

DTC	P2238	OXYGEN SENSOR PUMPING CURRENT CIRCUIT LOW (FOR A/F SENSOR)(BANK 1 SENSOR 1)
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DTC	P2239	OXYGEN SENSOR PUMPING CURRENT CIRCUIT HIGH (FOR A/F SENSOR)(BANK 1 SENSOR 1)
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DTC	P2252	OXYGEN SENSOR REFERENCE GROUND CIRCUIT LOW (FOR A/F SENSOR)(BANK 1 SENSOR 1)
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DTC	P2253	OXYGEN SENSOR REFERENCE GROUND CIRCUIT HIGH (FOR A/F SENSOR)(BANK 1 SENSOR 1)
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HINT:

Although the title (DTC description) says "oxygen sensor", this DTC is related to the "A/F sensor".

CIRCUIT DESCRIPTION

Refer to DTC P2195 on page [05-269](#) .

DTC No.	DTC Detection Condition	Trouble Area
P2238	A/F sensor (bank 1 sensor 1) circuit low A/F sensor admittance is less than 0.022 1/Ω (1 trip detection logic)	HINT: Main trouble area • Open in A/F sensor circuit
P2238	• Condition (a) continues for 5.0 seconds or more : (a) AF+ is 0.5 V or less • Condition (a) continues for 5.0 seconds or more : (a) (AF+) - (AF-) is 0.1 V or less (1 trip detection logic)	• Open or short in A/F sensor circuit • A/F sensor • A/F sensor heater • EFI relay • Open or short in A/F sensor heater and EFI relay circuits • ECM
P2239	A/F sensor (bank 1 sensor 1) circuit high (1 trip detection logic)	HINT: Main trouble area • Short in A/F sensor circuit
P2239	• Condition (a) continues for 5.0 seconds or more : (a) AF+ is more than 4.5 V • Condition (a) continues for 5.0 seconds or more : (a) (AF+) - (AF-) is more than 0.8 V (1 trip detection logic)	• Same as DTC No. P2238
P2252	Condition (a) continues for 5.0 seconds or more : (a) AF- is 0.5 V or less (1 trip detection logic)	• Same as DTC No. P2238
P2253	Condition (a) continues for 5.0 seconds or more : (a) AF- is more than 4.5 V (1 trip detection logic)	• Same as DTC No. P2238

MONITOR DESCRIPTION

The air-fuel ratio (A/F) sensor varies its voltage output in proportion to the air-fuel ratio. If impedance (alternating current resistance) or voltage output of the sensor deviates greatly from the standard, the ECM determines that an open or short is in the A/F sensor circuit.

MONITOR STRATEGY

Related DTCs	P2238: A/F sensor (Bank1) open circuit between AF+ and AF- P2238: A/F sensor (Bank1) short circuit between AF+ and AF- P2238: A/F sensor (Bank 1) short circuit between AF+ and GND P2239: A/F sensor (Bank 1) short circuit between AF+ and +B P2252: A/F sensor (Bank 1) short circuit between AF- and GND P2253: A/F sensor (Bank 1) short circuit between AF- and +B
Required sensors/ components (Main)	A/F sensor
Required sensors/ components (Related)	ECT sensor, CKP sensor
Frequency of operation	Once per driving cycle
Duration	10 sec.
MIL operation	2 driving cycles
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

All:

The monitor will run whenever these DTCs are not present	See page 05-16
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P2238 (open circuit between AF+ and AF-):

Duration while all of the following conditions are met:	20 seconds or more
AF+ terminal voltage	0.5 to 4.5 V
AF- terminal voltage	0.5 to 4.5 V
Difference between AF+ terminal and AF- terminal voltages	0.1 to 0.8 V
ECT	20°C (68°F) or more
Engine condition	Running
Time after engine start	20 seconds or more
Fuel-cut	OFF
A/F sensor heater duty cycle	0.5% or more
Time after A/F sensor heating	20 seconds or more
Battery voltage	10.5 V or more
Ignition switch	ON

Others:

Battery voltage	10.5 V or more
Ignition switch	ON

TYPICAL MALFUNCTION THRESHOLDS

P2238 (Open circuit between AF+ and AF-):

A/F sensor admittance	Below 0.022 1/ohm
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P2238 (Short circuit between AF+ and GND):

AF+ terminal voltage	0.5 V or less
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P2238 (Short circuit between AF+ and AF-):

Difference between AF+ terminal and AF- terminal voltages	0.1 V or less
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P2239 (Short circuit between AF+ and +B):

AF+ terminal voltage	More than 4.5 V
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P2252 (Short circuit between AF- and GND):

AF- terminal voltage	0.5 V or less
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P2253 (Short circuit between AF- and +B):

AF- terminal voltage	More than 4.5 V
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WIRING DIAGRAM

Refer to DTC P2195 on page [05-269](#) .

