DTC	P0110	Intake Air Temperature Circuit

DTC	P0112	Intake Air Temperature Circuit Low Input

DTC	P0113	Intake Air Temperature Circuit High Input

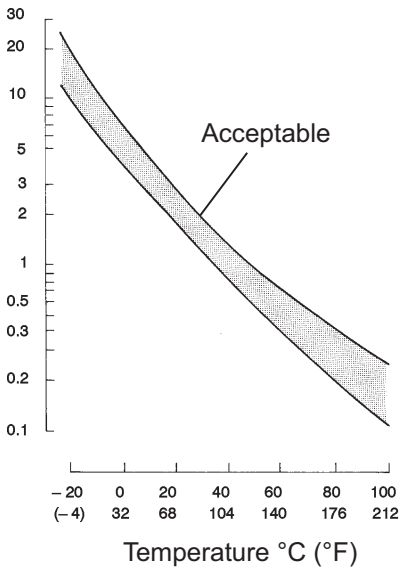
DESCRIPTION

The Intake Air Temperature (IAT) sensor, built into the Mass Air Flow (MAF) meter, monitors the intake air temperature. The IAT sensor has a thermistor that varies its resistance depending on the intake air temperature. When the intake air temperature is low, the resistance in the thermistor increases. When the temperature is high, the resistance drops. The variations in resistance are reflected as voltage changes to the ECM terminal (see Fig. 1).

The IAT sensor is connected to the ECM. The 5 V power source voltage in the ECM is applied to the IAT sensor from terminal THA via resistor R.

Resistor R and the IAT sensor are connected in series. When the resistance value of the IAT sensor changes, according to changes in the IAT, the voltage at terminal THA also varies. Based on this signal, the ECM increases the fuel injection volume when the engine is cold to improve drivability.

Fig. 1



HINT:

When any of DTCs P0110,P0112 and P0113 are set, the ECM enters fail-safe mode. During fail-safe mode, the IAT is estimated to be 20°C (68°F) by the ECM. Fail-safe mode continues until a pass condition is detected.

DTC No.	Proceed To	DTC Detection Conditions	Trouble Areas
P0110	Step 1	Open or short in IAT sensor circuit for 0.5 seconds (1 trip detection logic)	• Open or short in IAT sensor circuit • IAT sensor (built into MAF meter) • ECM
P0112	Step 4	Short in IAT sensor circuit for 0.5 seconds (1 trip detection logic)	• Short in IAT sensor circuit • IAT sensor (built into MAF meter) • ECM
P0113	Step 2	Open in IAT sensor circuit for 0.5 seconds (1 trip detection logic)	• Open in IAT sensor circuit • IAT sensor (built into MAF meter) • ECM

HINT:
When any of these DTCs are set, check the Intake Air Temperature (IAT) by selecting the following menu items on an intelligent tester: DIAGNOSIS / ENHANCED OBD II / DATA LIST / PRIMARY / INTAKE AIR.

Temperature Displayed	Malfunctions
-40°C (-40°F)	Open circuit
140°C (284°F)	Short circuit

MONITOR DESCRIPTION

The ECM monitors the sensor voltage and uses this value to calculate the intake air temperature. When the sensor output voltage deviates from the normal operating range, the ECM interprets this as a fault in the IAT sensor and sets a DTC.
Example:
If the sensor voltage output is more than 4.91 V for 0.5 seconds or more, the ECM determines that there is an open in the IAT sensor circuit, and sets DTC P0113. Conversely, if the voltage output is less than 0.18 V for 0.5 seconds or more, the ECM determines that there is a short in the sensor circuit, and sets DTC P0112.
If the malfunction is not repaired successfully, a DTC is set 0.5 seconds after the engine is next started.

