2006 ENGINE PERFORMANCE

Advanced Diagnostics - Insight

DTC P0106 (5): ADVANCED DIAGNOSTICS

DTC P0106: MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR VACUUM CONNECTION PROBLEM

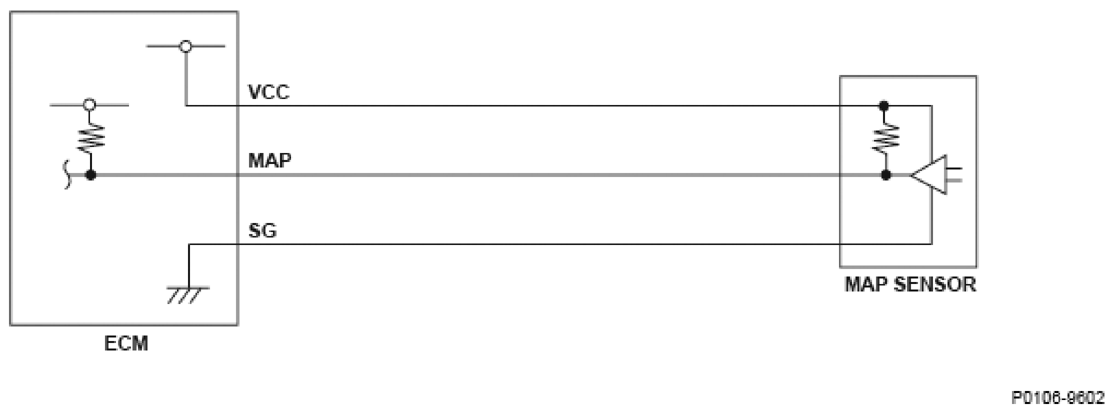


Fig. 1: Manifold Absolute Pressure (MAP) Sensor Circuit Diagram

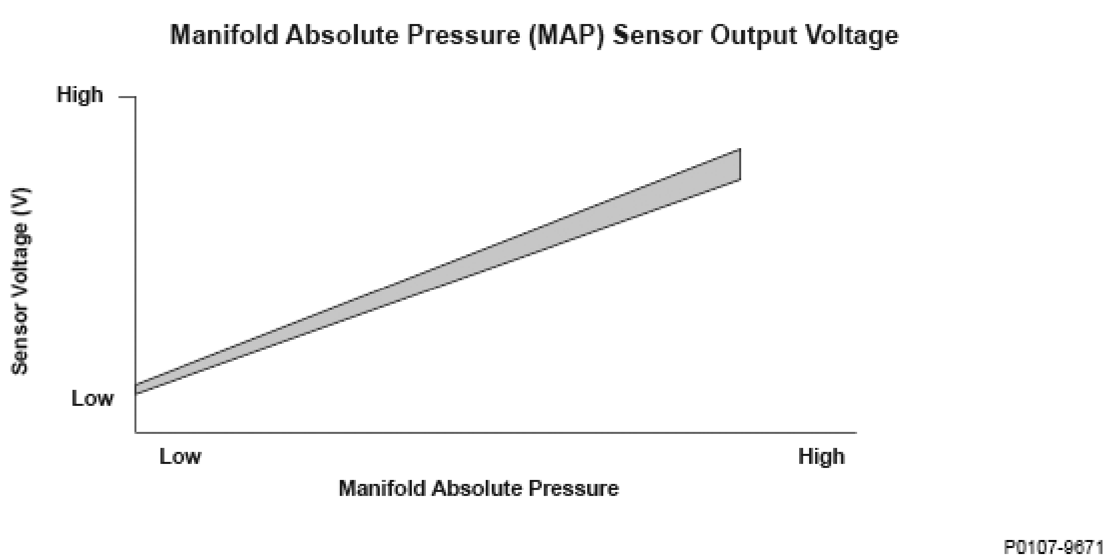


Fig. 2: Manifold Absolute Pressure (MAP) Sensor Output Voltage - Graph

General Description

The manifold absolute pressure (MAP) sensor senses manifold absolute pressure (vacuum) and converts it into electrical signals. The MAP sensor outputs low signal voltage at high-vacuum (throttle valve closed) and high signal voltage at low-vacuum (throttle valve wide open).

The engine control module (ECM) compares a predetermined MAP value at a given throttle position and manifold absolute pressure with the output voltage value of the MAP sensor. If the difference between the value from the MAP sensor before start-up (right after turning the ignition switch ON) and the current value is still a set value or less while the engine is running, the ECM detects a malfunction and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Once per driving cycle
Sequence	None
Duration	5 seconds or more
DTC Type	One drive cycle, MIL ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
Engine speed	400 rpm	-
Throttle position	-	9.8°
No active DTCs	MAP	

Malfunction Threshold

The difference between the MAP sensor value measured before start-up (immediately after the ignition is turned ON) and the value after starting the engine is 40 mV or less for at least 5 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0107 (3): ADVANCED DIAGNOSTICS

DTC P0107: MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR CIRCUIT LOW VOLTAGE

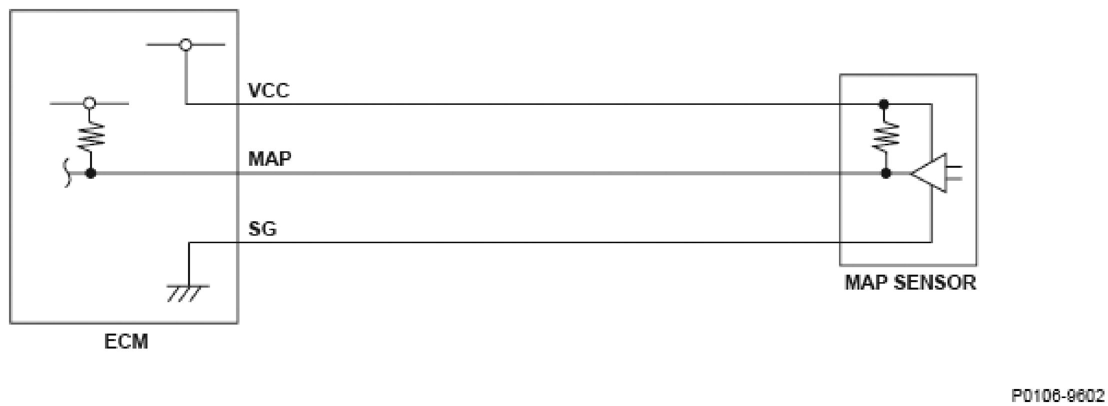


Fig. 3: Manifold Absolute Pressure (MAP) Sensor Circuit Diagram

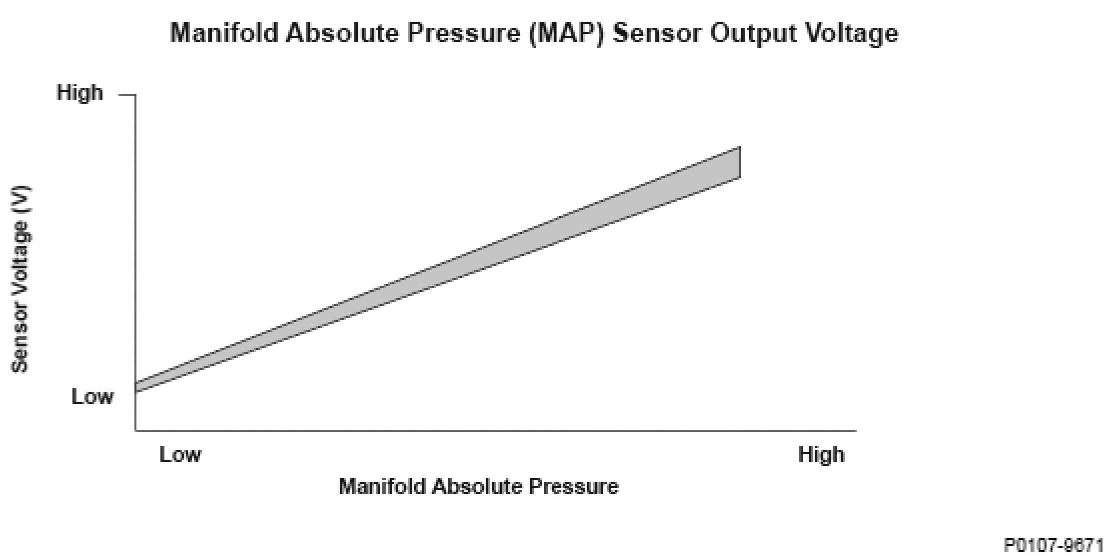


Fig. 4: Manifold Absolute Pressure (MAP) Sensor Output Voltage - Graph

General Description

The manifold absolute pressure (MAP) sensor senses manifold absolute pressure (vacuum) and converts it into electrical signals. The MAP sensor outputs low signal voltage at high-vacuum (throttle valve closed) and high signal voltage at low-vacuum (throttle valve wide open).

If a signal voltage from the MAP sensor is a set value or less, the engine control module (ECM) detects a malfunction and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	2 seconds or more
DTC Type	One drive cycle, MIL ON

ENABLE CONDITIONS CHART

Condition	
State of the engine	Running
No active DTCs	MAP

Malfunction Threshold

The MAP sensor output voltage value is 0.23 V or less for at least 2 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0108 (3): ADVANCED DIAGNOSTICS

DTC P0108: MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR CIRCUIT HIGH VOLTAGE

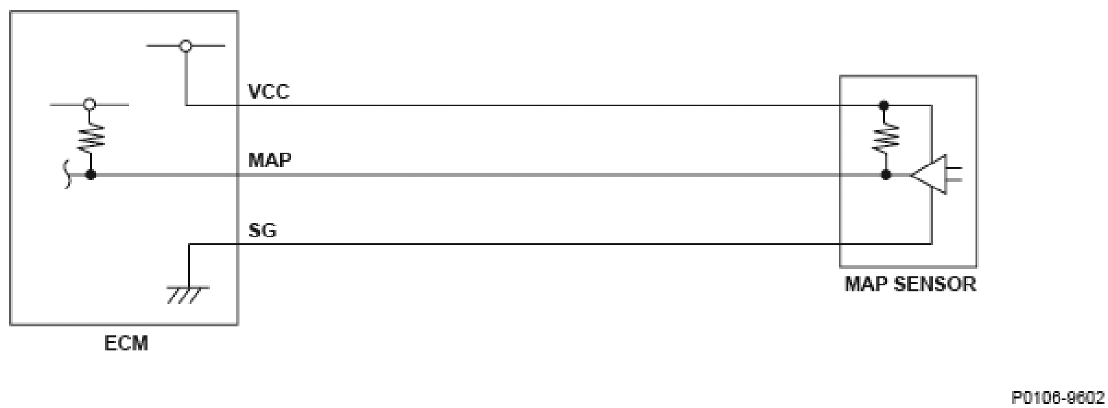


Fig. 5: Manifold Absolute Pressure (MAP) Sensor Circuit Diagram

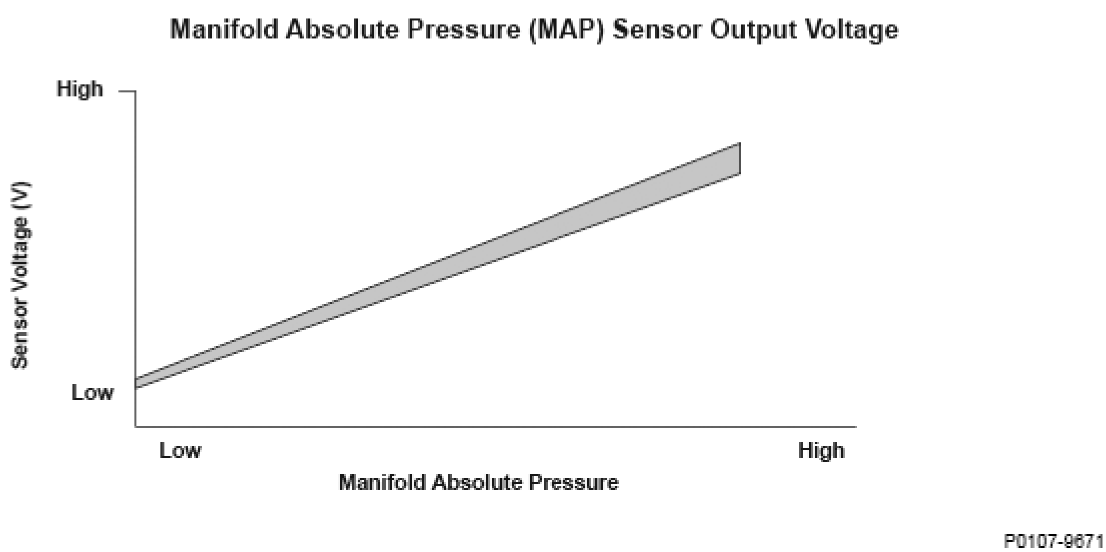


Fig. 6: Manifold Absolute Pressure (MAP) Sensor Output Voltage - Graph

General Description

The manifold absolute pressure (MAP) sensor senses manifold absolute pressure (vacuum) and converts it into electrical signals. The MAP sensor outputs low signal voltage at high-vacuum (throttle valve closed) and high signal voltage at low-vacuum (throttle valve wide open). If a signal voltage from the MAP sensor is a set value or more, the engine control module (ECM) detects a malfunction and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	2 seconds or more
DTC Type	One drive cycle, MIL ON

ENABLE CONDITIONS CHART

Condition	
State of the engine	Running
No active DTCs	MAP

Malfunction Threshold

The MAP sensor output voltage value is 4.49 V or more for at least 2 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0111 (10): ADVANCED DIAGNOSTICS

DTC P0111: INTAKE AIR TEMPERATURE (IAT) SENSOR CIRCUIT RANGE/PERFORMANCE PROBLEM

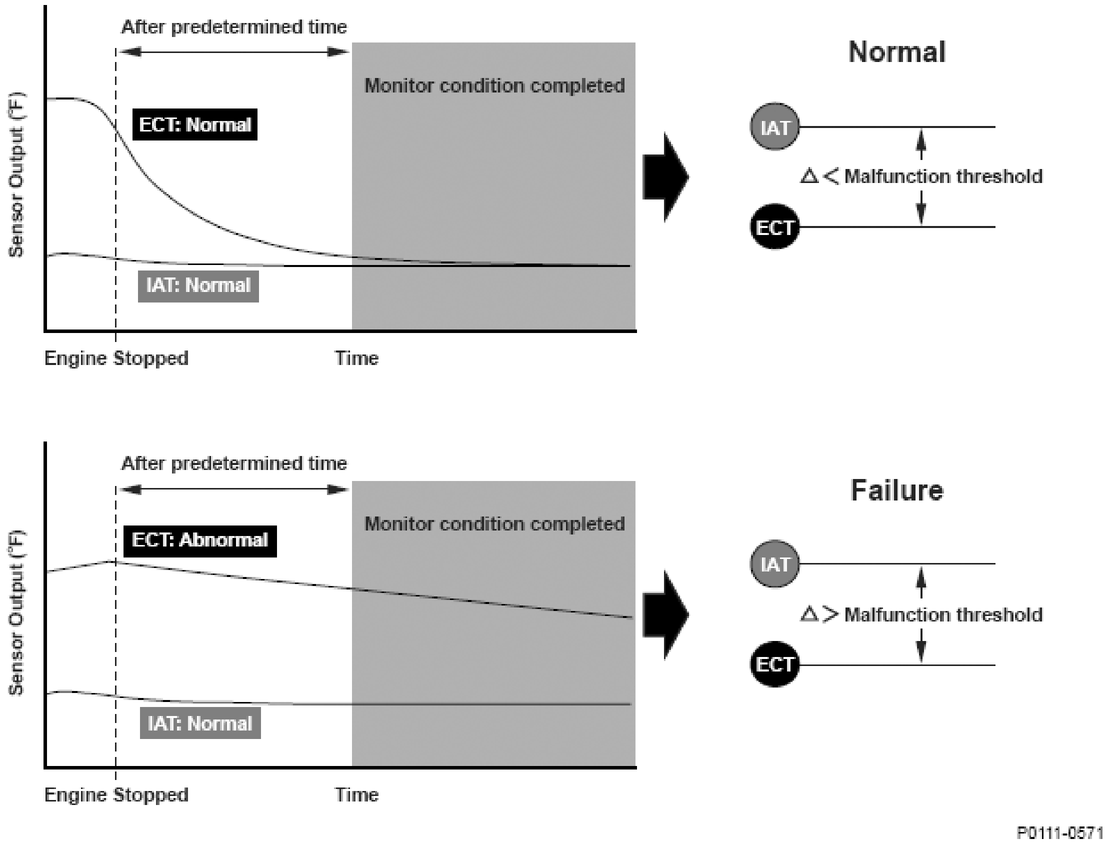


Fig. 7: Intake Air Temperature Sensor Graph

General Description

Two engine coolant temperature sensors and one intake air temperature sensor are used by the engine control module (ECM).

When the engine is stopped and enough time has passed, the temperature of the engine will equal the ambient temperature.

When an inappropriate temperature is detected after comparing the temperature readings of each sensor, a malfunction in the corresponding sensor is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Once per driving cycle
Sequence	None
Duration	10 seconds or more

DTC Type	Two drive cycles, MIL ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
Engine off time	6 hours	-
No active DTCs	MAP, CKP, CMP, ECT, IAT, TP, BARO, VTEC System	

Malfunction Threshold

A malfunction is detected if the following condition is not present after the engine and the ignition switch have been off for at least 6 hours:

- When the temperature (IAT minus ECT) is 90°F (50°C) or more.

Driving Pattern

1. Turn the ignition off, and wait at least 6 hours.
2. Start the engine, and let it idle for at least 10 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the ECM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0112 (10): ADVANCED DIAGNOSTICS

DTC P0112: INTAKE AIR TEMPERATURE (IAT) SENSOR CIRCUIT LOW VOLTAGE

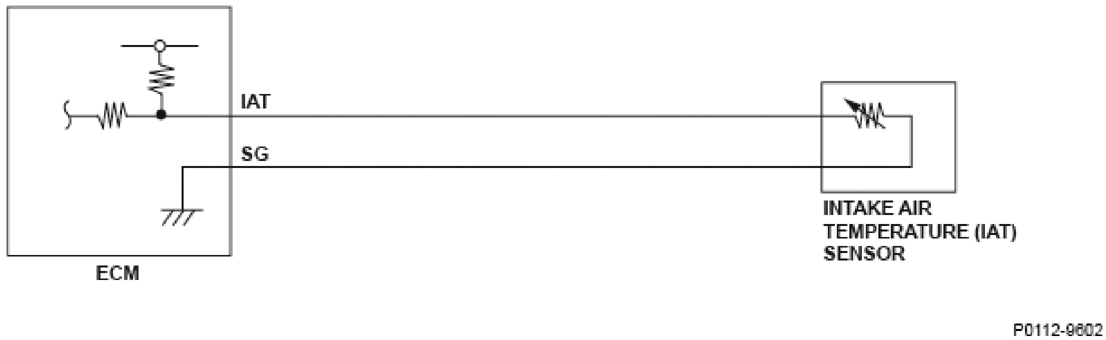


Fig. 8: Intake Air Temperature (IAT) Sensor Circuit Diagram

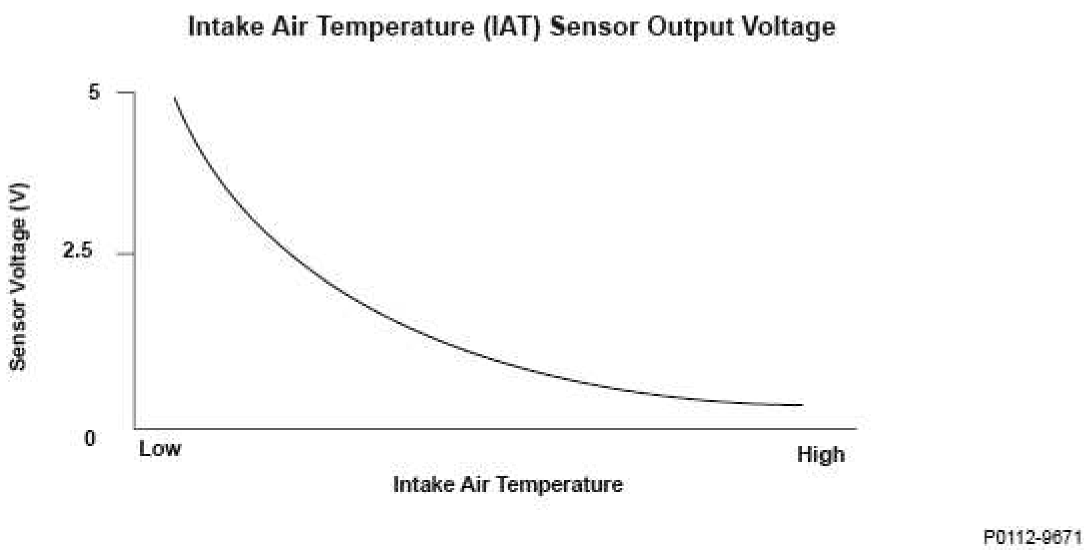


Fig. 9: Intake Air Temperature (IAT) Sensor Output Voltage - Graph

General Description

The intake air temperature (IAT) sensor is a thermistor that detects intake air temperature, and it is used for A/F feedback control to compensate for the atmospheric density fluctuations that accompany changes in intake air temperature.

The IAT sensor resistance varies depending on temperature. The output voltage and the sensor resistance increase as the intake air temperature decreases. Conversely, the output voltage and the sensor resistance decrease as the intake air temperature increases. If the IAT sensor output voltage is excessively low, the engine control module (ECM) detects a malfunction and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	2 seconds or more
DTC Type	One drive cycle, MIL ON

ENABLE CONDITIONS CHART

Condition	
Ignition switch	ON
No active DTCs	IAT

Malfunction Threshold

The IAT sensor output voltage is 0.08 V or less for at least 2 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0113 (10): ADVANCED DIAGNOSTICS

DTC P0113: INTAKE AIR TEMPERATURE (IAT) SENSOR CIRCUIT HIGH VOLTAGE

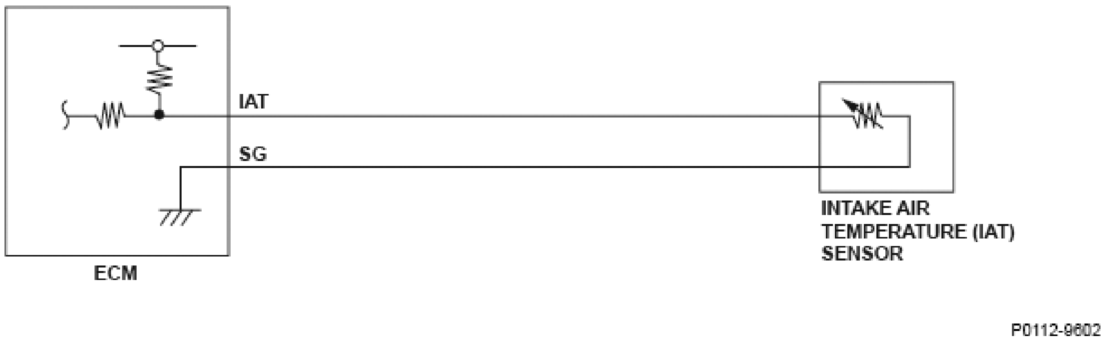


Fig. 10: Intake Air Temperature (IAT) Sensor Circuit Diagram

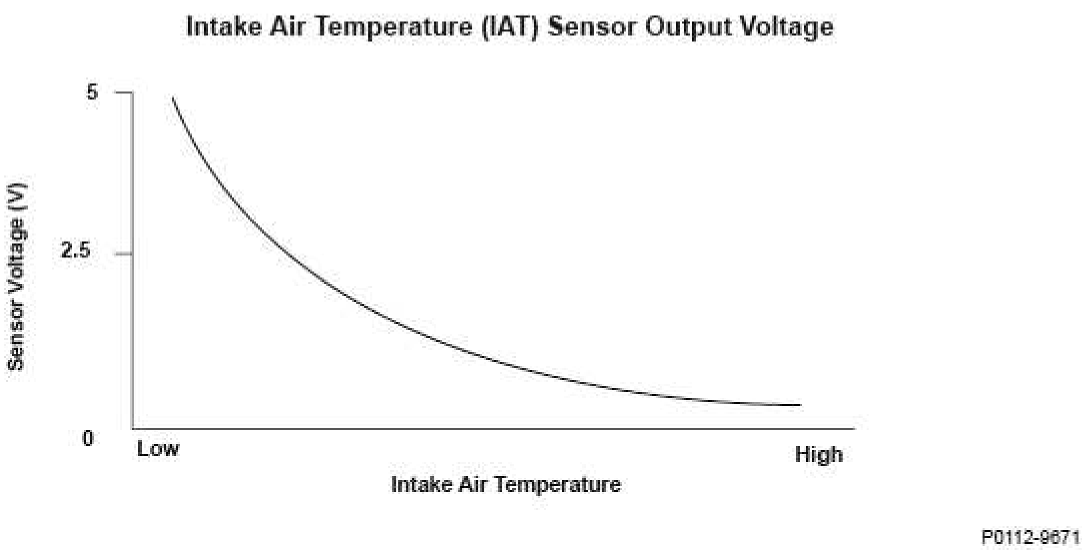


Fig. 11: Intake Air Temperature (IAT) Sensor Output Voltage - Graph

General Description

The intake air temperature (IAT) sensor is a thermistor that detects intake air temperature, and it is used for A/F feedback control to compensate for the atmospheric density fluctuations that accompany changes in intake air temperature.

The IAT sensor resistance varies depending on temperature. The output voltage and the sensor resistance increase as the intake air temperature decreases. Conversely, the output voltage and the sensor resistance decrease as the intake air temperature increases. If the IAT sensor output voltage is excessively high, the engine control module (ECM) detects a malfunction and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	2 seconds or more
DTC Type	One drive cycle, MIL ON

ENABLE CONDITIONS CHART

Condition	
Ignition switch	ON
No active DTCs	IAT

Malfunction Threshold

The IAT sensor output voltage is 4.92 V or more for at least 2 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0116 (86): ADVANCED DIAGNOSTICS

DTC P0116: ENGINE COOLANT TEMPERATURE (ECT) SENSOR CIRCUIT RANGE/PERFORMANCE PROBLEM

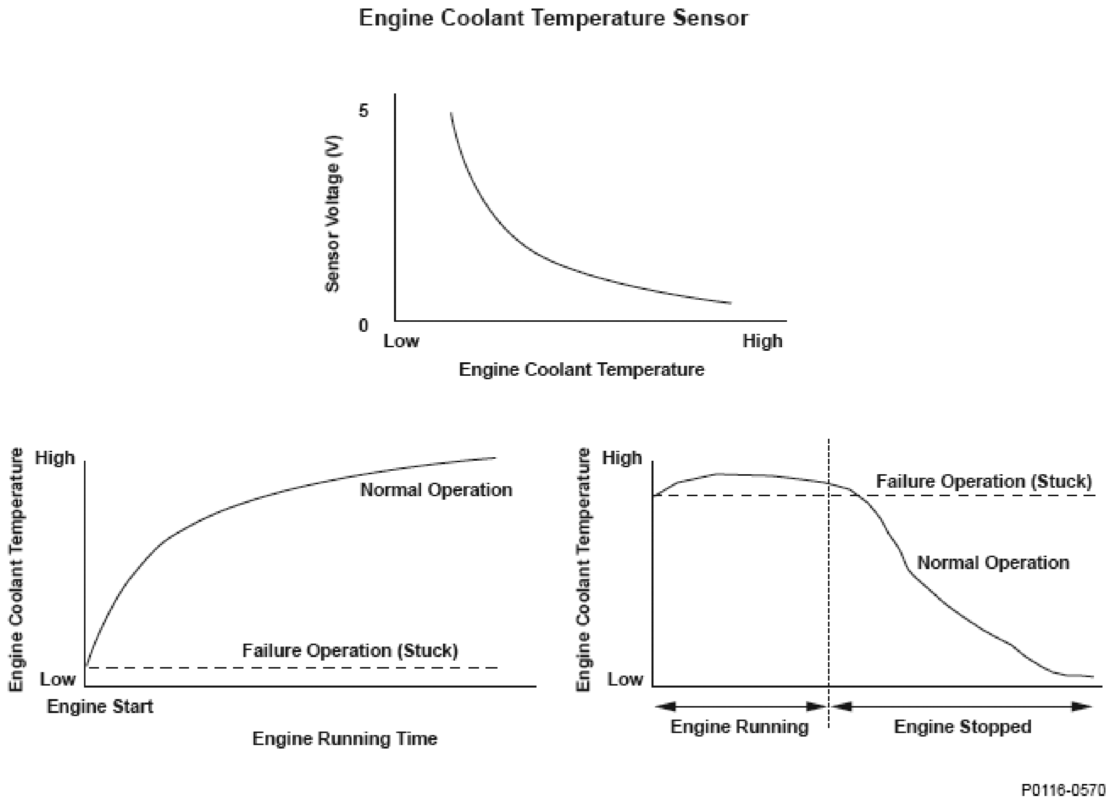


Fig. 12: Engine Coolant Temperature (ECT) Sensor 1 Circuit Range/ Performance Problem - Graph

General Description

The engine control module (ECM) supplies voltage to the engine coolant temperature (ECT) signal circuit (about 5 V) through a pull-up resistor. As the engine coolant cools, ECT sensor resistance increases, and the ECM detects a high signal voltage. As the engine coolant warms, ECT sensor resistance decreases, and the ECM detects a low signal voltage.

If the ECT output voltage after driving a set time after starting the engine does not reach a set temperature, or when the difference between the ECT output voltage when driving and the output voltage of the ECT after the engine is stopped a set time does not change a certain amount, a malfunction is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Once per driving cycle

Sequence	None
Duration	10 minutes or more
DTC Type	Two drive cycles, MIL ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
Elapsed time after starting the engine	10 seconds	-
Fuel feedback	Other than during fuel cut-off operation	
No active DTCs	ECM, A/F Sensor, A/F Sensor Heater, MAP, CKP, CMP, ECT, BARO, IAC, EGR, EVAP, VTEC System, Fuel System, Misfire	
Others	With a completely cooled engine (one that has been off for at least 6 hours): Judgment is made after the engine has been run for at least 10 minutes, turned off for at least 10 seconds, then started and run again for at least 10 seconds.	
	With a partially cooled engine (one that has been off for less than 6 hours): Judgment is made after the engine has been run for at least 10 minutes, turned off for at least 150 minutes then started and run again for at least 10 seconds.	

Malfunction Threshold

Malfunction determination 1:

With a completely cooled engine (one that has been off for at least 6 hours):

When the change in coolant temperature after 10 minutes or more of running time is 50°F (10°C) or less, a malfunction is detected.

Malfunction determination 2:

With a partially cooled engine (one that has been off for less than 6 hours):

When the difference between the coolant temperature after 10 minutes or more of running time minus the coolant temperature after the engine has been off for 150 minutes and then run for 10 seconds is 50°F (10°C) or less, a malfunction is detected.

Driving Pattern

- With a completely cooled engine (one that has been off for at least 6 hours).

1. Start the engine, and let it idle for at least 10 minutes.
2. Turn off the ignition for 10 seconds, then restart the engine and let it idle for at least 10 seconds.

- With a partially cooled engine (one that has been off for less than 6 hours).

1. Start the engine, and let it idle for at least 10 minutes.
2. Turn off the ignition for 150 minutes, then restart the engine and let it idle for at least 10 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the ECM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0117 (6): ADVANCED DIAGNOSTICS

DTC P0117: ENGINE COOLANT TEMPERATURE (ECT) SENSOR CIRCUIT LOW VOLTAGE

Fig. 13: Engine Coolant Temperature (ECT) Sensor Circuit Diagram

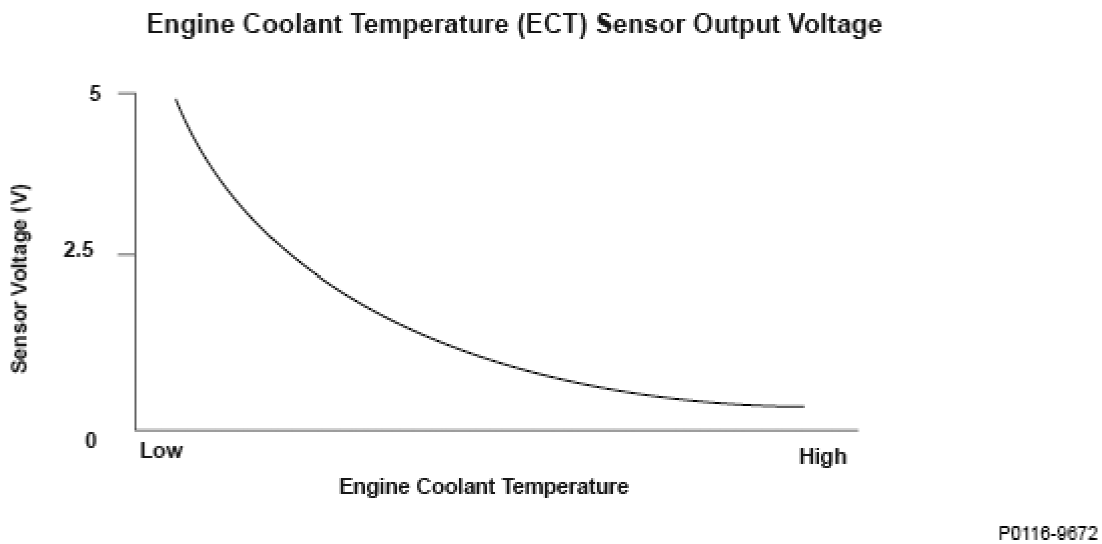


Fig. 14: Engine Coolant Temperature (ECT) Sensor Sensor Output Voltage Graph

General Description

The engine coolant temperature (ECT) sensor is used for the air/fuel ratio feedback control, the ignition timing control, the idle speed control, and other functions. The ECT sensor resistance varies depending on the engine coolant temperature. As the engine coolant cools, the ECT sensor resistance increases, and the engine control module (ECM) detects a high signal voltage. As the engine coolant warms, the ECT sensor resistance decreases, and the ECM detects a low signal voltage. If the ECT sensor output voltage is less than a set value when the engine coolant temperature is high, the ECM detects a malfunction and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	2 seconds or more
DTC Type	One drive cycle, MIL ON

ENABLE CONDITIONS CHART

Condition	
Ignition switch	ON
No active DTCs	ECT

Malfunction Threshold

The output voltage from the ECT sensor is 0.08 V or less for at least 2 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0118 (6): ADVANCED DIAGNOSTICS

DTC P0118: ENGINE COOLANT TEMPERATURE (ECT) SENSOR CIRCUIT HIGH VOLTAGE

Fig. 15: Engine Coolant Temperature (ECT) Sensor Circuit Diagram

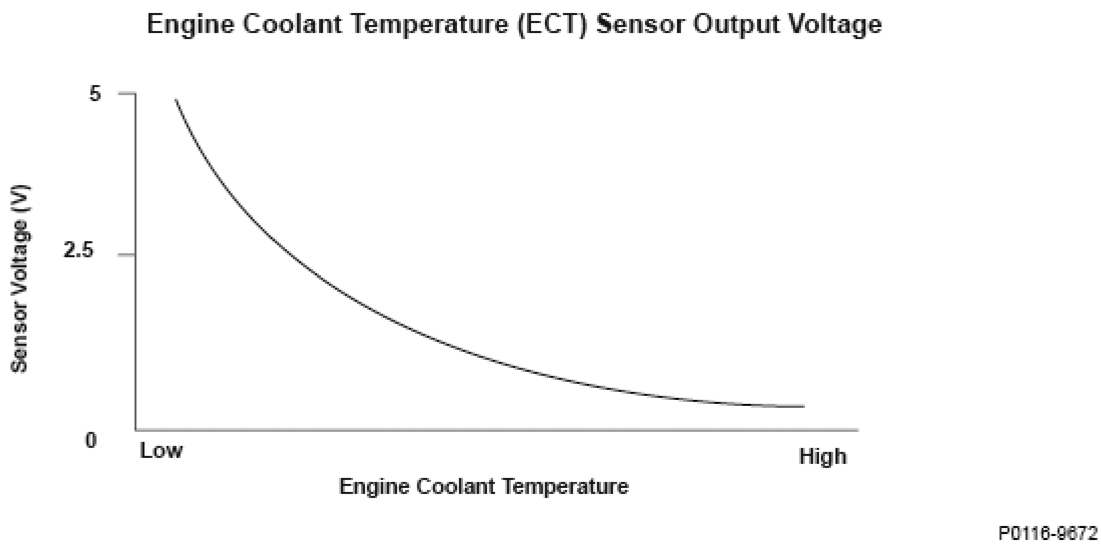


Fig. 16: Engine Coolant Temperature (ECT) Sensor Sensor Output Voltage Graph

General Description

The engine coolant temperature (ECT) sensor is used for the air/fuel ratio feedback control, the ignition timing control, the idle speed control, and other functions. The ECT sensor resistance varies depending on the engine coolant temperature. As the engine coolant cools, the ECT sensor resistance increases, and the engine control module (ECM) detects a high signal voltage. As the engine coolant warms, the ECT sensor resistance decreases, and the ECM detects a low signal voltage. If the ECT sensor output voltage is more than a set value when the engine coolant temperature is low, the ECM detects a malfunction and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	2 seconds or more
DTC Type	One drive cycle, MIL ON

ENABLE CONDITIONS CHART

Condition	
Ignition switch	ON
No active DTCs	ECT

Malfunction Threshold

The output voltage from the ECT sensor is 4.92 V or more for at least 2 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0122 (7): ADVANCED DIAGNOSTICS

DTC P0122: THROTTLE POSITION (TP) SENSOR CIRCUIT LOW VOLTAGE

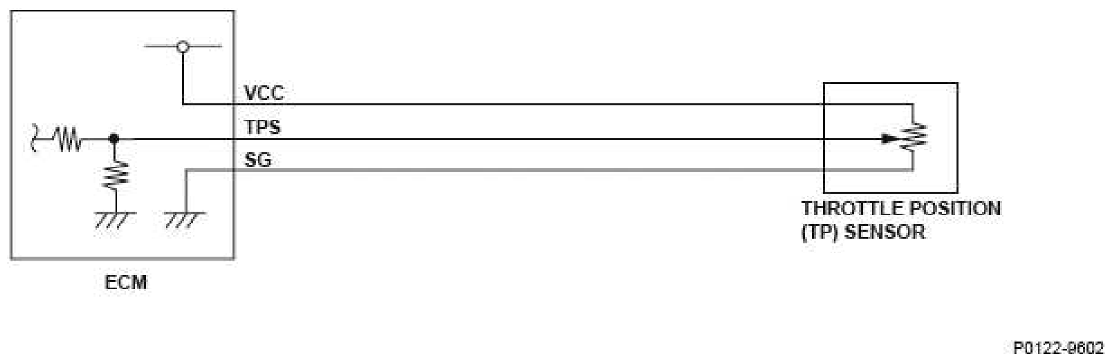


Fig. 17: Throttle Position (TP) Sensor Circuit Diagram

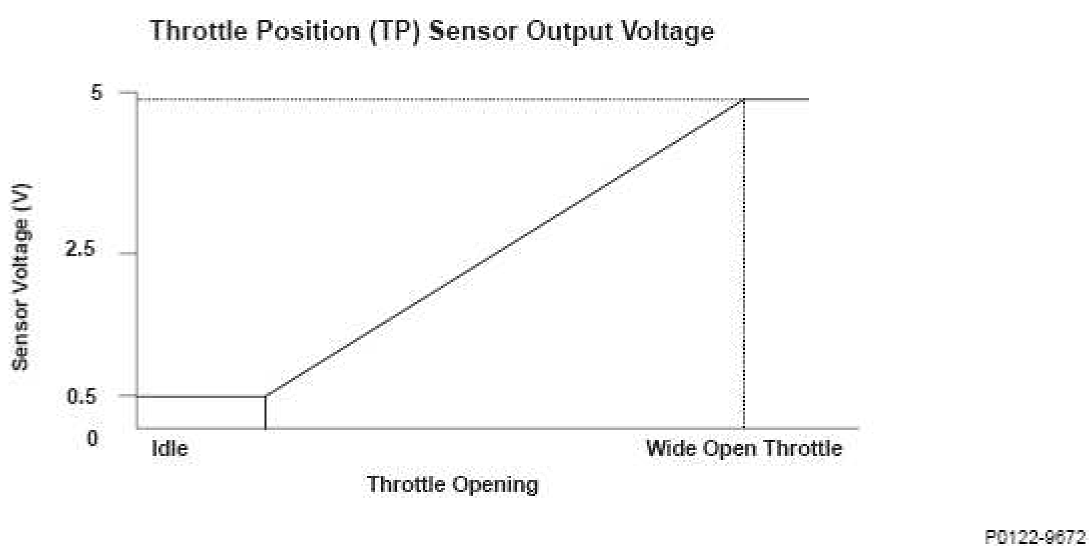


Fig. 18: Throttle Position Sensor Output Voltage Graph

General Description

The throttle position (TP) sensor is installed in the throttle body, and it detects the position of the throttle valve. This sensor includes a brush that moves with the throttle valve. The brush outputs voltage to the engine control module (ECM) that varies linearly with throttle position by sliding on a resistor. When accelerating or decelerating, the detected amount of intake airflow by the MAP sensor tends to be inaccurate due to rapid changes in throttle position. The TP sensor is used to correct the amount of airflow as it detects the throttle position. Also, the sensor is used for fuel cut-off operation to improve fuel economy and exhaust emissions when the throttle is fully closed during deceleration. The ECM monitors the throttle position (in degrees). If the output signal voltage from the TP sensor is excessively low, the

ECM detects a malfunction and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	2 seconds or more
DTC Type	One drive cycle, MIL ON

ENABLE CONDITIONS CHART

Condition	
State of the engine	Running
No active DTCs	TP

Malfunction Threshold

The output voltage from the TP sensor is 0.1 V or less for at least 2 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0123 (7): ADVANCED DIAGNOSTICS

DTC P0123: THROTTLE POSITION (TP) SENSOR CIRCUIT HIGH VOLTAGE

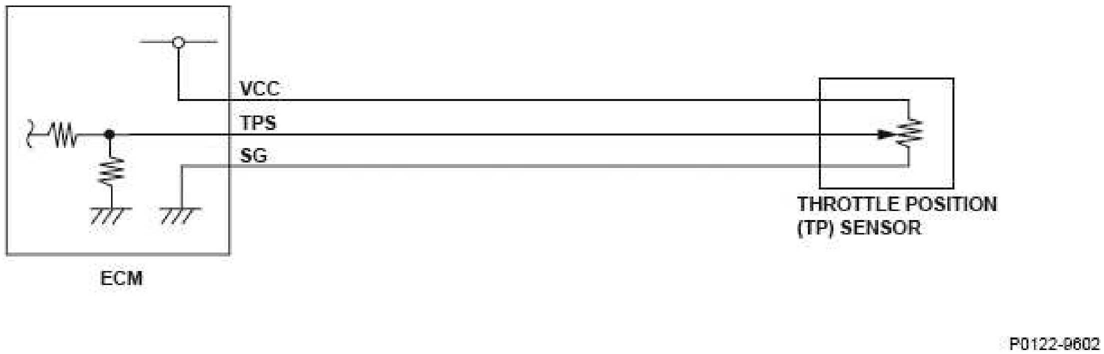


Fig. 19: Throttle Position (TP) Sensor Circuit Diagram

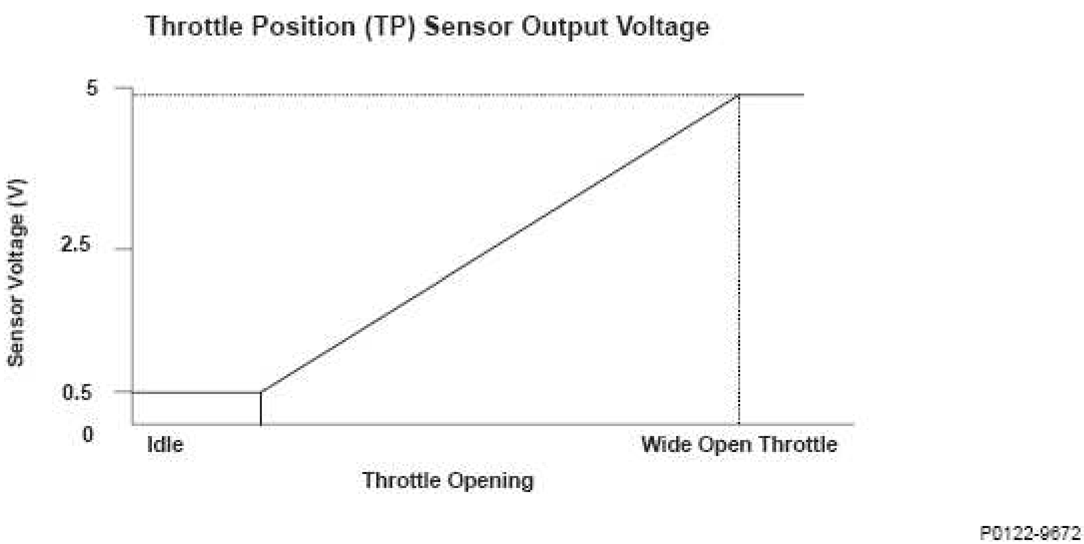


Fig. 20: Throttle Position Sensor Output Voltage Graph

General Description

The throttle position (TP) sensor is installed in the throttle body, and it detects the position of the throttle valve. This sensor includes a brush that moves with the throttle valve. The brush outputs voltage to the engine control module (ECM) that varies linearly with throttle position by sliding on a resistor. When accelerating or decelerating, the detected amount of intake airflow by the MAP sensor tends to be inaccurate due to rapid changes in throttle position. The TP sensor is used to correct the amount of airflow as it detects the throttle position. Also, the sensor is used for fuel cut-off operation to improve fuel economy and exhaust emissions when the throttle is fully closed during deceleration. The ECM monitors the throttle position (in degrees). If the output signal voltage from the TP sensor is excessively high, the

ECM detects a malfunction and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	2 seconds or more
DTC Type	One drive cycle, MIL ON

ENABLE CONDITIONS CHART

Condition	
State of the engine	Running
No active DTCs	TP

Malfunction Threshold

The output voltage from the TP sensor is 4.90 V or more for at least 2 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0125 (86): ADVANCED DIAGNOSTICS

DTC P0125: ENGINE COOLANT TEMPERATURE (ECT) SENSOR MALFUNCTION/SLOW RESPONSE

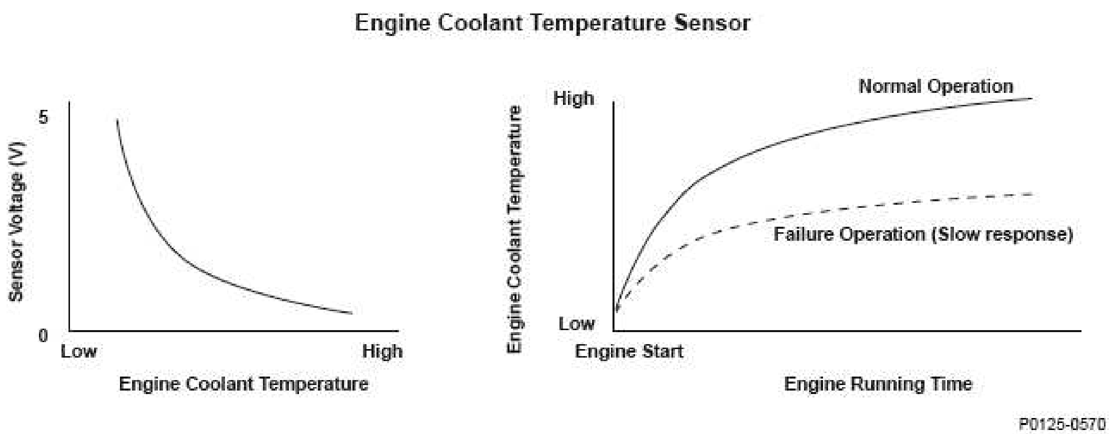


Fig. 21: Engine Coolant Temperature (ECT) Sensor 1 Malfunction/Slow Response - Graph

General Description

The engine control module (ECM) supplies voltage to the engine coolant temperature (ECT) signal circuit (about 5 V) through a pull-up resistor. As the engine coolant cools, the ECT sensor resistance increases, and the ECM detects a high signal voltage. As the engine coolant warms, the ECT sensor resistance decreases, and the ECM detects a low signal voltage.

If the ECT output voltage does not reach a specified temperature at which closed-loop control for stoichiometric air/fuel ratio starts within a set time, depending on the initial coolant temperature after starting the engine, the ECM detects a malfunction and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Once per driving cycle
Sequence	None
Duration	20 minutes or less
DTC Type	Two drive cycles, MIL ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
Initial engine coolant	-	14°F (-10°C)

temperature		
Fuel feedback	Other than during fuel cut-off operation	
No active DTCs	A/F Sensor, A/F Sensor Heater, MAP, CKP, CMP, ECT, IAT, BARO, IAC, EGR, EVAP, VTEC System, Fuel System, Misfire	

Malfunction Threshold

The engine running time before the engine coolant temperature reaches 98°F (36° C), based on the initial engine coolant temperatures, is as follows.

MALFUNCTION THRESHOLD CHART

Initial engine coolant temperature	-28°F (-33°C)	13°F (-10°C)
Engine running time	300 seconds or more	60 seconds or more

Driving Pattern

1. Start the engine at an engine coolant temperature as specified under Enable Conditions.
2. Let the engine idle for at least 20 minutes.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected during the first drive cycle with the ECT and IAT at engine start-up within the specified temperature range, a Temporary DTC is stored in the ECM memory. If the malfunction recurs during the next (second) drive cycle with the ECT and IAT at engine start-up within the specified temperature range, the MIL comes on and the DTC and the freeze frame data are stored.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0128 (87): ADVANCED DIAGNOSTICS

DTC P0128: COOLING SYSTEM MALFUNCTION

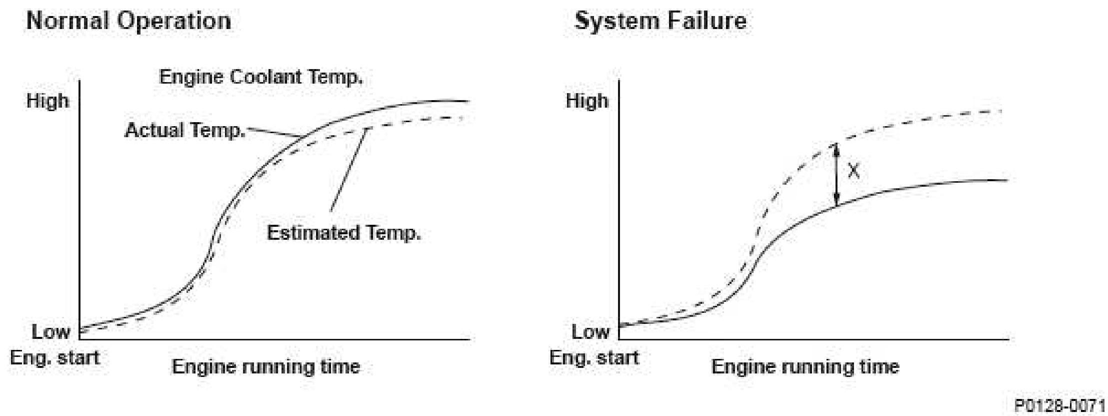


Fig. 22: Cooling System Malfunction Operation Graph

General Description

The thermostat is closed when the engine coolant temperature is low, and it stops the circulation of engine coolant to speed engine warm up. When the engine coolant temperature increases, the thermostat opens and circulates engine coolant to control its temperature. When the engine coolant temperature decreases, the opening area of the thermostat is reduced to regulate the engine coolant temperature. If the thermostat sticks open, engine warm up is delayed, and exhaust emissions are adversely affected. The engine control module (ECM) estimates the engine coolant temperature after starting the engine from the initial engine coolant temperature and driving conditions, and compares it with the actual engine coolant temperature that is detected by the engine coolant temperature (ECT) sensor.

If the actual engine coolant temperature is below the estimated engine coolant temperature (when X shown in the graph is large), a thermostat malfunction is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Once per driving cycle
Sequence	None
Duration	Depending on driving conditions

DTC Type	Two drive cycles, MIL ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
Initial engine coolant temperature	20°F (-6°C)	123°F (51°C)
Initial intake air temperature	20°F (-6°C)	123°F (51°C)
The difference between initial engine coolant temperature and initial intake air temperature	-	10°F (6°C)
The difference between intake air temperature and initial intake air temperature	-	3°F (2°C)
No active DTCs	A/F Sensor, A/F Sensor Heater, MAP, CKP, ECT, IAT, EGR, BARO, IAC, Fuel System, Misfire, TP, CMP	
Other	Test-drive on a flat road	

Malfunction Threshold

- The ECT sensor output is 158°F (70°C) or less when the estimated engine coolant temperature is 167°F (75°C) or more.
- The difference between the estimated engine coolant temperature and the ECT sensor output is 9°F (5°C) or more.

Driving Pattern

1. Start the engine at an engine coolant temperature and intake air temperature as specified under Enable Conditions.
2. Drive the vehicle at a speed between 15 - 75 mph (24 - 120 km/h) for at least 10 minutes.

- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the ECM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0133 (61): ADVANCED DIAGNOSTICS

DTC P0133: AIR/FUEL RATIO (A/F) SENSOR (SENSOR 1) SLOW RESPONSE

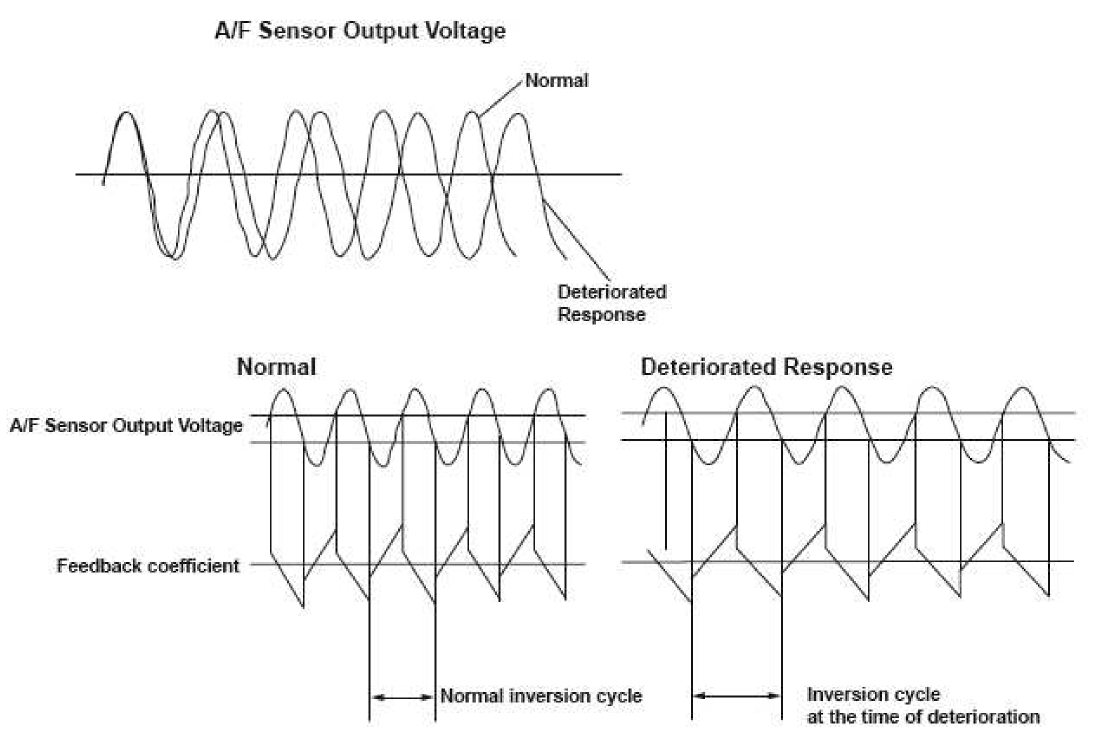


Fig. 23: Rear Air/Fuel Ratio (A/F) Sensor Output Voltage Blinking Pattern

General Description

The air/fuel ratio (A/F) sensor has a linear signal output in relation to the oxygen concentration. The engine control module (ECM) computes the air/fuel ratio from A/F sensor output voltage and uses the fuel feedback control to improve exhaust emissions. The ECM measures the inversion cycle of the A/F sensor output voltage during closed loop control of the stoichiometric ratio, detects a deteriorated response, and stores a DTC if the inversion cycle is longer than a specified time period.

MONITOR DESCRIPTION CHART

Execution	Once per driving cycle
Sequence	None
Duration	14 seconds or more
DTC Type	Two drive cycles, MIL ON

ENABLE CONDITIONS CHART

<table>
<tr><th colspan="2">Condition</th><th>Minimum</th><th>Maximum</th></tr>
<tr><td colspan="2">Engine coolant temperature</td><td>140°F (60°C)</td><td>-</td></tr>
<tr><td colspan="2">Intake air temperature</td><td>-14°F (-25°C)</td><td>-</td></tr>
<tr><td colspan="2">Engine speed</td><td>1,300 rpm</td><td>2,700 rpm</td></tr>
<tr><td rowspan="4">MAP value</td><td rowspan="2">1,300 rpm</td><td>38 kPa (285 mmHg, 11.3 in.Hg)[1]</td><td>90 kPa (680 mmHg, 26.7 in.Hg)[1]</td></tr>
<tr><td>48 kPa (360 mmHg, 14.2 in.Hg)[2]</td><td>94 kPa (710 mmHg, 27.9 in.Hg)[2]</td></tr>
<tr><td>2,200 rpm[1]</td><td>32 kPa (235 mmHg, 9.3 in.Hg)</td><td rowspan="2">90 kPa (680 mmHg, 26.7 in.Hg)</td></tr>
<tr><td>2,250 rpm[2]</td><td>42 kPa (310 mmHg, 12.3 in.Hg)</td></tr>
<tr><td colspan="2">Vehicle speed</td><td>35 mph (55 km/h)</td><td>-</td></tr>
<tr><td colspan="2">Fuel trim</td><td>0.65</td><td>1.40</td></tr>
<tr><td colspan="2">Fuel feedback</td><td colspan="2">Closed loop at stoichiometric</td></tr>
<tr><td colspan="2">Monitoring</td><td colspan="2">EVAP, Catalyst System</td></tr>
</table>

priority	
No active DTCs	ECM, A/F Sensor, A/F Sensor Heater, Secondary HO2S, Secondary HO2S Heater, MAP, CKP, ECT, TP(2), EGR, BARO, VSS, VTEC System, Fuel System, A/T System(2)
Other	Other than when there is excessive vapor generation (fuel level is 40 - 80%)
(1) M/T model (2) CVT model	

Malfunction Threshold

The average of at least six periods of the A/F sensor inversion cycle is 2.3 seconds or longer, or the average of six periods of the A/F sensor inversion cycle detected for 10 seconds is 2.3 seconds or longer.

Driving Pattern

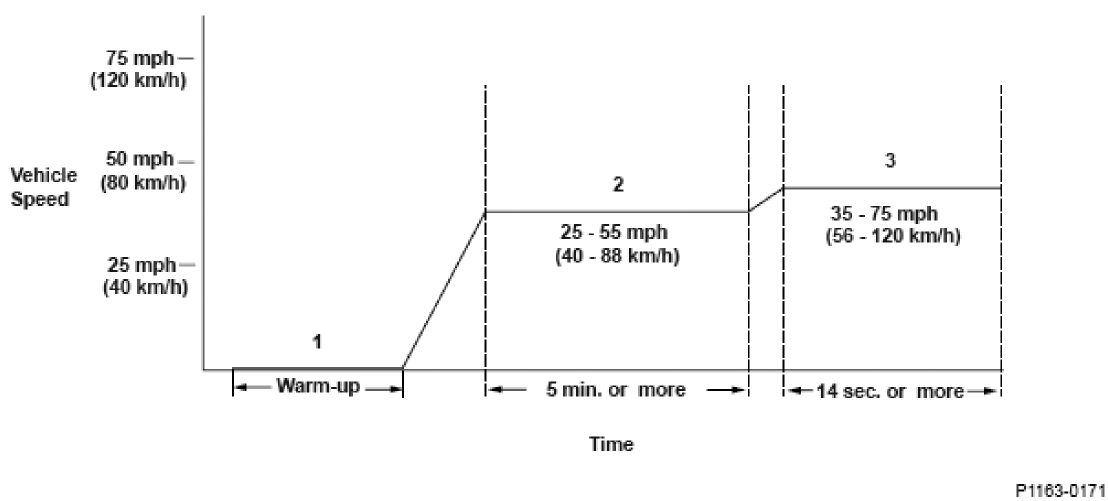


Fig. 24: Identifying Driving Pattern

1. Start the engine. Hold the engine at 3,000 rpm with no load (in park or neutral) until the radiator fan comes on.
2. Drive the vehicle at a steady speed between 25 - 55 mph (40 - 88 km/h) for at least 5 minutes.

3. Then, drive immediately at a steady speed between 35 - 75 mph (56 - 120 km/h) for at least 14 seconds.

- If the EVAP monitor runs instead of the HO2S monitor, turn the engine off, then restart it, and the HO2S monitor will restart.
- If you have difficulty duplicating the DTC, retest after turning off electrical components such as the audio system and A/C, and try a different gear position.
- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the ECM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0134 (41): ADVANCED DIAGNOSTICS

DTC P0134: AIR/FUEL RATIO (A/F) SENSOR (SENSOR 1) NO ACTIVITY DETECTED

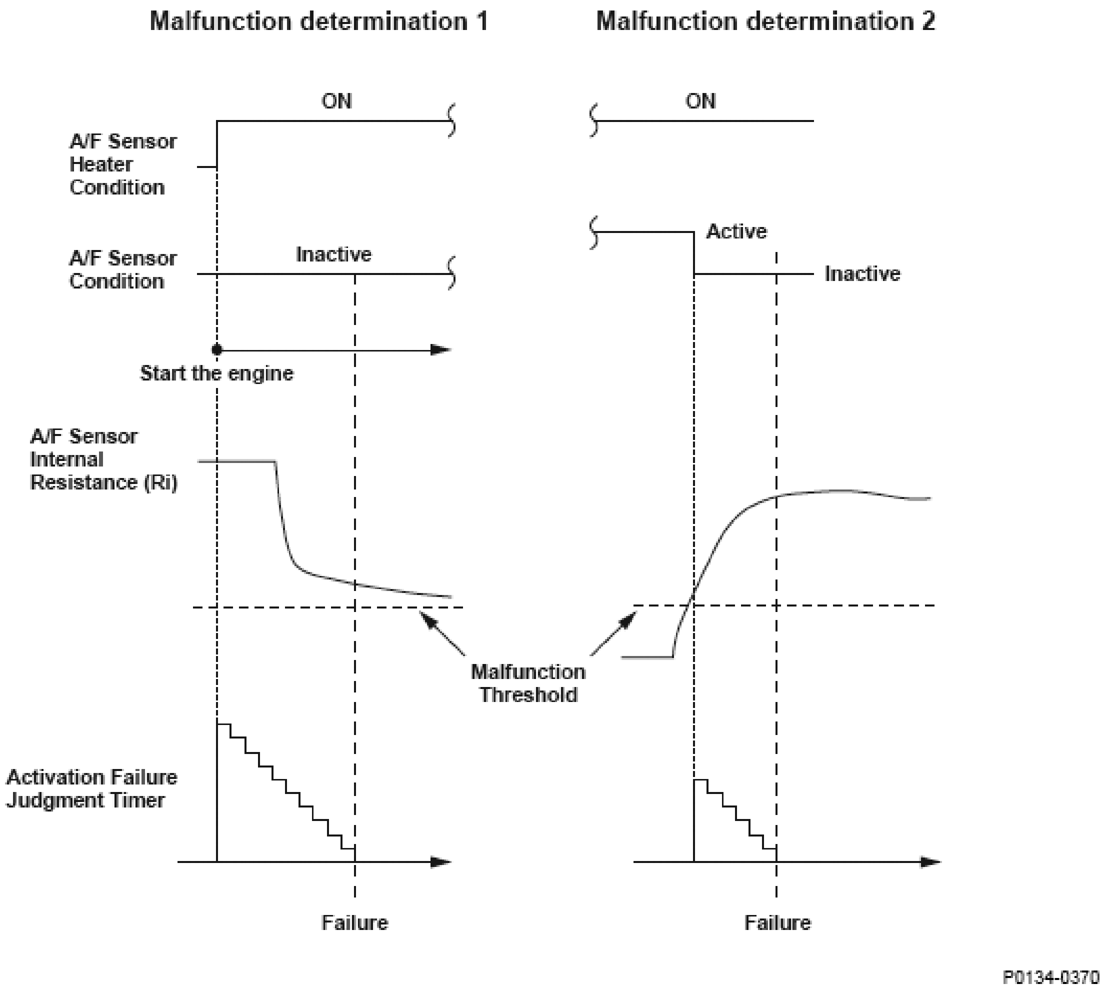


Fig. 25: Air/Fuel Ratio (A/F) Sensor (Sensor 1) No Activity Detected - Malfunction Chart

General Description

The air/fuel ratio (A/F) sensor is activated by warming the element with the heater and by maintaining it at a steady high temperature to accurately calculate the air/fuel (A/F) ratio. The A/F sensor does not become active when the element is not heated enough due to a heater malfunction, etc., and the exhaust emissions deteriorate. The engine control module (ECM) monitors the A/F sensor activity by the A/F sensor internal resistance.

1. When the A/F sensor does not activate in a fixed time after the A/F sensor heater starts to operate (during high A/F sensor internal resistance), a malfunction of the A/F sensor heater is detected, and a DTC is stored.

2. When the A/F sensor heater does not reactivate within a fixed time as indicated by a change from high A/F sensor internal resistance to low A/F sensor internal resistance though the heater is ON, a malfunction in the A/F sensor heater is detected, and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	90 seconds or more
DTC Type	One drive cycle, MIL ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
Engine coolant temperature	2°F (-17°C)	-
Battery voltage	10.5 V	16.0 V
Fuel feedback	Other than during fuel cut-off operation	
No active DTCs	A/F Sensor, ECT	

Malfunction Threshold

Malfunction determination 1

The A/F sensor internal resistance value is 40 ohms or more for at least 90 seconds right after the engine starts.

Malfunction determination 2

The A/F sensor internal resistance value is 40 ohms or more for at least 16 seconds.

