

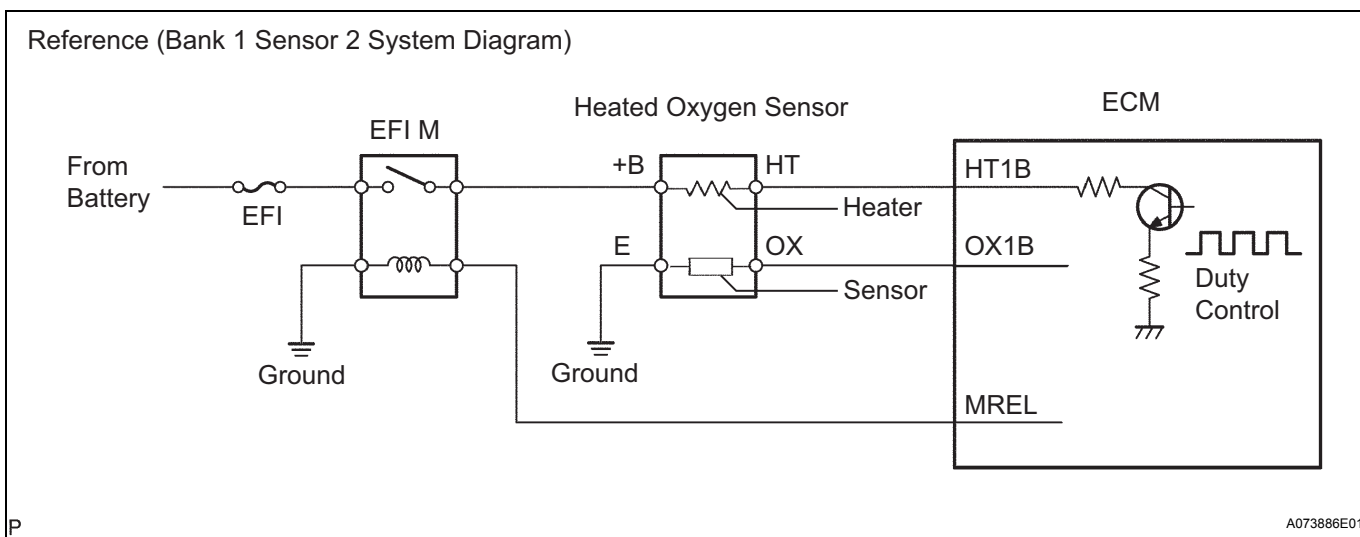
<b>DTC</b>	<b>P0037</b>	<b>Oxygen Sensor Heater Control Circuit Low (Bank 1 Sensor 2)</b>
<b>DTC</b>	<b>P0038</b>	<b>Oxygen Sensor Heater Control Circuit High (Bank 1 Sensor 2)</b>

## DESCRIPTION

Refer to DTC P0136 (see page [ES-115](#)).

### HINT:

The ECM provides a pulse width modulated control circuit to adjust current through the heater. The heated oxygen sensor heater circuit uses a relay on the +B side of the circuit.



DTC No.	DTC Detection Condition	Trouble Area
P0037	Heater current is less than 0.3 A when the heater operates with +B greater than 10.5 V (1 trip detection logic)	<ul style="list-style-type: none"> <li>Open or short in heater circuit of the heated oxygen sensor</li> <li>Heated oxygen sensor heater</li> <li>EFI M relay (integration relay)</li> <li>ECM</li> </ul>
P0038	When the heater operates, heater current exceeds 2 A (1 trip detection logic)	<ul style="list-style-type: none"> <li>Short in heater circuit of the heated oxygen sensor</li> <li>Heated oxygen sensor heater</li> <li>EFI M relay (integration relay)</li> <li>ECM</li> </ul>

### HINT:

- Sensor 1 refers to the sensor mounted before the TWC and is located near the engine assembly.
- Sensor 2 refers to the sensor mounted after the TWC and is located far from the engine assembly.

## MONITOR DESCRIPTION

The sensing portion of the heated oxygen sensor has a zirconia element which is used to detect oxygen concentration in the exhaust gas. If the zirconia element is at the proper temperature and difference of the oxygen concentration between the inside and outside surfaces of sensor is large, the zirconia element will generate voltage signals. In order to increase the oxygen concentration detecting capacity in the zirconia element, the ECM supplements the heat from the exhaust with heat from a heating element inside the sensor. When current in the sensor is out of the standard operating range, the ECM interprets this as a fault in the heated oxygen sensor and sets a DTC.

Example:

The ECM will set a high current DTC if the current in the sensor is more than 2 A when the heater is OFF. Similarly, the ECM will set a low current DTC if the current is less than 0.25 A when the heater is ON.

