MALFUNCTION - THROTTLE VALVE STUCK

COMPONENT LOCATION EB59E45B

Refer to DTC P1295.

GENERAL DESCRIPTION EE5F5D1C

Refer to DTC P1295.

DTC DESCRIPTION EB974B1A

Checking throttle valve return state under detecting condition, if an output signal is within the threshold value for more than designated time, PCM sets P1523.

DTC DETECTING CONDITION E50C17A4

Item	Detecting Condition	Possible cause
DTC Strategy	Monitor throttle valve return state	- Carbon in throttle - Broken Throttle return spring - throttle sticky - throttle icy
Enable Conditions	- ETC Power Control Mode - TPS 1 & 2 = normal - Sensor Supply voltage = Normal	
Threshold value	The throttle did not return to default range within 1 to 4 seconds of turning off. That is, (TPS1's signal > 0.9V AND TPS1's signal < 1.85V) or (TPS2's signal < 1.85V AND TPS2's signal > 0.9V) when the power to the ETC motor is turned off.	
DiagnosisTime	Continuous	
MIL On Condition	DTC only (NO MIL ON)	

SPECIFICATION E619966F

Throttle opening (°)	Output voltage (V) [Vref = 5.0V]	
	TPS1	TPS2
0°	0.0V	5.0V
10°	0.5V	4.5V
20°	0.9V	4.1V
30°	1.4V	3.6V
40°	1.8V	3.2V
50°	2.3V	2.7V
60°	2.7V	2.3V
70°	3.2V	1.8V
80°	3.6V	1.4V
90°	4.1V	0.9V

FLA -614

FUEL SYSTEM

100°	4.5V	0.5V
110°	5.0V	0.0V

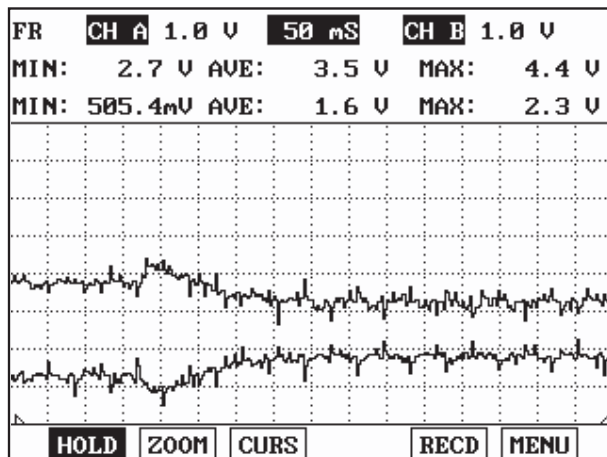
SCHEMATIC DIAGRAM

ED82E1D0

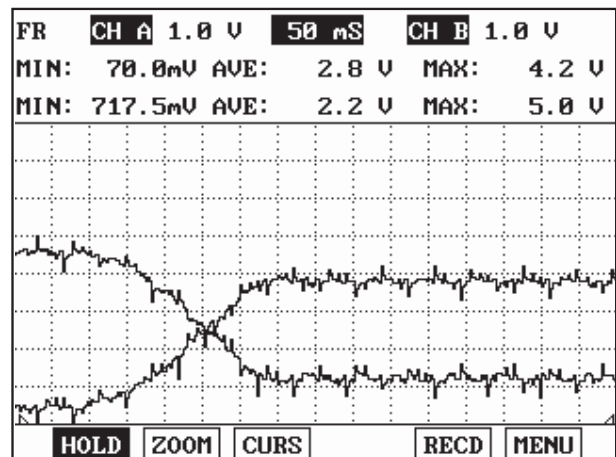
Refer to DTC P1295.

SIGNAL WAVEFROM AND DATA

EE3582E5



Stepping on accelleraton pedal.



Pulling out accelleration cable with hand.

EGRF963A

MONITOR DTC STATUS

E4C7F759

1. Check DTC Status

- 1) Connect scantool to Data Link Connector(DLC).
- 2) IG "ON".
- 3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F4(DTAL) to check DTC's information from the DTCs menu
- 4) Read "DTC Status" parameter.

1.1 DIAGNOSTIC TROUBLE CODES		
PXXXX DTC TITLE		
NUMBER OF DTC : 1 ITEMS		
PART	ERAS	DTAL

PXXXX TITLE
1.MIL STATUS: ON/OFF
2.DTC STATUS: PRESENT/HISTORY
3.DIAG.STATUS: DIAGNOSIS FINISHED
DTC CAUSE TO SYSTEM ERROR : PXXXX

SCMF16159L

5) Is parameter displayed "Present fault"?

YES

► Go to "System inspection" procedure.

NO

► Fault is intermittent caused by poor contact in the sensor' s and/or PCM' s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

SYSTEM INSPECTION E088FCD7

1. Visual Inspection

- 1) IG "OFF".
- 2) Check throttle valve after removing air duct.
 - Carbon deposit.
 - Throttle icy
 - Broken return spring.
 - Throttle sticky

3) Is the throttle valve return O.K ?

YES

► Thoroughly check that something interferes throttle movement and perform ETS Initialization as follows and then, go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.

Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

► Repair or replace as necessary and then, do ETS Initialization" as follows. then, go to "Verification of Vehicle Repair" procedure.

※ Procedure of ETS Initialization

1. Erase the trouble codes on PCM
2. Turn the ignition key off and keep this condition until the main relay is turned off.(It will takes 10sec.)
3. Turn ignition key on more than 1second to record the throttle motor position on the EEPROM

VERIFICATION OF VEHICLE REPAIR E5449986

Refer to DTC P1295.

DTC TROUBLESHOOTING PROCEDURES

FLA -617

DTC P2104 ETC (ELECTRONIC THROTTLE CONTROL) SYSTEM MALFUNCTION - FORCED IDLE

COMPONENT LOCATION EAF6C0A5

Refer to DTC P1295.

GENERAL DESCRIPTION E672DD19

Refer to DTC P1295.

DTC DESCRIPTION E079537C

If PCM recognizes vehicle state as forced idle under detecting condition, it sets P2104 and MIL(Malfunction Indication Lamp) turns on.

DTC DETECTING CONDITION EA11BB7A

Item	Detecting Condition	Possible cause
DTC Strategy	• This code detects if the system is in Forced Idle Mode	• Faulty APS • Faulty APS+Brake • Faulty APS + Vehicle speed sensor • Faulty APS + Vehicle speed sensor + Brake • Faulty PCM
Enable Conditions	• Ignition "ON"	
Threshold value	• Forced Idle Mode is active	
DiagnosisTime	• -	
MIL On Condition	• 1 Driving Cycle	

SCHEMATIC DIAGRAM EEFB2F29

Refer to DTC P1295.

MONITOR SCANTOOL DATA E761A2F3

Refer to DTC P1295.

VERIFICATION OF VEHICLE REPAIR E595CAE4

Refer to DTC P1295.

FLA -618

FUEL SYSTEM

DTC P2105 ETC (ELECTRONIC THROTTLE CONTROL) SYSTEM MALFUNCTION - FORCED ENGINE SHUTDOWN

COMPONENT LOCATION EA5E2801

Refer to DTC P1295.

GENERAL DESCRIPTION E4E6418B

Refer to DTC P1295.

DTC DESCRIPTION E6116072

If PCM recognizes vehicle state as forced engine shutdown under detecting condition, it sets P2105 and then MIL(Malfunction Indication Lamp) turns on.

DTC DETECTING CONDITION E09C8745

Item	Detecting Condition	Possible cause
DTC Strategy	This code detects if the system is in Forced Engine Shutdown Mode	- Faulty AFS+MAPS+ETS - Faulty PCM
Enable Conditions	Ignition "ON"	
Threshold value	Forced Engine Shutdown Mode Active	
DiagnosisTime	-	
MIL On Condition	1 Driving Cycle	

SCHEMATIC DIAGRAM EB102176

Refer to DTC P1295.

MONITOR SCANTOOL DATA E1EEC0F7

Refer to DTC P1295.

VERIFICATION OF VEHICLE REPAIR E7707F60

Refer to DTC P1295.

DTC TROUBLESHOOTING PROCEDURES

FLA -619

DTC P2106 ETC (ELECTRONIC THROTTLE CONTROL) SYSTEM MALFUNCTION - FORCED LIMITED POWER

COMPONENT LOCATION E8EA6F9D

Refer to DTC P1295.

GENERAL DESCRIPTION E9FD069C

Refer to DTC P1295.

DTC DESCRIPTION EAA5A429

If PCM recognizes vehicle state as forced limited power mode under detecting condition, it sets P2106 and then MIL (Malfunction Indication Lamp) turns on.

DTC DETECTING CONDITION E4E9FD11

Item	Detecting Condition	Possible cause
DTC Strategy	This code detects if the system is in Limit Performance Mode	- Faulty APS - Faulty APS+Brake - Faulty APS + Vehicle speed sensor - Faulty APS + Vehicle speed sensor + Brake - Faulty PCM
Enable Conditions	Ignition "ON"	
Threshold value	Limit Performance Mode is active	
DiagnosisTime	-	
MIL On Condition	1 Driving Cycle	

SCHEMATIC DIAGRAM E62C293C

Refer to DTC P1295.

MONITOR SCANTOOL DATA EBCDFCE1

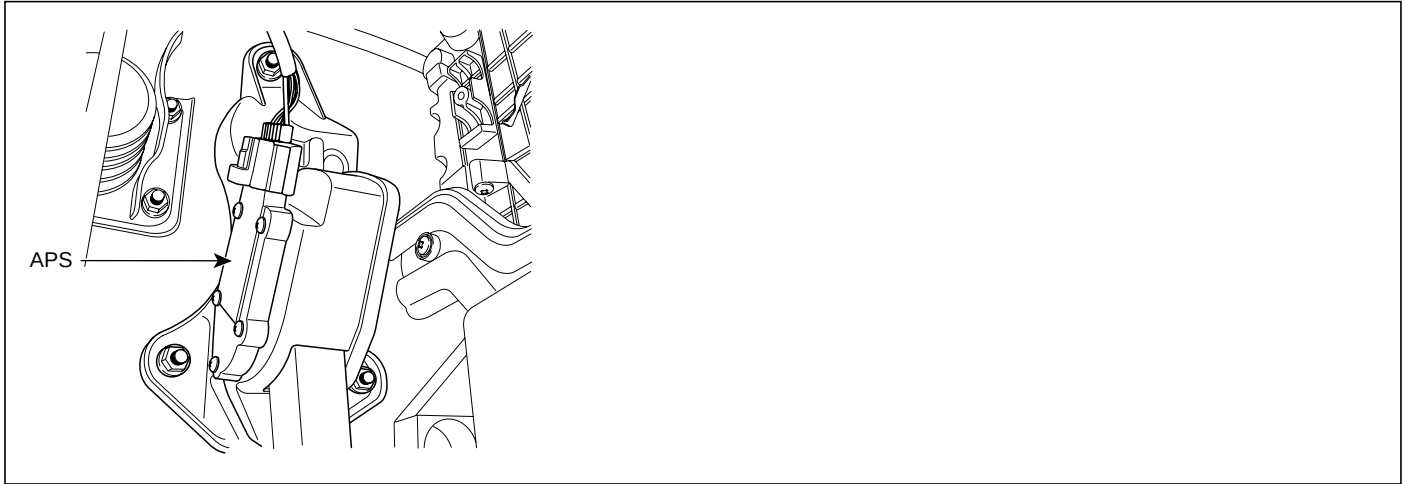
Refer to DTC P1295.

VERIFICATION OF VEHICLE REPAIR E76BBC64

Refer to DTC P1295.

DTC P2122 THROTTLE/PEDAL POSITION SENSOR/SWITCH "D" CIRCUIT LOW INPUT

COMPONENT LOCATION E0BE8A33



SCMF16410L

GENERAL DESCRIPTION E88851B5

The Electronic Throttle Control(ETC) system is made of the components throttle body, Throttle Position Sensor(TPS) 1 & 2 and Accelerator Position Sensor(APS) 1 & 2. The APS is mounted in the accelerator pedal to detect the opening angle of the accelerator pedal. It has 2 sensors to detect the accelerator position and a malfunction of the accelerator position sensor. The ECM judges the current opening angle of the accelerator pedal from APS1 & 2, and the ECM controls the throttle motor based on these signals.

DTC DESCRIPTION E1F29B0E

Checking output signals from APS 1, under detecting condition, if output signals are below the threshold, PCM sets P2122 and then MIL(Malfunction Indication Lamp) turns on.

DTC DETECTING CONDITION E55FAB15

Item	Detecting Condition	Possible Cause
DTC Strategy	This code detects a continuous short to ground or open in either the circuit or the sensor (0-100%)	- Poor connection - Open or short to ground in Power circuit - Open or short to ground in Signal Circuit - Faulty APS - Faulty PCM
Enable Conditions	Ignition "ON"	
Threshold	APS1 < 0.125V	
Diagnosis Time	Continuous	
MIL On Condition	1 Driving Cycle	

DTC TROUBLESHOOTING PROCEDURES

FLA -621

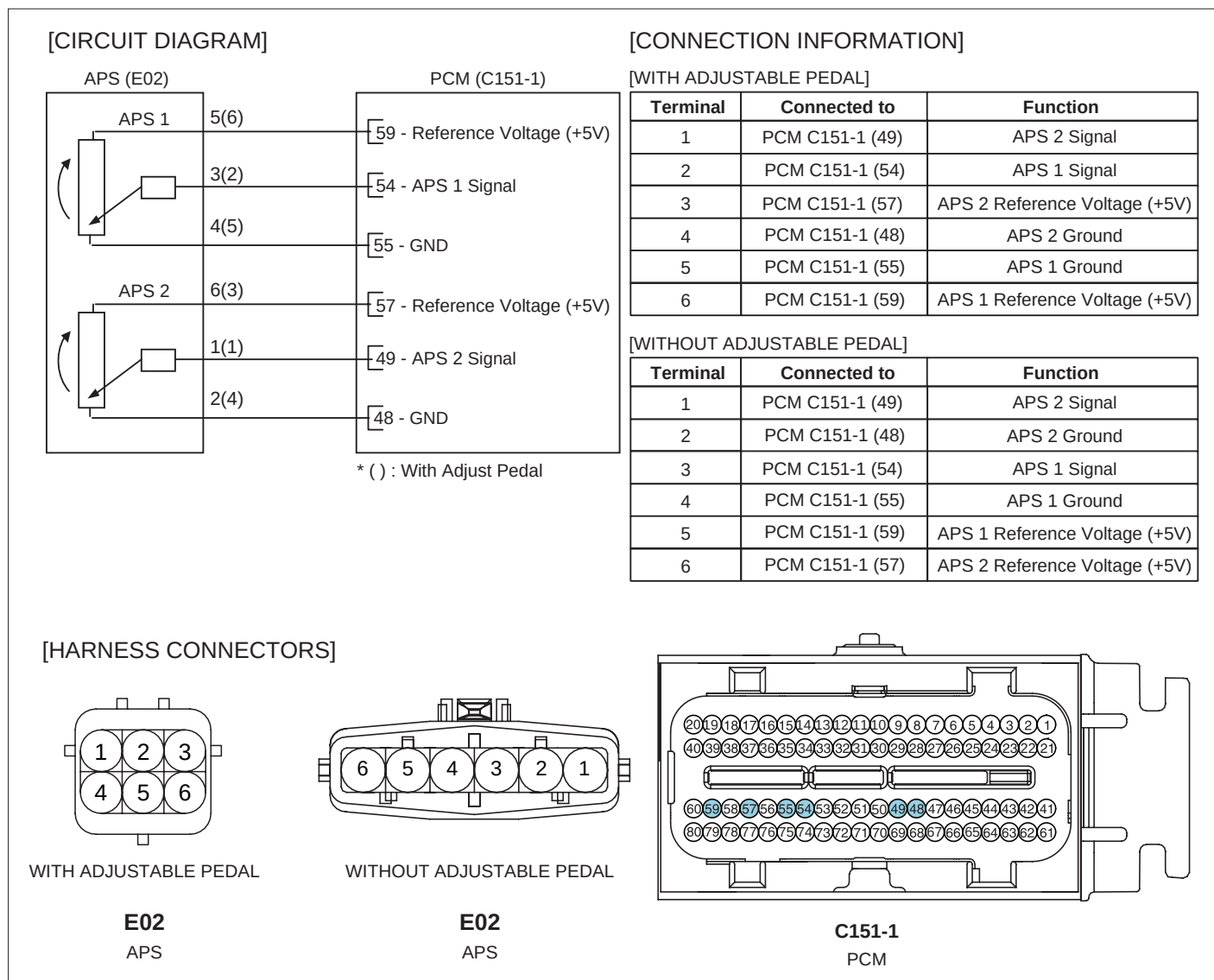
SPECIFICATION

E25F0160

Pedal Position	Output Voltage(V) [Vref = 5.0V]	
	APS1	APS2
C.T	0.7 ~ 0.8V	0.29 ~ 0.46V
W.O.T	3.85 ~ 4.35V	1.93 ~ 2.18V

SCHEMATIC DIAGRAM

EBAF75D1



SVQF16124L

SIGNAL WAVEFROM AND DATA

E2434D88

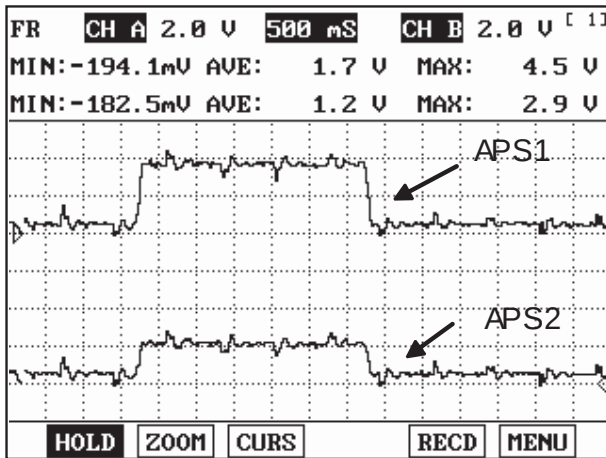


Fig. 1

Fig. 1 : This is a signal waveform of APS 1 & 2 which shows that APS 2 increases voltage just half of APS 1 voltage increase when acceleration.

EGRF970A

MONITOR DTC STATUS

EFFCAAE2

1. Check DTC Status

- 1) Connect scantool to Data Link Connector(DLC).
- 2) IG "ON".
- 3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F4(DTAL) to check DTC's information from the DTCs menu
- 4) Read "DTC Status" parameter.

1.1 DIAGNOSTIC TROUBLE CODES	
PXXXX	DTC TITLE
NUMBER OF DTC : 1 ITEMS	
PART	ERAS DTAL

PXXXX TITLE	
1.MIL STATUS:	ON/OFF
2.DTC STATUS:	PRESENT/HISTORY
3.DIAG.STATUS:	DIAGNOSIS FINISHED
DTC CAUSE TO SYSTEM ERROR : PXXXX	

SCMF16159L

5) Is parameter displayed "Present fault"?

YES

- Go to "Terminal and connector inspection" procedure.

DTC TROUBLESHOOTING PROCEDURES

FLA -623

NO

► Fault is intermittent caused by poor contact in the sensor' s and/or PCM' s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

TERMINAL AND CONNECTOR INSPECTION E3ADD732

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

► Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

► Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION ED8D9E1F

*(): W/O Pedal Adjust

1. IG "OFF" and disconnect APS connector.
2. IG "ON" & ENG "OFF"
3. Measure voltage between harness terminal 6(5) of APS and chassis ground.

Specification : Approx. 5V

4. Is the measured voltage within specification ?

YES

► Go to "Signal Circuit Inspection" procedure.

NO

► Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION E9B78805

*(): W/O Pedal Adjust

1. Check short to ground in harness.
 - 1) IG "OFF".
 - 2) Disconnect APS & PCM connector.

FLA -624

FUEL SYSTEM

- 3) Measure resistance between terminal 2(3) of APS harness connector and chassis ground.
- 4) Measure resistance between terminal 2(3) and 5(4) of APS harness connector.
- 5) Measure resistance between terminal 2(3) and 6(5) of APS harness connector.

Specification : Infinite

- 6) Is the measured resistance within specification ?

YES

► Go to "Check open in harness" as follows.

NO

► Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

2. Check open in harness

- 1) IG "OFF"
- 2) Disconnect "APS" and "PCM" connector.
- 3) Measure resistance between terminal 2 of APS harness connector and terminal 54 of PCM harness connector.

Specification : Approx. below 1Ω

- 4) Is the measured resistance within in specification ?

YES

► Go to "Component Inspection" procedure.

NO

► Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E1388164

1. Check APS

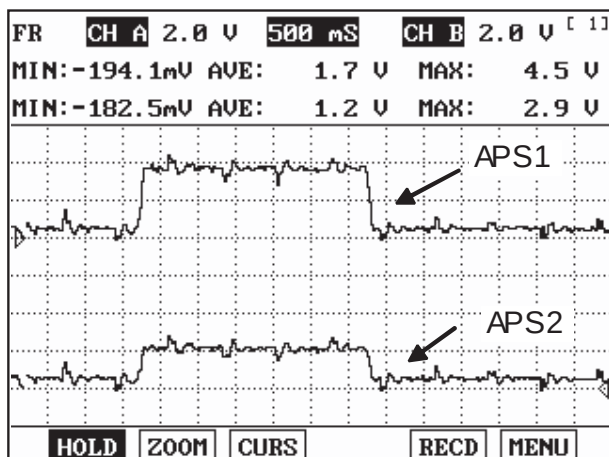
- 1) IG "ON" & ENG "OFF".
- 2) Measure signal waveform of APS by pressing and depressing accellerator pedal.

SPECIFICATION :

Pedal Position	Output Voltage(V) [Vref = 5.0V]	
	APS1	APS2
C.T	0.7 ~ 0.8V	0.29 ~ 0.46V
W.O.T	3.85 ~ 4.35V	1.93 ~ 2.18V

DTC TROUBLESHOOTING PROCEDURES

FLA -625



EGRF975A

3) Is the measured signal waveform O.K ?

YES

► Substitute with a known-good PCM and check for proper operation. If the problem is corrected, replace PCM and then go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.

Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

► Substitute with a known-good APS and check for proper operation. If the problem is corrected, replace APS and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

EF0B52E1

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

► System performing to specification at this time. Clear the DTC.

NO

► Go to the applicable troubleshooting procedure.

FLA -626

FUEL SYSTEM

DTC P2123 THROTTLE/PEDAL POSITION SENSOR/SWITCH "D" CIRCUIT HIGH INPUT

COMPONENT LOCATION EC80C888

Refer to DTC P2122.

GENERAL DESCRIPTION E0ED6377

Refer to DTC P2122.

DTC DESCRIPTION EEE20455

Checking output signals from APS 1, under detecting condition, if output signals are above the threshold, PCM sets P2123 and then MIL(Malfunction Indication Lamp) turns on.

DTC DETECTING CONDITION EC4C88A8

Item	Detecting Condition	Possible Cause
DTC Strategy	This code detects a short to high in either the circuit or the sensor	- Poor connection - Short to battery in Signal Circuit - Open in Ground Circuit - Faulty APS - Faulty PCM
Enable Conditions	Ignition "ON"	
Threshold	APS1 > 4.5V	
Diagnosis Time	Continuous	
MIL On Condition	1 Driving Cycle	

SPECIFICATION ED0F7FE7

Pedal Position	Output Voltage(V) [Vref = 5.0V]	
	APS1	APS2
C.T	0.7 ~ 0.8V	0.29 ~ 0.46V
W.O.T	3.85 ~ 4.35V	1.93 ~ 2.18V

SCHEMATIC DIAGRAM EAB55143

Refer to DTC P2122.

SIGNAL WAVEFROM AND DATA E7B2C861

Refer to DTC P2122.

MONITOR DTC STATUS EB28C76E

Refer to DTC P2122.

TERMINAL AND CONNECTOR INSPECTION E8D924E5

Refer to DTC P2122.

DTC TROUBLESHOOTING PROCEDURES

FLA -627

SIGNAL CIRCUIT INSPECTION

E294F1F8

*(): W/O Pedal Adjust

1. Check short to battery in harness
 - 1) IG "OFF".
 - 2) Disconnect APS and PCM connector.
 - 3) Measure resistance between terminal 2(3) and 3(6) of APS harness connector.
 - 4) Measure resistance between terminal 2(3) and 6(5) of APS harness connector.

Specification : Infinite

- 5) Is the measured resistance within specification ?

YES

► Go to "Ground Circuit Inspection" procedure.

NO

► Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

E7F55DD4

*(): W/O Pedal Adjust

1. Check open in harness
 - 1) IG "OFF".
 - 2) Disconnect APS connector.
 - 3) Measure voltage between terminal 6(5) of APS harness connector and chassis ground.(Fig. A)
 - 4) Measure voltage between terminal 6(5) and 5(4) of APS harness connector.(Fig. B)

Specification : Fig. "A" - Fig. "B" = approx. below. 200mV.

- 5) Is the measured voltage within specification ?

YES

► Go to "Component Inspection" procedure.