Driving Pattern

1. Start the engine. Hold the engine at 3,000 rpm with no load (in park or neutral) until the radiator fan comes on.
2. Let the engine idle for at least 2 minutes.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0135 (41): ADVANCED DIAGNOSTICS

DTC P0135: AIR/FUEL RATIO (A/F) SENSOR (SENSOR 1) HEATER CIRCUIT MALFUNCTION

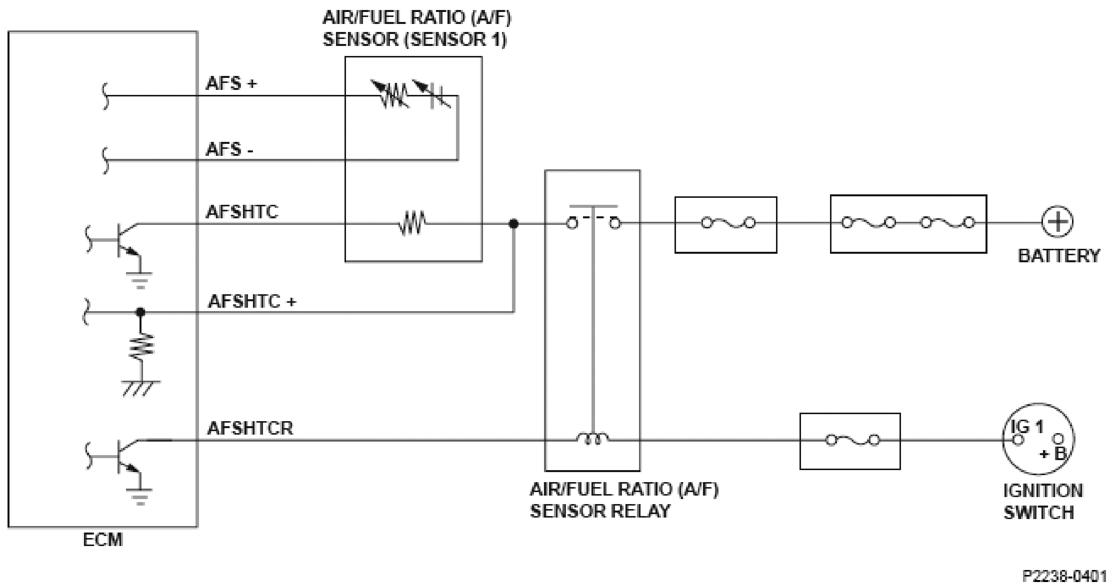


Fig. 26: Air/Fuel Ratio (A/F) Sensor (Sensor 1) Heater Circuit Malfunction Diagram

General Description

A heater for the sensor element is embedded in the air/fuel ratio (A/F) sensor (sensor 1), and it is controlled by the engine control module (ECM). It heats the sensor to stabilize and speed the detection of oxygen content when the exhaust gas temperature is cold.

If the A/F sensor (sensor 1) heater current is not a set value, or the heater is overheated, a malfunction is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	-
DTC Type	One drive cycle, MIL ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
Engine coolant temperature	-4°F (-20°C)	-
Battery voltage (IGP terminal of ECM)	10.5 V	16.0 V
State of the engine	Running	
No active DTCs	ECM, A/F Sensor (Sensor 1), A/F Sensor (Sensor 1) Heater, ECT	
Other	A/F sensor (sensor 1) heater is activated	

Malfunction Threshold

One of these conditions must be met.

- The heater current is 0.8 A or less for at least 4 seconds while the heater is activated, and the heater current is 0.8 A or less for at least 4 seconds while the heater is not activated.
- The heater current is 0.8 A or more for at least 4 seconds while the heater is activated, and the heater current is 0.8 A or more for at least 4 seconds while the heater is not activated.
- The heater current is 15.2 A or more for at least 0.6 seconds.

Driving Pattern

Start the engine. Hold the engine speed at 3,000 rpm without load (in Park or neutral) until the radiator fan comes on.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0137 (63): ADVANCED DIAGNOSTICS

DTC P0137: SECONDARY HEATED OXYGEN SENSOR (SECONDARY HO2S) (SENSOR 2) CIRCUIT LOW VOLTAGE

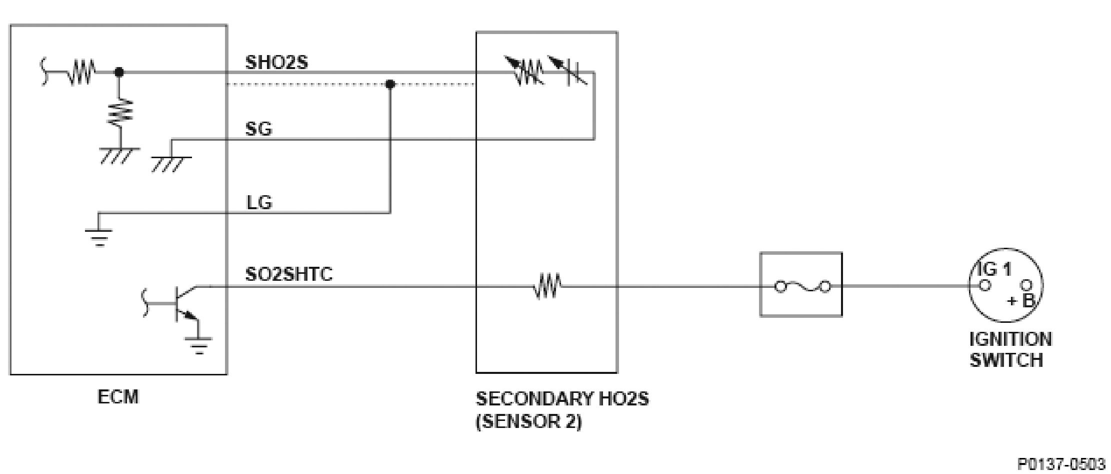


Fig. 27: Secondary Heated Oxygen Sensor (Secondary HO2S (Sensor 2)) Circuit Diagram

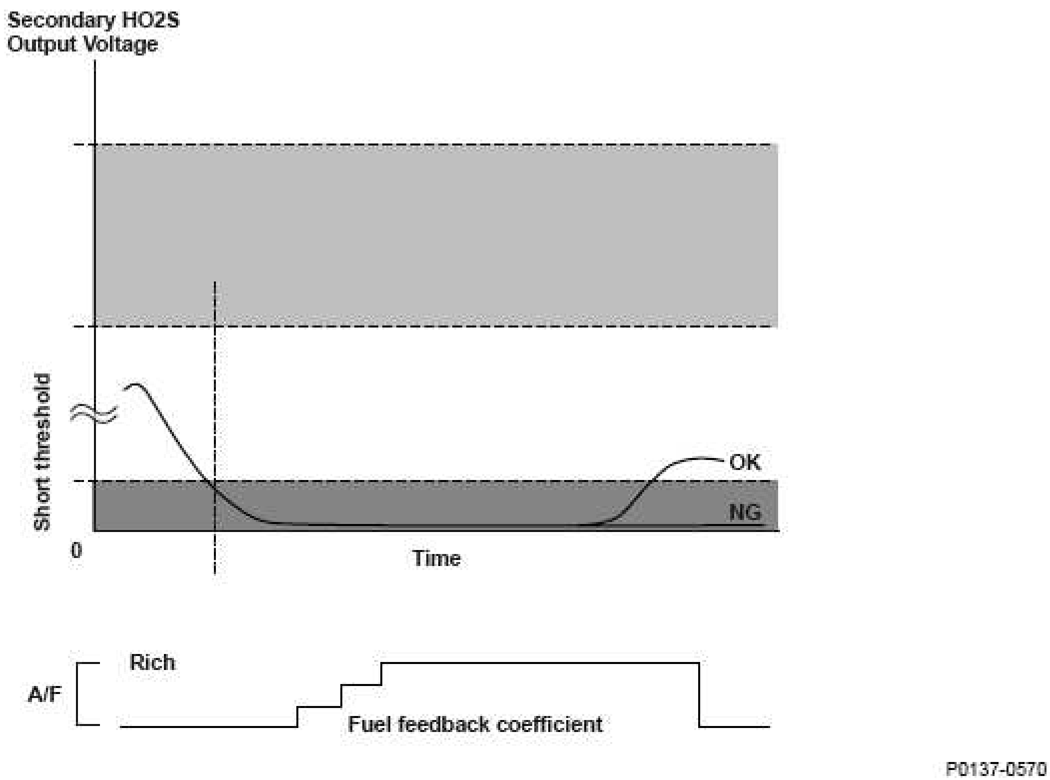


Fig. 28: Secondary Heated Oxygen Sensor Output Voltage - Graph

General Description

The secondary heated oxygen sensor (HO2S) (sensor 2) detects the oxygen content in the exhaust gas downstream of the three way catalytic converter (TWC) during stoichiometric air/fuel ratio feedback control based on the primary heated oxygen sensor (HO2S) (sensor 1) output voltage. The secondary HO2S controls the air/fuel ratio from the primary HO2S output voltage so that the TWC efficiency is optimized.

After current is applied to the secondary HO2S heater, if the secondary HO2S output continues low (lean) during feedback control, a malfunction is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	40(1), 70(2) seconds or more

DTC Type	One drive cycle, MIL ON

(1) M/T model

(2) CVT model

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
Elapsed time after starting the engine	120 seconds	-
Engine coolant temperature	140°F (60°C)	-
Fuel trim	1.36	0.70
Fuel feedback	Closed loop	
Monitoring priority	A/F Sensor, Catalyst System	
No active DTCs	A/F Sensor, A/F Sensor Heater, Secondary HO2S, MAP, ECT, IAT, EGR, Fuel System, CMP, Misfire	

Malfunction Threshold

The secondary HO2S output voltage is 0.33 V or less for at least 40*[1] , 70*[2] seconds.

Driving Pattern

1. Start the engine. Hold the engine speed at 3,000 rpm without load (in Park or neutral) until the radiator fan comes on.
2. Then, drive immediately at a steady engine speed between 1,500 - 3,000 rpm for at least 40*[1] , 70*[2] seconds.

- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0138 (63): ADVANCED DIAGNOSTICS

DTC P0138: SECONDARY HEATED OXYGEN SENSOR (SECONDARY HO2S) (SENSOR 2) CIRCUIT HIGH VOLTAGE

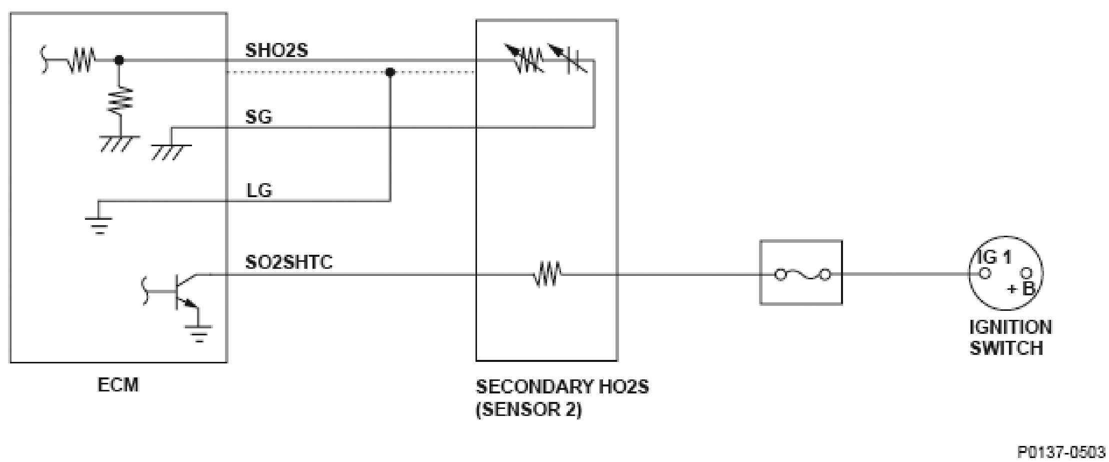


Fig. 29: Secondary Heated Oxygen Sensor (Secondary HO2S (Sensor 2)) Circuit Diagram

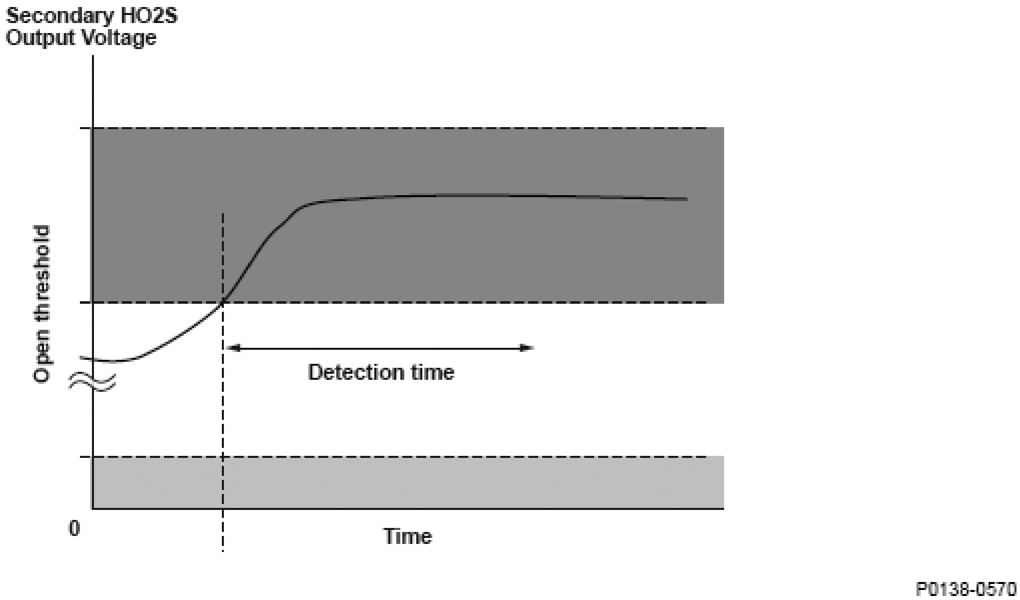


Fig. 30: Secondary Heated Oxygen Sensor Output Voltage - Graph

General Description

The secondary heated oxygen sensor (HO2S) (sensor 2) detects the oxygen content in the exhaust gas downstream of the three way catalytic converter (TWC) during stoichiometric air/fuel ratio feedback control based on the primary heated oxygen sensor (HO2S) (sensor 1) output voltage. The secondary HO2S controls the air/fuel ratio from the primary HO2S output voltage to optimize TWC efficiency.

After current is applied to the secondary HO2S heater, if the secondary HO2S output continues high (rich) exceeding the upper limit used during feedback control, a malfunction is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	5 seconds or more
DTC Type	One drive cycle, MIL ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
Elapsed time after		

starting the engine	120 seconds	-
Engine coolant temperature	140°F (60°C)	-
Fuel trim	1.36	0.70
Fuel feedback	Closed loop	
Monitoring priority	A/F sensor, Catalyst system	
No active DTCs	A/F Sensor, A/F Sensor Heater, Secondary HO2S, MAP, ECT, IAT, EGR, Fuel System, CMP, Misfire	

Malfunction Threshold

The secondary HO2S output voltage is 3.09 V or more for at least 5 seconds.

Driving Pattern

1. Start the engine. Hold the engine speed at 3,000 rpm without load (in Park or neutral) until the radiator fan comes on.
2. Then, drive immediately at a steady engine speed between 1,500 - 3,000 rpm for at least 5 seconds.

- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0139 (63): ADVANCED DIAGNOSTICS

DTC P0139: SECONDARY HEATED OXYGEN SENSOR (SECONDARY HO2S) (SENSOR 2) SLOW RESPONSE

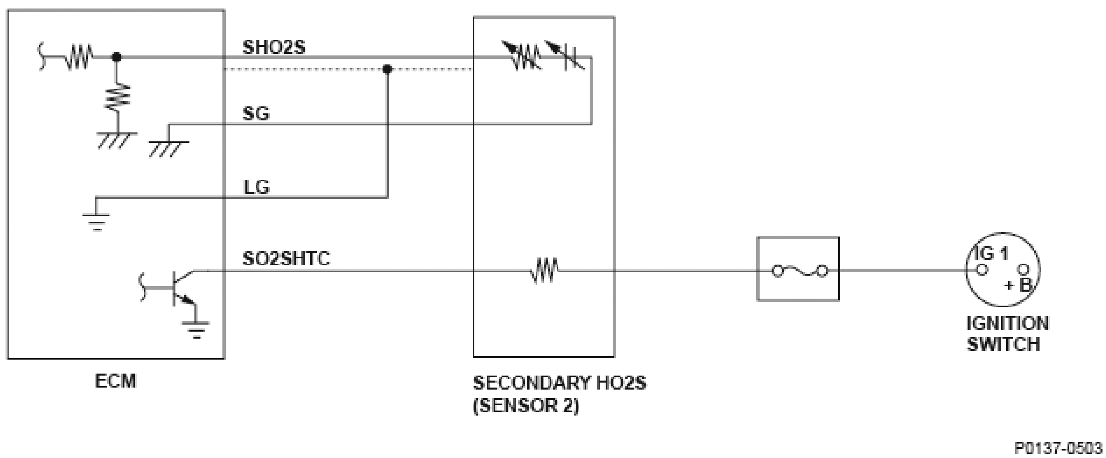


Fig. 31: Secondary Heated Oxygen Sensor (Secondary HO2S (Sensor 2)) Circuit Diagram

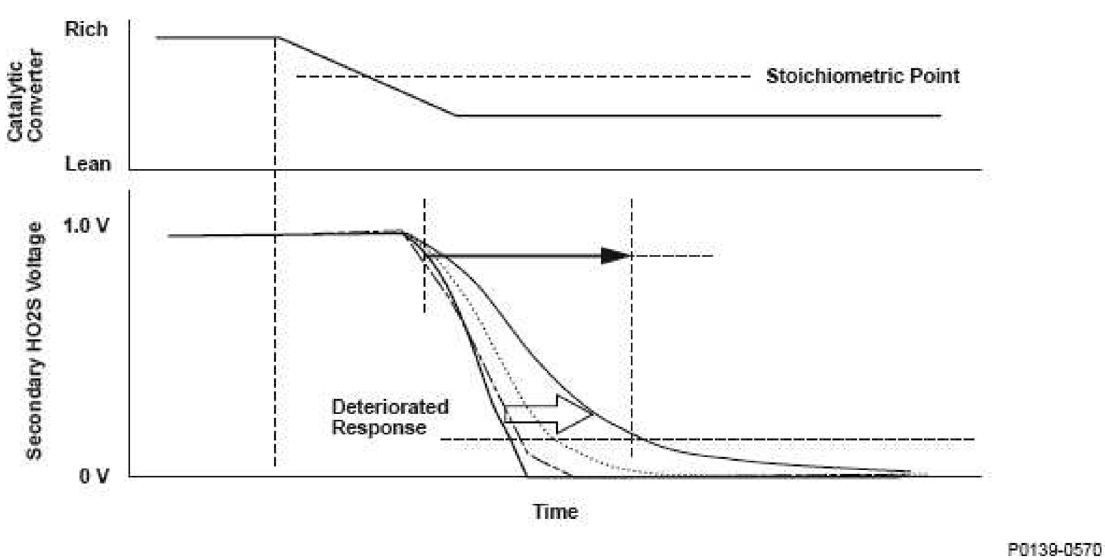


Fig. 32: Secondary Heated Oxygen Sensor Output Voltage - Graph

General Description

The secondary heated oxygen sensor (HO2S) (sensor 2) detects the oxygen content in the exhaust gas downstream of the three way catalytic converter (TWC) during stoichiometric air/fuel ratio feedback control. The secondary HO2S controls the air/fuel ratio from the A/F sensor output voltage to optimize TWC efficiency.

If the response time of the secondary HO2S becomes longer than the specified time after current to the secondary HO2S heater is applied, a malfunction is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Once per driving cycle
Sequence	"Catalyst System" is OK
Duration	27.5 seconds or less
DTC Type	Two drive cycles, MIL ON

ENABLE CONDITIONS CHART

Condition		Minimum	Maximum
Engine coolant temperature		158°F (70°C)	-
Intake air temperature		-14°F (-25°C)	-
Engine speed	CVT	1,200 rpm	2,700 rpm
	M/T	1,300 rpm	
MAP value	CVT	35 kPa (258 mmHg, 10.2 in.Hg)	90 kPa (680 mmHg, 26.0 in.Hg)
	M/T	42 kPa (312 mmHg, 12.3 in.Hg)	
Vehicle speed		30 mph (48 km/h)	-
Fuel trim		1.36	0.70
Fuel feedback		Closed loop	
No active DTCs		A/F Sensor, A/F Sensor Heater, Secondary HO2S, MAP, ECT, EGR, Fuel System, EVAP, CMP, Misfire	

Malfunction Threshold

1. When the secondary HO2S output is lowered to the response deterioration judgment threshold value and the response characteristics measurement is finished.

MALFUNCTION THRESHOLD CHART

MIN	0.2 seconds(1), 0.3 seconds(2)
MAX	0.6 seconds(1), 2.0 seconds(2)
(1) CVT model (2) M/T model	

2. The voltage does not lower to the response deterioration judgment threshold value after the predetermined time (15*2 , 25*1 seconds) has elapsed.

Driving Pattern

1. Start the engine. Hold the engine speed at 3,000 rpm without load (in Park or neutral) until the radiator fan comes on.
2. Then, drive immediately at a steady speed of 35 mph (57 km/h) or more, for at least 27.5 seconds.

- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the ECM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0141 (65): ADVANCED DIAGNOSTICS

DTC P0141: SECONDARY HEATED OXYGEN SENSOR (SECONDARY HO2S (SENSOR 2)) HEATER CIRCUIT MALFUNCTION

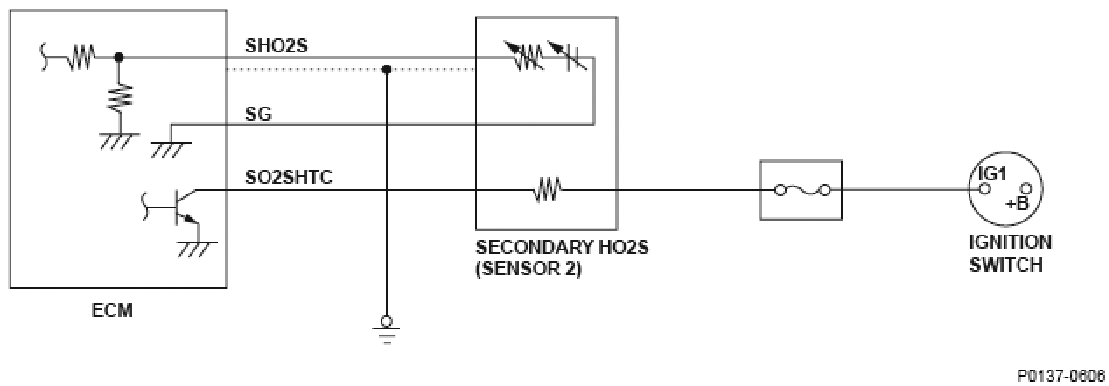


Fig. 33: Secondary Heated Oxygen Sensor (Secondary HO2S (Sensor 2)) Heater Circuit Malfunction

General Description

A heater for the zirconia element is embedded in the secondary heated oxygen sensor (secondary HO2S), and it is controlled by the engine control module (ECM). When activated, it heats the sensor to stabilize and speed up the detection of oxygen content when the exhaust gas temperature is cold.

If the secondary HO2S heater draws more or less than a specified amperage, the ECM detects a malfunction and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	5 seconds or more
DTC Type	One drive cycle, MIL ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
Battery voltage (IGP terminal of ECM)	10.5 V	16 V
Engine coolant temperature	41°F (5°C)	-
State of the engine	Running	

No active DTCs	ECT
Other	During secondary HO2S heater operation

Malfunction Threshold

The current is 0.4 A*[1] , 0.2 A*[2] or less, or 6.0 A*[1] , 3.4 A*[2] or more, for at least 5 seconds when the heater is on.

*1: CVT

*2: M/T

Driving Pattern

Start the engine. Hold the engine speed at 3,000 rpm without load (in Park or neutral) until the radiator fan comes on, then let it idle.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0143 (103): ADVANCED DIAGNOSTICS (M/T)

DTC P0143: THIRD HEATED OXYGEN SENSOR (THIRD HO2S) (SENSOR 3) CIRCUIT LOW VOLTAGE (M/T)

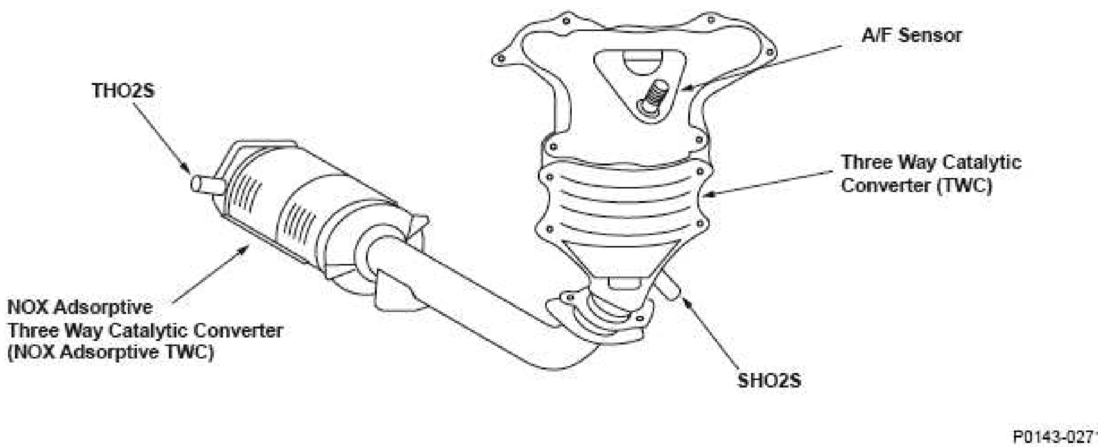


Fig. 34: Identifying Third Heated Oxygen Sensor (Third HO2S) (Sensor 3) Components

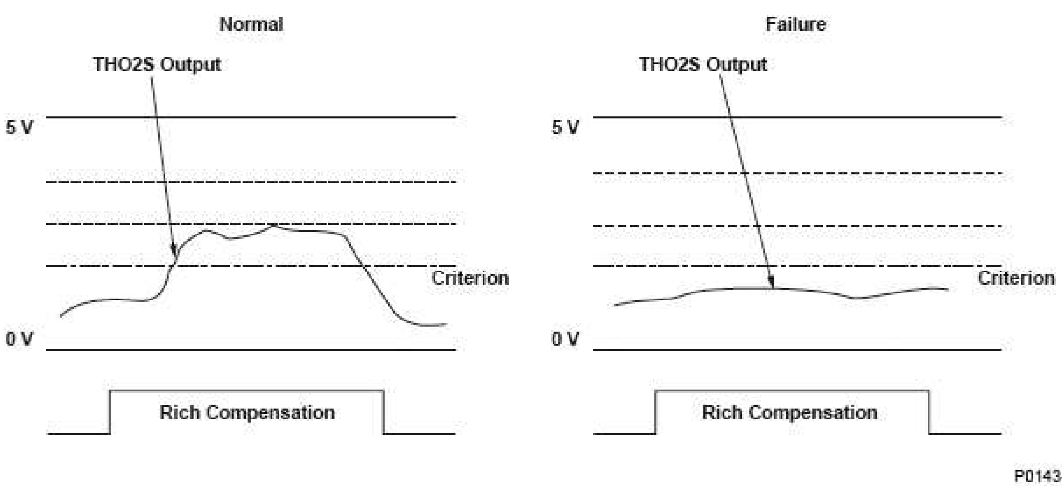


Fig. 35: Third Heated Oxygen Sensor (Third HO2S) (Sensor 3) Voltage Graph

General Description

The third heated oxygen sensor (THO2S) is installed downstream of the NOX adsorptive three way catalyst (TWC) and is used only to determine a malfunction in the NOX adsorptive TWC. If the THO2S output is not on the rich side during a rich running mode, a malfunction is detected and a DTC is stored. If the THO2S output stays on the low side, it may be caused by a sensor failure or a short in the THO2S circuit.

MONITOR DESCRIPTION CHART

Execution	Once per driving cycle

Sequence	None
Duration	50 seconds[1] or less
DTC Type	Two drive cycles, MIL ON
(1) At 2,000 rpm	

ENABLE CONDITIONS CHART

Condition		Minimum	Maximum
Elapsed time after starting the engine		605 seconds	-
Engine coolant temperature		168°F (76°C)	-
Engine speed		1,500 rpm	2,600 rpm
MAP value		35 kPa (260 mmHg, 10.3 in.Hg)	99 kPa (736 mmHg, 29.0 in.Hg)
The difference between atmospheric pressure and MAP value	1,500 rpm	8 kPa (54 mmHg, 2.2 in.Hg)	-
	2,600 rpm	11 kPa (81 mmHg, 3.2 in.Hg)	
Vehicle speed		25 mph (40 km/h)	-
Short term fuel trim		-	0.98
Fuel feedback		During lean burn running	
Monitoring priority		Catalyst System, A/F Sensor, EVAP	
No active DTCs		ECM, A/F Sensor, A/F Sensor Heater, Third HO2S Heater, MAP, CKP, ECT, TP, EGR, BARO, VSS, VTEC System, Fuel System, EVAP	
Others		Must be in 3rd, 4th, or 5th gear	
		The duration of lean burn running must be sufficient (at least 1 minute)	
		The IMA battery indicates at least 25%	

Malfunction Threshold

The third HO2S output is 0.29 V or less during a rich running mode for no more than 50 seconds.

Driving Pattern

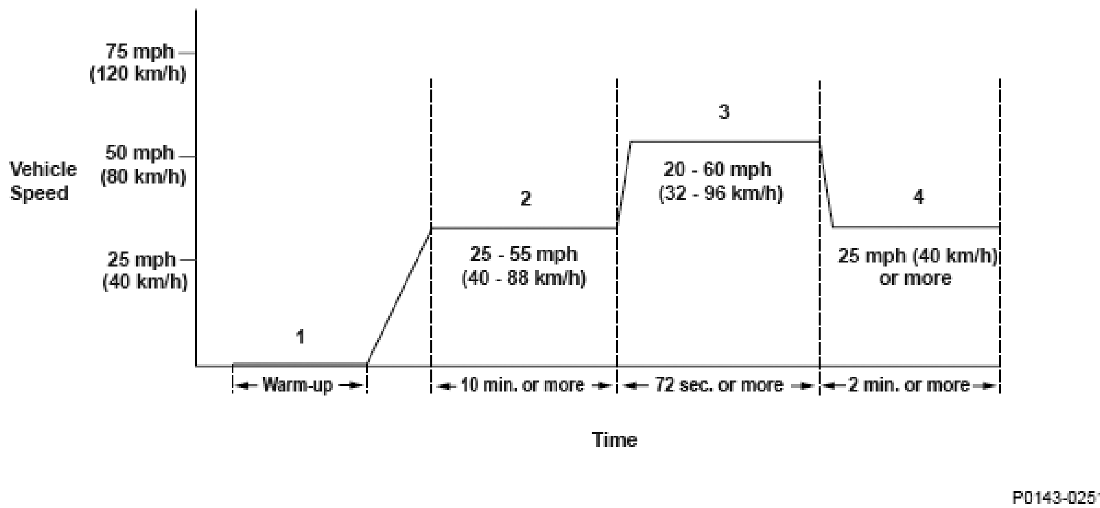


Fig. 36: Identifying Driving Pattern

1. Start the engine. Hold the engine at 3,000 rpm with no load (in park or neutral) until the radiator fan comes on.
2. Drive the vehicle at a speed between 25 - 55 mph (40 - 88 km/h) for at least 10 minutes to warm up the engine and the NOX adsorptive TWC.
3. Drive the vehicle at a speed between 20 - 60 mph (32 - 96 km/h) for at least 72 seconds.
4. Then, drive at a steady speed of 25 mph (40 km/h) or more in the lean burn running mode for at least 2 minutes.

- If you have difficulty duplicating the DTC, retest after turning off electrical components such as the audio system and A/C, and try a different gear position.
- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected during the first drive cycle, a Temporary DTC is

stored in the ECM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0144 (103): ADVANCED DIAGNOSTICS (M/T)

DTC P0144: THIRD HEATED OXYGEN SENSOR (THIRD HO2S) (SENSOR 3) CIRCUIT HIGH VOLTAGE (M/T)

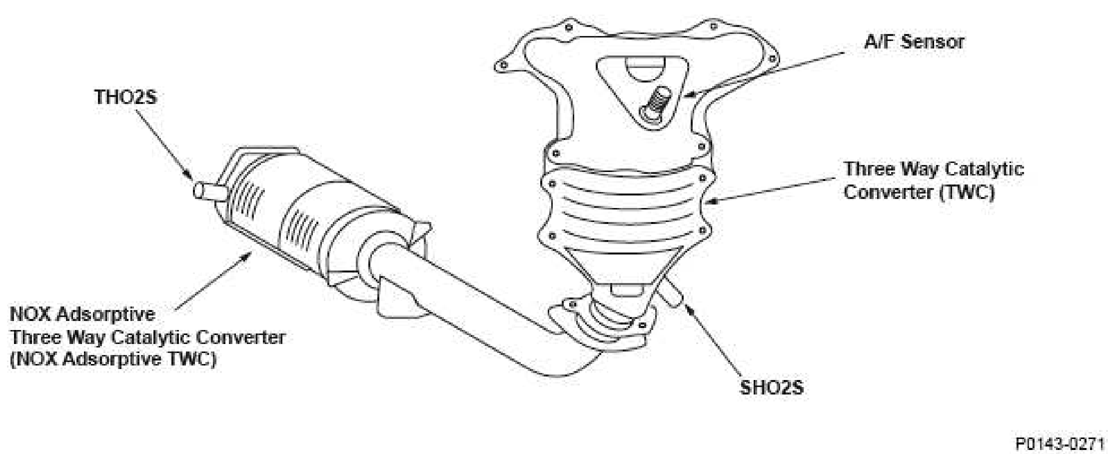


Fig. 37: Identifying Third Heated Oxygen Sensor (Third HO2S) (Sensor 3) Components

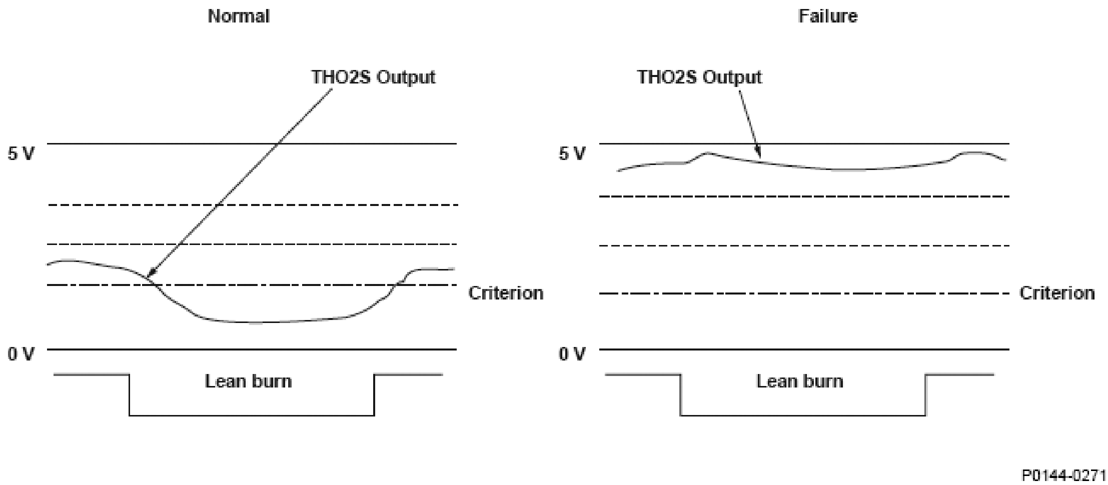


Fig. 38: Third Heated Oxygen Sensor (Third HO2S) (Sensor 3) Voltage Graph

General Description

The third heated oxygen sensor (THO2S) is installed downstream of the NOX adsorptive three way catalyst (TWC) and is used only to determine a malfunction in the NOX adsorptive TWC. If the THO2S output is not on the lean side during lean burn running, a malfunction is detected and a DTC is stored. If the THO2S output stays on the high side, it may be caused by a sensor failure or a short in the THO2S circuit.

MONITOR DESCRIPTION CHART

Execution	Once per driving cycle
Sequence	None
Duration	50 seconds(1) or less
DTC Type	Two drive cycles, MIL ON
(1) At 2,000 rpm	

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
Elapsed time after starting the engine	605 seconds	-
Engine coolant temperature	168°F (76°C)	-

Engine speed		1,500 rpm	2,600 rpm
MAP value		35 kPa (260 mmHg, 10.3 in.Hg)	99 kPa (736 mmHg, 29.0 in.Hg)
The difference between atmospheric pressure and MAP value	1,500 rpm	8 kPa (54 mmHg, 2.2 in.Hg)	-
	2,600 rpm	11 kPa (81 mmHg, 3.2 in.Hg)	
Vehicle speed		25 mph (40 km/h)	-
Short term fuel trim		-	0.98
Fuel feedback		During lean burn running	
Monitoring priority		Catalyst System, A/F Sensor, EVAP	
No active DTCs		ECM, A/F Sensor, A/F Sensor Heater, Third HO2S Heater, MAP, CKP, ECT, TP, EGR, BARO, VSS, VTEC System, Fuel System, EVAP	
Others		Must be in 3rd, 4th, or 5th gear	
		The duration of lean burn running must be sufficient (at least 1 minute)	
		The IMA battery indicates at least 25%	

Malfunction Threshold

The third HO2S output is 2.50 V or more during a lean burn running mode for no more than 50 seconds.

Driving Pattern

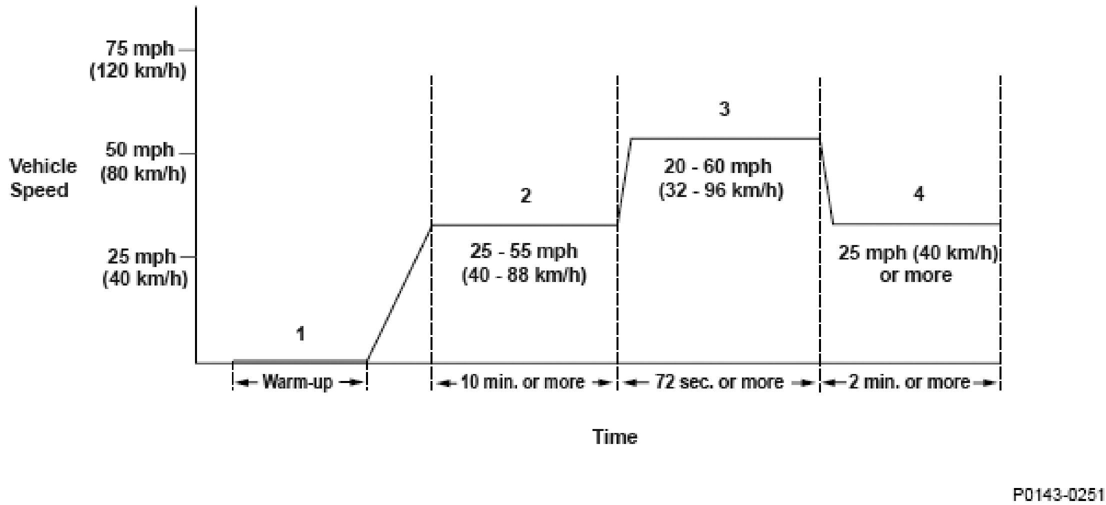


Fig. 39: Identifying Driving Pattern

1. Start the engine. Hold the engine at 3,000 rpm with no load (in park or neutral) until the radiator fan comes on.
2. Drive the vehicle at a speed between 25 - 55 mph (40 - 88 km/h) for at least 10 minutes to warm up the engine and the NOX adsorptive TWC.
3. Drive the vehicle at a speed between 20 - 60 mph (32 - 96 km/h) for at least 72 seconds.
4. Then, drive at a steady speed of 25 mph (40 km/h) or more in the lean burn running mode for at least 2 minutes.

- If you have difficulty duplicating the DTC, retest after turning off electrical components such as the audio system and A/C, and try a different gear position.
- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the ECM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0145 (103): ADVANCED DIAGNOSTICS (M/T)

DTC P0145: THIRD HEATED OXYGEN SENSOR (THIRD HO2S) (SENSOR 3) CIRCUIT SLOW RESPONSE (M/T)

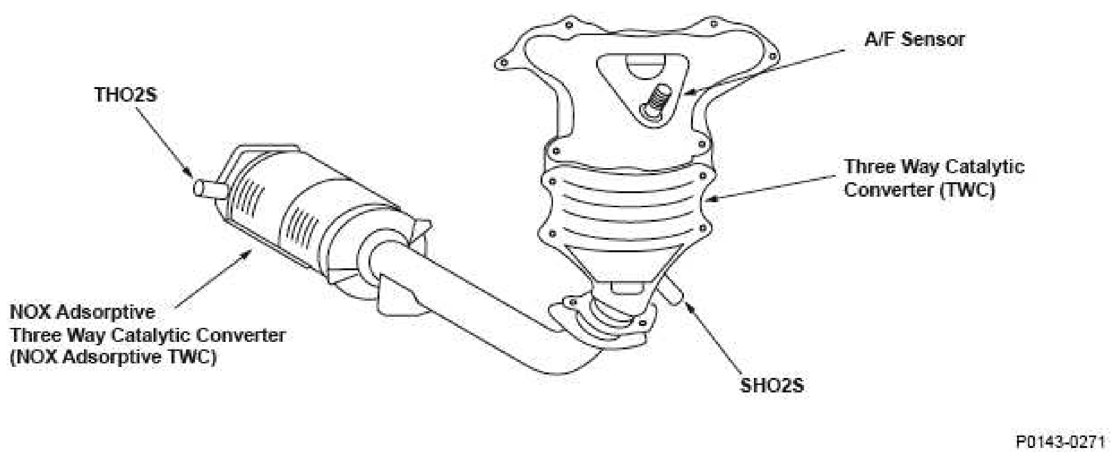


Fig. 40: Identifying Third Heated Oxygen Sensor (Third HO2S) (Sensor 3) Components

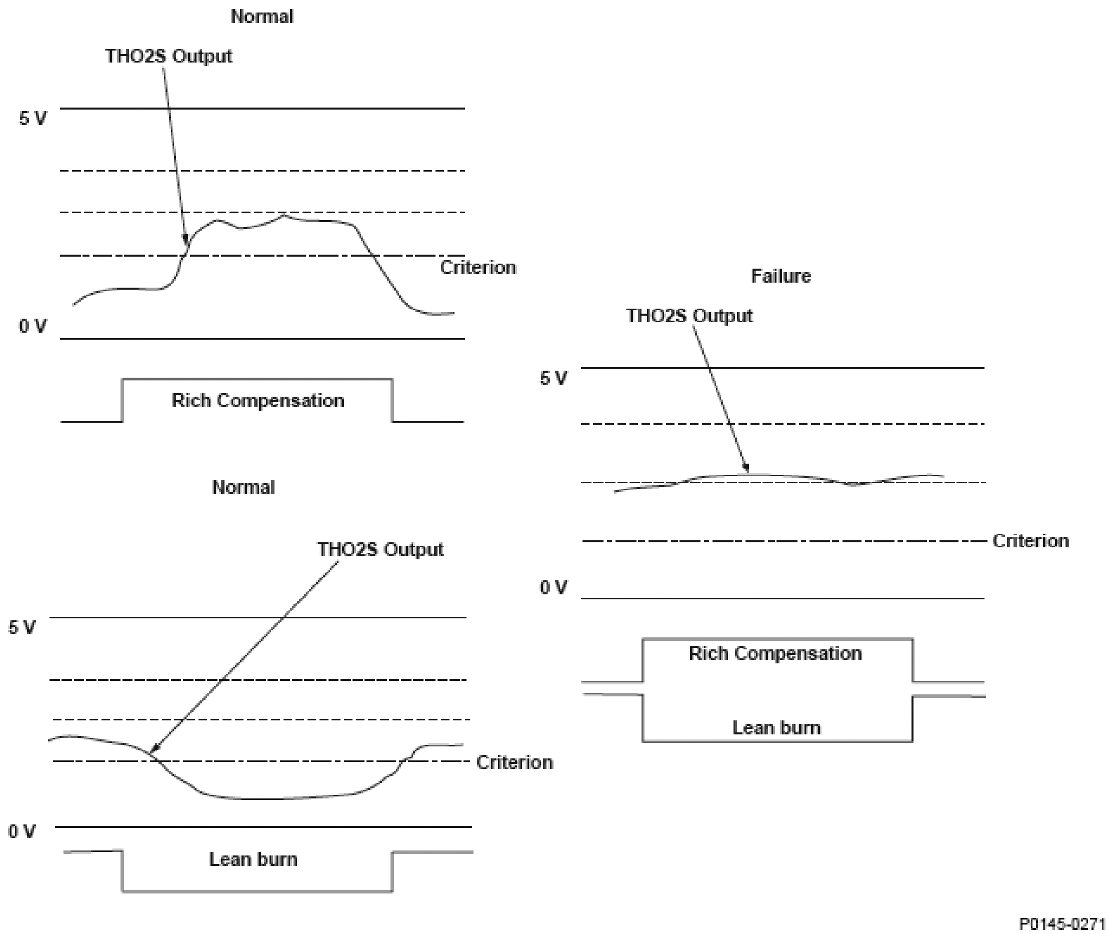


Fig. 41: Third Heated Oxygen Sensor (Third HO2S) (Sensor 3) Voltage Graph

General Description

The third heated oxygen sensor (THO2S) is installed downstream of the NOX adsorptive three way catalyst (TWC) and is used only to determine a malfunction in the NOX adsorptive TWC. If the THO2S output is not on the lean side during lean burn running, a malfunction is detected and a DTC is stored. That is, if the THO2S output does not change to the lean side nor rich side during enrichment (during lean burn running), a malfunction is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Once per driving cycle
Sequence	None
Duration	50 seconds(1) or less

DTC Type	Two drive cycles, MIL ON
(1) At 2,000 rpm	

ENABLE CONDITIONS CHART

<table>
<tr><th colspan="2">Condition</th><th>Minimum</th><th>Maximum</th></tr>
<tr><td colspan="2">Elapsed time after starting the engine</td><td>605 seconds</td><td>-</td></tr>
<tr><td colspan="2">Engine coolant temperature</td><td>168°F (76°C)</td><td>-</td></tr>
<tr><td colspan="2">Engine speed</td><td>1,500 rpm</td><td>2,600 rpm</td></tr>
<tr><td colspan="2">MAP value</td><td>35 kPa (260 mmHg, 10.3 in.Hg)</td><td>99 kPa (736 mmHg, 29.0 in.Hg)</td></tr>
<tr><td rowspan="2">The difference between atmospheric pressure and MAP value</td><td>1,500 rpm</td><td>8 kPa (54 mmHg, 2.2 in.Hg)</td><td rowspan="2">-</td></tr>
<tr><td>2,600 rpm</td><td>11 kPa (81 mmHg, 3.2 in.Hg)</td></tr>
<tr><td colspan="2">Vehicle speed</td><td>25 mph (40 km/h)</td><td>-</td></tr>
<tr><td colspan="2">Short term fuel trim</td><td>-</td><td>0.98</td></tr>
<tr><td colspan="2">Fuel feedback</td><td colspan="2">During lean burn running</td></tr>
<tr><td colspan="2">Monitoring priority</td><td colspan="2">Catalyst System, A/F Sensor, EVAP</td></tr>
<tr><td colspan="2">No active DTCs</td><td colspan="2">ECM, A/F Sensor, A/F Sensor Heater, Third HO2S Heater, MAP, CKP, ECT, TP, EGR, BARO, VSS, VTEC System, Fuel System, EVAP</td></tr>
<tr><td colspan="2" rowspan="3">Others</td><td colspan="2">Must be in 3rd, 4th, or 5th gear</td></tr>
<tr><td colspan="2">The duration of lean burn running must be sufficient (at least 1 minute)</td></tr>
<tr><td colspan="2">The IMA battery indicates at least 25%</td></tr>
</table>

Malfunction Threshold

The third HO2S output is between 0.29 V and 0.6 V during enrichment, or between 0.6 V and 2.5 V during lean burn running, for no more than 50 seconds.

Driving Pattern

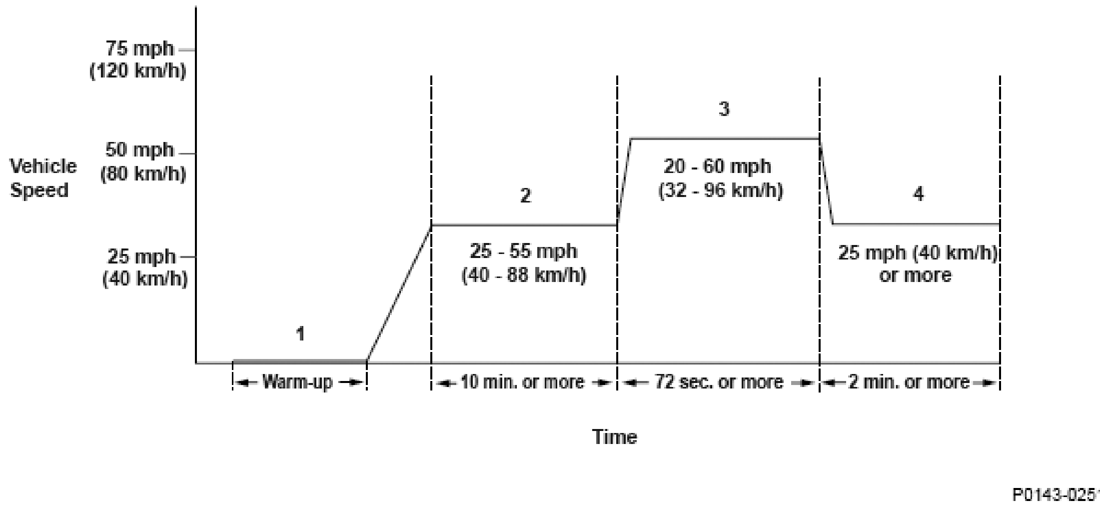


Fig. 42: Identifying Driving Pattern

1. Start the engine. Hold the engine at 3,000 rpm with no load (in park or neutral) until the radiator fan comes on.
2. Drive the vehicle at a speed between 25 - 55 mph (40 - 88 km/h) for at least 10 minutes to warm up the engine and the NOX adsorptive TWC.
3. Drive the vehicle at a speed between 20 - 60 mph (32 - 96 km/h) for at least 72 seconds.
4. Then, drive at a steady speed of 25 mph (40 km/h) or more in the lean burn running mode for at least 2 minutes.

- If you have difficulty duplicating the DTC, retest after turning off electrical components such as the audio system and A/C, and try a different gear position.
- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the ECM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0147 (104): ADVANCED DIAGNOSTICS (M/T)

DTC P0147: THIRD HEATED OXYGEN SENSOR (THIRD HO2S (SENSOR 3)) HEATER CIRCUIT MALFUNCTION (M/T MODEL)

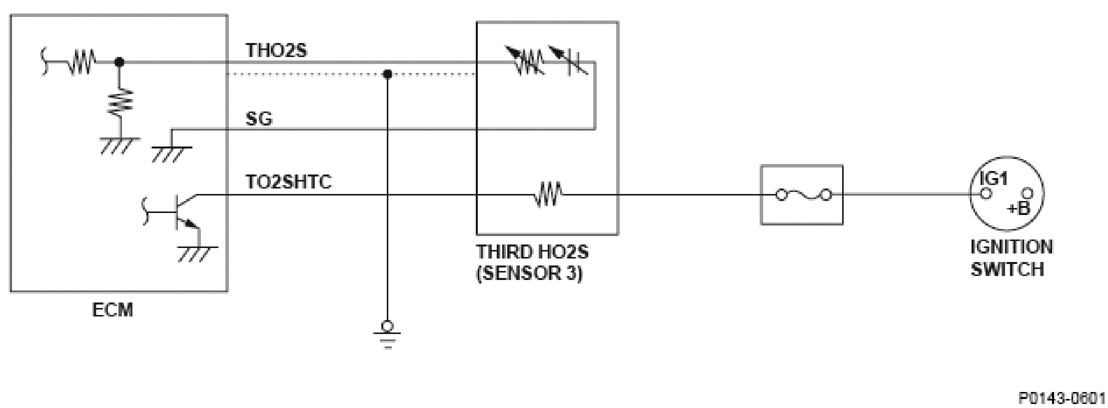


Fig. 43: Third Heated Oxygen Sensor (Third Ho2S (Sensor 3)) Heater Circuit Malfunction (M/T Model)

General Description

A heater for the zirconia element is embedded in the third heated oxygen sensor (third HO2S) and is controlled by the engine control module (ECM). When activated, it heats the sensor to stabilize and speed the detection of oxygen content when the exhaust gas temperature is cold.

If the third HO2S heater draws more or less than a specified amperage, the ECM detects a malfunction and stores a DTC.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	5 seconds or more

DTC Type	One drive cycle, MIL ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
Battery voltage (IGP terminal of ECM)	10.5 V	16 V
Engine coolant temperature	41°F (5°C)	-
State of the engine	Running	
No active DTCs	ECT	
Other	During third HO2S heater operation	

Malfunction Threshold

The current is 0.1 A or less, or 3.5 A or more, for at least 5 seconds when the heater is on.

Driving Pattern

Start the engine. Hold the engine speed at 3,000 rpm without load (in Park or neutral) until the radiator fan comes on, then let it idle.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0171 (45): ADVANCED DIAGNOSTICS

DTC P0171: FUEL SYSTEM TOO LEAN

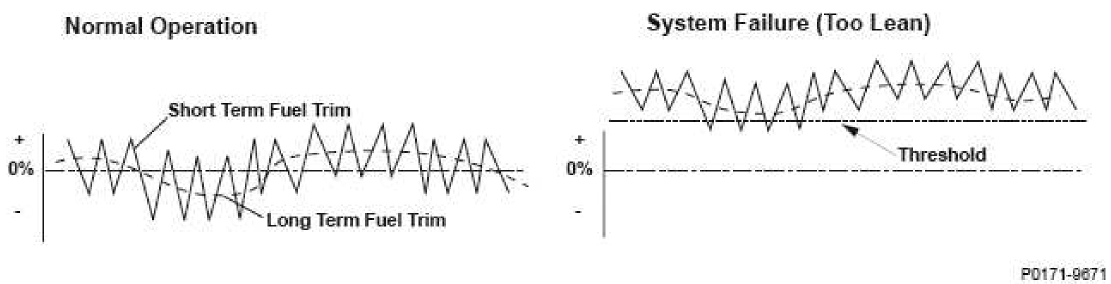


Fig. 44: Fuel System - Graph

General Description

The engine control module (ECM) detects the oxygen content in the exhaust gas from the primary heated oxygen sensor (HO2S) (Sensor 1) signal voltage, and it performs fuel feedback control to maintain the optimal air/fuel ratio. The air/fuel ratio coefficient for correcting the amount of injected fuel is the short term fuel trim. The ECM varies short term fuel trim continuously to keep the air/fuel ratio close to the stoichiometric ratio for all driving conditions.

Long term fuel trim is computed from short term fuel trim and is used to regulate long term deviation from the stoichiometric air/fuel ratio, which occurs when fuel metering components deteriorate with age or system failures occur. In addition, long term fuel trim is stored in the ECM memory and is used to determine when fuel metering components malfunction. When long term fuel trim is higher than normal, which is about 1.0 (0%), the amount of injected fuel must be increased, and when lower than normal, it must be decreased. If long term fuel trim is higher than normal (too lean), a malfunction in the fuel metering components is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	-
DTC Type	Two drive cycles, MIL ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum

Engine coolant temperature	158°F (70°C)	-
Intake air temperature	20°F (-7°C)	-
Engine speed	800 rpm	4,000 rpm
MAP value	20 kPa (150 mmHg, 5.9 in.Hg)	-
Fuel feedback	Closed loop	
Monitoring priority	Catalyst System, EVAP	
No active DTCs	ECM, A/F Sensor, A/F Sensor Heater, MAP, ECT, TP(1), IAT, EGR, BARO, VTEC System	
Other	Other than when there is excessive vapor generation (fuel level is 40 - 80%)	
(1) CVT		

Malfunction Threshold

Long term fuel trim is higher than 1.17 (+17%).

Driving Pattern

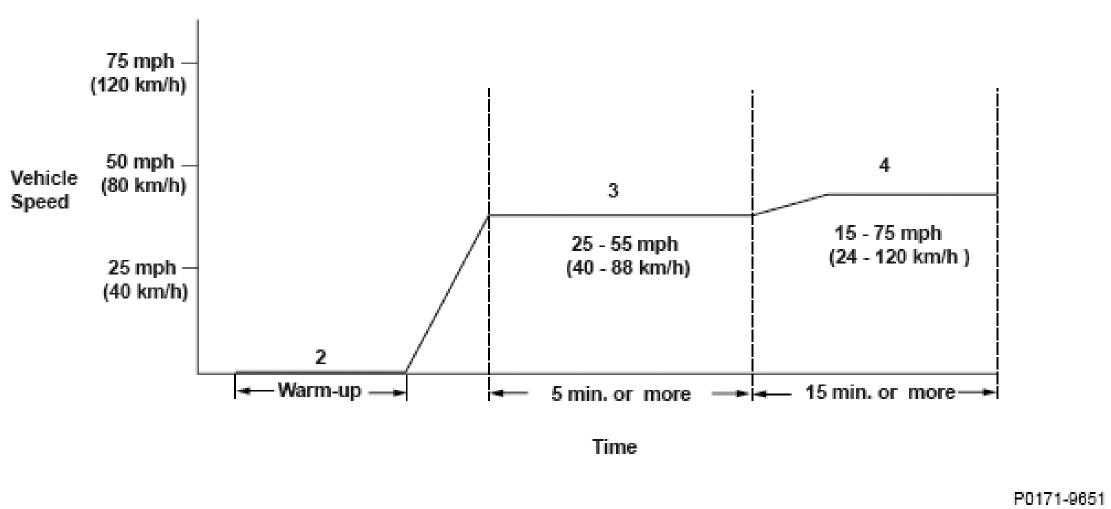


Fig. 45: Identifying Driving Pattern

1. Connect a scan tool to the vehicle.
2. Start the engine. Hold the engine at 3,000 rpm with no load (in park or neutral)

until the radiator fan comes on.

3. Drive at a speed between 25 - 55 mph (40 - 88 km/h) for at least 5 minutes.
4. Then, drive at a steady speed between 15 - 75 mph (24 - 120 km/h) for at least 15 minutes, and watch the long term fuel trim. If the long term fuel trim stays at about 1.0, the vehicle is OK or it is a very minor problem. If a significant fault is still present, the long term fuel trim will move up or down while driving.

- When freeze frame data is stored, drive the vehicle under those conditions instead of Driving Pattern 4.
- If the EVAP monitor runs instead of the HO2S monitor, turn the engine off, then restart it, and the HO2S monitor will restart.
- After clearing the DTC by disconnecting the battery or using the scan tool, drive at a speed between 25 - 55 mph (40 - 88 km/h) instead of Driving Pattern 3 for 40 minutes or longer to allow time for long term fuel trim to recover.
- If you have difficulty duplicating the DTC, retest after turning off electrical components such as the audio system and A/C, and try a different gear position.
- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the ECM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive drive cycles in which the engine conditions are similar to the first time the malfunction was detected.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0172 (45): ADVANCED DIAGNOSTICS

DTC P0172: FUEL SYSTEM TOO RICH

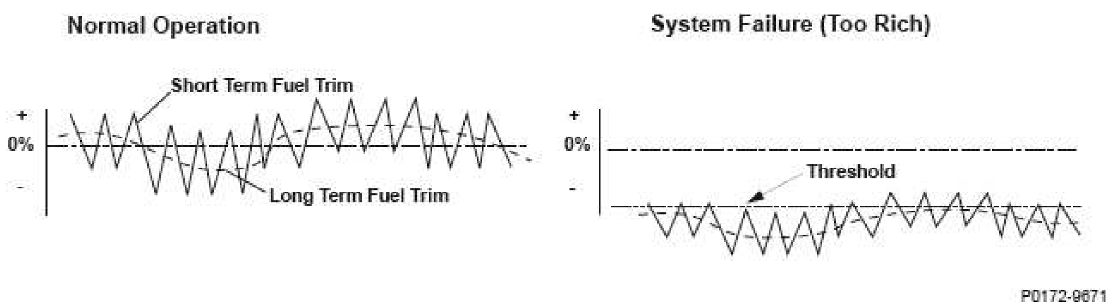


Fig. 46: Fuel System - Graph

General Description

The engine control module (ECM) detects the oxygen content in the exhaust gas from the primary heated oxygen sensor (HO2S) (Sensor 1) signal voltage, and it performs fuel feedback control to maintain the optimal air/fuel ratio. The air/fuel ratio coefficient for correcting the amount of injected fuel is the short term fuel trim. The ECM varies short term fuel trim continuously to keep the air/fuel ratio close to the stoichiometric ratio for all driving conditions. Long term fuel trim is computed from short term fuel trim and is used to regulate long term deviation from the stoichiometric air/fuel ratio, which occurs when fuel metering components deteriorate with age or system failures occur. In addition, long term fuel trim is stored in the ECM memory and is used to determine when fuel metering components malfunction. When long term fuel trim is higher than normal, which is about 1.0 (0%), the amount of injected fuel must be increased, and when lower than normal, it must be decreased. If long term fuel trim is lower than normal (too rich), a malfunction in the fuel metering components is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	-
DTC Type	Two drive cycles, MIL ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
Engine coolant temperature	158°F (70°C)	-
Intake air temperature	20°F (-7°C)	-
Engine speed	800 rpm	4,000 rpm
MAP value	20 kPa (150 mmHg, 5.9 in.Hg)	-
Fuel feedback	Closed loop	
Monitoring priority	Catalyst System, EVAP	
No active DTCs	ECM, A/F Sensor, A/F Sensor Heater, MAP, ECT, TP[1], IAT, EGR, BARO, VTEC System	
Other	Other than when there is excessive vapor generation (fuel level is 40 - 80%)	
(1) CVT		

Malfunction Threshold

Long term fuel trim is lower than 0.82 (-18%).

Driving Pattern

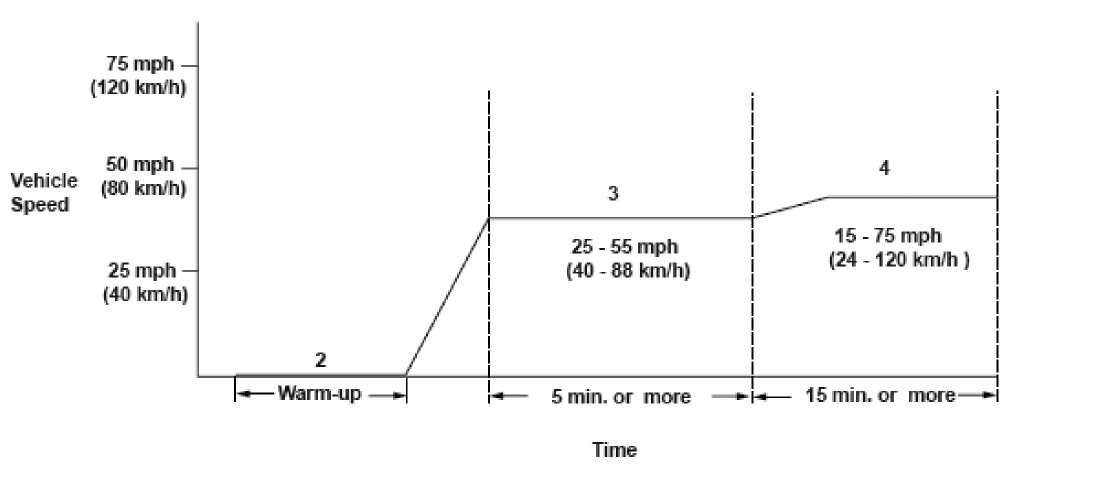


Fig. 47: Identifying Driving Pattern

1. Connect a scan tool to the vehicle.

2. Start the engine. Hold the engine at 3,000 rpm with no load (in park or neutral) until the radiator fan comes on.
3. Drive at a speed between 25 - 55 mph (40 - 88 km/h) for at least 5 minutes.
4. Then, drive at a steady speed between 15 - 75 mph (24 - 120 km/h) for at least 15 minutes, and watch the long term fuel trim. If the long term fuel trim stays at about 1.0, the vehicle is OK or it is a very minor problem. If a significant fault is still present, the long term fuel trim will move up or down while driving.

- When freeze frame data is stored, drive the vehicle under those conditions instead of Driving Pattern 4.
- If the EVAP monitor runs instead of the HO2S monitor, turn the engine off, then restart it, and the HO2S monitor will restart.
- After clearing the DTC by disconnecting the battery or using the scan tool, drive at a speed between 25 - 55 mph (40 - 88 km/h) instead of Driving Pattern 3 for 40 minutes or longer to allow time for long term fuel trim to recover.
- If you have difficulty duplicating the DTC, retest after turning off electrical components such as the audio system and A/C, and try a different gear position.
- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the ECM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive drive cycles in which the engine conditions are similar to the first time the malfunction was detected.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared

by using the scan tool Clear command or by disconnecting the battery.

DTC P0300: ADVANCED DIAGNOSTICS

DTC P0300: RANDOM MISFIRE

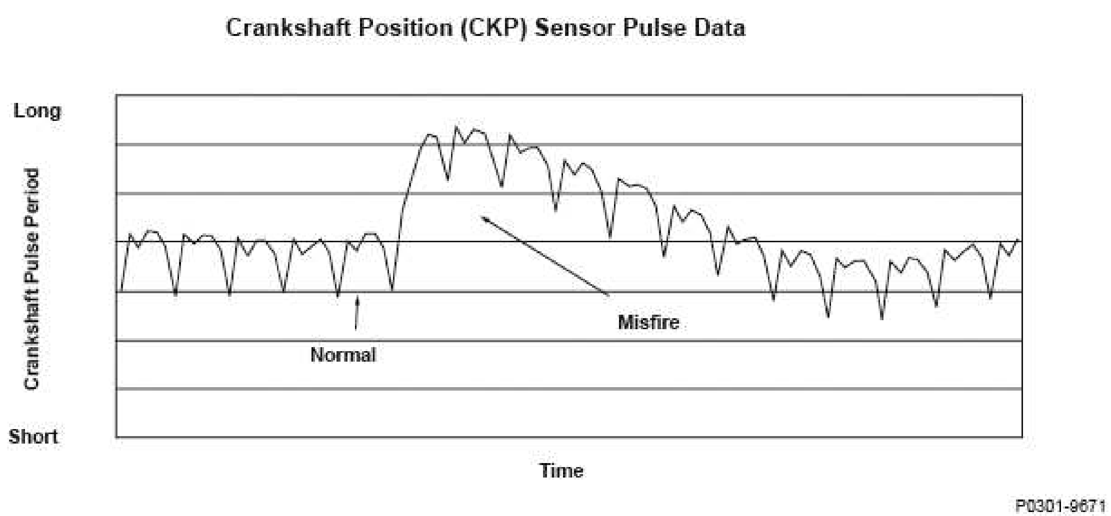


Fig. 48: Crankshaft Position Sensor Pulse Data - Graph

General Description

The crankshaft vibrates slightly when each cylinder fires. If a misfire occurs, the crankshaft rotation speed changes rapidly. The engine control module (ECM) monitors the crankshaft rotation speed based on the output pulses from the crankshaft position (CKP) sensor. By monitoring changes in the crankshaft rotation speed, the ECM counts the number of misfires and determines which cylinder is misfiring. If more than one DTC from P0301 through P0303 has been stored simultaneously while misfires in multiple cylinders are detected, a malfunction is detected and a DTC is stored.