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MONITOR STRATEGY

Related DTCs	P0110: IAT sensor range check (Fluctuating) P0112: IAT sensor range check (Low voltage) P0113: IAT sensor range check (High voltage)
Required Sensors/Components (Main)	IAT sensor
Required Sensors/Components (Related)	-
Frequency of Operation	Continuous
Duration	0.5 seconds
MIL Operation	Immediate
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor will run whenever these DTCs are not present	None

TYPICAL MALFUNCTION THRESHOLDS

P0110:

IAT sensor voltage	Less than 0.18 V, or more than 4.91 V

P0112:

IAT sensor voltage [intake air temperature]	Less than 0.18 V [more than 140°C (284°F)]

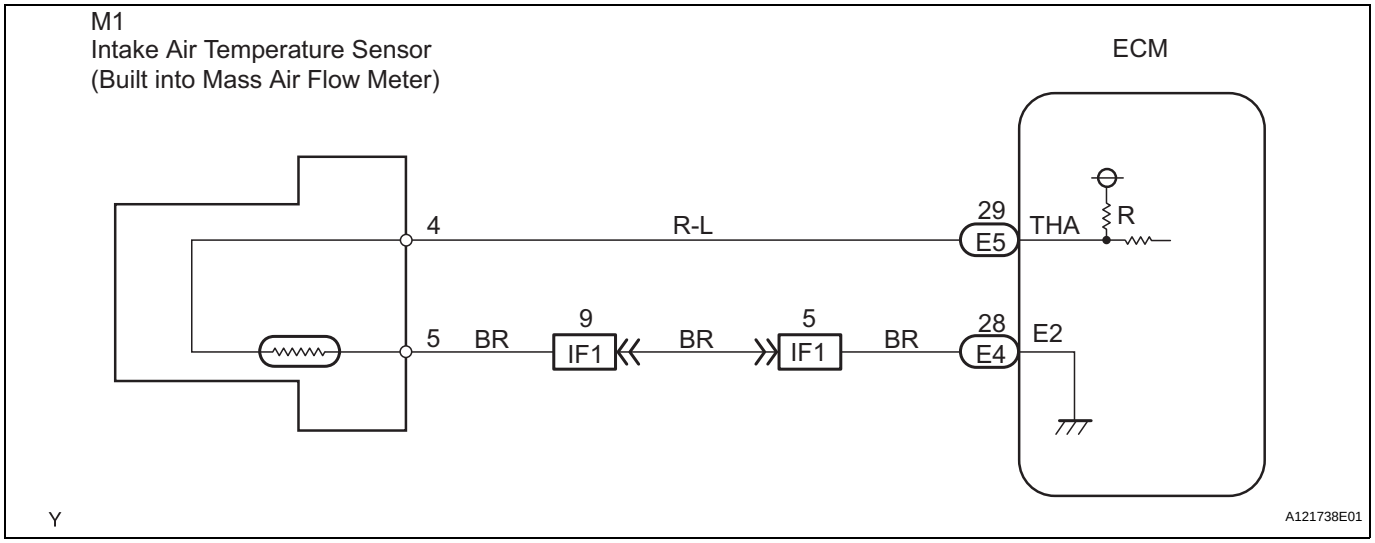
P0113:

IAT sensor voltage [intake air temperature]	More than 4.91 V [less than -40°C (-40°F)]

COMPONENT OPERATING RANGE

IAT sensor voltage [intake air temperature]	0.18 V to 4.91 V [-40 to 140°C (-40 to 284°F)]

WIRING DIAGRAM



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HINT:

- If other DTCs relating to different systems that have terminal E2 as the ground terminal are output simultaneously, terminal E2 may have an open circuit.
- Read freeze frame data using the intelligent tester. 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	READ DATA LIST (INTAKE AIR TEMPERATURE)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch to ON and turn the intelligent tester ON.
(c) Select the following menu items: DIAGNOSIS / ENHANCED OBD II / DATA LIST / PRIMARY / INTAKE AIR.
(d) Read the values displayed on the tester.

Standard:

Same value as actual IAT.

