DTC	P0037	Oxygen Sensor Heater Control Circuit Low (Bank 1 Sensor 2)

DTC	P0038	Oxygen Sensor Heater Control Circuit High (Bank 1 Sensor 2)

DTC	P0141	Oxygen Sensor Heater Circuit Malfunction (Bank 1 Sensor 2)

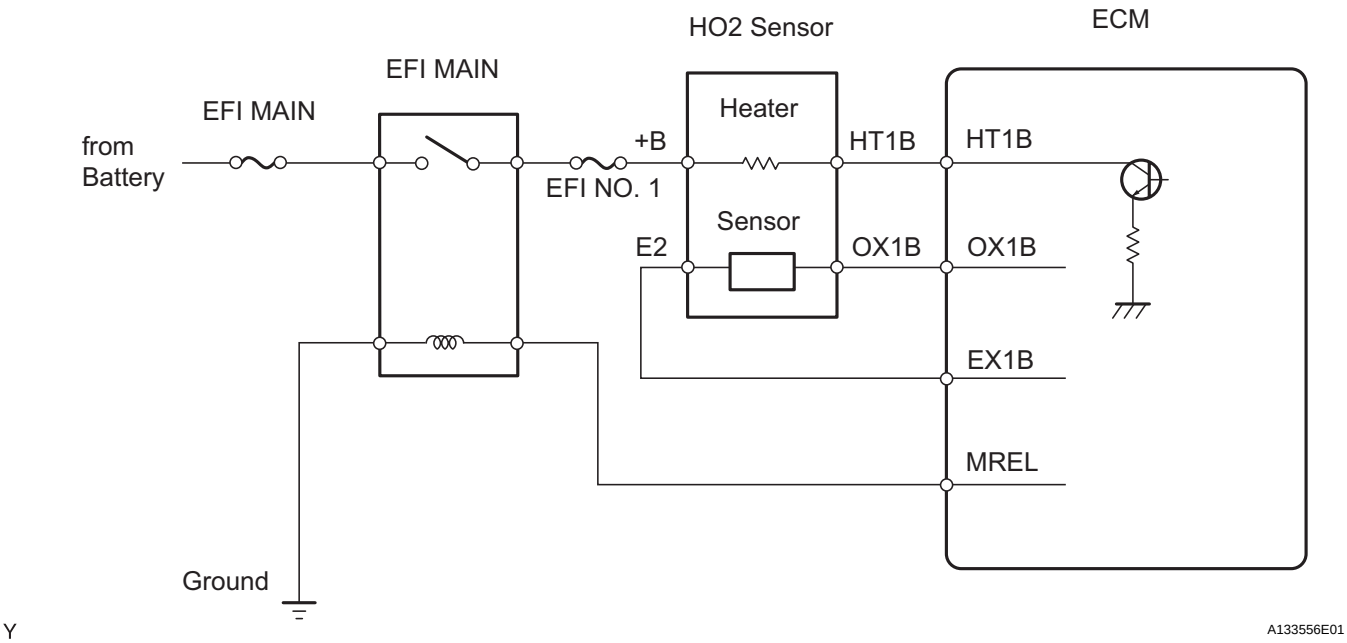
DESCRIPTION

Refer to DTC P0136 (see page ES-129).

HINT:

- When any of these DTCs are set, the ECM enters fail-safe mode. The ECM turns off the Heated Oxygen (HO2) Sensor heater in fail-safe mode. Fail-safe mode continues until the ignition switch is turned OFF.
- The ECM provides a pulse width modulated control circuit to adjust the current through the heater. The HO2 sensor heater circuit uses a relay on the B+ side of the circuit.

Reference (System Diagram of Sensor 2):



DTC No.	DTC Detection Conditions	Trouble Areas
P0037	Heated Oxygen (HO2) sensor heater current less than 0.3 A (1 trip detection logic)	• Open in HO2 sensor heater circuit • HO2 sensor heater (sensor 2) • Integration relay (EFI MAIN relay) • ECM
P0038	Heated Oxygen (HO2) sensor heater current more than 2 A (1 trip detection logic)	• Short in HO2 sensor heater circuit • HO2 sensor heater (sensor 2) • Integration relay (EFI MAIN relay) • ECM
P0141	Cumulative heater resistance correction value exceeds threshold (2 trip detection logic)	• Open or short in HO2 sensor heater circuit • HO2 sensor heater (sensor 2) • Integration relay (EFI MAIN relay) • ECM

MONITOR DESCRIPTION

The sensing position of the Heated Oxygen (HO2) sensor has a zirconia element which is used to detect the oxygen concentration in the exhaust gas. If the zirconia element is at the appropriate temperature, and the difference between the oxygen concentrations surrounding the inside and outside surfaces of the sensor is large, the zirconia element generates voltage signals. In order to increase the oxygen concentration detecting capacity of the zirconia element, the ECM supplements the heat from the exhaust with heat from a heating element inside the sensor.