There are two types of misfire detection.

Type 1 (1 drive cycle): When the number of misfires per 200 engine revolutions reaches the level that damages the three way catalyst (TWC), a DTC is stored and the MIL blinks. When the misfire ceases, the MIL remains on steady instead of blinking.

Type 2 (2 drive cycles): When the number of misfires per 1,000 engine revolutions reaches the level that affects exhaust emissions, a DTC is stored and the MIL illuminates.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	-
DTC Type	One or two drive cycles, MIL ON (1)
(1) See **DIAGNOSIS DETAILS**.	

ENABLE CONDITIONS CHART

Condition			Minimum	Maximum
Engine coolant temperature			14°F (-10°C)	-
Intake air temperature			14°F (-10°C)	-
Engine speed			500 rpm	6,000 rpm
MAP value	Stopped	500 rpm	22 kPa (160 mmHg, 6.3 in.Hg) (1)	-
			26 kPa (190 mmHg, 7.5 in.Hg) (2)	
		6,000 rpm	44 kPa (330 mmHg, 13.0 in.Hg) (1)	
			50 kPa (374 mmHg, 14.8 in.Hg) (2)	
	Driving (other than lean burn)	500 rpm	51 kPa (376 mmHg, 14.9 in.Hg) (1)	-
			26 kPa (190 mmHg, 7.5 in.Hg) (2)	
		6,000 rpm	44 kPa (330 mmHg, 13.0 in.Hg) (1)	
			58 kPa (435 mmHg, 17.2	

			in.Hg)[2]	
	Driving (lean burn)	500 rpm	51 kPa (376 mmHg, 14.9 in.Hg)[1]	-
		3,200 rpm	60 kPa (450 mmHg, 17.8 in.Hg)[1]	
Fuel feedback			Other than during fuel cut-off operation	
No active DTCs			ECM, MAP, ECT, CKP, TP, IAT, BARO	
Others			Test-drive on a flat road to avoid misdetection	
			Avoid abrupt acceleration, deceleration, and turns	

(1) M/T model

(2) CVT model

Malfunction Threshold

The number of misfires versus the number of engine revolutions is equal to or greater than the value in the table.

MALFUNCTION THRESHOLD CHART

Misfire Type	The number of engine revolutions	The number of misfires
Misfire Type 1	Per 200 revolutions	22 - 95 times[1]
Misfire Type 2	Per 1,000 revolutions	80 times

(1) Depending on engine speed and load.

Driving Pattern

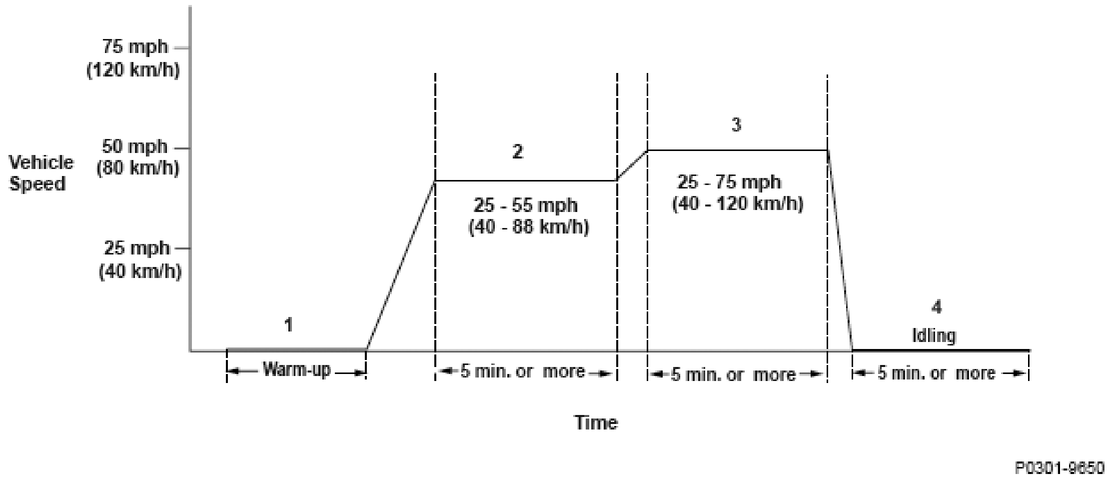


Fig. 49: Identifying Driving Pattern

1. Start the engine. Hold the engine at 3,000 rpm with no load (in park or neutral) until the radiator fan comes on.
2. Drive the vehicle at a speed between 25 - 55 mph (40 - 88 km/h) for at least 5 minutes.
3. To test while driving, drive at a steady speed between 25 - 75 mph (40 - 120 km/h) for at least 5 minutes.
4. To test at idle, stop the vehicle after step 2, and let the engine idle for at least 5 minutes.

- When freeze frame data is stored, drive the vehicle under those conditions instead of Driving Patterns 3 or 4.
- If you have difficulty duplicating the DTC, retest after turning off electrical components such as the audio system and A/C, and try a different gear position.
- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

Diagnosis Details

Conditions for illuminating the MIL

Misfire Type 1: Under high rpm or high load conditions: The MIL blinks once per second if a type 1 misfire (catalyst damaging) occurs, and a Temporary DTC is stored. If the type 1 misfire ceases, the MIL goes off. If a type 1 misfire occurs during the next (second) drive cycle, the MIL blinks at the first misfire occurrence, and the DTC and the freeze frame data are stored. The MIL remains on steady if the type 1 misfire ceases.

Under normal driving conditions: The MIL blinks once per second if a type 1 misfire occurs a third time, and a Temporary DTC is stored. If a type 1 misfire occurs during the next (second) drive cycle, the MIL blinks during the third type 1 misfire occurrence, and the DTC and the freeze frame data are stored. If the type 1 misfire ceases, the MIL remains on steady.

Misfire Type 2: When a type 2 misfire (emission-related but not severe enough to immediately damage the TWC) occurs within the first 1,000 crankshaft revolutions after engine start-up, a Temporary DTC is stored.

If a type 2 misfire occurs after the first 1,000 crankshaft revolutions after engine start-up, a Temporary DTC is stored during the fourth type 2 misfire occurrence.

If a type 2 misfire occurs during the next (second) drive cycle, the MIL comes on, and the DTC and the freeze frame data are stored.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive drive cycles in which the engine conditions are similar to the first time the malfunction was detected.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0301(71), P0302 (72), P0303 (73): ADVANCED DIAGNOSTICS

DTC P0301: NO. 1 CYLINDER MISFIRE; DTC P0302: NO. 2 CYLINDER MISFIRE; DTC P0303: NO. 3 CYLINDER MISFIRE

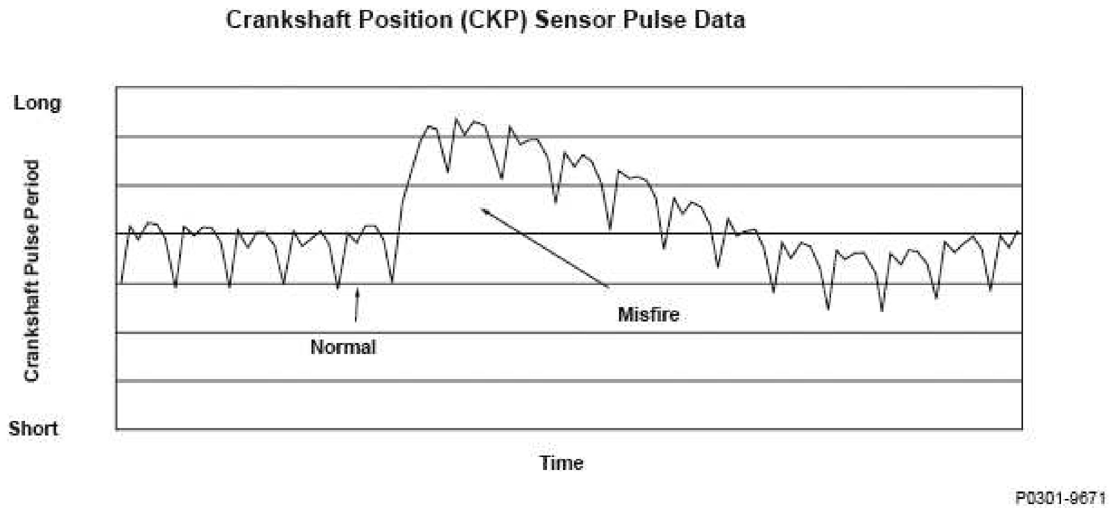


Fig. 50: Crankshaft Position Sensor Pulse Data - Graph

General Description

The crankshaft vibrates slightly when each cylinder fires. If a misfire occurs, the crankshaft rotation speed changes rapidly. The engine control module (ECM) monitors engine misfiring based on the output pulses from the crankshaft position (CKP) sensor, counts the number of misfires, and determines which cylinder is misfiring. If a misfire is detected, a DTC is stored. There are two types of misfire detection.

Type 1 (1 drive cycle): When the number of misfires per 200 engine revolutions reaches the level that damages the three way catalyst (TWC), a DTC is stored and the MIL blinks. When the misfire ceases, the MIL remains on steady instead of blinking.

Type 2 (2 drive cycles): When the number of misfires per 1,000 engine revolutions reaches the level that affects exhaust emissions, a DTC is stored and the MIL comes on.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	-
DTC Type	One or two drive cycles, MIL ON[1]

(1) See **DIAGNOSIS DETAILS**.

ENABLE CONDITIONS CHART

<table>
<tr><th colspan="3">Condition</th><th>Minimum</th><th>Maximum</th></tr>
<tr><td colspan="3">Engine coolant temperature</td><td>14°F (-10°C)</td><td>-</td></tr>
<tr><td colspan="3">Intake air temperature</td><td>14°F (-10°C)</td><td>-</td></tr>
<tr><td colspan="3">Engine speed</td><td>500 rpm</td><td>6,000 rpm</td></tr>
<tr><td rowspan="10">MAP value</td><td rowspan="4">Stopped</td><td rowspan="2">500 rpm</td><td>22 kPa (160 mmHg, 6.3 in.Hg)(1)</td><td rowspan="4">-</td></tr>
<tr><td>26 kPa (190 mmHg, 7.5 in.Hg)(2)</td></tr>
<tr><td rowspan="2">6,000 rpm</td><td>44 kPa (330 mmHg, 13.0 in.Hg)(1)</td></tr>
<tr><td>50 kPa (374 mmHg, 14.8 in.Hg)(2)</td></tr>
<tr><td rowspan="4">Driving (other than lean burn)</td><td rowspan="2">500 rpm</td><td>51 kPa (376 mmHg, 14.9 in.Hg)(1)</td><td rowspan="4">-</td></tr>
<tr><td>26 kPa (190 mmHg, 7.5 in.Hg)(2)</td></tr>
<tr><td rowspan="2">6,000 rpm</td><td>44 kPa (330 mmHg, 13.0 in.Hg)(1)</td></tr>
<tr><td>58 kPa (435 mmHg, 17.2 in.Hg)(2)</td></tr>
<tr><td rowspan="2">Driving (lean burn)</td><td>500 rpm</td><td>51 kPa (376 mmHg, 14.9 in.Hg)(1)</td><td rowspan="2">-</td></tr>
<tr><td>3,200 rpm</td><td>60 kPa (450 mmHg, 17.8 in.Hg)(1)</td></tr>
<tr><td colspan="3">Fuel feedback</td><td colspan="2">Other than during fuel cut-off operation</td></tr>
</table>

No active DTCs	ECM, MAP, ECT, CKP, TP, IAT, BARO
Others	Test-drive on a flat road to avoid misdetection
	Avoid abrupt acceleration, deceleration, and turns
(1) M/T model (2) CVT model	

Malfunction Threshold

The number of misfires versus the number of engine revolutions is equal to or greater than the value in the table.

MALFUNCTION THRESHOLD CHART

Misfire Type	The number of engine revolutions	The number of misfires
Misfire Type 1	Per 200 revolutions	22 - 95 times (1)
Misfire Type 2	Per 1,000 revolutions	80 times
(1) Depending on engine speed and load.		

Driving Pattern

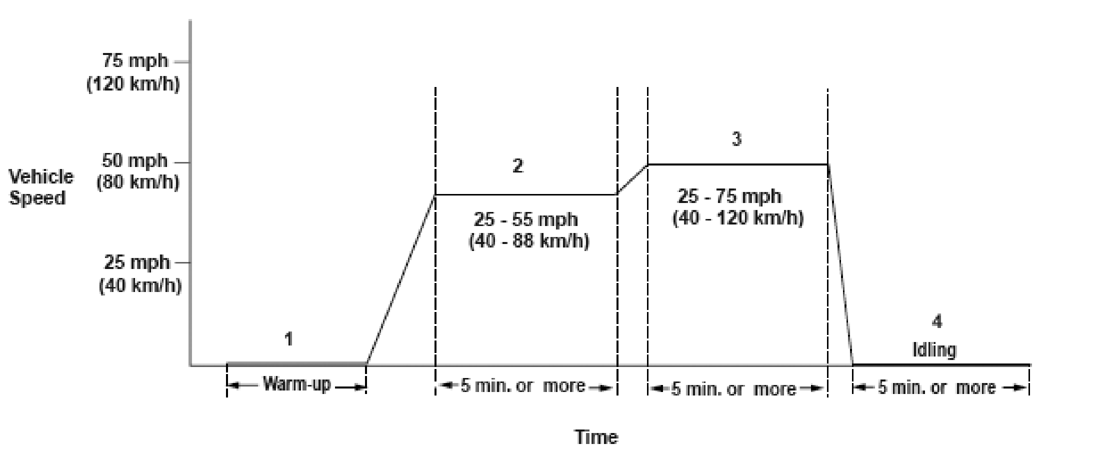


Fig. 51: Identifying Driving Pattern

1. Start the engine. Hold the engine at 3,000 rpm with no load (in park or neutral) until the radiator fan comes on.
2. Drive the vehicle at a speed between 25 - 55 mph (40 - 88 km/h) for at least 5 minutes.
3. To test while driving, drive at a steady speed between 25 - 75 mph (40 - 120 km/h) for at least 5 minutes.
4. To test at idle, stop the vehicle after step 2, and let the engine idle for at least 5 minutes.

- When freeze frame data is stored, drive the vehicle under those conditions instead of Driving Patterns 3 or 4.
- If you have difficulty duplicating the DTC, retest after turning off electrical components such as the audio system and A/C, and try a different gear position.
- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

Diagnosis Details

Conditions for illuminating the MIL

Misfire Type 1: Under high rpm or high load conditions: The MIL blinks once per second if a type 1 misfire (catalyst damaging) occurs, and a Temporary DTC is stored. If the type 1 misfire ceases, the MIL goes off. If a type 1 misfire occurs during the next (second) drive cycle, the MIL blinks at the first misfire occurrence, and the DTC and the freeze frame data are stored. The MIL remains on steady if the type 1 misfire ceases.

Under normal driving conditions: The MIL blinks once per second if a type 1 misfire occurs a third time, and a Temporary DTC is stored. If a type 1 misfire occurs during the next (second) drive cycle, the MIL blinks during the third type 1 misfire occurrence, and the DTC and the freeze frame data are stored. If the type 1 misfire ceases, the MIL remains on steady.

Misfire Type 2: When a type 2 misfire (emission-related but not severe enough to immediately damage the TWC) occurs within the first 1,000 crankshaft revolutions after engine start-up, a Temporary DTC is stored.

If a type 2 misfire occurs after the first 1,000 crankshaft revolutions after engine start-up, a Temporary DTC is stored during the fourth type 2 misfire occurrence.

If a type 2 misfire occurs during the next (second) drive cycle, the MIL comes on, and the DTC and the freeze frame data are stored.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive drive cycles in which the engine conditions are similar to the first time the malfunction was detected.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0325 (23): ADVANCED DIAGNOSTICS

DTC P0325: KNOCK SENSOR (KS) CIRCUIT MALFUNCTION

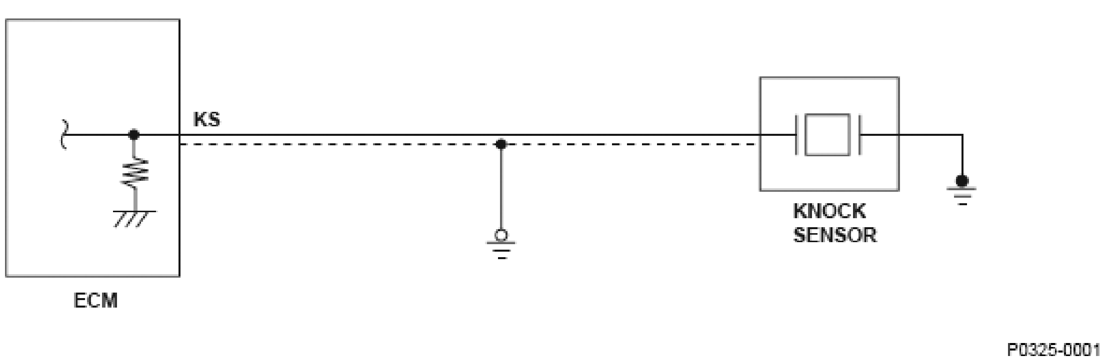


Fig. 52: Knock Sensor Malfunction - Circuit Diagram

General Description

The knock sensor is mounted on the engine block and detects engine knocking. The vibrations caused by knocking are converted into electrical signals through the piezo ceramic element. The engine control module (ECM) controls the ignition timing based on the electrical signals. If the signals from the knock sensor do not vary for a set time, the ECM detects a malfunction and stores a DTC.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	5 seconds or more
DTC Type	One drive cycle, MIL ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
Engine speed	1,700 rpm	-
Engine coolant temperature	-	140°F (60°C)
No active DTCs	CKP, ECT, CMP A (TDC 1), CMP B (TDC 2), IAT, VTEC System	

Malfunction Threshold

No signals from the KS are detected for at least 5 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0335 (4): ADVANCED DIAGNOSTICS

DTC P0335: CRANKSHAFT POSITION (CKP) SENSOR NO SIGNAL

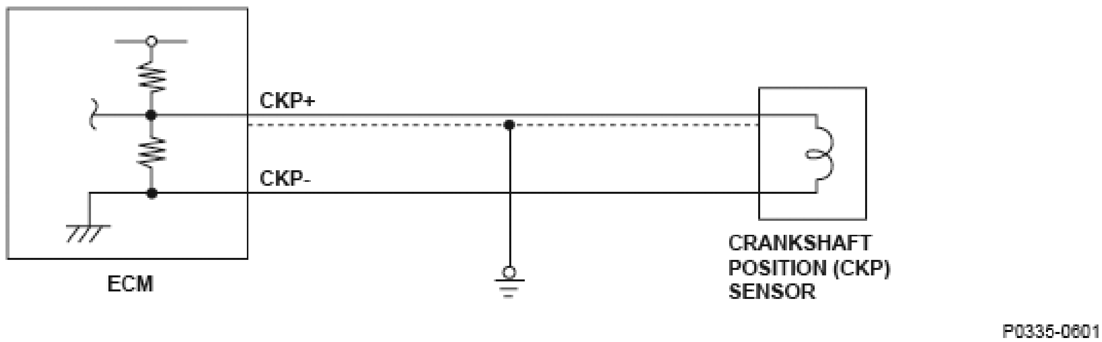


Fig. 53: Crankshaft Position (CKP) Sensor No Signal - Circuit Diagram

General Description

The crankshaft position (CKP) sensor consists of a rotor and a pick-up coil that detect rotor position. When the engine starts, the rotor turns and the magnetic flux in the pick-up coil changes. The changes of magnetic flux are converted into pulsing signals to the engine control module (ECM). The CKP sensor detects injection/ignition timing for each cylinder and the engine speed.

If no pulsing signals from the CKP sensor are received, a malfunction is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	-
DTC Type	One drive cycle, MIL ON

ENABLE CONDITIONS CHART

Condition	
State of the engine	Running
No active DTCs	CKP

Malfunction Threshold

No CKP signal is detected 37 times in succession.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0339 (4): ADVANCED DIAGNOSTICS

DTC P0339: CRANKSHAFT POSITION (CKP) SENSOR INTERMITTENT INTERRUPTION

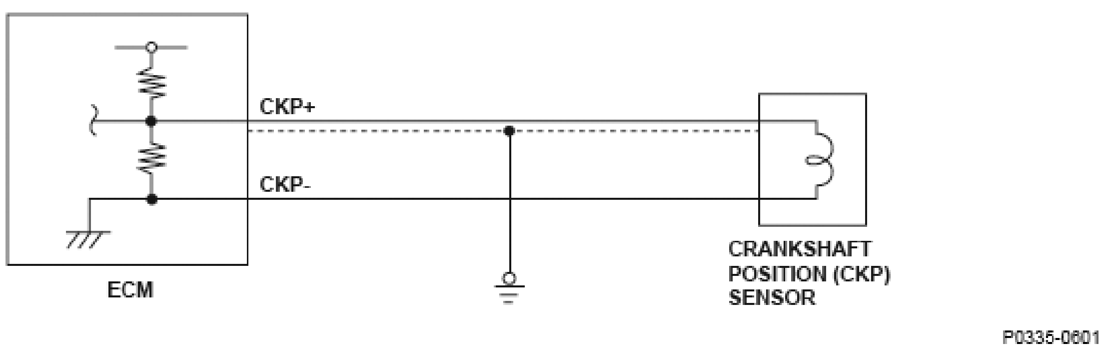


Fig. 54: Crankshaft Position (CKP) Sensor No Signal - Circuit Diagram

General Description

The crankshaft position (CKP) sensor consists of a rotor and a pick-up coil that detects rotor position. When the engine starts, the rotor turns and the magnetic flux in the pick-up coil changes. The changes of magnetic flux are converted into pulsing signals to the engine control module (ECM). The CKP sensor detects injection/ignition timing for each cylinder and the engine speed. If an abnormal amount of pulsing signals from the CKP sensor signals are output, a malfunction is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous

Sequence	None
Duration	-
DTC Type	One drive cycle, MIL ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
Engine speed	500 rpm	-
No active DTCs	CKP	

Malfunction Threshold

Other than eight pulses are detected during intervals between reference pulses for each crankshaft revolution. This condition has been detected at least 30 times.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0340 (8): ADVANCED DIAGNOSTICS

DTC P0340: CAMSHAFT POSITION (CMP) SENSOR A (TOP DEAD CENTER (TDC1) SENSOR 1) NO SIGNAL

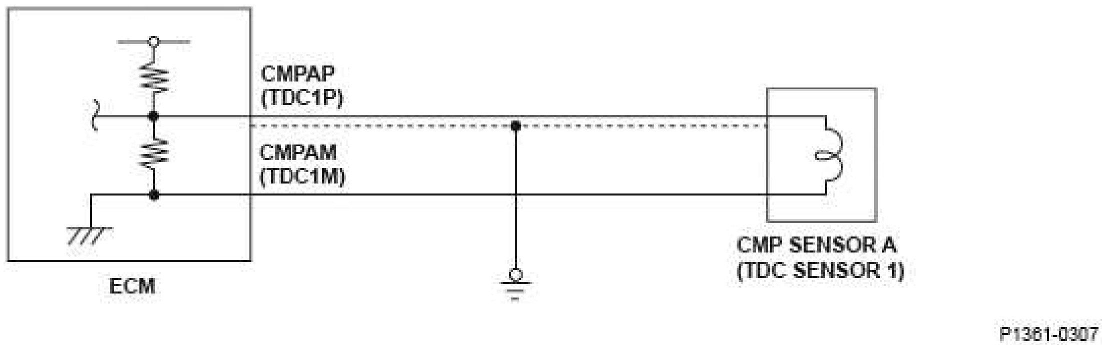


Fig. 55: Camshaft Position (CMP) Sensor A (Top Dead Center (TDC1) Sensor 1) No Signal - Circuit Diagram

General Description

Camshaft position (CMP) sensor A (top dead center (TDC) sensor 1) consists of a rotor and a pick-up coil that detects rotor position. When the rotor turns after starting the engine, the changes of magnetic flux in the pick-up coil are converted into pulsing signals to the engine control module (ECM). CMP sensor A (TDC sensor 1) signals are used to detect top dead center of each cylinder for fuel injection.

If no pulsing signals from CMP sensor A (TDC sensor 1) are detected, a malfunction is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	-
DTC Type	One drive cycle, MIL ON

ENABLE CONDITIONS CHART

Condition	
State of the engine	Running
No active DTCs	CKP, CMP A (TDC 1)

Malfunction Threshold

No CMP sensor A (TDC sensor 1) pulses are detected at least 38 times in succession.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0344 (8): ADVANCED DIAGNOSTICS

DTC P0344: CAMSHAFT POSITION (CMP) SENSOR A (TOP DEAD CENTER (TDC1) SENSOR 1) INTERMITTENT INTERRUPTION

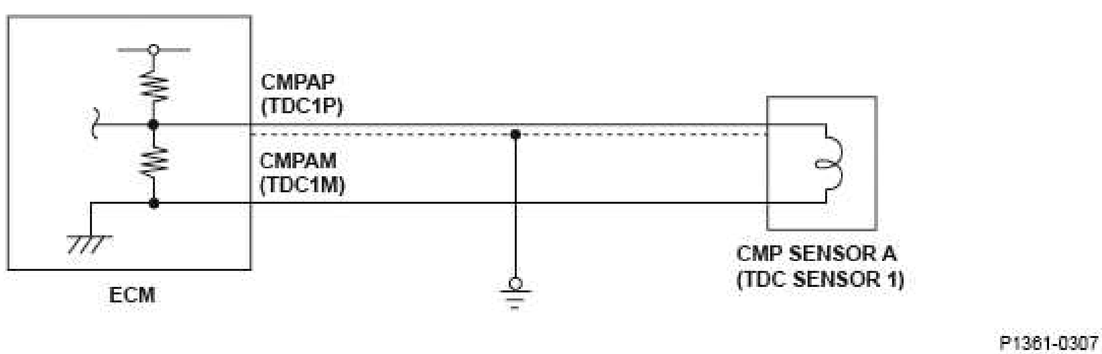


Fig. 56: Camshaft Position (CMP) Sensor A (Top Dead Center (TDC1) Sensor 1) No Signal - Circuit Diagram

General Description

Camshaft position (CMP) sensor A (top dead center (TDC) sensor 1) consists of a rotor and a pick-up coil that detects rotor position. When the rotor turns after starting the engine, the changes of magnetic flux in the pick-up coil are converted into pulsing signals to the engine control module (ECM). CMP sensor A (TDC sensor 1) signals are used to detect top dead center of each cylinder for fuel injection.

If CMP sensor A (TDC sensor 1) pulsing signals are detected an abnormal number of times due to noise, a malfunction is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	-
DTC Type	One drive cycle, MIL ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
Engine speed	500 rpm	-
No active DTCs	CKP, CMP A (TDC 1)	

Malfunction Threshold

The CKP sensor outputs more or less than eight pulses for each CMP sensor A (TDC sensor 1) pulse at least 30 times in succession.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0365 (58): ADVANCED DIAGNOSTICS

DTC P0365: CAMSHAFT POSITION (CMP) SENSOR B (TOP DEAD CENTER (TDC2) SENSOR 2)

NO SIGNAL

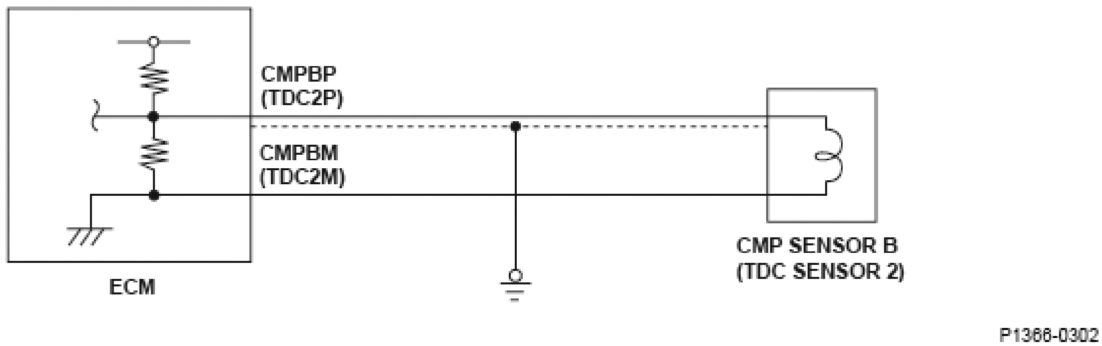


Fig. 57: Camshaft Position (CMP) Sensor B (Top Dead Center (TDC2) Sensor 2) No Signal - Circuit Diagram

General Description

Camshaft position (CMP) sensor B (top dead center (TDC) sensor 2) consists of a rotor and a pick-up coil that detects rotor position. When the rotor turns after starting the engine, the changes of magnetic flux in the pick-up coil are converted into pulsing signals to the engine control module (ECM). CMP sensor B (TDC sensor 2) signals are used to detect top dead center of each cylinder for fuel injection.

If no pulsing signals from CMP sensor B (TDC sensor 2) are detected, a malfunction is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	-
DTC Type	One drive cycle, MIL ON

ENABLE CONDITIONS CHART

Condition	
State of the engine	Running
No active DTCs	CKP, CMP B (TDC 2)

Malfunction Threshold

No CMP sensor B (TDC sensor 2) pulses are detected at least 38 times in succession.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0369 (58): ADVANCED DIAGNOSTICS

DTC P0369: CAMSHAFT POSITION (CMP) SENSOR B (TOP DEAD CENTER (TDC2) SENSOR 2) INTERMITTENT INTERRUPTION

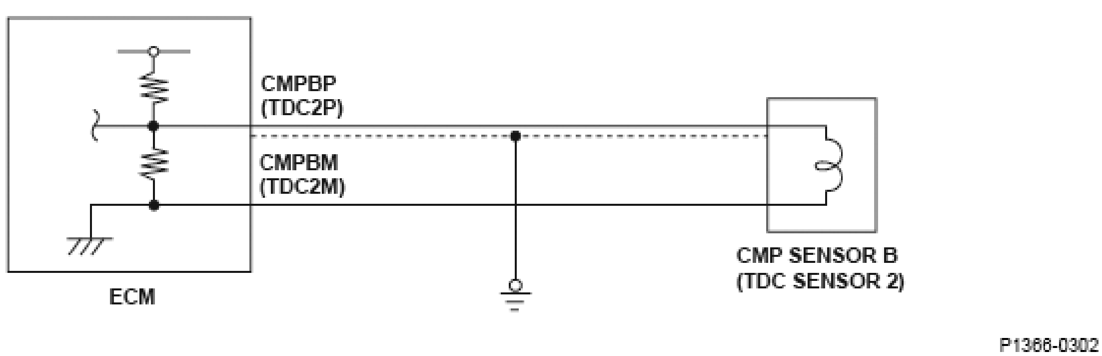


Fig. 58: Camshaft Position (CMP) Sensor B (Top Dead Center (TDC2) Sensor 2) No Signal - Circuit Diagram

General Description

Camshaft position (CMP) sensor B (top dead center (TDC) sensor 2) consists of a rotor and a pick-up coil that detects rotor position. When the rotor turns after starting the engine, the changes of magnetic flux in the pick-up coil are converted into pulsing signals to the engine control module (ECM). CMP sensor B (TDC sensor 2) signals are used to detect top dead center of each cylinder for fuel injection.

If CMP sensor B (TDC sensor 2) pulsing signals are detected an abnormal number of times due to noise, a malfunction is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	-
DTC Type	One drive cycle, MIL ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
Engine speed	500 rpm	-
No active DTCs	CKP, CMP B (TDC 2)	

Malfunction Threshold

The CKP sensor outputs more or less than eight pulses for each CMP sensor B (TDC sensor 2) pulse at least 30 times in succession.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0401 (80): ADVANCED DIAGNOSTICS

DTC P0401: EXHAUST GAS RECIRCULATION (EGR) INSUFFICIENT FLOW

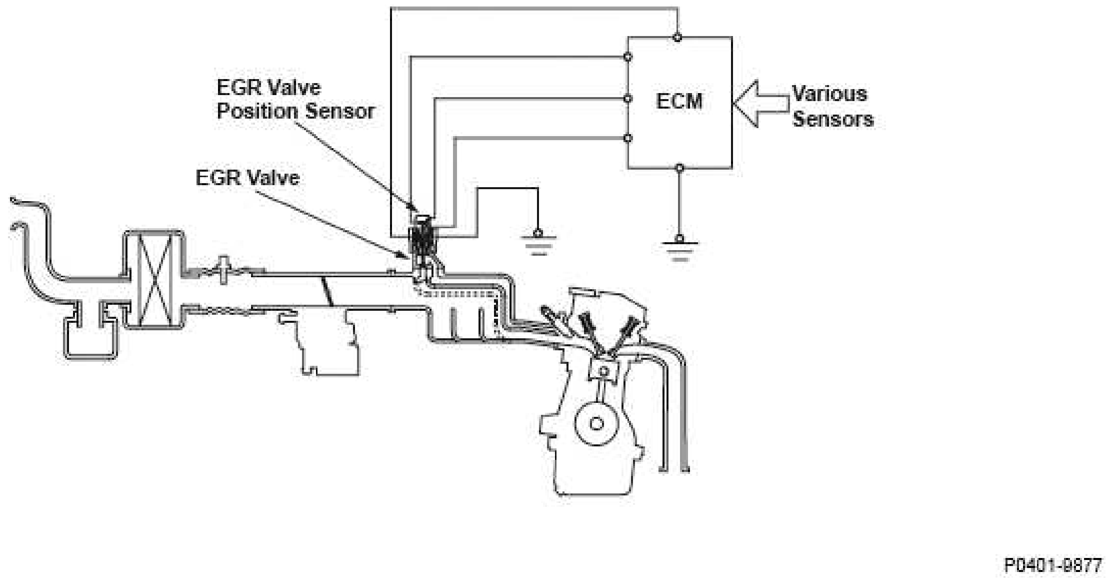


Fig. 59: Exhaust Gas Recirculation (EGR) Insufficient Flow Diagram

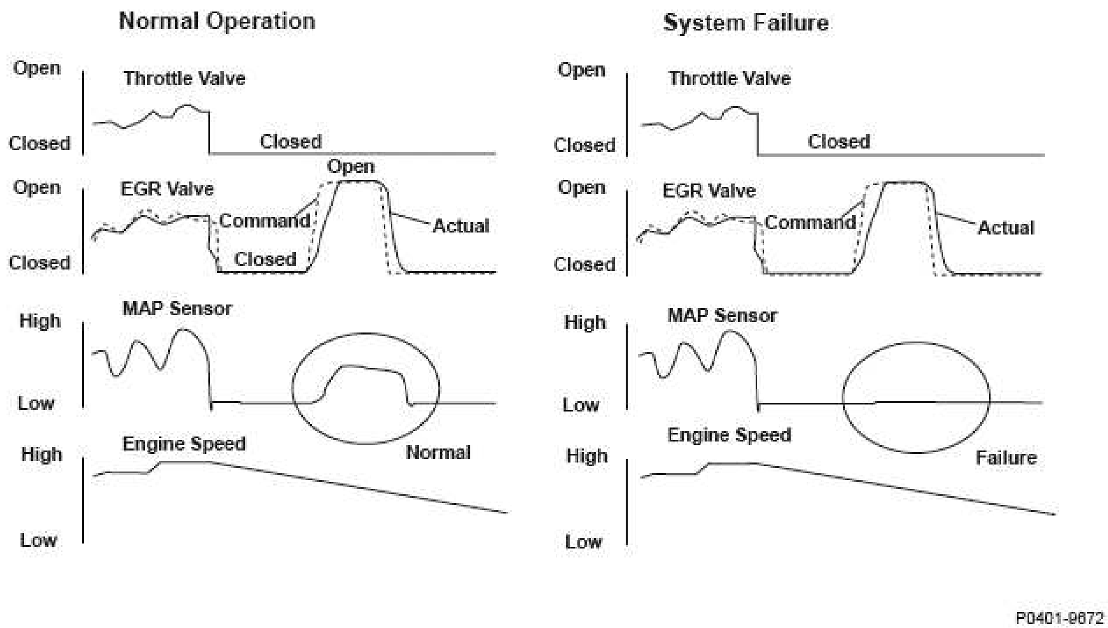


Fig. 60: Exhaust Gas Recirculation (EGR) Operation Graph

General Description

The exhaust gas recirculation (EGR) system reduces oxides of nitrogen (NOx). NOx is generated by high combustion temperatures. The EGR system lowers peak combustion temperatures by recirculating exhaust gas into the air/fuel mixture, thus reducing NOx. The manifold absolute pressure (MAP) sensor detects the intake manifold pressure (vacuum) and the engine control module (ECM) determines if the amount of exhaust gas recirculation is sufficient. When starting to decelerate with the throttle valve closed, the EGR valve is closed. If the intake manifold pressure changes only slightly while the EGR valve opens fully and closes again within a specified time period, a malfunction is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Once per driving cycle
Sequence	"EGR feedback monitor" is OK
Duration	4 seconds or more
DTC Type	Two drive cycles, MIL ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
Engine coolant temperature	158°F (70°C)	-
Engine speed	1,300 rpm	2,700 rpm
MAP value	13 kPa (94 mmHg, 3.8 in.Hg)	-
Vehicle speed	30 mph (48 km/h)	-
Battery voltage	10.5 V	-
Throttle position	Fully closed	
Fuel feedback	During deceleration	
No active DTCs	ECM, A/F Sensor, A/F Sensor Heater, MAP, CKP, ECT, TP, EGR, BARO, IAC, VSS, VTEC System, A/T System (1)	
Other	Test-drive on a flat road	
(1) CVT		

Malfunction Threshold

The MAP sensor output fluctuates by 2 kPa (20 mmHg, 0.7 in.Hg) or less for at least 4 seconds.

Driving Pattern

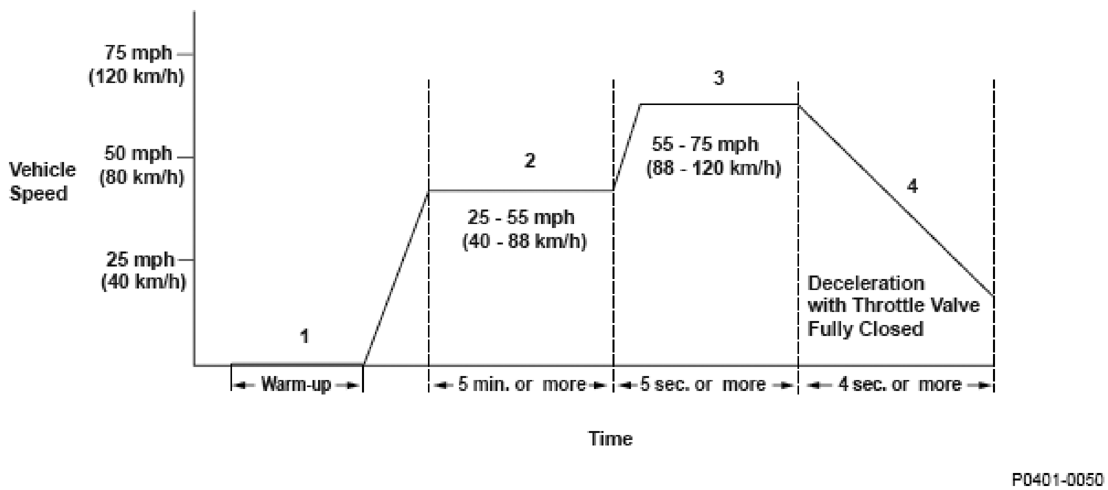


Fig. 61: Identifying Driving Pattern

1. Start the engine. Hold the engine at 3,000 rpm with no load (in park or neutral) until the radiator fan comes on.
2. Drive the vehicle at a speed between 25 - 55 mph (40 - 88 km/h) for at least 5 minutes.
3. Then, drive at a steady speed between 55 - 75 mph (88 - 120 km/h) for at least 5 seconds.
4. Decelerate with the throttle valve fully closed for at least 4 seconds.

- If you have difficulty duplicating the DTC, retest after turning off electrical components such as the audio system and A/C, and try a different gear position.
- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the ECM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0404 (12): ADVANCED DIAGNOSTICS

DTC P0404: EXHAUST GAS RECIRCULATION (EGR) VALVE INSUFFICIENT LIFT

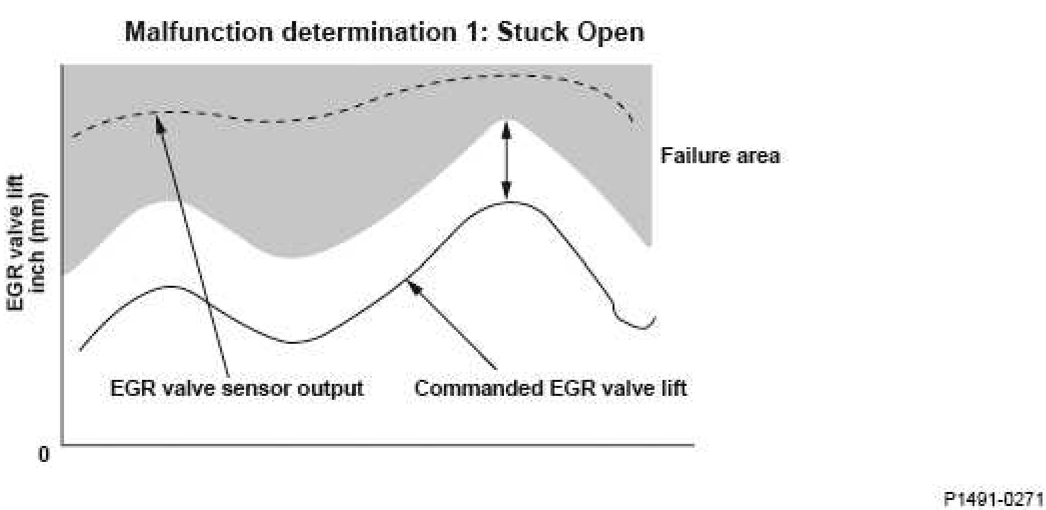


Fig. 62: Exhaust Gas Recirculation (EGR) Valve Insufficient Lift Malfunction - Stuck Open

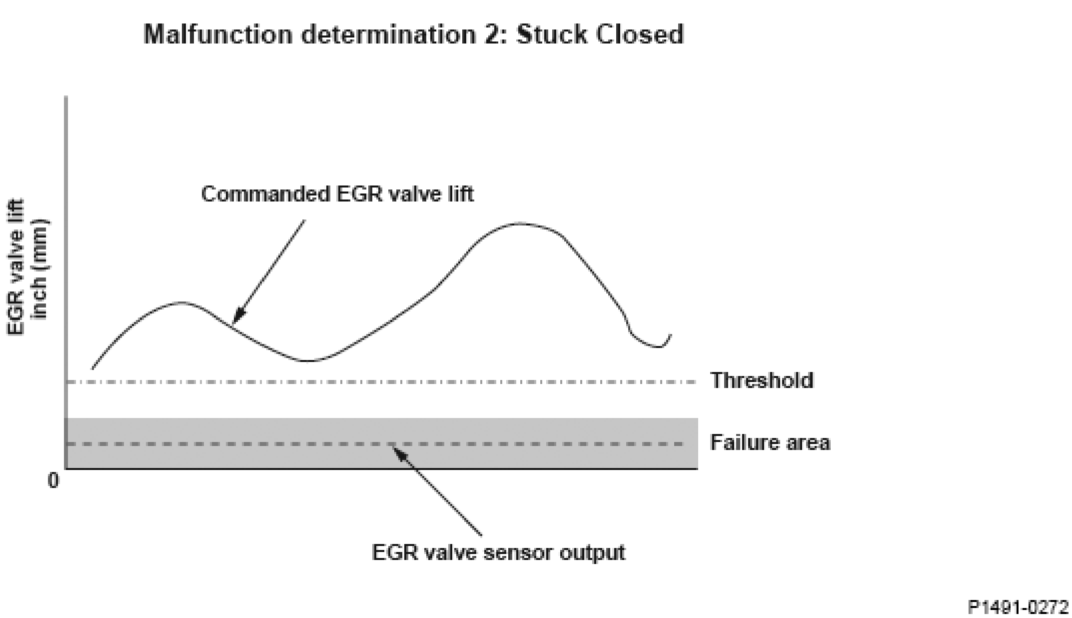


Fig. 63: Exhaust Gas Recirculation (EGR) Valve Insufficient Lift Malfunction - Stuck Closed

General Description

The exhaust gas recirculation (EGR) valve is controlled by the engine control module (ECM). Exhaust gas recirculates into the intake manifold through the exhaust manifold and the EGR passage. The exhaust gas is recirculated into the air/fuel mixture and is drawn into the combustion chamber to lower the combustion temperatures, thus reducing oxides of nitrogen (NOx) emissions.

A sensor (lift sensor) is built into the EGR valve and detects the amount of valve lift. The command value for the target valve lift is stored in the ECM so that exhaust gas recirculation can be optimized according to driving conditions.

Comparing this command value with the lift sensor output signal value, the ECM controls the EGR valve to make the amount of actual valve lift equal to the command value.

Malfunction determination 1: Stuck open

If the lift sensor output (actual valve lift) is greater than the commanded valve lift, an abnormality in the EGR valve or the lift sensor output is determined.

Malfunction determination 2: Stuck closed

If the valve sensor output is insufficient for the commanded valve lift, a malfunction is detected.

MONITOR DESCRIPTION CHART

Execution	Under the Enable Conditions
Sequence	-
Duration	5 seconds or more
DTC Type	Two drive cycles, MIL ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum

Engine speed	-	4,000 rpm
Battery voltage	10.6 V	-
Monitoring priority	EGR	
No active DTCs	ECM, A/F Sensor, A/F Sensor Heater, MAP, CKP, ECT, EGR	

Malfunction Threshold

Malfunction determination 1:

If the difference between the commanded valve lift in the ECM and the actual valve lift is 0.781 mm (0.031 in.) or more for at least 5 seconds, it is considered that the valve is stuck open.

Malfunction determination 2:

If the actual valve lift is 0.146 mm (0.005 in.) or less for at least 5 seconds, it is considered that the valve is stuck closed.

Driving Pattern

1. Start the engine. Hold the engine at 3,000 rpm with no load (in park or neutral) until the radiator fan comes on.
2. Drive the vehicle at a steady speed between 30 - 60 mph (48 - 96 km/h) with the engine speed at 4,000 rpm or less for at least 5 seconds.

- If you have difficulty duplicating the DTC, retest after turning off electrical components such as the audio system and A/C, and try a different gear position.
- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected during the first drive cycle, a Temporary DTC is

stored in the ECM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0406 (12): ADVANCED DIAGNOSTICS

DTC P0406: EXHAUST GAS RECIRCULATION (EGR) VALVE POSITION SENSOR CIRCUIT HIGH VOLTAGE

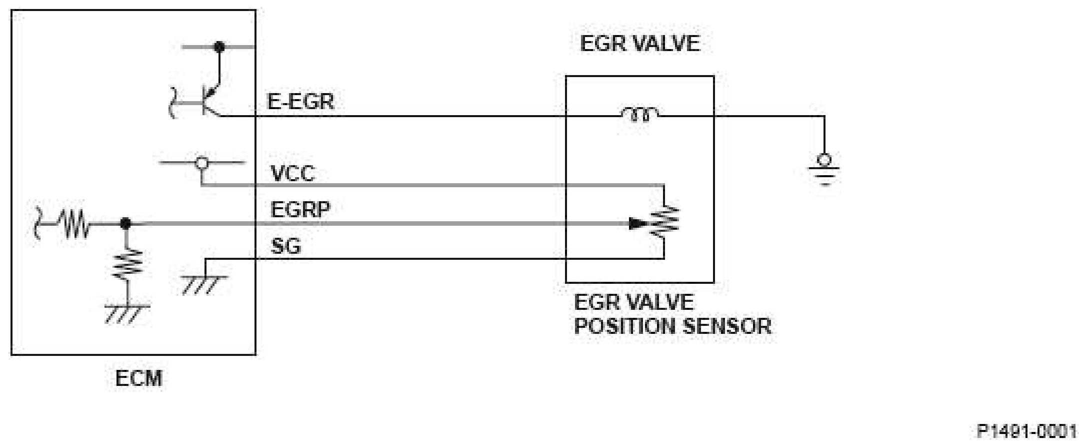


Fig. 64: Exhaust Gas Recirculation (EGR) Valve Position Sensor Circuit High Voltage - Circuit Diagram

General Description

The exhaust gas recirculation (EGR) system reduces oxides of nitrogen (NOx). NOx is generated by high combustion temperatures. The EGR system lowers peak combustion temperature by recirculating exhaust gas into the air/fuel mixture, thus reducing NOx emissions. To determine the optimal amount of recirculating exhaust gas, depending on driving conditions, a command value (the amount of valve lift) is stored in the engine control module (ECM). The EGR valve position sensor indicates the amount of valve lift, and the ECM controls the EGR valve so that the amount of actual valve lift equals the command value by comparing the command value and the actual amount of valve lift.

If the EGR valve position sensor output signal voltage is not within a specified value, a malfunction is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	2 seconds or more
DTC Type	One drive cycle, MIL ON

ENABLE CONDITIONS CHART

Condition	
State of the engine	Running

Malfunction Threshold

The EGR valve position sensor output is 4.88 V or more for at least 2 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0420 (67): ADVANCED DIAGNOSTICS

DTC P0420: CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD

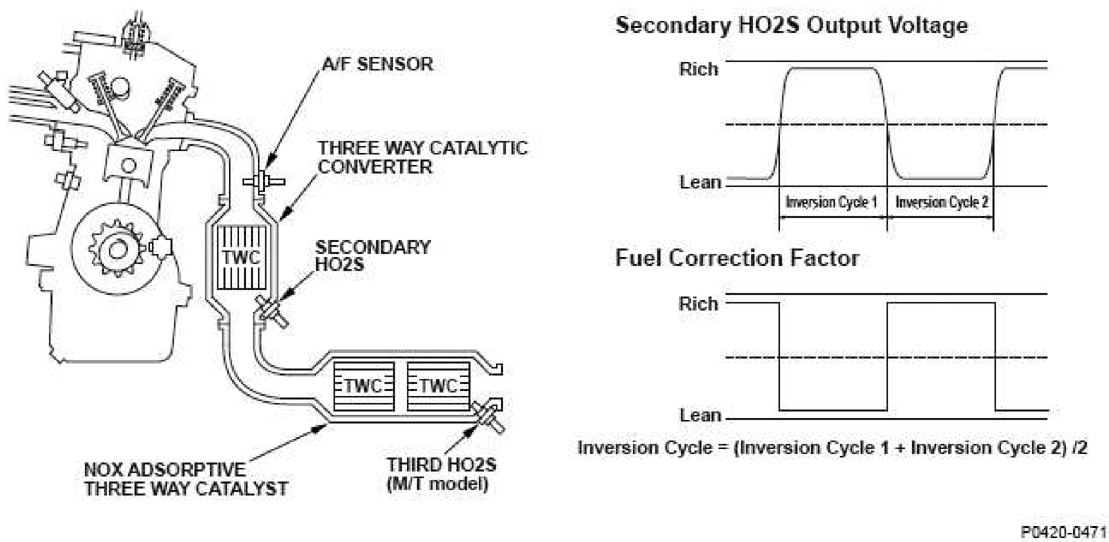


Fig. 65: Catalyst System Efficiency Below Threshold Malfunction

General Description

The three way catalytic converter (TWC) is installed in the exhaust system. The TWC converts hydrocarbons (HC), carbon monoxide (CO), and oxides of nitrogen (NOx) in the exhaust gas to water vapor, carbon dioxide (CO2), and dinitrogen (N2). The TWC adsorbs/releases oxygen during this process. This ability to adsorb oxygen deteriorates as the TWC performance deteriorates. The TWC performance correlates with the storage capacity for oxygen, so the TWC deterioration can be detected by monitoring the storage capacity for oxygen. The storage capacity for oxygen can be monitored according to the inversion cycle of the secondary HO2S (Sensor 2) which detects the oxygen content after passing through the TWC.

The engine control module (ECM) determines fuel feedback control by monitoring the secondary HO2S for a set time period, and then calculates the average time of the inversion cycle of the secondary HO2S, whose waveform alternates between rich and lean. This inversion cycle varies by the amount of the exhaust gas entering the TWC and needs to be regulated by the OSC INDEX (Oxygen Storage Capacity INDEX):

OSC INDEX = The inversion cycle of the secondary HO2S x (times) the amount of exhaust gas during calculation of the inversion cycle.

The ECM calculates the moving average of six drive cycles and compares it to the predetermined threshold in the ECM. If the latest moving average is cleared by resetting the ECM, each threshold is applied according to the number of drive cycles until the moving average of six drive cycles is evaluated. If the calculated value is less than the threshold, the TWC performance is considered to be deteriorated and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Once per driving cycle
Sequence	After judged OK for the secondary HO2S
Duration	3 seconds or more
DTC Type	Two drive cycles, MIL ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
Engine coolant temperature	158°F (70°C)	-
Intake air temperature	-13°F (-25°C)	-
Estimated TWC temperature	752°F (400°C)	-
Engine speed	1,300 rpm	2,700 rpm
MAP value	26 kPa (190 mmHg, 7.5 in.Hg)	90 kPa (680 mmHg, 26.7 in.Hg)
Vehicle speed	30 mph (49 km/h)	-
Fuel trim	0.65	1.40
Fuel feedback	Closed loop	
Monitoring priority	EVAP, A/F Sensor	
No active DTCs	ECM, A/F Sensor, A/F Sensor Heater, Secondary HO2S, Secondary HO2S Heater, MAP, ECT, TP, IAT, EGR, VSS, VTEC System, Fuel System	

Malfunction Threshold

OSC INDEX is the value shown in the table or less.

MALFUNCTION THRESHOLD CHART

The number of detections	OSC INDEX
1 time	1,765
2 times	1,797
3 times	1,820
4 times	1,861
5 times	1,954
6 times or more	2,123

Driving Pattern

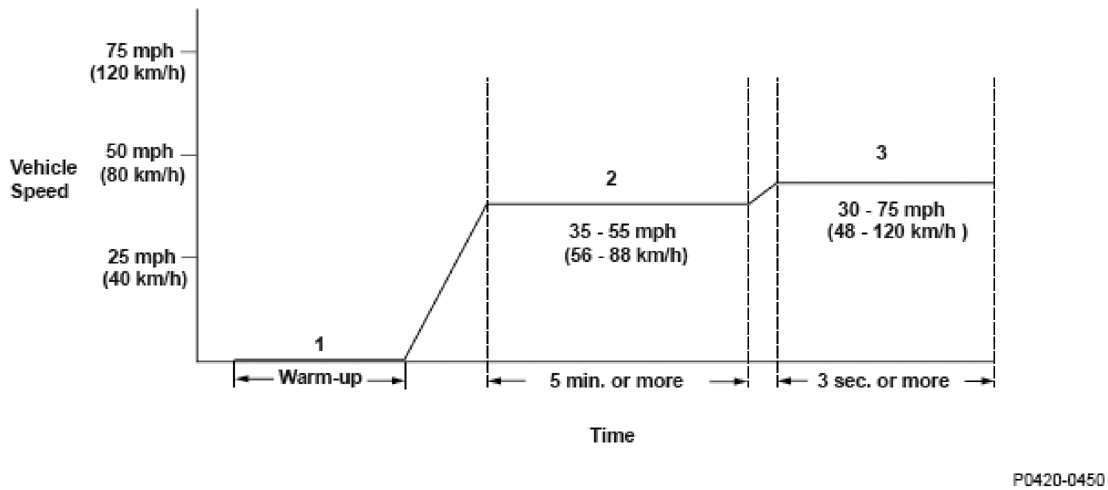


Fig. 66: Identifying Driving Pattern

1. Start the engine. Hold the engine at 3,000 rpm with no load (in park or neutral) until the radiator fan comes on.
2. Drive the vehicle at a speed between 35 - 55 mph (56 - 88 km/h) for at least 5 minutes.
3. Then, drive immediately at a steady speed between 30 - 75 mph (48 - 120 km/h) for at least 3 seconds.

- If the EVAP monitor runs instead of the HO2S monitor, turn the engine off, then restart it, and the HO2S monitor will restart.
- If you have difficulty duplicating the DTC, retest after turning off electrical components such as the audio system and A/C, and try a different gear

position.

- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the ECM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0442 (90): ADVANCED DIAGNOSTICS

DTC P0442: EVAPORATIVE EMISSION (EVAP) SYSTEM SMALL LEAK DETECTED

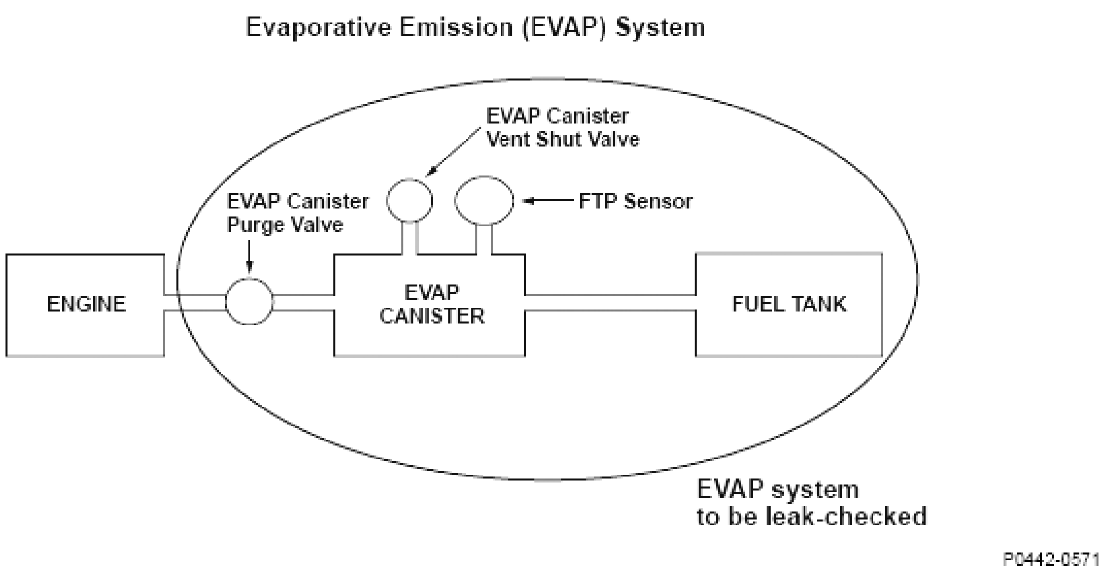


Fig. 67: Evaporative Emission (EVAP) System Diagram

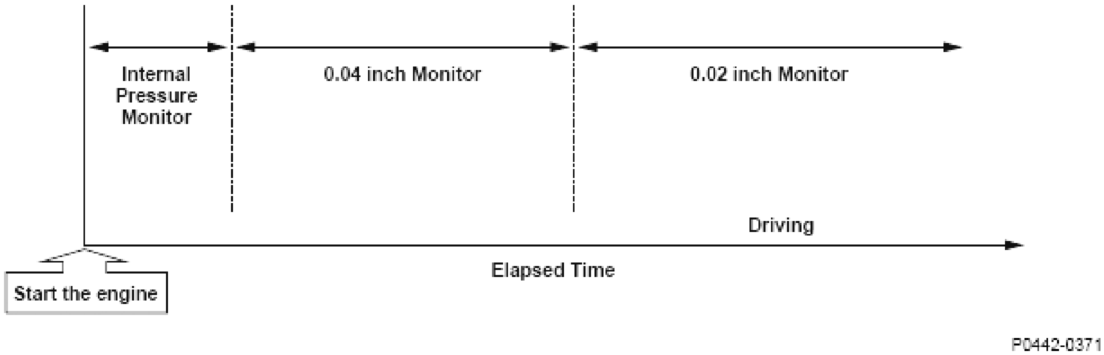


Fig. 68: Identifying Leak Detection Value

General Description

The evaporative emission (EVAP) leak detection system uses a vacuum-retention (decompression) method to check for vacuum leaks. This method detects leakage by monitoring the vacuum retention ability after applying vacuum to the EVAP system (from the EVAP canister purge valve to the fuel tank).

Here is an overview of the malfunction detection using this method:

Step 1: Judgment as normal operation (no 0.04 inch leak/no 0.02 inch leak) < internal pressure monitor >

Step 2: Detection of 0.04 inch leak < decompressing monitor > (including the purge flow failure detection and the fuel fill cap loose/off detection)

Step 3: Detection of 0.02 inch leak < decompressing monitor > (including the purge flow failure detection and the fuel fill cap loose/off detection)

The methods used in Step 2 and Step 3 are basically the same. Here are the details:

Step 1:

After starting the engine, the engine control module (ECM) monitors the FTP sensor output until the EVAP purge starts, then judges it as normal (no "0.04 inch leak" nor "0.02 inch leak") by the change in the FTP sensor output.

- If "no 0.02 inch leak" is detected, the ECM judges it as normal and the malfunction diagnosis is completed.

- If "no 0.04 inch leak" is detected, go to the 0.02 inch leak decompressing monitor Step 3.
- If neither "no 0.04 inch leak" nor "no 0.02 inch leak" is detected, go to Step 2.

Step 2:

Detection of a 0.04 inch leak is done as follows.

The ECM decompresses the EVAP system (from the EVAP canister purge valve to the fuel tank) if all decompressing monitor conditions are met. The ECM detects a 0.04 inch leak in the EVAP system by the change in fuel tank pressure.

- If "0.04 inch leak" is detected, the ECM judges a malfunction and completes the malfunction diagnosis.
- If "no 0.04 inch leak" is detected, go to the 0.02 inch leak decompressing monitor Step 3.
- If the FTP sensor output does not change enough, the ECM detects a purge flow malfunction (P0497) or a fuel fill cap loose/off malfunction (P0457) and a DTC is stored.

Step 3:

Detection of a 0.02 inch leak is done as follows.

The ECM decompresses the EVAP system (from the EVAP canister purge valve to the fuel tank) if all decompressing monitor conditions are met. The ECM detects a 0.02 inch leak in the EVAP system by the change in fuel tank pressure.

- If "0.02 inch leak" is detected, the ECM judges a malfunction and completes the malfunction diagnosis.
- If the ECM judges "reserved", the ECM completes the malfunction diagnosis as it is.
- If "no 0.02 inch leak" is detected, the ECM judges it as normal and completes the malfunction diagnosis.
- If the FTP sensor output does not change enough, a purge flow malfunction (P0497) or a fuel fill cap loose/off malfunction (P0457) is detected and a DTC

is stored.

Monitor Execution, Sequence, Duration, DTC Type

MONITOR DESCRIPTION CHART

Execution	Once per driving cycle
Sequence	None
Duration(1)	-
DTC Type	Two drive cycles, MIL ON
(1) By the time EVAP purge starts.	

MONITOR DESCRIPTION CHART

Execution	Once per driving cycle
Sequence	None
Duration	78(1), 83.2(2) seconds or less
DTC Type	Two drive cycles, MIL ON
(1) CVT model (2) M/T model	

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
Initial condition A(1)	-	27°F (15°C)
Initial condition B(2)	-	12°F (7°C)
Initial condition C(3)	-	9°F (5°C)
Initial engine coolant temperature	20°F (-6°C)	95°F (35°C)
Initial intake air temperature	20°F (-6°C)	95°F (35°C)
Engine coolant temperature before EVAP purge control starts	149°F (65°C)	-
Battery voltage	10.5 V	-
	ECM, ECT, BARO, IAT, VSS,	

No active DTCs	EVAP, FTP

(1) The initial engine coolant temperature minus the initial intake air temperature
(2) The initial intake air temperature minus the initial engine coolant temperature
(3) The initial intake air temperature minus the current intake air temperature

ENABLE CONDITIONS CHART

<table>
<tr><th colspan="2">Condition</th><th>Minimum</th><th>Maximum</th></tr>
<tr><td colspan="2">Initial condition A[1]</td><td>-</td><td>27°F (15°C)</td></tr>
<tr><td colspan="2">Initial condition B[2]</td><td>-</td><td>12°F (7°C)</td></tr>
<tr><td colspan="2">Initial condition C[3]</td><td>-</td><td>9°F (5°C)</td></tr>
<tr><td colspan="2">Initial engine coolant temperature</td><td>20°F (-6°C)</td><td>95°F (35°C)</td></tr>
<tr><td colspan="2">Initial intake air temperature</td><td>20°F (-6°C)</td><td>95°F (35°C)</td></tr>
<tr><td colspan="2">Engine coolant temperature</td><td>155°F (68°C)</td><td>212°F (100°C)</td></tr>
<tr><td colspan="2">Intake air temperature</td><td>20°F (-6°C)</td><td>186°F (85°C)</td></tr>
<tr><td colspan="2">Engine coolant temperature after EVAP purge control starts</td><td>149°F (65°C)</td><td>-</td></tr>
<tr><td colspan="2">Engine speed</td><td>1,000 rpm</td><td>3,500 rpm</td></tr>
<tr><td rowspan="2">MAP value</td><td>1,500 rpm</td><td>53 kPa (15.6 in.Hg, 395 mmHg)</td><td rowspan="2">96 kPa (28.4 in.Hg, 722 mmHg)</td></tr>
<tr><td>3,000 rpm</td><td>24 kPa (6.9 in.Hg, 175 mmHg)</td></tr>
<tr><td colspan="2">Vehicle speed</td><td>28 mph (45 km/h)</td><td>82 mph (132 km/h)</td></tr>
<tr><td colspan="2">Barometric pressure</td><td>13 kPa (3.6 in.Hg, 91 mmHg)</td><td>-</td></tr>
<tr><td colspan="2">Battery voltage</td><td>10.5 V</td><td>-</td></tr>
<tr><td rowspan="2">Fuel trim</td><td>CVT</td><td rowspan="2">0.63</td><td>1.40</td></tr>
<tr><td>M/T</td><td>1.35</td></tr>
<tr><td colspan="2">Fuel feedback</td><td colspan="2">Closed loop at stoichiometric</td></tr>
</table>

No active DTCs	ECM, ECT, BARO, IAT, VSS, EVAP, FTP
Others	Other than when there is excessive vapor generation (fuel level is 40 - 90 %)
	Test-drive on a flat road to avoid misdetection
	Avoid abrupt acceleration, deceleration, and turns
(1) The initial engine coolant temperature minus the initial intake air temperature (2) The initial intake air temperature minus the initial engine coolant temperature (3) The initial intake air temperature minus the current intake air temperature	

Malfunction Threshold

0.04 inch Leak (Step 1) Detection

The change of fuel tank pressure is -0.4 kPa (-0.1 in.Hg, -3 mmHg) or more.