Result

Temperature Displayed	Proceed to
-40°C (-40°F)	A
140°C (284°F)	B
Same as actual IAT	C

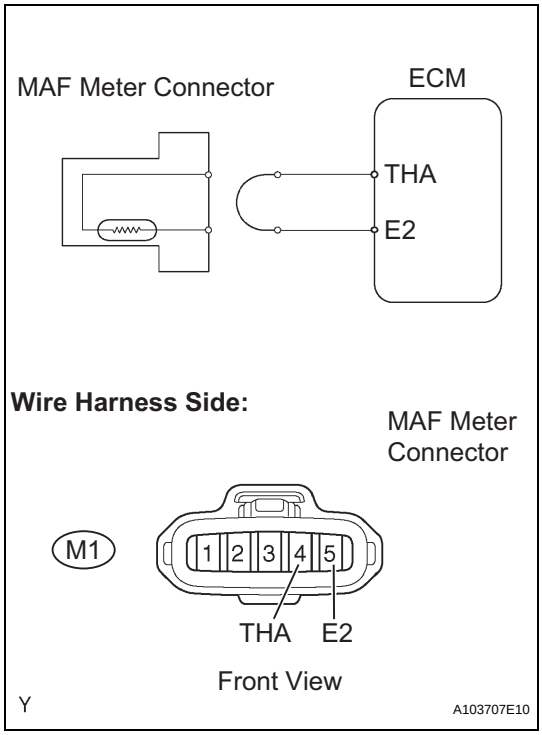
HINT:

- If there is an open circuit, the intelligent tester indicates -40°C (-40°F).
- If there is a short circuit, the intelligent tester indicates 140°C (284°F).

B	Go to step 4
C	CHECK FOR INTERMITTENT PROBLEMS

A

2	READ DATA LIST (CHECK FOR OPEN IN WIRE HARNESS)

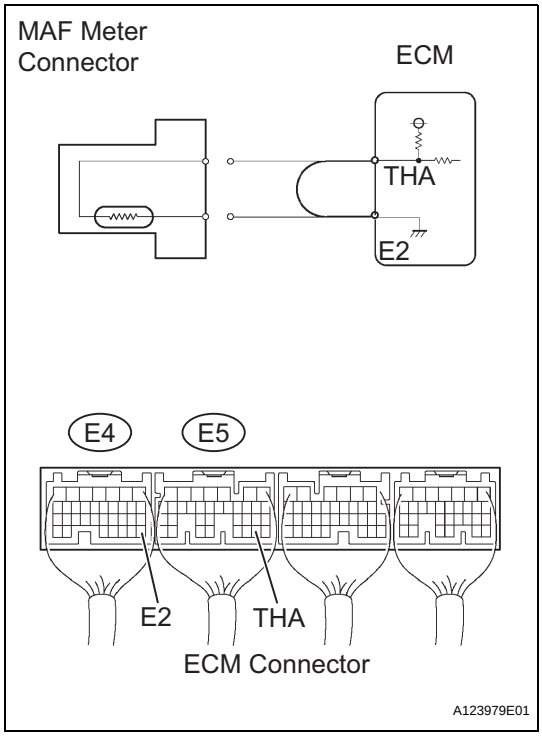


(a) Disconnect the M1 MAF meter connector.
(b) Connect terminals THA and E2 of the MAF meter wire harness side connector.
(c) Connect the intelligent tester to the DLC3.
(d) Turn the ignition switch to ON and turn the intelligent tester ON.
(e) Select the following menu items: DIAGNOSIS / ENHANCED OBD II / DATA LIST / PRIMARY / INTAKE AIR.
(f) Read the value displayed on the tester.
Standard:
140°C (284°F)
(g) Reconnect the MAF meter connector.