Heated oxygen sensor heater range check (P0037 and P0038):

The ECM monitors the current applied to the O2 sensor heater to check the heater for malfunctions. If the current is below the threshold value, the ECM determines that there is an open circuit in the heater. If the current is above the threshold value, the ECM determines that there is a short circuit in the heater.

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The ECM constantly monitors the current applied to the heater. If the ECM detects an open or short circuit, the ECM turns the MIL on and sets a DTC.

If a malfunction is detected, the ECM cuts off the current applied to the heater.

Example:

The ECM sets DTC P0038 when the current in the HO2 sensor heater is more than 2 A. Conversely, when the heater current is less than 0.3 A, DTC P0037 is set.

Heated oxygen sensor heater performance (P0141):

After the accumulated heater ON time exceeds 100 seconds, the ECM calculates the heater resistance using the battery voltage and the current applied to the heater.

If the resistance is above the threshold value, the ECM determines that there is a malfunction in the HO2 sensor heater and set DTC P0141.

MONITOR STRATEGY

Related DTCs	P0037: Heated oxygen sensor heater range check (Low electrical current) P0038: Heated oxygen sensor heater range check (High electrical current) P0141: Heated oxygen sensor heater performance
Required Sensors/Components (Main)	Heated oxygen sensor heater
Required Sensors/Components (Related)	-
Frequency of Operation	Continuous: P0037 and P0038 Once per driving cycle: P0141
Duration	1 second: P0037 and P0038 10 seconds: P0141
MIL Operation	Immediate: P0037 and P0038 2 driving cycles: P0141
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

All:

Monitor runs whenever following DTCs not present	None

P0037:

Battery voltage	10.5 to 20 V

P0038:

Battery voltage	10.5 to 20 V

P0141 (Heater performance monitor check):

All of following conditions met:	-
Battery voltage	10.5 V or more
Fuel cut	OFF
Time after fuel cut ON to OFF	30 seconds or more

Accumulated heater ON time	100 seconds or more

TYPICAL MALFUNCTION THRESHOLDS

P0037:

Heater current	Less than 0.3 A

P0038:

Heater current	More than 2 A

P0141 (Heater performance monitor check):

Accumulated heater resistance	Varies with sensor element temperature (Example: More than 23 Ω)

COMPONENT OPERATING RANGE

Heated Oxygen (HO2) sensor heater current	0.4 to 1 A (when engine idles, HO2 sensor warmed up and battery voltage 11 to 14 V)

WIRING DIAGRAM

Refer to DTC P0136 (see page ES-136).

CONFIRMATION DRIVING PATTERN

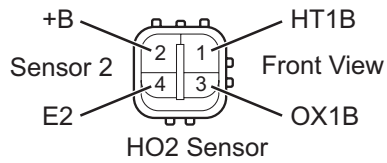
These DTCs are detected when the engine idles for 110 seconds or more.

INSPECTION PROCEDURE

HINT:
Sensor 2 refers to the sensor mounted behind the Three-Way Catalytic Converter (TWC) and located far from the engine assembly.
Read freeze frame data using the intelligent tester. Freeze frame data records the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, 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 HEATED OXYGEN SENSOR (HEATER RESISTANCE)

Component Side :



A115661E02

(a) Disconnect the B19 Heated Oxygen (HO2) sensor connector.
(b) Measure the resistance of the HO2 sensor connector.
Standard resistance

Tester Connections	Specified Conditions
1 (HT1B) - 2 (+B)	11 to 16 Ω at 20°C (68°F)
1 (HT1B) - 4 (E2)	10 kΩ or higher

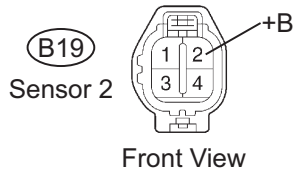
(c) Reconnect the HO2 sensor connector.

NG → **REPLACE HEATED OXYGEN SENSOR**

OK

2	CHECK TERMINAL VOLTAGE (+B OF HO2 SENSOR)

Wire Harness Side:



A072895E07

(a) Disconnect the B19 HO2 sensor connector.
(b) Turn the ignition switch ON.
(c) Measure the voltage between the terminals of the B19 HO2 sensor connector and body ground.

Standard voltage

Tester Connections	Specified Conditions
B19-2 (+B) - Body ground	9 to 14 V

(d) Reconnect the HO2 sensor connector.