0.04 inch Leak (Step 2) Detection

The change of fuel tank pressure is 4 kPa (1.2 in.Hg, 30 mmHg)/min or more.

Driving Pattern

1. Start the engine at an engine coolant temperature and intake air temperature as specified under Enable Conditions, and let it idle until the radiator fan comes on.
2. Drive the vehicle immediately at a speed between 45 - 75 mph (72 - 120 km/h) for at least 10 minutes.

- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected during the first drive cycle with the ECT and IAT at engine start-up within the specified temperature range, a Temporary DTC is stored in the ECM memory. If the malfunction recurs during the next (second) drive cycle with the ECT and IAT at engine start-up within the specified temperature range, the MIL comes on and the DTC and the freeze frame data are stored.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0443 (92): ADVANCED DIAGNOSTICS

DTC P0443: EVAPORATIVE EMISSION (EVAP) CANISTER PURGE VALVE CIRCUIT MALFUNCTION

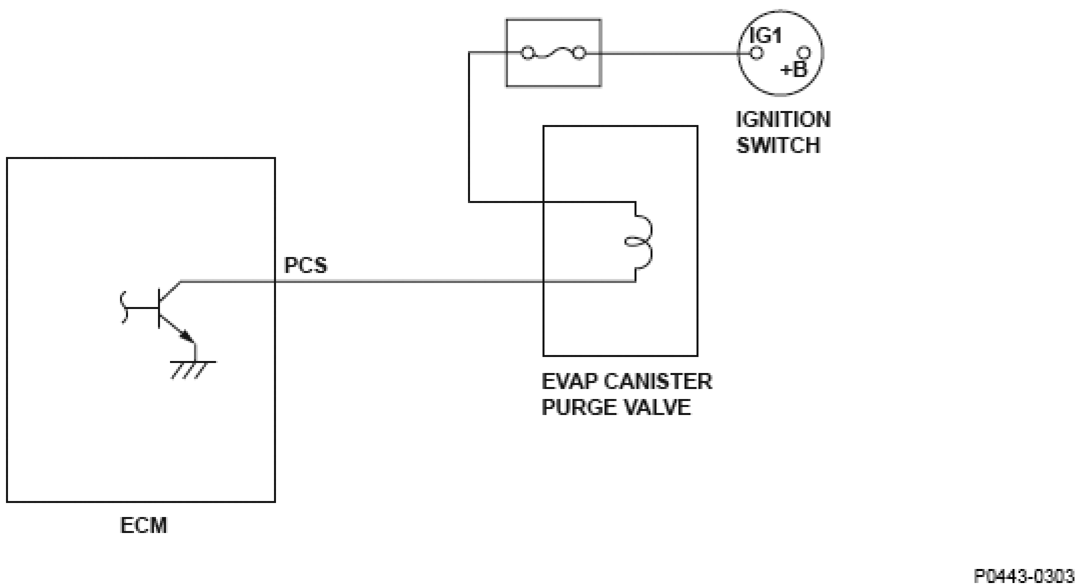


Fig. 69: Evaporative Emission (EVAP) Canister Purge Valve Circuit Malfunction - Circuit Diagram

General Description

The evaporative emission (EVAP) canister purge valve is attached to the vacuum port between the EVAP canister and the intake manifold. The engine control module (ECM) does not turn on the EVAP canister purge valve when the engine coolant temperature is 149°F (65°C) or less. The ECM adjusts the amount of fuel vapor sent to the engine by controlling the EVAP canister purge valve duty cycle.

When the return signal does not change according to the EVAP canister purge valve output for a set time, the ECM detects a malfunction, and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	5 seconds or more
DTC Type	One drive cycle, MIL ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
Battery voltage	10.1 V	-
EVAP canister purge valve output duty	2 %	98 %
State of the engine	Running	

Malfunction Threshold

The return signal does not change according to the EVAP canister purge valve output for at least 5 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool

Clear command or by disconnecting the battery.

DTC P0451 (91): ADVANCED DIAGNOSTICS

DTC P0451: FUEL TANK PRESSURE (FTP) SENSOR CIRCUIT RANGE/PERFORMANCE PROBLEM

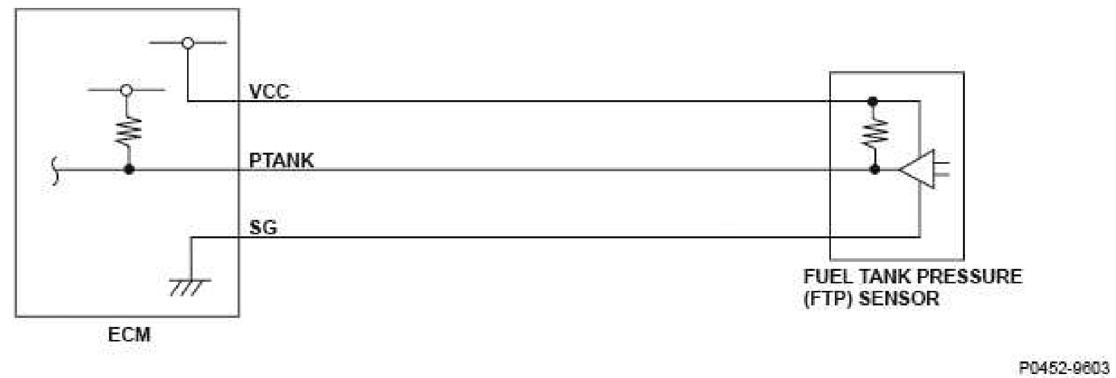


Fig. 70: Fuel Tank Pressure (FTP) Sensor Performance Diagram

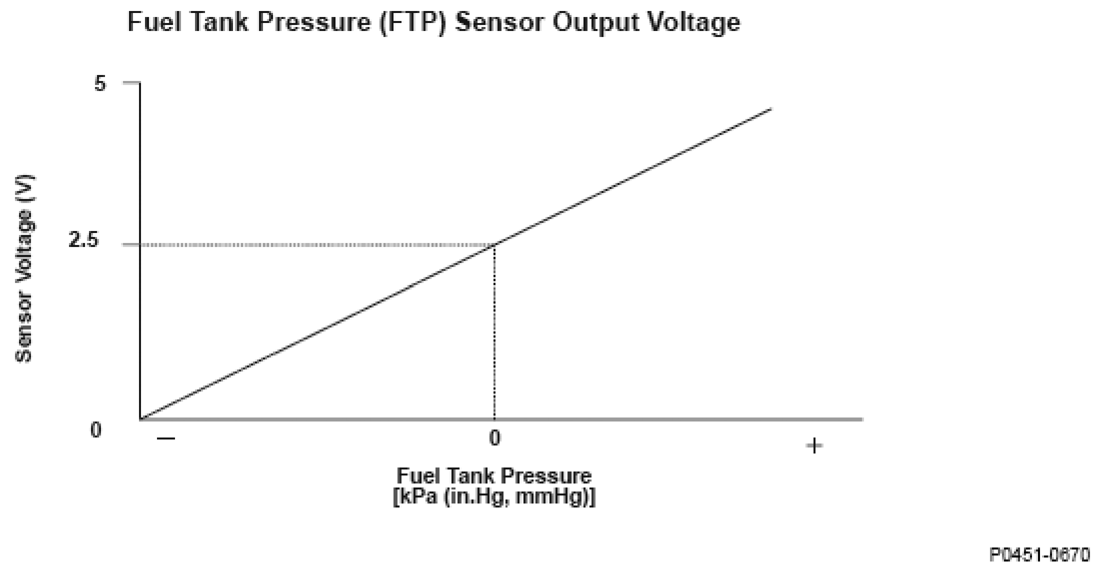


Fig. 71: Fuel Tank Pressure (FTP) Sensor Voltage - Graph

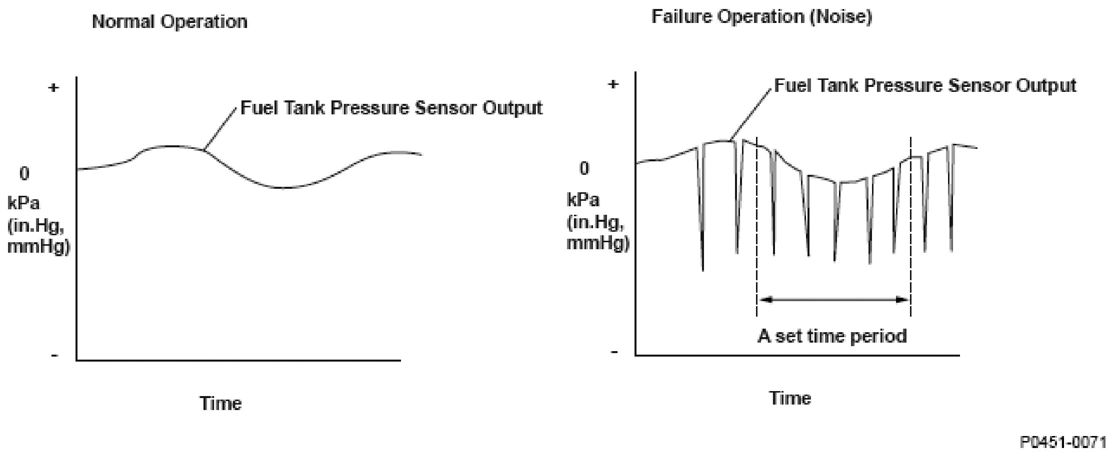


Fig. 72: Fuel Tank Pressure - Graph

General Description

The fuel tank pressure (FTP) sensor is installed on the evaporative emission (EVAP) canister. The FTP sensor is used to detect leaks in the EVAP system. The engine control module (ECM) monitors the FTP sensor output voltage. The FTP sensor output voltage rises as the fuel tank pressure increases. Conversely, the FTP sensor output voltage drops as the fuel tank pressure decreases. Rapid changes in the FTP sensor output voltage due to electrical noise or an intermittent open during the EVAP leak detection may cause incorrect leak detection, so abnormal output is monitored.

If the FTP sensor output voltage changes a specified number of times within a set time, the ECM detects a malfunction and stores a DTC.

MONITOR DESCRIPTION CHART

Execution	Once per driving cycle
Sequence	None
Duration	20 seconds or more
DTC Type	Two drive cycles, MIL ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
Elapsed time after starting the engine	2 seconds	-
Throttle position	Fully closed	

No active DTCs	FTP, TP, VSS

Malfunction Threshold

The FTP sensor output fluctuates by 0.3 kPa (0.1 in.Hg, 2 mmHg) or more at least five times within 3 seconds.

Driving Pattern

Start the engine in a cold condition, and let it idle for at least 20 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the ECM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0452 (91): ADVANCED DIAGNOSTICS

DTC P0452: FUEL TANK PRESSURE (FTP) SENSOR CIRCUIT LOW VOLTAGE

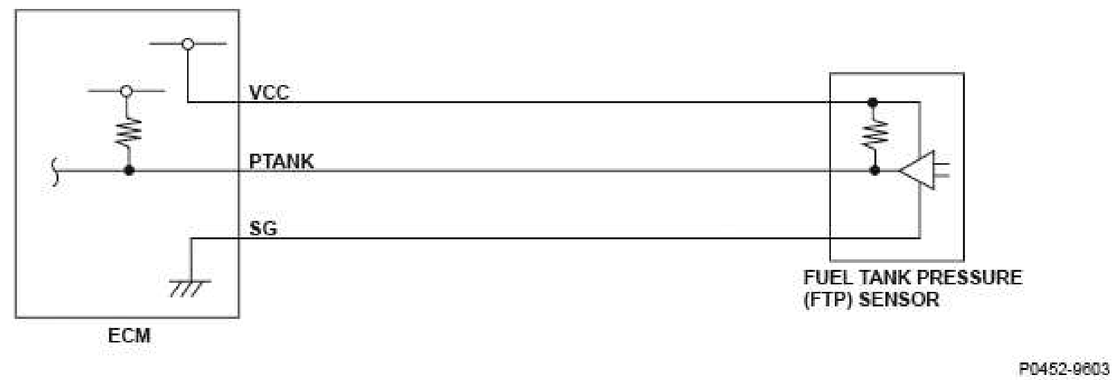


Fig. 73: Fuel Tank Pressure (FTP) Sensor Performance Diagram

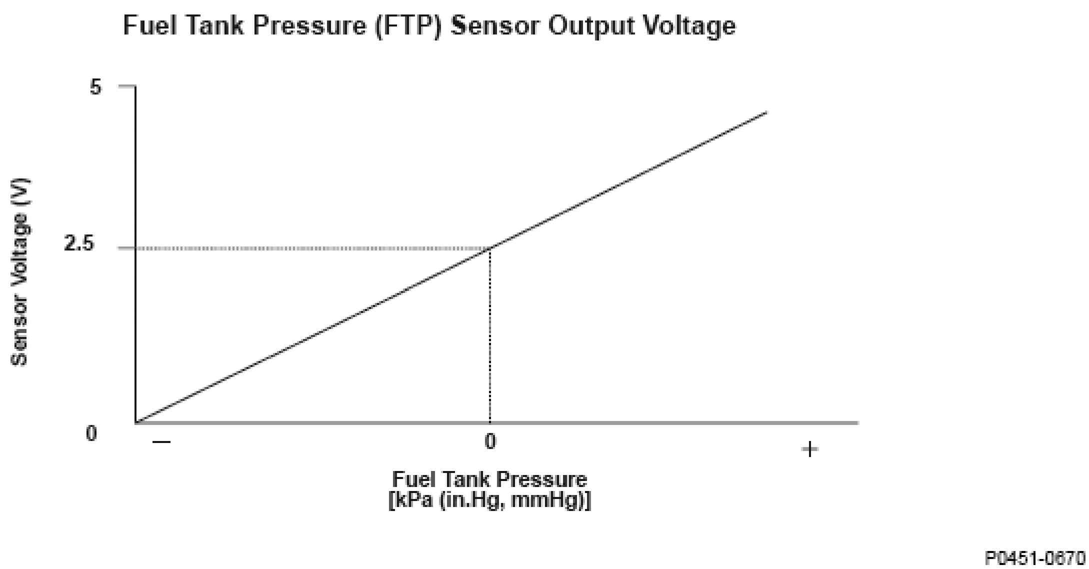


Fig. 74: Fuel Tank Pressure (FTP) Sensor Voltage - Graph

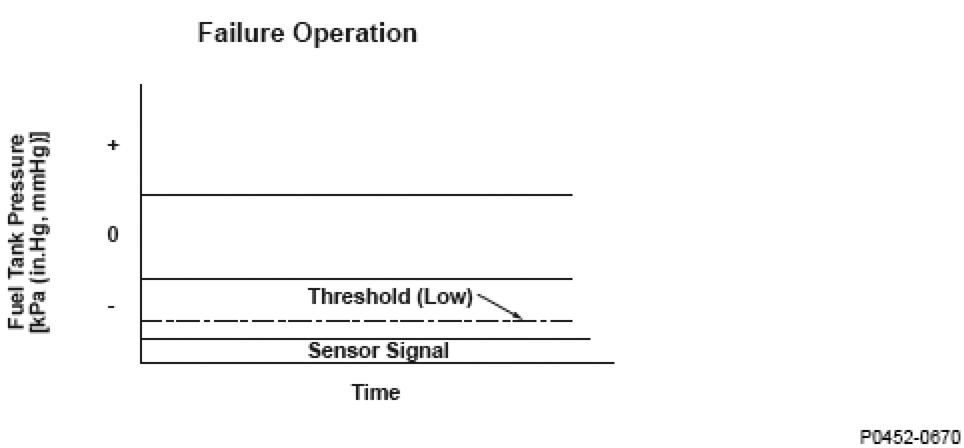


Fig. 75: Fuel Tank Pressure Operation - Graph

General Description

The fuel tank pressure (FTP) sensor is installed on the evaporative emission (EVAP) canister and detects the fuel tank pressure. The FTP sensor is used to detect leaks in the EVAP system.

The engine control module (ECM) monitors the FTP sensor output voltage. The FTP sensor output voltage rises as the fuel tank pressure increases. Conversely, the FTP sensor output voltage drops as the fuel tank pressure decreases. If the FTP sensor output voltage does not reach a target value within a set time after starting the engine in a cold condition, the ECM detects a malfunction and stores a DTC.

MONITOR DESCRIPTION CHART

Execution	Once per driving cycle
Sequence	None
Duration	3 seconds or more
DTC Type	One drive cycle, MIL ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
Elapsed time after starting the engine	2 seconds	-
Other	At idle	

Malfunction Threshold

The output from the fuel tank pressure sensor is less than -7 kPa (-2.1 in.Hg, -55 mmHg) for at least 3 seconds.

Driving Pattern

Start the engine in a cold condition, and let it idle until the radiator fan comes on.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0453 (91): ADVANCED DIAGNOSTICS

DTC P0453: FUEL TANK PRESSURE (FTP) SENSOR CIRCUIT HIGH VOLTAGE

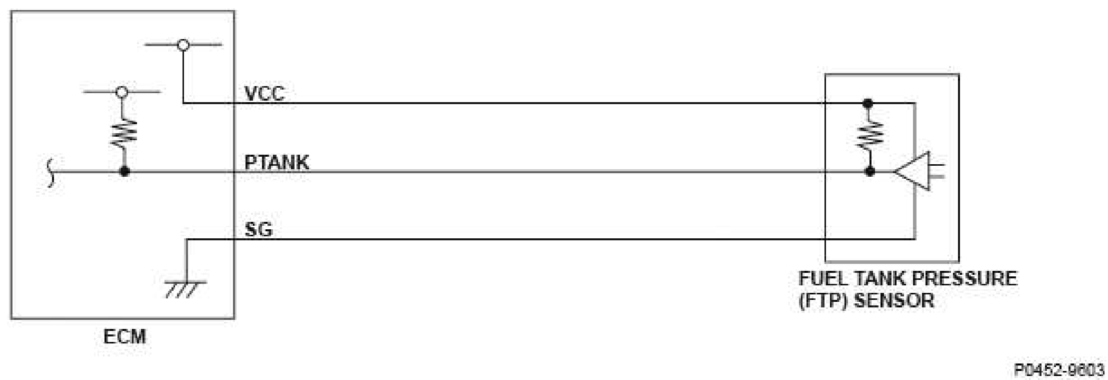


Fig. 76: Fuel Tank Pressure (FTP) Sensor Performance Diagram

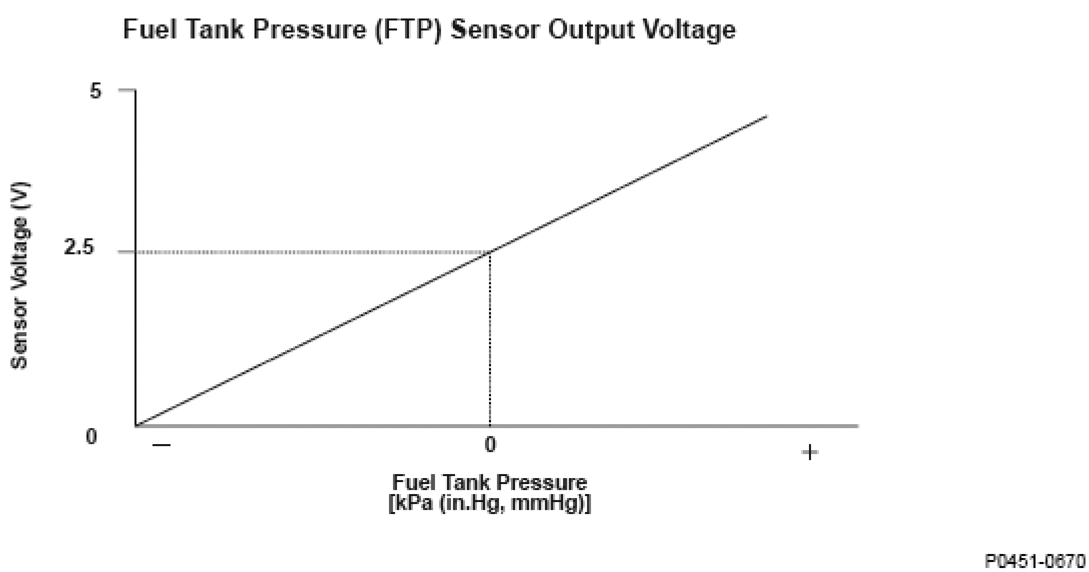


Fig. 77: Fuel Tank Pressure (FTP) Sensor Voltage - Graph

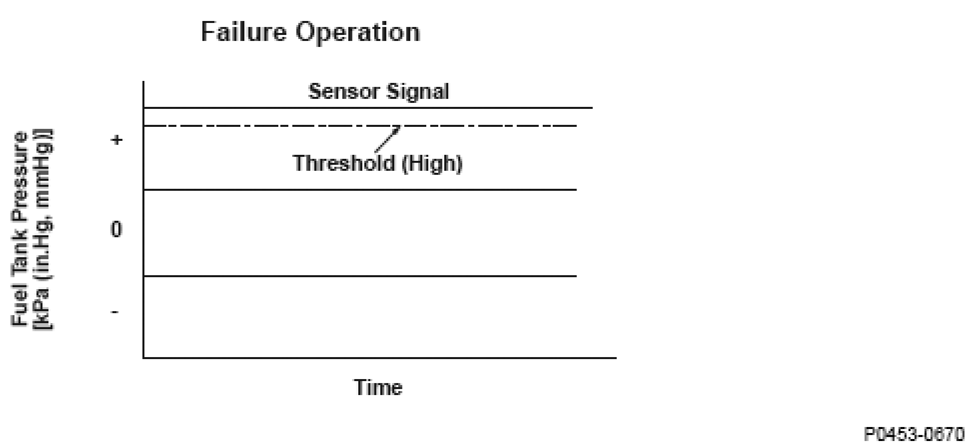


Fig. 78: Fuel Tank Pressure Operation - Graph

General Description

The fuel tank pressure (FTP) sensor is installed on the evaporative emission (EVAP) canister and detects the fuel tank pressure. The FTP sensor is used to detect leaks in the EVAP system.

The engine control module (ECM) monitors the FTP sensor output voltage. The FTP sensor output voltage rises as the fuel tank pressure increases. Conversely, the FTP sensor output voltage drops as the fuel tank pressure decreases. If the FTP sensor output voltage is higher than a target value within a set time after starting the engine in a cold condition, the ECM detects a malfunction and stores a DTC.

MONITOR DESCRIPTION CHART

Execution	Once per driving cycle
Sequence	None
Duration	3 seconds or more
DTC Type	One drive cycle, MIL ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
Elapsed time after starting the engine	2 seconds	-
Other	At idle	

Malfunction Threshold

The output from the fuel tank pressure sensor is more than 8 kPa (2.2 in.Hg, 55 mmHg) for at least 3 seconds.

Driving Pattern

Start the engine in a cold condition, and let it idle until the radiator fan comes on.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0456 (90): ADVANCED DIAGNOSTICS

DTC P0456: EVAPORATIVE EMISSION (EVAP) SYSTEM VERY SMALL LEAK DETECTED

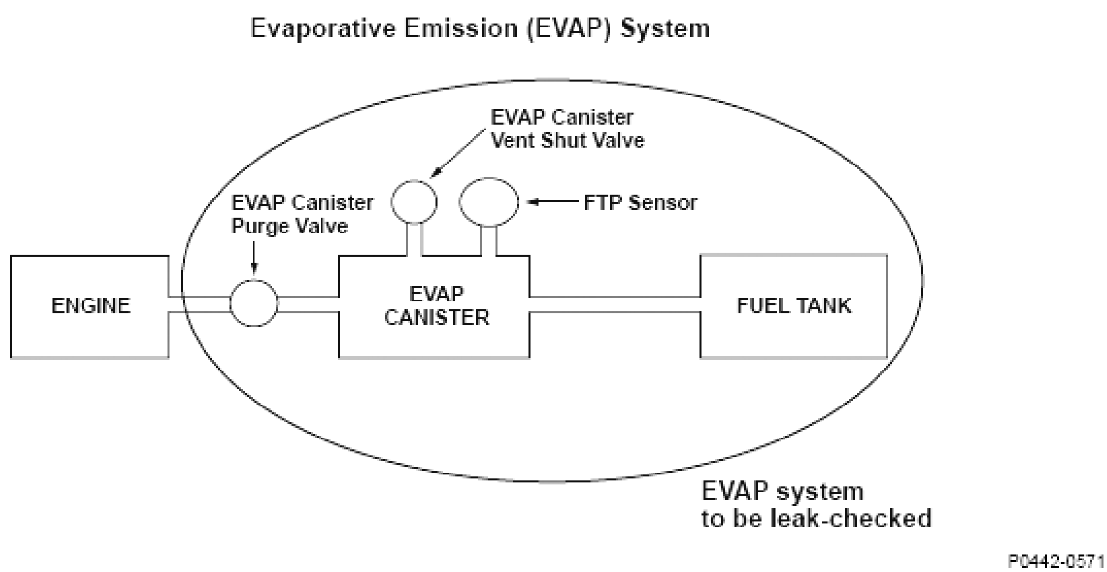


Fig. 79: Evaporative Emission (EVAP) System Diagram

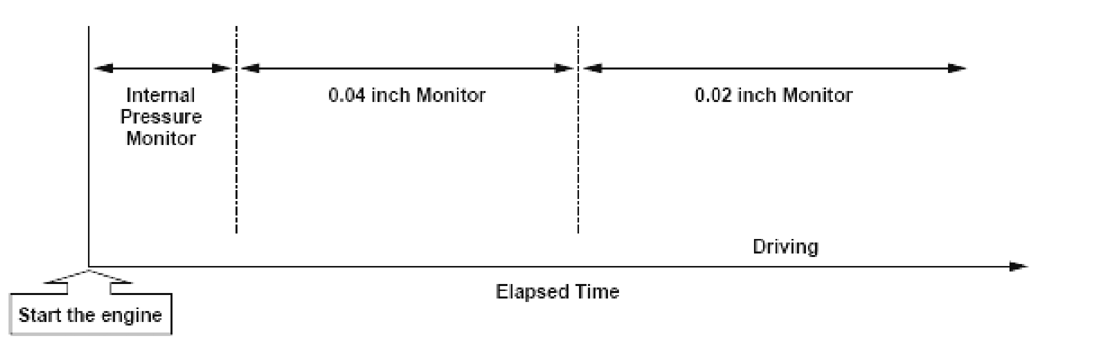


Fig. 80: Identifying Leak Detection Value

General Description

The evaporative emission (EVAP) leak detection system uses a vacuum-retention (decompression) method to check for vacuum leaks. This method detects leakage by monitoring the vacuum retention ability after applying vacuum to the EVAP system (from the EVAP canister purge valve to the fuel tank).

Here is an overview of the malfunction detection using this method:

Step 1: Judgment as normal operation (no 0.04 inch leak/no 0.02 inch leak) < internal pressure monitor >

Step 2: Detection of 0.04 inch leak < decompressing monitor > (including the purge flow failure detection and the fuel fill cap loose/off detection)

Step 3: Detection of 0.02 inch leak < decompressing monitor > (including the purge flow failure detection and the fuel fill cap loose/off detection)

The methods used in Step 2 and Step 3 are basically the same. Here are the details:

Step 1:

After starting the engine, the engine control module (ECM) monitors the FTP sensor output until the EVAP purge starts, then judges it as normal (no "0.04 inch leak" nor "0.02 inch leak") by the change in the FTP sensor output.

- If "no 0.02 inch leak" is detected, the ECM judges it as normal and the malfunction diagnosis is completed.
- If "no 0.04 inch leak" is detected, go to the 0.02 inch leak decompressing monitor Step 3.
- If neither "no 0.04 inch leak" nor "no 0.02 inch leak" is detected, go to Step 2.

Step 2:

Detection of a 0.04 inch leak is done as follows.

The ECM decompresses the EVAP system (from the EVAP canister purge valve to the fuel tank) if all decompressing monitor conditions are met. The ECM detects a

0.04 inch leak in the EVAP system by the change in fuel tank pressure.

- If "0.04 inch leak" is detected, the ECM judges a malfunction and completes the malfunction diagnosis.
- If "no 0.04 inch leak" is detected, go to the 0.02 inch leak decompressing monitor Step 3.
- If the FTP sensor output does not change enough, the ECM detects a purge flow malfunction (P0497) or a fuel fill cap loose/off malfunction (P0457) and a DTC is stored.

Step 3:

Detection of a 0.02 inch leak is done as follows.

The ECM decompresses the EVAP system (from the EVAP canister purge valve to the fuel tank) if all decompressing monitor conditions are met. The ECM detects a 0.02 inch leak in the EVAP system by the change in fuel tank pressure.

- If "0.02 inch leak" is detected, the ECM judges a malfunction and completes the malfunction diagnosis.
- If the ECM judges "reserved", the ECM completes the malfunction diagnosis.
- If "no 0.02 inch leak" is detected, the ECM judges it as normal and completes the malfunction diagnosis.
- If the FTP sensor output does not change enough, a purge flow malfunction (P0497) or a fuel fill cap loose/off malfunction (P0457) is detected and a DTC is stored.

Monitor Execution, Sequence, Duration, DTC Type

MONITOR DESCRIPTION CHART

Execution	Once per driving cycle
Sequence	None
Duration	217.8 seconds or less
DTC Type	Two drive cycles, MIL ON

ENABLE CONDITIONS CHART

Condition		Minimum	Maximum
Initial condition A[1]		-	27°F (15°C)
Initial condition B[2]		-	12°F (7°C)
Initial condition C[3]		-	9°F (5°C)
Initial engine coolant temperature		40°F (5°C)	95°F (35°C)
Initial intake air temperature		40°F (5°C)	95°F (35°C)
Engine coolant temperature		155°F (68°C)	212°F (100°C)
Intake air temperature		40°F (5°C)	186°F (85°C)
Engine coolant temperature after EVAP purge control starts		149°F (65°C)	-
Engine speed		1,500 rpm	3,500 rpm
MAP value	1,500 rpm	53 kPa (15.6 in.Hg, 395 mmHg)	96 kPa (28.4 in.Hg, 722 mmHg)
	3,000 rpm	24 kPa (6.9 in.Hg, 175 mmHg)	
Vehicle speed		45 mph (72 km/h)	82 mph (132 km/h)
Barometric pressure		13 kPa (3.6 in.Hg, 91 mmHg)	-
Battery voltage		10.5 V	-
Fuel trim	CVT	0.63	1.40
	M/T		1.35
Fuel feedback		Closed loop at stoichiometric	
No active DTCs		ECM, ECT, BARO, IAT, VSS, EVAP, FTP	
Others		Other than when there is excessive vapor generation (fuel level is 40 - 90 %)	
		Test-drive on a flat road to avoid misdetection	
		Avoid abrupt acceleration, deceleration, and turns	

(1) The Initial engine coolant temperature minus the initial intake air

temperature
(2) The Initial intake air temperature minus the initial engine coolant temperature
(3) The Initial intake air temperature minus the current intake air temperature

Malfunction Threshold

0.02 inch Leak (Step 3) Detection

The change of fuel tank pressure is 0.6 kPa (0.2 in.Hg, 4 mmHg)/min or more.

Driving Pattern

1. Start the engine at an engine coolant temperature and intake air temperature as specified under Enable Conditions, and let it idle until the radiator fan comes on.
2. Drive the vehicle immediately at a speed between 45 - 75 mph (72 - 120 km/h) for at least 10 minutes.

- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected during the first drive cycle with the ECT and IAT at engine start-up within the specified temperature range, a Temporary DTC is stored in the ECM memory. If the malfunction recurs during the next (second) drive cycle with the ECT and IAT at engine start-up within the specified temperature range, the MIL comes on and the DTC and the freeze frame data are stored.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared

by using the scan tool Clear command or by disconnecting the battery.

DTC P0457 (90): ADVANCED DIAGNOSTICS

DTC P0457: EVAPORATIVE EMISSION (EVAP) SYSTEM LEAK DETECTED/FUEL FILL CAP LOOSE OR MISSING

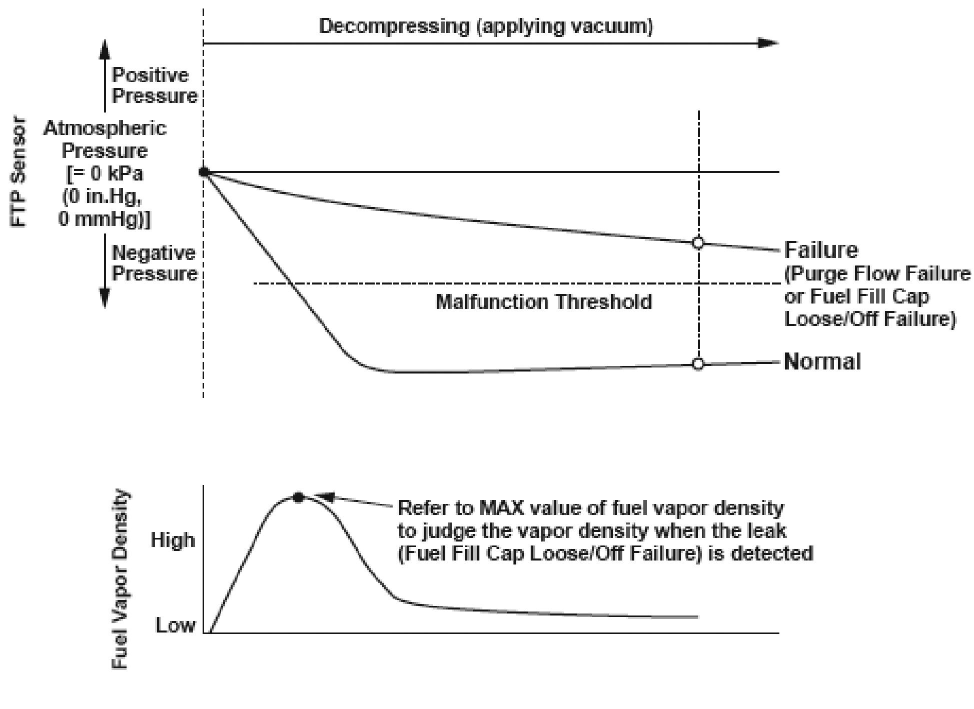


Fig. 81: Evaporative Emission (EVAP) System Leak Detected/Fuel Fill Cap Loose Or Missing - Graph

General Description

There are two conditions when the evaporative emission (EVAP) system will not hold vacuum sufficiently, and the pressure in the fuel tank doesn't become negative.

1. EVAP system low purge flow.
2. EVAP system leakage or the fuel fill cap is loose/off.

Here is a description of condition 2:

The engine control module (ECM) monitors the fuel tank pressure (FTP) sensor output. If the FTP sensor output does not indicate the specified vacuum when leak checking when the fuel vapor density is high, the ECM detects a large leak (fuel fill cap loose/off) and a DTC is stored. [The malfunction detection is performed during EVAP system leak detection (P0442, P0456).]

MONITOR DESCRIPTION CHART

Execution	Once per driving cycle
Sequence	None
Duration	65[1], 67[2], 214.76 [3], 216.76 [4] seconds or less
DTC Type	Three drive cycles, MIL ON
OBD Status	N/A
(1) 0.04 inch Leak Detection (CVT model) (2) 0.04 inch Leak Detection (M/T model) (3) 0.02 inch Leak Detection (CVT model) (4) 0.02 inch Leak Detection (M/T model)	

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
Initial condition A[1]	-	27°F (15°C)
Initial condition B[2]	-	12°F (7°C)
Initial condition C[3]	-	9°F (5°C)
Initial engine coolant temperature	20°F (-6°C)	95°F (35°C)
Initial intake air temperature	20°F (-6°C)	95°F (35°C)
Engine coolant temperature	154°F (68°C)	212°F (100°C)
Intake air temperature	20°F (-6°C)	186°F (85°C)
Engine coolant temperature after EVAP purge control starts	149°F (65°C)	-
Engine speed	1,000 rpm	3,500 rpm
1,500 rpm	53 kPa (15.6 in.Hg,	

MAP value		395 mmHg)	96 kPa (28.4 in.Hg, 722 mmHg)
	3,000 rpm	24 kPa (6.9 in.Hg, 175 mmHg)	
Vehicle speed		28 mph (45 km/h)	82 mph (132 km/h)
Barometric pressure		13 kPa (3.6 in.Hg, 91 mmHg)	-
Battery voltage		10.5 V	-
Fuel trim	CVT	0.63	1.40
	M/T		1.35
Fuel feedback		Closed loop at stoichiometric	
No active DTCs		A/F Sensor, A/F Sensor Heater, MAP, IAT, ECT, CKP, BARO, VSS, EVAP, FTP	
Others		Other than when there is excessive vapor generation (fuel level is 40 - 90 %)	
		Test-drive on a flat road to avoid misdetection	
		Avoid abrupt acceleration, deceleration, and turns	

(1) The initial engine coolant temperature minus the initial intake air temperature

(2) The initial intake air temperature minus the initial engine coolant temperature

(3) The initial intake air temperature minus the current intake air temperature

Malfunction Threshold

The output from the fuel tank pressure sensor is at least -0.6 kPa (-0.1 in.Hg, -5 mmHg) for up to 65*[1] , 67*[2] , 214.76*[3] , 216.76*[4] seconds.

Driving Pattern

1. After the vehicle has been left for an appropriate amount of time as specified, with the engine coolant temperature and intake air temperature within the specified range, start the engine.
2. Warm up the engine at idle until the radiator fan comes on.

3. Drive the vehicle immediately at a speed between 45 - 75 mph (72 - 120 km/h) for at least 10 minutes.

- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected during the first drive cycle with the ECT at engine start-up within the specified temperature range, a Temporary DTC is stored in the ECM memory. If the malfunction recurs during the next (second) drive cycle with the ECT at engine start-up within the specified temperature range, the MIL comes on and the DTC and the freeze frame data are stored.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0496 (92): ADVANCED DIAGNOSTICS

DTC P0496: EVAPORATIVE EMISSION (EVAP) SYSTEM HIGH PURGE FLOW

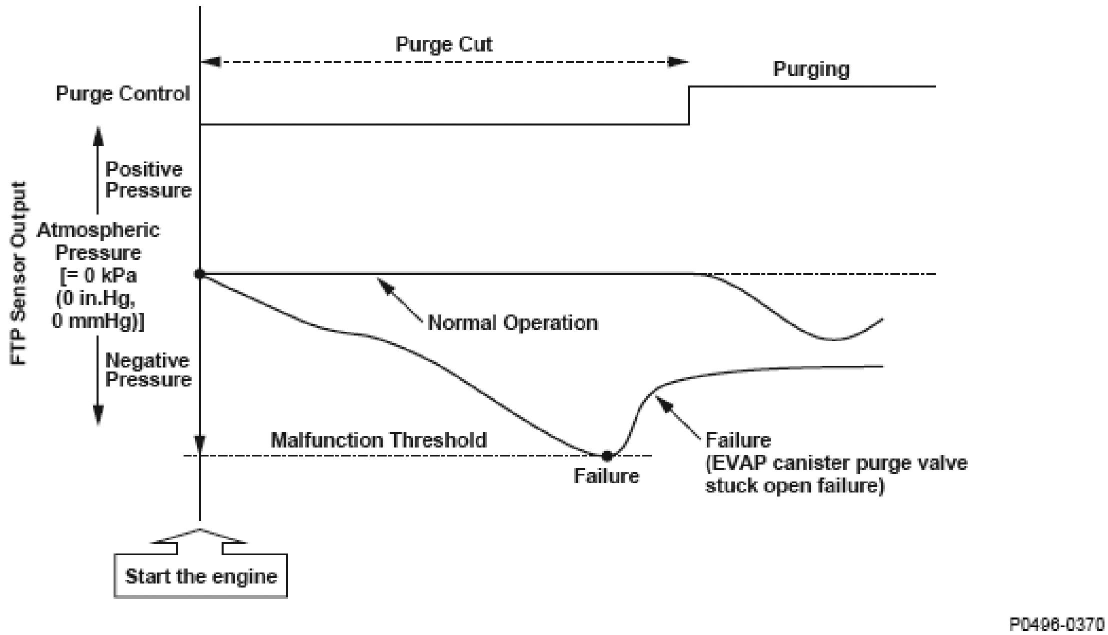


Fig. 82: Evaporative Emission (EVAP) System High Purge Flow - Graph

General Description

The engine control module (ECM) adjusts the amount of fuel vapor sent to the engine by controlling the evaporative emission (EVAP) canister purge valve. If the EVAP canister purge valve is stuck open, engine vacuum flows into the purge line before purge control starts when starting the engine. The ECM monitors the fuel tank pressure (FTP) sensor output when purge control starts. If the FTP sensor output indicates negative pressure, the ECM detects a malfunction in the EVAP canister purge valve, and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Once per driving cycle
Sequence	None
Duration	10 seconds or more
DTC Type	Two drive cycles, MIL ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
Elapsed time before starting the engine	5 seconds	-

Initial condition A[1]		-	27°F (15°C)
Initial condition B[2]		-	12°F (7°C)
Initial condition C[3]		-	9°F (5°C)
Initial engine coolant temperature		20°F (-6°C)	95°F (35°C)
Initial intake air temperature		20°F (-6°C)	95°F (35°C)
Engine coolant temperature before EVAP purge control starts		-	149°F (65°C)
MAP value		-	81 kPa (24.0 in.Hg, 610 mmHg)
Battery voltage		10.5 V	-
Fuel trim	CVT	0.63	1.40
	M/T		1.35
Fuel feedback		Closed loop	
No active DTCs		MAP, ECT, BARO, IAT, EVAP, FTP	

(1) The Initial engine coolant temperature minus the initial intake air temperature

(2) The Initial intake air temperature minus the initial engine coolant temperature

(3) The Initial intake air temperature minus the current intake air temperature

Malfunction Threshold

The output from the fuel tank pressure sensor is -2 kPa (-0.6 in.Hg, -15 mmHg) or less for at least 10 seconds.

Driving Pattern

Start the engine at an engine coolant temperature and intake air temperature as specified under Enable Conditions, and let it idle until the radiator fan comes on.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected during the first drive cycle with the ECT and IAT at engine start-up within the specified temperature range, a Temporary DTC is stored in the ECM memory. If the malfunction recurs during the next (second) drive cycle with the ECT and IAT at engine start-up within the specified temperature range, the MIL comes on and the DTC and the freeze frame data are stored.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0497 (90): ADVANCED DIAGNOSTICS

DTC P0497: EVAPORATIVE EMISSION (EVAP) SYSTEM LOW PURGE FLOW

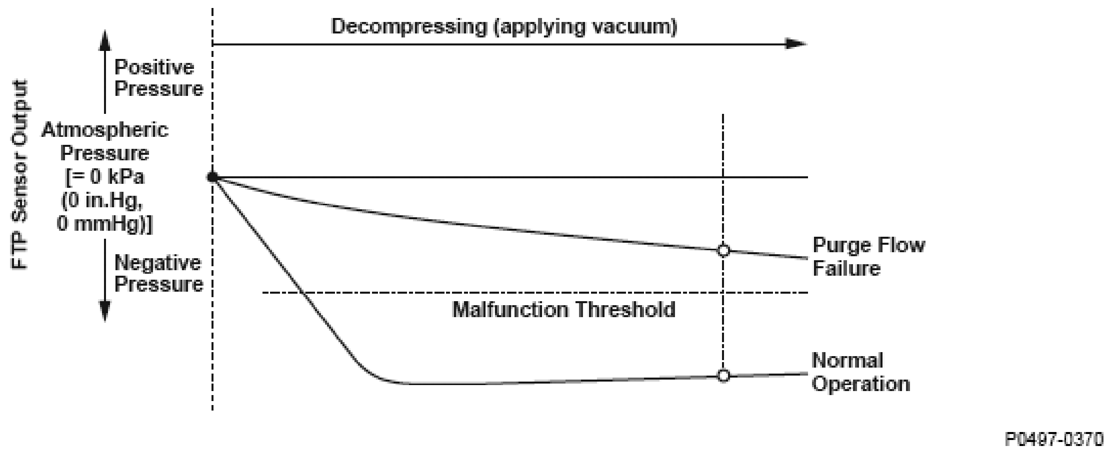


Fig. 83: Evaporative Emission (EVAP) System Low Purge Flow - Graph

General Description

There are two conditions when the evaporative emission (EVAP) system will not hold vacuum sufficiently, and the pressure in the fuel tank doesn't become negative.

1. EVAP system low purge flow.
2. EVAP system leakage or the fuel fill cap is loose/off.

Here is a description of condition 1:

The malfunction detection is done during EVAP system leak detection (P0442, P0456).

The engine control module (ECM) monitors the fuel tank pressure (FTP) sensor output. If the FTP sensor output does not indicate the prescribed negative pressure when purging, the ECM detects a malfunction and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Once per driving cycle
Sequence	None
Duration	65(1), 214.76(2) seconds or less
DTC Type	Two drive cycles, MIL ON
(1) 0.04 inch Leak Detection (2) 0.02 inch Leak Detection	

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
Initial condition A(1)	-	27°F (15°C)
Initial condition B(2)	-	12°F (7°C)
Initial condition C(3)	-	9°F (5°C)
Initial engine coolant temperature	20°F (-6°C)	95°F (35°C)
Initial intake air temperature	20°F (-6°C)	95°F (35°C)
Engine coolant temperature	154°F (68°C)	212°F (100°C)
Intake air temperature	20°F (-6°C)	186°F (85°C)
Engine coolant temperature	149°F (65°C)	-

after EVAP purge control starts			
Engine speed		1,000 rpm	3,500 rpm
MAP value	1,500 rpm	53 kPa (15.6 in.Hg, 395 mmHg)	96 kPa (28.4 in.Hg, 722 mmHg)
	3,000 rpm	24 kPa (6.9 in.Hg, 175 mmHg)	
Vehicle speed		28 mph (45 km/h)	82 mph (132 km/h)
Barometric pressure change		13 kPa (3.6 in.Hg, 91 mmHg)	-
Battery voltage		10.5 V	-
Fuel trim	CVT	0.63	1.40
	M/T		1.35
Fuel feedback		Closed loop at stoichiometric	
No active DTCs		A/F Sensor, A/F Sensor Heater, MAP, ECT, CKP, BARO, IAT, VSS, EVAP, FTP	
Others		Other than when there is excessive vapor generation (fuel level is 40 - 90 %)	
		Test-drive on a flat road to avoid misdetection	
		Avoid abrupt acceleration, deceleration, and turns	

(1) The initial engine coolant temperature minus the initial intake air temperature

(2) The initial intake air temperature minus the initial engine coolant temperature

(3) The initial intake air temperature minus the current intake air temperature

Malfunction Threshold

- The output from the fuel tank pressure sensor is at least -0.6 kPa (-0.1 in.Hg, -5 mmHg) for up to 65*[1] , 214.76*[2] seconds.
- The fuel vapor density during compression is at least 0.2 g (0.008 oz) for up to 65*[1] , 214.76*[2] seconds.

Driving Pattern

1. After the vehicle has been left for an appropriate amount of time as specified, with the engine coolant temperature and intake air temperature within the specified range, start the engine.
2. Warm up the engine at idle until the radiator fan comes on.
3. Drive the vehicle immediately at a speed between 45 - 75 mph (72 - 120 km/h) for at least 10 minutes.

- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected during the first drive cycle with the ECT and IAT at engine start-up within the specified temperature range, a Temporary DTC is stored in the ECM memory. If the malfunction recurs during the next (second) drive cycle with the ECT and IAT at engine start-up within the specified temperature range, the MIL comes on and the DTC and the freeze frame data are stored.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0498 (117): ADVANCED DIAGNOSTICS

DTC P0498: EVAPORATIVE EMISSION (EVAP) CANISTER VENT SHUT VALVE CIRCUIT LOW VOLTAGE

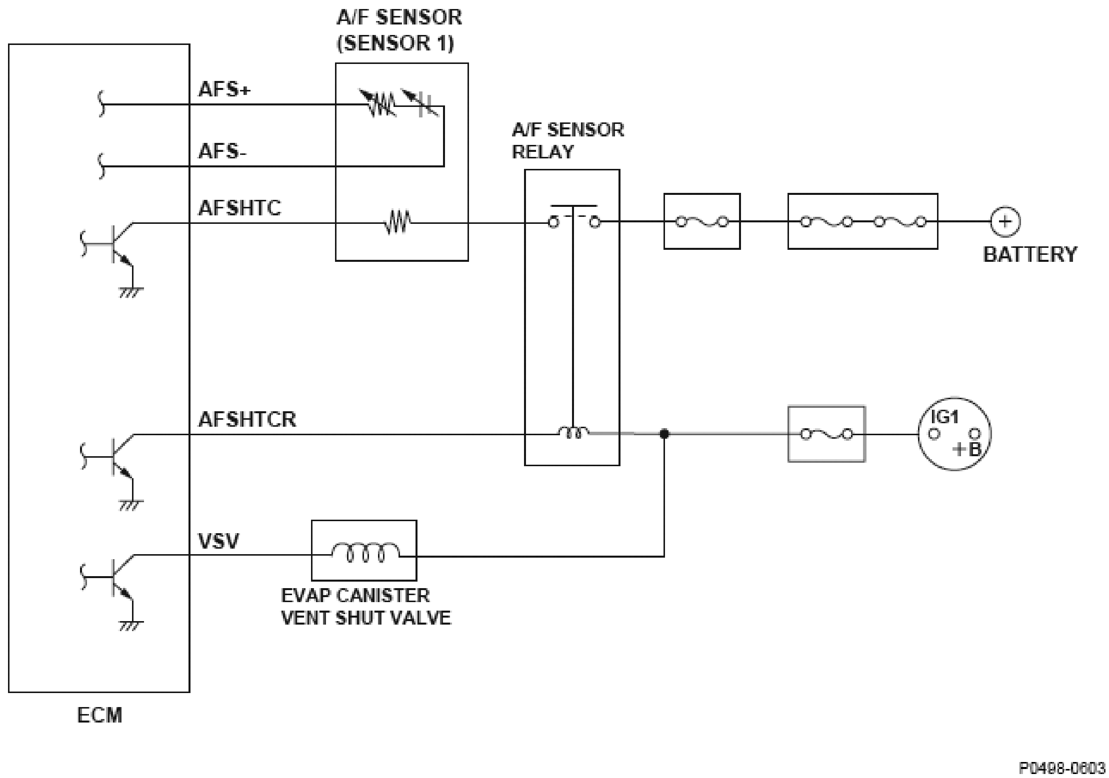


Fig. 84: Evaporative Emission (EVAP) Canister Vent Shut Valve Circuit Circuit Diagram

General Description

The evaporative emission (EVAP) canister vent shut valve is attached to the EVAP canister to control the venting of the EVAP canister to atmosphere.

The EVAP canister vent shut valve is open (open to atmosphere) when the VSV signal is OFF.

If the return signal is "OFF" when the engine control module (ECM) outputs the "ON" signal to the EVAP canister vent shut valve, the ECM detects a malfunction and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	5 seconds or more

DTC Type	One drive cycle, MIL ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
Battery voltage	10.1 V	-
State of the engine	Running	
No active DTCs	EVAP Canister Vent Shut Valve	

Malfunction Threshold

The return signal is "OFF" for at least 5 seconds when the ECM outputs the "ON" signal to the EVAP canister vent shut valve.

Confirmation Procedure with the HDS

Do the EVAP CVS ON in the INSPECTION MENU with the HDS.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0499 (117): ADVANCED DIAGNOSTICS

DTC P0499: EVAPORATIVE EMISSION (EVAP) CANISTER VENT SHUT VALVE CIRCUIT HIGH VOLTAGE

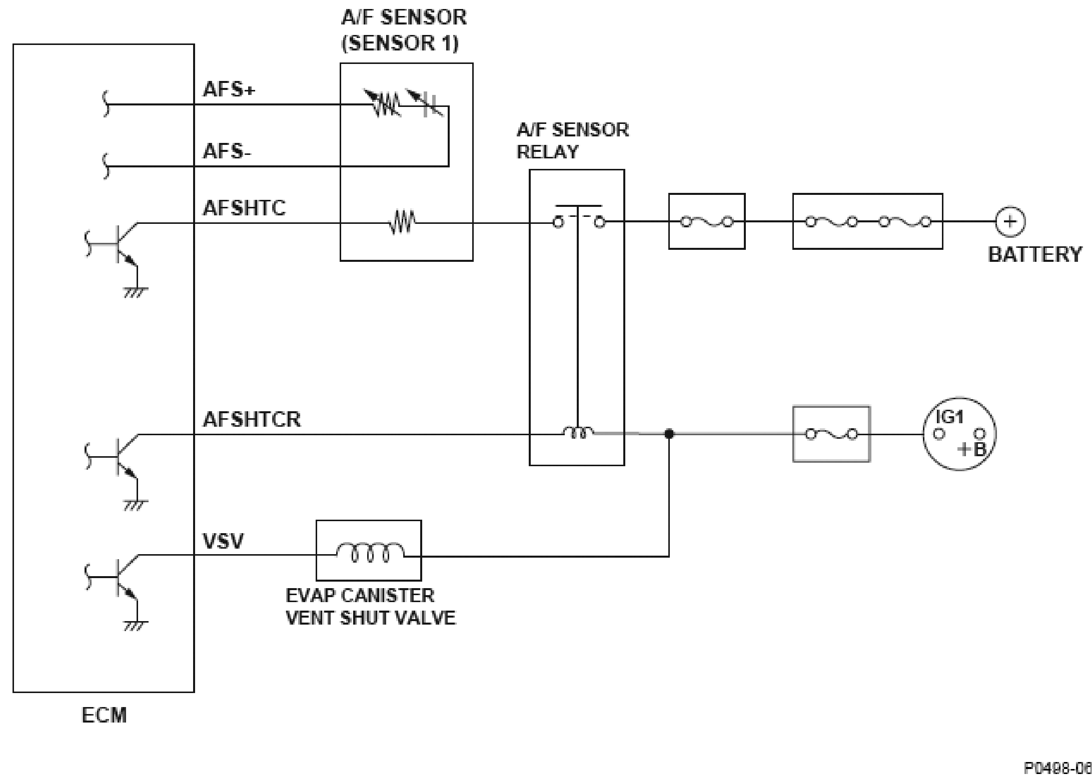


Fig. 85: Evaporative Emission (EVAP) Canister Vent Shut Valve Circuit Circuit Diagram

General Description

The evaporative emission (EVAP) canister vent shut valve is attached to the EVAP canister to control the venting of the EVAP canister to atmosphere.

The EVAP canister vent shut valve is open (open to atmosphere) when the VSV signal is OFF.

If the return signal is "ON" when the engine control module (ECM) outputs the "OFF" signal to the EVAP canister vent shut valve, the ECM detects a malfunction and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	5 seconds or more

DTC Type	One drive cycle, MIL ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
Battery voltage	10.1 V	-
State of the engine	Running	
No active DTCs	EVAP Canister Vent Shut Valve	

Malfunction Threshold

The return signal is "ON" for at least 5 seconds when the ECM outputs the "OFF" signal to the EVAP canister vent shut valve.

Confirmation Procedure with the HDS

Do the EVAP CVS ON in the INSPECTION MENU with the HDS.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0500 (17): ADVANCED DIAGNOSTICS

DTC P0500: VEHICLE SPEED SENSOR (VSS) CIRCUIT MALFUNCTION

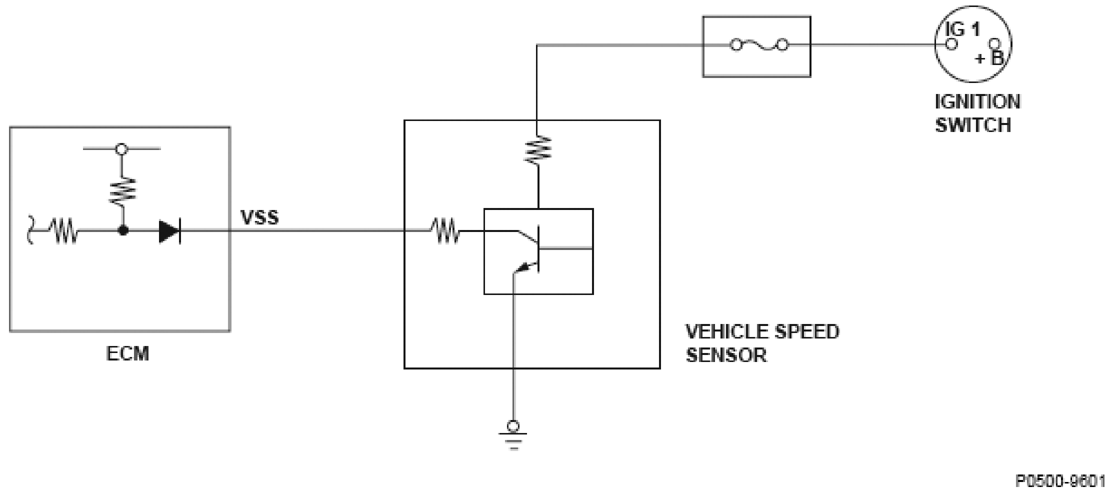


Fig. 86: Vehicle Speed Sensor (VSS) Circuit Malfunction - Circuit Diagram

General Description

The vehicle speed sensor (VSS) is attached to the transmission housing. The VSS outputs a pulsing signal for every revolution of the differential gear via the speedometer gear. The engine control module (ECM) determines the vehicle speed based on the frequency of these signals. If there is a loss of VSS signals to the ECM, the ECM detects a malfunction. If an open, a temporary open, or a short to ground causes a malfunction, a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	5 seconds
DTC Type	One drive cycle, MIL ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
Engine speed	-	2,500 rpm
Battery voltage	10.05 V	-
Engine condition	During fuel cut-off operation for deceleration	

Malfunction Threshold

The VSS signal stops for at least 5 seconds while the vehicle is being driven.

However, the failure detection speed is 2,500 rpm or less to avoid misdetection during fuel cut-off operation at high speed.

Driving Pattern

1. Start the engine. Hold the engine speed at 3,000 rpm without load (in neutral) until the radiator fan comes on, then let it idle.
2. Drive the vehicle and accelerate once, then close the throttle fully and keep decelerating at a speed of 2,500 rpm or less for at least 5 seconds

- If you have difficulty duplicating the DTC, retest after turning off electrical components such as the audio system and A/C, and try a different gear position.
- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0501 (4): ADVANCED DIAGNOSTICS (CVT)

DTC P0501: RANGE/PERFORMANCE PROBLEM IN VEHICLE SPEED SENSOR CIRCUIT

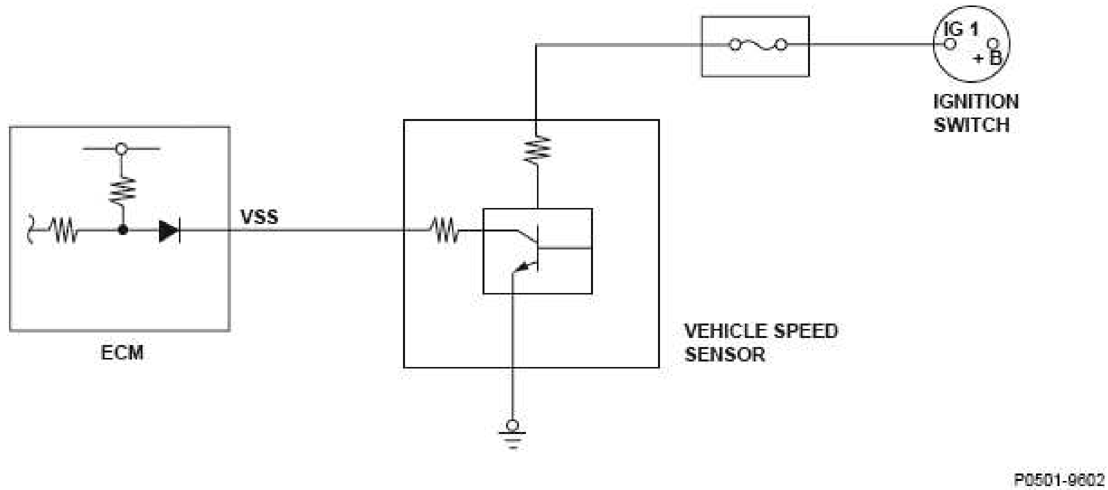


Fig. 87: Range/Performance Problem In Vehicle Speed Sensor Circuit - Circuit Diagram

General Description

The vehicle speed sensor (VSS) is attached to the transmission housing. The VSS outputs a pulsing signal for every revolution of the differential gear via the speedometer gear. The engine control module (ECM) receives the signal and determines the vehicle speed. If there are signal dropouts, the ECM detects a malfunction that may be caused by an open, a temporary open, or a short to ground. Based on the velocity ratio measured by the VSS and the CVT speed sensor, a malfunction is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	10 seconds or more
DTC Type	One drive cycle, MIL ON, D indicator blinks

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
Vehicle speed measured by the CVT speed sensor	13 mph (21 km/h)	-
No active DTCs	CVT speed sensor	

Malfunction Threshold

The vehicle speed measured by the VSS < the vehicle speed measured by the CVT speed sensor by a factor of 0.53 for at least 10 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0502 (4): ADVANCED DIAGNOSTICS (CVT)

DTC P0502: PROBLEM IN VEHICLE SPEED SENSOR CIRCUIT (NO SIGNAL INPUT)

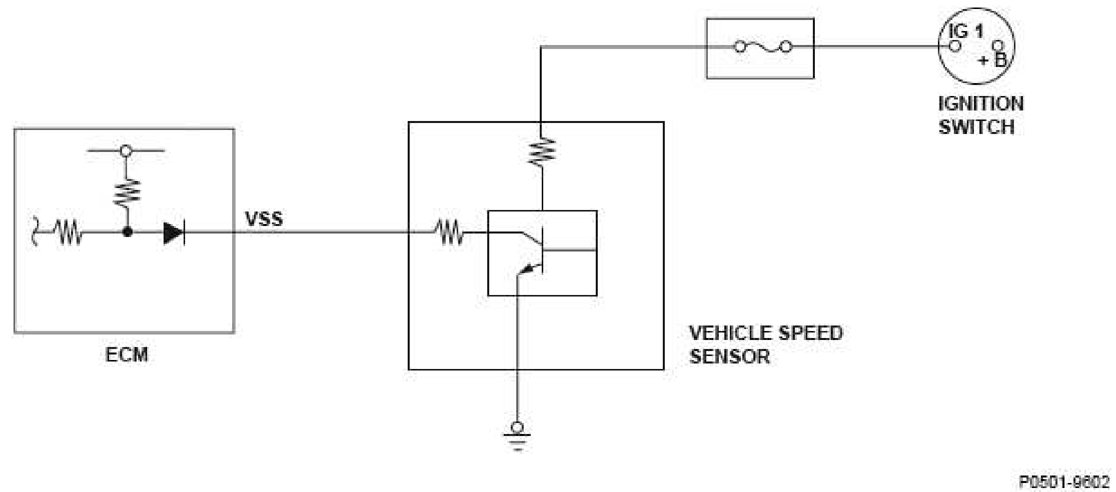


Fig. 88: Range/Performance Problem In Vehicle Speed Sensor Circuit - Circuit Diagram

General Description

The vehicle speed sensor (VSS) is attached to the transmission housing. The VSS outputs a pulsing signal for every revolution of the differential gear via the speedometer gear. The engine control module (ECM) receives the signal and determines the vehicle speed. If there are signal dropouts, the ECM detects a malfunction that may be caused by an open, a temporary open, or a short to ground. When the speed measured by the CVT speed sensor is a specified value or more, and the speed measured by the VSS is at a set value or less, and this condition continues for a set time or more, a malfunction is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	10 seconds or more
DTC Type	One drive cycle, MIL ON, D indicator blinks

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
Vehicle speed measured by the CVT speed sensor	13 mph (21 km/h)	-
No active DTCs	CVT speed sensor	

Malfunction Threshold

The vehicle speed measured by the VSS is 1.2 mph (2 km/h) or less for at least 10 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0506 (14): ADVANCED DIAGNOSTICS

DTC P0506: IDLE CONTROL SYSTEM RPM LOWER THAN EXPECTED

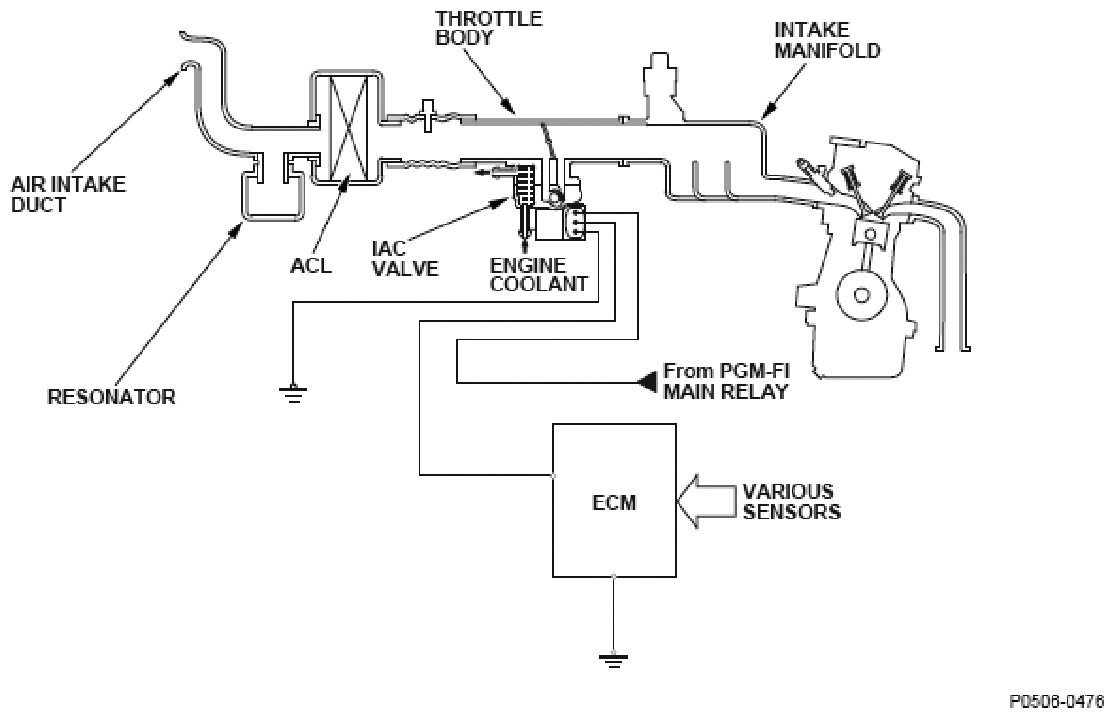


Fig. 89: Idle Control System RPM Lower Than Expected - System Diagram

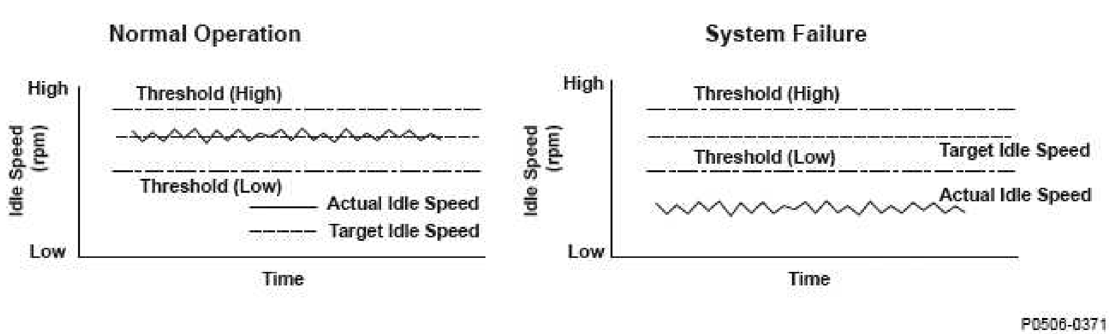


Fig. 90: Idle Control System RPM - Graph

General Description

A target idle speed that meets the engine operating conditions (coolant temperature, A/C ON or OFF, etc.) is stored in the engine control module (ECM). The ECM monitors and controls the idle speed so that the actual idle speed is equal to the target idle speed. If the actual idle speed varies beyond a specified value from the target speed over a certain period of time, the ECM detects a malfunction in the idle speed control system and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Under the Enable Conditions
Sequence	None
Duration	20 seconds or more
DTC Type	Two drive cycles, MIL ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
Elapsed time after starting the engine	15 seconds	-
Engine coolant temperature	158°F (70°C)	-
Intake air temperature	20°F (-7°C)	-
Atmospheric pressure (1)	67 kPa (500 mmHg, 20.0 in.Hg)	-
Fuel trim	0.65	1.47
Battery voltage	10.53 V	-
Fuel feedback	Closed loop	
Throttle position	Fully closed	
No active DTCs	ECM, MAP, ECT, TP, IAT, EGR, BARO, IAC, VSS, VTEC System, A/T System(1), Fuel System	
Others	At idle	
	The engine is under no load	
(1) CVT model		

Malfunction Threshold

The actual idle speed is at least 100 rpm less than the target idle speed for at least

20 seconds.