NO

► Repair or replace contact resistance or open in harness and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

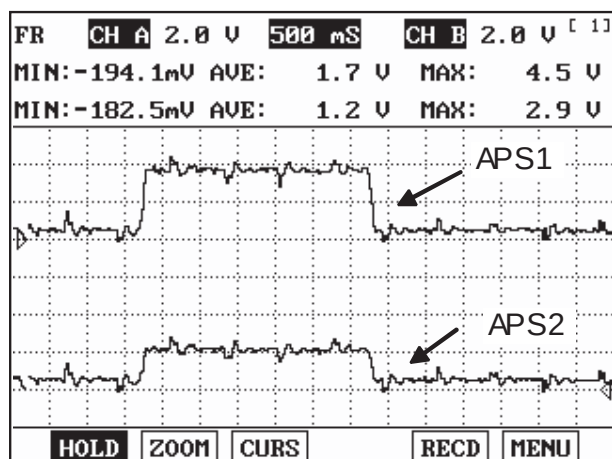
EF093B88

1. Check APS
 - 1) Ignition "ON" & ENG "OFF".

- 2) Measure waveform of APS by pressing and depressing accelerator pedal with scantool.

SPECIFICATION :

Pedal Position	Output Voltage(V) [Vref = 5.0V]	
	APS1	APS2
C.T	0.7 ~ 0.8V	0.29 ~ 0.46V
W.O.T	3.85 ~ 4.35V	1.93 ~ 2.18V



EGRF975A

- 3) Is the measured signal waveform O.K ?

YES

- Substitute with a known-good PCM and check for proper operation. If the problem is corrected,replace PCM and then go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM.

Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

- Substitute with a known-good APS and check for proper operation. If the problem is corrected,replace APS and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

E9D238F9

Refer to DTC P2122.

DTC TROUBLESHOOTING PROCEDURES

FLA -629

DTC P2127 THROTTLE/PEDAL POSITION SENSOR/SWITCH "E" CIRCUIT LOW INPUT

COMPONENT LOCATION E25E809E

Refer to DTC P2122.

GENERAL DESCRIPTION EB95F666

Refer to DTC P2122.

DTC DESCRIPTION ED213EE1

Checking output signals from APS 2, under detecting condition, if output signals are below the threshold, PCM sets P2127 and then MIL(Malfunction Indication Lamp) turns on.

DTC DETECTING CONDITION EA171D94

Item	Detecting Condition	Possible Cause
DTC Strategy	This code detects a continuous short to ground or open in either the circuit or the sensor	- Poor connection - Open or short to ground in Power Circuit - Open or short to ground in Signal Circuit - Faulty APS - Faulty PCM
Enable Conditions	Ignition "ON"	
Threshold	APS1 < 0.125V	
Diagnosis Time	Continueous	
MIL On Condition	1 Driving Cycle	

SPECIFICATION E2CFB9C8

Pedal Position	Output Voltage(V) [Vref = 5.0V]	
	APS1	APS2
C.T	0.7 ~ 0.8V	0.29 ~ 0.46V
W.O.T	3.85 ~ 4.35V	1.93 ~ 2.18V

SCHEMATIC DIAGRAM EAB6B552

Refer to DTC P2122.

SIGNAL WAVEFROM AND DATA E0A303E9

Refer to DTC P2122.

MONITOR DTC STATUS E088E573

Refer to DTC P2122.

TERMINAL AND CONNECTOR INSPECTION E782158C

Refer to DTC P2122.

POWER CIRCUIT INSPECTION

E32CA386

*(): W/O Pedal Adjust

1. IG "OFF".
2. Disconnect APS connector.
3. IG "ON" & ENG "OFF".
4. Measure voltage between terminal 3(6) of APS harness connector and chassis ground.

Specification : Approx. 5V

5. Is the measured voltage within specification ?

YES

► Go to "Signal Circuit Inspection" procedure.

NO

► Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION

E046360C

*(): W/O Pedal Adjust

1. Check short to ground in harness
 - 1) IG "OFF".
 - 2) Disconnect APS and PCM connector.
 - 3) Measure resistance between terminal 1(1) of APS harness connector and chassis ground.
 - 4) Measure resistance between terminal 1(1) and 5(4) of APS harness connector.
 - 5) Measure resistance between terminal 1(1) and 4(2) of APS harness connector.

Specification : Infinite

- 6) Is the measured resistance within specification ?

YES

► Go to "Check open in harness" as follows.

NO

► Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

2. Check open in harness

- 1) IG "OFF".
- 2) Disconnect APS and PCM connector.

DTC TROUBLESHOOTING PROCEDURES

FLA -631

- 3) Measure resistance between terminal 1(1) of APS harness connector and terminal 49 of PCM harness connector.

Specification : Approx. below 1Ω

- 4) Is the measured resistance within specification ?

YES

- Go to "Component Inspection" procedure.

NO

- Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

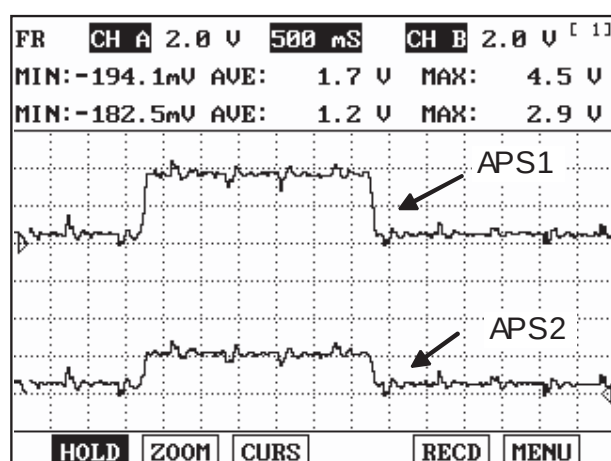
E95BEDB4

1. Check APS

- 1) Ignition "ON" & ENG "OFF".
- 2) Measure waveform of APS by pressing and depressing accellerator pedal with scantool.

SPECIFICATION :

Pedal Position	Output Voltage(V) [Vref = 5.0V]	
	APS1	APS2
C.T	0.7 ~ 0.8V	0.29 ~ 0.46V
W.O.T	3.85 ~ 4.35V	1.93 ~ 2.18V



EGRF975A

- 3) Is the measured signal waveform O.K ?

YES

- Substitute with a known-good PCM and check for proper operation. If the problem is corrected, replace PCM and then go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.

Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

- Substitute with a known-good APS and check for proper operation. If the problem is corrected, replace APS and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

E4CF9F32

Refer to DTC P2122.

DTC TROUBLESHOOTING PROCEDURES

FLA -633

DTC P2128 THROTTLE/PEDAL POSITION SENSOR/SWITCH "E" CIRCUIT HIGH INPUT

COMPONENT LOCATION E7A0BA19



SCMF16410L

GENERAL DESCRIPTION EB70AF82

The Electronic Throttle Control(ETC) system is made of the components throttle body, Throttle Position Sensor(TPS) 1 & 2 and Accelerator Position Sensor(APS) 1 & 2. The APS is mounted in the accelerator pedal to detect the opening angle of the accelerator pedal. It has 2 sensors to detect the accelerator position and a malfunction of the accelerator position sensor. The ECM judges the current opening angle of the accelerator pedal from APS1 & 2, and the ECM controls the throttle motor based on these signals.

DTC DESCRIPTION E8C2A639

Checking output signals from APS 2, under detecting condition, if output signals are above the threshold, PCM sets P2128 and then MIL(Malfunction Indication Lamp) turns on.

DTC DETECTING CONDITION E50B99ED

Item	Detecting Condition	Possible Cause
DTC Strategy	This code detects a continuous short to ground or open in either the circuit or the sensor	- Poor connection - Short to battery in Signal Circuit - Open in Ground Circuit - Faulty APS - Faulty PCM
Enable Conditions	Ignition "ON"	
Threshold	APS2 > 3V	
Diagnosis Time	Continuous	
MIL On Condition	1 Driving Cycle	

SPECIFICATION

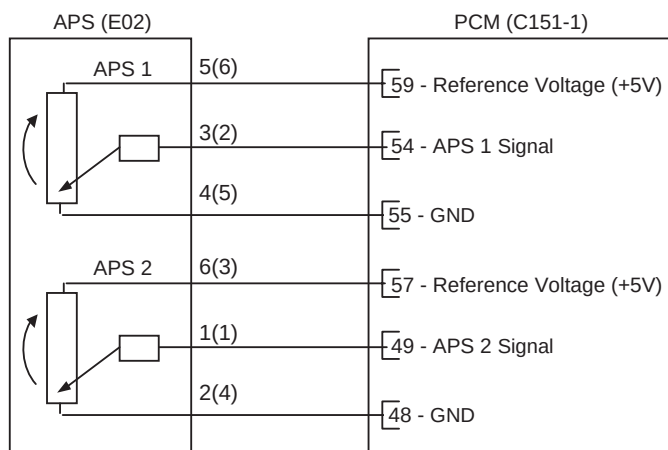
ED176FA6

Pedal Position	Output Voltage(V) [Vref = 5.0V]	
	APS1	APS2
C.T	0.7 ~ 0.8V	0.29 ~ 0.46V
W.O.T	3.85 ~ 4.35V	1.93 ~ 2.18V

SCHEMATIC DIAGRAM

EB805662

[CIRCUIT DIAGRAM]



* () : With Adjust Pedal

[CONNECTION INFORMATION]

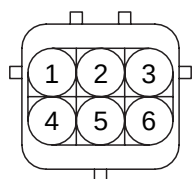
[WITH ADJUSTABLE PEDAL]

Terminal	Connected to	Function
1	PCM C151-1 (49)	APS 2 Signal
2	PCM C151-1 (54)	APS 1 Signal
3	PCM C151-1 (57)	APS 2 Reference Voltage (+5V)
4	PCM C151-1 (48)	APS 2 Ground
5	PCM C151-1 (55)	APS 1 Ground
6	PCM C151-1 (59)	APS 1 Reference Voltage (+5V)

[WITHOUT ADJUSTABLE PEDAL]

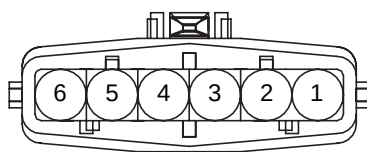
Terminal	Connected to	Function
1	PCM C151-1 (49)	APS 2 Signal
2	PCM C151-1 (48)	APS 2 Ground
3	PCM C151-1 (54)	APS 1 Signal
4	PCM C151-1 (55)	APS 1 Ground
5	PCM C151-1 (59)	APS 1 Reference Voltage (+5V)
6	PCM C151-1 (57)	APS 2 Reference Voltage (+5V)

[HARNESS CONNECTORS]



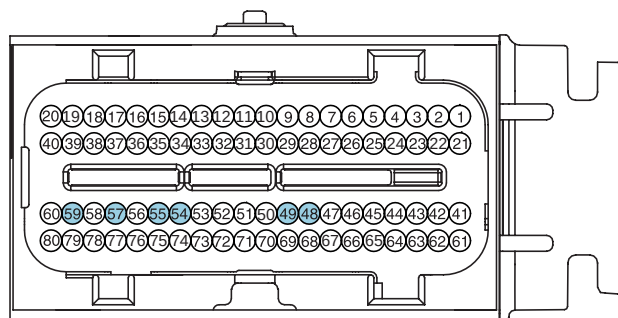
WITH ADJUSTABLE PEDAL

E02
APS



WITHOUT ADJUSTABLE PEDAL

E02
APS



C151-1
PCM

SVQF16124L

SIGNAL WAVEFROM AND DATA E2F1536A

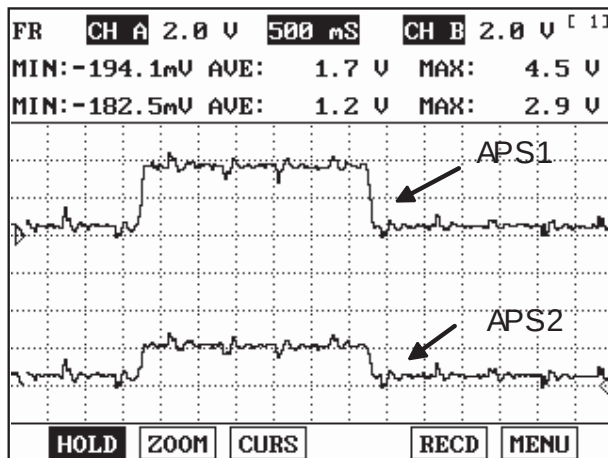


Fig. 1

Fig. 1 : This is a signal waveform of APS 1 & 2 which shows that APS 2 increases voltage just half of APS 1 voltage increase when acceleration.

EGRF970A

MONITOR DTC STATUS ECDE74E9

1. Check DTC Status

- 1) Connect scantool to Data Link Connector(DLC).
- 2) IG "ON".
- 3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F4(DTAL) to check DTC's information from the DTCs menu
- 4) Read "DTC Status" parameter.

1.1 DIAGNOSTIC TROUBLE CODES	
PXXXX	DTC TITLE
NUMBER OF DTC : 1 ITEMS	
PART	ERAS DTAL

PXXXX TITLE	
1.MIL STATUS:	ON/OFF
2.DTC STATUS:	PRESENT/HISTORY
3.DIAG.STATUS:	DIAGNOSIS FINISHED
DTC CAUSE TO SYSTEM ERROR : PXXXX	

SCMF16159L

5) Is parameter displayed "Present fault"?

YES

- Go to "Terminal and connector inspection" procedure.

NO

► Fault is intermittent caused by poor contact in the sensor' s and/or PCM' s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

TERMINAL AND CONNECTOR INSPECTION E9E39273

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

► Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

► Go to "Signal Circuit Inspection " procedure.

SIGNAL CIRCUIT INSPECTION EEFFBACB

*(): W/O Pedal Adjust

1. Check short to battery in harness
 - 1) IG "OFF".
 - 2) Disconnect APS and PCM connector.
 - 3) Measure resistance between terminal 1(1) and 3(6) of APS harness connector.
 - 4) Measure resistance between terminal 1(1) and 6(5) of APS harness connector.

Specification : Infinite

- 5) Is the measured reisistance within specification ?

YES

► Go to "Ground Circuit Inpsection" procedure.

NO

► Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION E3E6D32A

1. Check open in harness
 - 1) IG "OFF"

DTC TROUBLESHOOTING PROCEDURES

FLA -637

- 2) Disconnect APS connector.
- 3) Measure voltage between terminal 3(6) of APS harness connector and chassis ground.(Fig. A)
- 4) Measure voltage between terminal 3(6) and 4(2) of APS harness connector.(Fig. B)

Specification : Fig."A" - Fig. "B" = Approx. below 200V

- 5) Is the measured voltage within specification ?

YES

- Go to "Component Inspection" procedure.

NO

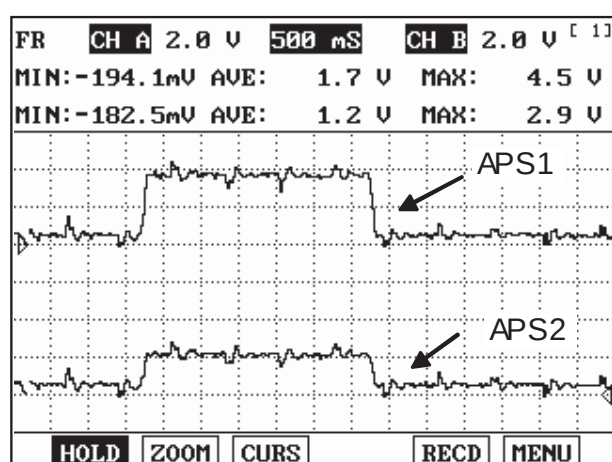
- Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

1. Check APS
 - 1) Ignition "ON" & ENG "OFF".
 - 2) Measure waveform of APS by pressing and depressing accelerator pedal with scantool.

SPECIFICATION :

Pedal Position	Output Voltage(V) [Vref = 5.0V]	
	APS1	APS2
C.T	0.7 ~ 0.8V	0.29 ~ 0.46V
W.O.T	3.85 ~ 4.35V	1.93 ~ 2.18V



EGRF975A

- 3) Is the measured signal waveform O.K. ?

YES

- Substitute with a known-good PCM and check for proper operation. If the problem is corrected, replace PCM and then go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.

Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

- ▶ Substitute with a known-good APS and check for proper operation. If the problem is corrected, replace APS and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

EFB6E222

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

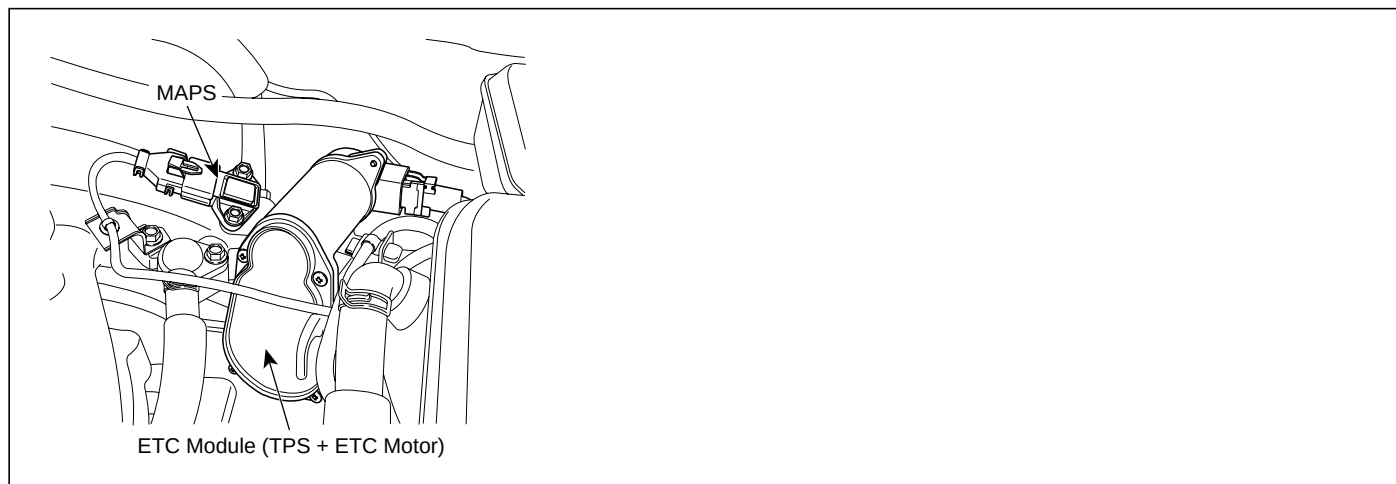
- ▶ System performing to specification at this time. Clear the DTC.

NO

- ▶ Go to the applicable troubleshooting procedure.

DTC P2135 THROTTLE/PEDAL POSITION SENSOR/SWITCH "A" / "B" VOLTAGE CORRELATION

COMPONENT LOCATION E54108CE



SCMF16192L

GENERAL DESCRIPTION EE7EF8F3

The Electronic Throttle Control(ETC) system is made of the components throttle body, Throttle Position Sensor(TPS)1 & 2 and Accelerator Position Sensor(APS) 1 & 2. TPS1 & 2 are sharing the same source voltage and ground. The throttle valve opening is control by throttle motor which is controlled by Engine Control Module(ECM). The opposite position indicator shows inverted signal characteristics. TPS1 output voltage increases smoothly in proportion with the throttle valve opening angle after starting. TPS2 output voltage decreases in inverse proportion with the throttle valve opening angle after starting. TPS provides feedback to the ECM to control the throttle motor in order to control the throttle valve opening angle properly in response to the driving condition.

DTC DESCRIPTION EF544ACE

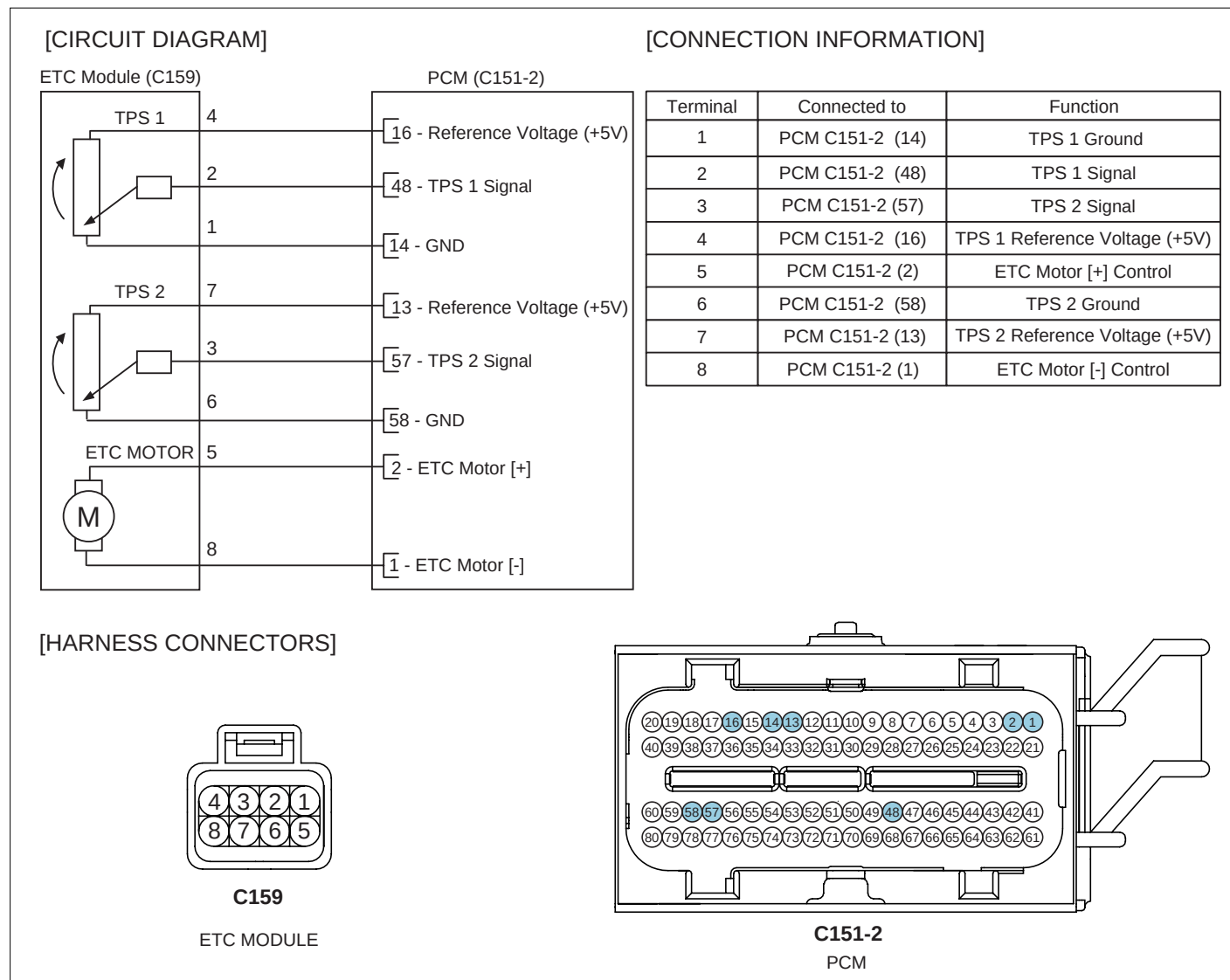
Checking output signals from TPS 1 and 2 under detecting condition, if output signals difference between TPS1 and TPS2 are detected more than 4.5% for the specified number of times., PCM sets P2135. And then MIL(Malfunction Indication Lamp) turns on.

DTC DETECTING CONDITION E5764B91

Item	Detecting Condition	Possible Cause
DTC Strategy	• Determines if TPS#1 disagrees with TPS#2	• Poor connection • Open or short in TPS circuit • Faulty TPS • Faulty PCM
Enable condition	• Ignition "ON"	
Threshold value	• Difference between average values of TPS1 and TPS2 > 4.5%	
Diagnosis time	• Continuous (More than 0.34sec failure for every 10.92sec. Test)	
MIL ON condition	• 1 Drivig cycle	

SCHEMATIC DIAGRAM

E6FFC24B



SVQF16101L

SPECIFICATION

E6C4A697

Throttle opening (°)	Output voltage(V) [Vref=5.0V]	
	TPS1	TPS2
0°	0.0V	5.0V
10°	0.5V	4.5V
20°	0.9V	4.1V
30°	1.4V	3.6V
40°	1.8V	3.2V
50°	2.3V	2.7V
60°	2.7V	2.3V
70°	3.2V	1.8V
80°	3.6V	1.4V

DTC TROUBLESHOOTING PROCEDURES

FLA -641

90°	4.1V	0.9V
100°	4.5V	0.5V
110°	5.0V	0.0V

MONITOR DTC STATUS E52B2098

1. Check DTC Status

- 1) Connect scantool to Data Link Connector(DLC).
- 2) IG "ON".
- 3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F4(DTAL) to check DTC's information from the DTCs menu
- 4) Read "DTC Status" parameter.

1.1 DIAGNOSTIC TROUBLE CODES		
PXXXX DTC TITLE		
NUMBER OF DTC : 1 ITEMS		
PART	ERAS	DTAL

PXXXX TITLE	
1.MIL STATUS:	ON/OFF
2.DTC STATUS:	PRESENT/HISTORY
3.DIAG.STATUS:	DIAGNOSIS FINISHED
DTC CAUSE TO SYSTEM ERROR : PXXXX	

SCMF16159L

5) Is parameter displayed "Present fault"?