OK → **Go to step 5**

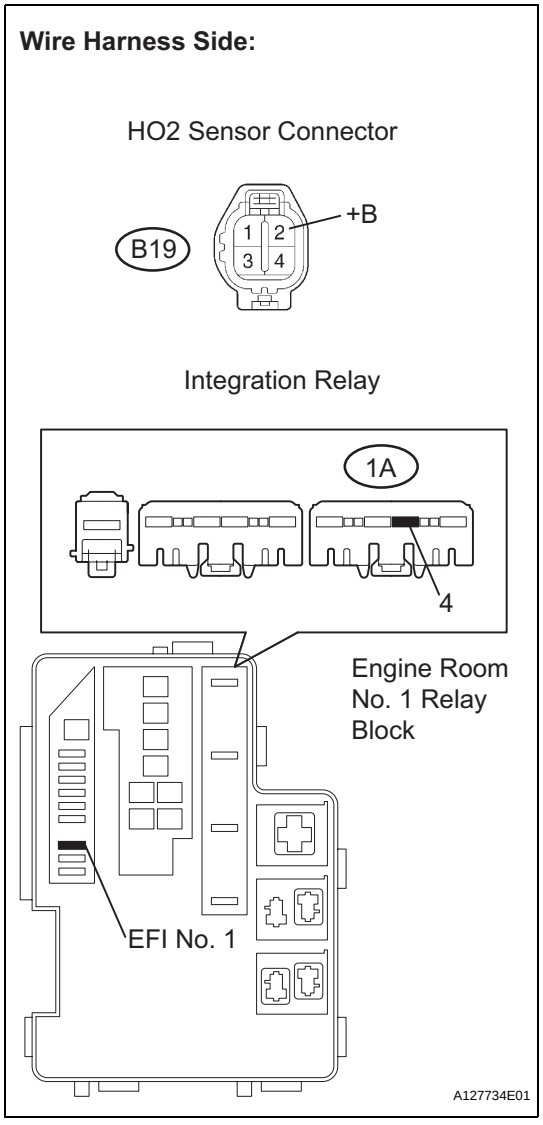
NG

3	INSPECT INTEGRATION RELAY (EFI MAIN RELAY) (See page ES-84)

NG → **REPLACE INTEGRATION RELAY**

OK

4	CHECK HARNESS AND CONNECTOR (HO2 SENSOR - EFI RELAY)



(a) Check the EFI No. 1 fuse.
(b) Disconnect the B19 HO2 sensor connector.
(c) Remove the integration relay from the engine room No. 1 relay block.
(d) Check the resistance.

Standard resistance (Check for open)

Tester Connections	Specified Conditions
B19-2 (+B) - 1A-4 (Engine room No. 1 R/B)	Below 1 Ω

Standard resistance (Check for short)

Tester Connections	Specified Conditions
B19-2 (+B) or 1A-4 (Engine room No. 1 R/B) - Body ground	10 kΩ or higher

(e) Reconnect the HO2 sensor connector.
(f) Reinstall the integration relay.

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

CHECK ECM POWER SOURCE CIRCUIT

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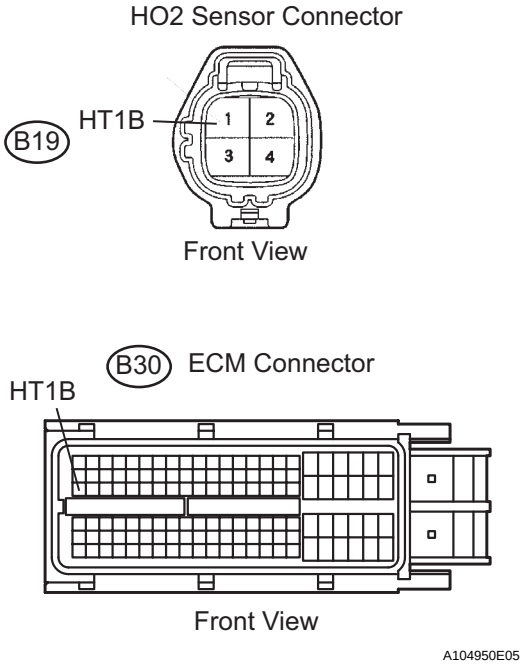
5 CHECK HARNESS AND CONNECTOR (HO2 SENSOR - ECM)



(a) Disconnect the B19 HO2 sensor connector.
(b) Disconnect the B30 ECM connector.
(c) Measure the resistance.

Standard resistance (Check for open)

Tester Connections	Specified Conditions
B19-1 (HT1B) - B30-47 (HT1B)	Below 1 Ω

Standard resistance (Check for short)

Tester Connections	Specified Conditions
B19-1 (HT1B) or B30-47 (HT1B) - Body ground	10 kΩ or higher

(d) Reconnect the HO2 sensor connector.
(e) Reconnect the ECM connector.

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

6 CHECK WHETHER DTC OUTPUT RECURS

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON.
(c) Turn the tester ON.
(d) Clear DTCs (see page ES-35).
(e) Start the engine.
(f) Allow the engine to idle for 2 minutes or more.
(g) Select the following menu items: DIAGNOSIS / ENHANCED OBD II / DTC INFO / CURRENT CODES.
(h) Read DTCs.

Result

Display (DTC Output)	Proceed To
No output	A
P0037, P0038 and/or P0141	B

B → **REPLACE ECM**

A

CHECK FOR INTERMITTENT PROBLEMS