Driving Pattern

1. Start the engine. Hold the engine at 3,000 rpm with no load (in park or neutral) until the radiator fan comes on.
2. Let the engine idle for at least 20 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the ECM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0507 (14): ADVANCED DIAGNOSTICS

DTC P0507: IDLE CONTROL SYSTEM RPM HIGHER THAN EXPECTED

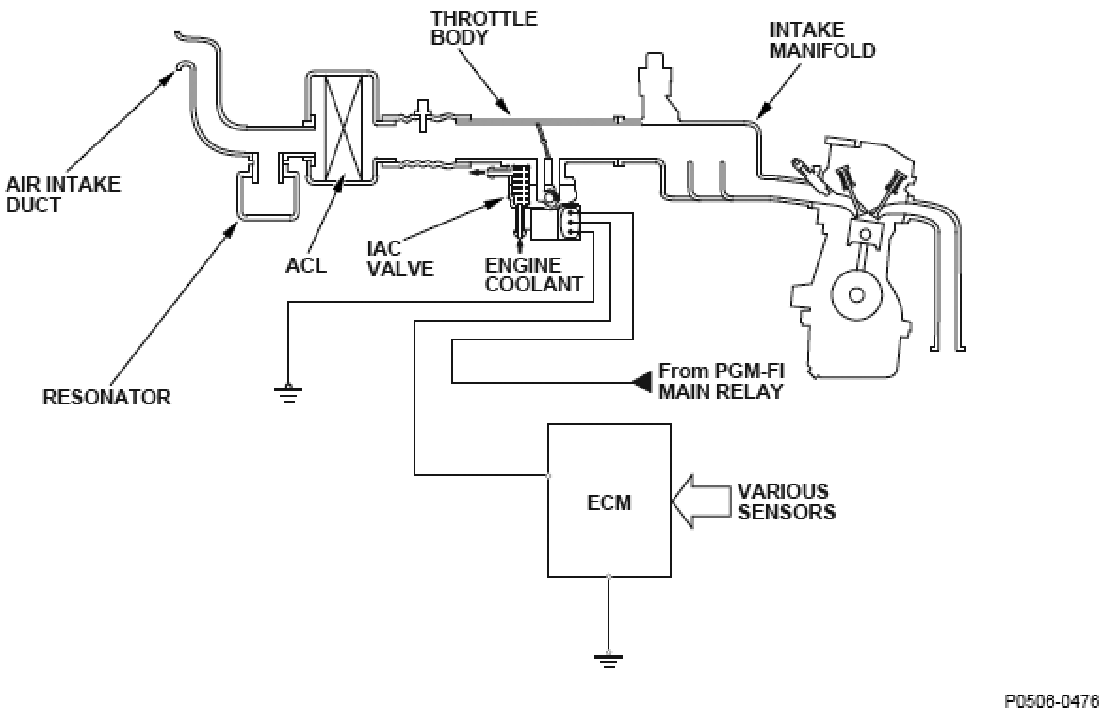


Fig. 91: Idle Control System RPM Lower Than Expected - System Diagram

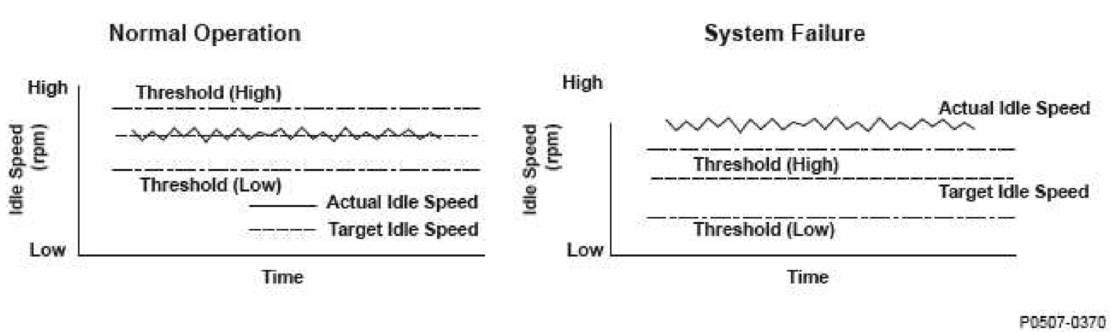


Fig. 92: Idle Control System RPM - Graph

General Description

A target idle speed that meets the engine operating conditions (coolant temperature, A/C ON or OFF, etc.) is stored in the engine control module (ECM). The ECM monitors and controls the idle speed so that the actual idle speed is equal to the target idle speed. If the actual idle speed varies beyond a specified value from the target speed over a certain period of time, the ECM detects a malfunction in the idle speed control system and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Under the Enable Conditions
Sequence	None
Duration	20 seconds or more
DTC Type	Two drive cycles, MIL ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
Elapsed time after starting the engine	15 seconds	-
Engine coolant temperature	158°F (70°C)	-
Intake air temperature	20°F (-7°C)	-
Atmospheric pressure (1)	67 kPa (500 mmHg, 20.0 in.Hg)	-
Fuel trim	0.65	1.47
Battery voltage	10.53 V	-
Fuel feedback	Closed loop	
Throttle position	Fully closed	
No active DTCs	ECM, MAP, ECT, TP, IAT, EGR, BARO, IAC, VSS, VTEC System, A/T System (1), Fuel System	
Others	At idle	
	The engine is under no load	
(1) CVT model		

Malfunction Threshold

The actual idle speed is at least 200 rpm greater than the target idle speed for at least 20 seconds.

Driving Pattern

1. Start the engine. Hold the engine at 3,000 rpm with no load (in park or neutral) until the radiator fan comes on.

2. Let the engine idle for at least 20 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the ECM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0511 (14): ADVANCED DIAGNOSTICS

DTC P0511: IDLE AIR CONTROL (IAC) VALVE CIRCUIT MALFUNCTION

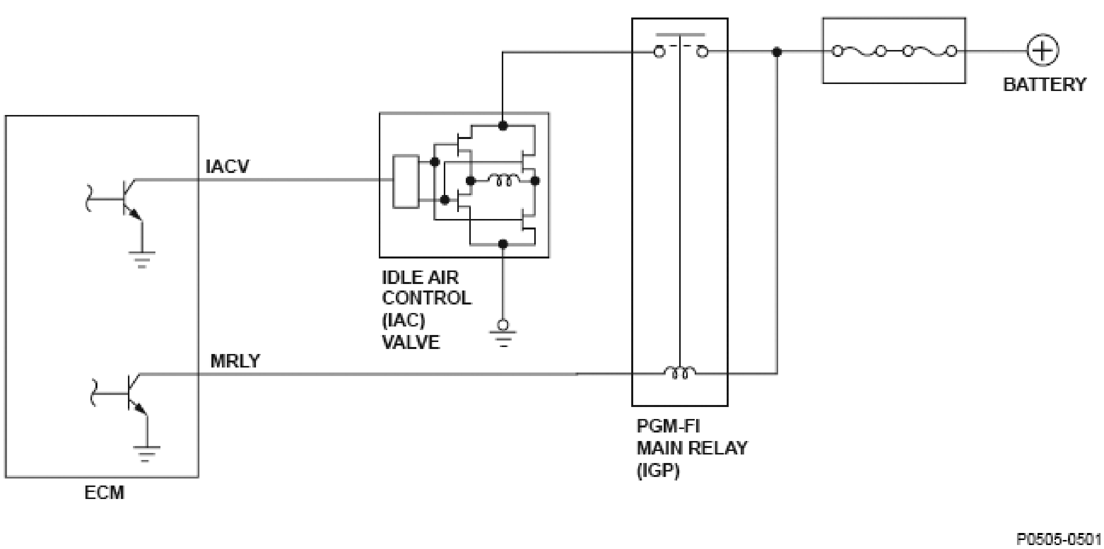


Fig. 93: Idle Air Control (IAC) Valve Circuit Malfunction - Circuit Diagram

General Description

The target idle speed is in the engine control module (ECM) memory for various engine conditions (coolant temperature, A/C operation, and other functions). The ECM keeps the actual idle speed at the target idle speed by switching the idle air control (IAC) valve ON/OFF to control the airflow. In addition, the IAC valve functions as the fast idle valve to control the speed according to the engine coolant temperature. If the duty cycle signals are not received by the circuit that checks return signals in the ECM, a malfunction is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	5 seconds or more
DTC Type	One drive cycle, MIL ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
Battery voltage	10.05 V	-
IAC valve duty value	5 %	95 %
State of the engine	Running	

Malfunction Threshold

The return circuit did not receive the duty signals from the ECM for at least 5 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0603 (0): ADVANCED DIAGNOSTICS (CVT)

DTC P0603: PROBLEM IN TRANSMISSION CONTROL MODULE (TCM)

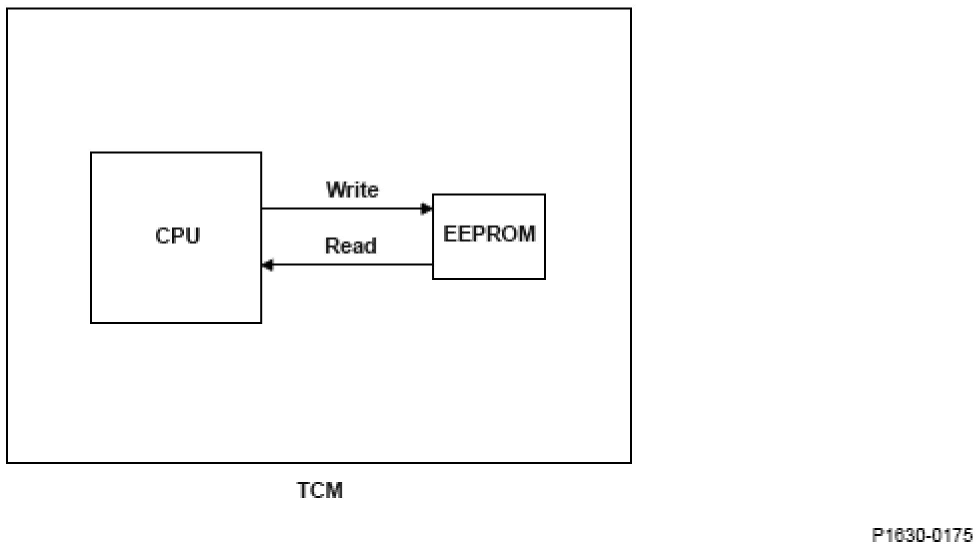


Fig. 94: Transmission Control Module (TCM) - Communication Diagram

General Description

The electronically erasable programmable read-only memory (EEPROM) in the transmission control module (TCM) can read data to/from its memory. This memory also can hold data even after the battery is disconnected. If an abnormality in the data read from the EEPROM occurs a set number of times, the CPU detects a malfunction and stores a DTC.

MONITOR DESCRIPTION CHART

Execution	Once per driving cycle
Sequence	None
Duration	60 seconds or less
DTC Type	One drive cycle, MIL ON, D indicator blinks

ENABLE CONDITIONS CHART

Condition	
Ignition switch	ON
Other	When disconnecting and reconnecting the battery

Malfunction Threshold

One of these conditions occurs.

- The results of the retrieved data stored in the EEPROM do not coincide.
- The sum check result of the retrieved data from the EEPROM is no good.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0607 (0): ADVANCED DIAGNOSTICS

DTC P0607: ENGINE CONTROL MODULE (ECM) INTERNAL CIRCUIT MALFUNCTION

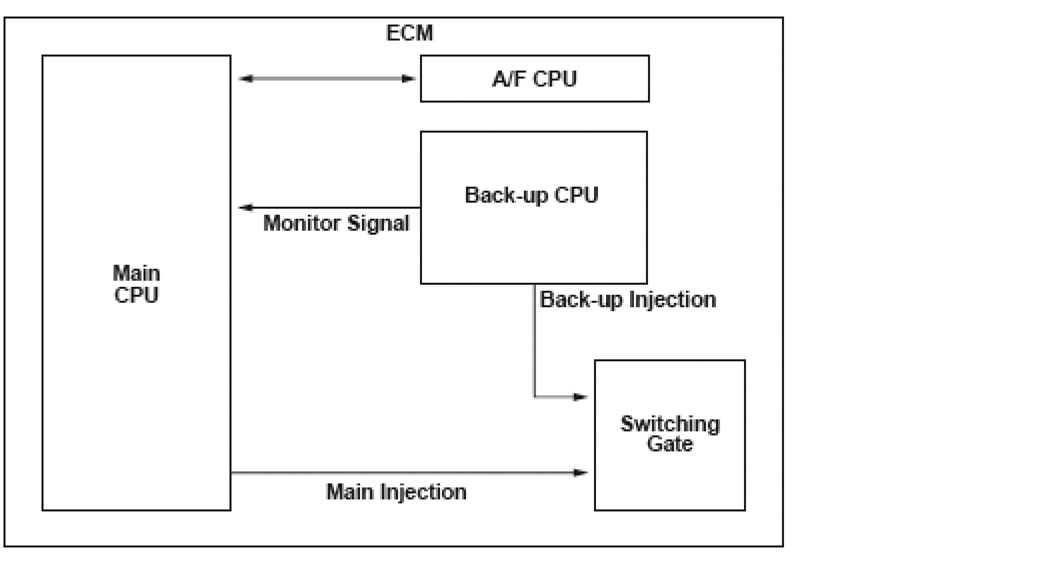


Fig. 95: Engine Control Module (ECM) Internal - Communication Diagram

General Description

If something is wrong in the engine control module (ECM), and there is a loss of monitor signals from the back-up CPU, or the communication signals from the A/F CPU are abnormal for a set time period, or an abnormality in the communication signals occurs a set number of times continuously, a malfunction is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	5 seconds or more
DTC Type	One drive cycle, MIL ON

ENABLE CONDITIONS CHART

Condition	
Ignition switch	ON

Malfunction Threshold

One of the following conditions must be met.

- No signal from the back-up CPU is detected for at least 5 seconds.
- An abnormality in the A/F CPU lasts for at least 5 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0630 (139): ADVANCED DIAGNOSTICS

DTC P0630: VIN NOT PROGRAMMED OR MISMATCH

General Description

When the VIN information is not registered in the EEPROM, the main CPU detects a malfunction and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Once per driving cycle
Sequence	None
Duration	-
DTC Type	One drive cycle, MIL ON

ENABLE CONDITIONS CHART

Condition	
Ignition switch	ON

Malfunction Threshold

The VIN information is not registered in the EEPROM.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool

Clear command or by disconnecting the battery.

DTC P0685 (135): ADVANCED DIAGNOSTICS

DTC P0685: ENGINE CONTROL MODULE (ECM) POWER CONTROL CIRCUIT/INTERNAL CIRCUIT MALFUNCTION

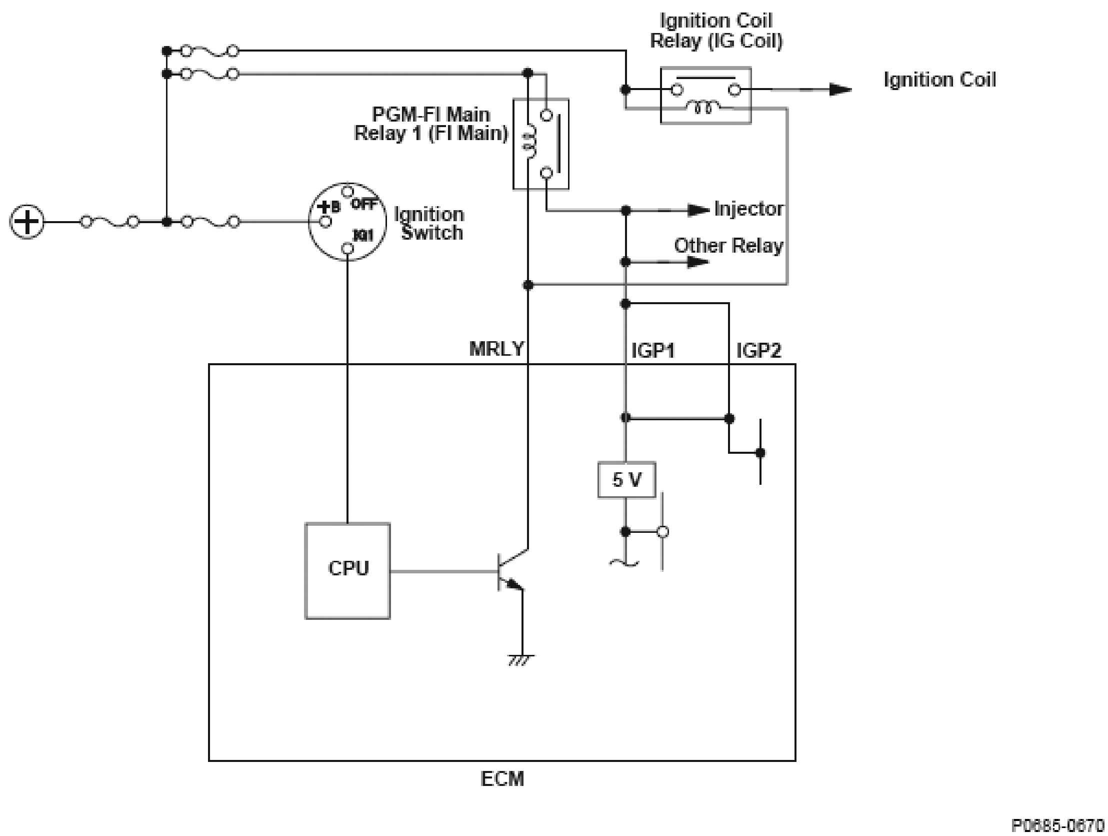


Fig. 96: Engine Control Module (ECM) Power Control Circuit - Circuit Diagram

General Description

After the ignition switch is turned off, the engine control module (ECM) does not shut down immediately. After finishing a predetermined process according to the request of each device and system, the power supply is automatically disconnected (self shut-down function). The ECM power is disconnected by controlling PGM-FI main relay 1 (FI MAIN).

During a normal ECM shut down, the shut down process is executed by the CPU, PGM-FI main relay 1 (FI MAIN) is turned off, and the voltage to the ECM is turned off to shut down the ECM. When the voltage to the ECM is turned off and the ECM shuts down without the normal shut down procedure, a malfunction in the PGM-FI main relay 1 (FI MAIN) control circuit is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	1 second or less
DTC Type	Two drive cycles, MIL ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
Engine Speed	400 rpm	-

Malfunction Threshold

The ECM is shut down without the normal shut down procedure.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the ECM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive drive cycles in which the engine conditions are similar to the first time the malfunction was detected.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0700 (70): ADVANCED DIAGNOSTICS (CVT)

DTC P0700: AUTOMATIC TRANSAXLE SYSTEM

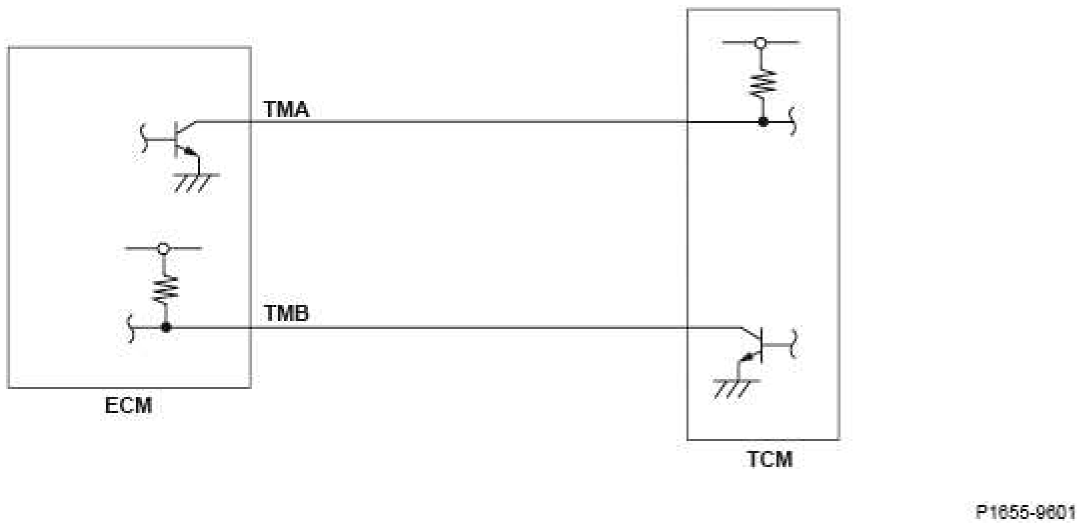


Fig. 97: Automatic Transaxle System - Circuit Diagram

General Description

This DTC is used to determine if a malfunction is on the engine side or the A/T side when checking with the HDS. When a device on the A/T side malfunctions, the transmission control module (TCM) signals the engine control module (ECM) to turn on the MIL. If the ECM receives a signal from the TCM to turn on the MIL, the MIL is turned on and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	-
DTC Type	One drive cycle, MIL ON

ENABLE CONDITIONS CHART

Condition	
Ignition switch	ON
No active DTCs	A/T System

Malfunction Threshold

It depends on the "Enable Conditions" on A/T side.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs. The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0705 (5): ADVANCED DIAGNOSTICS (CVT)

DTC P0705: SHORT IN TRANSMISSION RANGE SWITCH CIRCUIT (MULTIPLE SHIFT-POSITION INPUT)

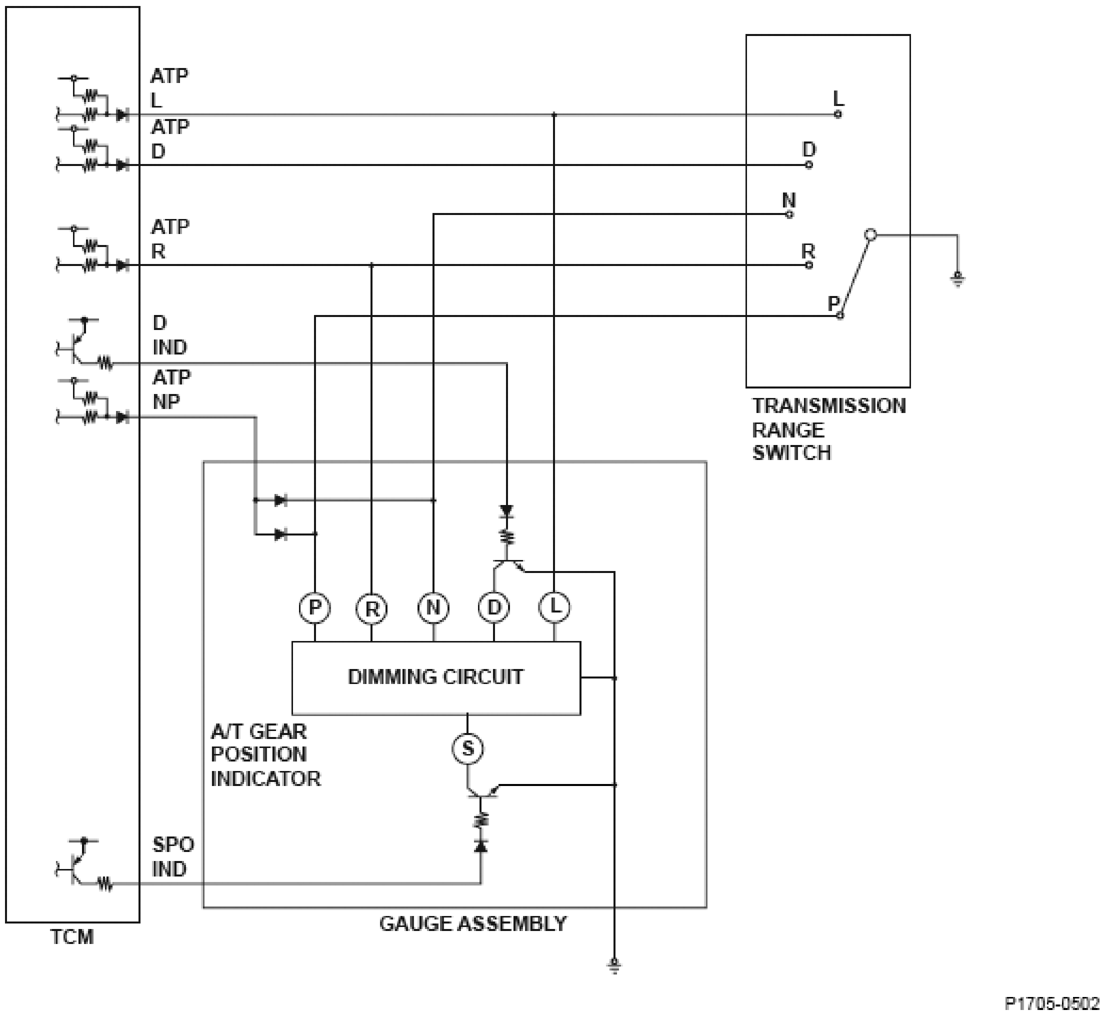


Fig. 98: Short In Transmission Range Switch Circuit (Multiple Shift-Position Input) - Circuit Diagram

TRANSMISSION RANGE SWITCH SPECIFICATION

Shift lever position	Input per switch				
	P	R	N	D	L
P	O	X	X	X	X
R	X	O	X	X	X
N	X	X	O	X	X
D	X	X	X	O	X
L	X	X	X	X	O
O: Closed X: Open					

General Description

The transmission range switch is attached to the control shaft. Operating the shift lever makes the control shaft rotate via the shift cable. The A/T gear position indicator indicates which position is selected according to the five Low/High signal combinations which vary based on the control shaft rotational angle. The control shaft changes the position of the transmission range switch, activates the manual valve, and switches hydraulic pressure to shift the transmission through forward/neutral/reverse. The transmission range switch signal is used to determine the shift schedule. The voltage is 5 V (High) at the transmission control module (TCM) input terminal when each transmission range switch position is open, and it is 0 V (Low) when each switch is closed. If the TCM detects a different range switch input instead of the correct switch input (see) in the selected range at that time, it detects a malfunction and stores a DTC.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	1 second or more
DTC Type	One drive cycle, MIL ON, D indicator blinks

ENABLE CONDITIONS CHART

Condition	
Ignition switch	ON

Malfunction Threshold

Two or more contact points of the transmission range switch stay ON for at least 1 second.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0706 (6): ADVANCED DIAGNOSTICS (CVT)

DTC P0706: OPEN IN TRANSMISSION RANGE SWITCH CIRCUIT

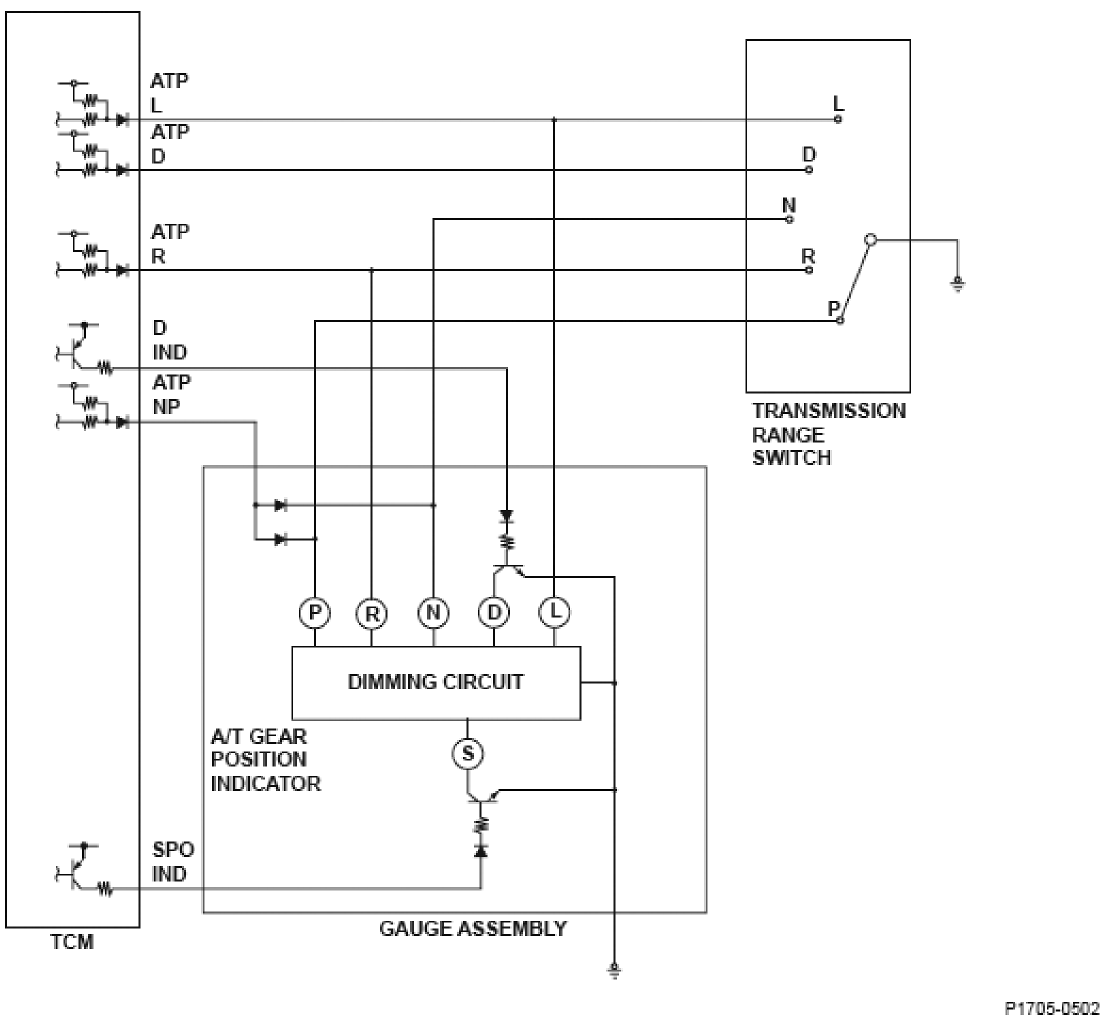


Fig. 99: Short In Transmission Range Switch Circuit (Multiple Shift-Position Input) - Circuit Diagram

TRANSMISSION RANGE SWITCH SPECIFICATION

	Input per switch

Shift lever position	P	R	N	D	L
P	O	X	X	X	X
R	X	O	X	X	X
N	X	X	O	X	X
D	X	X	X	O	X
L	X	X	X	X	O
O: Closed X: Open					

General Description

The transmission range switch is attached to the control shaft. Operating the shift lever makes the control shaft rotate via the shift cable. The A/T gear position indicator indicates which position is selected according to the five Low/High signal combinations which vary based on shift lever position. The control shaft changes the position of the transmission range switch, activates the manual valve, and switches hydraulic pressure to shift the transmission through forward/neutral/reverse. The transmission range switch signal is used to determine the shift schedule. The voltage is 5 V (High) at the transmission control module (TCM) input terminal when each transmission range switch position is open, and it is 0 V (Low) when each switch is closed. If the D switch stays open while the vehicle repeatedly accelerates to a specified vehicle speed and then stops despite being in D position, the TCM detects a malfunction in the transmission range switch (open) and stores a DTC.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	Depending on the driving pattern
DTC Type	Two drive cycles, MIL ON, D indicator OFF

ENABLE CONDITIONS CHART

Condition	
Shift lever position	D

Malfunction Threshold

The D switch is open during acceleration or deceleration.

Driving Pattern

1. Start the engine, and accelerate to a speed of 32 mph (50 km/h) or more in D position.
2. Decelerate to a speed of 6 mph (10 km/h) or less in D position.

- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the ECM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0716 (34): ADVANCED DIAGNOSTICS (CVT)

DTC P0716: RANGE/PERFORMANCE PROBLEM IN CVT INPUT SHAFT (DRIVE PULLEY) SPEED SENSOR CIRCUIT

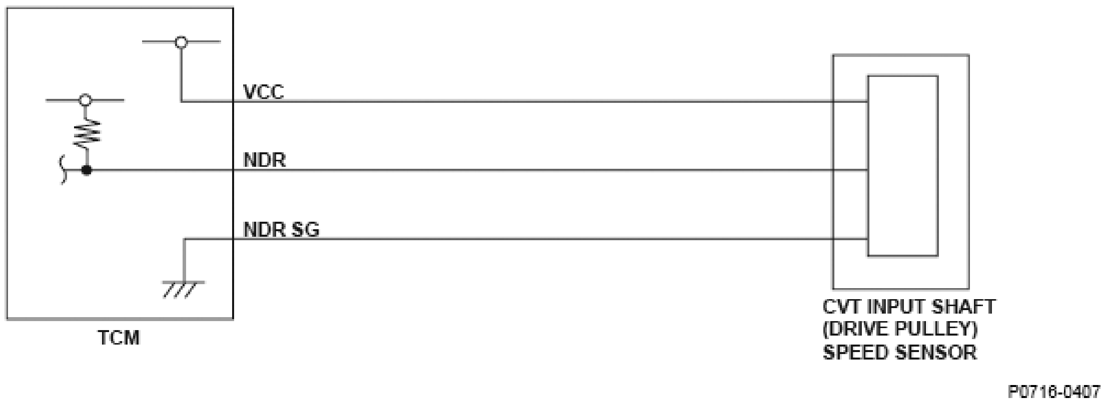


Fig. 100: Range/Performance Problem In CVT Input Shaft (Drive Pulley) Speed Sensor Circuit - Circuit Diagram

General Description

The CVT input shaft (drive pulley) speed sensor detects the number of revolutions of the gear on the drive pulley and sends a pulsing signal to the transmission control module (TCM). The TCM converts the pulsing signal into drive pulley speed. In addition, the TCM converts the engine ignition signal into the engine speed signal.

If the drive pulley speed is lower than the value that is estimated based on the engine speed in D, L, or R position, a malfunction in the CVT input shaft (drive pulley) speed sensor is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	15 seconds or more
DTC Type	One drive cycle, MIL ON, D indicator blinks

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
Engine speed	576 rpm	-
Driven pulley speed	128 rpm	-
Shift lever position	D, L, or R	

No active DTCs	Transmission range switch, CVT output shaft (driven pulley) speed sensor, Engine RPM signal input circuit

Malfunction Threshold

The drive pulley speed < the engine speed estimated by the TCM by a factor of 0.53 for at least 15 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0717 (34): ADVANCED DIAGNOSTICS (CVT)

DTC P0717: PROBLEM IN CVT INPUT SHAFT (DRIVE PULLEY) SPEED SENSOR CIRCUIT (NO SIGNAL INPUT)

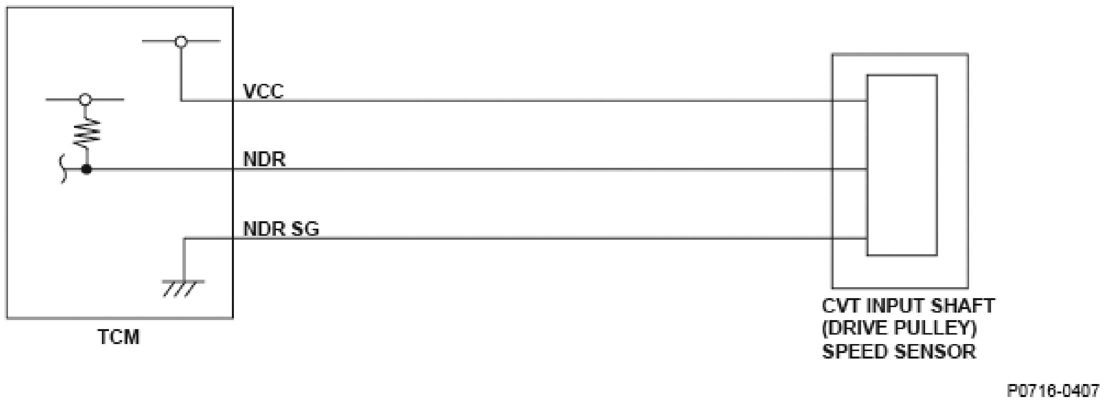


Fig. 101: Range/Performance Problem In CVT Input Shaft (Drive Pulley) Speed Sensor Circuit - Circuit Diagram

General Description

The CVT input shaft (drive pulley) speed sensor detects the number of revolutions of the gear on the drive pulley and sends a pulsing signal to the transmission control module (TCM).

When the shift lever is in D, L, or R, and the engine speed is at a specified value or more while there is no input signal from the CVT input shaft (drive pulley) speed sensor, a malfunction is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	15 seconds or more
DTC Type	One drive cycle, MIL ON, D indicator blinks

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
Engine speed	576 rpm	-
Driven pulley speed	128 rpm	-
Shift lever position	D, L, or R	
No active DTCs	Transmission range switch, CVT output shaft (driven pulley) speed sensor, Engine RPM signal input circuit	

Malfunction Threshold

The drive pulley speed is 128 rpm or less for at least 15 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0721 (35): ADVANCED DIAGNOSTICS (CVT)

DTC P0721: RANGE/PERFORMANCE PROBLEM IN CVT OUTPUT SHAFT (DRIVEN PULLEY) SPEED SENSOR CIRCUIT

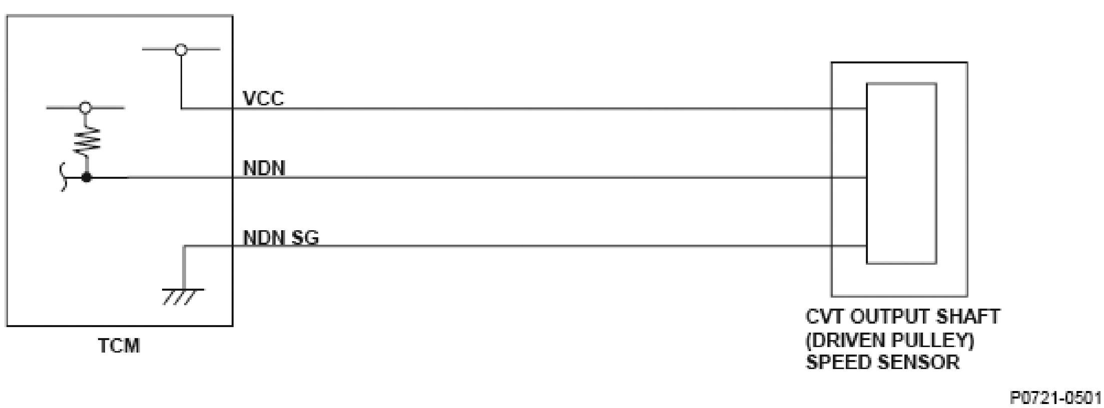


Fig. 102: Range/Performance Problem In CVT Output Shaft (Driven Pulley) Speed Sensor Circuit - Circuit Diagram

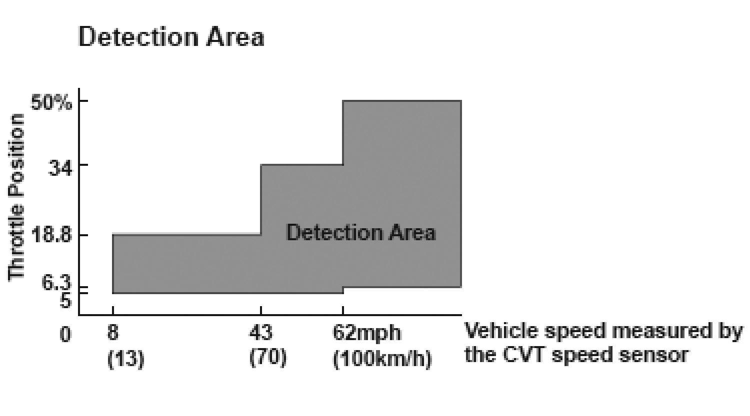


Fig. 103: Throttle Position Graph

General Description

The CVT output shaft (driven pulley) speed sensor detects the number of revolutions of the gear on the driven pulley and sends a pulsing signal to the transmission control module (TCM). The TCM converts the pulsing signal into the driven pulley speed.

When the shift lever is in D or L and the number of revolutions of the driven pulley is lower than the specified ratio of the secondary gear shaft speed (the number of revolutions equivalent to the driven pulley shaft calculated from the CVT speed sensor), a malfunction of the CVT output shaft (driven pulley) speed sensor is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	10 seconds or more
DTC Type	One drive cycle, MIL ON, D indicator blinks

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
Engine speed	576 rpm	6,848 rpm
Shift lever position	D, or L	
No active DTCs	Vehicle speed sensor, Transmission range switch, Shift control system, Start clutch control system, CVT drive pulley pressure control valve, CVT driven pulley pressure control valve, CVT start clutch pressure control valve, TP sensor	
Others	Both the vehicle speed measured by the vehicle speed sensor (VSS) and the vehicle speed measured by the CVT speed sensor are 8 mph (13 km/h) or more	
	Difference between the vehicle speed measured by the CTV speed sensor and the vehicle speed measured by the vehicle speed sensor (VSS) is 3mph (5 km/h) or less	
	The vehicle speed measured by the CVT speed sensor and the throttle position are in the Detection Area shown in the graph	

Malfunction Threshold

The driven pulley speed < the vehicle speed measured by the CVT speed sensor by a factor of 0.53 for at least 10 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0722 (35): ADVANCED DIAGNOSTICS (CVT)

DTC P0722: PROBLEM IN CVT OUTPUT SHAFT (DRIVEN PULLEY) SPEED SENSOR CIRCUIT (NO SIGNAL INPUT)

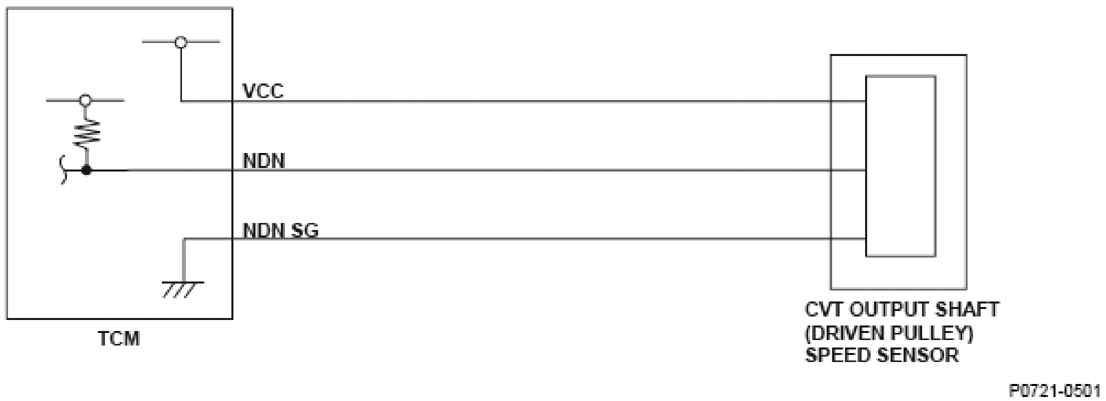
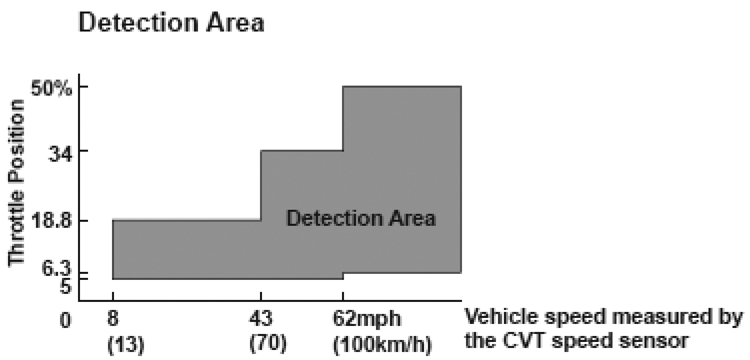


Fig. 104: Range/Performance Problem In CVT Output Shaft (Driven Pulley) Speed Sensor Circuit - Circuit Diagram



P1886-0570

Fig. 105: Throttle Position Graph

General Description

The CVT output shaft (driven pulley) speed sensor detects the number of revolutions of the gear on the driven pulley and sends a pulsing signal to the transmission control module (TCM). The TCM converts the pulsing signal into the driven pulley speed.

Pattern 1

If no signals from the CVT output shaft (driven pulley) speed sensor are detected at a set engine speed or more in D, L, or R, a malfunction in the CVT output shaft (driven pulley) speed sensor is detected and a DTC is stored.

Pattern 2

If no signals from the CVT output shaft (driven pulley) speed sensor are detected when driving the vehicle at a steady speed (a set value) within a set engine speed range in D or L (with the start clutch engaged), a malfunction in the CVT output shaft (driven pulley) speed sensor is detected, and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	5 seconds or more(1)
	10 seconds or more(2)

DTC Type	One drive cycle, MIL ON, D indicator blinks
(1) Pattern 1 (2) Pattern 2	

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
Engine speed	576 rpm	-
The vehicle speed measured by the vehicle speed sensor	8 mph (13 km/h)	-
Shift lever position	D, L, or R	
No active DTCs	Vehicle speed sensor, Transmission range switch, Shift control system, Start clutch control system, CVT drive pulley pressure control valve, CVT driven pulley pressure control valve, CVT start clutch pressure control valve, TP sensor	
Other	Difference between engine speed and drive pulley speed is 256 rpm or less	

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
Engine speed	576 rpm	6,848 rpm
Shift lever position	D, L	
No active DTCs	TP, CVT speed sensor, TCM, Transmission range switch, CVT input shaft (drive pulley) speed sensor, Engine RPM signal input circuit, CVT start clutch pressure control valve, CVT drive pulley pressure control valve, CVT driven pulley pressure control valve	
	Both the vehicle speed measured by the vehicle speed sensor (VSS) and the vehicle speed measured by the CVT speed sensor	

Others	are 8 mph (13 km/h) or more
	Difference between the vehicle speed measured by the CVT speed sensor and the vehicle speed measured by the vehicle speed sensor (VSS) is 3mph (5 km/h) or less
	The vehicle speed measured by the CVT speed sensor and the throttle position are in the Detection Area shown in the graph

Malfunction Threshold

One of these conditions occurs.

- No signals from the CVT output shaft (driven pulley) speed sensor are detected for at least 15 seconds during Pattern 1.
- No signals from the CVT output shaft (driven pulley) speed sensor are detected for at least 10 seconds during Pattern 2.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0726 (11): ADVANCED DIAGNOSTICS (CVT)

DTC P0726: RANGE/PERFORMANCE PROBLEM IN ENGINE RPM SIGNAL INPUT CIRCUIT

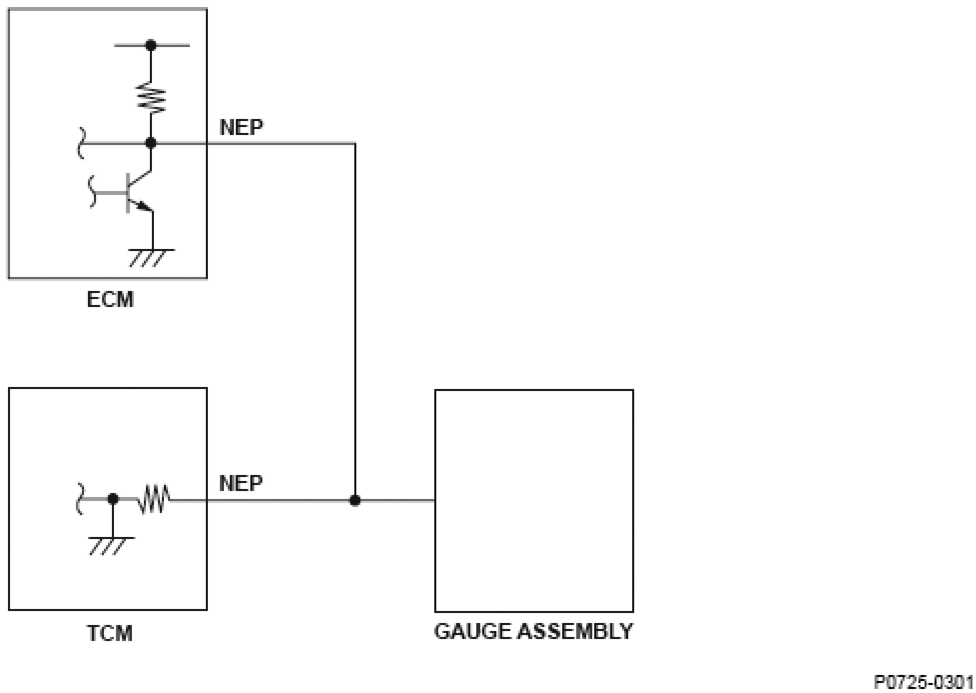


Fig. 106: Range/Performance Problem In Engine RPM Signal Input Circuit - Circuit Diagram

General Description

The transmission control module (TCM) converts the engine ignition signal into the engine speed signal. The CVT input shaft (drive pulley) speed sensor detects the number of revolutions of the gear on the drive pulley and outputs a pulsing signal to the TCM. The TCM converts the pulsing signal into the drive pulley speed. If the engine speed is lower than an estimated value based on the drive pulley speed when the shift lever is in D, L, or R, a malfunction is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	10 seconds or more
DTC Type	One drive cycle, MIL ON, D indicator blinks

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum

Drive pulley speed	576 rpm(1) 323 rpm(2)	-
Manifold absolute pressure	-	67 kPa (510 mmHg, 20.0 in.Hg)
Shift lever position	D, L, or R	
No active DTCs	Transmission range switch, CVT input shaft (drive pulley) speed sensor, CVT output shaft (driven pulley) speed sensor	
(1) D, L position (2) R position		

Malfunction Threshold

The drive pulley speed > the engine speed estimated by the TCM by a factor of 1.8 for at least 10 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0727 (11): ADVANCED DIAGNOSTICS (CVT)

DTC P0727: PROBLEM IN ENGINE RPM SIGNAL INPUT CIRCUIT (NO SIGNAL INPUT)

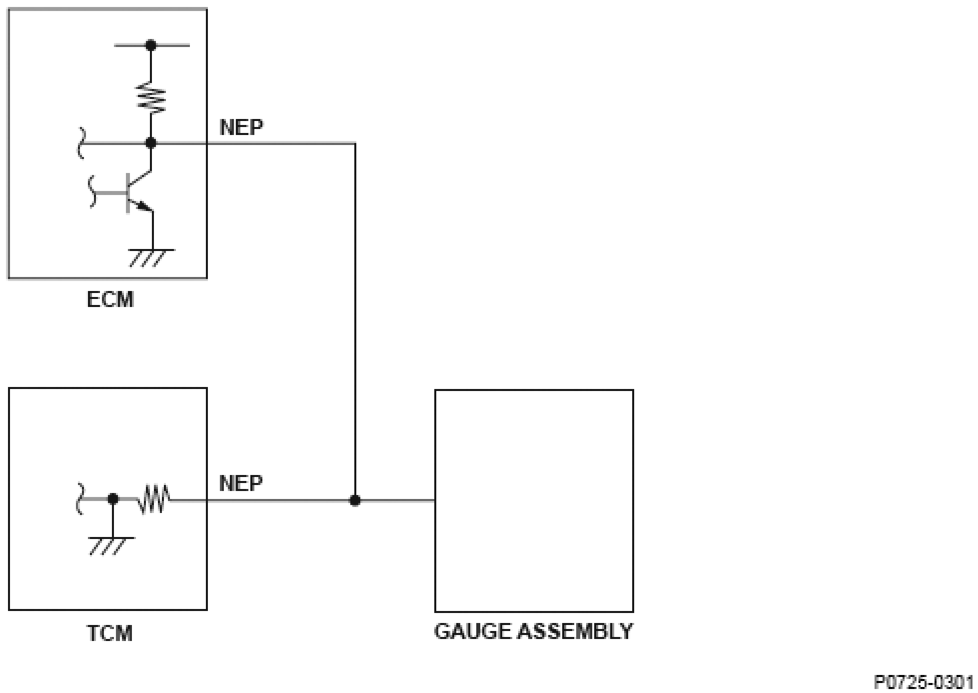


Fig. 107: Range/Performance Problem In Engine RPM Signal Input Circuit - Circuit Diagram

General Description

The transmission control module (TCM) converts the engine ignition signal into the engine speed signal. The CVT input shaft (drive pulley) speed sensor detects the number of revolutions of the gear on the drive pulley and outputs a pulsing signal to the TCM. The TCM converts the pulsing signal into the drive pulley speed.

When the shift lever is in D, L, or R, and at a specified value of the drive pulley speed or more, and there is no engine speed signal input, a malfunction is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	10 seconds or more
DTC Type	One drive cycle, MIL ON, D indicator blinks

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
Drive pulley speed	576 rpm[1]	-
	323 rpm[2]	
Manifold absolute pressure	-	67 kPa (510 mmHg, 20.0 in.Hg)
Shift lever position	D, L, or R	
No active DTCs	Transmission range switch, CVT input shaft (drive pulley) speed sensor, CVT output shaft (driven pulley) speed sensor	

(1) D, L position

(2) R position

Malfunction Threshold

The engine speed is 128 rpm or less for at least 10 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0780 (42): ADVANCED DIAGNOSTICS (CVT)

DTC P0780: PROBLEM IN SHIFT CONTROL SYSTEM

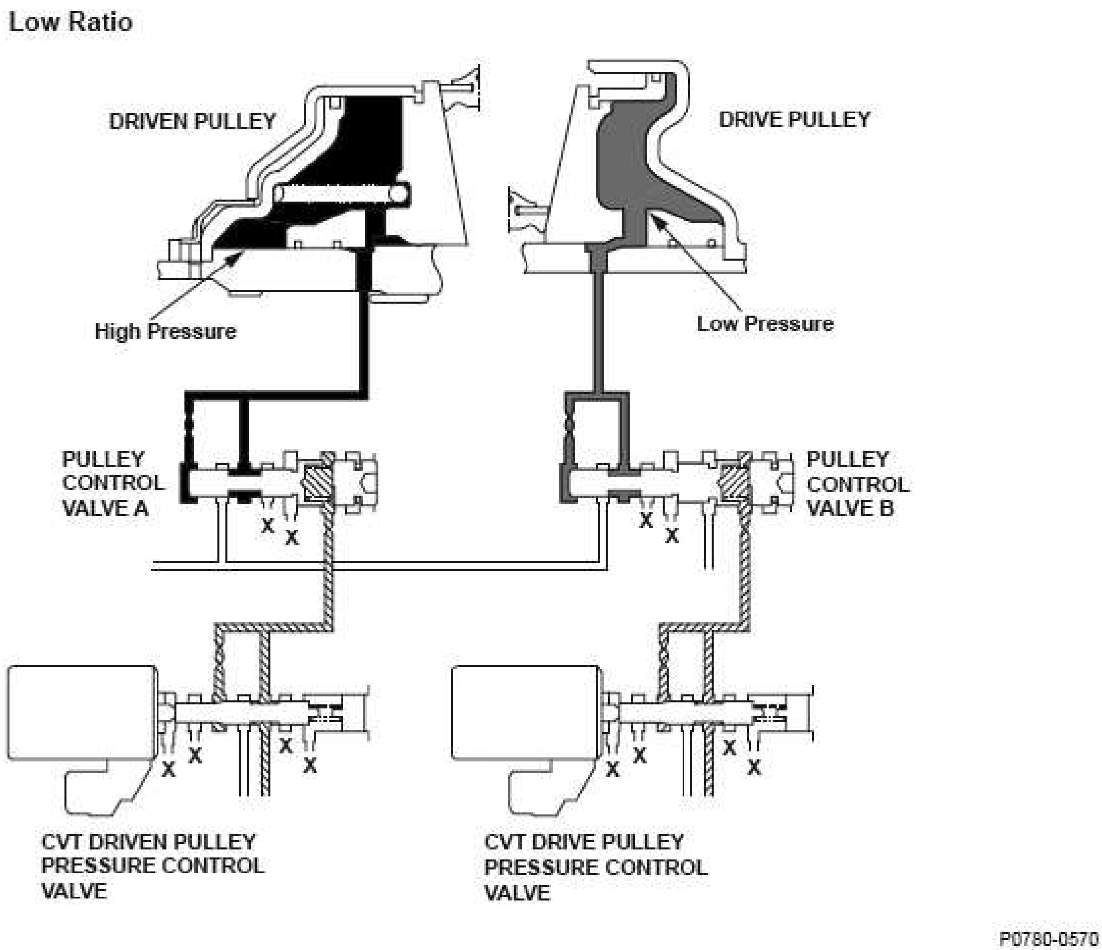


Fig. 108: Shift Control System Diagram - Low Ratio

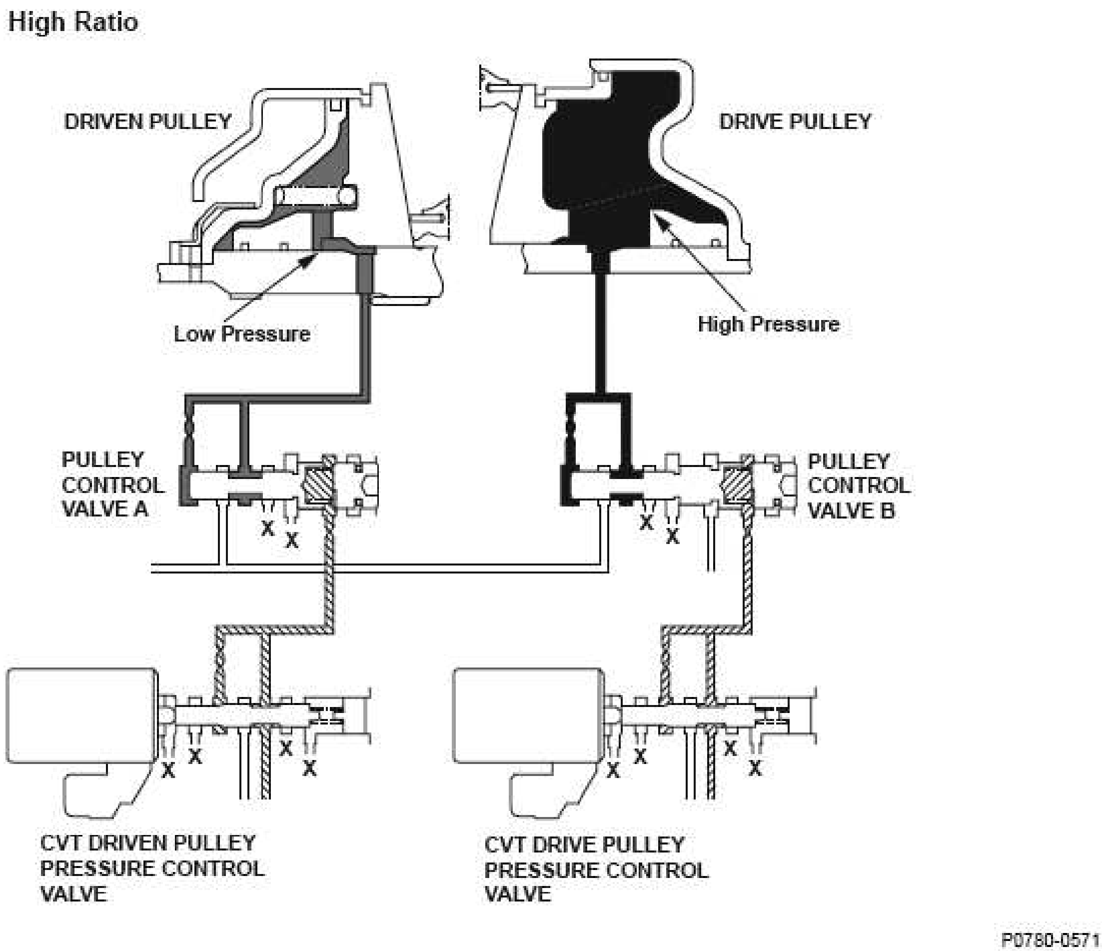


Fig. 109: Shift Control System Diagram - High Ratio

General Description

The shift control system controls shifts based on gear position and on the map previously stored in the engine control module (ECM) memory. The shift control system is also designed to activate the CVT drive pulley pressure control valve and the CVT driven pulley pressure control valve according to the vehicle speed and the throttle position so the engine speed becomes equal to the target value. The pulley hydraulic pressure in the low and high pressure circuits is applied via pulley control valves A and B, and differential pressure between the low and high pressure at each of the drive and driven pulleys is generated. By changing the pulley ratio by the differential pressure, the shift control system gives feedback of the difference between the target and actual engine speed. It supplies high hydraulic pressure to the driven pulley and increases the driven pulley belt diameter when shifting to a lower ratio. It supplies high hydraulic pressure to the drive pulley and increases the drive pulley belt diameter when shifting to a higher ratio.