YES

- Go to "Terminal and connector inspection" procedure.

NO

- Fault is intermittent caused by poor contact in the sensor' s and/or PCM' s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

TERMINAL AND CONNECTOR INSPECTION E18311F3

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

- ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

- ▶ Go to "Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION E9FFC195

1. IG "OFF".
2. Disconnect TPS connector.
3. IG "ON" & ENG "OFF".
4. Measure voltage between terminal 7 of TPS harness connector and chassis ground.
5. Measure voltage between terminal 4 of TPS harness connector and chassis ground.

Specification : Approx. 5V

6. Is the measured voltage within specification ?

YES

- ▶ Go to "Signal Circuit Inspection" procedure.

NO

- ▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION EF8A326B

1. IG "OFF".
2. Disconnect TPS & PCM connector.
3. Measure resistance between terminal 2 and 3 of TPS harness connector.

Specification : Infinite

4. Is the measured resistance within specification ?

YES

- ▶ Go to "Component Inspection" procedure.

NO

- ▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION ED70587B

1. Check TPS

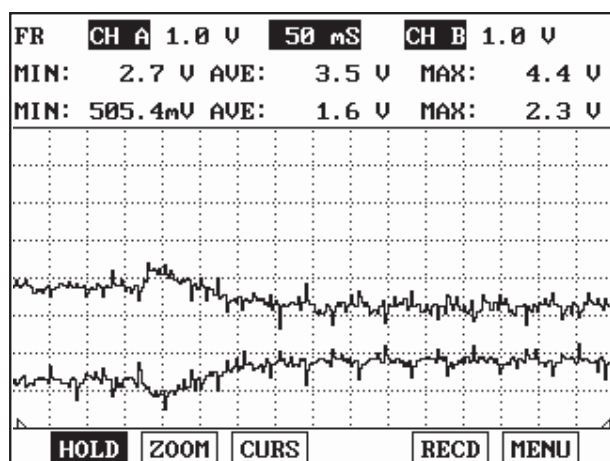
DTC TROUBLESHOOTING PROCEDURES

FLA -643

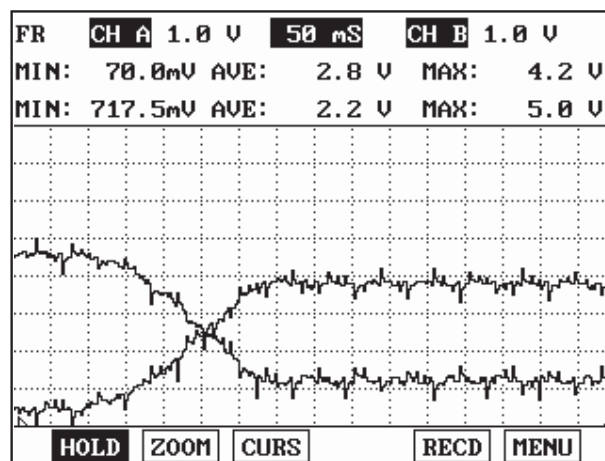
- 1) Ignition "ON" & ENG "OFF".
- 2) Monitor signal waveform of TPS by stepping on and off the accellerator padel on scantool

SPECIFICATION :

Throttle opening (°)	Output voltage(V) [Vref=5.0V]	
	TPS1	TPS2
0°	0.0V	5.0V
10°	0.5V	4.5V
20°	0.9V	4.1V
30°	1.4V	3.6V
40°	1.8V	3.2V
50°	2.3V	2.7V
60°	2.7V	2.3V
70°	3.2V	1.8V
80°	3.6V	1.4V
90°	4.1V	0.9V
100°	4.5V	0.5V
110°	5.0V	0.0V



Pressing accellerator pedal at idle



Pulling out accellerator cable with hand at idle

EGRF986A

- 3) Is the measured signal waveform O.K ?

YES

- Substitute with a known-good PCM and check for proper operation. If the problem is corrected,replace PCM and then go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM.

Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

► Substitute with a known-good TPS and check for proper operation. If the problem is corrected, replace TPS and then go to "Verification of Vehicle Repair" procedure.
(After replacing ETC, do initialization of ETC as follows)

※ Procedure of ETS Initialization

1. Erase the trouble codes on PCM
2. Turn the ignition key off and keep this condition until the main relay is turned off. (It will take 10sec.)
3. Turn ignition key on more than 1 second to record the throttle motor position on the EEPROM

VERIFICATION OF VEHICLE REPAIR ECE44003

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

► System performing to specification at this time. Clear the DTC.

NO

► Go to the applicable troubleshooting procedure.

DTC TROUBLESHOOTING PROCEDURES

FLA -645

DTC P2138 THROTTLE/PEDAL POSITION SENSOR/SWITCH "D" / "E" VOLTAGE CORRELATION

COMPONENT LOCATION EC293548

Refer to DTC P2128.

GENERAL DESCRIPTION EE42BF44

Refer to DTC P2128.

DTC DESCRIPTION E52F0EF2

Checking output signals from APS 1 and 2, under detecting condition, if output signals difference between APS 1 and 2 are detected more than 4.5% for the specified number of times., PCM sets P2138 and then MIL(Malfunction Indication Lamp) turns on.

DTC DETECTING CONDITION E658889F

Item	Detecting Condition	Possible Cause
DTC Strategy	This code detects a correlation error between APS 1 and APS 2	- Poor connection - Open or short in APS Circuit - Faulty APS - Faulty PCM
Enable condition	Ignition "ON"	
Threshold value	Difference between APS1 and APS2 Normalized values > 4.5%	
Diagnosis time	Continuous	
MIL ON condition	1 Driving Cycle	

SPECIFICATION E5ADAEB3

Pedal Position	Output Voltage(V) [Vref = 5.0V]	
	APS1	APS2
C.T	0.7 ~ 0.8V	0.29 ~ 0.46V
W.O.T	3.85 ~ 4.35V	1.93 ~ 2.18V

SCHEMATIC DIAGRAM EB14BE4E

Refer to DTC P2128.

SIGNAL WAVEFROM AND DATA E2010367

Refer to DTC P2128.

MONITOR DTC STATUS EF6ECCAA

Refer to DTC P2128.

TERMINAL AND CONNECTOR INSPECTION EFE15F35

Refer to DTC P2128.

POWER CIRCUIT INSPECTION EEB805D6

*(): W/O Pedal Adjust

1. IG "OFF"
2. Disconnect APS connector.
3. IG "ON" & ENG "OFF".
4. Measure voltage between terminal 3(6) of APS harness connector and chassis ground.
5. Measure voltage between terminal 6(5) of APS harness connector and chassis ground.

Specification : Approx. 5V

6. Is the measured voltage within specification ?

YES

- ▶ Go to "Signal Circuit Inspection" procedure.

NO

- ▶ Repair or replace as necessary and then, go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION ECC0CD0B

*(): W/O Pedal Adjust

1. IG "OFF".
2. Disconnect APS and PCM connector.
3. Measure resistance between terminal 1(1) and 2(3) of APS harness connector.

Specification : Infinite

4. Is the measured resistance within specification ?

YES

- ▶ Go to "Component Inspection" procedure.

NO

- ▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E5400450

1. Check APS
 - 1) IG "ON" & ENG "OFF".

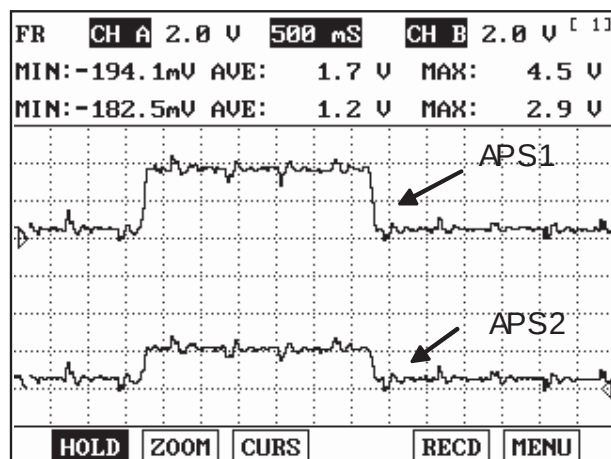
DTC TROUBLESHOOTING PROCEDURES

FLA -647

- 2) Measure signal waveform of APS 1 and APS 2 by stepping on and off with scantool

SPECIFICATION :

Pedal Position	Output Voltage(V) [Vref = 5.0V]	
	APS1	APS2
C.T	0.7 ~ 0.8V	0.29 ~ 0.46V
W.O.T	3.85 ~ 4.35V	1.93 ~ 2.18V



EGRF986E

- 3) Is the measured signal waveform O.K ?

YES

- Substitute with a known-good PCM and check for proper operation. If the problem is corrected, replace PCM and then go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.

Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

- Substitute with a known-good APS and check for proper operation. If the problem is corrected, replace APS and then go to "Verification of Vehicle Repair" procedure.

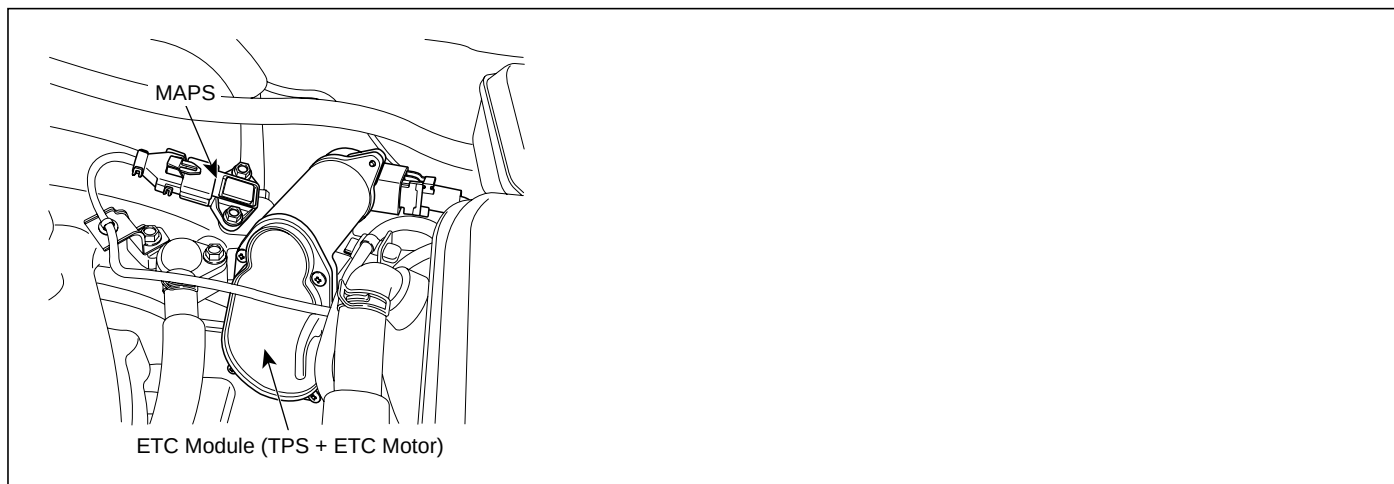
VERIFICATION OF VEHICLE REPAIR

EE76DF17

Refer to DTC P2128.

DTC P2173 ETC (ELECTRONIC THROTTLE CONTROL) SYSTEM MALFUNCTION - HIGH AIR FLOW DETECTED

COMPONENT LOCATION EFFBE3B3



SCMF16192L

GENERAL DESCRIPTION E292F965

The Electronic Throttle Control(ETC) system is made of the components throttle body, Throttle Position Sensor(TPS)1 & 2 and Accelerator Position Sensor(APS) 1 & 2. The throttle body contains the actuator, the throttle plate and the throttle position sensor (potentiometer), which are integrated in one housing. The actuator consists of a DC motor with a two-stage gear. The opening angle of the throttle valve is detected by the throttle position sensor which is mounted on the throttle body. And it provides feedback to the ECM to control the throttle motor in order to control the throttle valve opening angle properly in response to the driving condition.

DTC DESCRIPTION E2141A89

Comparing real intake air flow and the intake air flow calculated by ETS under detecting condition, if the air flow more than threshold value is detected for more than 19 sec., PCM sets P2173. And then MIL(Malfunction Indication Lamp) turns on.

DTC DETECTING CONDITION EE78EB92

Item		Detecting Condition	Possible Cause
DTC Strategy		Monitor the measured engine airflow and the estimated airflow	- Air Leakage between TPS and MAFS - Faulty throttle body or intake manifold - Faulty PCM
Enable Conditions		- Engine running - No faults present	
Thresh- old	Case 1	MAPS reading - ETC estimated airflow > 9 g/s	
	Case 2	MAFS reading - ETC estimated airflow > 7g/s	
Diagnosis Time		Contineous (Within 20 sec.)	
MIL On Condition		1 Driving Cycle	

DTC TROUBLESHOOTING PROCEDURES

FLA -649

SPECIFICATION E6F349EF

MAFS

Air flow (kg/h)	Frequency (Hz)
0 kg/h	720 ~ 880 Hz
12.6 kg/h	2,595 Hz
18.0 kg/h	2,930 Hz
23.4 kg/h	3,208 Hz
32.4 kg/h	3,609 Hz
43.2 kg/h	3,975 Hz
57.6 kg/h	4,361 Hz
72.0 kg/h	4,683 Hz
108.0 kg/h	5,362 Hz
144.0 kg/h	5,885 Hz
198.0 kg/h	6,527 Hz
270.0 kg/h	7,219 Hz
360.0 kg/h	7,945 Hz
486.0 kg/h	8,736 Hz
666.0 kg/h	9,660 Hz
900.0 kg/h	10,613 Hz

TPS

Throttle opening (°)	Output voltage(V) [Vref=5.0V]	
	TPS1	TPS2
0°	0.0V	5.0V
10°	0.5V	4.5V
20°	0.9V	4.1V
30°	1.4V	3.6V
40°	1.8V	3.2V
50°	2.3V	2.7V
60°	2.7V	2.3V
70°	3.2V	1.8V
80°	3.6V	1.4V
90°	4.1V	0.9V
100°	4.5V	0.5V
110°	5.0V	0.0V

MAPS

Pressure(kPa)(kPa)	Output voltage(V)
20.0kPa	0.79V
35kPa	1.382V

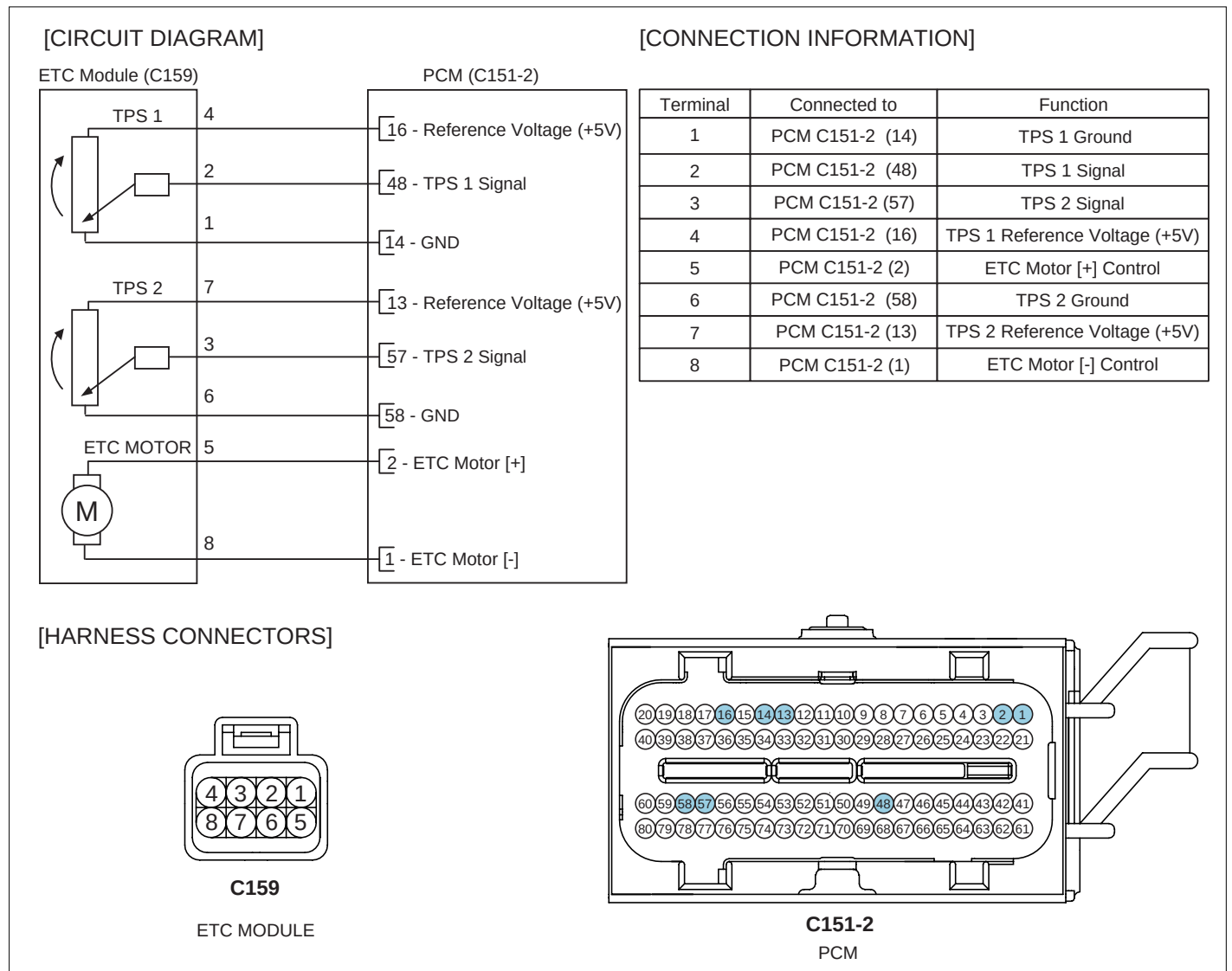
FLA -650

FUEL SYSTEM

46.66kPa	1.84V
60kPa	2.369V
90kPa	3.75V
101.32kPa	4.00V

SCHEMATIC DIAGRAM

E4E2CD87



SVQF16101L

MONITOR DTC STATUS

EAB43615

1. Check DTC Status

- 1) Connect scantool to Data Link Connector(DLC).
- 2) IG "ON".
- 3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F4(DTAL) to check DTC's information from the DTCs menu
- 4) Read "DTC Status" parameter.

1.1 DIAGNOSTIC TROUBLE CODES			
PXXXX DTC TITLE			
NUMBER OF DTC : 1 ITEMS			
PART	ERAS	DTAL	

PXXXX TITLE	
1.MIL STATUS:	ON/OFF
2.DTC STATUS:	PRESENT/HISTORY
3.DIAG.STATUS:	DIAGNOSIS FINISHED
DTC CAUSE TO SYSTEM ERROR : PXXXX	

SCMF16159L

5) Is parameter displayed "Present fault"?

YES

► Go to "System inspection" procedure.

NO

► Fault is intermittent caused by poor contact in the sensor' s and/or PCM' s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

SYSTEM INSPECTION EFDBC19F

1. Visual Inspection

- 1) Check the air hose between MAFS and throttle body is torn or installation.
- 2) Check deforamtion, crack or installation of throttle valve(body)
- 3) Has a problem been found ?

YES

► Substitute with a known-good Air hose or throttle body and check for proper operation. If the problem is corrected,replace air hose or throttle body and then go to "Verification of Vehicle Repair" procedure.

NO

► Substitute with a known-good PCM and check for proper operation. If the problem is corrected,replace PCM and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR ED410949

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.

FLA -652

FUEL SYSTEM

2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

- ▶ System performing to specification at this time. Clear the DTC.

NO

- ▶ Go to the applicable troubleshooting procedure.

DTC P2187 SYSTEM TOO LEAN AT IDLE (←ADDITIVE) (BANK 1)

GENERAL DESCRIPTION EC6A1680

In order to provide the best possible combination of drivability, fuel economy and emission control, the ECM uses a closed loop air/fuel metering system. The ECM monitors the HO2S signal voltage and adjusts fuel delivery based it in closed loop fuel control. Changes in fuel delivery will be indicated by the long-term and the short-term fuel trim values. The ideal fuel trim value is around 0%. The ECM will add fuel when the HO2S signal is Indicating a lean condition. Additional fuel is indicated by fuel trim values that are above 0%. The ECM will reduce fuel when the HO2S signal is Indicating a rich condition. Reduction in fuel is indicated by fuel trim values that are below 0%. The DTC relevant to fuel trim will be set when the amount reaches excessive levels because of a lean or rich condition.

DTC DESCRIPTION E072F760

Checking the fuel trime value at idle under detecting condition, if its average exceeds the limit over certain period, PCM sets P2187. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E36D2926

Item	Detecting Condition	Possible cause
DTC Strategy	Monitor the fuel trim value at idle	- Air leakage - Improper fuel pressure - PCV valve stuck - Clogging of injector
Enable Conditions	- Engine warm-up sufficiently - Engine running under Idle state over 5 minutes 60°C(140°F) ≤ Engine coolant temperature ≤ 115°C(239°F) - No disabling faults (DTCs related to HO2S, purge valve,catalyst)	
Threshold value	Average of short term fuel trim > 0.8 and Average of long term fuel trim > 1.24	
Diagnosis Time	Continuous	
MIL On Condition	2 Driving Cycles	

MONITOR DTC STATUS ED3BB1B6

- Monitor DTCs related to HO2S, MAFS, MAPS, ECTS, PCSV, Injector or CVVT items with scantool.
- Are there the DTCs above-mentioned?

YES

- ▶ Do all repairs associated with those codes before proceeding with this procedure.

NO

- ▶ Go to "System Inspection" procedure

SYSTEM INSPECTION E0780E15

- Check air leakage
 - Visually/physically inspect the air leakage in intake/exhaust system for following items
 - ▶ Throttle body gasket

- ▶ Gasket between intake manifold and cylinder head
- ▶ Seals between intake manifold and fuel injectors
- ▶ Exhaust system between HO2S and three way catalyst for air leakage

2) Has a problem found in this procedure?

YES

- ▶ Repair or replace it which has a problem, and go to "Verification of Vehicle Repair" procedure.

NO

- ▶ Go to "Check the fuel line" as follows

2. Check the fuel line

- 1) Check the fuel line for following items.
 - ▶ Connector connection state
 - ▶ Damage/ connection state for vacuum hoses connected to fuel line
 - ▶ Bent/ pressed/ twisted fuel line or fuel leakage

2) Has a problem found in this procedure?

YES

- ▶ Repair or replace it which has a problem, and go to " Verification of Vehicle Repair" procedure.

NO

- ▶ Go to "Check fuel pressure" as follows

3. Check fuel pressure



NOTE

- Be cautious that Fuel is explosive and an empty fuel tank can still contain explosive gases. When working on fuel system make sure to supply adequate ventilation to the work area. Do not smoke, and keep sparks and open flames away.
- The fuel system remains under pressure when the engine is not running. Release fuel system pressure before disconnecting any fuel line to reduce the chance of personal injury or fire damage to vehicle components.

- 1) IG "OFF" and disconnect Fuel Pump Relay in Junction Box.
- 2) Start-up and wait until it stops itself.
- 3) IG "OFF" and connect Fuel Pump Relay.
- 4) Install the fuel pressure gauge to the delivery pipe with the fuel pressure gauge adaptor.
- 5) Activate the fuel pump, and with fuel pressure applied, check that there is no fuel leakage from the pressure gauge or connection part.
- 6) Measure the fuel pressure at idle.

Specification : 374.6 ~ 384.4 kPa(3.82 ~ 3.92 kg/cm², 54.3 ~ 55.8 psi)

7) Is the measured fuel pressure within specifications ?

YES

DTC TROUBLESHOOTING PROCEDURES

FLA -655

- ▶ Go to "Component Inspection" procedure.

NO

- ▶ Repair or replace according to the below table. And then, go to " Verification of Vehicle Repair"procedure.

Condition	Possible Cause
Fuel pressure too low	Fuel filter,fuel pressure regulator, in-tank fuel hose or the fuel pump
Fuel pressure too high	Fuel pressure regulator, hose or pipe

COMPONENT INSPECTION

E0ABE2C2

1. Check PCV

- 1) IG "OFF" and remove PCV valve from rocker cover.
- 2) Insert a thin stick into the PCV valve from the threaded side and verify that the plunger is moving.
- 3) Is the PCV valve normally moving?

YES

- ▶ Go to "Check injector" as follows

NO

- ▶ Replace it, and go to "Verification of Vehicle Repair" procedure.

2. Check injector for normal operation

- 1) Start engine.
- 2) Check its RPM decrease when doing the injector's actuation test
- 3) Is there any cylinder with no change in RPM or only a small change in RPM?

YES

- ▶ Clear DTC and Test-drive under enable conditions above-mentioned. After the test, If this DTC is set, go to "Inspection & Repair" procedure. If not, troubleshooting is completed.

NO

- ▶ Replace injector, and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

EABAD7B7

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.

4. Is parameter displayed "History(Not Present) fault"?

YES

- ▶ System performing to specification at this time. Clear the DTC.

NO

- ▶ Go to the applicable troubleshooting procedure.

