

P0101 Mass Air Flow (MAF) Sensor Performance

Circuit Description

The mass air flow (MAF) sensor is located in the air intake duct. The MAF sensor is an airflow meter that measures the amount of air that enters the engine. The MAF sensor uses a hot film that is cooled by air flowing past the sensing film as air enters the engine. The amount of cooling is proportional to the amount of the air flow. As the air flow increases, more current is required in order to maintain the hot film at a constant temperature. The engine control module (ECM) uses the MAF sensor in order to provide the correct fuel delivery for all operating conditions. The MAF sensor uses the following circuits in order to operate:

- An ignition 1 voltage circuit
- A 5-volt reference circuit
- A low reference circuit
- A signal circuit

The ECM monitors the following inputs in order to calculate a predicted MAF sensor value:

- The throttle position (TP)
- The engine speed

The ECM monitors the MAF sensor signal for being stuck in range, for being too low, or for being too high for a given operating condition. If the ECM detects the actual MAF sensor signal is not within a predetermined range of the calculated MAF sensor value, this DTC sets.

DTC Descriptor

This diagnostic procedure supports the following DTC. DTC P0101 Mass Air Flow (MAF) Sensor Performance

Conditions for Running the DTC

- Before the ECM can report DTC P0101 failed, DTCs P0121, P0122, P0123, P0221, P0222, P0223, P0336, and P0338 must run and pass.
- The engine is operating.

- The MAF sensor signal is between ~ 14 and $+278$ grams per second.
- The ignition 1 voltage is more than 10.5 volts.
- The ECM detects more than 150 revolutions of the camshaft.
- DTC P0101 runs continuously once the above conditions are met.

Conditions for Setting the DTC

- The ECM detects that the MAF sensor signal is not within a predetermined range of the calculated MAF value.
- The condition exists for 2 seconds.

Action Taken When the DTC Sets

- The control module illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The control module records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the control module stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the control module records the operating conditions at the time of the failure. The control module writes the operating conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The control module turns OFF the malfunction indicator lamp (MIL) after 4 consecutive ignition cycles that the diagnostic runs and does not fail.
- A current DTC, Last Test Failed, clears when the diagnostic runs and passes.
- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other emission related diagnostic.
- Clear the MIL and the DTC with a scan tool.

Diagnostic Aids

- Use the J 35616-C Connector Test Adapter Kit for any test that requires probing the ECM harness connector or a component harness connector.
- The lower connector of the ECM is connector C1 and the upper connector of the ECM is connector C2. Refer to Engine Controls Component Views.

- Any un-metered air that enters the engine may cause this DTC to set.
- Inspect the throttle plate for sticking, or for deposits on the throttle plate, or in the throttle bore.
- For an intermittent condition, refer to Intermittent Conditions.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

3. A circuit failure may cause this DTC to set. If DTC P0102 or P0103 are set, diagnose DTC P0102 or P0103 first.
6. This step tests for high resistance in the ignition 1 voltage circuit of the MAF sensor. If the DMM does not display near battery voltage there is high resistance in the circuit.
8. The ECM produces a measurable steady-state amperage that provides the 5-volt reference to the MAF sensor. If the amperage on the 5-volt reference circuit is less than 80 mA, test the 5-volt reference circuit for an open or a high resistance.
9. This step tests for high resistance in the signal circuit of the MAF sensor.
10. This step tests for high resistance in the low reference circuit of the mass air flow (MAF)/intake air temperature (IAT) sensor. The MAF sensor and the IAT sensor share the low reference circuit. If there is a condition with the low reference circuit, a MAF and IAT sensor DTC may set. The ECM must be completely powered down to obtain an accurate resistance reading. It may take up to 30 minutes for the ECM to power down after the ignition key is removed. Removal of the ECM/TCM fuse allows the ECM to power down completely.
15. Inspect the MAF/IAT sensor connector for water intrusion, corrosion, and bent or damaged terminals.
16. Inspect the ECM connectors for water intrusion, corrosion, and bent or damaged terminals.

DTC P0101

Step	Action	Values	Yes	No
<p>Schematic Reference: Engine Controls Schematics on page 6-1196 Connector End View Reference: Engine Control Module (ECM) Connector End Views or Engine Controls Connector End Views</p>				
1	Did you perform the Diagnostic System Check—Engine Controls?	—	Go to Step 2	Go to Diagnostic System Check—Engine Controls
2	<p>Important: If you were sent here from a fuel trim DTC, go to step 5 of this diagnostic procedure.</p> <p>1. Start the engine. 2. Observe the Diagnostic Trouble Code (DTC) Information with a scan tool. Does the DTC fail this ignition?</p>	—	Go to Step 3	Go to Step 4
3	Is DTC P0102 or DTC P0103 also set?	—	Go to DTC P0102 or DTC P0103	Go to Step 5
4	<p>1. Observe the Freeze Frame/Failure Records for this DTC. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?</p>	—	Go to Step 5	Go to Diagnostic Aids