## MONITOR STRATEGY

Related DTCs	P0037: Heated oxygen sensor heater current bank 1 sensor 2 (low current) P0038: Heated oxygen sensor heater current bank 1 sensor 2 (high current)
Required sensors/components	Main sensors: Heated oxygen sensor Related sensors: Vehicle speed sensor
Frequency of operation	Continuous
Duration	0.5 seconds
MIL operation	1 driving cycle
Sequence of operation	None

## TYPICAL ENABLING CONDITIONS

### All:

Monitor runs whenever following DTCs not present	None
Battery voltage	10.5 V or more
Engine	Running
Starter	OFF
Catalyst intrusive monitoring	Not operating
Intrusive heating	Not operating

### P0037:

When the following conditions are met	0.5 seconds or more
Learned heater current during heater OFF	Completed
Intrusive heating	Not operating
Heating is OFF	Less than 0.1 seconds
Heater current	Less than 0.3 A
Intrusive heating for high current monitor	Not operating
Time after heaters are OFF	1 second or more

### P0038:

When the following conditions are met	0.3 seconds or more
Learned heater current during heater OFF	Completed
Intrusive heating	Not operating
Heating is OFF	Less than 0.1 seconds
Heater current	2 A or more
Time after heaters are OFF	1 second or more

## TYPICAL MALFUNCTION THRESHOLDS

### P0037:

Heated oxygen sensor heater current	Less than 0.3 A (at 0.5 seconds after heater is turned ON)
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### P0038:

Heated oxygen sensor heater current	More than 2 A (while supplemental heating is OFF)
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## COMPONENT OPERATING RANGE

Heated oxygen sensor heater current  
(after engine is warmed up)

0.4 to 1.0 A (at idle and battery voltage 11 to 14 V)

## MONITOR RESULT

Refer to detailed information (see page [ES-15](#)).

## WIRING DIAGRAM

Refer to DTC P0136 (see page [ES-121](#)).

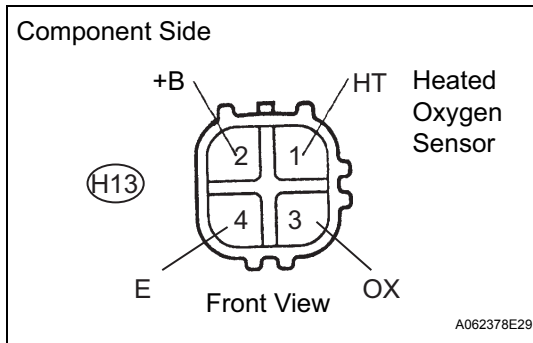
## INSPECTION PROCEDURE

HINT:

- Read freeze frame data using the intelligent tester. Freeze frame data records the engine condition when 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.
- When DTC P0038 is detected, proceed to step 4 if the heater resistance is in normal range.

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### 1 INSPECT HEATED OXYGEN SENSOR (HEATER RESISTANCE)



- Disconnect the H13 heated oxygen sensor connector.
- Measure the resistance between the terminals of the heated oxygen sensor connector.

**Standard resistance (Bank 1 sensor 2):**

Tester Connection	Specified Condition
H13-1 (HT) - H13-2 (+B)	11 to 16 $\Omega$ at 20°C (68°F)
H13-1 (HT) - H13-4 (E)	10 k $\Omega$ or higher

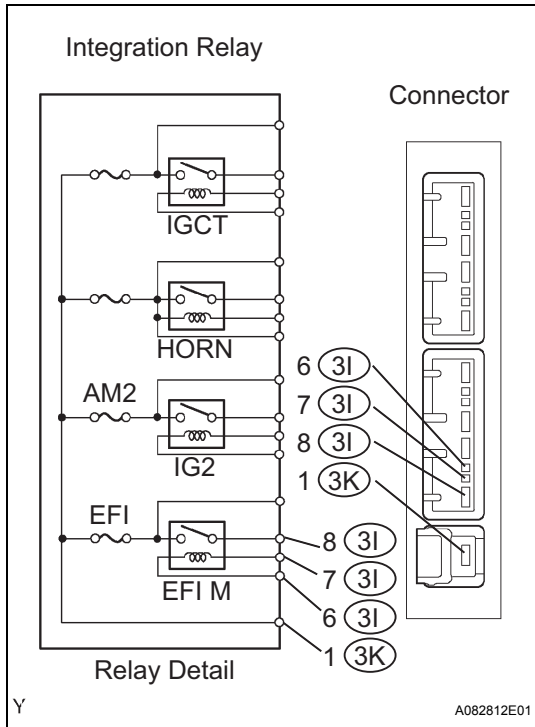
- Reconnect the heated oxygen sensor connector.

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**REPLACE HEATED OXYGEN SENSOR**

OK

**2 INSPECT INTEGRATION RELAY (EFI M RELAY)**



(a) Remove the integration relay from the engine room relay block.

(b) Inspect the EFI M relay.  
**Standard resistance**

Tester Connection	Specified Condition
3K-1 - 3I-8	10 kΩ or higher
3K-1 - 3I-8	Below 1 Ω (Apply battery voltage to terminals 3I-6 and 3I-7)

(c) Reinstall the integration relay.