DTC TROUBLESHOOTING PROCEDURES

FLA -657

DTC P2188 SYSTEM TOO RICH AT IDLE (BANK 1)

GENERAL DESCRIPTION E608ACB0

Refer to DTC P2187.

DTC DESCRIPTION EF24E337

Checking the fuel trime value at idle under detecting condition, if its average exceeds the limit over certain period, PCM sets P2188. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E45CB3DA

Item	Detecting Condition	Possible cause
DTC Strategy	Monitor the fuel trim value at idle	- Blocking of intake system - Fuel leakage in injector - Improper fuel pressure
Enable Conditions	- Engine warm-up sufficiently - Engine running under Idle state over 5 minutes 60°C(140°F) ≤ Engine coolant temperature ≤ 115°C(239°F) - No disabling faults (DTCs related to HO2S, purge valve,catalyst)	
Threshold value	Average of short term fuel trim < 1.5 and Average of long term fuel trim < 0.76	
DiagnosisTime	Continuous	
MIL On Condition	2 Driving Cycles	

MONITOR DTC STATUS E8E61521

Refer to DTC P2187.

SYSTEM INSPECTION E465FC4C

1. Check blocking of intake system

- 1) Visually/physically inspect the blocking in intake system for following items
 - ▶ Throttle body gasket and damage
 - ▶ Blocking in intake manifold and injector caused by any foreign substance

2) Has a problem found?

YES

- ▶ Repair or replace it, and go to "Verification of Vehicle Repair" procedure.

NO

- ▶ Go to " Check fuel pressure" as follows.

2. Check the fuel line

- 1) Check the fuel line for following items.
 - ▶ Connector connection state

- ▶ Damage/ connection state for vacuum hoses connected to fuel line
- ▶ Bent/ pressed/ twisted fuel line or fuel leakage

2) Has a problem found in this procedure?

YES

- ▶ Repair or replace it which has a problem, and go to " Verification of Vehicle Repair" procedure.

NO

- ▶ Go to "Check fuel pressure" as follows

3. Check fuel pressure



NOTE

- Be cautious that Fuel is explosive and an empty fuel tank can still contain explosive gases. When working on fuel system make sure to supply adequate ventilation to the work area. Do not smoke, and keep sparks and open flames away.
- The fuel system remains under pressure when the engine is not running. Release fuel system pressure before disconnecting any fuel line to reduce the chance of personal injury or fire damage to vehicle components.

- 1) IG "OFF" and disconnect Fuel Pump Relay in Junction Box.
- 2) Start-up and wait until it stops itself.
- 3) IG "OFF" and connect Fuel Pump Relay.
- 4) Install the fuel pressure gauge to the delivery pipe with the fuel pressure gauge adaptor.
- 5) Activate the fuel pump, and with fuel pressure applied, check that there is no fuel leakage from the pressure gauge or connection part.
- 6) Measure the fuel pressure at idle.

Specification : 374.6 ~ 384.4 kPa(3.82 ~ 3.92 kg/cm², 54.3 ~ 55.8 psi)

7) Is the measured fuel pressure within specifications ?

YES

- ▶ Go to "Check fuel leakage in injector" as follow.

NO

- ▶ Repair or replace according to the below table. And then, go to " Verification of Vehicle Repair"procedure.

Condition	Possible Cause
Fuel pressure too low	Fuel filter,fuel pressure regulator, in-tank fuel hose or the fuel pump
Fuel pressure too high	Fuel pressure regulator, hose or pipe

4. Check fuel leakage in injector

- 1) IG "OFF" after checking the fuel pressure test.
- 2) Stop engine and check for a change in the fuel pressure gauge reading for 5 minutes.

DTC TROUBLESHOOTING PROCEDURES

FLA -659

Specification : After engine stops, fuel gauge reading is maintained for 5 minutes.

3) Is the fuel gauge reading maintained ?

YES

► Clear DTC and Test-drive under enable conditions above-mentioned. After the test, If this DTC is set, go to "Inspection & Repair" procedure. If not, troubleshooting is completed.

NO

► There is a fuel leakage in injector. Replace it, and go to " Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

ED8766A7

Refer to DTC P2187.

DTC P2189 SYSTEM TOO LEAN AT IDLE (←ADDITIVE) (BANK 2)

GENERAL DESCRIPTION ED5D6E4D

Refer to DTC P2187.

DTC DESCRIPTION EFBBE190

Checking the fuel trime value at idle under detecting condition, if its average exceeds the limit over certain period, PCM sets P2189. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION ED790AA3

Item	Detecting Condition	Possible cause
DTC Strategy	Monitor the fuel trim value at idle	- Air leakage - Improper fuel pressure - PCV valve stuck - Clogging of injector
Enable Conditions	- Engine warm-up sufficiently - Engine running under Idle state over 5 minutes 60℃(140°F) ≤ Engine coolant temperature ≤ 115℃(239°F) - No disabling faults (DTCs related to HO2S, purge valve,catalyst)	
Threshold value	Average of short term fuel trim > 0.8 and Average of long term fuel trim > 1.24	
Diagnosis Time	Continuous	
MIL On Condition	2 Driving Cycles	

MONITOR DTC STATUS EC49B27C

Refer to DTC P2187.

SYSTEM INSPECTION ECAE320A

1. Check air leakage

- 1) Visually/physically inspect the air leakage in intake/exhaust system for following items
 - ▶ Throttle body gasket
 - ▶ Gasket between intake manifold and cylinder head
 - ▶ Seals between intake manifold and fuel injectors
 - ▶ Exhaust system between HO2S and three way catalyst for air leakage

2) Has a problem found in this procedure?

YES

- ▶ Repair or replace it which has a problem, and go to "Verification of Vehicle Repair" procedure.

NO

- ▶ Go to "Check the fuel line" as follows

2. Check the fuel line

- 1) Check the fuel line for following items.

DTC TROUBLESHOOTING PROCEDURES

FLA -661

- ▶ Connector connection state
- ▶ Damage/ connection state for vacuum hoses connected to fuel line
- ▶ Bent/ pressed/ twisted fuel line or fuel leakage

2) Has a problem found in this procedure?

YES

- ▶ Repair or replace it which has a problem, and go to " Verification of Vehicle Repair" procedure.

NO

- ▶ Go to "Check fuel pressure" as follows

3. Check fuel pressure



NOTE

- Be cautious that Fuel is explosive and an empty fuel tank can still contain explosive gases. When working on fuel system make sure to supply adequate ventilation to the work area. Do not smoke, and keep sparks and open flames away.
- The fuel system remains under pressure when the engine is not running. Release fuel system pressure before disconnecting any fuel line to reduce the chance of personal injury or fire damage to vehicle components.

- 1) IG "OFF" and disconnect Fuel Pump Relay in Junction Box.
- 2) Start-up and wait until it stops itself.
- 3) IG "OFF" and connect Fuel Pump Relay.
- 4) Install the fuel pressure gauge to the delivery pipe with the fuel pressure gauge adaptor.
- 5) Activate the fuel pump, and with fuel pressure applied, check that there is no fuel leakage from the pressure gauge or connection part.
- 6) Measure the fuel pressure at idle.

Specification : 374.6 ~ 384.4 kPa(3.82 ~ 3.92 kg/cm², 54.3 ~ 55.8 psi)

7) Is the measured fuel pressure within specifications ?

YES

- ▶ Go to "Component Inspection" procedure.

NO

- ▶ Repair or replace according to the below table. And then, go to " Verification of Vehicle Repair" procedure.

Condition	Possible Cause
Fuel pressure too low	Fuel filter, fuel pressure regulator, in-tank fuel hose or the fuel pump
Fuel pressure too high	Fuel pressure regulator, hose or pipe

COMPONENT INSPECTION

E99102B3

1. Check PCV

- 1) IG "OFF" and remove PCV valve from rocker cover.
- 2) Insert a thin stick into the PCV valve from the threaded side and verify that the plunger is moving.
- 3) Is the PCV valve normally moving?

YES

- ▶ Go to "Check injector" as follows

NO

- ▶ Replace it, and go to "Verification of Vehicle Repair" procedure.

2. Check injector for normal operation

- 1) Start engine.
- 2) Check its RPM decrease when doing the injector's actuation test
- 3) Is there any cylinder with no change in RPM or only a small change in RPM?

YES

- ▶ Clear DTC and Test-drive under enable conditions above-mentioned. After the test, If this DTC is set, go to "Inspection & Repair" procedure. If not, troubleshooting is completed.

NO

- ▶ Replace injector, and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E061830A

Refer to DTC P2187.

DTC TROUBLESHOOTING PROCEDURES

FLA -663

DTC P2190 SYSTEM TOO RICH AT IDLE (BANK 2)

GENERAL DESCRIPTION ED09B0C8

Refer to DTC P2187.

DTC DESCRIPTION EF466F70

Checking the fuel trime value at idle under detecting condition, if its average exceeds the limit over certain period, PCM sets P2190. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION EFDE060E

Item	Detecting Condition	Possible cause
DTC Strategy	Monitor the fuel trim value at idle	- Blocking of intake system - Fuel leakage in injector - Improper fuel pressure
Enable Conditions	- Engine warm-up sufficiently - Engine running under Idle state over 5 minutes 60°C(140°F) ≤ Engine coolant temperature ≤ 115°C(239°F) - No disabling faults (DTCs related to HO2S, purge valve,catalyst)	
Threshold value	Average of short term fuel trim < 1.5 and Average of long term fuel trim < 0.76	
DiagnosisTime	Continuous	
MIL On Condition	2 Driving Cycles	

MONITOR DTC STATUS E4C37A84

Refer to DTC P2187.

SYSTEM INSPECTION ECB8A460

1. Check blocking of intake system

- 1) Visually/physically inspect the blocking in intake system for following items
 - ▶ Throttle body gasket and damage
 - ▶ Blocking in intake manifold and injector caused by any foreign substance

2) Has a problem found?

YES

- ▶ Repair or replace it, and go to "Verification of Vehicle Repair" procedure.

NO

- ▶ Go to " Check fuel pressure" as follows.

2. Check the fuel line

- 1) Check the fuel line for following items.
 - ▶ Connector connection state
 - ▶ Damage/ connection state for vacuum hoses connected to fuel line

► Bent/ pressed/ twisted fuel line or fuel leakage

2) Has a problem found in this procedure?

YES

► Repair or replace it which has a problem, and go to " Verification of Vehicle Repair" procedure.

NO

► Go to "Check fuel pressure" as follows

3. Check fuel pressure



NOTE

- Be cautious that Fuel is explosive and an empty fuel tank can still contain explosive gases. When working on fuel system make sure to supply adequate ventilation to the work area. Do not smoke, and keep sparks and open flames away.
- The fuel system remains under pressure when the engine is not running. Release fuel system pressure before disconnecting any fuel line to reduce the chance of personal injury or fire damage to vehicle components.

1) IG "OFF" and disconnect Fuel Pump Relay in Junction Box.

2) Start-up and wait until it stops itself.

3) IG "OFF" and connect Fuel Pump Relay.

4) Install the fuel pressure gauge to the delivery pipe with the fuel pressure gauge adaptor.

5) Activate the fuel pump, and with fuel pressure applied, check that there is no fuel leakage from the pressure gauge or connection part.

6) Measure the fuel pressure at idle.

Specification : 374.6 ~ 384.4 kPa(3.82 ~ 3.92 kg/cm², 54.3 ~ 55.8 psi)

7) Is the measured fuel pressure within specifications ?

YES

► Go to "Check fuel leakage in injector" as follow.

NO

► Repair or replace according to the below table. And then, go to " Verification of Vehicle Repair"procedure.

Condition	Possible Cause
Fuel pressure too low	Fuel filter,fuel pressure regulator, in-tank fuel hose or the fuel pump
Fuel pressure too high	Fuel pressure regulator, hose or pipe

4. Check fuel leakage in injector

1) IG "OFF" after checking the fuel pressure test.

2) Stop engine and check for a change in the fuel pressure gauge reading for 5 minutes.

DTC TROUBLESHOOTING PROCEDURES

FLA -665

Specification : After engine stops, fuel gauge reading is maintained for 5 minutes.

3) Is the fuel gauge reading maintained ?

YES

► Clear DTC and Test-drive under enable conditions above-mentioned. After the test, If this DTC is set, go to "Inspection & Repair" procedure. If not, troubleshooting is completed.

NO

► There is a fuel leakage in injector. Replace it, and go to " Verification of Vehicle Repair" procedure.

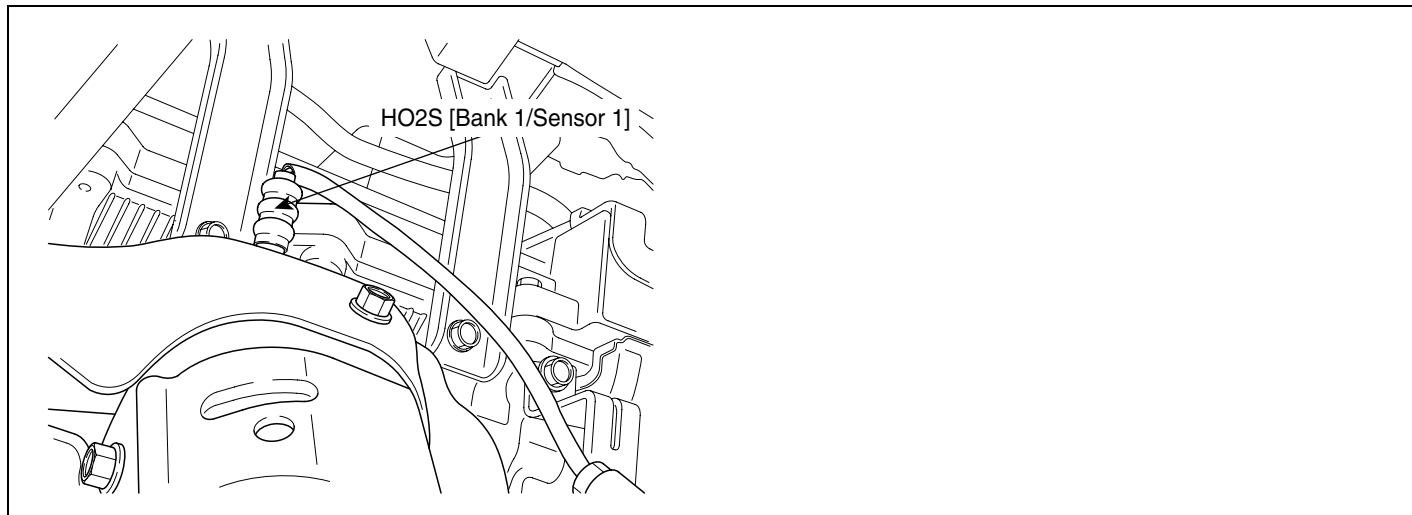
VERIFICATION OF VEHICLE REPAIR

E72F95D0

Refer to DTC P2187.

DTC P2195 HO2S SIGNAL STUCK LEAN (BANK 1 / SENSOR 1)

COMPONENT LOCATION E74F8321



LGLG504A

GENERAL DESCRIPTION E72A34C4

In order to control emissions of the CO, HC and NO_x components of the exhaust gas, heated oxygen sensor (HO2S), mounted on the front side and rear side of catalytic converter, detects the oxygen content in the exhaust gas. The front HO2S signal is used to control air/fuel ratio (closed loop fuel control) and the rear HO2S signal is used to monitor front HO2S and catalyst for proper operation. The HO2S requires a minimum temperature to operate properly and provide a closed loop fuel control system. The HO2S contains the heater element to reduce its warming-up time and ensure its performance during all driving conditions. The oxygen sensor generates a voltage that indicates the difference between the oxygen content of the exhaust stream and the oxygen content of ambient air. When the exhaust stream is “ rich,” there is more oxygen in the ambient air than in the exhaust stream, so the voltage will be higher.

DTC DESCRIPTION E622C1AE

Checking output signals from HO2S under detecting condition, if HO2S's signal is lean during power enrichment conditions, PCM sets P2195. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E1EC9544

Item	Detecting Condition	Possible cause
DTC Strategy	Monitor HO2S's signal	- Poor Connection - Faulty HO2S - Clogging of fuel filter in fuel pump - Faulty PCM
Enable Conditions	- Battery voltage $\geq 10V$ - Engine running $\geq 60\text{sec.}$ - Power Enrichment conditions - Engine warm-up state - Not in Transient Conditions	
Threshold value	HO2S's signal $< 0.35V$ and Air Fuel Ratio ≤ 13.5	
DiagnosisTime	Continuous (More than 8 sec. failure for every 9 sec. Test)	
MIL On Condition	2 Driving Cycles	

DTC TROUBLESHOOTING PROCEDURES

FLA -667

SPECIFICATION EF6C8E54

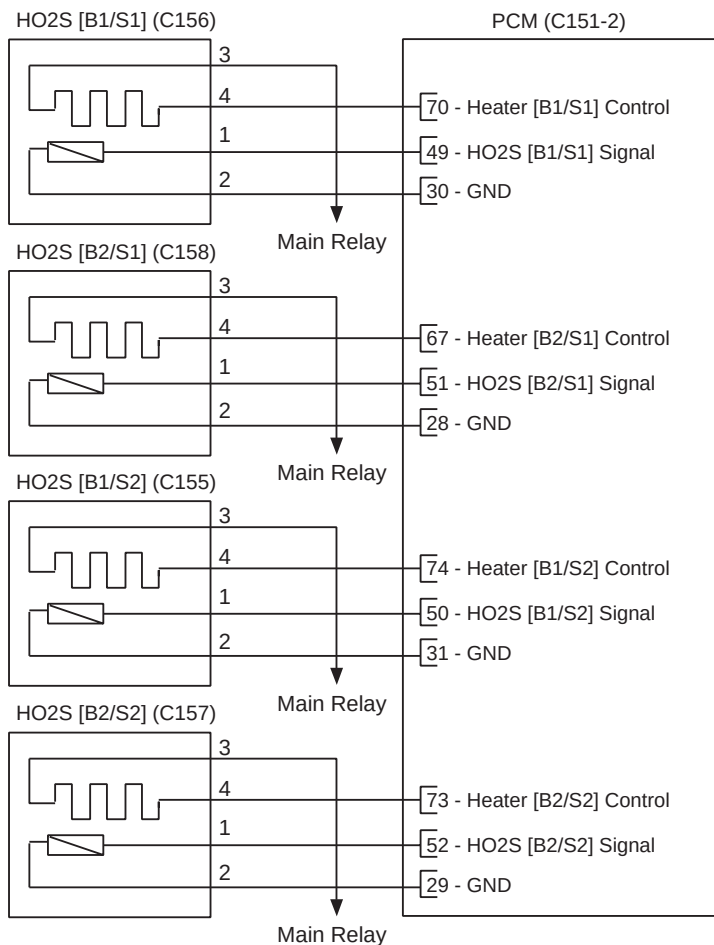
(REFERENCE ONLY)

Test Condition	HO2S Voltage(Sensor1)	HO2S Voltage(Sensor2)
HO2S Signal at idle after warm-up	Signal is commonly switching from rich to lean more than 3 times in 10 sec.	Signal is commonly above 0.6V.
HO2S signal at open circuit (Pumping current OFF)	Approx. 0.45V	
HO2S signal at open circuit (Pumping current ON)	Approx. 3.5V	

SCHEMATIC DIAGRAM

EF321788

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

HO2S [B1/S1]

Terminal	Connected to	Function
1	PCM C151-2 (49)	HO2S [B1/S1] Signal
2	PCM C151-2 (30)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C151-2 (70)	Heater [B1/S1] Control

HO2S [B2/S1]

Terminal	Connected to	Function
1	PCM C151-2 (51)	HO2S [B2/S1] Signal
2	PCM C151-2 (28)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C151-2 (67)	Heater [B2/S1] Control

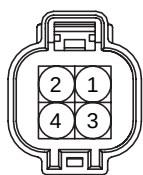
HO2S [B1/S2]

Terminal	Connected to	Function
1	PCM C151-2 (50)	HO2S [B1/S2] Signal
2	PCM C151-2 (31)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C151-2 (74)	Heater [B1/S2] Control

HO2S [B2/S2]

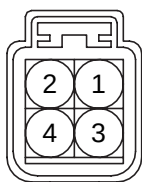
Terminal	Connected to	Function
1	PCM C151-2 (52)	HO2S [B2/S2] Signal
2	PCM C151-2 (29)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C151-2 (73)	Heater [B2/S2] Control

[HARNESS CONNECTORS]



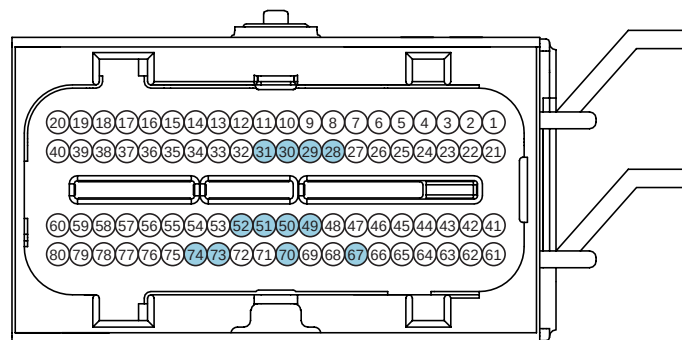
C156, C158

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]



C155, C157

HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]



C151-2
PCM

SVQF16110L

SIGNAL WAVEFORM AND DATA ECDD1CFC

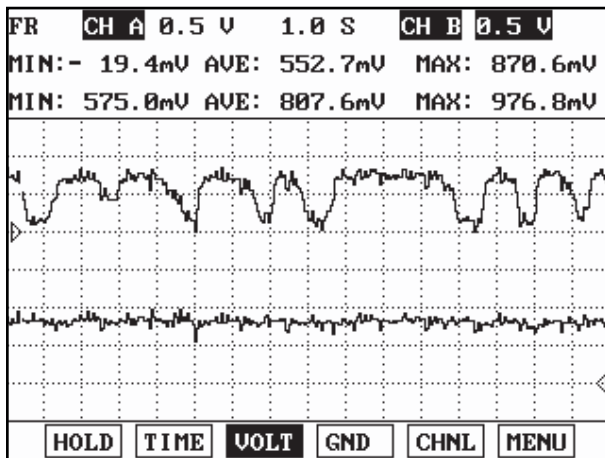


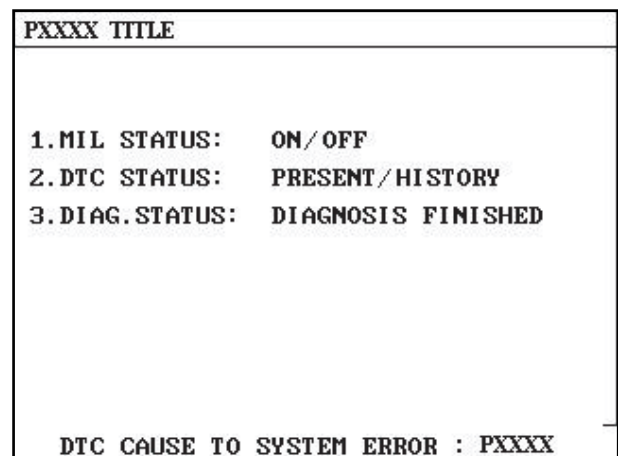
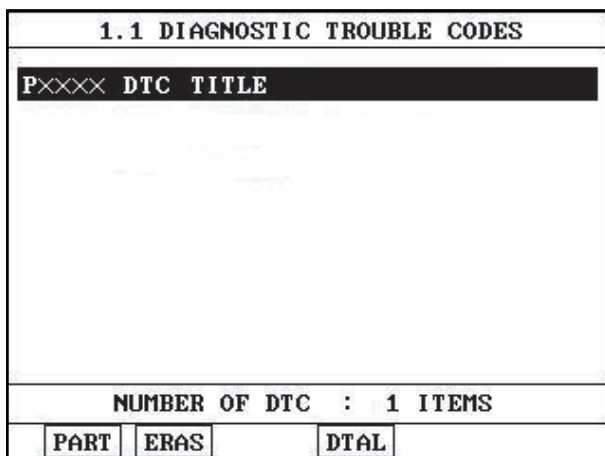
Fig) Signal waveforms of front HO2S(the upper) and rear HO2S(the lower)

SCMF16223L

After warming-up, if accelerator pedal is released suddenly around 4000rpm, the HO2S signal reading will be lower than 200mV resulting from Fuel cut-off for the moment. Conversely, if suddenly accelerator pedal is depressed, HO2S signal reading will be around 0.6V ~1.0V. At idle, Normally HO2S signal will switch from lean to rich with 3 Hz. And as racing, Its frequency rises.

MONITOR DTC STATUS EC91DBE0

1. Check DTC Status
 - 1) Connect scantool to Data Link Connector(DLC).
 - 2) IG "ON".
 - 3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F4(DTAL) to check DTC's information from the DTCs menu
 - 4) Read "DTC Status" parameter.



SCMF16159L

- 5) Is parameter displayed "Present fault"?

YES

- Go to "Component Inspection" procedure.

NO

- Fault is intermittent caused by poor contact in the sensor' s and/or PCM' s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E30CE7C1

1. Check the condition of HO2S

- 1) Check HO2S for poor connection or loose terminal.
- 2) Check if HO2S is ensurely installed.
- 3) Is the conditions of HO2S normal ?

YES

- Go to "Check the Signal waveform of HO2S" as follows.