INSPECTION PROCEDURE

HINT:

Hand-held tester only:

The malfunctioning area can be found by the ACTIVE TEST A/F CONTROL operation. The A/F CONTROL operation can determine if the A/F sensor, heated oxygen sensor or other suspected trouble areas are malfunctioning or not.

(a) Perform the ACTIVE TEST A/F CONTROL operation.

HINT:

The A/F CONTROL operation lowers the injection volume by 12.5 % or increases the injection volume by 25 %.

- (1) Connect the hand-held tester to the DLC3 on the vehicle.
- (2) Turn the ignition switch ON.
- (3) Warm up the engine by running the engine at 2,500 rpm for approximately 90 seconds.
- (4) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / ACTIVE TEST / A/F CONTROL.
- (5) Perform the A/F CONTROL operation with the engine idling (press the right or left button).

Result:

A/F sensor reacts in accordance with increase and decrease of injection volume:

+25 % → RICH output: Less than 3.0 V

-12.5 % → LEAN output: More than 3.35 V

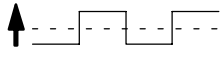

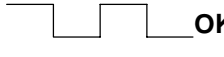

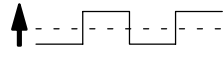

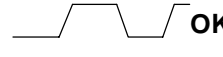

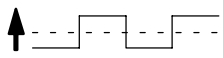

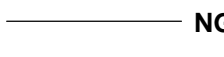
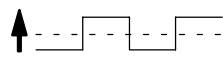

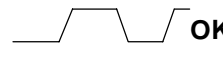

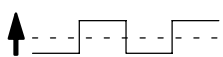

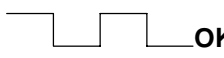
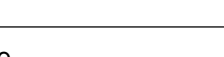
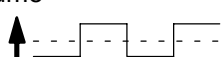

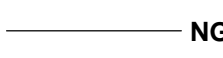
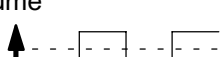
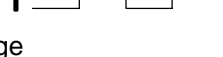

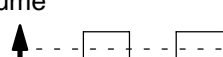
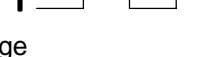

Heated oxygen sensor reacts in accordance with increase and decrease of injection volume:

+25 % → RICH output: More than 0.55 V

-12.5 % → LEAN output: Less than 0.4 V

NOTICE:

The A/F sensor output has a few seconds of delay and the heated oxygen sensor output has about 20 seconds of delay at maximum.

	Output voltage of A/F sensor (sensor 1)	Output voltage of heated oxygen sensor (sensor 2)	Main suspect trouble area
Case 1	Injection volume +25 %  -12.5 %  Output voltage More than 3.35 V  OK Less than 3.0 V 	Injection volume +25 %  -12.5 %  Output voltage More than 0.55 V  OK Less than 0.4V 	—
Case 2	Injection volume +25 %  -12.5 %  Output voltage Almost No reaction  NG	Injection volume +25 %  -12.5 %  Output voltage More than 0.55 V  OK Less than 0.4V 	A/F sensor (A/F sensor, heater, A/F sensor circuit)
Case 3	Injection volume +25 %  -12.5 %  Output voltage More than 3.35 V  OK Less than 3.0V 	Injection volume +25 %  -12.5 %  Output voltage Almost No reaction  NG	Heated oxygen sensor (heated oxygen sensor, heater, heated oxygen sensor circuit)
Case 4	Injection volume +25 %  -12.5 %  Output voltage Almost No reaction  NG	Injection volume +25 %  -12.5 %  Output voltage Almost No reaction  NG	Extremely rich or lean actual air-fuel ratio (Injector, fuel pressure, gas leakage in exhaust system, etc.)

The following A/F CONTROL procedure enables a technician to check and graph the voltage outputs of both the A/F sensor and the heated oxygen sensor.

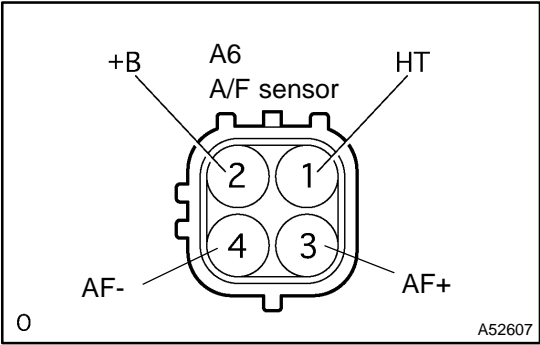
For displaying the graph, enter "ACTIVE TEST / A/F CONTROL / USER DATA", select "AFS B1S1 and O2S B1S2" by pressing "YES" and push "ENTER". Then press "F4".

HINT:

- If DTC P2237, P2238, P2239, P2251, P2252 or P2253 is displayed, check the bank 1 sensor 1 circuit.
- Read freeze frame data using the hand-held tester or the OBD II scan tool. Freeze frame data records the engine conditions when a malfunction is detected. When troubleshooting, freeze frame data can help determine if the vehicle was running or stopped, if the engine was warmed up or not, if the air-fuel ratio was lean or rich, and other data from the time the malfunction occurred.