If the difference between the target engine rpm and the actual engine rpm is a specified value or more and this condition continues for a set time or more, a malfunction is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	13 seconds or more
DTC Type	One drive cycle, MIL ON, D indicator blinks

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
Engine speed	600 rpm	-
Throttle position	4.6°	-
Throttle position variation	-	89°/1 second
Vehicle speed measured by CVT speed sensor	8 mph (13 km/h)	-
Shift lever position	D, L, or R	
No active DTCs	Transmission range switch, CVT input shaft (drive pulley) speed sensor, CVT output shaft (driven pulley) speed sensor, Engine RPM signal input circuit, Start clutch control system, CVT drive pulley pressure control valve, CVT driven pulley pressure control valve, CVT start clutch pressure control valve, TP sensor, CVT speed sensor	
Other	Difference between the engine speed and the drive pulley speed is 256 rpm or less	

Malfunction Threshold

The Difference between the target engine rpm and the actual engine rpm is 500 rpm or more for at least 13 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0811 (43): ADVANCED DIAGNOSTICS (CVT)

DTC P0811: PROBLEM IN START CLUTCH CONTROL SYSTEM

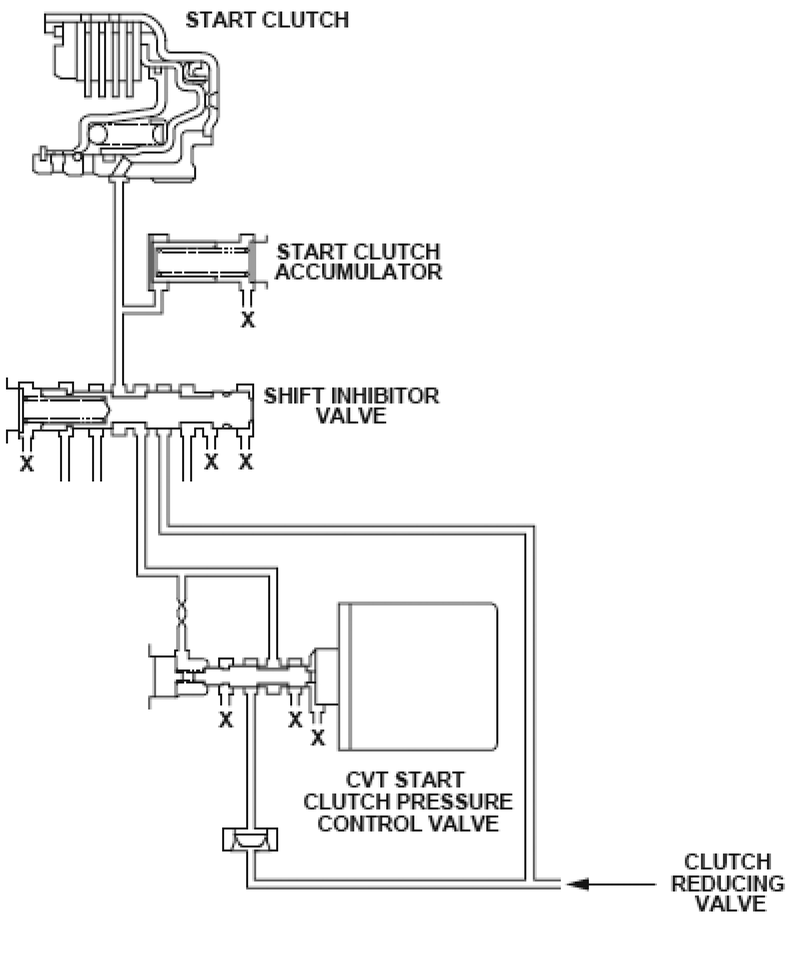


Fig. 110: Start Clutch Control System Diagram

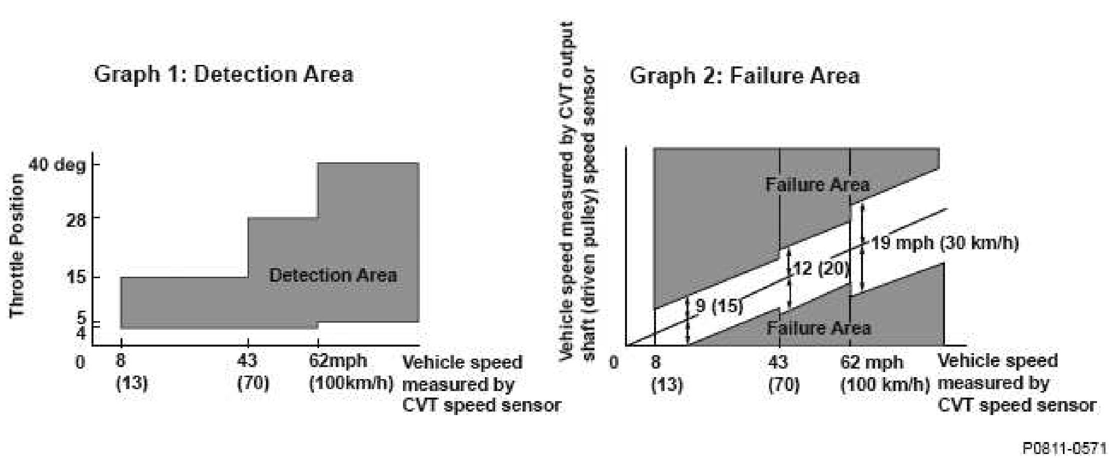


Fig. 111: Throttle Position Graph

General Description

The start clutch control system controls the clutch piston hydraulic pressure that affects the amount of power transmitted by the multiplate wet start clutch on the driven pulley shaft. According to the vehicle operating conditions, the engine control module (ECM) activates the CVT start clutch pressure control valve to control the hydraulic pressure that is applied to the start clutch piston. The start clutch control system detects clutch slip. If the difference between the vehicle speed measured by the CVT output shaft (driven pulley) speed sensor and the one measured by the CVT speed sensor is excessive when driving under certain conditions, a malfunction is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	10 seconds or more
DTC Type	One drive cycle, MIL ON, D indicator blinks

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
Vehicle speed measured by the CVT speed sensor	8 mph (13 km/h)	-
Engine speed	580 rpm	-
Shift lever position	D, L	
No active DTCs	Vehicle speed sensor, Transmission range switch, CVT input shaft (drive pulley) speed sensor, CVT output shaft (driven pulley) speed sensor, Engine RPM signal input circuit, Shift control system, CVT drive pulley pressure control valve, CVT driven pulley pressure control valve, CVT start clutch pressure control valve, TP sensor, CVT speed sensor	
Others	The vehicle speed measured by the CVT speed sensor is equal to the vehicle speed measured by the vehicle speed sensor (VSS)	

	Both the vehicle speed measured by the CVT speed sensor and the throttle position are in the Detection Area shown in Graph 1

Malfunction Threshold

The deviation in vehicle speed measured by the CVT speed sensor and the CVT output shaft (driven pulley) speed sensor is in the Failure Area shown in Graph 2 for at least 10 seconds when the relationship between the vehicle speed measured by the CVT speed sensor and the throttle position is as shown in Graph 1.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0962 (38): ADVANCED DIAGNOSTICS (CVT)

DTC P0962: CVT DRIVE PULLEY PRESSURE CONTROL VALVE CIRCUIT LOW VOLTAGE

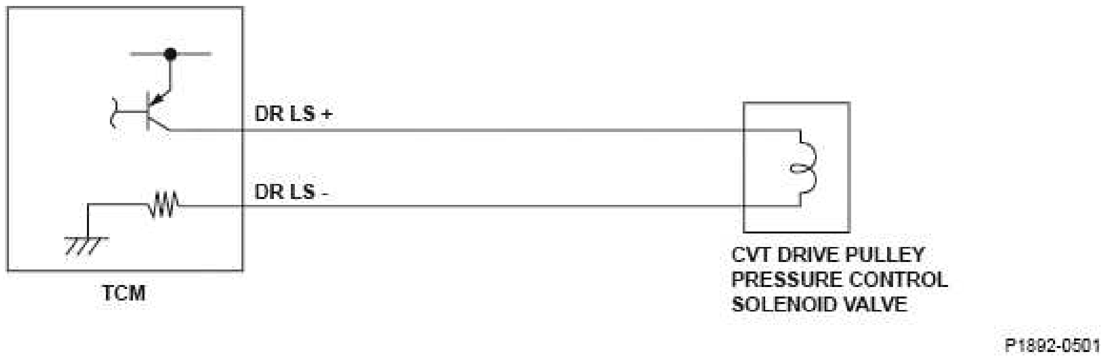


Fig. 112: CVT Drive Pulley Pressure Control Valve Circuit Circuit Diagram

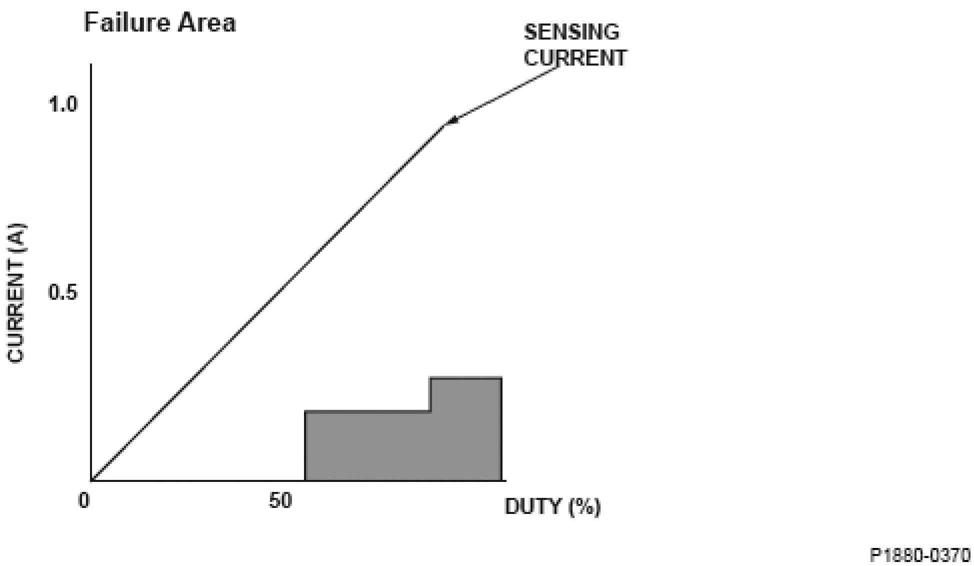


Fig. 113: CVT Drive Pulley Pressure Control Valve Current Graph

General Description

The CVT drive pulley pressure control solenoid valve controls hydraulic pressure to the drive pulley. The spool in the linear solenoid moves the valve by duty cycle, and produces hydraulic pressure in proportion to the current. The CVT drive pulley pressure control solenoid valve measures the current that passes through the linear solenoid and uses feedback control to compensate for the difference between the measured current and the commanded one. If the measured current is not equal to the duty cycle command, a malfunction (open, short to ground) is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	1 second or more
DTC Type	One drive cycle, MIL ON, D indicator blinks

ENABLE CONDITIONS CHART

Condition	
State of the engine	Running

No active DTCs	CVT input shaft (drive pulley) speed sensor, CVT output shaft (driven pulley) speed sensor, Engine RPM signal input circuit, Shift control system, Start clutch control system, CVT driven pulley pressure control valve, CVT start clutch pressure control valve

Malfunction Threshold

The measured current for the TCM's command value is as specified here for at least 1 second.

MALFUNCTION THRESHOLD CHART

Duty (%)	Current (A)	Failure mode
56.5 - 90.0	0.18 or less	Low Input
90.1 or more	0.27 or less	Low Input

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0963 (38): ADVANCED DIAGNOSTICS (CVT)

DTC P0963: CVT DRIVE PULLEY PRESSURE CONTROL VALVE CIRCUIT HIGH VOLTAGE

Fig. 114: CVT Drive Pulley Pressure Control Valve Circuit Circuit Diagram

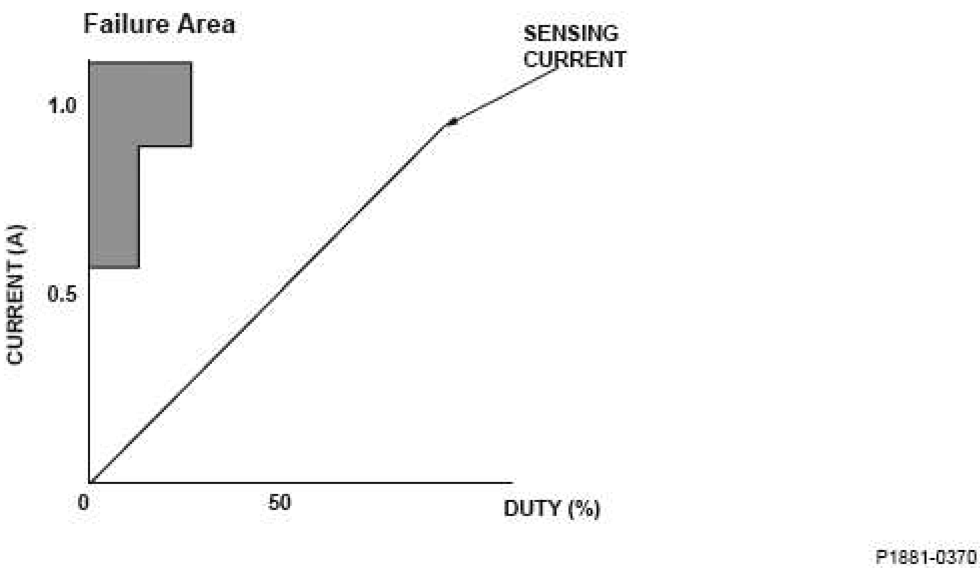


Fig. 115: CVT Drive Pulley Pressure Control Valve Current Graph

General Description

The CVT drive pulley pressure control solenoid valve controls hydraulic pressure to the drive pulley. The spool in the linear solenoid moves the valve by duty cycle, and produces hydraulic pressure in proportion to the current. The CVT drive pulley pressure control solenoid valve measures the current that passes through the linear solenoid and uses feedback control to compensate for the difference between the measured current and the commanded one. If the measured current is not equal to the duty cycle command, a malfunction (short to power on the plus terminal side of linear solenoid) is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	1 second or more
DTC Type	One drive cycle, MIL ON, D indicator blinks

ENABLE CONDITIONS CHART

Condition	
State of the engine	Running
No active DTCs	CVT input shaft (drive pulley) speed sensor, CVT output shaft (driven pulley) speed sensor, Engine RPM signal input circuit, Shift control system, Start clutch control system, CVT driven pulley pressure control valve, CVT start clutch pressure control valve

Malfunction Threshold

The measured current for the TCM's command value is as specified here for at least 1 second.

MALFUNCTION THRESHOLD CHART

Duty (%)	Current (A)	Failure mode
13.7 or less	0.58 or more	High Input
13.8 - 27.5	0.89 or more	High Input

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0966 (39): ADVANCED DIAGNOSTICS (CVT)

DTC P0966: CVT DRIVEN PULLEY PRESSURE CONTROL VALVE CIRCUIT LOW VOLTAGE

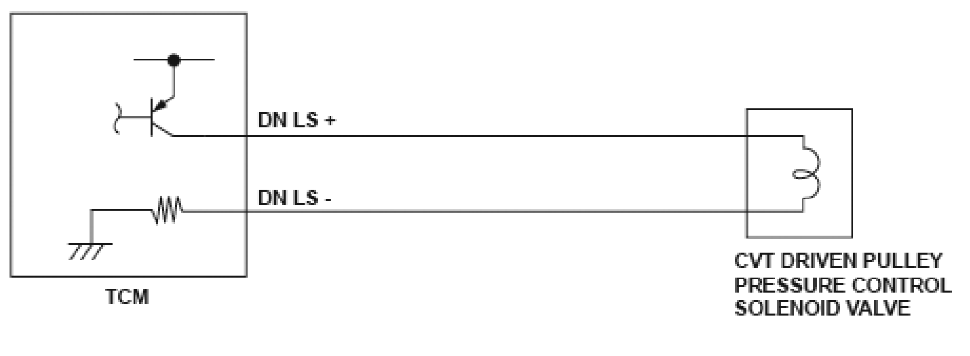


Fig. 116: CVT Driven Pulley Pressure Control Valve Circuit Circuit Diagram

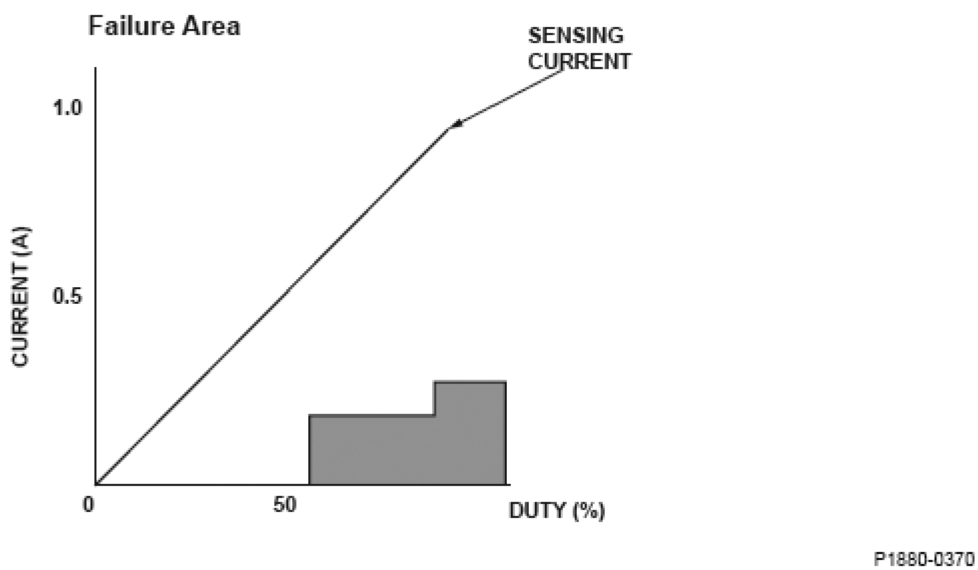


Fig. 117: CVT Drive Pulley Pressure Control Valve Current Graph

General Description

The CVT driven pulley pressure control solenoid valve controls hydraulic pressure to the driven pulley. The spool in the linear solenoid moves the valve by duty cycle, and produces hydraulic pressure in proportion to the current. The CVT driven pulley pressure control solenoid valve measures the current that passes through the linear solenoid and uses feedback control to compensate for the difference between the measured current and the commanded one. If the measured current is not equal to the duty cycle command, a malfunction (open, short to ground) is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	1 second or more
DTC Type	One drive cycle, MIL ON, D indicator blinks

ENABLE CONDITIONS CHART

Condition	
State of the engine	Running
No active DTCs	CVT input shaft (drive pulley) speed sensor, CVT output shaft (driven pulley) speed sensor, Engine RPM signal input circuit, Shift control system, Start clutch control system, CVT drive pulley pressure control valve, CVT start clutch pressure control valve

Malfunction Threshold

The measured current for the TCM's command value is as specified here for at least 1 second.

MALFUNCTION THRESHOLD CHART

Duty (%)	Current (A)	Failure mode
56.5 - 90.0	0.18 or less	Low Input
90.1 or more	0.27 or less	Low Input

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0967 (39): ADVANCED DIAGNOSTICS (CVT)

DTC P0967: CVT DRIVEN PULLEY PRESSURE CONTROL VALVE CIRCUIT HIGH VOLTAGE

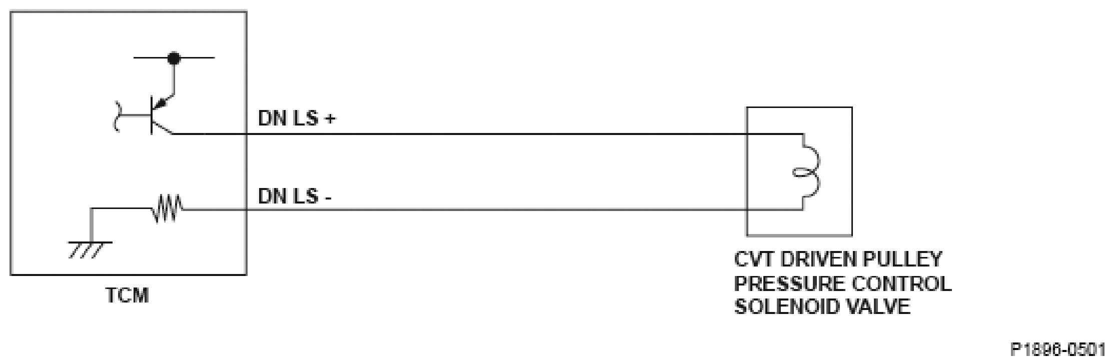


Fig. 118: CVT Driven Pulley Pressure Control Valve Circuit Circuit Diagram

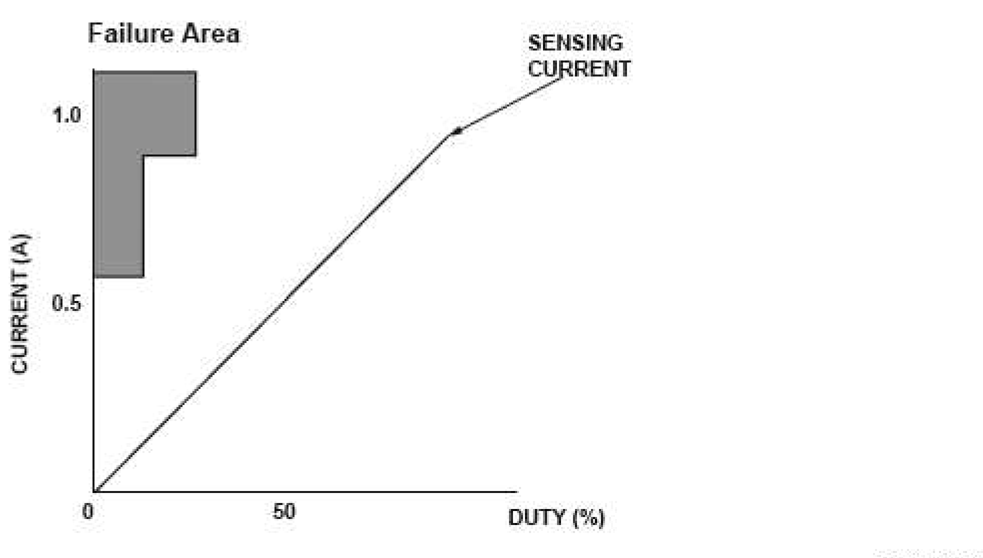


Fig. 119: CVT Drive Pulley Pressure Control Valve Current Graph

General Description

The CVT driven pulley pressure control solenoid valve controls hydraulic pressure to the driven pulley. The spool in the linear solenoid moves the valve by duty cycle, and produces hydraulic pressure in proportion to the current. The CVT driven pulley pressure control solenoid valve measures the current that passes through the linear solenoid and uses feedback control to compensate for the difference between the measured current and the commanded one. If the measured current is not equal to the duty cycle command, a malfunction (short to power on the plus terminal side of linear solenoid) is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	1 second or more
DTC Type	One drive cycle, MIL ON, D indicator blinks

ENABLE CONDITIONS CHART

Condition	
State of the engine	Running
No active DTCs	CVT input shaft (drive pulley) speed sensor, CVT output shaft (driven pulley) speed sensor, Engine RPM signal input circuit, Shift control system, Start clutch control system, CVT drive pulley pressure control valve, CVT start clutch pressure control valve

Malfunction Threshold

The measured current for the TCM's command value is as specified here for at least 1 second.

MALFUNCTION THRESHOLD CHART

Duty (%)	Current (A)	Failure mode
13.7 or less	0.58 or more	High Input
13.8 - 27.5	0.89 or more	High Input

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0970 (32): ADVANCED DIAGNOSTICS (CVT)

DTC P0970: CVT START CLUTCH PRESSURE CONTROL VALVE CIRCUIT LOW VOLTAGE

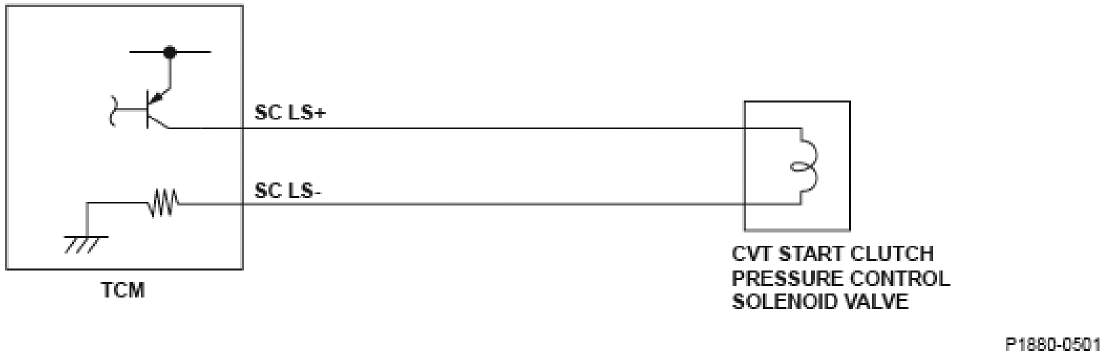


Fig. 120: CVT Start Clutch Pressure Control Valve Circuit Circuit Diagram

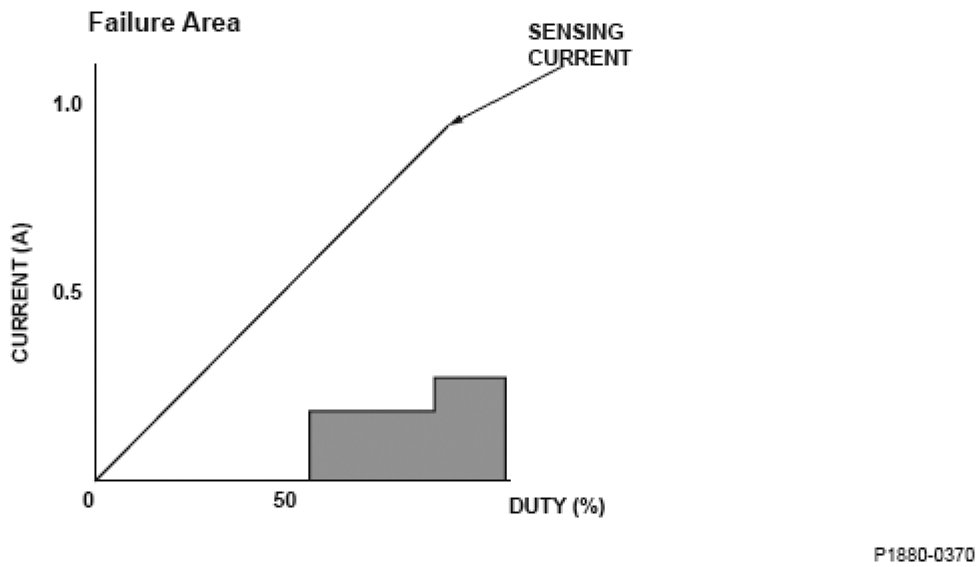


Fig. 121: CVT Drive Pulley Pressure Control Valve Current Graph

General Description

The CVT start clutch pressure control solenoid valve controls and optimizes clutch pressure (hydraulic pressure) for various driving conditions. The spool in the linear solenoid moves the valve by duty cycle, and produces hydraulic pressure in proportion to the current. The CVT start clutch pressure control solenoid valve measures the current that passes through the linear solenoid and uses feedback control to compensate for the difference between the measured current and the commanded one. If the measured current is not equal to the duty cycle command, a malfunction (open, short to ground) is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	1 second or more
DTC Type	One drive cycle, MIL ON, D indicator blinks

ENABLE CONDITIONS CHART

Condition	
State of the engine	Running

No active DTCs	CVT input shaft (drive pulley) speed sensor, CVT output shaft (driven pulley) speed sensor, Engine RPM signal input circuit, Shift control system, Start clutch control system, CVT drive pulley pressure control valve, CVT driven pulley pressure control valve

Malfunction Threshold

The measured current for the TCM's command value is as specified here for at least 1 second.

MALFUNCTION THRESHOLD CHART

Duty (%)	Current (A)	Failure mode
56.5 - 90.0	0.18 or less	Low Input
90.1 or more	0.27 or less	Low Input

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0971 (32): ADVANCED DIAGNOSTICS (CVT)

DTC P0971: CVT START CLUTCH PRESSURE CONTROL VALVE CIRCUIT HIGH VOLTAGE

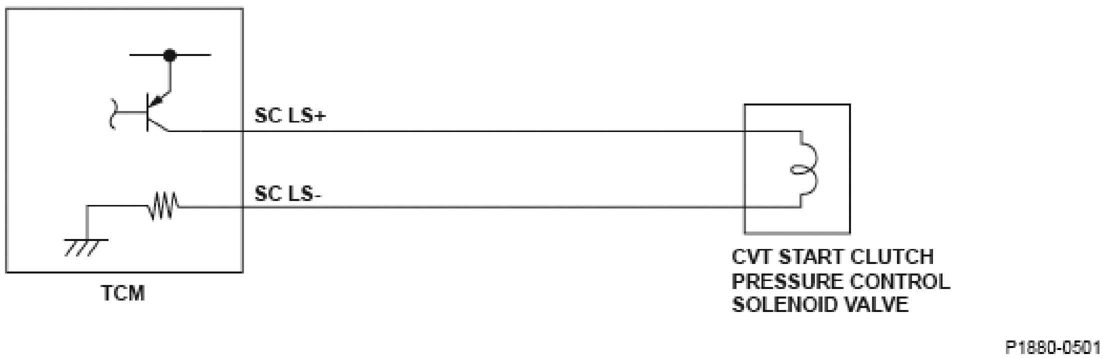


Fig. 122: CVT Start Clutch Pressure Control Valve Circuit Circuit Diagram

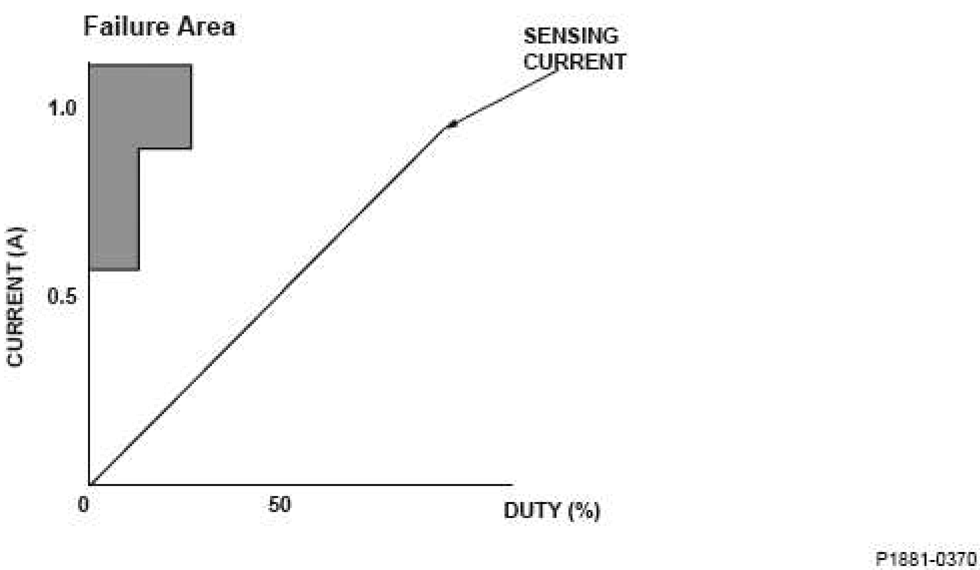


Fig. 123: CVT Drive Pulley Pressure Control Valve Current Graph

General Description

The CVT start clutch pressure control solenoid valve controls and optimizes clutch pressure (hydraulic pressure) for various driving conditions. The spool in the linear solenoid moves the valve by the duty cycle, and produces hydraulic pressure in proportion to the current. The CVT start clutch pressure control solenoid valve measures the current that passes through the linear solenoid and uses feedback control to compensate for the difference between the measured current and the commanded one. If the measured current is not equal to the duty cycle command, a malfunction (short to power on the plus terminal side of linear solenoid) is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	1 second or more
DTC Type	One drive cycle, MIL ON, D indicator blinks

ENABLE CONDITIONS CHART

Condition	
State of the engine	Running
No active DTCs	CVT input shaft (drive pulley) speed sensor, CVT output shaft (driven pulley) speed sensor, Engine RPM signal input circuit, Shift control system, Start clutch control system, CVT drive pulley pressure control valve, CVT driven pulley pressure control valve

Malfunction Threshold

The measured current for the TCM's command value is as specified here for at least 1 second.

MALFUNCTION THRESHOLD CHART

Duty (%)	Current (A)	Failure mode
13.7 or less	0.58 or more	High Input
13.8 - 27.5	0.89 or more	High Input

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0A3C (39): ADVANCED DIAGNOSTICS

DTC P0A3C (39): MOTOR DRIVE MODULE (MDM) OVERHEATING

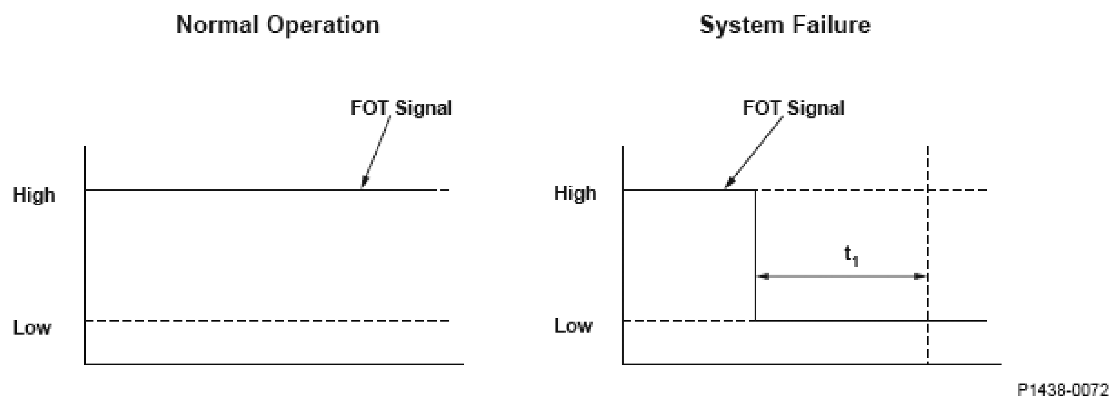


Fig. 124: Motor Drive Module (MDM) Overheating - Operation Graph

General Description

If the motor power inverter (MPI) module temperature increases when driving, the flag over temperature (FOT) signals from the MPI module change from a high voltage level to a low voltage level to trigger self-protection. If the FOT signals stay at a low voltage level for a set time (t1), the motor control module (MCM) detects a malfunction and stores a DTC.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	0.5 seconds or more
DTC Type	One drive cycle, MIL ON, IMA system indicator ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
MCM power-supply voltage	10.5 V	-
Ignition switch	ON	

No active DTCs	MCM

Malfunction Threshold

The FOT signals stay at a low voltage level for at least 0.5 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0A5E (24): ADVANCED DIAGNOSTICS

DTC P0A5E (24): MOTOR CURRENT U PHASE SIGNAL CIRCUIT LOW INPUT

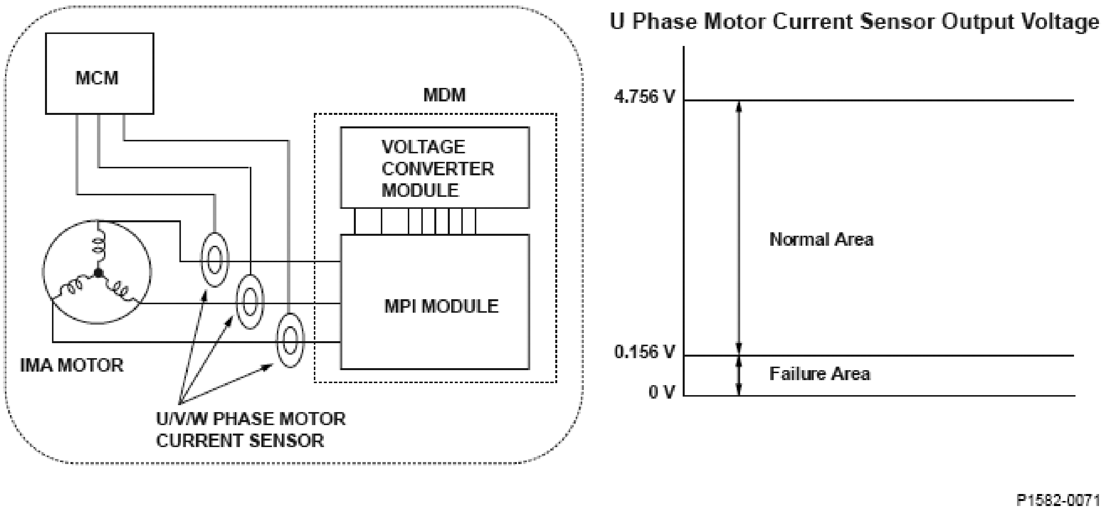


Fig. 125: Motor Current U Phase Signal Circuit Low Input - Circuit Diagram

General Description

If the input voltage to the MCM (motor control module) from the U phase motor current sensor is below the lower limit, a faulty sensor, an open in the sensor power supply, an open in the signal wire, a short to ground, or a faulty MCM input circuit is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	0.5 seconds or more
DTC Type	One drive cycle, MIL ON, IMA system indicator ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
MCM power-supply voltage	10.5 V	-
Ignition switch	ON	
No active DTCs	Motor current sensor A	

Malfunction Threshold

The U phase motor current sensor input voltage is 0.156 V or less for at least 0.5 seconds.

Driving Pattern

Turn on the ignition switch, and wait for at least 5 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool

Clear command or by disconnecting the battery.

DTC P0A5F (25): ADVANCED DIAGNOSTICS

DTC P0A5F (25): MOTOR CURRENT U PHASE SIGNAL CIRCUIT HIGH INPUT

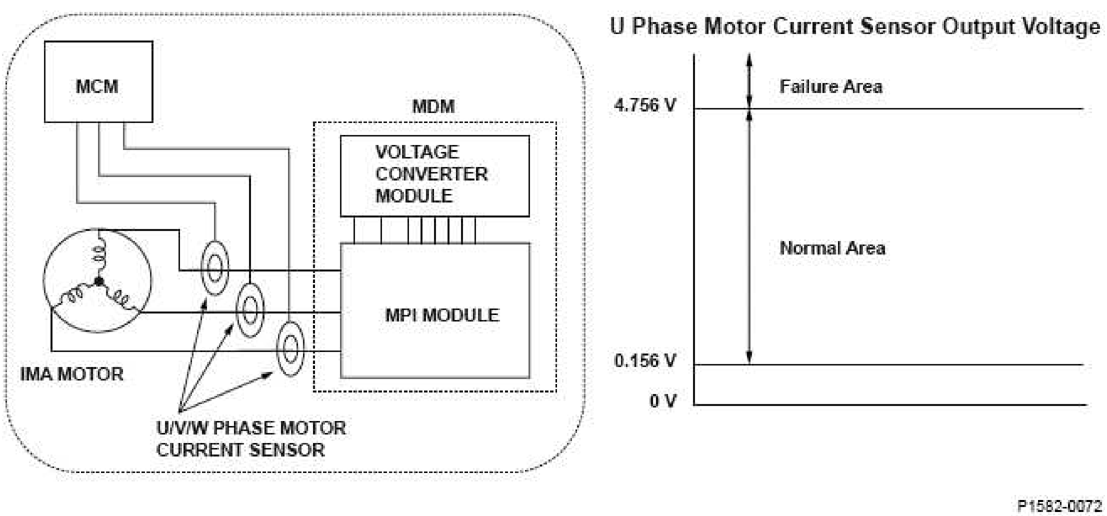


Fig. 126: Motor Current U Phase Signal Circuit High Input - Circuit Diagram

General Description

If the input voltage to the MCM (motor control module) from the U phase motor current sensor is above the upper limit, a faulty sensor, an open in the sensor ground, or a faulty MCM input circuit is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	0.5 seconds or more
DTC Type	One drive cycle, MIL ON, IMA system indicator ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
MCM power-supply voltage	10.5 V	-
Ignition switch	ON	
No active DTCs	Motor current sensor A	

Malfunction Threshold

The U phase motor current sensor input voltage is 4.756 V or more for at least 0.5 seconds.

Driving Pattern

Turn on the ignition switch, and wait for at least 5 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0A61 (26): ADVANCED DIAGNOSTICS

DTC P0A61 (26): MOTOR CURRENT V PHASE SIGNAL CIRCUIT LOW INPUT

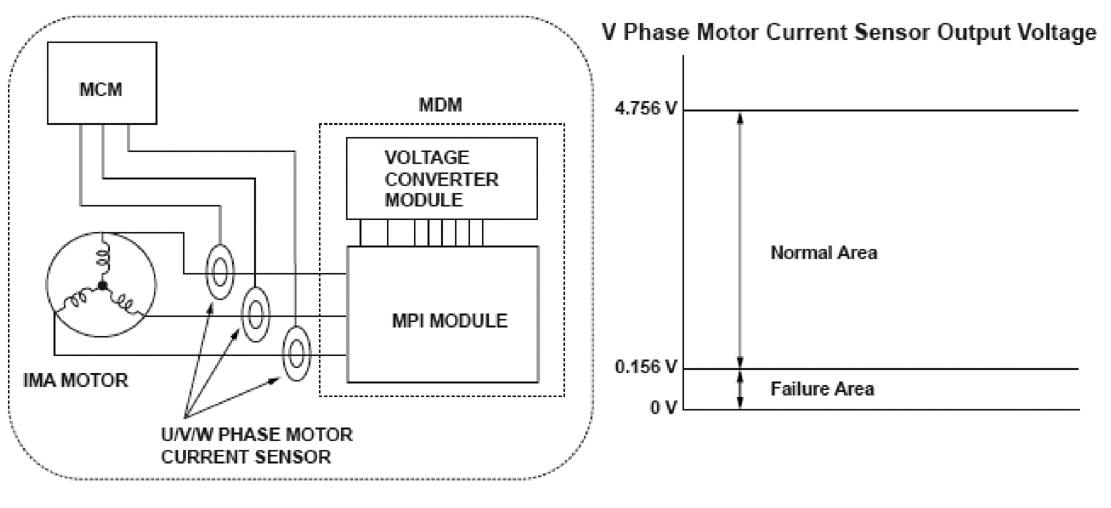


Fig. 127: Motor Current V Phase Signal Circuit Low Input - Circuit Diagram

General Description

If the input voltage to the MCM (motor control module) from the V phase motor current sensor is below the lower limit, a faulty sensor, an open in the sensor power supply, an open in the signal wire, a short to ground, or a faulty MCM input circuit is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	0.5 seconds or more
DTC Type	One drive cycle, MIL ON, IMA system indicator ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
MCM power-supply voltage	10.5 V	-
Ignition switch	ON	
No active DTCs	Motor current sensor B	

Malfunction Threshold

The V phase motor current sensor input voltage is 0.156 V or less for at least 0.5 seconds.

Driving Pattern

Turn on the ignition switch, and wait for at least 5 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0A62 (27): ADVANCED DIAGNOSTICS

DTC P0A62 (27): MOTOR CURRENT V PHASE SIGNAL CIRCUIT HIGH INPUT

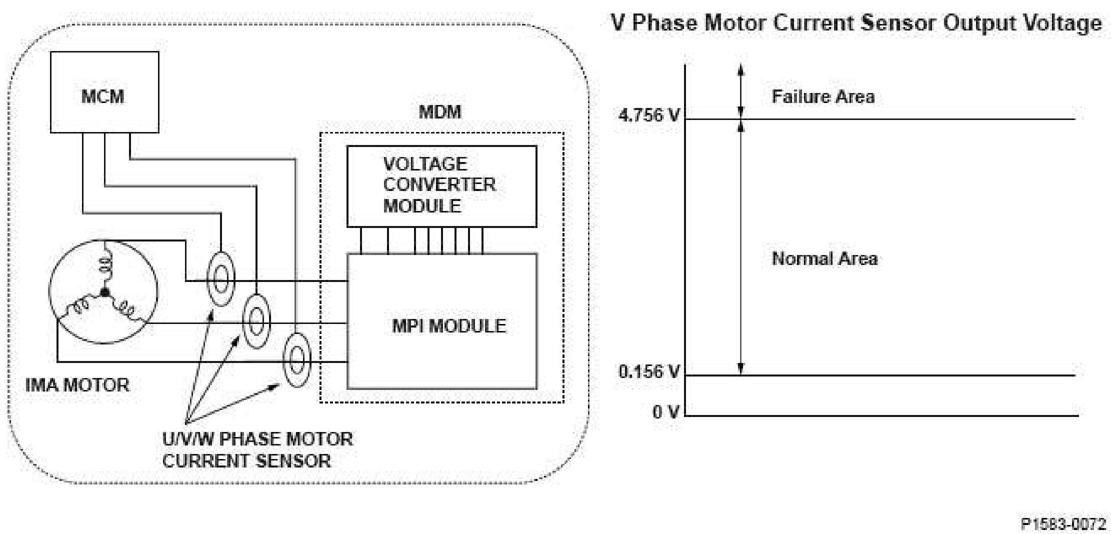


Fig. 128: Motor Current V Phase Signal Circuit High Input - Circuit Diagram

General Description

If the input voltage to the MCM (motor control module) from the V phase motor current sensor is above the upper limit, a faulty sensor, an open in the sensor power supply, or a faulty MCM input circuit is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	0.5 seconds or more
DTC Type	One drive cycle, MIL ON, IMA system indicator ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
MCM power-supply voltage	10.5 V	-
Ignition switch	ON	

No active DTCs	Motor current sensor B

Malfunction Threshold

The V phase motor current sensor input voltage is 4.756 V or more for at least 0.5 seconds.

Driving Pattern

Turn on the ignition switch, and wait for at least 5 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0A64 (28): ADVANCED DIAGNOSTICS

DTC P0A64 (28): MOTOR CURRENT W PHASE SIGNAL CIRCUIT LOW INPUT

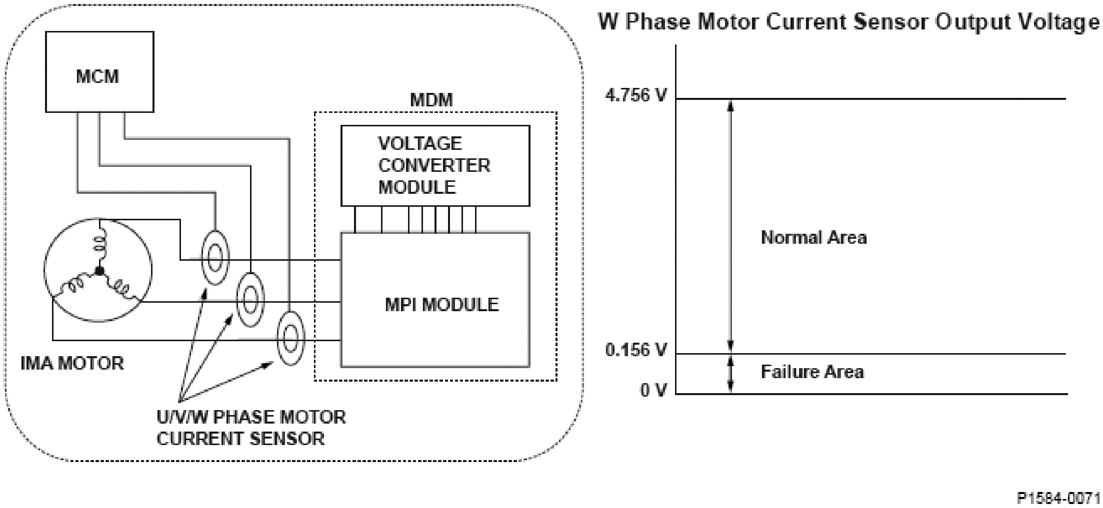


Fig. 129: Motor Current W Phase Signal Circuit Low Input - Circuit Diagram

General Description

If the input voltage to the MCM (motor control module) from the W phase motor current sensor is below the lower limit, a faulty sensor, an open in the sensor power supply, an open in the signal wires, a short to ground, or a faulty MCM input circuit is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	0.5 seconds or more
DTC Type	One drive cycle, MIL ON, IMA system indicator ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
MCM power-supply voltage	10.5 V	-
Ignition switch	ON	
No active DTCs	Motor current sensor C	

Malfunction Threshold

The W phase motor current sensor input voltage is 0.156 V or less for at least 0.5 seconds.

Driving Pattern

Turn on the ignition switch, and wait for at least 5 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0A65 (29): ADVANCED DIAGNOSTICS

DTC P0A65 (29): MOTOR CURRENT W PHASE SIGNAL CIRCUIT HIGH INPUT

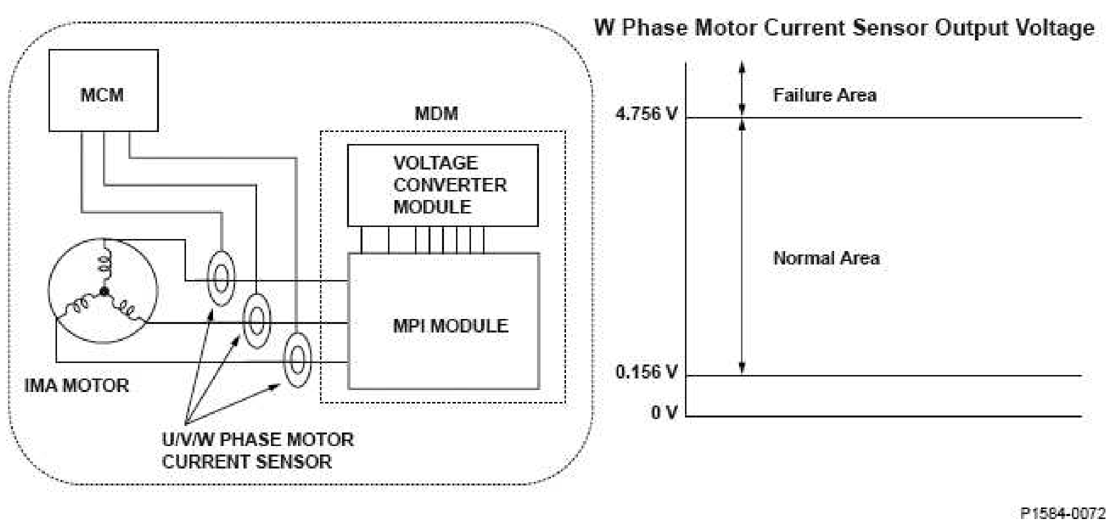


Fig. 130: Motor Current W Phase Signal Circuit High Input - Circuit Diagram

General Description

If the input voltage to the MCM (motor control module) from the W phase motor current sensor is above the upper limit, a faulty sensor, an open in the sensor power supply, or a faulty MCM input circuit is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	0.5 seconds or more
DTC Type	One drive cycle, MIL ON, IMA system indicator ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
MCM power-supply voltage	10.5 V	-
Ignition switch	ON	
No active DTCs	Motor current sensor C	

Malfunction Threshold

The W phase motor current sensor input voltage is 4.756 V or more for at least 0.5 seconds.

Driving Pattern

Turn on the ignition switch, and wait for at least 5 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0A7E (72): ADVANCED DIAGNOSTICS

DTC P0A7E (72): BATTERY MODULE OVERHEATING

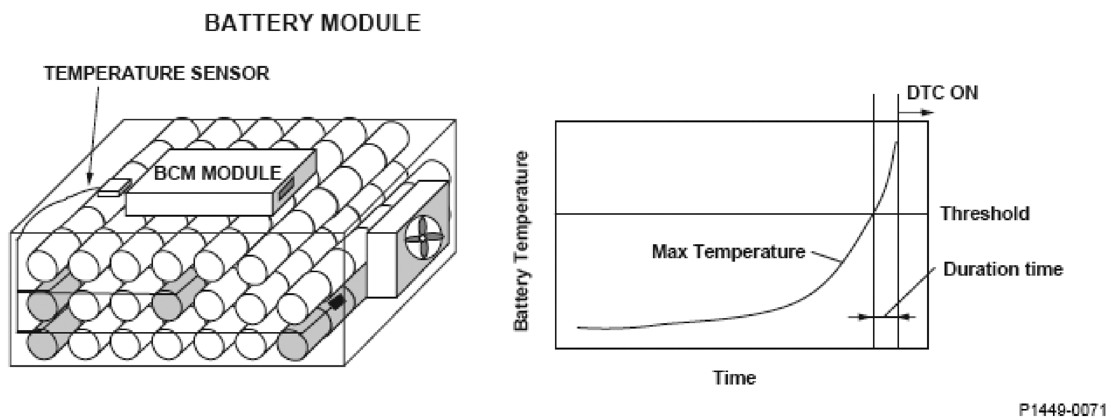


Fig. 131: Battery Module Temperature Graph

General Description

The high voltage battery for the IMA (integrated motor assist) system temperature can increase from exposure to high ambient temperature, overcharging, excessive battery drain, or a battery short. If the battery temperature increases beyond a set value, it is difficult to use the battery continuously due to the thermal deformation of the electrical insulating material or the deterioration of the pole plates.

If the battery temperature is out of a set value for a specified time when driving, a malfunction in the battery is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	Battery module, BCM
Duration	2 seconds or more
DTC Type	One drive cycle, MIL ON, IMA system indicator ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
BCM module power-supply voltage	7.5 V	-
Ignition		

switch	ON
No active DTCs	MPI, Motor current sensor, Battery module, Battery module temperature sensor, MCM, MDM, Motor operation system, Bypass contactor, Motor commutation sensor, MDM voltage sensor, Battery current sensor, MPI module current sensor, MDM current sensor, BCM

Malfunction Threshold

The IMA battery module temperature is 167°F (75°C) or more for at least 2 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0A7F (78): ADVANCED DIAGNOSTICS

DTC P0A7F (78): BATTERY MODULE DETERIORATION

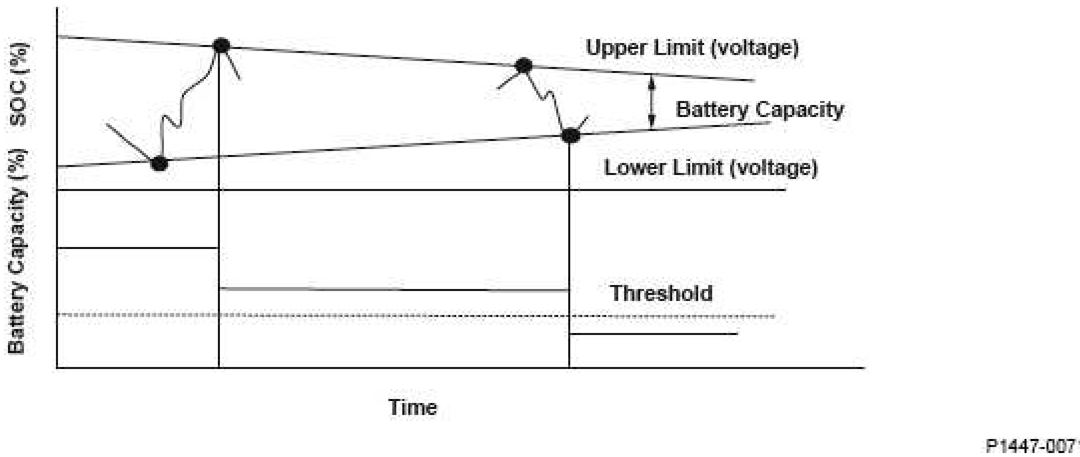


Fig. 132: Battery Module Deterioration Graph

General Description

The high-voltage battery in the IMA (integrated motor assist) system is designed to operate within the upper and lower limits of the SOC (state of charge) voltage and the battery capacity limits. When the battery deteriorates, the voltage is subject to increase or decrease, so the limits of the battery capacity are reduced. Therefore, if the upper and lower limits of the SOC are detected when driving, the BCM (battery condition monitor) calculates the sum of the current and calculates the battery capacity. If the power is less than a set value, a malfunction is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	Battery module, Battery current circuit, BCM
Duration	Depending on the driving pattern
DTC Type	One drive cycle, MIL ON, IMA system indicator ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
ECU power-supply voltage	7.5 V	-
Battery	50°F (10°C)	113°F (45°C)

temperature		
No active DTCs	MPI, Motor current sensor, Battery module, Battery module temperature sensor, MCM, MDM, Motor operation system, Bypass contactor, Motor commutation sensor, MDM voltage sensor, Battery current sensor, MPI module current sensor, MDM current sensor, BCM	
Other	The upper and lower limits are detected while the ignition switch is ON	

Malfunction Threshold

The battery capacity is less than 10 % of 6.5 A.

Driving Pattern

1. Keep the battery temperature at 68 - 86°F (20°C - 30°C) for at least 12 hours.
2. Start the engine.
3. Raise the engine speed to 3,500 - 4,000 rpm in Park or neutral until the IMA battery charge gauge indicates 19 segments.
4. Then, drive the vehicle with the accessories on (the blower MAX, the headlights ON, etc.). Without turning the ignition switch off, accelerate and decelerate repeatedly under conditions in which the assist continues until the IMA battery charge gauge indicates one segment.

- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0A82 (63): ADVANCED DIAGNOSTICS

DTC P0A82 (63): BATTERY MODULE OVERHEATING

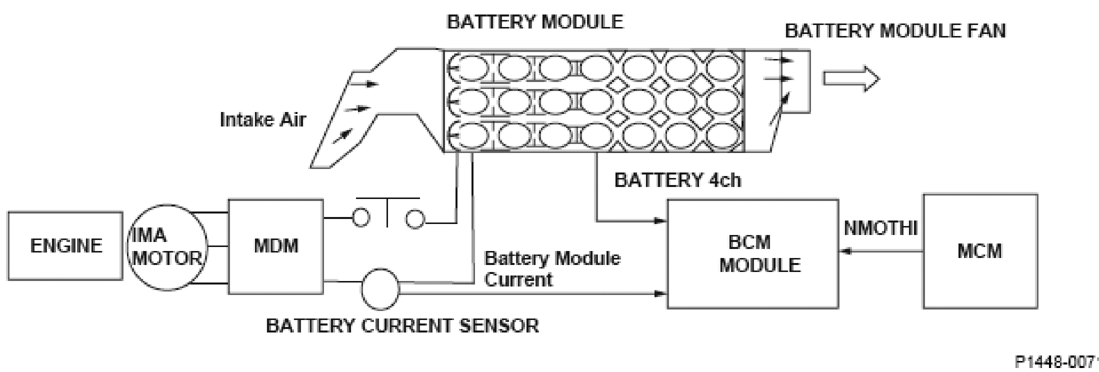


Fig. 133: Battery Module Overheating - Communication Diagram

General Description

To control the battery module temperature, the IMA (integrated motor assist) system is equipped with a battery module fan. The motor assist stops regeneration and the IMA system is shut down when there is an increase in the battery module temperature because the battery module fan is malfunctioning. Therefore, a malfunction in the battery module fan is detected to avoid problems caused by overheating. If the battery module cooling system works normally when the battery module temperature is high and the battery module is in the power save mode, the battery module temperature decreases depending on the input/output current.

If the amount of decrease in the battery module temperature is out of a set value when comparing both the input/output current and the battery module temperature with their predetermined values, a malfunction is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	30 minutes or more
DTC Type	One drive cycle, MIL ON, IMA system indicator ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
BCM module power-supply voltage	7.5 V	-
Battery module fan mode	Low	-
Engine speed	1,500 rpm	-
No active DTCs	BCM	

MALFUNCTION THRESHOLD CHART

Battery Current Average (A)	Decreasing Temperature of Battery Module °F (°C)
0	5.4 (3) or less
2	3.6 (2) or less
5	1.8 (1) or less
9	0.9 (0.5) or less
12	-2.7 (-1.5) or less
15	-5.4 (-3) or less

Driving Pattern

When the HDS is used:

1. Connect the HDS, and start the engine.
2. Remove the IPU lid.
3. Request the battery module fan drive on the HDS.
4. Verify that the battery module fan is actually running.

When the HDS is not used:

1. Remove the IPU lid.
2. Reset the BCM. (Disconnect the 12 V battery terminal once and reconnect it.)
3. Remove the No. 15 EPS (40 A) fuse from the under-hood fuse/relay box.
4. Hold the engine at a speed between 3,500 - 4,000 rpm without load (in Park or neutral), and wait until 19 segments of the indicator on the IMA battery charge gauge are indicated.

5. Turn off the ignition switch.
6. Repeat steps 2 - 5 five times. (Increase the battery module temperature.)
7. Verify that the battery module fan drive is running when the engine is idling.
8. Reinstall the No. 15 EPS (40 A) fuse and IPU lid.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P0A9B (67): ADVANCED DIAGNOSTICS

DTC P0A9B (67): BATTERY MODULE TEMPERATURE SIGNAL CIRCUIT PROBLEM

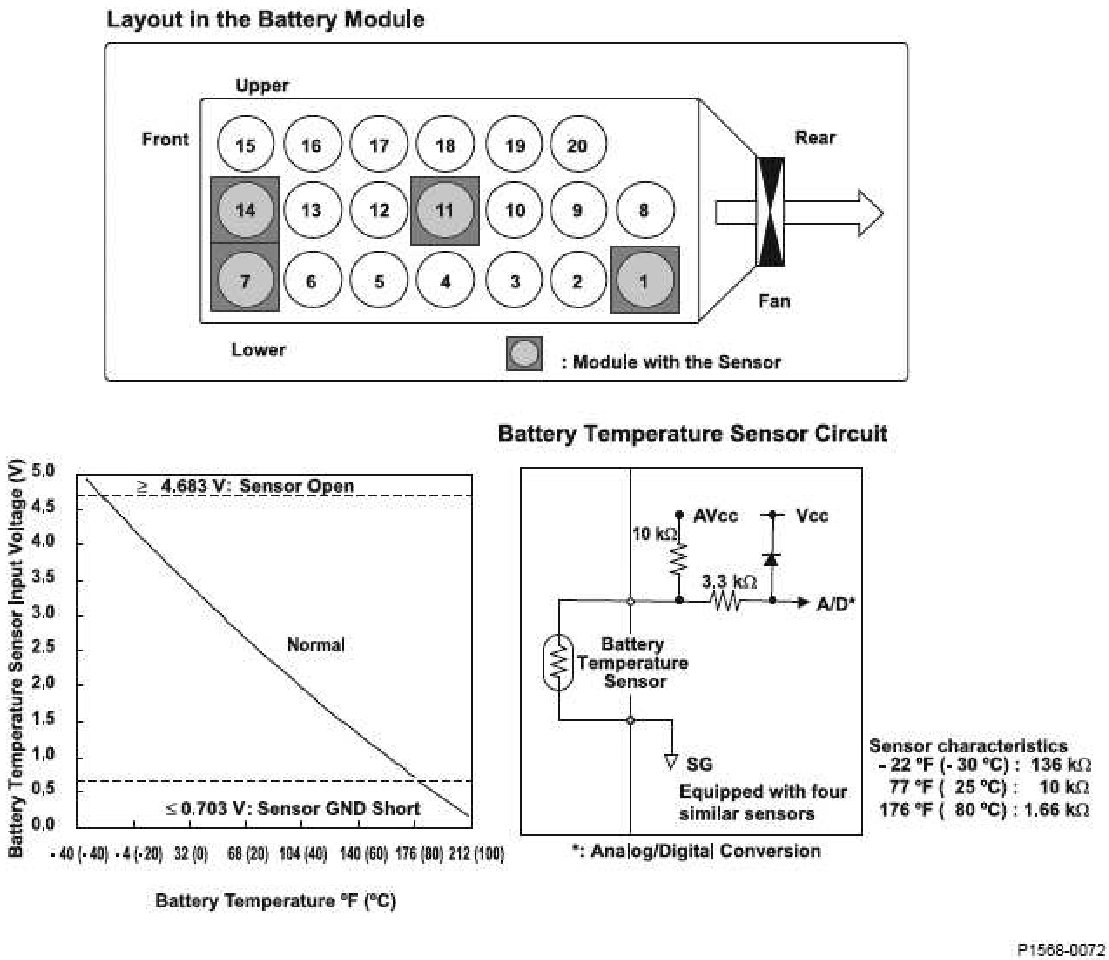


Fig. 134: Battery Module Temperature Signal Circuit Malfunction

General Description

The battery module temperature sensor is used for various controls in the IMA (integrated motor assist) system. If the sensor output voltage is out of its normal range, exhaust emissions, fuel economy, or drivability may be adversely affected, and a malfunction in the sensor is detected and the MIL comes on. The battery temperature is measured by the thermistor that is attached to four of the 20 modules in the battery module. By using this temperature sensor, the maximum and minimum temperature in the battery module can be measured to within ±1.8°F (±1° C). Monitoring is done through the upper and lower limit of output voltage from four channels in the sensor.

If the voltage is higher than the upper threshold, an open is detected, and if it is less than the lower threshold, a malfunction is detected. If an individual temperature problem is detected in all four channels, a malfunction is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	BCM
Duration	2 seconds or more
DTC Type	One drive cycle, MIL ON, IMA system indicator ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
BCM power-supply voltage	7.5 V	-
No active DTCs	BCM	
Ignition switch	ON	

Malfunction Threshold

The sensor input voltage is 4.683 V or more, or 0.703 V or less, for at least 2 seconds.

Driving Pattern

Turn on the ignition switch, and wait for at least 5 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P1109 (13): ADVANCED DIAGNOSTICS

DTC P1109: BAROMETRIC PRESSURE (BARO) SENSOR CIRCUIT OUT OF RANGE-HIGH

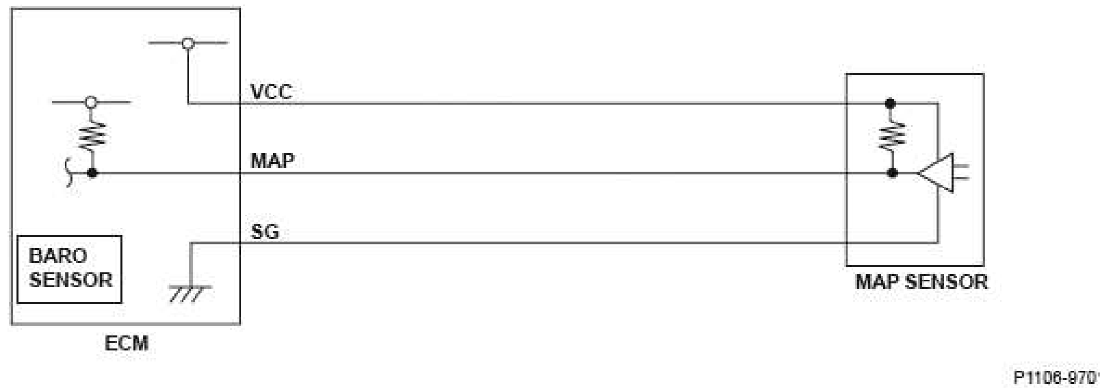


Fig. 135: Barometric Pressure (BARO) Sensor Circuit Out Of Range-High - Circuit Diagram

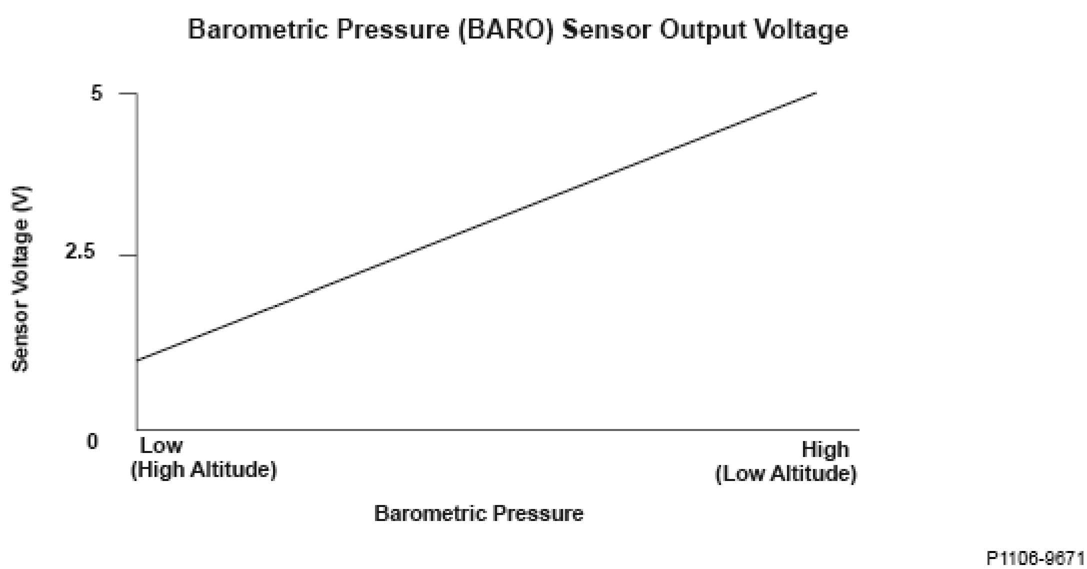


Fig. 136: Barometric Pressure (BARO) Sensor Voltage - Graph

General Description

The barometric pressure (BARO) sensor is built into the engine control module (ECM) and monitors atmospheric pressure. The ECM estimates appropriate intake airflow from the manifold absolute pressure (MAP) sensor output voltage and BARO sensor output voltage. When BARO sensor output voltage is outside of the normal specified range, a malfunction is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	2 seconds or more
DTC Type	One drive cycle, MIL ON

ENABLE CONDITIONS CHART

Condition	
State of the engine	Running

Malfunction Threshold

The BARO sensor output voltage is between 3.59 V to 4.49 V for at least 2 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P1116 (86): ADVANCED DIAGNOSTICS

DTC P1116: ENGINE COOLANT TEMPERATURE (ECT) SENSOR CIRCUIT RANGE/PERFORMANCE PROBLEM

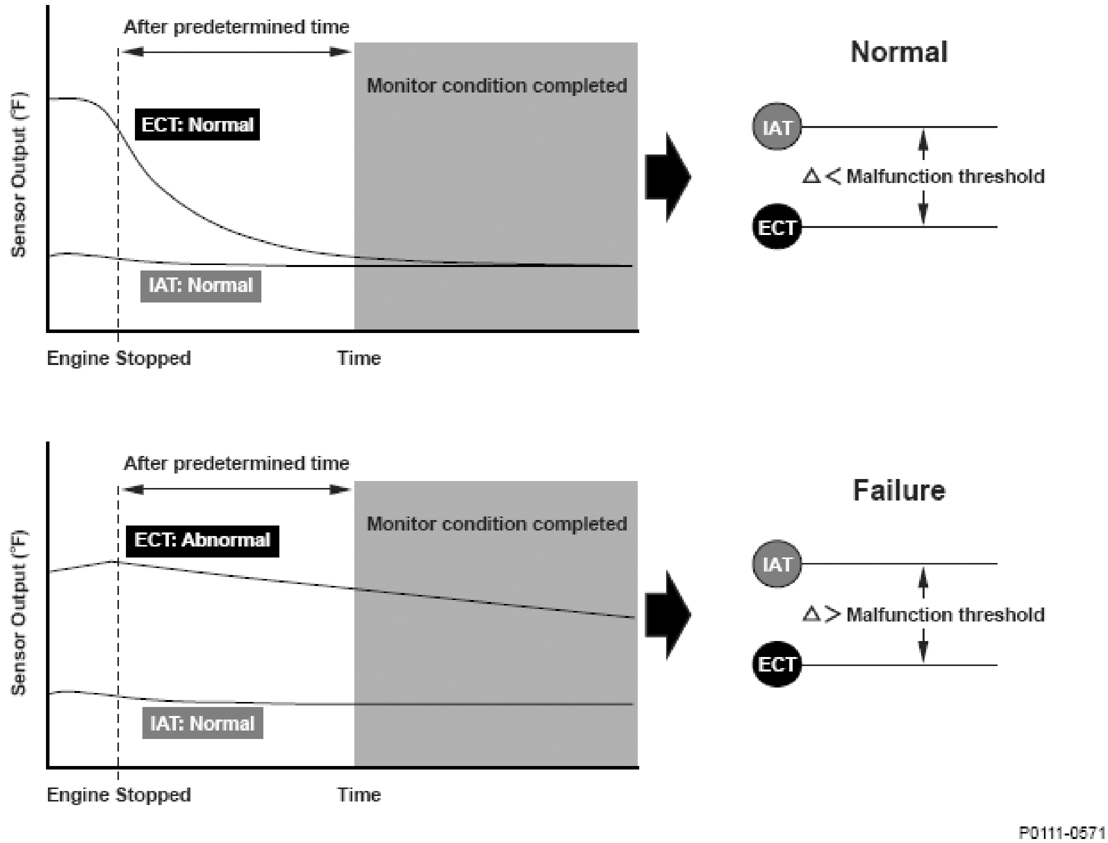


Fig. 137: Intake Air Temperature Sensor Graph

General Description

Two engine coolant temperature sensors and one intake air temperature sensor are used by the engine control module (ECM).