NO

- Repair it and then go to "Verification of Vehicle Repair" procedure.

2. Check the Signal waveform of HO2S

- 1) IG "OFF" and connect HO2S connector.
- 2) Engine start.
- 3) After warming-up, monitor signal waveform of HO2S with scantool.?

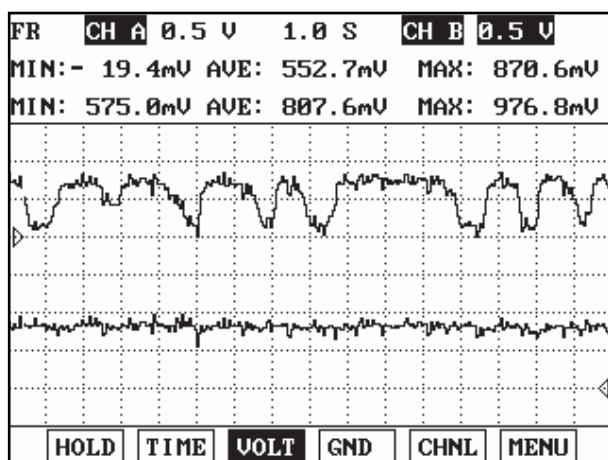


Fig) Signal waveform of front(the upper) and rear(the lower) HO2S at idle

SCMF16225L

- 4) Is the sensor switching properly?

YES

DTC TROUBLESHOOTING PROCEDURES

FLA -671

- ▶ Go to "Check fuel filter" as follows.

NO

- ▶ Substitute with a known - good HO2S and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.

3. Check the fuel filter of fuel pump

- 1) IG "OFF" and disconnect the fuel pump connector.
- 2) Start the engine and wait until fuel in fuel line is exhausted. After the engine stalls, IG "OFF"
- 3) Remove the fuel pump assembly.
- 4) Check the fuel filter for clogging by dust, a foreign substance.
- 5) Is the fuel filter O.K.?

YES

- ▶ Substitute with a known - good PCM and check for proper operation.
If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

- ▶ Substitute with a known - good fuel filter and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR

E7B398AA

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

- ▶ System performing to specification at this time. Clear the DTC.

NO

- ▶ Go to the applicable troubleshooting procedure.

FLA -672

FUEL SYSTEM

DTC P2196 HO2S SIGNAL STUCK RICH (BANK 1 / SENSOR 1)

COMPONENT LOCATION E162B279

Refer to DTC P2195.

GENERAL DESCRIPTION E4511625

Refer to DTC P2195.

DTC DESCRIPTION EC9FDB54

Checking output signals from HO2S under detecting condition, if HO2S's signal is rich during fuel cut-off conditions, PCM sets P2196. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION EED8307F

Item	Detecting Condition	Possible cause
DTC Strategy	Monitor HO2S's signal	- Poor Connection - Faulty HO2S - Faulty PCM
Enable Conditions	- Battery voltage $\geq 10V$ - Engine running $\geq 60sec$ - Fuel cut-off conditions - Engine warm-up state - Not in Transient Conditions	
Threshold value	HO2S's signal $> 0.42V$	
DiagnosisTime	Continuous (More than 8 sec. failure for every 9 sec. Test)	
MIL On Condition	2 Driving Cycles	

SPECIFICATION EAB4411D

(REFERENCE ONLY)

Test Condition	HO2S Voltage(Sensor1)	HO2S Voltage(Sensor2)
HO2S Signal at idle after warm-up	Signal is commonly switching from rich to lean more than 3 times in 10 sec.	Signal is commonly above 0.6V.
HO2S signal at open circuit (Pumping current OFF)	Approx. 0.45V	
HO2S signal at open circuit (Pumping current ON)	Approx. 3.5V	

SCHEMATIC DIAGRAM E973CBAA

Refer to DTC P2195.

SIGNAL WAVEFORM AND DATA E0C0F1BD

Refer to DTC P2195.

DTC TROUBLESHOOTING PROCEDURES

FLA -673

MONITOR DTC STATUS E7335320

Refer to DTC P2195.

COMPONENT INSPECTION EA6FE12F

1. Check the condition of HO2S

- 1) Check HO2S for poor connection or loose terminal.
- 2) Check if HO2S is ensurely installed.
- 3) Is the conditions of HO2S normal ?

YES

► Go to "Check the Signal waveform of HO2S" as follows.

NO

► Repair it and then go to "Verification of Vehicle Repair" procedure.

2. Check the Signal waveform of HO2S

- 1) IG "OFF" and connect HO2S connector.
- 2) Engine start.
- 3) After warming-up, monitor signal waveform of HO2S with scantool.?

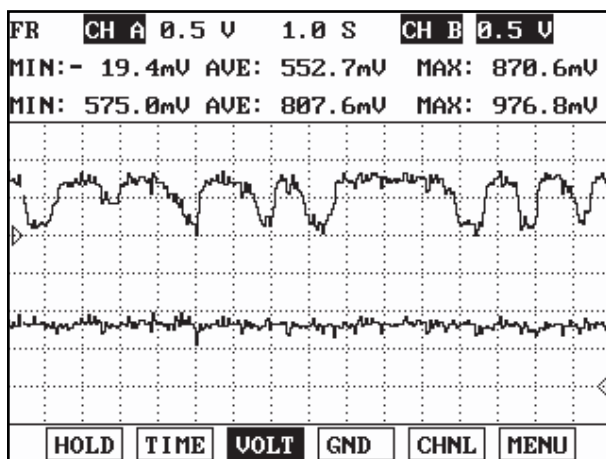


Fig) Signal waveform of front(the upper) and rear(the lower) HO2S at idle

SCMF16225L

4) Is the sensor switching properly?

YES

► Substitute with a known - good PCM and check for proper operation.
If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

► Substitute with a known - good HO2S and check for proper operation.

If the problem is corrected, go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

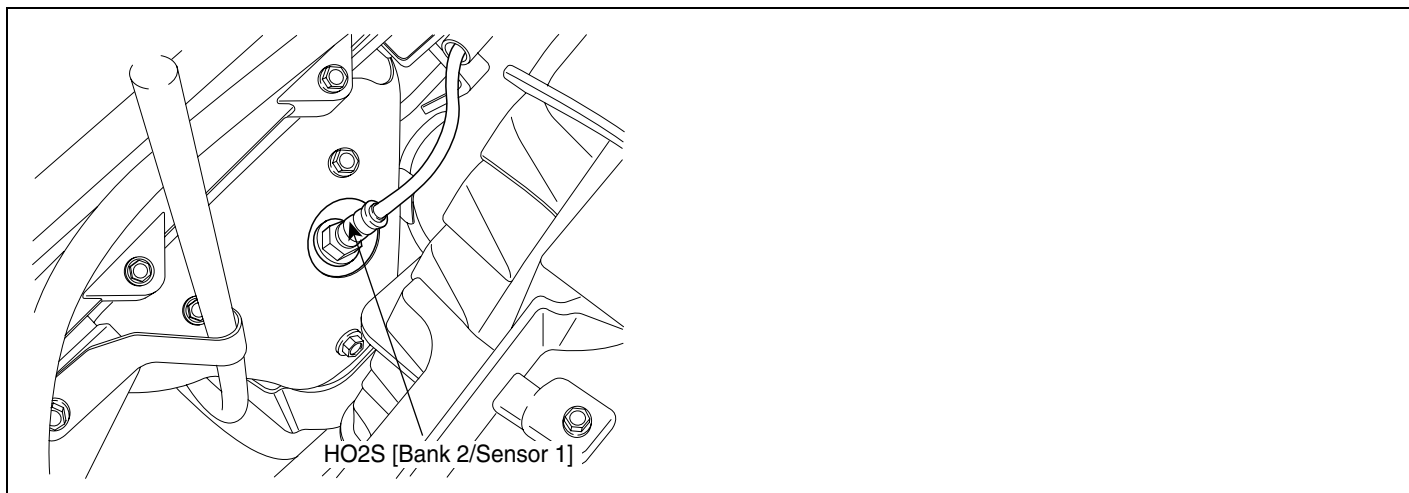
VERIFICATION OF VEHICLE REPAIR

E0913C4F

Refer to DTC P2195.

DTC P2197 HO2S SIGNAL STUCK LEAN (BANK 2 / SENSOR 1)

COMPONENT LOCATION ECEB14C1



LGLG506A

GENERAL DESCRIPTION E3645AB8

In order to control emissions of the CO, HC and NO_x components of the exhaust gas, heated oxygen sensor (HO2S), mounted on the front side and rear side of catalytic converter, detects the oxygen content in the exhaust gas. The front HO2S signal is used to control air/fuel ratio (closed loop fuel control) and the rear HO2S signal is used to monitor front HO2S and catalyst for proper operation. The HO2S requires a minimum temperature to operate properly and provide a closed loop fuel control system. The HO2S contains the heater element to reduce its warming-up time and ensure its performance during all driving conditions. The oxygen sensor generates a voltage that indicates the difference between the oxygen content of the exhaust stream and the oxygen content of ambient air. When the exhaust stream is “rich,” there is more oxygen in the ambient air than in the exhaust stream, so the voltage will be higher.

DTC DESCRIPTION E21645C5

Checking output signals from HO2S under detecting condition, if HO2S's signal is lean during power enrichment conditions, PCM sets P2197. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E815CC81

Item	Detecting Condition	Possible cause
DTC Strategy	Monitor HO2S's signal	- Poor Connection - Faulty HO2S - Clogging of fuel filter in fuel pump - Faulty PCM
Enable Conditions	- Battery voltage $\geq 10V$ - Engine running $\geq 60sec.$ - Power Enrichment conditions - Engine warm-up state - Not in Transient Conditionsatus	
Threshold value	HO2S's signal $< 0.35V$ and Air Fuel Ratio ≤ 13.5	
DiagnosisTime	Continuous (More than 8 sec. failure for every 9 sec. Test)	
MIL On Condition	2 Driving Cycles	

FLA -676

FUEL SYSTEM

SPECIFICATION E7DC80BC

(REFERENCE ONLY)

Test Condition	HO2S Voltage(Sensor1)	HO2S Voltage(Sensor2)
HO2S Signal at idle after warm-up	Signal is commonly switching from rich to lean more than 3 times in 10 sec.	Signal is commonly above 0.6V.
HO2S signal at open circuit (Pumping current OFF)	Approx. 0.45V	
HO2S signal at open circuit (Pumping current ON)	Approx. 3.5V	

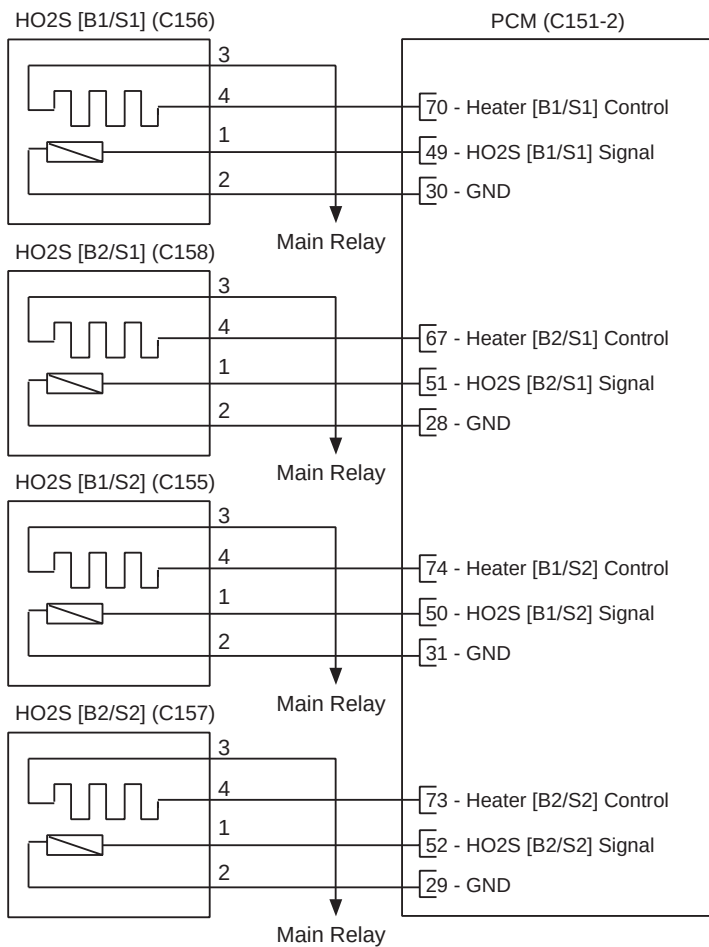
DTC TROUBLESHOOTING PROCEDURES

FLA -677

SCHEMATIC DIAGRAM

E84C21A1

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

HO2S [B1/S1]

Terminal	Connected to	Function
1	PCM C151-2 (49)	HO2S [B1/S1] Signal
2	PCM C151-2 (30)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C151-2 (70)	Heater [B1/S1] Control

HO2S [B2/S1]

Terminal	Connected to	Function
1	PCM C151-2 (51)	HO2S [B2/S1] Signal
2	PCM C151-2 (28)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C151-2 (67)	Heater [B2/S1] Control

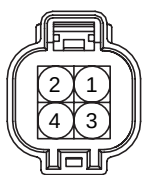
HO2S [B1/S2]

Terminal	Connected to	Function
1	PCM C151-2 (50)	HO2S [B1/S2] Signal
2	PCM C151-2 (31)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C151-2 (74)	Heater [B1/S2] Control

HO2S [B2/S2]

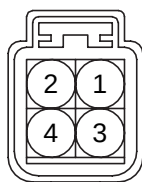
Terminal	Connected to	Function
1	PCM C151-2 (52)	HO2S [B2/S2] Signal
2	PCM C151-2 (29)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C151-2 (73)	Heater [B2/S2] Control

[HARNESS CONNECTORS]



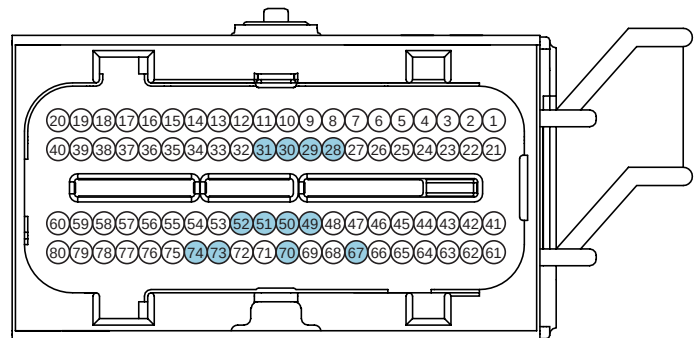
C156, C158

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]



C155, C157

HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]



C151-2
PCM

SVQF16110L

SIGNAL WAVEFORM AND DATA

EB33658C

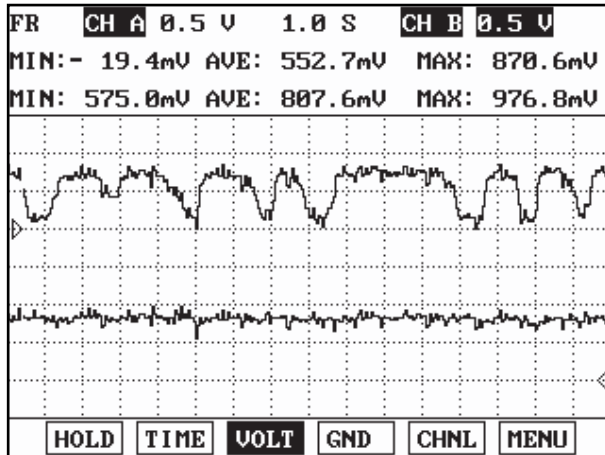


Fig) Signal waveforms of front HO2S(the upper) and rear HO2S(the lower)

SCMF16223L

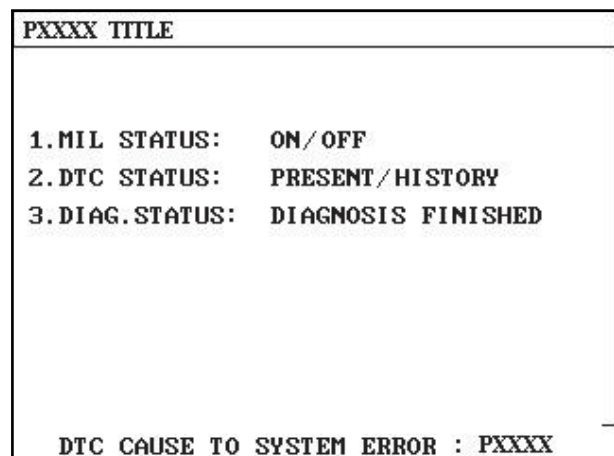
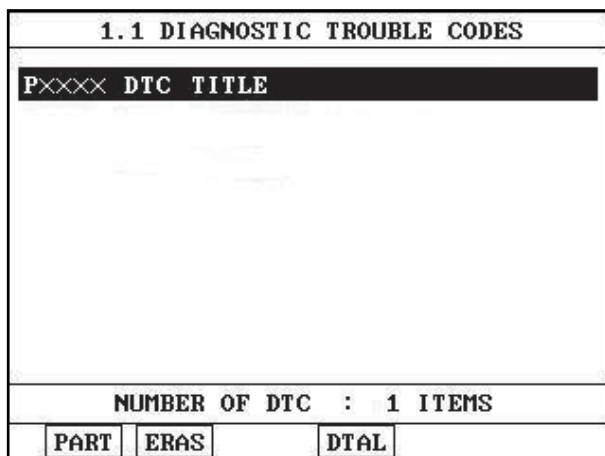
After warming-up, if accelerator pedal is released suddenly around 4000rpm, the HO2S signal reading will be lower than 200mV resulting from Fuel cut-off for the moment. Conversely, if suddenly accelerator pedal is depressed, HO2S signal reading will be around 0.6V ~1.0V. At idle, Normally HO2S signal will switch from lean to rich with 3 Hz. And as racing, Its frequency rises.

MONITOR DTC STATUS

E3C15C92

1. Check DTC Status

- 1) Connect scantool to Data Link Connector(DLC).
- 2) IG "ON".
- 3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F4(DTAL) to check DTC's information from the DTCs menu
- 4) Read "DTC Status" parameter.



SCMF16159L

- 5) Is parameter displayed "Present fault"?

YES

- ▶ Go to "Component Inspection" procedure.

NO

- ▶ Fault is intermittent caused by poor contact in the sensor' s and/or PCM' s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

E2E4FDDEE

1. Check the condition of HO2S

- 1) Check HO2S for poor connection or loose terminal.
- 2) Check if HO2S is ensurely installed.
- 3) Is the conditions of HO2S normal ?

YES

- ▶ Go to "Check the Signal waveform of HO2S" as follows.

NO

- ▶ Repair it and then go to "Verification of Vehicle Repair" procedure.

2. Check the Signal waveform of HO2S

- 1) IG "OFF" and connect HO2S connector.
- 2) Engine start.
- 3) After warming-up, monitor signal waveform of HO2S with scantool.?

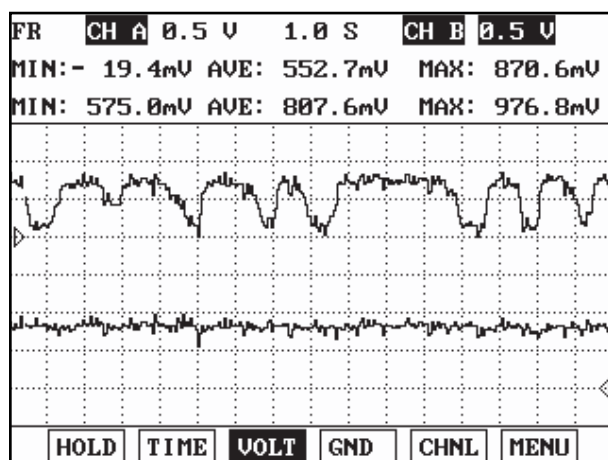


Fig) Signal waveform of front(the upper) and rear(the lower) HO2S at idle

SCMF16225L

- 4) Is the sensor switching properly?

YES

- ▶ Go to "Check fuel filter" as follows.

NO

- ▶ Substitute with a known - good HO2S and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.

3. Check the fuel filter of fuel pump

- 1) IG "OFF" and disconnect the fuel pump connector.
- 2) Start the engine and wait until fuel in fuel line is exhausted. After the engine stalls, IG "OFF"
- 3) Remove the fuel pump assembly.
- 4) Check the fuel filter for clogging by dust, a foreign substance.
- 5) Is the fuel filter O.K.?

YES

- ▶ Substitute with a known - good PCM and check for proper operation.
If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

- ▶ Substitute with a known - good fuel filter and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR E5D33ACC

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

- ▶ System performing to specification at this time. Clear the DTC.

NO

- ▶ Go to the applicable troubleshooting procedure.

DTC TROUBLESHOOTING PROCEDURES

FLA -681

DTC P2198 HO2S SIGNAL STUCK RICH (BANK 2 / SENSOR 1)

COMPONENT LOCATION E1A74602

Refer to DTC P2197.

GENERAL DESCRIPTION E3D25E6A

Refer to DTC P2197.

DTC DESCRIPTION E792AE78

Checking output signals from HO2S under detecting condition, if HO2S's signal is rich during fuel cut-off conditions, PCM sets P2198. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E576419E

Item	Detecting Condition	Possible cause
DTC Strategy	Monitor HO2S's signal	- Poor Connection - Faulty HO2S - Faulty PCM
Enable Conditions	- Battery voltage $\geq 10V$ - Engine running $\geq 60\text{sec.}$ - Fuel cut-off conditions - Engine warm-up state - Not in Transient Conditionsatus	
Threshold value	HO2S's signal $> 0.42V$	
DiagnosisTime	Continuous (More than 8 sec. failure for every 9 sec. Test)	
MIL On Condition	2 Driving Cycles	

SPECIFICATION E021974B

(REFERENCE ONLY)

Test Condition	HO2S Voltage(Sensor1)	HO2S Voltage(Sensor2)
HO2S Signal at idle after warm-up	Signal is commonly switching from rich to lean more than 3 times in 10 sec.	Signal is commonly above 0.6V.
HO2S signal at open circuit (Pumping current OFF)	Approx. 0.45V	
HO2S signal at open circuit (Pumping current ON)	Approx. 3.5V	

SCHEMATIC DIAGRAM E7E982CC

Refer to DTC P2197.

SIGNAL WAVEFORM AND DATA EE49F467

Refer to DTC P2197.

MONITOR DTC STATUS E47391E3

Refer to DTC P2197.

COMPONENT INSPECTION E688A7CE

1. Check the condition of HO2S

- 1) Check HO2S for poor connection or loose terminal.
- 2) Check if HO2S is ensurely installed.
- 3) Is the conditions of HO2S normal ?

YES

► Go to "Check the Signal waveform of HO2S" as follows.

NO

► Repair it and then go to "Verification of Vehicle Repair" procedure.

2. Check the Signal waveform of HO2S

- 1) IG "OFF" and connect HO2S connector.
- 2) Engine start.
- 3) After warming-up, monitor signal waveform of HO2S with scantool.?

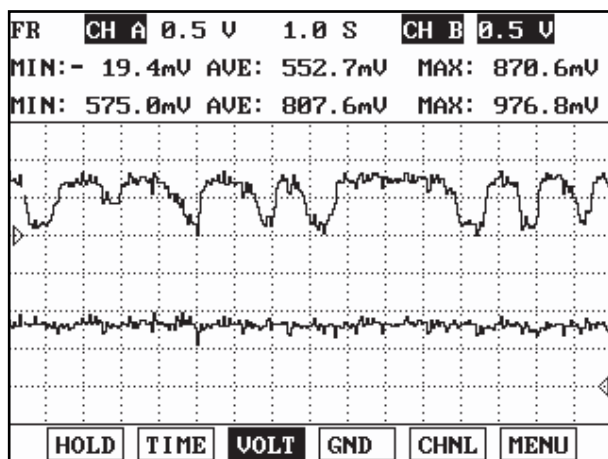


Fig) Signal waveform of front(the upper) and rear(the lower) HO2S at idle

SCMF16225L

4) Is the sensor switching properly?

YES

► Substitute with a known - good PCM and check for proper operation.
If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

► Substitute with a known - good HO2S and check for proper operation.

DTC TROUBLESHOOTING PROCEDURES

FLA -683

If the problem is corrected, go to "Verification of Vehicle Repair" procedure.