1

INSPECT AIR FUEL RATIO SENSOR (HEATER RESISTANCE)



- (a) Disconnect the A6 A/F sensor connector.
- (b) Measure the resistance of the A/F sensor terminals.

Standard:

Tester Connection	Condition	Specified Condition
1 (HT) - 2 (+B)	20°C (68°F)	1.8 to 3.4 Ω
1 (HT) - 4 (AF-)	-	10 kΩ or higher

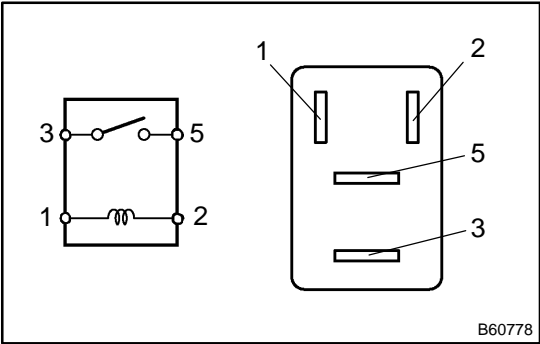
NG

REPLACE AIR FUEL RATIO SENSOR

OK

2

INSPECT RELAY (EFI)



- (a) Remove the EFI relay from the engine room J/B.
- (b) Measure the resistance of the EFI relay.

Standard:

Tester Connection	Specified Condition
3 - 5	10 kΩ or higher
3 - 5	Below 1 Ω (when battery voltage is applied to terminals 1 and 2)

NG

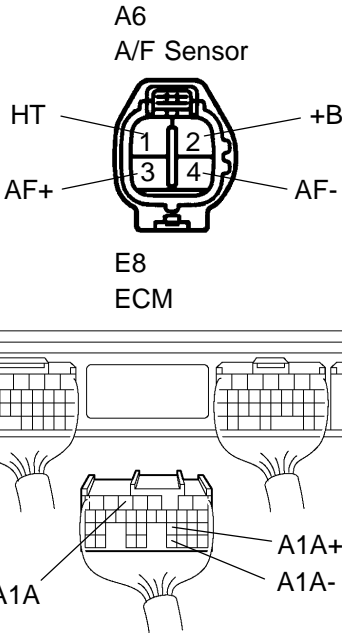
REPLACE RELAY

OK

3

CHECK WIRE HARNESS (A/F SENSOR - ECM)

Wire Harness Side



A76787
A81695

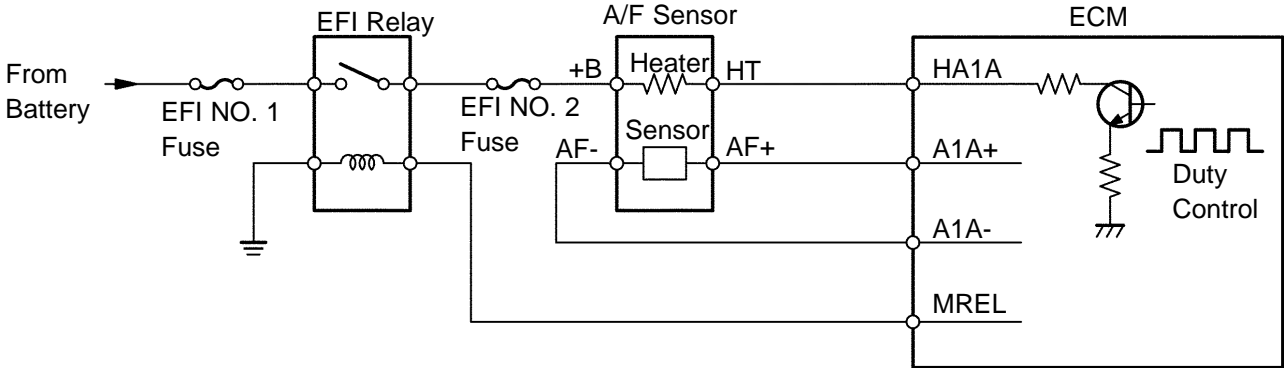
A86849

- (a) Check the wire harness between the ECM and A/F sensor.
- (1) Disconnect the A6 A/F sensor connector.
 - (2) Disconnect the E8 ECM connector.
 - (3) Measure the resistance of the wire harness side connectors.

Standard:

Tester Connection	Specified Condition
A6-3 (AF+) - E8-23 (A1A+) A6-4 (AF-) - E8-31 (A1A-) A6-1 (HT) - E8-5 (HA1A)	Below 1 Ω
A6-3 (AF+) or A1A+ (E8-23) - Body ground A6-4 (AF-) or A1A- (E8-31) - Body ground A6-1 (HT) or HA1A (E8-5) - Body ground	10 k Ω or higher

Reference



P

A90346

NG

REPAIR OR REPLACE HARNESS AND CONNECTOR

OK

REPLACE ECM (See page 10-9)