Step	Action	Values	Yes	No
5	<p>Inspect for the following conditions:</p> <ul style="list-style-type: none">• An engine vacuum leak• An air leak in the intake air duct between the mass air flow (MAF) sensor and the throttle body• A plugged or collapsed intake air duct• Objects that block the MAF sensor air inlet• An air filter element that is restricted• A restricted throttle plate or for carbon build-up around the throttle plate• An unseated engine oil dip stick• A loose or missing engine oil fill cap• An over filled crankcase <p>Did you find and correct the condition?</p>	—	Go to Step 20	Go to Step 6

6	<ol style="list-style-type: none"> 1. Turn OFF the ignition. 2. Disconnect the MAF/intake air temperature (IAT) sensor. 3. Turn ON the ignition, with the engine OFF. Notice: Do NOT use the low reference circuit in the component harness connector for this test. Damage to the control module may occur due to excessive current draw. Important: Use the J 35616-200 Test Lamp Kit for this test. If the J 35616-200 is not available, use a test lamp that measures more than 20 ohms. 4. Connect a test lamp between the ignition 1 voltage circuit of the MAF sensor and the engine control module (ECM) housing. 5. Connect a DMM to the probe of the test lamp and the ECM housing. Refer to Measuring Voltage Drop in Wiring Systems. Is the voltage at the specified value? 	B+	Go to Step 7	Go to Step 17
7	Measure the voltage between the 5-volt reference circuit of the MAF sensor and the ECM housing, with a DMM. Is the voltage more than specified value?	5.2 V	Go to Step 12	Go to Step 8
8	<ol style="list-style-type: none"> 1. Set-up a DMM to test amperage on the 400 mA scale. 2. Measure the amperage from the 5-volt reference circuit of the MAF sensor to the ECM housing. Is the amperage more than the specified value? 	80 mA	Go to Step 9	Go to Step 13

9	<p>1. Connect a 3-amp fused jumper wire between the 5-volt reference circuit of the MAF sensor and the signal circuit of the MAF sensor.</p> <p>2. Observe the MAF sensor voltage parameter with a scan tool.</p> <p>Is the voltage within the specified range?</p>	4.8–5.2 V	Go to Step 10	Go to Step 11
10	<p>1. Turn OFF the ignition.</p> <p>2. Remove the ECM/TCM fuse from the underhood electrical center. Notice: Do NOT use a test lamp to test the continuity of the circuit. Damage to the control module may occur due to excessive current draw.</p> <p>3. Measure the resistance from the low reference circuit of the MAF/IAT sensor to the ECM housing, with a DMM.</p> <p>Is the resistance less than the specified value?</p>	5 W	Go to Step 15	Go to Step 14
11	<p>Test the signal circuit of the MAF sensor for a high resistance. Refer to Circuit Testing and Wiring Repairs in Wiring Systems. Did you find and correct the condition?</p>	—	Go to Step 20	Go to Step 16
12	<p>Important: The 5-volt reference circuits are internally and externally connected at the controller. Other sensors that share the 5-volt reference circuit may also have DTCs set. Disconnecting a sensor on the shared 5-volt reference circuit may isolate a shorted sensor. Review the electrical schematic and diagnose the shared circuits and sensors. Test the 5-volt reference circuit of the MAF sensor for a short to voltage. Refer to Circuit Testing on page 8-1184 and Wiring Repairs on page 8-1189 in Wiring Systems. Did you find and correct the condition?</p>	—	Go to Step 20	Go to Step 16

13	Important: The 5-volt reference circuits are internally and externally connected at the controller. Other sensors that share the 5-volt reference circuit may also have DTCs set. Disconnecting a sensor on the shared 5-volt reference circuit may isolate a shorted sensor. Review the electrical schematic and diagnose the shared circuits and sensors. Test the 5-volt reference circuit of the MAF sensor for a high resistance. Refer to Circuit Testing and Wiring Repairs in Wiring Systems. Did you find and correct the condition?	—	Go to Step 20	Go to Step 16
14	Test the low reference circuit of the MAF/IAT sensor for a high resistance. Refer to Circuit Testing and Wiring Repairs in Wiring Systems. Did you find and correct the condition?	—	Go to Step 20	Go to Step 16
15	Test for shorted terminals and poor connections at the MAF/IAT sensor. Refer to Testing for Intermittent and Poor Connections and Connector Repairs in Wiring Systems. Did you find and correct the condition?	—	Go to Step 20	Go to Step 18
16	Test for shorted terminals and poor connections at the ECM. Refer to Testing for Intermittent and Poor Connections and Connector Repairs in Wiring Systems. Did you find and correct the condition?	—	Go to Step 20	Go to Step 19
17	Repair the high resistance in the ignition 1 voltage circuit of the MAF sensor. Refer to Wiring Repairs in Wiring Systems. Did you complete the repair?	—	Go to Step 20	—
18	Replace the MAF/IAT sensor. Refer to Mass Air Flow (MAF)/Intake Air Temperature	—	Go to Step 20	—

	(IAT) Sensor Replacement. Did you complete the replacement?			
19	Replace the ECM. Refer to Engine Control Module (ECM) Replacement. Did you complete the replacement?	—	Go to Step 20	—
20	1. Clear the DTCs with a scan tool. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	—	Go to Step 2	Go to Step 21
21	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	—	Go to Diagnostic Trouble Code (DTC) List	System OK