NOTE

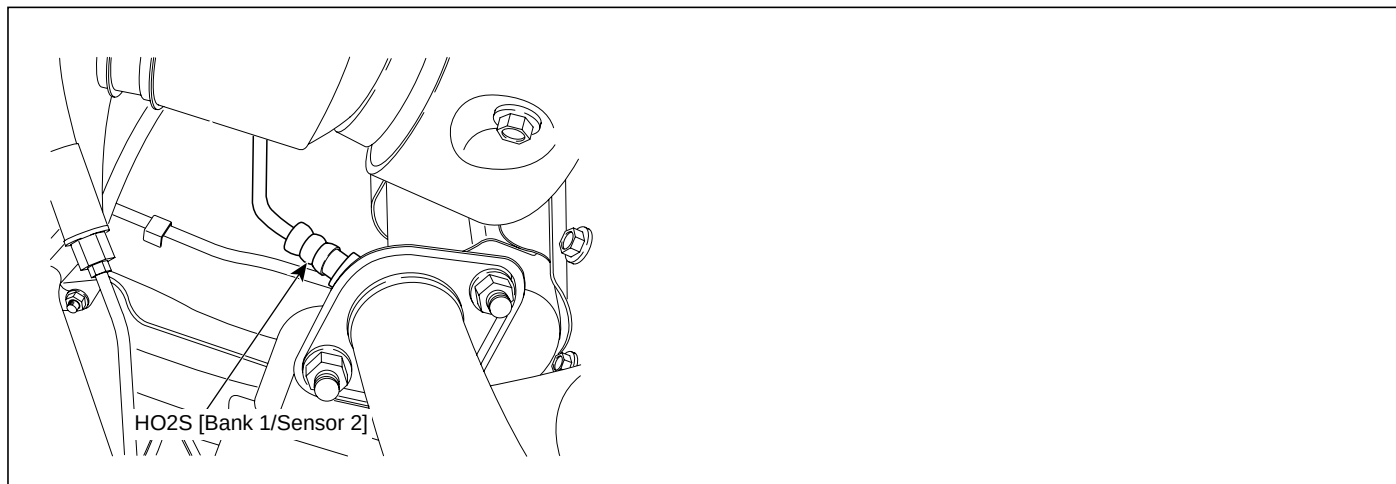
There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR ED59D34E

Refer to DTC P2197.

DTC P2270 O2 SENSOR SIGNAL STUCK LEAN (BANK 1 / SENSOR 2)

COMPONENT LOCATION E0BA2B9F



SCMF16165L

GENERAL DESCRIPTION E1E3E707

The rear heated oxygen sensor is mounted on the rear side of the Catalytic Converter (warm-up catalytic converter) or in the rear exhaust pipe, which is able to detect catalyst efficiency. The rear heated oxygen sensor (HO2S) produces a voltage between 0V and 1V. This rear heated oxygen sensor is used to estimate the oxygen storage capability. If a catalyst has good conversion properties, the oxygen fluctuations are smoothed by the oxygen storage capacity of the catalyst. If the conversion provided by the catalyst is low due to aging, poisoning or misfiring, then the oxygen fluctuations are similar to signals from the front oxygen sensor.

DTC DESCRIPTION E3CF5835

Checking output signals from HO2S under detecting condition, if HO2S's signal is lean during power enrichment conditions, PCM sets P2270. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION EA5010E1

Item	Detecting Condition	Possible cause
DTC Strategy	Monitor HO2S's signal	- Poor Connection - Faulty HO2S - Clogging of fuel filter in fuel pump - Faulty PCM
Enable Conditions	- Battery voltage $\geq 10V$ - Engine running $\geq 60sec.$ - Power Enrichment conditions - Engine warm-up state - Not in Transient Conditions	
Threshold value	HO2S's signal $< 0.35V$ and Air Fuel Ratio ≤ 13.5	
Diagnosis Time	Continuous (More than 8 sec. failure for every 9 sec. Test)	
MIL On Condition	2 Driving Cycles	

DTC TROUBLESHOOTING PROCEDURES

FLA -685

SPECIFICATION E0CB4CF7

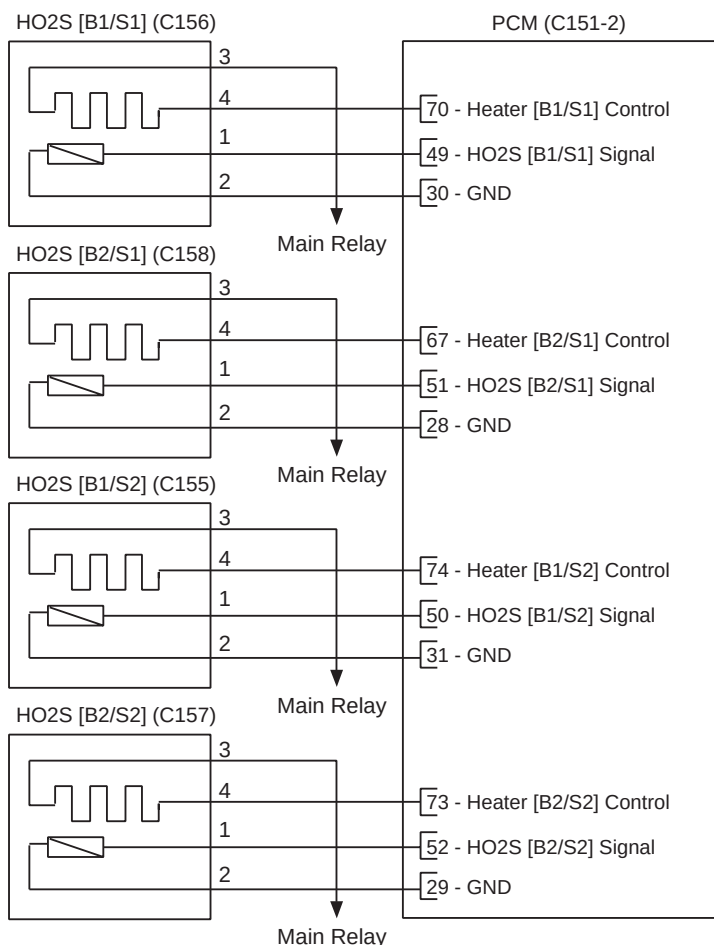
(REFERENCE ONLY)

Test Condition	HO2S Voltage(Sensor1)	HO2S Voltage(Sensor2)
HO2S Signal at idle after warm-up	Signal is commonly switching from rich to lean more than 3 times in 10 sec.	Signal is commonly above 0.6V.
HO2S signal at open circuit (Pumping current OFF)	Approx. 0.45V	
HO2S signal at open circuit (Pumping current ON)	Approx. 3.5V	

SCHEMATIC DIAGRAM

E9A1FBC4

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

HO2S [B1/S1]

Terminal	Connected to	Function
1	PCM C151-2 (49)	HO2S [B1/S1] Signal
2	PCM C151-2 (30)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C151-2 (70)	Heater [B1/S1] Control

HO2S [B2/S1]

Terminal	Connected to	Function
1	PCM C151-2 (51)	HO2S [B2/S1] Signal
2	PCM C151-2 (28)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C151-2 (67)	Heater [B2/S1] Control

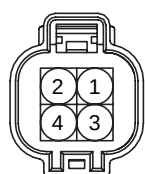
HO2S [B1/S2]

Terminal	Connected to	Function
1	PCM C151-2 (50)	HO2S [B1/S2] Signal
2	PCM C151-2 (31)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C151-2 (74)	Heater [B1/S2] Control

HO2S [B2/S2]

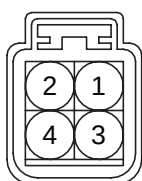
Terminal	Connected to	Function
1	PCM C151-2 (52)	HO2S [B2/S2] Signal
2	PCM C151-2 (29)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C151-2 (73)	Heater [B2/S2] Control

[HARNESS CONNECTORS]



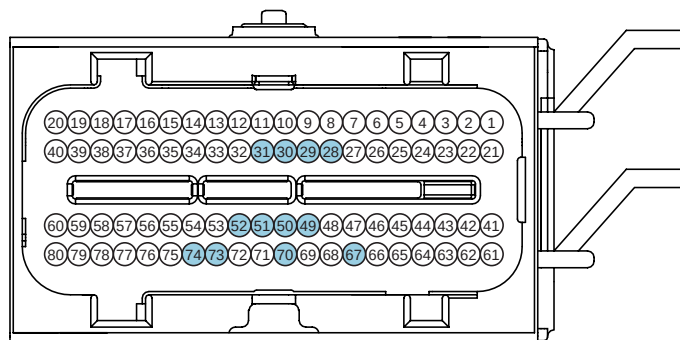
C156, C158

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]



C155, C157

HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]



C151-2
PCM

SVQF16110L

SIGNAL WAVEFORM AND DATA EC8D199E

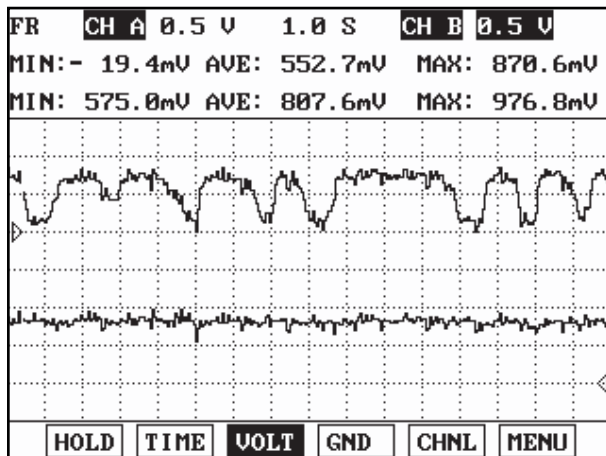


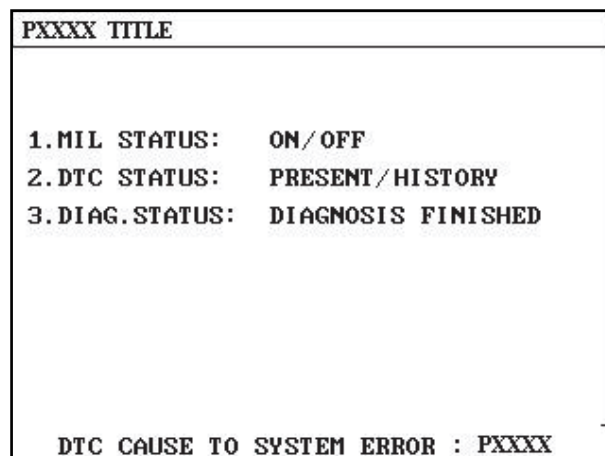
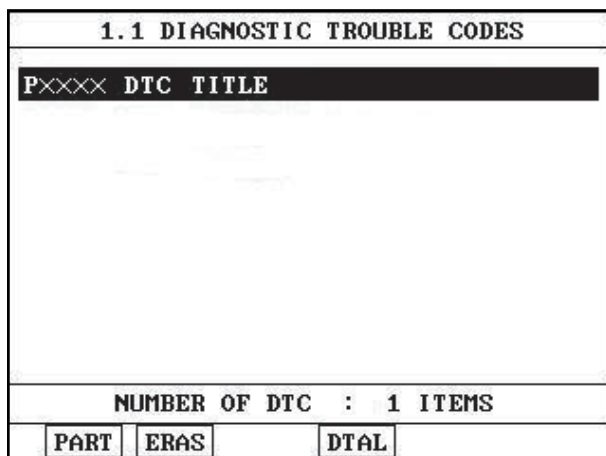
Fig) Signal waveforms of front HO2S(the upper) and rear HO2S(the lower)

SCMF16223L

After warming-up, if accelerator pedal is released suddenly around 4000rpm, the HO2S signal reading will be lower than 200mV resulting from Fuel cut-off for the moment. Conversely, if suddenly accelerator pedal is depressed, HO2S signal reading will be around 0.6V ~1.0V. At idle, Normally HO2S signal will switch from lean to rich with 3 Hz. And as racing, Its frequency rises.

MONITOR DTC STATUS E209D901

1. Check DTC Status
 - 1) Connect scantool to Data Link Connector(DLC).
 - 2) IG "ON".
 - 3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F4(DTAL) to check DTC's information from the DTCs menu
 - 4) Read "DTC Status" parameter.



SCMF16159L

- 5) Is parameter displayed "Present fault"?

YES

- Go to "Component Inspection" procedure.

NO

- Fault is intermittent caused by poor contact in the sensor' s and/or PCM' s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E4CFC8AB

1. Check the condition of HO2S

- 1) Check HO2S for poor connection or loose terminal.
- 2) Check if HO2S is ensurely installed.
- 3) Is the conditions of HO2S normal ?

YES

- Go to "Check the Signal waveform of HO2S" as follows.

NO

- Repair it and then go to "Verification of Vehicle Repair" procedure.

2. Check the Signal waveform of HO2S

- 1) IG "OFF" and connect HO2S connector.
- 2) Engine start.
- 3) After warming-up, monitor signal waveform of HO2S with scantool.?

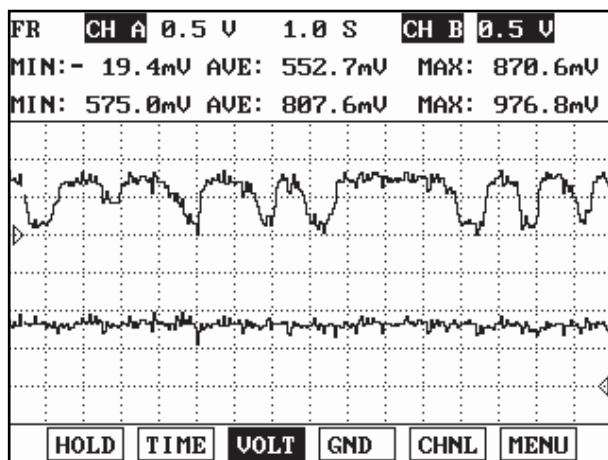


Fig) Signal waveform of front(the upper) and rear(the lower) HO2S at idle

SCMF16225L

- 4) Is the sensor switching properly?

YES

DTC TROUBLESHOOTING PROCEDURES

FLA -689

- ▶ Go to "Check fuel filter" as follows.

NO

- ▶ Substitute with a known - good HO2S and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.

3. Check the fuel filter of fuel pump

- 1) IG "OFF" and disconnect the fuel pump connector.
- 2) Start the engine and wait until fuel in fuel line is exhausted. After the engine stalls, IG "OFF"
- 3) Remove the fuel pump assembly.
- 4) Check the fuel filter for clogging by dust, a foreign substance.
- 5) Is the fuel filter O.K.?

YES

- ▶ Substitute with a known - good PCM and check for proper operation.
If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

- ▶ Substitute with a known - good fuel filter and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR

E538C54C

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

- ▶ System performing to specification at this time. Clear the DTC.

NO

- ▶ Go to the applicable troubleshooting procedure.

FLA -690

FUEL SYSTEM

DTC P2271 O2 SENSOR SIGNAL STUCK RICH (BANK 1 /SENSOR 2)

COMPONENT LOCATION EA3D78C1

Refer to DTC P2270.

GENERAL DESCRIPTION EFC7EA8D

Refer to DTC P2270.

DTC DESCRIPTION EEBEAC61

Checking output signals from HO2S under detecting condition, if HO2S's signal is rich during fuel cut-off conditions, PCM sets P2271. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION EA11B8E6

Item	Detecting Condition	Possible cause
DTC Strategy	Monitor HO2S's signal	- Poor Connection - Faulty HO2S - Faulty PCM
Enable Conditions	- Battery voltage $\geq 10V$ - Engine running $\geq 60sec.$ - Fuel cut-off conditions - Engine warm-up state - Not in Transient Conditions	
Threshold value	HO2S's signal $> 0.42V$	
Diagnosis Time	Continuous (More than 8 sec. failure for every 9 sec. Test)	
MIL On Condition	2 Driving Cycles	

SPECIFICATION E92C9C03

(REFERENCE ONLY)

Test Condition	HO2S Voltage(Sensor1)	HO2S Voltage(Sensor2)
HO2S Signal at idle after warm-up	Signal is commonly switching from rich to lean more than 3 times in 10 sec.	Signal is commonly above 0.6V.
HO2S signal at open circuit (Pumping current OFF)	Approx. 0.45V	
HO2S signal at open circuit (Pumping current ON)	Approx. 3.5V	

SCHEMATIC DIAGRAM E181B282

Refer to DTC P2270.

SIGNAL WAVEFORM AND DATA E9EBFE74

Refer to DTC P2270.

DTC TROUBLESHOOTING PROCEDURES

FLA -691

MONITOR DTC STATUS E62EEA8B

Refer to DTC P2270.

COMPONENT INSPECTION E4CCDBB3

1. Check the condition of HO2S

- 1) Check HO2S for poor connection or loose terminal.
- 2) Check if HO2S is ensurely installed.
- 3) Is the conditions of HO2S normal ?

YES

► Go to "Check the Signal waveform of HO2S" as follows.

NO

► Repair it and then go to "Verification of Vehicle Repair" procedure.

2. Check the Signal waveform of HO2S

- 1) IG "OFF" and connect HO2S connector.
- 2) Engine start.
- 3) After warming-up, monitor signal waveform of HO2S with scantool.?

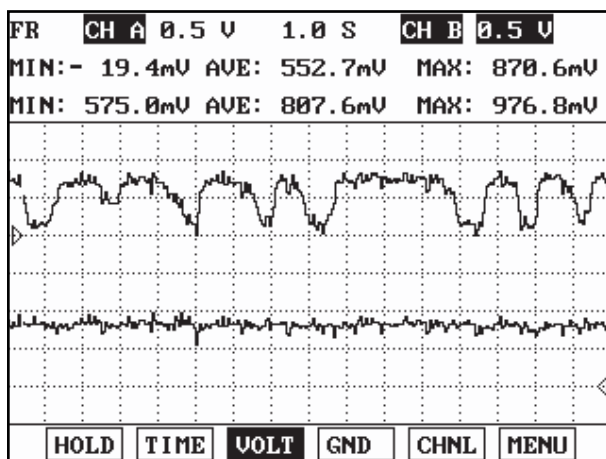


Fig) Signal waveform of front(the upper) and rear(the lower) HO2S at idle

SCMF16225L

4) Is the sensor switching properly?

YES

► Substitute with a known - good PCM and check for proper operation.
If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

► Substitute with a known - good HO2S and check for proper operation.

If the problem is corrected, go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR

E375662C

Refer to DTC P2270.

DTC P2272 HO2S SIGNAL STUCK LEAN (BANK 2 / SENSOR 2)

COMPONENT LOCATION E102FFFA



SCMF16176L

GENERAL DESCRIPTION E19C9915

The rear heated oxygen sensor is mounted on the rear side of the Catalytic Converter (warm-up catalytic converter) or in the rear exhaust pipe, which is able to detect catalyst efficiency. The rear heated oxygen sensor (HO2S) produces a voltage between 0V and 1V. This rear heated oxygen sensor is used to estimate the oxygen storage capability. If a catalyst has good conversion properties, the oxygen fluctuations are smoothed by the oxygen storage capacity of the catalyst. If the conversion provided by the catalyst is low due to aging, poisoning or misfiring, then the oxygen fluctuations are similar to signals from the front oxygen sensor.

DTC DESCRIPTION EA1F9A79

Checking output signals from HO2S under detecting condition, if HO2S's signal is lean during power enrichment conditions, PCM sets P2272. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E544989E

Item	Detecting Condition	Possible cause
DTC Strategy	Monitor HO2S's signal	- Poor Connection - Faulty HO2S - Clogging of fuel filter in fuel pump - Faulty PCM
Enable Conditions	- Battery voltage $\geq 10V$ - Engine running $\geq 60sec.$ - Power Enrichment conditions - Engine warm-up state - Not in Transient Conditions	
Threshold value	HO2S's signal $< 0.35V$ and Air Fuel Ratio ≤ 13.5	
Diagnosis Time	Continuous (More than 8 sec. failure for every 9 sec. Test)	
MIL On Condition	2 Driving Cycles	

FLA -694

FUEL SYSTEM

SPECIFICATION EB49A558

(REFERENCE ONLY)

Test Condition	HO2S Voltage(Sensor1)	HO2S Voltage(Sensor2)
HO2S Signal at idle after warm-up	Signal is commonly switching from rich to lean more than 3 times in 10 sec.	Signal is commonly above 0.6V.
HO2S signal at open circuit (Pumping current OFF)	Approx. 0.45V	
HO2S signal at open circuit (Pumping current ON)	Approx. 3.5V	

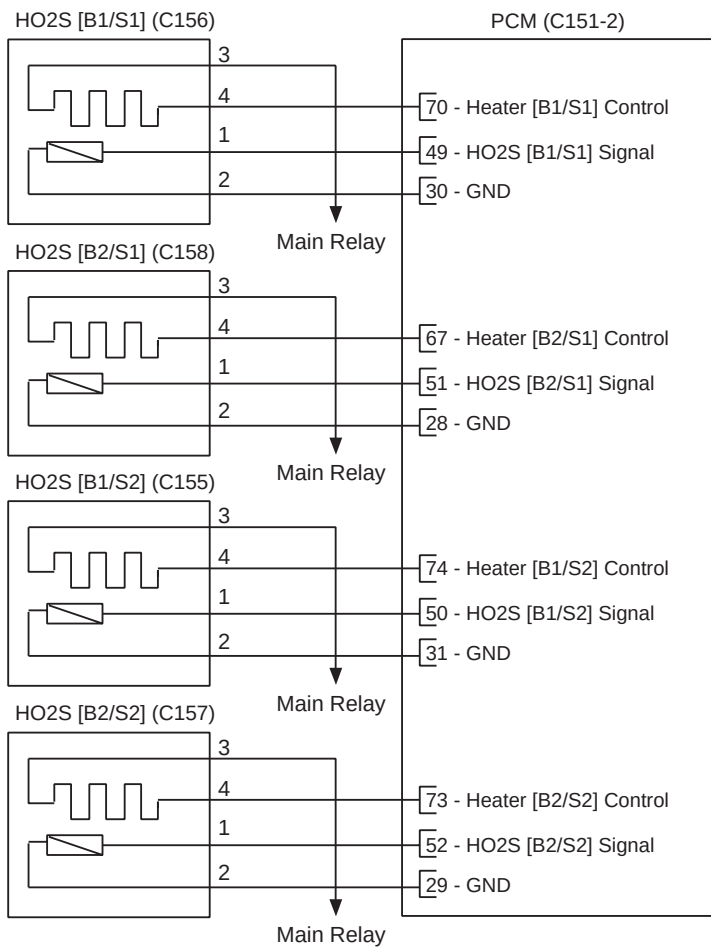
DTC TROUBLESHOOTING PROCEDURES

FLA -695

SCHEMATIC DIAGRAM

ED382119

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

HO2S [B1/S1]

Terminal	Connected to	Function
1	PCM C151-2 (49)	HO2S [B1/S1] Signal
2	PCM C151-2 (30)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C151-2 (70)	Heater [B1/S1] Control

HO2S [B2/S1]

Terminal	Connected to	Function
1	PCM C151-2 (51)	HO2S [B2/S1] Signal
2	PCM C151-2 (28)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C151-2 (67)	Heater [B2/S1] Control

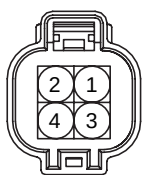
HO2S [B1/S2]

Terminal	Connected to	Function
1	PCM C151-2 (50)	HO2S [B1/S2] Signal
2	PCM C151-2 (31)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C151-2 (74)	Heater [B1/S2] Control

HO2S [B2/S2]

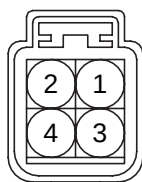
Terminal	Connected to	Function
1	PCM C151-2 (52)	HO2S [B2/S2] Signal
2	PCM C151-2 (29)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C151-2 (73)	Heater [B2/S2] Control

[HARNESS CONNECTORS]



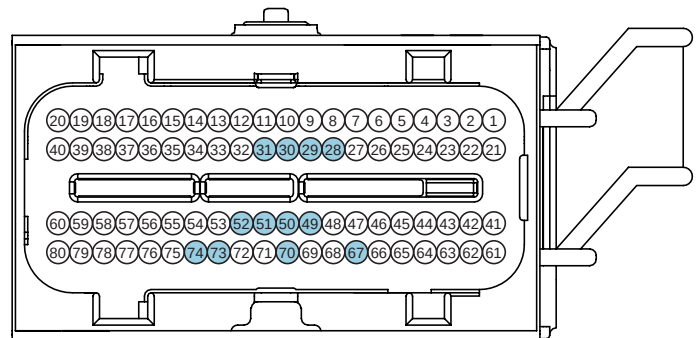
C156, C158

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]



C155, C157

HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]



C151-2
PCM

SVQF16110L

SIGNAL WAVEFORM AND DATA

E2BA8DCB

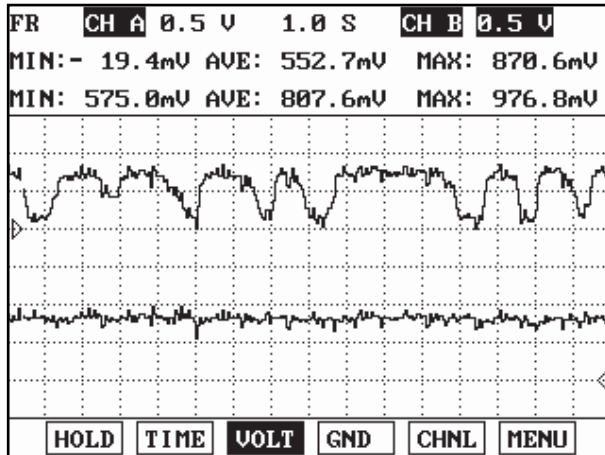


Fig) Signal waveforms of front HO2S(the upper) and rear HO2S(the lower)

SCMF16223L

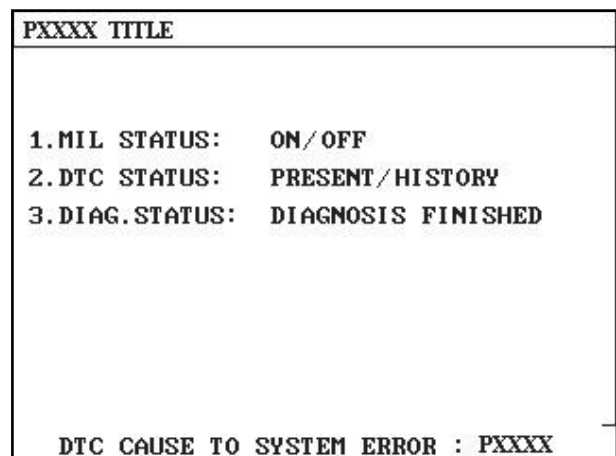
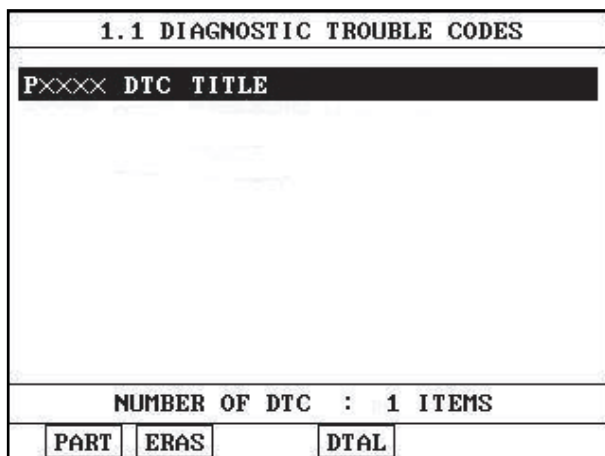
After warming-up, if accelerator pedal is released suddenly around 4000rpm, the HO2S signal reading will be lower than 200mV resulting from Fuel cut-off for the moment. Conversely, if suddenly accelerator pedal is depressed, HO2S signal reading will be around 0.6V ~1.0V. At idle, Normally HO2S signal will switch from lean to rich with 3 Hz. And as racing, Its frequency rises.