OK	CONFIRM GOOD CONNECTION TO SENSOR. IF OK, REPLACE MASS AIR FLOW METER

NG

3	READ DATA LIST (CHECK FOR OPEN IN ECM)



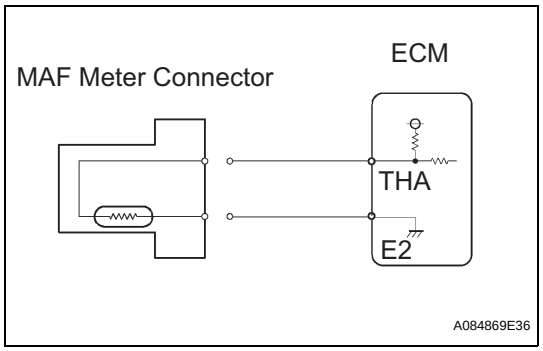
(a) Disconnect the M1 MAF meter connector.
(b) Connect terminals THA and E2 of the ECM connector.
HINT:
Before checking, do a visual and contact pressure check for the ECM connector.
(c) Connect the intelligent tester to the DLC3.
(d) Turn the ignition switch to ON and turn the intelligent tester ON.
(e) Select the following menu items: DIAGNOSIS / ENHANCED OBD II / DATA LIST / PRIMARY / INTAKE AIR.
(f) Read the value displayed on the tester.
Standard:
140°C (284°F)
(g) Reconnect the MAF meter connector.

NG	CONFIRM GOOD CONNECTION TO ECM. IF OK, REPLACE ECM

OK

REPAIR OR REPLACE HARNESS OR CONNECTOR

4	READ DATA LIST (CHECK FOR SHORT IN WIRE HARNESS)

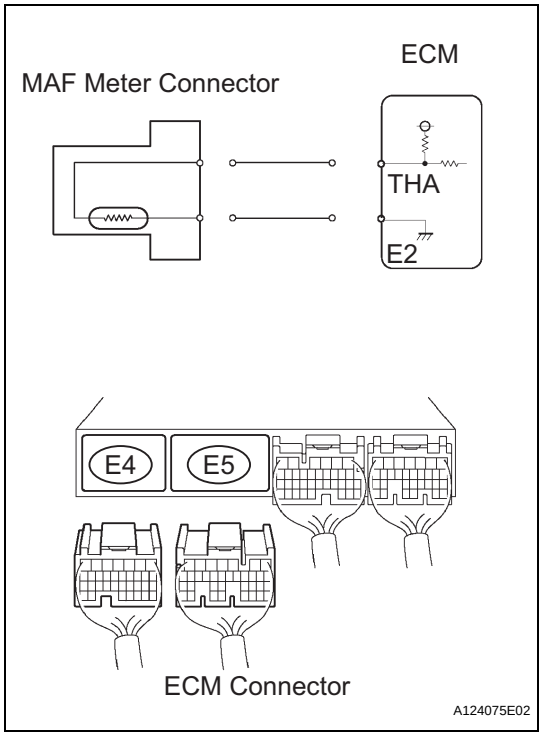


(a) Disconnect the M1 MAF meter connector.
(b) Connect the intelligent tester to the DLC3.
(c) Turn the ignition switch to ON and turn the intelligent tester ON.
(d) Select the following menu items: DIAGNOSIS / ENHANCED OBD II / DATA LIST / PRIMARY / INTAKE AIR.
(e) Read the value displayed on the tester.
Standard:
-40°C (-40°F)
(f) Reconnect the MAF meter connector.

OK → **REPLACE MASS AIR FLOW METER**

NG

5	READ DATA LIST (CHECK FOR SHORT IN ECM)



(a) Disconnect the E4 and E5 ECM connector.
(b) Connect the intelligent tester to the DLC3.
(c) Turn the ignition switch to ON and turn the intelligent tester ON.
(d) Select the following menu items: DIAGNOSIS / ENHANCED OBD II / DATA LIST / PRIMARY / INTAKE AIR.
(e) Read the value displayed on the tester.
Standard:
-40°C (-40°F)
(f) Reconnect the ECM connectors.

NG → **REPLACE ECM**

OK

REPAIR OR REPLACE HARNESS OR CONNECTOR

ES