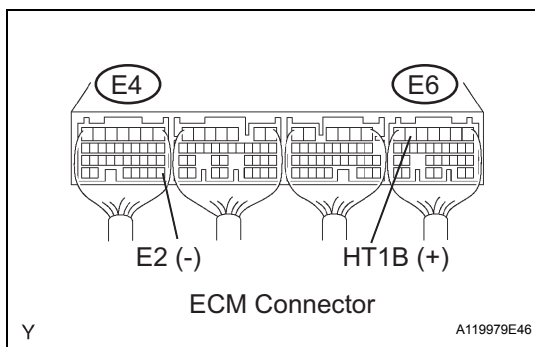
**NG**

**REPLACE INTEGRATION RELAY**

**ES**

**OK**

**3 CHECK ECM (HT1B VOLTAGE)**



(a) Turn the power switch ON (IG).

(b) Measure the voltage between the applicable terminals of the E4 and E6 ECM connectors.

**Standard voltage**

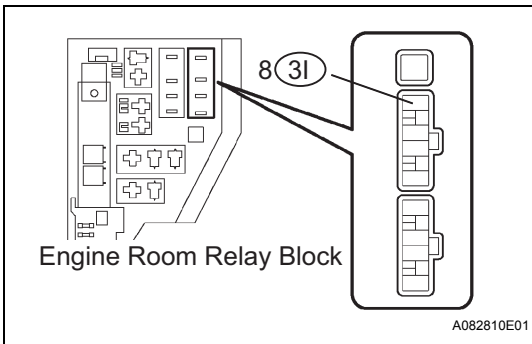
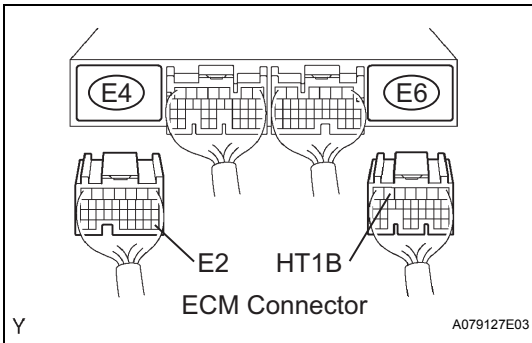
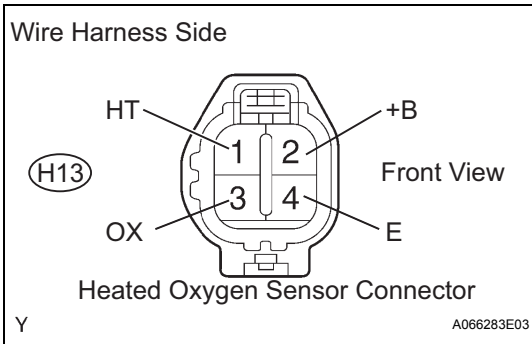
Tester Connection	Specified Condition
E6-6 (HT1B) - E4-28 (E2)	9 to 14 V

**OK**

**REPLACE ECM**

**NG**

**4 CHECK HARNESS AND CONNECTOR (HEATED OXYGEN SENSOR - ECM AND EFI M RELAY)**



(a) Check the harness and the connectors between the ECM and the heated oxygen sensor connectors.

- (1) Disconnect the H13 heated oxygen sensor connector.

- (2) Disconnect the E4 and E6 ECM connectors.
- (3) Measure the resistance between the wire harness side connectors.

**Standard resistance (Check for open)**

Tester Connection	Specified Condition
H13-1 (HT) - E6-6 (HT1B)	Below 1 Ω
H13-4 (E) - E4-28 (E2)	Below 1 Ω

**Standard resistance (Check for short)**

Tester Connection	Specified Condition
H13-1 (HT) or E6-6 (HT1B) - Body ground	10 kΩ or higher
H13-1 (HT) - H13-2 (+B)	10 kΩ or higher

- (4) Reconnect the heated oxygen sensor connector.
- (5) Reconnect the ECM connectors.

(b) Check the harness and the connectors between the heated oxygen sensor connector and the EFI M relay.

- (1) Disconnect the H13 heated oxygen sensor connector.
- (2) Remove the integration relay from the engine room relay block.
- (3) Measure the resistance between the wire harness side connectors.

**Standard resistance (Check for open)**

Tester Connection	Specified Condition
H13-2 (+B) - 3I-8 (EFI M relay)	Below 1 Ω

**Standard resistance (Check for short)**

Tester Connection	Specified Condition
H13-2 (+B) or 3I-8 (EFI M relay) - Body ground	10 kΩ or higher

- (4) Reconnect the heated oxygen sensor connector.
- (5) Reinstall the integration relay.

**NG REPAIR OR REPLACE HARNESS AND CONNECTOR**

OK

REPLACE ECM