MONITOR DTC STATUS

EDE0794A

1. Check DTC Status

- 1) Connect scantool to Data Link Connector(DLC).
- 2) IG "ON".
- 3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F4(DTAL) to check DTC's information from the DTCs menu
- 4) Read "DTC Status" parameter.



SCMF16159L

- 5) Is parameter displayed "Present fault"?

YES

- ▶ Go to "Component Inspection" procedure.

NO

- ▶ Fault is intermittent caused by poor contact in the sensor' s and/or PCM' s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E219BE04

1. Check the condition of HO2S

- 1) Check HO2S for poor connection or loose terminal.
- 2) Check if HO2S is ensurely installed.
- 3) Is the conditions of HO2S normal ?

YES

- ▶ Go to "Check the Signal waveform of HO2S" as follows.

NO

- ▶ Repair it and then go to "Verification of Vehicle Repair" procedure.

2. Check the Signal waveform of HO2S

- 1) IG "OFF" and connect HO2S connector.
- 2) Engine start.
- 3) After warming-up, monitor signal waveform of HO2S with scantool.?

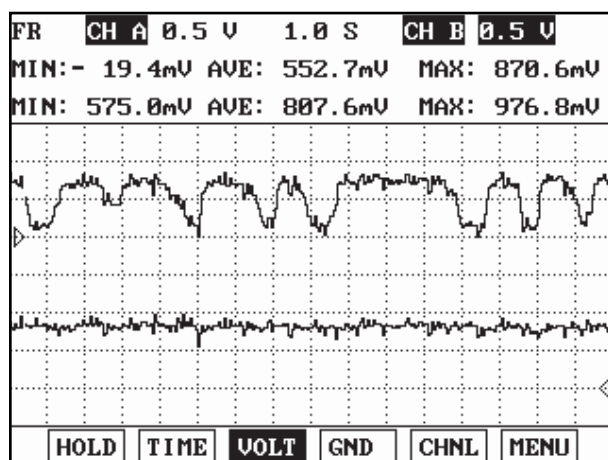


Fig) Signal waveform of front(the upper) and rear(the lower) HO2S at idle

SCMF16225L

- 4) Is the sensor switching properly?

YES

- ▶ Go to "Check fuel filter" as follows.

NO

- ▶ Substitute with a known - good HO2S and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.

3. Check the fuel filter of fuel pump

- 1) IG "OFF" and disconnect the fuel pump connector.
- 2) Start the engine and wait until fuel in fuel line is exhausted. After the engine stalls, IG "OFF"
- 3) Remove the fuel pump assembly.
- 4) Check the fuel filter for clogging by dust, a foreign substance.
- 5) Is the fuel filter O.K.?

YES

- ▶ Substitute with a known - good PCM and check for proper operation.
If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

- ▶ Substitute with a known - good fuel filter and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR E3AE4890

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

- ▶ System performing to specification at this time. Clear the DTC.

NO

- ▶ Go to the applicable troubleshooting procedure.

DTC TROUBLESHOOTING PROCEDURES

FLA -699

DTC P2273 HO2S SIGNAL STUCK RICH (BANK 2 / SENSOR 2)

COMPONENT LOCATION E1290AB1

Refer to DTC P2272.

GENERAL DESCRIPTION EACCB643

Refer to DTC P2272.

DTC DESCRIPTION EE9ECA5D

Checking output signals from HO2S under detecting condition, if HO2S's signal is rich during fuel cut-off conditions, PCM sets P2273. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION EC3634CF

Item	Detecting Condition	Possible cause
DTC Strategy	Monitor HO2S's signal	- Poor Connection - Faulty HO2S - Faulty PCM
Enable Conditions	- Battery voltage $\geq 10V$ - Engine running $\geq 60sec.$ - Fuel cut-off conditions - Engine warm-up state - Not in Transient Conditions.	
Threshold value	HO2S's signal $> 0.42V$	
Diagnosis Time	Continuous (More than 8 sec. failure for every 9 sec. Test)	
MIL On Condition	2 Driving Cycles	

SPECIFICATION EC3DAADD

(REFERENCE ONLY)

Test Condition	HO2S Voltage(Sensor1)	HO2S Voltage(Sensor2)
HO2S Signal at idle after warm-up	Signal is commonly switching from rich to lean more than 3 times in 10 sec.	Signal is commonly above 0.6V.
HO2S signal at open circuit (Pumping current OFF)	Approx. 0.45V	
HO2S signal at open circuit (Pumping current ON)	Approx. 3.5V	

SCHEMATIC DIAGRAM EDB55561

Refer to DTC P2272.

SIGNAL WAVEFORM AND DATA E4EBDD14

Refer to DTC P2272.

MONITOR DTC STATUS E4037FE2

Refer to DTC P2272.

COMPONENT INSPECTION E00CD08E

1. Check the condition of HO2S

- 1) Check HO2S for poor connection or loose terminal.
- 2) Check if HO2S is ensurely installed.
- 3) Is the conditions of HO2S normal ?

YES

► Go to "Check the Signal waveform of HO2S" as follows.

NO

► Repair it and then go to "Verification of Vehicle Repair" procedure.

2. Check the Signal waveform of HO2S

- 1) IG "OFF" and connect HO2S connector.
- 2) Engine start.
- 3) After warming-up, monitor signal waveform of HO2S with scantool.?

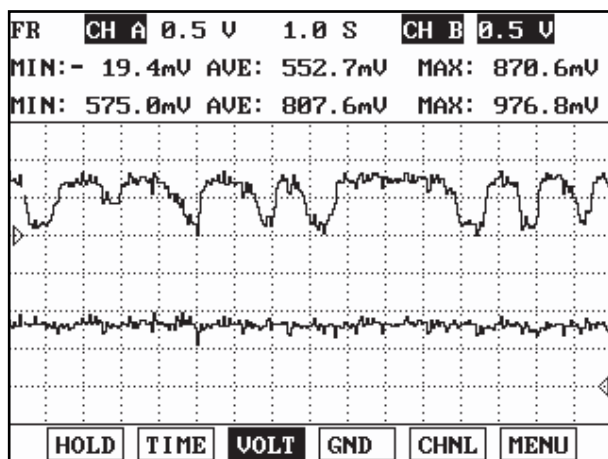


Fig) Signal waveform of front(the upper) and rear(the lower) HO2S at idle

SCMF16225L

4) Is the sensor switching properly?

YES

► Substitute with a known - good PCM and check for proper operation.
If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

► Substitute with a known - good HO2S and check for proper operation.

DTC TROUBLESHOOTING PROCEDURES

FLA -701

If the problem is corrected, go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR E42DD3FF

Refer to DTC P2272.

DTC P2610 ECM/PCM INTERNAL ENGINE OFF TIMER PERFORMANCE

COMPONENT LOCATION EF84EAD7



SCMF16386L

GENERAL DESCRIPTION E5334D98

Continuing to calculate data of several sensor despite turning ignition OFF, when ignition turns ON, this enables PCM to be easy using calculated data.

DTC DESCRIPTION E14CFFF7

If abnormal countdown is detected for a calibratable time, PCM sets P2610. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E4B758C2

ITEM		Detecting Condition	Possible Cause
DTC Strategy	Case 1	• Compares the time elapsed recorded by the LPC(Low Power Counter) against that recorded by the test timer	• PCM
	Case 2	• Checks for abnormal resets of the LPC	
Enable Condition	Case 1	• Engine running > 10sec. • Battery voltage > 8V	
	Case 2	• No Memory Failure Occurred	
Threshold	Case 1	• The difference between the counter the LPC and the calibration the test timer clocks up > 20sec.	
	Case 2	• The LPC is reset to zero abnormally	
Diagnosis Time		• -	
MIL On Condition		• 2 Driving Cycle	

MONITOR DTC STATUS E75D5DB7

1. Check DTC Status
 - 1) Connect scantool to Data Link Connector(DLC).

DTC TROUBLESHOOTING PROCEDURES

FLA -703

- 2) IG "ON".
- 3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F4(DTAL) to check DTC's information from the DTCs menu
- 4) Read "DTC Status" parameter.

1.1 DIAGNOSTIC TROUBLE CODES		
PXXXX DTC TITLE		
NUMBER OF DTC : 1 ITEMS		
PART	ERAS	DTAL

PXXXX TITLE	
1.MIL STATUS:	ON/OFF
2.DTC STATUS:	PRESENT/HISTORY
3.DIAG.STATUS:	DIAGNOSIS FINISHED
DTC CAUSE TO SYSTEM ERROR : PXXXX	

SCMF16159L

- 5) Is parameter displayed "Present fault"?

YES

- Go to "Terminal and connector inspection" procedure.

NO

- Fault is intermittent caused by poor contact in the sensor' s and/or PCM' s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

TERMINAL AND CONNECTOR INSPECTION

E371FCF4

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

- Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

- Substitute with a known-good PCM and check for proper operation. If the problem is corrected,replace PCM and then go to "Verification of Vehicle Repair" procedure.



NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR

E5910E0D

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Press F4(DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
3. Read "DTC Status" parameter.
4. Is parameter displayed "History(Not Present) fault"?

YES

- System performing to specification at this time. Clear the DTC.

NO

- Go to the applicable troubleshooting procedure.

DTC TROUBLESHOOTING PROCEDURES

FLA -705

DTC U0001 CAN COMMUNICATION MALFUNCTION

GENERAL DESCRIPTION E03A959E

Several control units are applied to electronically controlled vehicles. These units perform each control with informations from various sensors. Thus, sharing signal information from sensors is needed, so CAN communication type whose communication speed is high and insensitive to electrical noise by spark generation is adopted to controlling power-train(PCM, ABS, ESP)

As sharing signals of engine speed, APS, gear shifting, torque reduction in ESP,ABS and various modules, active control is performed.

DTC DESCRIPTION E21BF1DB

Checking CAN communication, under detecting condition, if an error within the detecting condition is detected for more than 1.5 sec., PCM sets U0001. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E42C5BA1

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects failures in communication between the PCM and another or modules in the vehicle which are on the CAN serial bus.	• CAN BUS • CAN communication module component
EnableConditions	• Engine Run Time $\geq$ 2sec. • Ignition Voltage $\geq$ 11V	
Threshold value	• CAN communicatin error	
DiagnosisTime	• Continuous	
MIL On Condition	• 2 Driving Cycles	

SPECIFICATION E4BAA2D9

Format	DIGITAL "0"		DIGITAL "1"(BUS IDLE)		CAN Communication Line Resistance	
	HIGH	LOW	HIGH	LOW	PCM	CAN RESISTOR
CAN 2.0B	3.5V	1.5V	2.5V	2.5V	120 Ω (20℃)	120 Ω (20℃)

SIGNAL WAVEFORM AND DATA

EFD86111

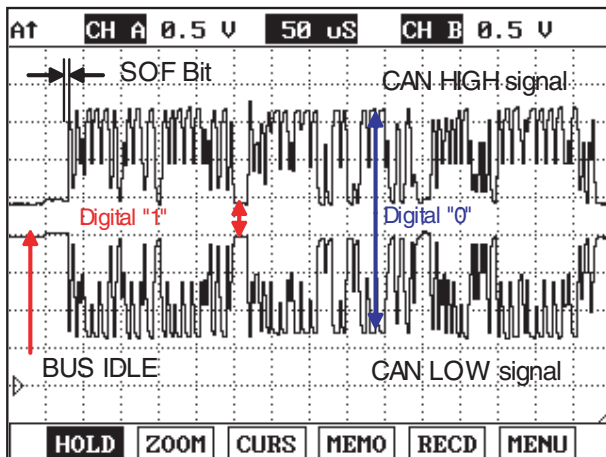


Fig.1

Fig.1) CAN communication waveform

Monitoring CAN HIGH and LOW simultaneously is important in monitoring CAN communication waveform. When CAN HIGH signal rise to 3.5V and LOW signal drops to 1.5V - voltage difference between HIGH and LOW signal is 2V - at BUS IDLE state(DIGITAL "1") whose reference voltage is 2.5V, "0" is recognized. Besides, comparing HIGH and LOW signal if opposite waveform is detected with the reference voltage of 2.5V, Check if current cam signal transfers correctly.

Continuous "0" signal above 6BIT means the occurrence of error in CAN communication. 1BIT is easily distinguished as calculating the time when "SOF"(START OF FRAME) which notifies the start of frame occurs.

Check if "0" signal above 6BIT is detected continuously when monitoring CAN communication waveform.

LGLG397A

MONITOR DTC STATUS

E9EAD6E3

1. Check DTC Status

- 1) Connect scantool to Data Link Connector(DLC).
- 2) IG "ON".
- 3) Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F4(DTAL) to check DTC's information from the DTCs menu
- 4) Read "DTC Status" parameter.

1.1 DIAGNOSTIC TROUBLE CODES		
PXXXX DTC TITLE		
NUMBER OF DTC : 1 ITEMS		
PART	ERAS	DTAL

PXXXX TITLE	
1.MIL STATUS:	ON/OFF
2.DTC STATUS:	PRESENT/HISTORY
3.DIAG.STATUS:	DIAGNOSIS FINISHED
DTC CAUSE TO SYSTEM ERROR : PXXXX	

SCMF16159L

5) Is parameter displayed "Present fault"?

YES

► Go to "Terminal and connector inspection" procedure.

NO

► Fault is intermittent caused by poor contact in the sensor' s and/or PCM' s connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

TERMINAL AND CONNECTOR INSPECTION

E0934A34

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

► Repair as necessary and go to "Verification of Vehicle Repair" procedure

NO

► Go to "Signal Circuit Inspection" procedure.

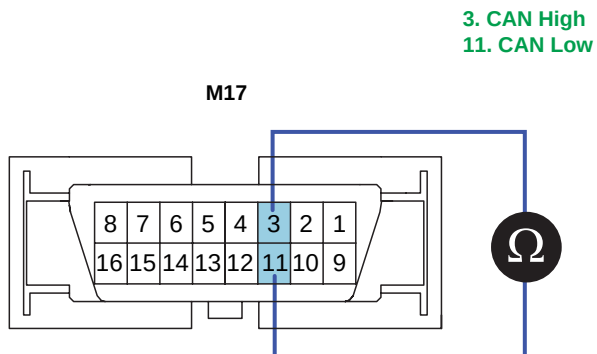
SIGNAL CIRCUIT INSPECTION

E385D809

1. Check CAN BUS resistance in Data Link Connector
 - 1) Ignition "OFF"
 - 2) Measure the resistance between terminals 3 and 11 of data link connector (Test 1)
 - 3) Disconnect PCM connector.

- 4) Measure the resistance between terminals 3 and 11 of data link connector (Test 2)

Specification : PCM and ABS(or ESP) connected : $60 \pm 3\Omega$ (Test 1)
PCM and ABS(or ESP) disconnected : $120 \pm 3\Omega$ (Test 2)



SVQF16428L

- 5) Is CAN BUS resistance within the specification?

YES

- Go to "2.Check short to ground in CAN BUS" as follows.

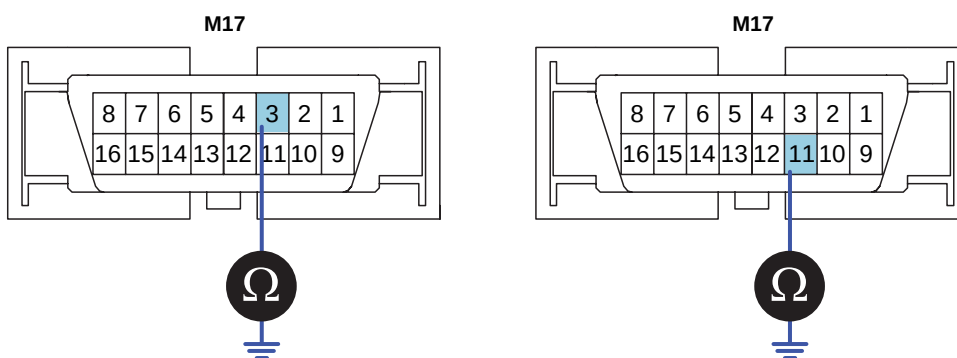
NO

- Below 10Ω for both conditions(disconnected, connected) : Repair short between CAN BUS lines and go to "Verification of Vehicle Repair".
► 120Ω for both conditions(disconnected, connected) : Go to "4. Check CAN BUS continuity".
► Infinite Ω for both conditions(disconnected, connected) :Repair open in CAN communication circuit between DLC terminal and In-pannel junction box.

2. Check short to ground in CAN BUS

- 1) Ignition "OFF"
- 2) Disconnect PCM and ABS(or ESP) connector.
- 3) Check continuity between DLC terminal 3 and chassis ground. (CAN HIGH line)
- 4) Check continuity between DLC terminal 11 and chassis ground. (CAN LOW line)

Specification : Discontinuity (Infinite Ω)



3. CAN High
11. CAN Low

SVQF16429L

5) Is measured resistance within the specification?

YES

► Go to "3. Check short to battery in CAN BUS".

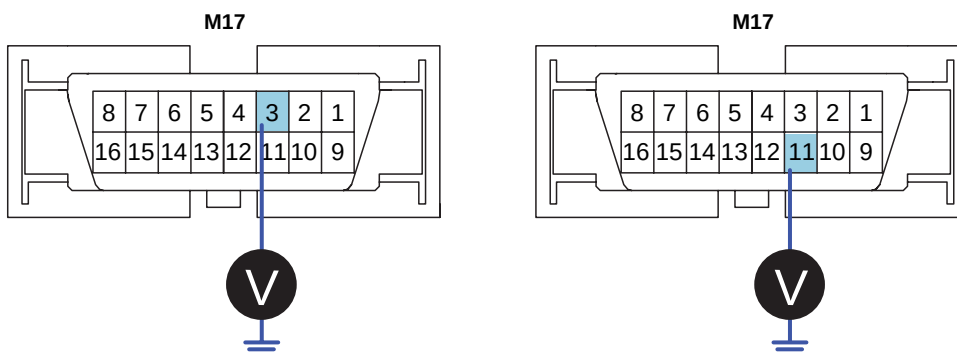
NO

► Repair short to ground in circuit and go to "Verification of Vehicle Repair".

3. Check short to battery in CAN BUS

- 1) Ignition "OFF"
- 2) Disconnect PCM and ABS(or ESP) connector.
- 3) Ignition "ON"
- 4) Measure the voltage of DLC terminal 3. (CAN HIGH line)
- 5) Measure the voltage of DLC terminal 11. (CAN LOW line)

Specification : 0.0V~0.1V



3. CAN High
11. CAN Low

SVQF16430L

6) Is measured resistance within the specification with both connector disconnected?

YES

► Go to "4. Check CAN BUS continuity" as follows.

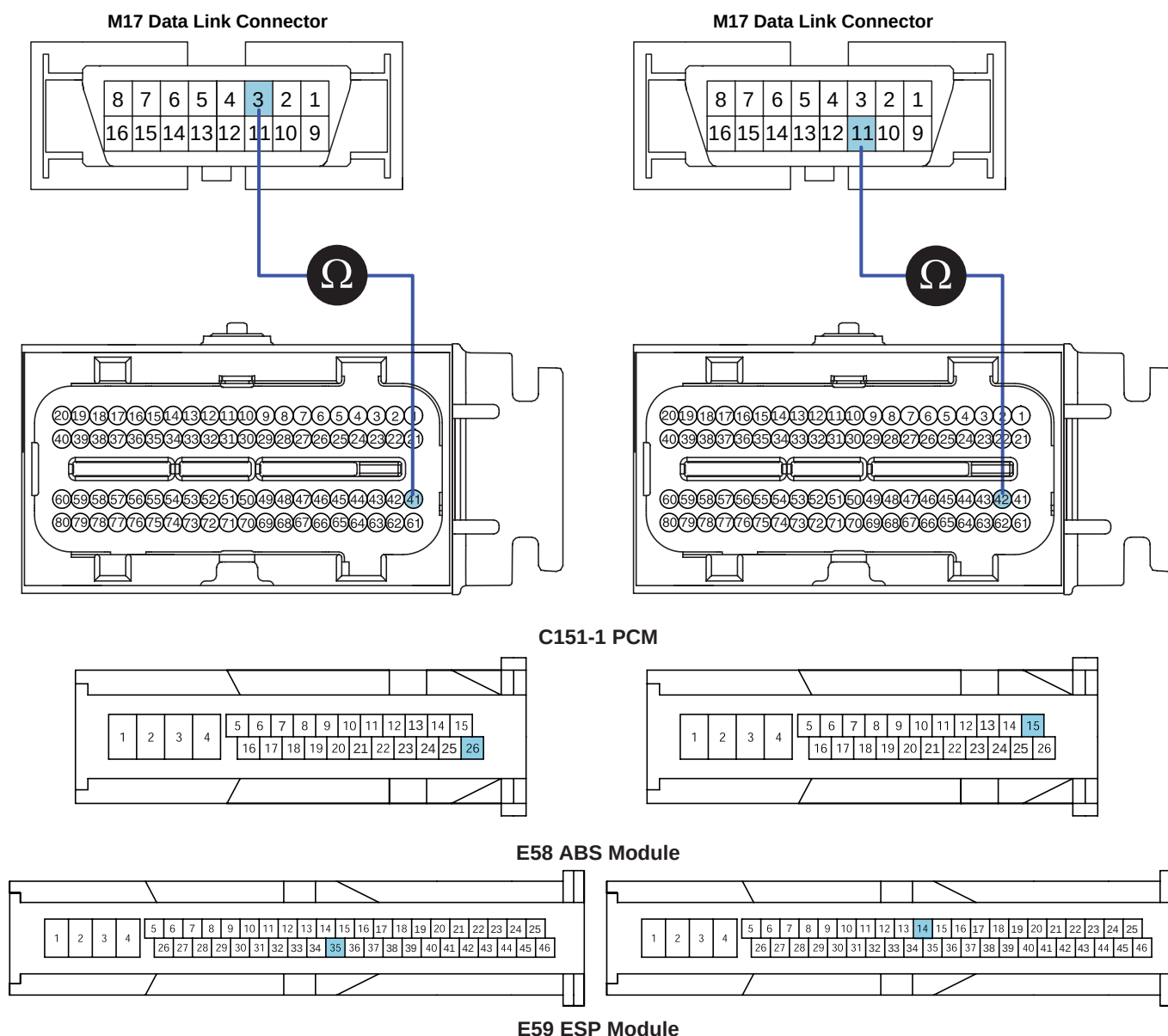
NO

► Repair short to battery and go to "Verification of Vehicle Repair".

4. Check CAN BUS continuity

- 1) Ignition "OFF"
- 2) Disconnect PCM and ABS(or ESP) connector.
- 3) Check continuity in CAN HIGH line.
(CAN HIGH : PCM connector terminal 41, ABS connector terminal 26, ESP connector terminal 35, Data link connector(DLC) terminal 3)
- 4) Check continuity CAN LOW line.
(CAN LOW : PCM connector terminal 42, ABS connector terminal 15, ESP connector terminal 14, Data link connector(DLC) terminal 11)

Specification : Continuity(below 1.0Ω)



SVQF16431L

5) Is the measured resistance within the specification?

YES

► Go to "Component Inspection".

NO

► Repair open in CAN BUS line and go to "Verification of Vehicle Repair".