When the engine is stopped and enough time has passed, the temperature of the engine will equal the ambient temperature. When an inappropriate temperature is detected after comparing the temperature readings of each sensor, a malfunction in the corresponding sensor is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Once per driving cycle
Sequence	None
Duration	10 seconds or more
DTC Type	Two drive cycles, MIL ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
Engine off time	6 hours	-
No active DTCs	ECM, ECT, IAT	

Malfunction Threshold

A malfunction is detected if the following condition is not present after the engine and the ignition switch have been off for at least 6 hours before restarting the engine.

- When the temperature (IAT minus ECT) is 90°F (50°C) or more.

Driving Pattern

1. Turn the ignition off, and wait at least 6 hours.
2. Start the engine, and let it idle for at least 10 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the ECM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P1121 (7): ADVANCED DIAGNOSTICS

DTC P1121: THROTTLE POSITION (TP) SENSOR SIGNAL LOWER THAN EXPECTED

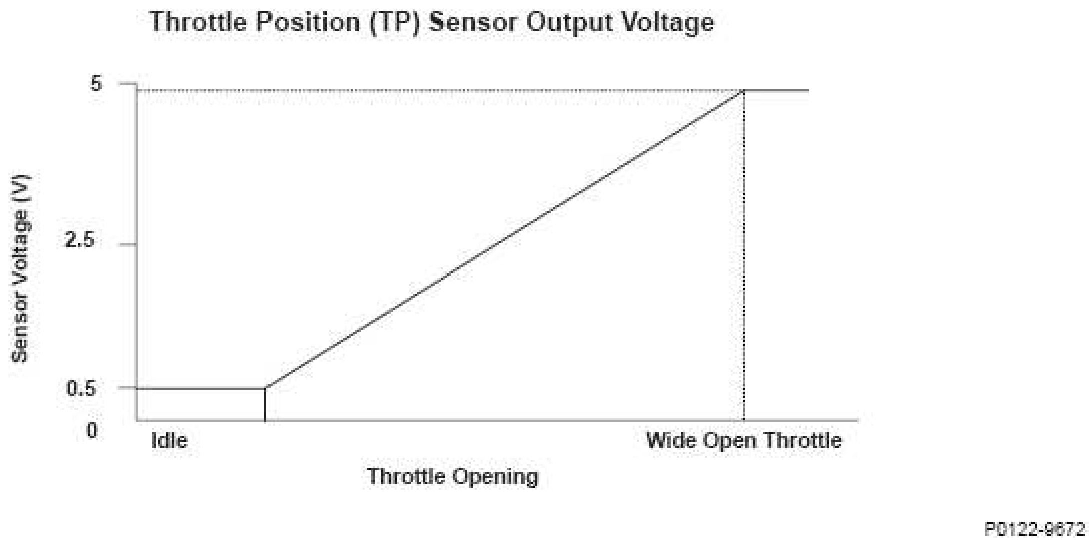


Fig. 138: Throttle Position Sensor Output Voltage Graph

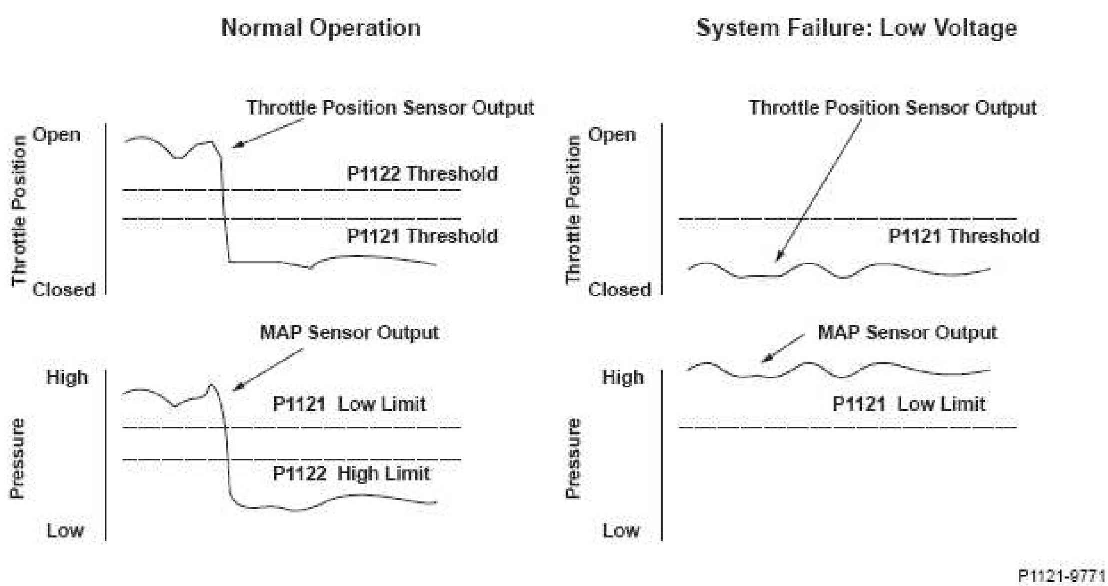


Fig. 139: Throttle Position Sensor Output Graph

General Description

The throttle position (TP) sensor detects the position of the throttle valve. When the throttle valve is open (low-vacuum), the manifold absolute pressure (MAP) sensor outputs a high MAP value, and when the throttle valve is closed (high-vacuum), it outputs a low MAP value.

If the TP sensor detects a throttle position that is less than the set value when the

MAP sensor outputs a higher MAP value (higher pressure) than the set value, a malfunction is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Under the Enable Conditions
Sequence	None
Duration	2 seconds or more
DTC Type	Two drive cycles, MIL ON

ENABLE CONDITIONS CHART

<table>
<tr><th>Condition</th><th>Minimum</th><th>Maximum</th></tr>
<tr><td>Engine coolant temperature</td><td>158°F (70°C)</td><td>-</td></tr>
<tr><td>Engine speed</td><td>1,300 rpm</td><td>5,500 rpm</td></tr>
<tr><td>Vehicle speed</td><td>15 mph (24 km/h)</td><td>-</td></tr>
<tr><td rowspan="2">MAP value</td><td>83 kPa (620 mmHg, 24.5 in.Hg)(1)</td><td rowspan="2">-</td></tr>
<tr><td>50 kPa (368 mmHg, 14.5 in.Hg)(2)</td></tr>
<tr><td>No active DTCs</td><td colspan="2">MAP, ECT, TP, EGR, BARO, IAC, Fuel System, Misfire, Intake Air System</td></tr>
<tr><td colspan="3">(1) Barometric pressure is 101 kPa (760 mmHg, 29.9 in.Hg).
(2) Barometric pressure is 61 kPa (460 mmHg, 18.1 in.Hg).</td></tr>
</table>

Malfunction Threshold

The throttle position is 3.2° or less at 1,300 rpm, or 14.4° or less at 5,500 rpm, for at least 2 seconds.

Driving Pattern

1. Start the engine. Hold the engine speed at 3,000 rpm without load (in Park or neutral) until the radiator fan comes on.
2. Drive the vehicle at a steady speed between 15 - 75 mph (25 - 120 km/h) (the set MAP value or more) for at least 2 seconds.

- If you have difficulty duplicating the DTC, retest after turning off electrical components such as the audio system and A/C, and try a different gear position.
- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the ECM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P1122 (7): ADVANCED DIAGNOSTICS

DTC P1122: THROTTLE POSITION (TP) SENSOR SIGNAL HIGHER THAN EXPECTED

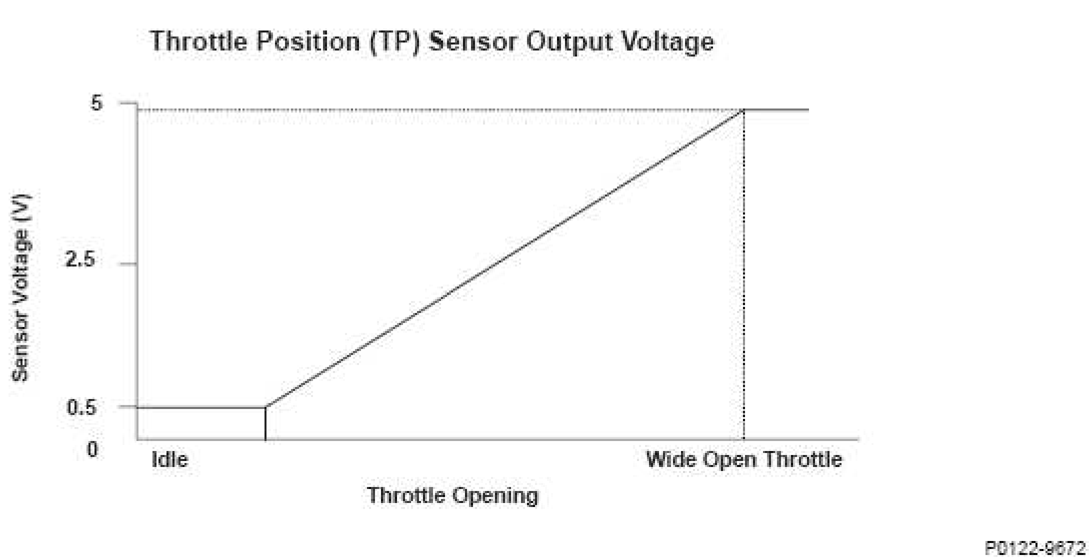


Fig. 140: Throttle Position Sensor Output Voltage Graph

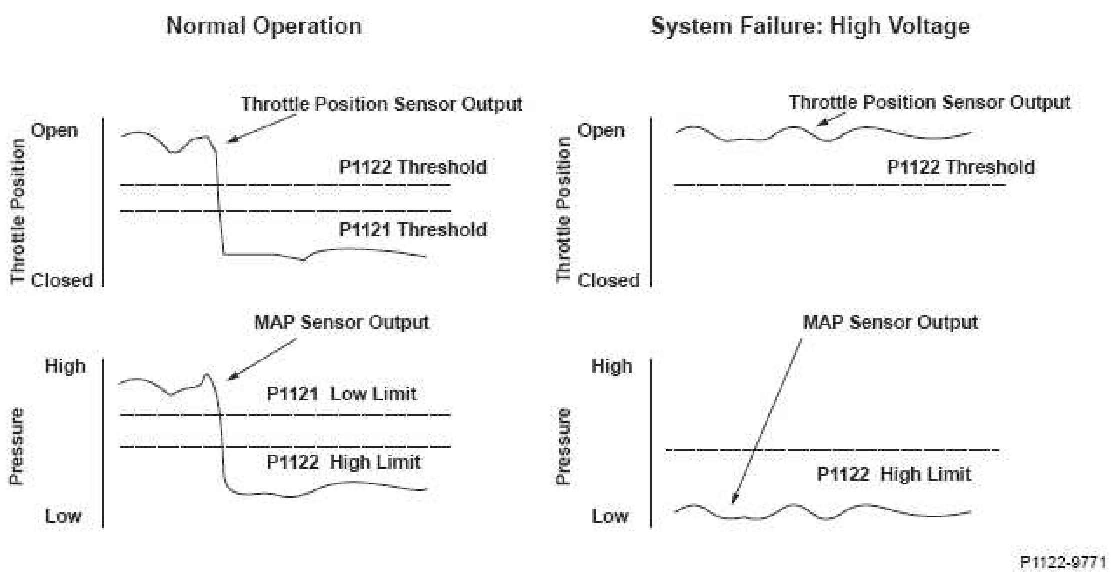


Fig. 141: Throttle Position Sensor Output Graph

General Description

The throttle position (TP) sensor detects the position of the throttle valve. When the throttle valve is open (low-vacuum), the manifold absolute pressure (MAP) sensor outputs a high MAP value, and when the throttle valve is closed (high-vacuum), it outputs a low MAP value.

If the TP sensor detects a throttle position that is more than the set value when the MAP sensor outputs a lower MAP value (lower pressure) than the set value, a malfunction is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Under the Enable Conditions
Sequence	None
Duration	2 seconds or more
DTC Type	Two drive cycles, MIL ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
Engine coolant		

temperature	158°F (70°C)	-
Engine speed	1,300 rpm	5,500 rpm
Vehicle speed	15 mph (24 km/h)	-
MAP value	-	34 kPa (261 mmHg, 10.2 in.Hg)(1)
		26 kPa (199 mmHg, 7.8 in.Hg)(2)
No active DTCs	MAP, ECT, TP, EGR, BARO, IAC, Fuel System, Misfire, Intake Air System	
(1) Barometric pressure is 77 kPa (580 mmHg, 22.8 in.Hg). (2) Barometric pressure is 61 kPa (460 mmHg, 18.1 in.Hg).		

Malfunction Threshold

The throttle position is 10.2° or more at 1,300 rpm, or 28.3° or more at 5,500 rpm, for at least 2 seconds.

Driving Pattern

1. Start the engine. Hold the engine speed at 3,000 rpm without load (in Park or neutral) until the radiator fan comes on.
2. Drive the vehicle at a steady speed between 15 - 75 mph (25 - 120 km/h) (the set MAP value or less) for at least 2 seconds.

- If you have difficulty duplicating the DTC, retest after turning off electrical components such as the audio system and A/C, and try a different gear position.
- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the ECM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P1128 (5): ADVANCED DIAGNOSTICS

DTC P1128: MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR SIGNAL LOWER THAN EXPECTED

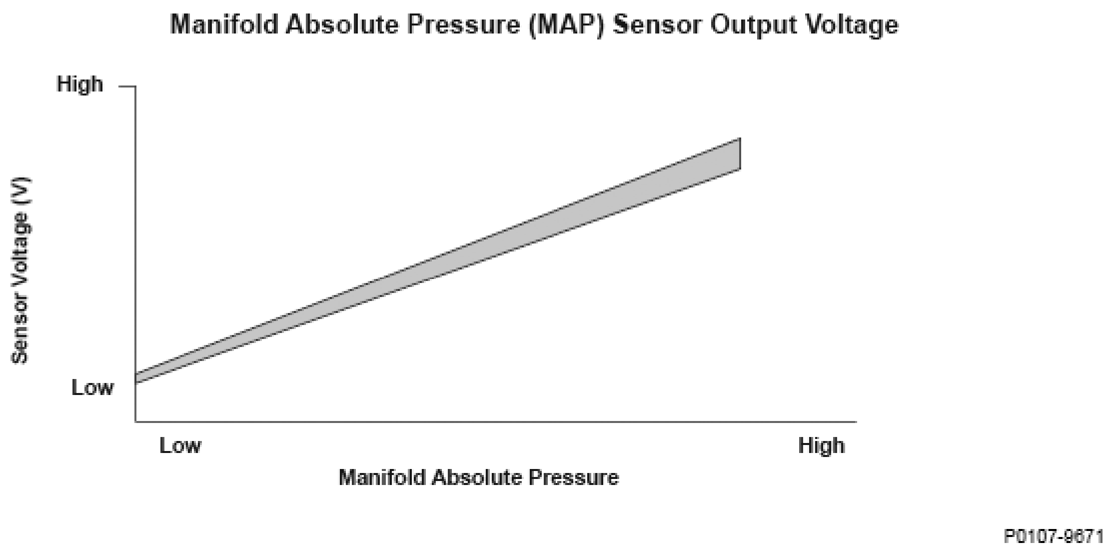


Fig. 142: Manifold Absolute Pressure (MAP) Sensor Output Voltage - Graph

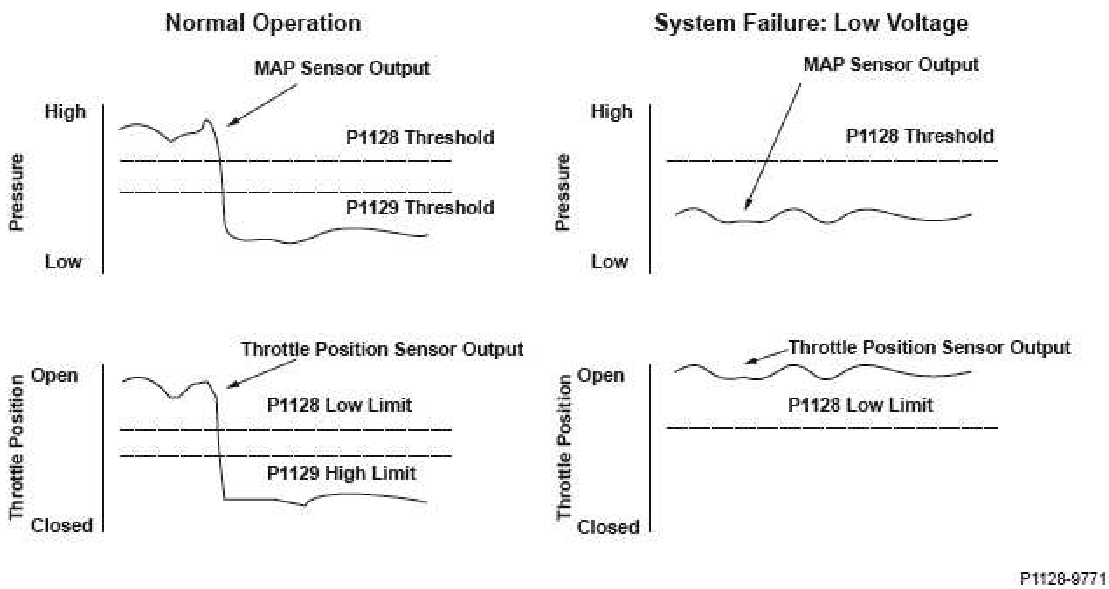


Fig. 143: Manifold Absolute Pressure (MAP) Sensor Signal Lower Than Expected - Graph

General Description

The manifold absolute pressure (MAP) sensor senses manifold absolute pressure (vacuum) and converts it into electrical signals. The MAP sensor outputs low signal voltage at high-vacuum (idling) and high signal voltage at low-vacuum (throttle valve wide open).

The engine control module (ECM) compares a predetermined MAP value at a given throttle position and manifold absolute pressure to the output voltage value of the MAP sensor.

If the MAP sensor outputs lower voltage than expected, the ECM detects a malfunction and stores a DTC.

MONITOR DESCRIPTION CHART

Execution	Under the Enable Conditions
Sequence	None
Duration	2 seconds or more
DTC Type	Two drive cycles, MIL ON

ENABLE CONDITIONS CHART

Condition		Minimum	Maximum
Engine coolant temperature		158°F (70°C)	-
Engine speed		1,300 rpm	5,500 rpm
Vehicle speed		15 mph (24 km/h)	-
Throttle position	1,000 rpm	8.8°	-
	3,000 rpm	18.9°	-
No active DTCs		A/F Sensor, A/F Sensor Heater, MAP, ECT, TP, EGR, BARO, IAC, Fuel System, Misfire, Intake Air System	

Malfunction Threshold

- The MAP sensor output is 54 kPa (406 mmHg, 15.9 in.Hg) or less for at least 2 seconds when atmospheric pressure is 103 kPa (776 mmHg, 30.5 in.Hg).
- The MAP sensor output is 30 kPa (226 mmHg, 8.8 in.Hg) or less for at least 2 seconds when atmospheric pressure is 61 kPa (460 mmHg, 18.1 in.Hg).

Driving Pattern

1. Start the engine. Hold the engine speed at 3,000 rpm without load (in Park or neutral) until the radiator fan comes on.
2. Drive the vehicle at a speed of 15 mph (24 km/h) or more with a throttle position as specified under Enable Conditions for at least 2 seconds.

- If you have difficulty duplicating the DTC, retest after turning off electrical components such as the audio system and A/C, and try a different gear position.
- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected during the first drive cycle, a Temporary DTC is

stored in the ECM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P1129 (5): ADVANCED DIAGNOSTICS

DTC P1129: MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR SIGNAL HIGHER THAN EXPECTED

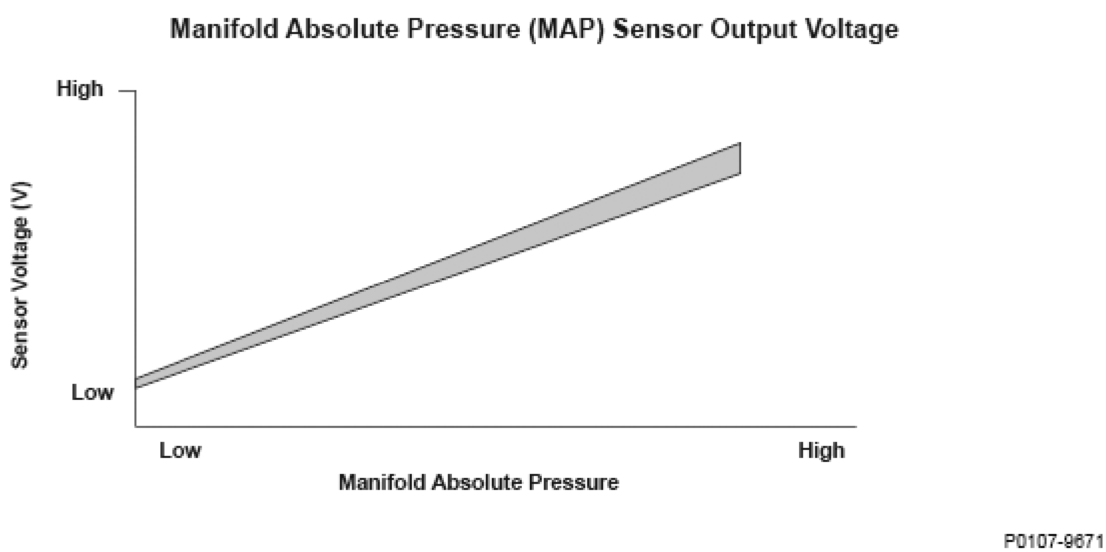


Fig. 144: Manifold Absolute Pressure (MAP) Sensor Output Voltage - Graph

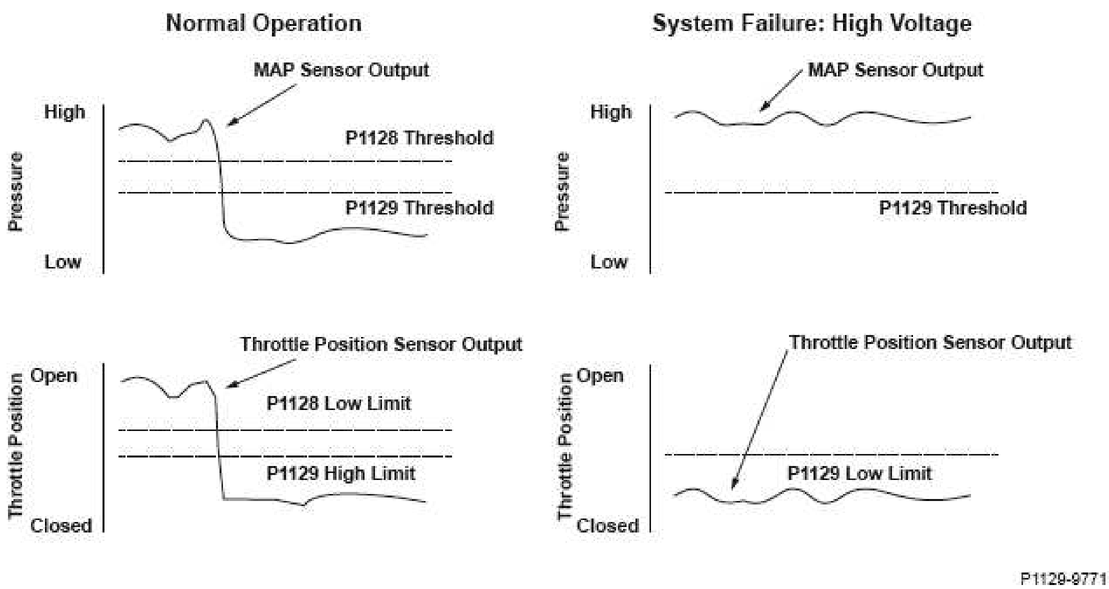


Fig. 145: Manifold Absolute Pressure (MAP) Sensor Signal Higher Than Expected - Graph

General Description

The manifold absolute pressure (MAP) sensor senses manifold absolute pressure (vacuum) and converts it into electrical signals. The MAP sensor outputs low signal voltage at high-vacuum (throttle valve closed) and high signal voltage at low-vacuum (throttle valve wide open).

The engine control module (ECM) compares a predetermined MAP value at a given throttle position and manifold absolute pressure to the output voltage value of the MAP sensor.

If the MAP sensor outputs high voltage during fuel cut-off operation for deceleration with the throttle valve fully closed, which should make the manifold absolute pressure lower, the ECM detects a malfunction and stores a DTC.

MONITOR DESCRIPTION CHART

Execution	Under the Enable Conditions
Sequence	None
Duration	2 seconds or more
DTC Type	Two drive cycles, MIL ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
Engine coolant temperature	158°F (70°C)	-
Engine speed	1,300 rpm	5,500 rpm
Vehicle speed	15 mph (24 km/h)	-
Fuel feedback	During deceleration	
Throttle position	Fully closed	
Monitoring priority	EGR	
No active DTCs	MAP, ECT, TP, EGR, IAC, Fuel System, Misfire, Intake Air System	

Malfunction Threshold

The MAP sensor output is 43 kPa (325 mmHg, 12.7 in.Hg) or more for at least 2 seconds.

Driving Pattern

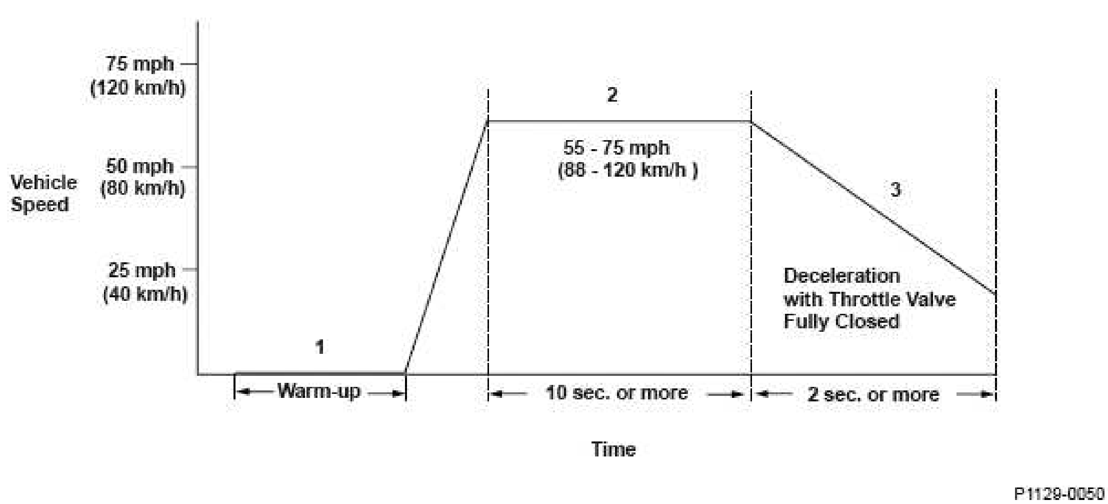


Fig. 146: Driving Pattern - Graph

1. Start the engine. Hold the engine speed at 3,000 rpm without load (in Park or neutral) until the radiator fan comes on.
2. Drive the vehicle at a steady speed between 55 - 75 mph (88 - 120 km/h) for at least 10 seconds.

3. Then, decelerate with the throttle valve fully closed for at least 2 seconds.

- If you have difficulty duplicating the DTC, retest after turning off electrical components such as the audio system and A/C, and try a different gear position.
- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the ECM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P1130 (111): ADVANCED DIAGNOSTICS (M/T)

DTC P1130: DEMAND FOR CHANGING BOTH SECONDARY HEATED OXYGEN SENSOR (SECONDARY HO2S) (SENSOR 2) AND THIRD HEATED OXYGEN SENSOR (THIRD HO2S) (SENSOR 3) (M/T)

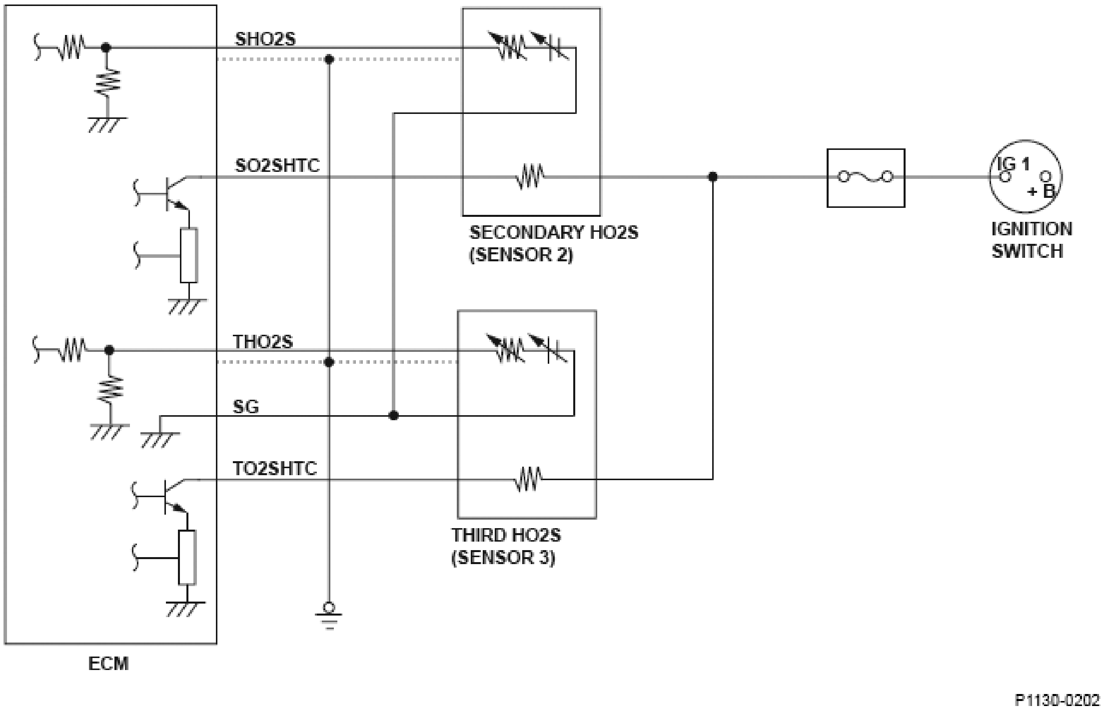


Fig. 147: Third Heated Oxygen Sensor (Third HO2S) (Sensor 3) (M/T) - Circuit Diagram

General Description

To prevent a difference in response characteristics from causing false DTCs, both the secondary heated oxygen sensor (HO2S) and the third HO2S must be replaced simultaneously. If a malfunction that is related to the secondary HO2S or the third HO2S (deterioration, a faulty heater) is detected, the DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Once per driving cycle (1), Continuous (2)
Sequence	None
Duration	-
DTC Type	One drive cycle (2) or Two drive cycles (1), MIL ON
(1) Secondary HO2S, Third HO2S (2) Secondary HO2S heater, Third HO2S heater	

ENABLE CONDITIONS CHART

Condition	
Other	Refer to **ENABLE CONDITIONS** for these malfunctions: the secondary HO2S, the third HO2S, the secondary HO2S heater and the third HO2S heater

Malfunction Threshold

Refer to **MALFUNCTION THRESHOLD** for these malfunctions: the secondary HO2S, the third HO2S, the secondary HO2S heater, and the third HO2S heater.

Driving Pattern

Refer to **DRIVING PATTERNS** for the secondary HO2S (P0137, P0138, P0139) and the third HO2S (P0143, P0144, P0145).

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P1157 (48): ADVANCED DIAGNOSTICS

DTC P1157: AIR/FUEL RATIO (A/F) SENSOR (SENSOR 1) AFS CIRCUIT HIGH VOLTAGE

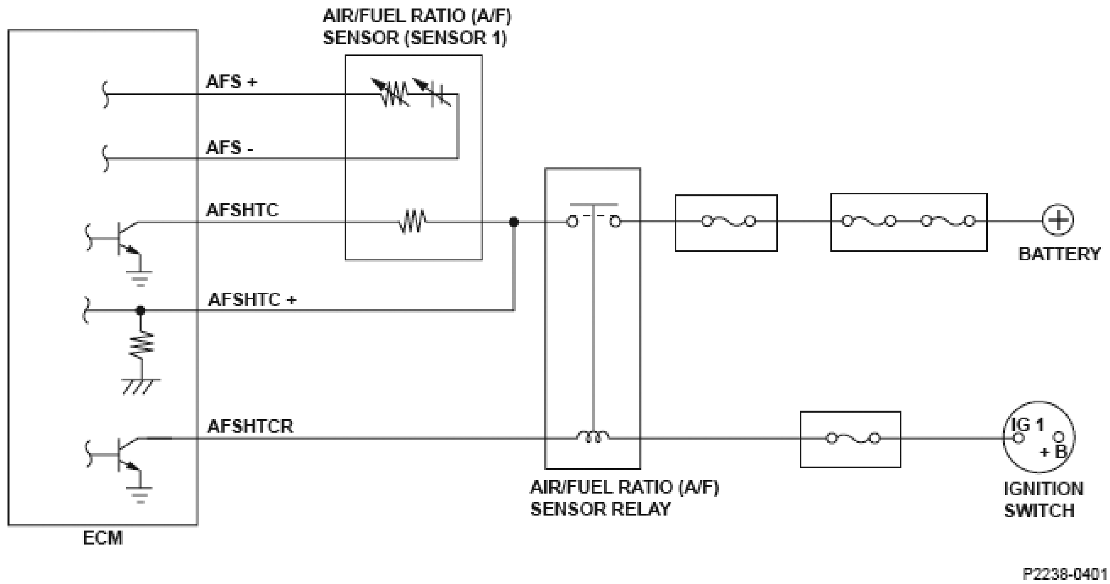


Fig. 148: Air/Fuel Ratio (A/F) Sensor (Sensor 1) Heater Circuit Malfunction Diagram

General Description

The air/fuel ratio (A/F) sensor (sensor 1) is installed in the exhaust system and detects oxygen content in the exhaust gas. The A/F sensor outputs voltage to the engine control module (ECM). A heater for the sensor element is embedded in the A/F sensor (sensor 1). When activated, it heats the sensor to stabilize and speed the detection of oxygen content by controlling current flow through the heater. The current diminishes as the voltage applied to the element electrode reaches a certain range because the amount of oxygen that passes through the diffusion layer is limited. The current is proportional to the oxygen content in the exhaust gas, so the air/fuel ratio is detected by the measurement of the current. The ECM compares the set target air/fuel ratio to the detected air/fuel ratio and adjusts the fuel injection duration.

If the A/F sensor (sensor 1) voltage is low, the air/fuel ratio is lean, and the ECM uses A/F feedback control to issue a Rich command. If the A/F sensor (sensor 1) voltage is high, the air/fuel ratio is rich, and the ECM uses A/F feedback control to issue a Lean command.

If the element is not activated for a set time when the power is drawn by the A/F sensor (sensor 1) heater, a malfunction is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Once per driving cycle
Sequence	None
Duration	5 seconds or more
DTC Type	One drive cycle, MIL ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
Battery voltage	9.5 V	16.0 V
Elapsed time after starting the engine	60 seconds	-
Engine coolant temperature	41°F (5°C)	-
No active DTCs	ECM, A/F Sensor (Sensor 1), A/F Sensor Heater (Sensor 1), ECT	

Malfunction Threshold

The A/F sensor (sensor 1) heater power is 25 W or more and the element resistance is 250 ohms or more for at least 5 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P1172 (61): ADVANCED DIAGNOSTICS

DTC P1172: AIR/FUEL RATIO (A/F) SENSOR (SENSOR 1) CIRCUIT OUT OF RANGE-HIGH

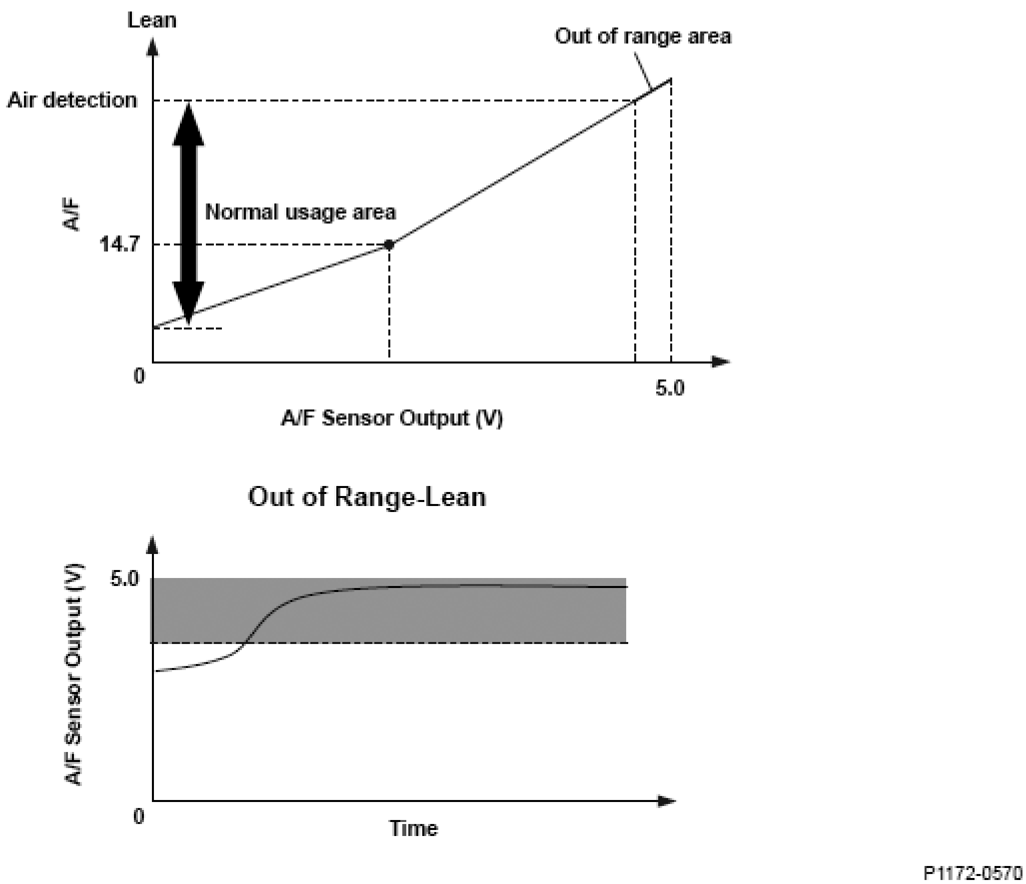


Fig. 149: Air/Fuel Ratio (A/F) Sensor Voltage - Graph

General Description

If a malfunction causes the air/fuel sensor reading value to the engine control module (ECM) to deviate from the normal control area, the air/fuel ratio (A/F) sensor becomes active after the engine starts, but the air/fuel feedback does not start normally and the emissions deteriorate. When the A/F sensor output is out of the normal area, and this condition continues after the A/F sensor is active, the ECM detects a malfunction and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	2 seconds or more
DTC Type	One drive cycle, MIL ON

ENABLE CONDITIONS CHART

Condition	
No active DTCs	MAP, ECT, A/F Sensor Heater, A/F Sensor, Misfire

Malfunction Threshold

A malfunction is detected when the A/F sensor output voltage is 4.8 V or more.

Driving Pattern

Start the engine. Hold the engine speed at 3,000 rpm without load (in Park or neutral) until the radiator fan comes on, then let it idle.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the ECM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P1429 (38): ADVANCED DIAGNOSTICS

DTC P1429 (38): MOTOR DRIVE MODULE (MDM) OVERHEATING SIGNAL CIRCUIT PROBLEM

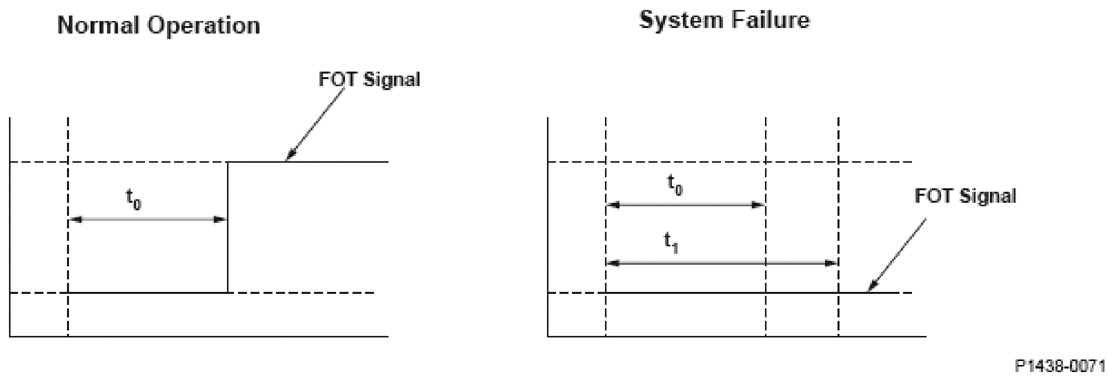


Fig. 150: Motor Drive Module (MDM) Overheating Signal - Operation Graph

General Description

If the flag over temperature (FOT) signals from the power drive unit (PDU) do not vary from the low voltage level to the high voltage level within a set time after turning the ignition switch on, a malfunction is detected. The signals vary from a low voltage level to a high voltage level within a set time (t0) under normal conditions. If a problem occurs in the signal circuit, the signal stays at a low voltage level for a set time (t1) (t1>t0) after turning the ignition switch on, and the motor control module (MCM) detects a malfunction and stores a DTC.

MONITOR DESCRIPTION CHART

Execution	Once per driving cycle
Sequence	None
Duration	2 seconds or more
DTC Type	One drive cycle, MIL ON, IMA system indicator ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
MCM power-supply voltage	10.5 V	-

Malfunction Threshold

The FOT signals stay at a low voltage level for at least 2 seconds.

Driving Pattern

Turn the ignition switch off, and wait for at least 1 minute. Then, turn the ignition switch on.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P1430 (40): ADVANCED DIAGNOSTICS

DTC P1430 (40): MOTOR DRIVE MODULE (MDM) SHORT CIRCUIT SENSOR PROBLEM

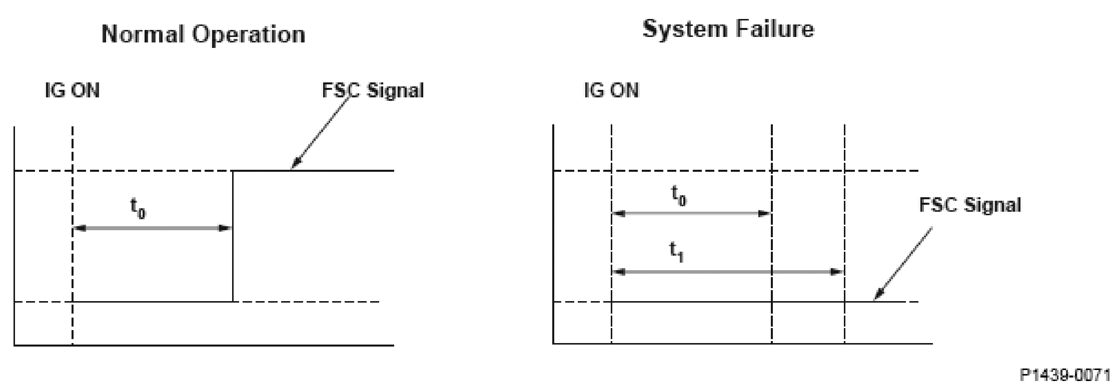


Fig. 151: Motor Drive Module (MDM) Short Circuit Sensor - Operation Graph

General Description

If the flag short circuit (FSC) signals from the motor power inverter (MPI) module do not vary from a low voltage level to a high voltage level within a set time after turning the ignition switch on, a malfunction is detected. The signals vary from a low voltage level to a high voltage level within a set time (t0) under normal conditions. If a problem occurs in the signal circuit, the signals stay at a low voltage level for a set time (t1) (t1>t0) after turning the ignition switch on, and the motor control module (MCM) detects a malfunction and stores a DTC.

MONITOR DESCRIPTION CHART

Execution	Once per driving cycle
Sequence	None
Duration	0.5 seconds or more
DTC Type	One drive cycle, MIL ON, IMA system indicator ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
MCM power-supply voltage	10.5 V	-
Ignition switch	ON	

Malfunction Threshold

The FSC signals stay at a low voltage level for at least 0.5 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P1432 (73): ADVANCED DIAGNOSTICS

DTC P1432 (73): BATTERY CELL OVERHEATING

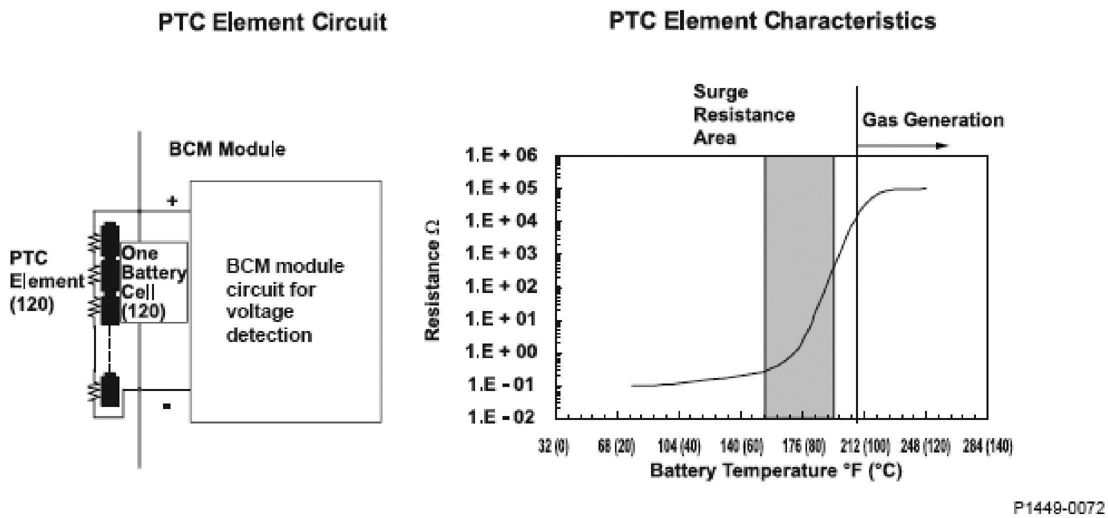


Fig. 152: PTC Element Circuit Diagram

General Description

There are 120 cells connected in series in the high voltage battery for the IMA (integrated motor assist) system, and every cell has a positive temperature coefficient (PTC) element. Serially connected cells enable the BCM (battery condition monitor) module to detect a change in resistance (PTC+ side to ground, the BCM module detected voltage) when one or more monitoring cells' temperature is beyond a set value. Consequently, overheating is detected even if only one cell is malfunctioning. If the BCM module detected voltage is a set value or more for a specified time, a malfunction in the battery is detected and a DTC is stored.

NOTE: The PTC element has characteristics as shown in the graph (the resistance increases at a faster rate within a certain range), so it is used to detect that a monitored object temperature is beyond a specified value.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	Battery cell temperature signal circuit, BCM
Duration	2 seconds or more
DTC Type	One drive cycle, MIL ON, IMA system indicator ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
BCM module power-supply voltage	7.5 V	-
No active DTCs	MPI, Motor current sensor, Battery module, Battery module temperature sensor, MCM, MDM, Motor operation system, Bypass contactor, Motor commutation sensor, MDM voltage sensor, Battery current sensor, MPI module current sensor, MDM current sensor, BCM	

Malfunction Threshold

The BCM module detected voltage is 3.5 V or more for at least 2 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P1437 (41): ADVANCED DIAGNOSTICS

DTC P1437 (41): MOTOR DRIVE MODULE (MDM) SHORT CIRCUIT SENSOR PROBLEM

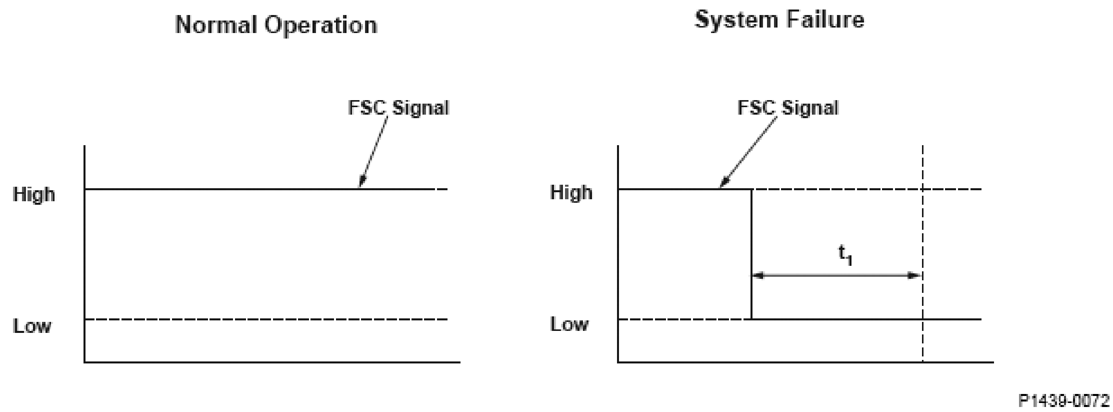


Fig. 153: Motor Drive Module (MDM) Short Circuit Sensor - Operation Graph

General Description

If a short circuit occurs in the three-phase coil of the integrated motor assist (IMA) motor when driving, the motor drive module (MDM) stops functioning and changes the flag short circuit (FSC) signals from a high level to a low level to protect itself. If the FSC signals stay at a low voltage level for a set time (t1), the motor control module (MCM) detects a malfunction and stores a DTC.

MONITOR DESCRIPTION CHART

Execution	Once per driving cycle
Sequence	Motor current U/V/W phase signal circuit, Battery module, Battery cell, IMA system, Bypass contactor, Motor commutation sensor, Battery cell temperature signal circuit, Detection signal circuit, Battery current circuit, Motor current signal circuit, MPI, MDM, BCM, MCM
Duration	0.6 seconds or more
DTC Type	One drive cycle, MIL ON, IMA system indicator ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
MCM power-supply voltage	10.5 V	-
No active DTCs	MCM	

Malfunction Threshold

The FSC signals stay at a low voltage level for at least 0.6 seconds.

Driving Pattern

1. Start the engine.
2. Accelerate the vehicle to a speed of 40 mph (64 km/h) under conditions that illuminate the IMA motor assist level gauge while the IMA battery charge gauge indicates 10 through 18 segments.
3. Decelerate gradually by applying the brakes.

- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P1440 (57): ADVANCED DIAGNOSTICS

DTC P1440 (57): IMA SYSTEM PROBLEM

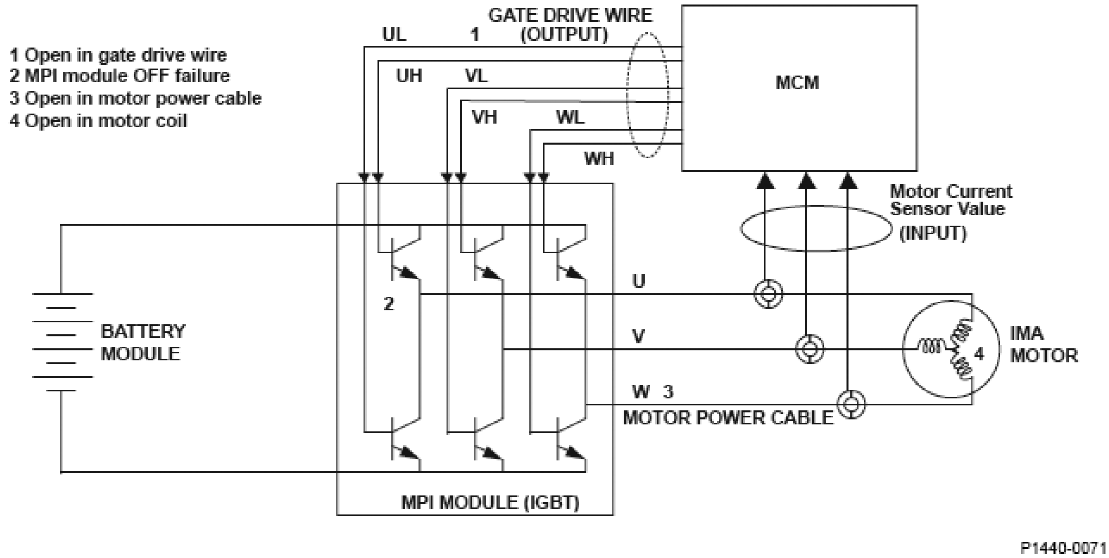


Fig. 154: IMA System - Circuit Diagram

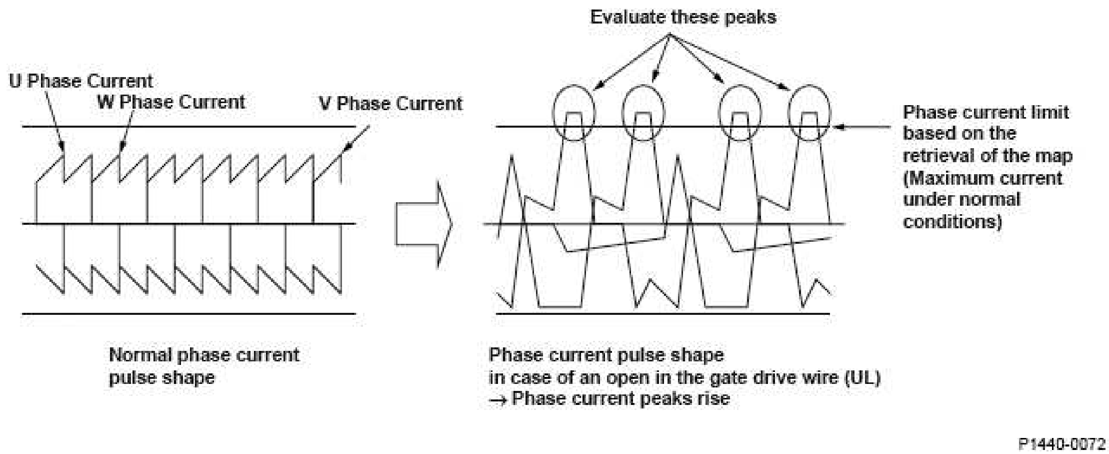


Fig. 155: IMA System Pulse Pattern (1 Of 2)

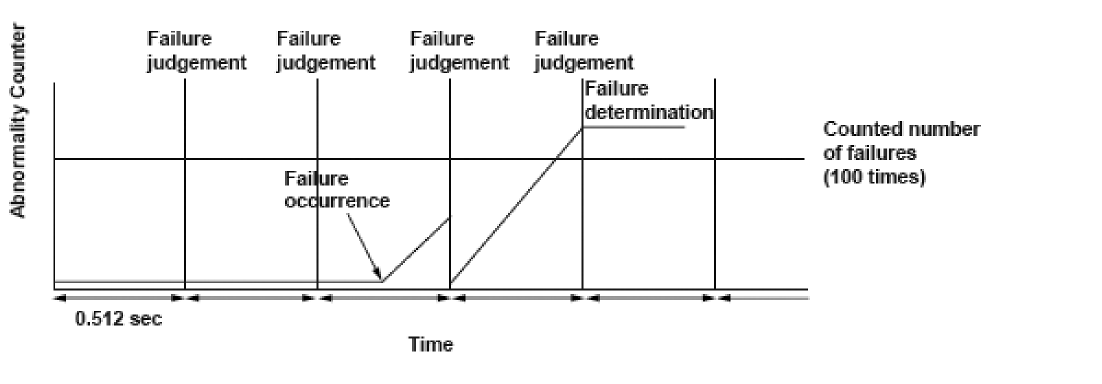


Fig. 156: IMA System Pulse Pattern (2 Of 2)

General Description

An open in the gate drive wire, an insulated gate bipolar transistor (IGBT) OFF failure, and an open in the motor power cable or in the motor coil causes a deviation from the target value of torque in the integrated motor assist (IMA) system. By monitoring changes in phase current when an abnormality occurs, the function monitor detects a malfunction in the IMA system. An open in the gate drive wire or in the motor power cable causes an increase in the other two normal phases. current to compensate for a decrease in the phase when the motor control range is not in the low speed range.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	Motor current U/V/W phase signal circuit, Battery module, Battery cell, Bypass contactor, Motor commutation sensor, Battery cell temperature signal circuit, Detection signal circuit, Battery current circuit, Motor current signal circuit, MPI, MDM, BCM, MCM
Duration	0.512 seconds or more
DTC Type	One drive cycle, MIL ON, IMA system indicator ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
MCM power-supply voltage	10.5 V	-
Motor speed	2,000 rpm	-
Motor driving torque	10 N.m (1 kgf.m, 7.2 lbf.ft)	-
Battery module voltage	120 V	192 V
No active DTCs	MPI, Motor current sensor, Battery module, Battery module temperature sensor, MCM, MDM, Bypass contactor, Motor commutation sensor, MDM voltage sensor, Battery current	

	sensor, MPI module current sensor, MDM current sensor, BCM

Malfunction Threshold

The three motor current sensors output values exceed the value based on the retrieval of the map (current used for failure determination), depending on the demanded motor torque, battery module voltage, and speed, while the cycle time is at least 0.512 seconds, at least 100 times.

Driving Pattern

1. Start the engine.
2. Accelerate the vehicle to an engine speed of 2,000 rpm or more with wide open throttle for at least 2 seconds while 10 or more segments are illuminated on the IMA battery charge gauge.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P1445 (62): ADVANCED DIAGNOSTICS

DTC P1445 (62): BYPASS CONTACTOR PROBLEM

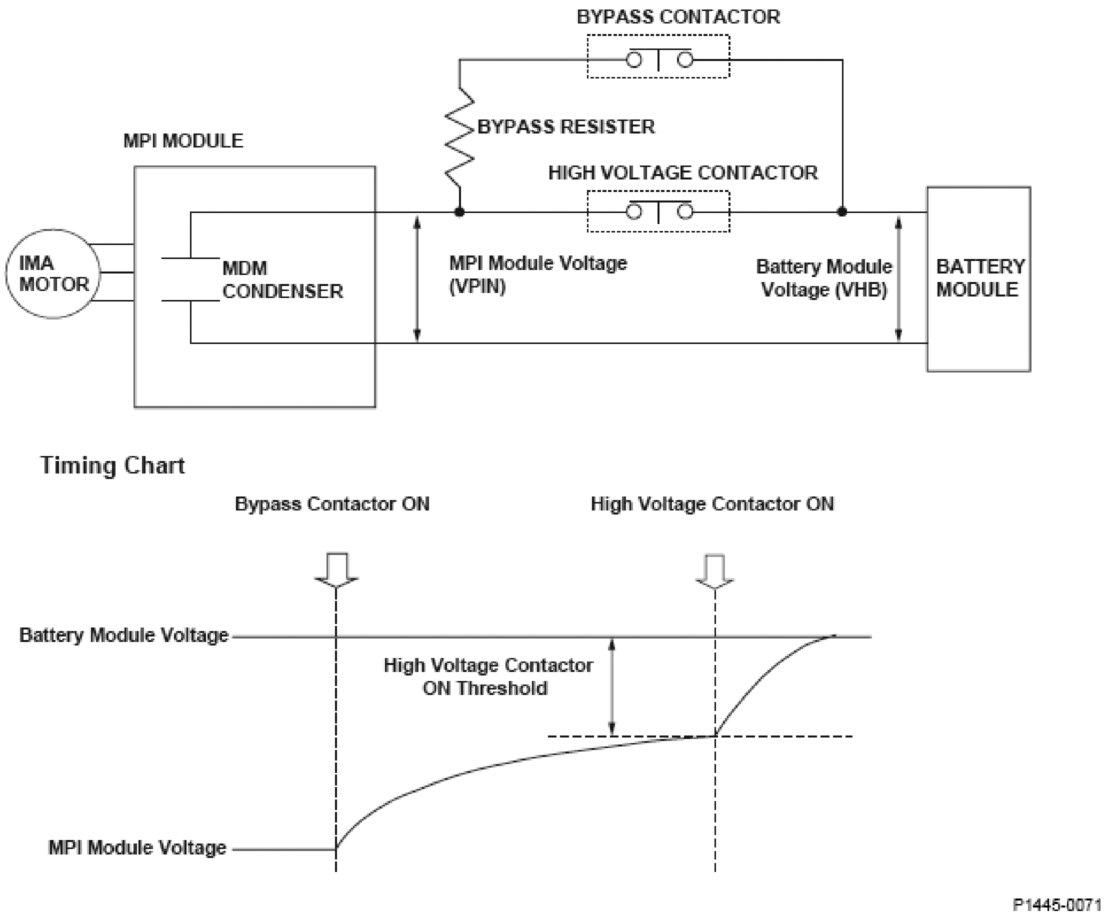


Fig. 157: Bypass Contactor - Circuit Diagram

General Description

The high voltage contactor between the battery module and the motor power inverter (MPI) module is turned on to activate the integrated motor assist (IMA) system after turning the ignition switch on. Before turning the high voltage contactor on, the bypass contactor is turned on and the motor drive module (MDM) condenser is charged gradually by current limited by the bypass resistor. When the difference between the voltage on the MPI module side and the battery module side is within a set range, the high voltage contactor is turned on, then the bypass contactor is turned off.

If the difference between the voltage on the MPI module side and the battery module side is out of a set range for a specified time after the bypass contactor is turned on, a malfunction is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Once per driving cycle
Sequence	None
Duration	2 seconds or more
DTC Type	One drive cycle, MIL ON, IMA system indicator ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
MCM power-supply voltage	10.5 V	-
MPI module voltage (Ignition switch ON)	-	240 V
Motor speed (Ignition switch ON)	-	1,000 rpm
Ignition switch	ON	

Malfunction Threshold

The difference between the voltage on the MPI module side and the battery module side is 37 V or more for at least 2 seconds after the bypass contactor is turned on.

Driving Pattern

1. Connect the HDS.
2. Turn the ignition switch on, and wait for at least 5 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P1446 (74): ADVANCED DIAGNOSTICS

DTC P1446 (74): BATTERY MODULE INDIVIDUAL VOLTAGE INPUT DEVIATION

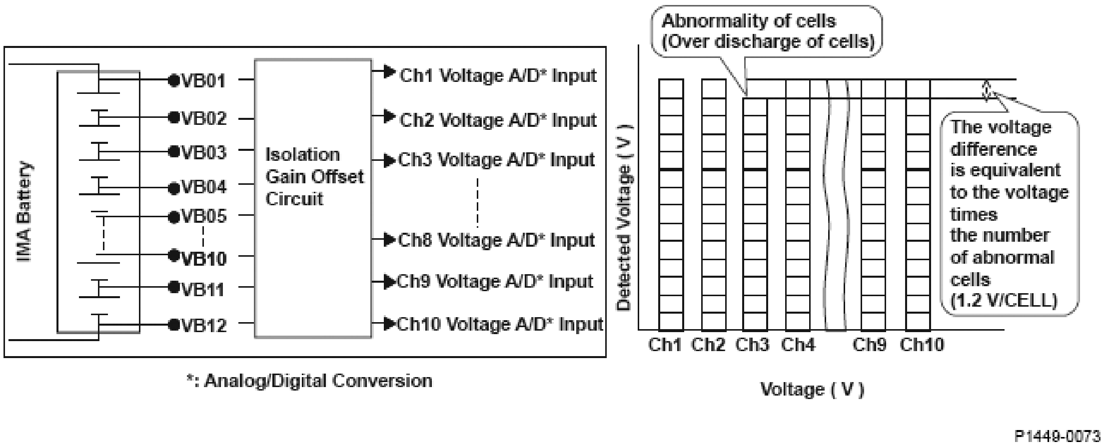


Fig. 158: Battery Module Individual Voltage Input - Circuit Diagram

General Description

Each channel monitors the voltage of 12 cells. When one cell in a channel is abnormal, the voltage differs by 1.2 V from the other channels.

Therefore, if the difference between channels increases to 1.2 V or more, at least one cell is considered to be abnormal or the voltage detection system is considered to be abnormal.

If the difference between the channels is a specified value for a set time, the motor control module (MCM) detects a malfunction, and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	Battery module, BCM
Duration	25.4 seconds or more
DTC Type	One drive cycle, MIL ON, IMA system indicator ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
Detected		

individual voltage (at ch1 through ch10)	14.53 V	-
Detected individual temperature (at ch1 through ch4)	77°F (25°C)	-
Battery input/output current amperage	-20 A	11 A
BCM module power-supply voltage	7.5 V	-
No active DTCs	MPI, Motor current sensor, Battery module, Battery module temperature sensor, MCM, MDM, Motor operation system, Bypass contactor, Motor commutation sensor, MDM voltage sensor, Battery current sensor, MPI module current sensor, MDM current sensor, BCM	

Malfunction Threshold

The voltage difference between channels is 1.2 V or more for at least 25.4 seconds.

Driving Pattern

1. Reset the BCM module. (Disconnect the 12 V battery terminal once and reconnect it.)
2. Remove the No. 15 EPS (40 A) fuse from the under-dash fuse/relay box.
3. Raise the engine to a speed between 3,500 - 4,000 rpm in Park or neutral until the IMA battery charge level gauge indicates 19 segments.
4. Turn the ignition switch off.
5. Repeat steps 1 - 4 five times. (Increase the battery temperature and voltage to meet the Enable Conditions.)
6. Install the No. 15 EPS (40 A) fuse in the under-dash fuse/relay box.
7. Start the engine.