COMPONENT INSPECTION

EB35D1E8

1. Check CAN communication waveform generation

1) Ignition "OFF"

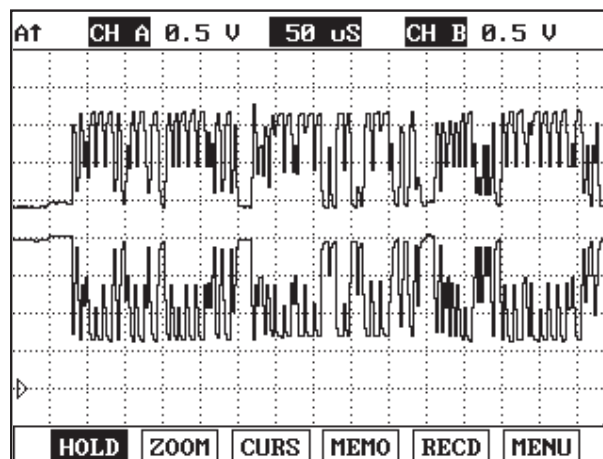
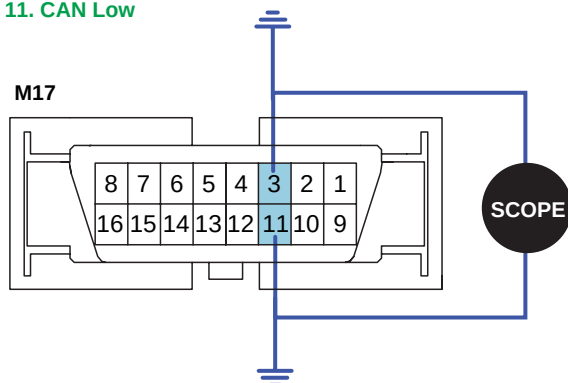
2) Connect 2 channel scope to DLC terminal 3(CAN HIGH) and 11(CAN LOW).

- 3) Ignition "ON" after connecting only PCM to CAN BUS.
- 4) Ignition "ON" after connecting only ABS or ESP module to CAN BUS.

Specification : At Ignition "ON", the waveform same as "Signal Waveform & Data" of above signal waveform.

※ Different from "Signal Waveform & Data", if 1) both CAN HIGH and LOW signal are fixed at 2.5 V or 2) HIGH and LOW signal are fixed at 3.5 V and 1.5 V, respectively, it is due to communication error between modules.

3. CAN High
11. CAN Low



SVQF16432L

- 5) Does correct waveform generate from each module?

YES

► Go to "Verification of Vehicle Repair".

NO

► Replace the module which generates poor communication waveform, and go to "Verification of Vehicle Repair".

VERIFICATION OF VEHICLE REPAIR EDE62C44

After a repair, it is essential to verify that the fault has been corrected.

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all readiness test have been verified as " Complete "
5. Are any DTCs present ?

YES

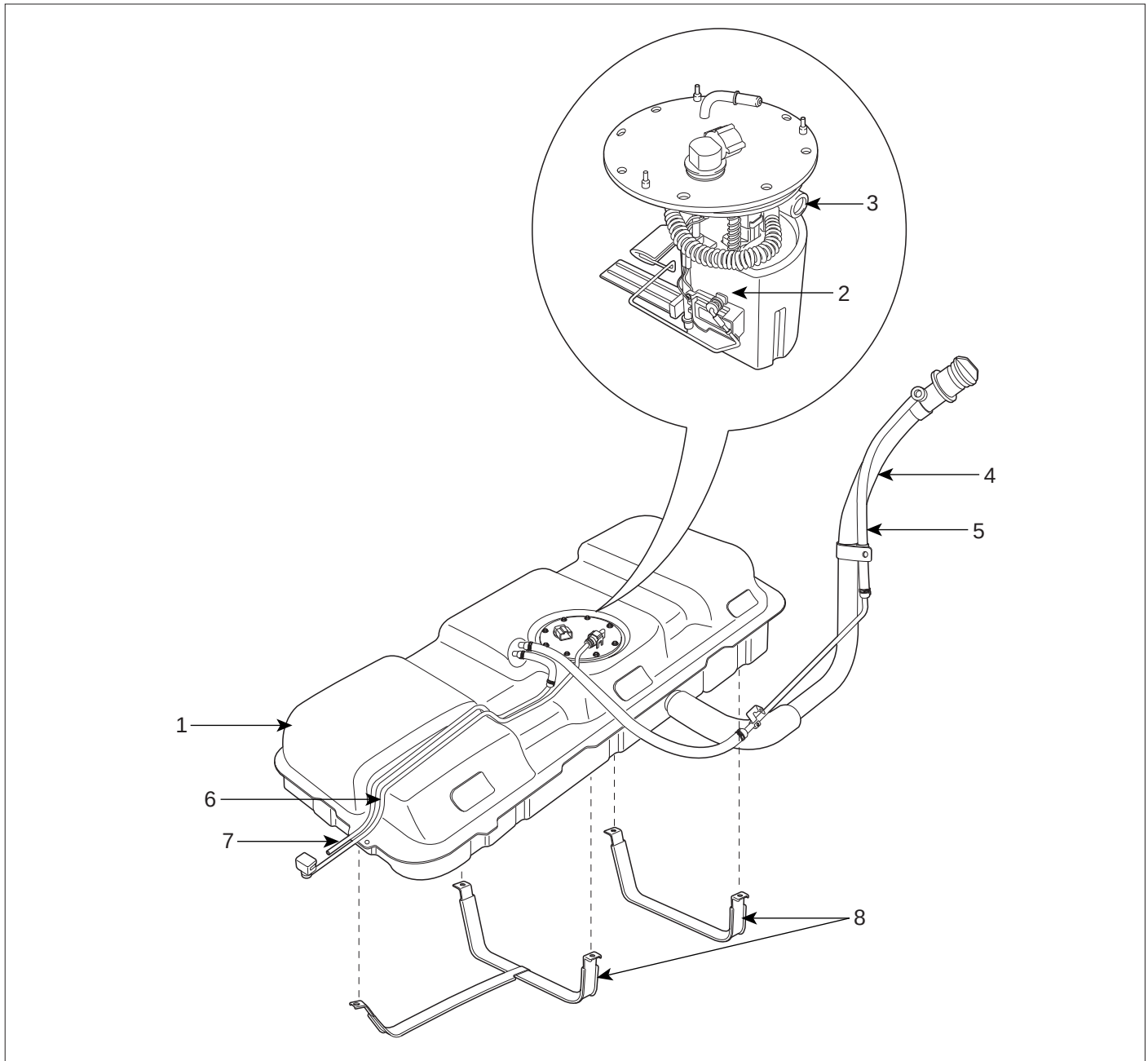
► Go to the applicable troubleshooting procedure.

NO

► System is performing to specification at this time.

FUEL DELIVERY SYSTEM

COMPONENT LOCATION E01D0466



- 1. Fuel Tank
- 2. Fuel Pump (including Fuel Filter)
- 3. Fuel Pressure Regulator
- 4. Fuel Filler Pipe

- 5. Leveling Pipe
- 6. Tube - Fuel Feed
- 7. Tube (Canister ↔ Fuel Tank)
- 8. Fuel Tank Band

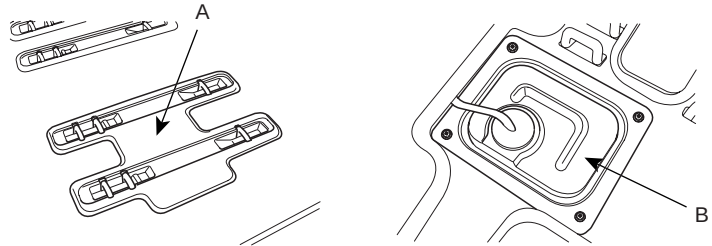
LGKG300B

FUEL PRESSURE TEST

EE0B21DE

1. PREPARING

1. Remove the 2nd seat(s) (Refer to "BD" group in this WORKSHOP MANUAL).
2. Remove the Striker Cover (A).
3. Remove the Service Cover (B).



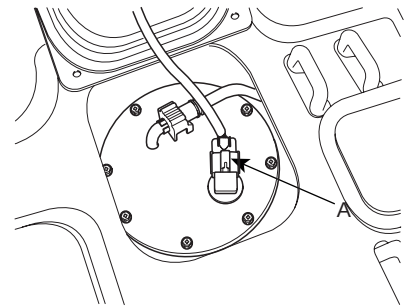
2. RELEASE THE INTERNAL PRESSURE

1. Disconnect the fuel pump connector(A).
2. Start the engine and wait until fuel in fuel line is exhausted.
3. After the engine stalls, turn the ignition switch to OFF position and disconnect the negative (-) terminal from the battery.



NOTE

Be sure to reduce the fuel pressure before disconnecting the fuel feed hose, otherwise fuel will spill out.



3. INSTALL THE SPECIAL SERVICE TOOL (SST) FOR MEASURING THE FUEL PRESSURE

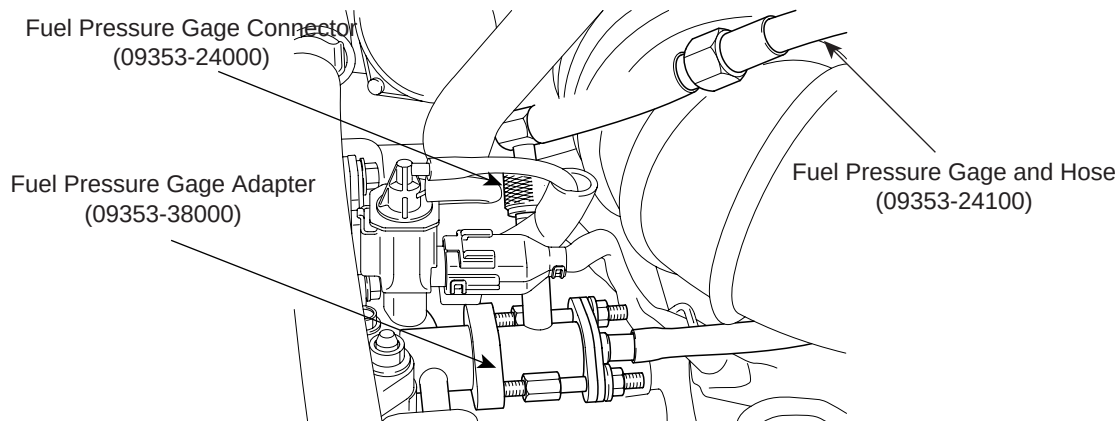
1. Disconnect the fuel feed hose from the delivery pipe.



CAUTION

Cover the hose connection with a shop towel to prevent splashing of fuel caused by residual pressure in the fuel line.

2. Install the Fuel Pressure Gauge Adapter (09353-38000) between the delivery pipe and the fuel feed hose.
3. Connect the Fuel Pressure Gauge Connector (09353-24000) to the Fuel Pressure Gauge Adapter (09353-38000).
4. Connect the Fuel Pressure Gauge and Hose (09353-24100) to Fuel Pressure Gauge Connector (09353-24000).
5. Connect the fuel feed hose to the Fuel Pressure Gauge Adapter (09353-38000).



SVQF16133L

4. INSPECT FUEL LEAKAGE ON CONNECTION

1. Connect the battery negative (-) terminal.
2. Apply battery voltage to the fuel pump terminal and activate the fuel pump. With fuel pressure applied, check that there is no fuel leakage from the fuel pressure gauge or connection part.

5. FUEL PRESURE TEST

1. Disconnect the negative (-) terminal from the battery.
2. Connect the fuel pump connector.
3. Connect the battery negative (-) terminal.
4. Start the engine and measure the fuel pressure at idle.

Standard Value: 374 ~ 384 kpa (3.82 ~ 3.92 kgf/cm², 54.3 ~ 55.8 psi)

- If the measured fuel pressure differs from the standard value, perform the necessary repairs using the table below.

Condition	Probable Cause	Suspected Area
Fuel Pressure too low	Clogged fuel filter	Fuel filter
	Fuel leak on the fuel-pressure regulator that is assembled on fuel pump because of poor seating of the fuel-pressure regulator.	Fuel Pressure Regulator
Fuel Pressure too High	Sticking fuel pressure regulator	Fuel Pressure Regulator

5. Stop the engine and check for a change in the fuel pressure gauge reading.

After engine stops, the gauge reading should hold for about 5 minutes

- Observing the declination of the fuel pressure when the gauge reading drops and perform the necessary repairs using the table below.

Condition	Probable Cause	Supected Area
Fuel pressure drops slowly after engine is stopped	Injector leak	Injector
Fuel pressure drops immediately after engine is stopped	The check valve within the fuel pump is open	Fuel Pump

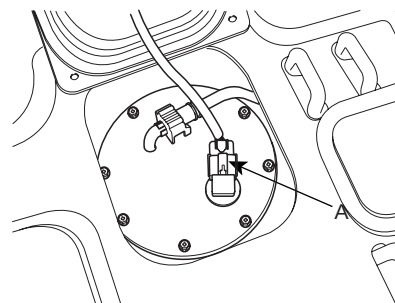
6. RELEASE THE INTERNAL PRESSURE

1. Disconnect the fuel pump connector(A).
2. Start the engine and wait until fuel in fuel line is exhausted.
3. After the engine stalls, turn the ignition switch to OFF position and disconnect the negative (-) terminal from the battery.



NOTE

Be sure to reduce the fuel pressure before disconnecting the fuel feed hose, otherwise fuel will spill out.



7. REMOVE THE SPECIAL SERVICE TOOL (SST) AND CONNECT THE FUEL LINE

1. Disconnect the Fuel Pressure Gauge and Hose (09353-24100) from the Fuel Pressure Gauge Connector (09353-24000).
2. Disconnect the Fuel Pressure Gauge Connector (09353-24000) from the Fuel Pressure Gauge Adapter (09353-38000).
3. Disconnect the fuel feed hose from the Fuel Pressure Gauge Adapter (09353-38000).
4. Disconnect the Fuel Pressure Gauge Adapter (09353-38000) from the delivery pipe.



CAUTION

Cover the hose connection with a shop towel to prevent splashing of fuel caused by residual pressure in the fuel line.

5. Connect the fuel feed hose to the delivery pipe.

8. INSPECT FUEL LEAKAGE ON CONNECTION

1. Connect the battery negative (-) terminal.
2. Apply battery voltage to the fuel pump terminal and activate the fuel pump. With fuel pressure applied, check that there is no fuel leakage from the fuel pressure gauge or connection part.
3. If the vehicle is normal, connect the fuel pump connector.

LGKG300D

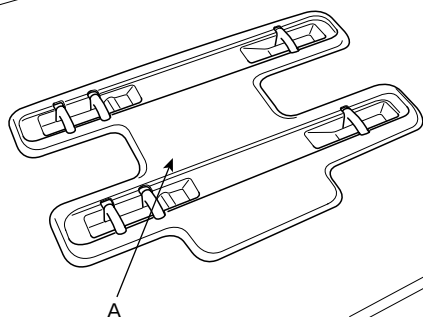
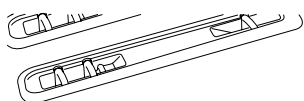
FUEL PUMP

REMOVAL(INCLUDING FUEL FILTER AND FUEL PRESSURE REGULATOR)

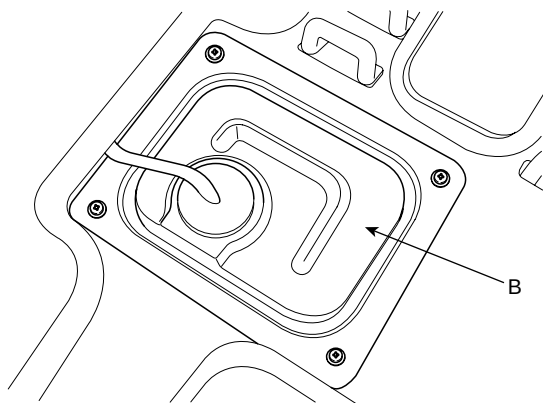
E7DAE93F

1. Preparation

- 1) Remove the 2nd seat(s) (Refer to "BD" group in this WORKSHOP MANUAL).
- 2) Remove the striker cover (A).
- 3) Remove the Service Cover (B).

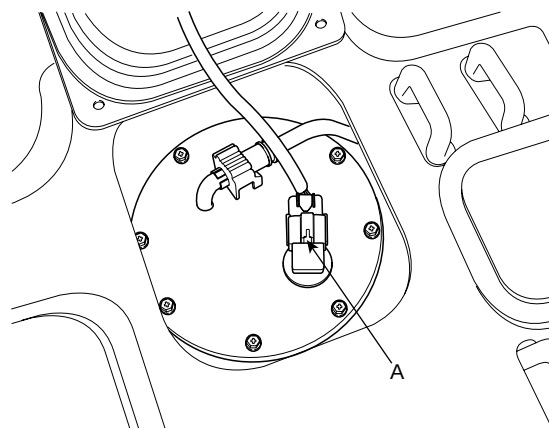


LGKG001D



LGKG001B

- 4) Disconnect the Fuel Pump Connector (A).

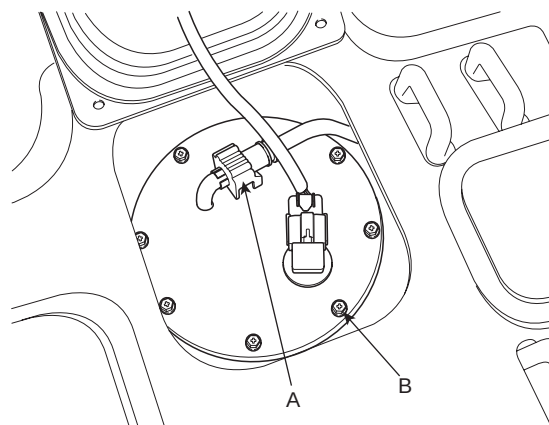


LGKG001C

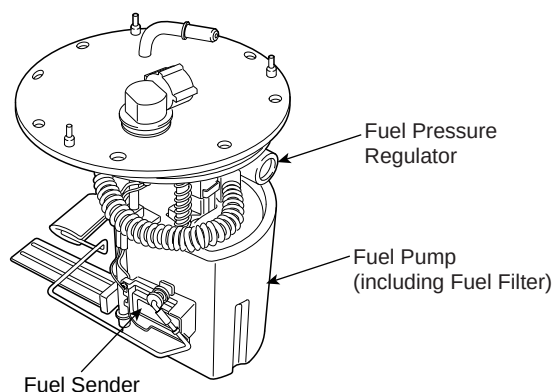
- 5) Start the engine and wait until fuel in fuel line is exhausted.

- 6) After the engine stalls, turn the ignition switch OFF.

2. After disconnecting the fuel feed quick connector (A) and unscrewing the the eight screws (B), remove the fuel pump assembly.



LGKG001G



LGKG001F

INSTALLATION EDA3ADC5

1. Install the Fuel Pump assembly according to the reverse order of "REMOVAL" procedure.

Fuel Pump assembly mounting bolts :
2.0 ~ 2.9 N·m (0.2 ~ 0.3 kgf·m, 1.4 ~ 2.2 lbf·ft)

FUEL DELIVERY SYSTEM

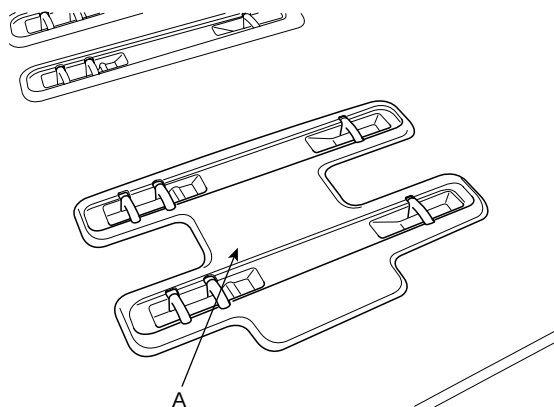
FLA -719

FUEL TANK

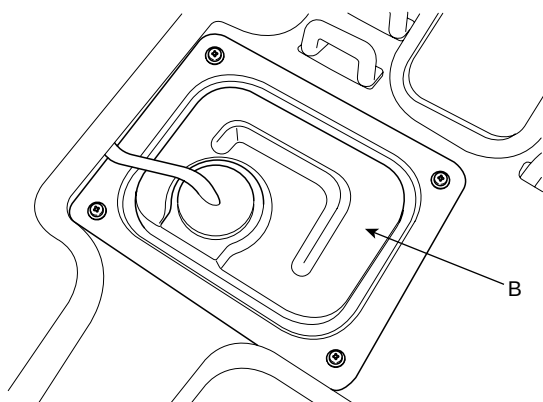
REMOVAL ECA56A48

1. Preparation

- 1) Remove the 2nd seat(s) (Refer to "BD" group in this WORKSHOP MANUAL).
- 2) Remove the striker cover (A).
- 3) Remove the Service Cover (B).

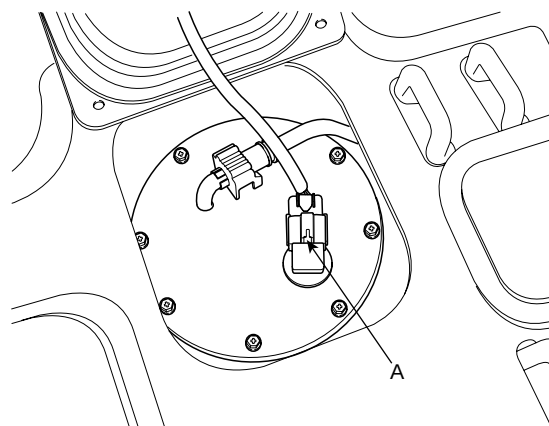


LGKG001D



LGKG001B

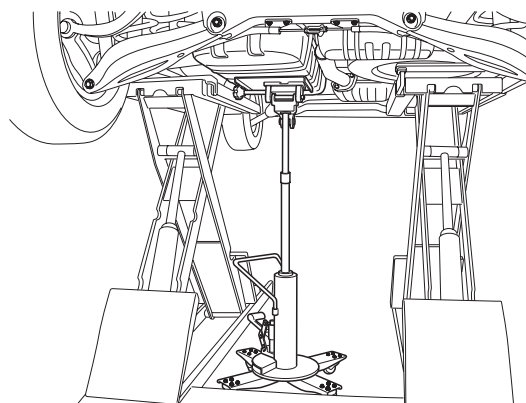
- 4) Disconnect the Fuel Pump Connector (A).



LGKG001C

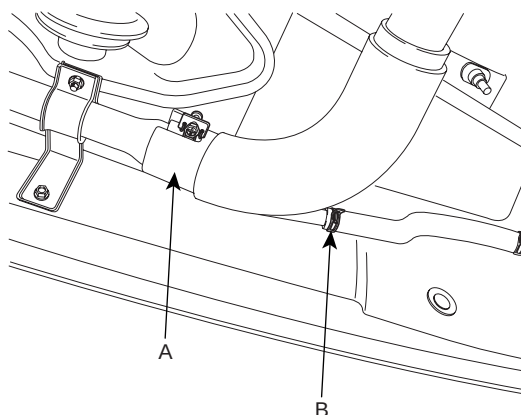
- 5) Start the engine and wait until fuel in fuel line is exhausted.
- 6) After the engine stalls, turn the ignition switch OFF.

2. Lift the vehicle and support it with a jack.



BFGK001P

3. Disconnect the fuel filler hose (A) and the leveling hose (B).

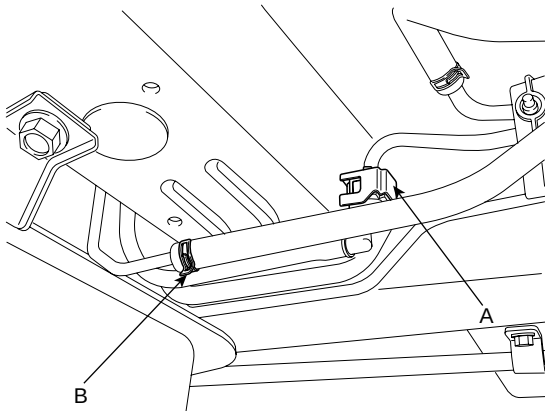


BFGK001T

FLA -720

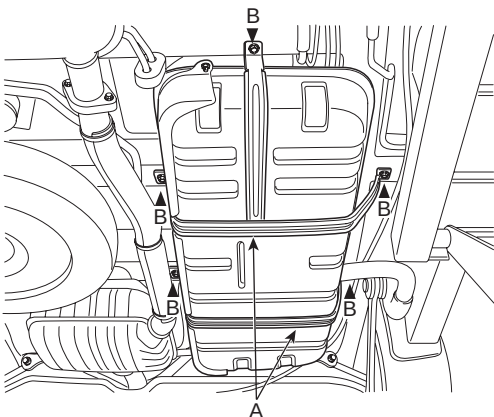
FUEL SYSTEM

4. Disconnect the fuel feed quick connector (A) and vacuum hose (B).



LGKG001A

5. Remove the fuel tank band (A) with unscrewing the mounting bolts (B) and remove the fuel tank from the vehicle.



BFKG001U

INSTALLATION E6D7D4CB

1. Install the Fuel Tank according to the reverse order of "REMOVAL" procedure.

Fuel tank band mounting bolts :
39.2 ~ 53.9 N·m (4.0 ~ 5.5 kgf·m, 28.9 ~ 39.8 lbf·ft)