8. Let the engine idle for at least 3 minutes.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P1454 (91): ADVANCED DIAGNOSTICS

DTC P1454: FUEL TANK PRESSURE (FTP) SENSOR CIRCUIT RANGE/PERFORMANCE PROBLEM

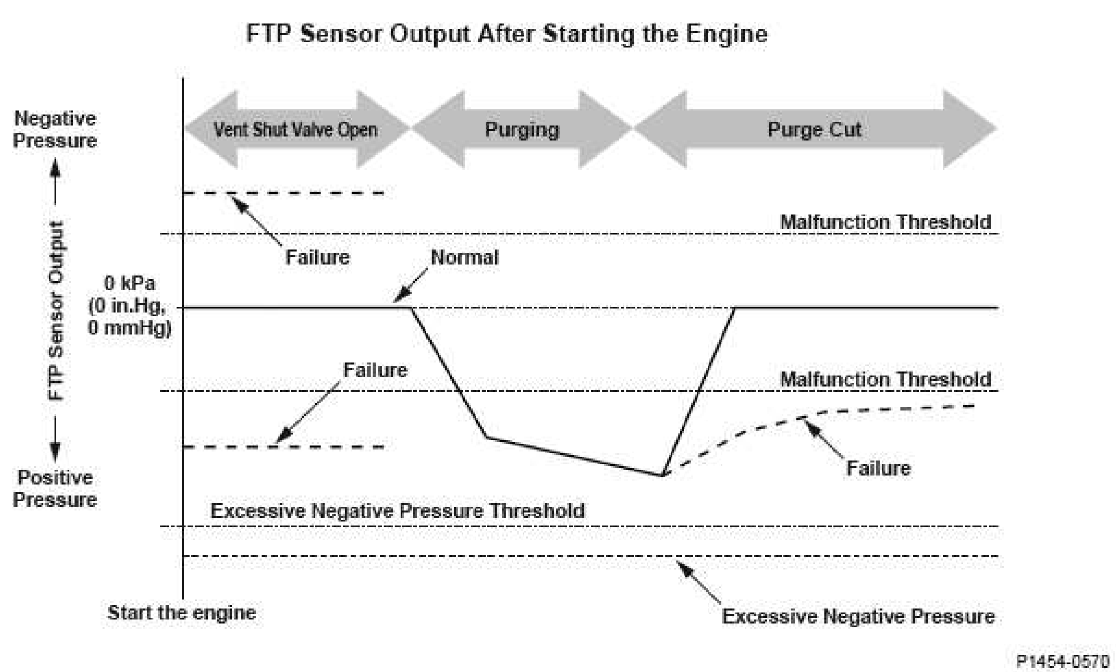


Fig. 159: Fuel Tank Pressure (FTP) - Graph

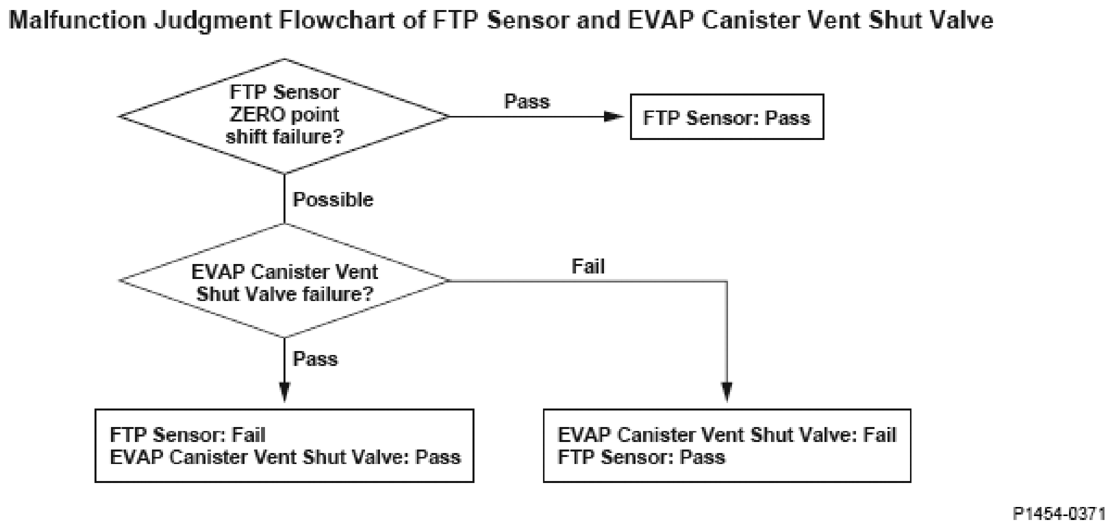


Fig. 160: Flow Chart

General Description

The fuel tank pressure is about 0 kPa (0 in.Hg, 0 mmHg) when starting a cold engine. When the fuel tank pressure (FTP) sensor output value is out of a specified range and the engine control module (ECM) judges that there's no other cause [no evaporative emission (EVAP) canister vent shut valve failure, etc.] of the FTP sensor zero point shift, the ECM detects an FTP sensor malfunction.

However, if the FTP sensor output when starting the engine is a prescribed negative value or less (excessive negative pressure is detected), the malfunction judgment should be done as follows because it is difficult to distinguish the FTP sensor zero point shift (P1454) from the EVAP canister vent shut valve failure (P2422).

1. If either Temporary DTC P1454 or P2422 is not stored, the ECM stores both DTCs.
2. If both P1454 and P2422 Temporary DTCs are stored and an excessive negative pressure is detected, both P1454 and P2422 DTCs are stored.
3. If either Temporary DTC P1454 or P2422 is stored and an excessive negative pressure is detected, the ECM stores the DTC of the temporary DTC that was stored.

MONITOR DESCRIPTION CHART

Execution	Once per driving cycle

Sequence	None
Duration	3 seconds or more
DTC Type	Two drive cycles, MIL ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
Elapsed time after starting the engine	20 seconds	-
Elapsed time after stopping the purge control	5 seconds	-
No active DTCs	A/F Sensor, A/F Sensor Heater, MAP, CKP, ECT, BARO, EVAP, FTP	

Malfunction Threshold

- The FTP sensor output fluctuates by 0.7 kPa (0.2 in.Hg, 5 mmHg) or more, or -0.7 kPa (-0.2 in.Hg, -5 mmHg) or less, for at least 3 seconds.
- The FTP sensor output value is -1.3 kPa (-0.3 in.Hg, -10 mmHg) or less for at least 3 seconds.

Driving Pattern

Start the engine, and let it idle until the radiator fan comes on.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the ECM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared

by using the scan tool Clear command or by disconnecting the battery.

DTC P1559 (16): ADVANCED DIAGNOSTICS

DTC P1559 (16): MOTOR COMMUTATION SENSOR A CIRCUIT LOW INPUT

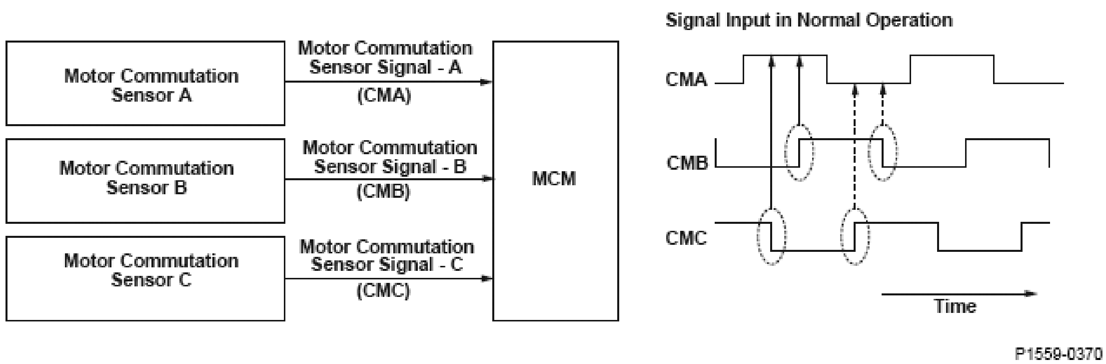


Fig. 161: Motor Commutation Sensor A Circuit Low Input - Communication Diagram

General Description

The motor control module (MCM) monitors the motor rotor position to control motor output. The motor commutation sensor outputs six pulsing signals for each motor revolution.

The Low/High combination of the motor commutation sensor signals and its transition state follow a specific pattern (shown above), and normally they agree.

The MCM monitors the motor commutation sensor A (CMA) phase when the High/Low combination of the motor commutation sensor B (CMB) and the motor commutation sensor C (CMC) input pulses change.

When the CMB signal is changing to High or the CMC signal is changing to Low during normal operation, the transition state of the CMA is High. If the CMA signal is low a certain number of times within a specified duration, a malfunction of the CMA signal is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None

Duration	0.5 seconds or more
DTC Type	One drive cycle, MIL ON, IMA system indicator ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
MCM power-supply voltage	7.0 V	-
Motor (engine) speed	500 rpm	-

Malfunction Threshold

The CMA lower limit malfunction detection counter value is at least 25 within 0.5 seconds.

Driving Pattern

Start the engine, and let it idle for at least 5 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P1560 (17): ADVANCED DIAGNOSTICS

DTC P1560 (17): MOTOR COMMUTATION SENSOR A CIRCUIT HIGH INPUT

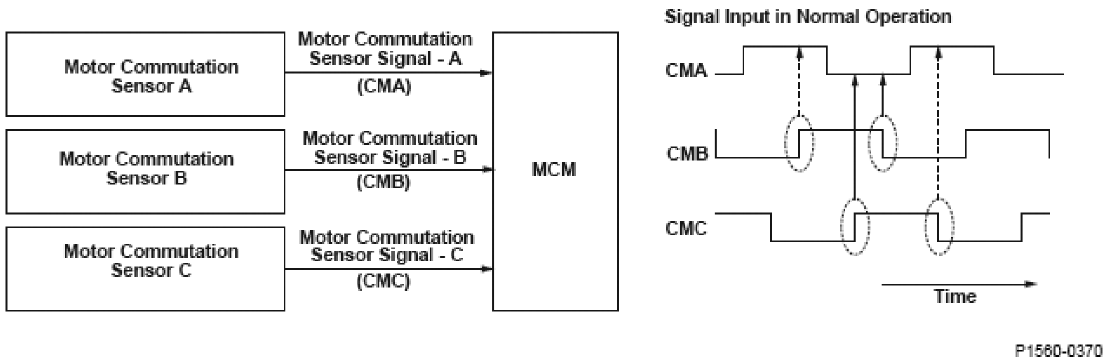


Fig. 162: Motor Commutation Sensor A Circuit High Input - Communication Diagram

General Description

The motor control module (MCM) monitors the motor rotor position to control motor output. The motor commutation sensor outputs six pulsing signals for each motor revolution.

The Low/High combination of the motor commutation sensor signals and its transition state follow a specific pattern (shown above), and normally they agree.

The MCM monitors the motor commutation sensor A (CMA) phase when the High/Low combination of the motor commutation sensor B (CMB) and the motor commutation sensor C (CMC) input pulses change.

When the CMB signal is changing to Low or the CMC signal is changing to High during normal operation, the transition state of the CMA is Low. If the CMA signal is high a certain number of times within a specified duration, a malfunction of the CMA signal is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	0.5 seconds or more
DTC Type	One drive cycle, MIL ON, IMA system indicator ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
MCM power-supply voltage	7.0 V	-
Motor (engine) speed	500 rpm	-

Malfunction Threshold

The CMA upper limit malfunction detection counter value is at least 25 within 0.5 seconds.

Driving Pattern

Start the engine, and let it idle for at least 5 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P1561 (18): ADVANCED DIAGNOSTICS

DTC P1561 (18): MOTOR COMMUTATION SENSOR B CIRCUIT LOW INPUT

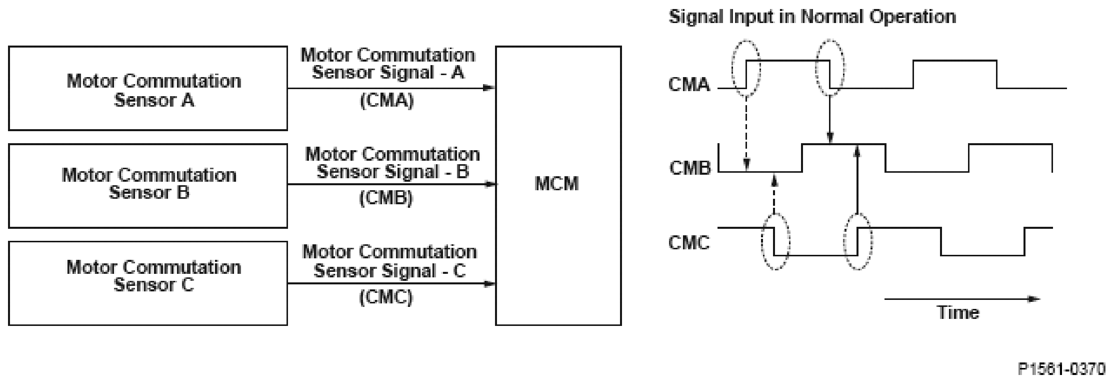


Fig. 163: Motor Commutation Sensor B Circuit Low Input - Communication Diagram

General Description

The motor control module (MCM) monitors the motor rotor position to control motor output. The motor commutation sensor outputs six pulsing signals for each motor revolution.

The Low/High combination of the motor commutation sensor signals and its transition state follow a specific pattern (shown above), and normally they agree.

The MCM monitors the motor commutation sensor B (CMB) phase when the High/Low combination of the motor commutation sensor A (CMA) and the motor commutation sensor C (CMC) input pulses change.

When the CMA signal is changing to Low or the CMC signal is changing to High during normal operation, the transition state of the CMB is High. If the CMB signal is low a certain number of times within a specified duration, a malfunction of the CMB signal is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	0.5 seconds or more
DTC Type	One drive cycle, MIL ON, IMA system indicator ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
MCM power-supply voltage	7.0 V	-
Motor (engine) speed	500 rpm	-

Malfunction Threshold

The CMB lower limit malfunction detection counter value is at least 25 within 0.5 seconds.

Driving Pattern

Start the engine, and let it idle for at least 5 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P1562 (52): ADVANCED DIAGNOSTICS

DTC P1562 (52): MOTOR COMMUTATION SENSOR B CIRCUIT HIGH INPUT

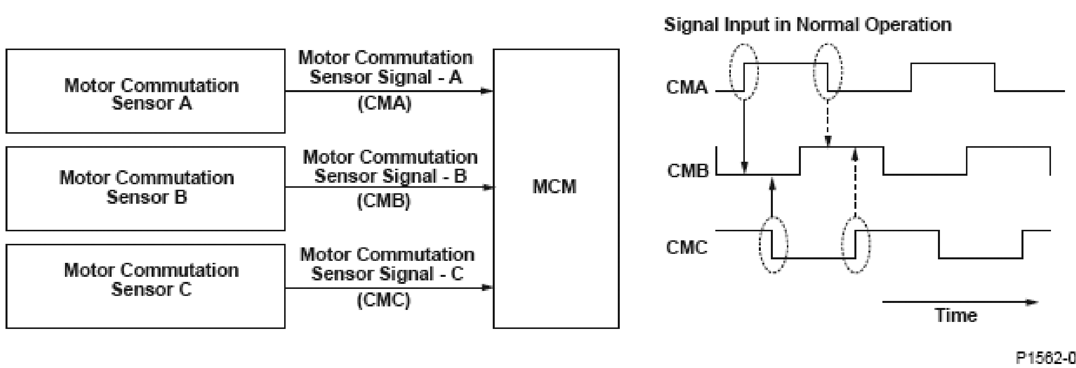


Fig. 164: Motor Commutation Sensor B Circuit High Input - Communication Diagram

General Description

The motor control module (MCM) monitors the motor rotor position to control motor output. The motor commutation sensor outputs six pulsing signals for each motor revolution.

The Low/High combination of the motor commutation sensor signals and its transition state follow a specific pattern (shown above), and normally they agree.

The MCM monitors the motor commutation sensor B (CMB) phase when the High/Low combination of the motor commutation sensor A (CMA) and the motor commutation sensor C (CMC) input pulses change.

When the CMA signal is changing to High or the CMC signal is changing to Low during normal operation, the transition state of the CMB is Low. If the CMB signal is high a certain number of times within a specified duration, a malfunction of the CMB signal is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	0.5 seconds or more
DTC Type	One drive cycle, MIL ON, IMA system indicator ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
MCM power-supply voltage	7.0 V	-
Motor (engine) speed	500 rpm	-

Malfunction Threshold

The CMB upper limit malfunction detection counter value is at least 25 within 0.5 seconds.

Driving Pattern

Start the engine, and let it idle for at least 5 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P1563 (53): ADVANCED DIAGNOSTICS

DTC P1563 (53): MOTOR COMMUTATION SENSOR C CIRCUIT LOW INPUT

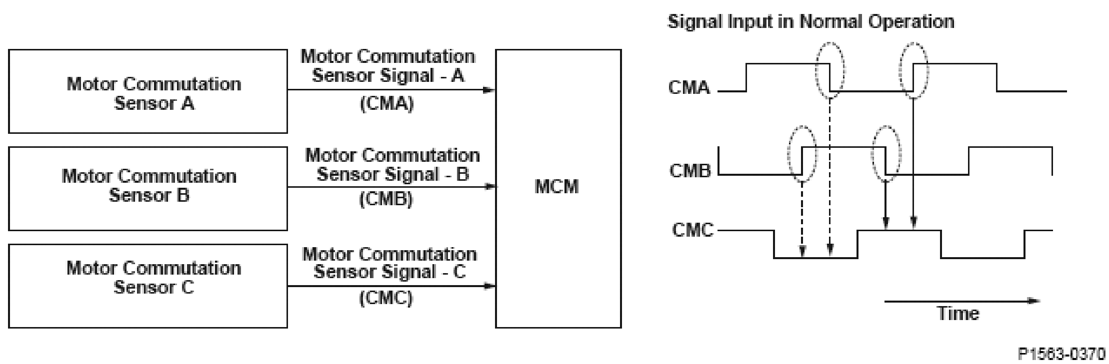


Fig. 165: Motor Commutation Sensor C Circuit Low Input - Communication Diagram

General Description

The motor control module (MCM) monitors the motor rotor position to control motor output. The motor commutation sensor outputs six pulsing signals for each motor revolution.

The Low/High combination of the motor commutation sensor signals and its transition state follow a specific pattern (shown above), and normally they agree.

The MCM monitors the motor commutation sensor C (CMC) phase when the High/Low combination of the motor commutation sensor A (CMA) and the motor commutation sensor B (CMB) input pulses change.

When the CMA signal is changing to High or the CMB signal is changing to Low during normal operation, the transition state of the CMC is High. If the CMC signal is low a certain number of times within a specified duration, a malfunction of the CMC signal is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	0.5 seconds or more
DTC Type	One drive cycle, MIL ON, IMA system indicator ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
MCM power-supply voltage	7.0 V	-
Motor (engine) speed	500 rpm	-

Malfunction Threshold

The CMC lower limit malfunction detection counter value is at least 25 within 0.5 seconds.

Driving Pattern

Start the engine, and let it idle for at least 5 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P1564 (54): ADVANCED DIAGNOSTICS

DTC P1564 (54): MOTOR COMMUTATION SENSOR C CIRCUIT HIGH INPUT

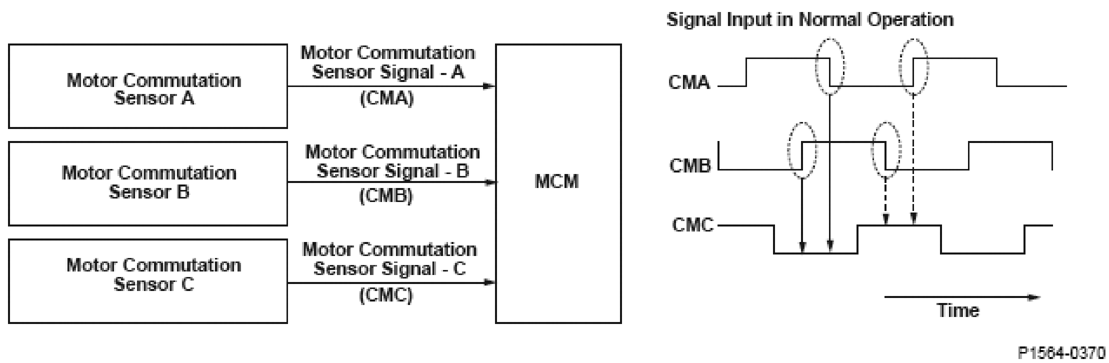


Fig. 166: Motor Commutation Sensor C Circuit High Input - Communication Diagram

General Description

The motor control module (MCM) monitors the motor rotor position to control motor output. The motor commutation sensor outputs six pulsing signals for each motor revolution.

The Low/High combination of the motor commutation sensor signals and its transition state follow a specific pattern (shown above), and normally they agree.

The MCM monitors the motor commutation sensor C (CMC) phase when the High/Low combination of the motor commutation sensor A (CMA) and the motor commutation sensor B (CMB) input pulses change.

When the CMA signal is changing to Low or the CMB signal is changing to High during normal operation, the transition state of the CMC is Low. If the CMC signal is high a certain number of times within a specified duration, a malfunction of the CMC signal is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	0.5 seconds or more
DTC Type	One drive cycle, MIL ON, IMA system indicator ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
MCM power-supply voltage	7.0 V	-
Motor (engine) speed	500 rpm	-

Malfunction Threshold

The CMC upper limit malfunction detection counter value is at least 25 within 0.5 seconds.

Driving Pattern

Start the engine, and let it idle for at least 5 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P1566 (42): ADVANCED DIAGNOSTICS

DTC P1566 (42): MOTOR COMMUTATION SIGNAL PROBLEM

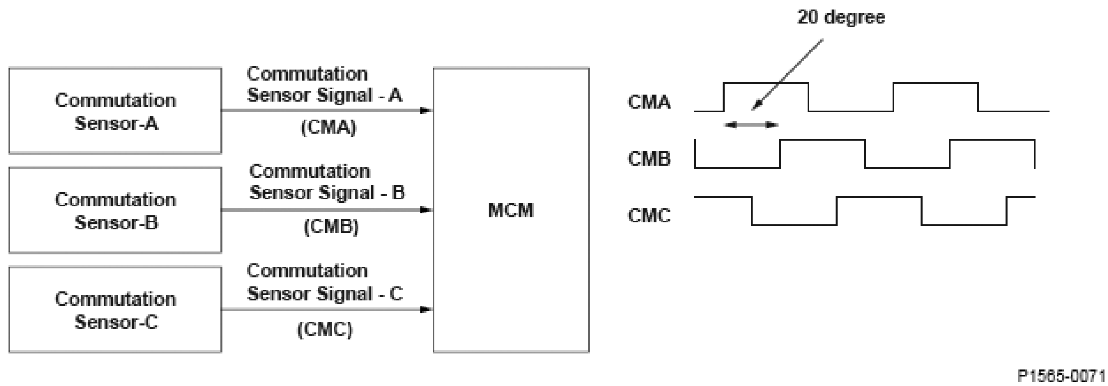


Fig. 167: Motor Commutation Signal - Communication Diagram

General Description

The motor control module (MCM) detects rotor polar position based on the Low/High combinations of three commutation sensors signals (CMA, CMB, CMC) to supply power to the motor. Each commutation sensor outputs six pulsing signals for each motor revolution, and each signal (CMA, CMB, CMC) phase differs by 20 degrees. The Low/High combination of the signals and its transition state follows a specific pattern, and they are considered abnormal when they do not agree. Normally, the transition state of CMA, CMB, and CMC is synchronized if it follows this pattern:

[L:L:H]-->[H:L:H]-->[H:L:L]-->[H:H:L]-->[L:H:L]-->[L:H:H]-->[L:L:H]--> . . . (H represents High, L represents Low)

If the MCM detects abnormalities a specific number of times within a set duration, it determines the commutation sensor signal is faulty and stores a DTC.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	0.5 seconds or more
DTC Type	One drive cycle, MIL ON, IMA system indicator ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
MCM power-supply voltage	7.0 V	-
Motor speed	500 rpm	-

Malfunction Threshold

An abnormality has been detected at least 150 times within 0.5 seconds when the transition state of CMA, CMB, or CMC is abnormal.

Driving Pattern

Drive the vehicle at a steady speed of 25 mph (40km/h) with the brake pedal released on a flat road for at least 2 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P1569 (70): ADVANCED DIAGNOSTICS

DTC P1569 (70): BATTERY CELL TEMPERATURE SIGNAL CIRCUIT LOW INPUT

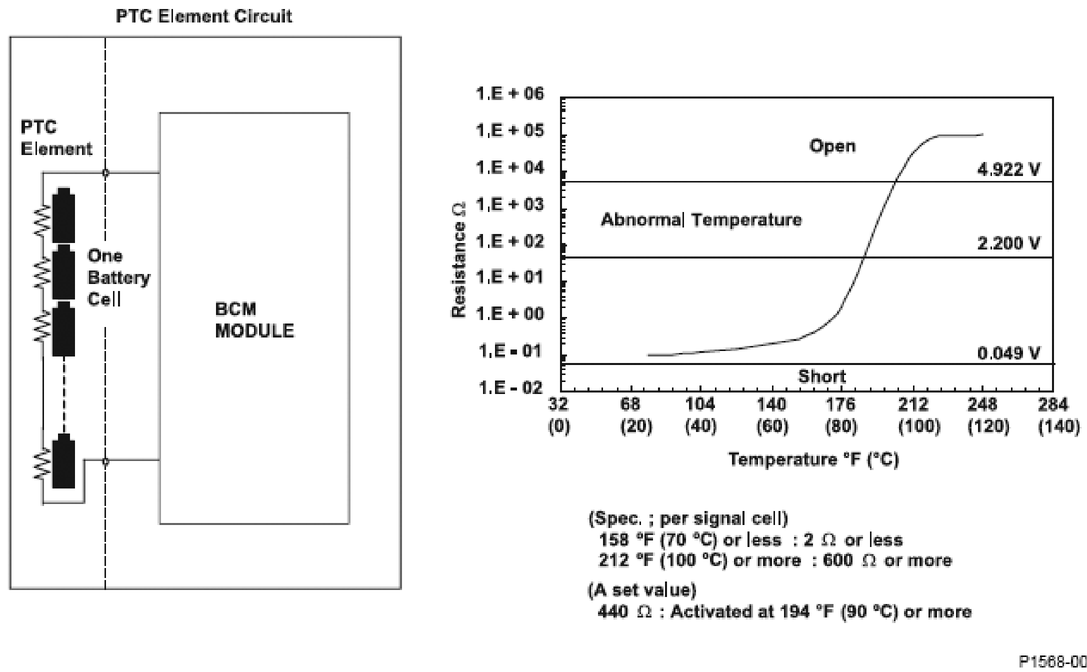


Fig. 168: Battery Cell Temperature Signal Circuit Low Input - Circuit Diagram

General Description

A PTC (positive temperature coefficient) element has the characteristics shown above (for example, the resistance increases drastically at a temperature between 158 - 212°F (70 - 100°C)), and it is used to determine if a monitored object's temperature exceeds a set value. A PTC is installed in each of the 120 battery cells to detect overheating, an open, or a short. If the PTC input voltage is less than the lower threshold, a malfunction is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	2 seconds or more
DTC Type	One drive cycle, MIL ON, IMA system indicator ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
BCM power-supply voltage	7.5 V	-

Ignition switch	ON
No active DTCs	BCM, Battery module

Malfunction Threshold

The PTC output voltage is 0.049 V or less for at least 2 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P1570 (66): ADVANCED DIAGNOSTICS

DTC P1570 (66): BATTERY MODULE INDIVIDUAL VOLTAGE INPUT PROBLEM

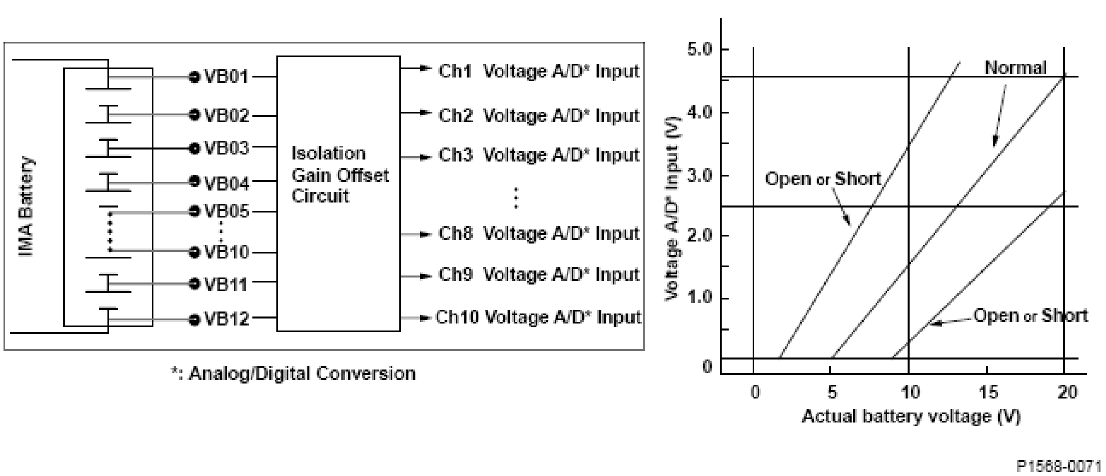


Fig. 169: Battery Module Individual Voltage Input - Communication Diagram

General Description

The high voltage side resistance of the voltage sensor is divided into two (2 Mohms and 1 Mohms) to measure the voltage that is divided at adjacent channels (individual voltage) when the circuit is open. If the battery pack is normal, the voltage hardly varies (about 1 V at the maximum). However, if there is an open in the line shared by adjacent channels, a voltage of four thirds or two thirds is measured, that is, if the individual voltage output from each battery is 12 V, a voltage of 16 V or 8 V is detected. Consequently, judging by the difference between the maximum and minimum voltage, a malfunction is detected and a DTC is stored.

If there are no adjacent channels, the high voltage side is considered to be shorted to resistance and the minimum voltage is detected.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	BCM
Duration	2 seconds or more
DTC Type	One drive cycle, MIL ON, IMA system indicator ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
Detected individual voltage (one or more channels between ch1 - ch10)	15 V	-
BCM module power-supply voltage	7.5 V	-
No active DTCs	BCM	

Malfunction Threshold

The difference between the maximum and minimum voltage is 4 V or more for at least 2 seconds.

Driving pattern

1. Do the BCM module reset procedure. (Disconnect the 12 V battery terminal and reconnect it.)
2. Remove the No.15 EPS (40 A) fuse from the under-dash fuse/relay box.
3. Hold the engine at a speed between 3,500 - 4,000 rpm without load (in Park or

neutral), and wait until 14 segments of the indicator on the IMA battery charge gauge are illuminated.

4. Turn off the ignition switch.
5. Reinstall the No.15 EPS (40 A) fuse.
6. Turn on the ignition switch, and wait for at least 5 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P1571 (55): ADVANCED DIAGNOSTICS

DTC P1571 (55): MOTOR COMMUTATION SENSOR VOLTAGE PROBLEM

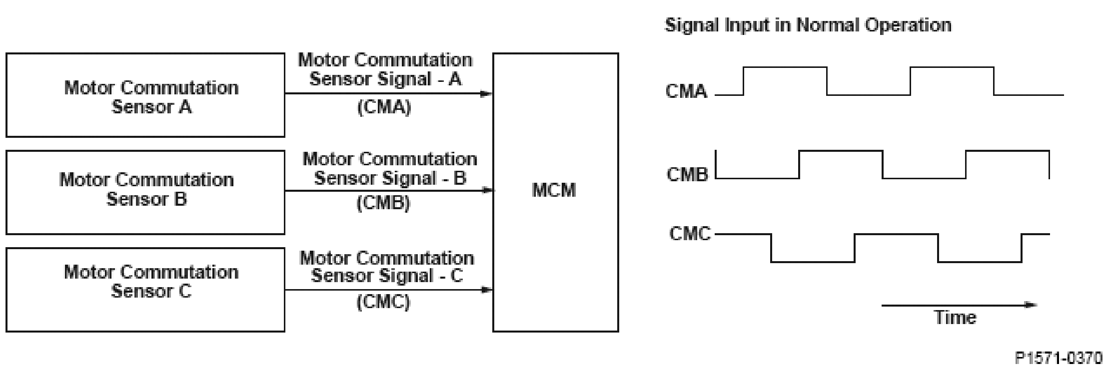


Fig. 170: Motor Commutation Sensor Voltage - Communication Diagram

General Description

The motor control module (MCM) monitors the motor rotor position to control motor output. The MCM senses the motor rotor position from the High/Low combination of the three motor commutation sensor signals.

Under normal conditions, the transition status of the three input signals do not match (High or Low).

The MCM monitors the input signal phase of motor commutation sensor A (CMA), motor commutation sensor B (CMB), and motor commutation sensor C (CMC). If all three signal phases stay High or Low together for a specified time, a high/low limit malfunction of the three sensor signals are detected, and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	0.5 seconds or more
DTC Type	One drive cycle, MIL ON, IMA system indicator ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
MCM power-supply voltage	7.0 V	-
Motor (engine) speed	-	500 rpm
Ignition switch	ON	

Malfunction Threshold

All the CMA, CMB and CMC signals are low or high at least 40 times within 0.5 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P1575 (12): ADVANCED DIAGNOSTICS

DTC P1575 (12): MOTOR DRIVE MODULE (MDM) VOLTAGE PROBLEM

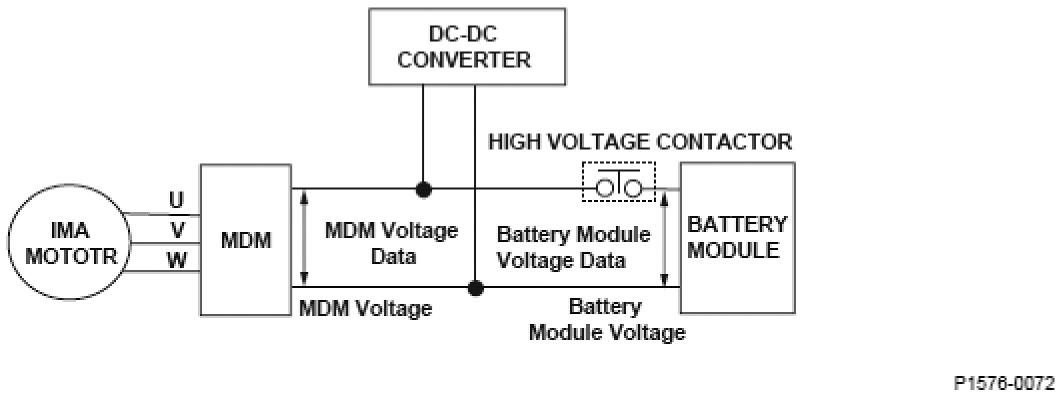


Fig. 171: Motor Drive Module (MDM) Voltage - Communication Diagram

General Description

To avoid an increase or a decrease in motor output caused by the voltage sensor malfunctioning, it is necessary to compare voltage transmitted from the BCM (battery condition monitor) module with the MDM (motor drive module) voltage. If the difference between them is more than a set value for a specified time, a malfunction is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	Engine speed signal circuit, IMA system, Detection signal circuit, MPI, Mode signal circuit 2
Duration	2 seconds or more
DTC Type	One drive cycle, MIL ON, IMA system indicator ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
MCM power-		

supply voltage	10.5 V	-
MDM voltage sensor (VPIN)	100 V	-
High battery voltage sensor (VHB)	100 V	-
No active DTCs	MPI, Motor current sensor, Battery module, Battery module temperature sensor, MCM, MDM, Motor operation system, Bypass contactor, Motor commutation sensor, MDM voltage sensor, Battery current sensor, MPI module current sensor, MDM current sensor, BCM	
Other	Other than MDM voltage sensor (VPIN) input voltage that is out of the upper and lower malfunction threshold (failure range)	

Malfunction Threshold

The VPIN (MDM voltage) minus the VHB (high battery voltage sensor) equals 10 V or more for at least 2 seconds.

Driving Pattern

Turn on the ignition switch, and wait for at least 10 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P1577 (8): ADVANCED DIAGNOSTICS

DTC P1577 (8): HIGH VOLTAGE DETECTION SIGNAL CIRCUIT PROBLEM

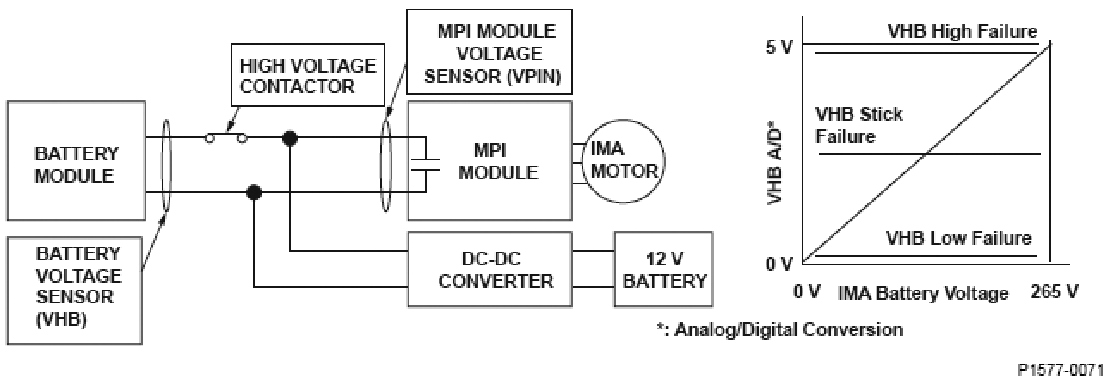


Fig. 172: High Voltage Detection Signal - Communication Diagram

General Description

The BCM (battery condition monitor) module voltage (VHB) is used to turn the high voltage contactor in the IMA (integrated motor assist) system on or off. The IMA system will not operate when the high voltage contactor cannot be turned on due to a problem in the VHB. Also, this problem may cause a failure in the detection of a short to ground. Comparing both the MPI (motor power inverter) module voltage (VPIN) and the VHB sensor values, various types of problem detection are possible because the VPIN and the VHB are measured at the same point while applying voltage to the high voltage contactor in the IMA system. If the difference between the VHB and the VPIN is a set value for a specified time, a malfunction in the VHB is detected, and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	Motor current U/V/W phase signal circuit, Battery module, Battery cell, IMA system, Bypass contactor, Motor commutation sensor, Battery cell temperature signal circuit, Battery current circuit, Motor current signal circuit, MPI, MDM, BCM, MCM
Duration	5 seconds or more
DTC Type	One drive cycle, MIL ON, IMA system indicator ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
MCM power-supply voltage	10.5 V	-
No active DTCs	MPI, Motor current sensor, Battery module, Battery module temperature sensor, MCM, MDM, Motor operation system, Bypass contactor, Motor commutation sensor, MDM voltage sensor, Battery current sensor, MPI module current sensor, MDM current sensor, BCM	

Malfunction Threshold

The BCM module voltage (VHB) minus the MPI module voltage (VPIN) equals 20 V or more for at least 5 seconds.

Driving Pattern

1. Connect the HDS.
2. Start the engine, and let it idle for at least 20 seconds.
3. Accelerate the vehicle for at least 10 seconds with IMA assist.
4. Apply the brakes, and decelerate the vehicle for at least 10 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P1580 (65): ADVANCED DIAGNOSTICS

DTC P1580 (65): BATTERY CURRENT CIRCUIT PROBLEM

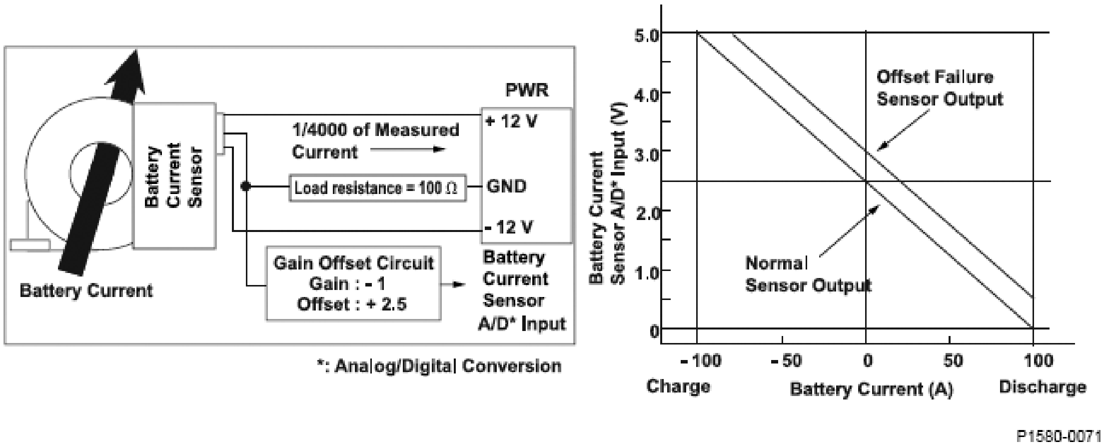


Fig. 173: Battery Current Circuit - Communication Diagram

General Description

The BCM (battery condition monitor) module samples the battery current sensor value several times during a set time until the power supply is stabilized after activation, and determines the amount of offset by using a moving average technique. The offset is at the midpoint (±6.7 A) between the maximum tolerance (±3.4 A) and the maximum offset error that allows the system to work normally (±10.0 A), and it is used as an offset failure threshold.

If the offset is beyond the threshold, a malfunction is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Once per driving cycle
Sequence	BCM
Duration	0.5 seconds or more
DTC Type	One drive cycle, MIL ON, IMA system indicator ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
BCM power-supply voltage	7.5 V	-

Malfunction Threshold

The battery current sensor voltage is 167.2 mV or more, or -167.2 mV or less, for at least 0.5 seconds.

Driving Pattern

Turn on the ignition switch, and wait for at least 5 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P1585 (30): ADVANCED DIAGNOSTICS

DTC P1585 (30): MOTOR CURRENT SIGNAL CIRCUIT PROBLEM

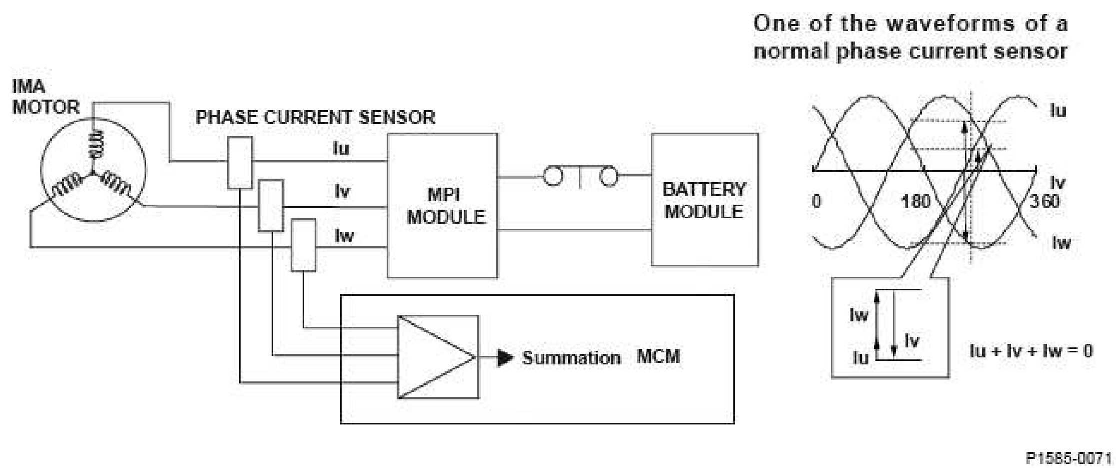


Fig. 174: Motor Current Signal - Circuit Diagram

General Description

If the output voltage is drifting or freezing due to a faulty phase current sensor, the motor output torque may not be properly controlled. If the three phase current sensors (Iu, Iv, Iw) work normally, the summation value is always 0 A. However, if one of the three sensors is drifting or freezing, the summation is not 0 A. By using a built-in circuit which calculates the sum of the three phase current sensor's amperage in the MCM (motor control module), the output from the counting circuit can be monitored. If the output is beyond a set value, a malfunction is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	Motor current U/V/W phase signal circuit
Duration	0.5 seconds or more (depending on changes in motor speed)
DTC Type	One drive cycle, MIL ON, IMA system indicator ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
MCM power-supply voltage	10.5 V	-
No active DTCs	U/V/W Motor current sensors	

Malfunction Threshold

The MCM internal counting circuit output voltage is 2.1 V or less, or 2.9 V or more, for at least 0.5 seconds.

Driving Pattern

Turn on the ignition switch, and wait for at least 5 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P1586 (23): ADVANCED DIAGNOSTICS

DTC P1586 (23): MOTOR POWER INVERTER (MPI) MODULE CURRENT SIGNAL/BATTERY CURRENT SIGNAL CIRCUIT PROBLEM

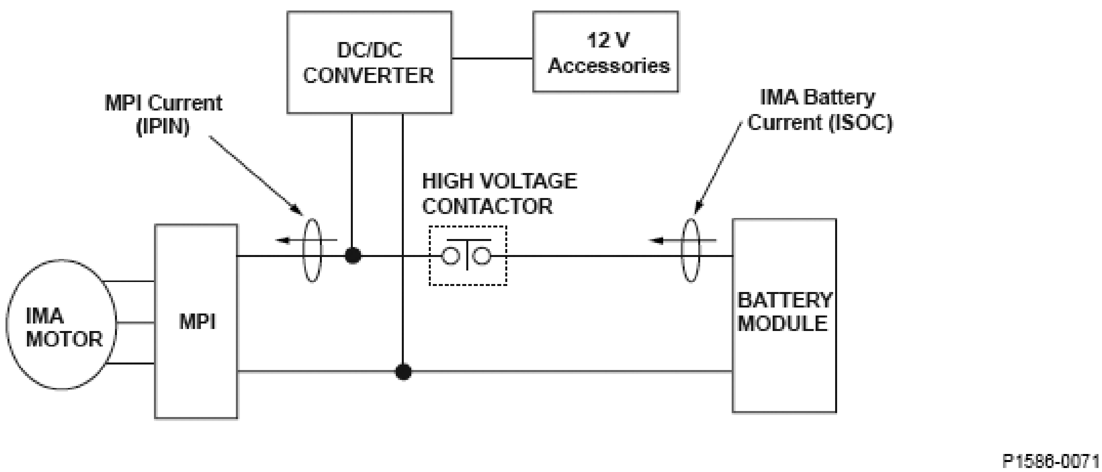


Fig. 175: Motor Power Inverter (MPI) Module Current Signal - Communication Diagram

General Description

The MPI (motor power inverter) current (IPIN) and the battery module (BM) current (ISOC) are used for energy management or motor control in the IMA (integrated motor assist) system. If the correct current cannot be detected, the exhaust emission, the fuel economy or drivability may be adversely affected.

With the high-voltage contactor ON, the IPIN and the ISOC are used to monitor current flowing on the same line through the DC-DC converter which supplies power to the accessories. Comparing the IPIN and the ISOC in relation to the DC-DC converter power consumption enables it to detect a faulty IPIN or ISOC.

If the difference between the IPIN and the ISOC is a set value for a specified time, a malfunction is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	Motor current U/V/W phase signal circuit, Battery module, Battery cell, IMA system, Bypass contactor, Motor commutation sensor, Battery cell temperature signal circuit, Detection signal circuit, Battery current circuit, Motor current signal circuit, MPI, MDM, BCM, MCM
Duration	2 seconds or more
DTC Type	One drive cycle, MIL ON, IMA system indicator ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
MCM power-supply voltage	10.5 V	-
No active DTCs	MPI, Motor current sensor, Battery module, Battery module temperature sensor, MCM, MDM, Motor operation system, Bypass contactor, Motor commutation sensor, MDM voltage sensor, Battery current sensor, MDM current sensor, BCM	

Malfunction Threshold

The MPI current (IPIN) minus the IMA battery current (ISOC) equals -9 A or less, or 23 A or more, for at least 2 seconds.

Driving Pattern

1. Connect the HDS and start the engine, then turn all accessories (the headlights, the defroster, the blower, the A/C, and the ceiling light) off to minimize the engine load.
2. Let the engine idle for at least 5 seconds.
3. Accelerate the vehicle with wide open throttle for at least 5 seconds.
4. Then, apply the brakes, and decelerate the vehicle for at least 5 seconds, then turn all accessories on to maximize the engine load (the high beam headlights on, the defroster on, the blower on high speed, the A/C on, and the ceiling light

on).
5. Repeat steps 2 through 4 once more.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P1587 (19): ADVANCED DIAGNOSTICS

DTC P1587 (19): MOTOR POWER INVERTER (MPI) MODULE CURRENT SIGNAL CIRCUIT LOW INPUT

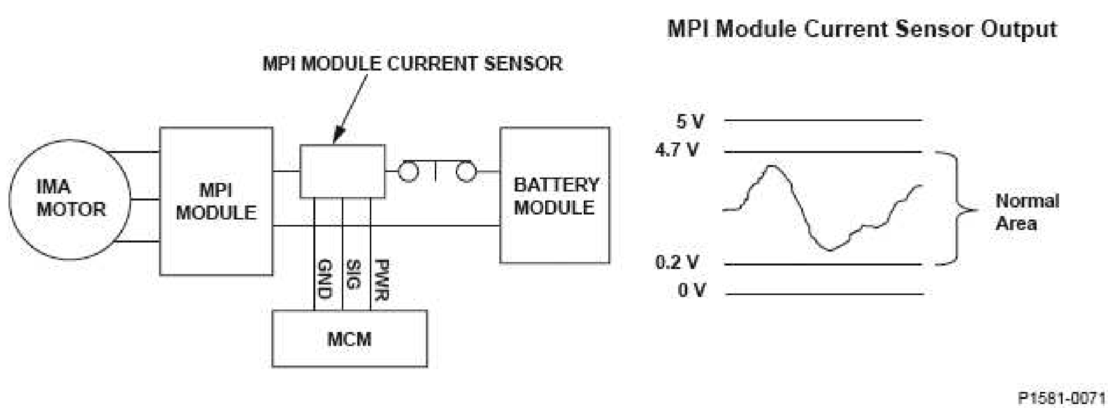


Fig. 176: Motor Power Inverter (MPI) Module Current Signal Circuit Low Input - Communication Diagram

General Description

The MCM (motor control module) controls the motor output based on the MPI (motor power inverter) module current sensor signals. Under ordinary conditions, the MPI module current sensor has these characteristics: if its input current is -200

A or less, the output voltage is between 4.5 - 4.7 V, or if its input current is +200 A or more, the output voltage is between 0.2 - 0.5 V. If an open in the signal wire, a short to ground, or a faulty ground wiring harness or a faulty sensor power source line occurs, the output voltage stays out of range.

If the input voltage to the MCM is much lower than the normal range, a malfunction such as an open in the signal wire, a short to ground, or a faulty ground wiring harness or a short to ground is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	2 seconds or more
DTC Type	One drive cycle, MIL ON, IMA system indicator ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
MCM power-supply voltage	10.5 V	-
Ignition switch	ON	
No active DTCs	MDM	

Malfunction Threshold

The MCM input voltage is 0.156 V or less for at least 2 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool

Clear command or by disconnecting the battery.

DTC P1588 (20): ADVANCED DIAGNOSTICS

DTC P1588 (20): MOTOR POWER INVERTER (MPI) MODULE CURRENT SIGNAL CIRCUIT HIGH INPUT

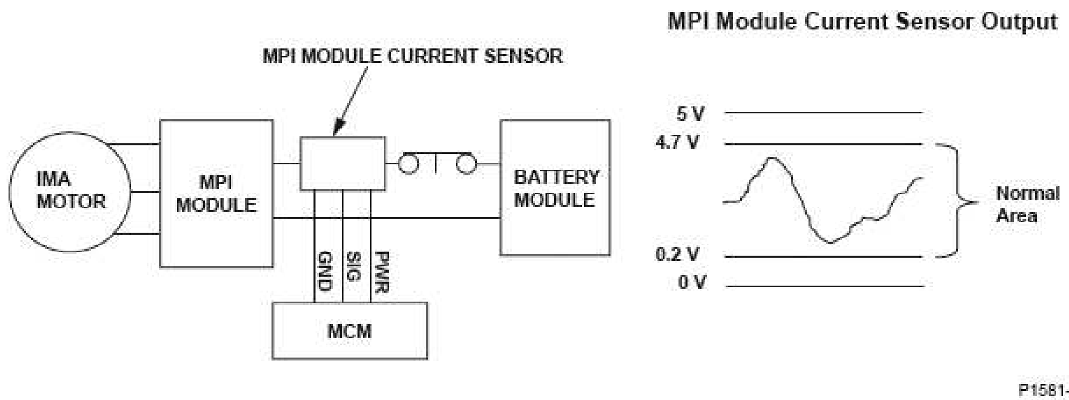


Fig. 177: Motor Power Inverter (MPI) Module Current Signal Circuit Low Input - Communication Diagram

General Description

The motor control module (MCM) controls the integrated motor assist (IMA) motor output based on the motor power inverter (MPI) module current sensor signal. Under ordinary conditions, the MPI module current sensor shows certain characteristics: If its input current is -200 A or less, the output voltage is between 4.5 - 4.7 V, or if its input current is 200 A or more, the output voltage is between 0.2 - 0.5 V. When an open in the signal wire, a short to ground, a faulty sensor power supply cable or a faulty ground wiring harness occurs, the output voltage stays out of the aforementioned range.

If the input signal voltage to the MCM is much higher than the normal range, a malfunction in the sensor ground wiring harness is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	2 seconds or more

DTC Type	One drive cycle, MIL ON, IMA system indicator ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
MCM power-supply voltage	10.5 V	-
Ignition switch	ON	
No active DTCs	MDM	

Malfunction Threshold

The MCM input voltage is 4.843 V or more for at least 2 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P1589 (21): ADVANCED DIAGNOSTICS

DTC P1589 (21): MOTOR POWER INVERTER (MPI) MODULE CURRENT SIGNAL CIRCUIT PROBLEM

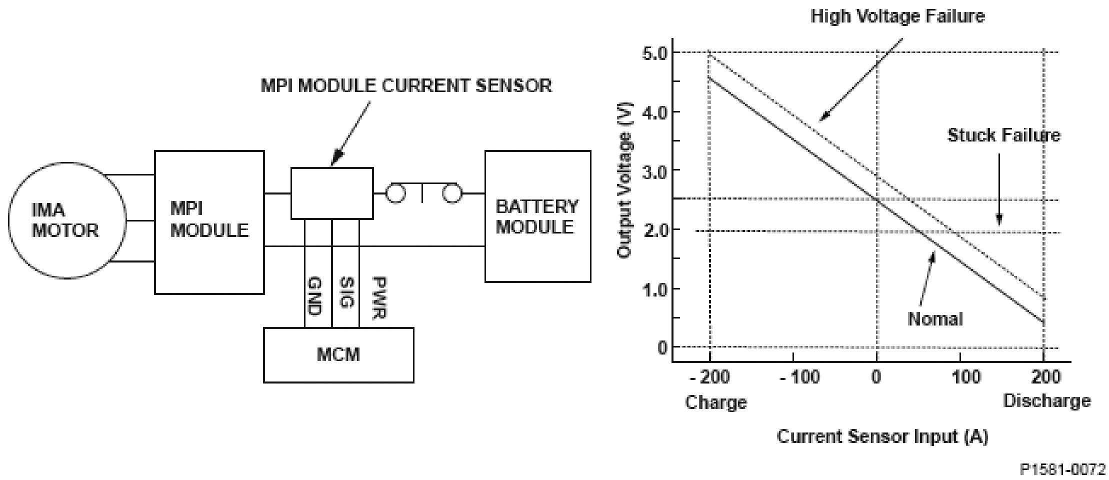


Fig. 178: Motor Power Inverter (MPI) Module Current Signal Circuit Problem - Communication Diagram

General Description

The motor output torque may not be properly controlled when the output voltage is drifting or freezing due to a faulty MPI (motor power inverter) module current sensor. The sensor output voltage should be 2.5 V ± 50 mV when the input current is 0 A. The current flowing to the MPI module before precharge or while the motor is not turning is 0 A. Therefore, it is possible to detect drifting or freezing from the sensor output voltage at that time.

The MCM (motor control module) samples the current sensor output voltage several times and computes offset voltage at 0 A. If the computed offset voltage is beyond a set value, a malfunction in the sensor is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Before the pre-charge, immediately after the ignition switch is turned on and during idle stop
Sequence	None
Duration	80 milliseconds or more
DTC Type	One drive cycle, MIL ON, IMA system indicator ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
MCM power-supply voltage	10.5 V	-
Motor (engine) speed	-	1,500 rpm
Motor torque	0 N.m (0 kgf.m, 0 lbf.ft)	

Malfunction Threshold

The MCM input voltage is 2.4 V or less, or 2.6 V or more, for at least 80 milliseconds.

Driving Pattern

1. Turn on the ignition switch, and wait for at least 5 seconds.
2. Start the engine.
3. Stop the engine, and wait for at least 5 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P15A0 (32): ADVANCED DIAGNOSTICS

DTC P15A0 (32): MOTOR DRIVE MODULE (MDM) TEMPERATURE SIGNAL CIRCUIT LOW INPUT

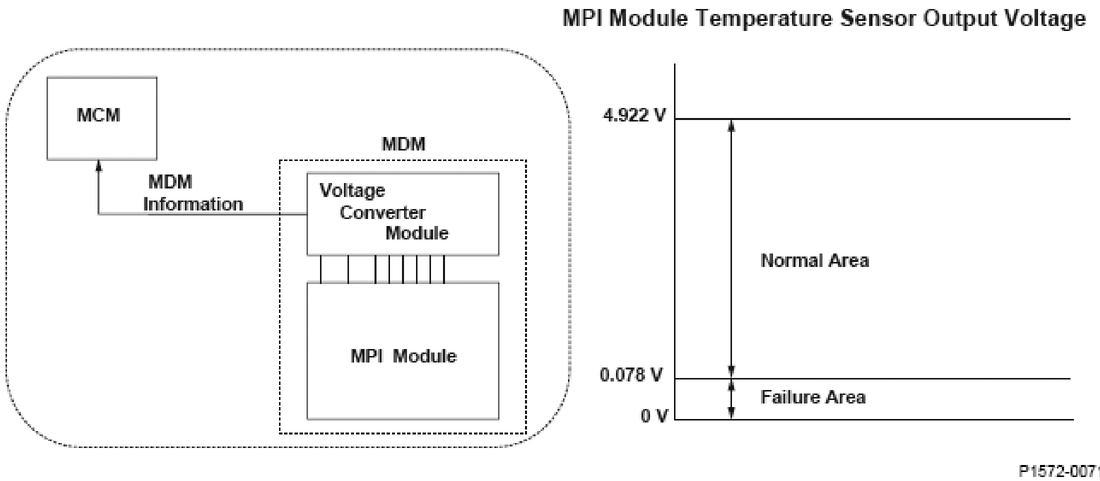


Fig. 179: Motor Drive Module (MDM) Temperature Signal Circuit Low Input - Communication Diagram

General Description

If the MCM (motor control module) control input voltage from the MPI (motor power inverter) module temperature sensor is below the lower limit of a set range, a short to ground in the sensor signals or a malfunction in the MCM input circuit is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	2 seconds or more
DTC Type	One drive cycle, MIL ON, IMA system indicator ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
BCM power-supply voltage	10.5 V	-
No active DTCs	MPI	

Malfunction Threshold

The MPI module temperature sensor output voltage is 0.078 V or less for at least 2 seconds.

Driving Pattern

Turn on the ignition switch, and wait for at least 5 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P15A1 (33): ADVANCED DIAGNOSTICS

DTC P15A1 (33): MOTOR DRIVE MODULE (MDM) TEMPERATURE SIGNAL CIRCUIT HIGH INPUT

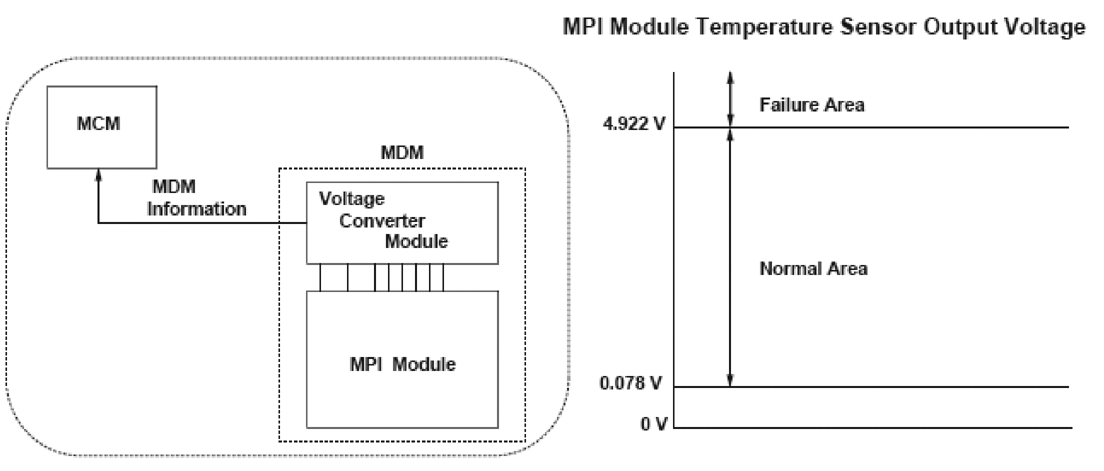


Fig. 180: Motor Drive Module (MDM) Temperature Signal Circuit High Input - Communication Diagram

General Description

If the MCM (motor control module) control input voltage from the MPI (motor power inverter) module temperature sensor is above the upper limit of a set range, an open in the signal wire, an open in the voltage converter module ground or a malfunction in the MCM input circuit is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	2 seconds or more
DTC Type	One drive cycle, MIL ON, IMA system indicator ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
BCM power-supply voltage	10.5 V	-
No active DTCs	MPI	

Malfunction Threshold

The MPI module temperature sensor output voltage is 4.922 V or more for at least 2 seconds.

Driving Pattern

Turn on the ignition switch, and wait for at least 5 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P15A2 (10): ADVANCED DIAGNOSTICS

DTC P15A2 (10): MOTOR DRIVE MODULE (MDM) VOLTAGE SIGNAL CIRCUIT LOW INPUT

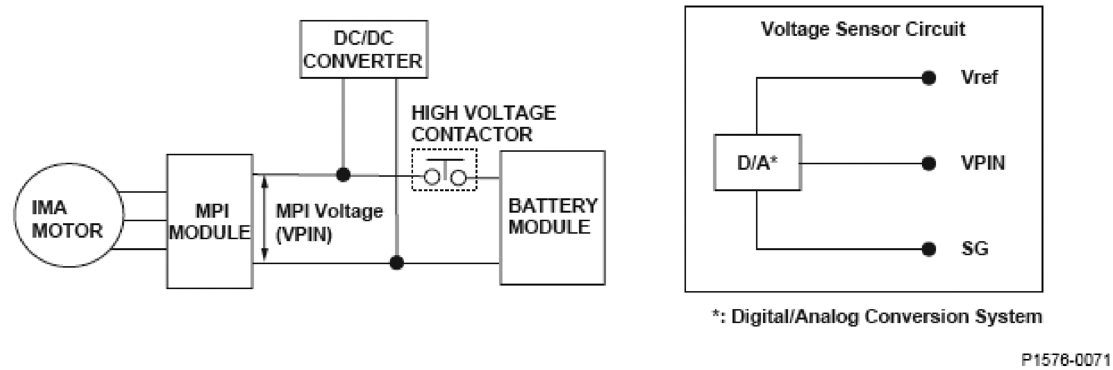


Fig. 181: Motor Drive Module (MDM) Voltage Signal Circuit Low Input - Communication Diagram

General Description

The MPI (motor power inverter) module voltage (VPIN) is used to control the IMA (integrated motor assist) motor and IMA battery energy management. If the VPIN cannot be detected precisely, the exhaust emissions, fuel economy, or drivability may be adversely affected.

Normally, the sensor output VPIN is more than 0.156 V. If it is below the specified range, a malfunction is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	2 seconds or more
DTC Type	One drive cycle, MIL ON, IMA system indicator ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
MCM power-supply voltage	10.5 V	-

No active DTCs	MPI, Motor current sensor, Battery module, Battery module temperature sensor, MCM, MDM, Motor operation system, Bypass contactor, Motor commutation sensor, MDM voltage sensor, Battery current sensor, MPI module current sensor, MDM current sensor, BCM

Malfunction Threshold

The MPI voltage (VPIN) sensor output is 0.156 V or less for at least 2 seconds.

Driving Pattern

1. Connect the HDS.
2. Turn on the ignition switch, and wait for at least 5 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P15A3 (11): ADVANCED DIAGNOSTICS

DTC P15A3 (11): MOTOR DRIVE MODULE (MDM) VOLTAGE SIGNAL CIRCUIT HIGH INPUT

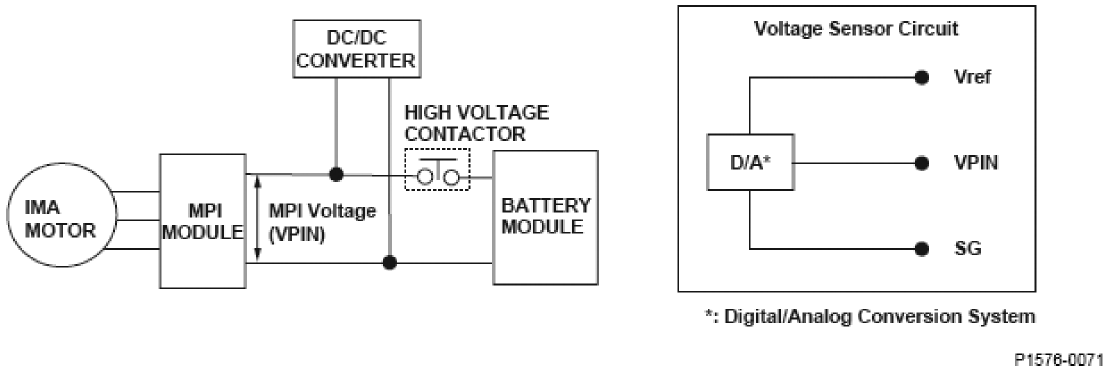


Fig. 182: Motor Drive Module (MDM) Voltage Signal Circuit Low Input - Communication Diagram

General Description

The MPI (motor power inverter) module voltage (VPIN) is used to control the IMA (integrated motor assist) motor and IMA battery energy management. If the VPIN cannot be detected precisely, the exhaust emissions, fuel economy, or drivability may be adversely affected.

Normally, the sensor output VPIN is less than 4.756 V. If it is above the specified range, a malfunction is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	2 seconds or more
DTC Type	One drive cycle, MIL ON, IMA system indicator ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
MCM power-supply voltage	10.5 V	-
No active DTCs	MPI, Motor current sensor, Battery module, Battery module temperature sensor, MCM, MDM, Motor operation system, Bypass contactor, Motor commutation sensor, MDM voltage	

	sensor, Battery current sensor, MPI module current sensor, MDM current sensor, BCM

Malfunction Threshold

The MPI voltage (VPIN) sensor output is 4.756 V or more for at least 2 seconds.

Driving Pattern

1. Connect the HDS.
2. Turn on the ignition switch, and wait for at least 5 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P1600 (69): ADVANCED DIAGNOSTICS

DTC P1600: IMA SYSTEM MALFUNCTION

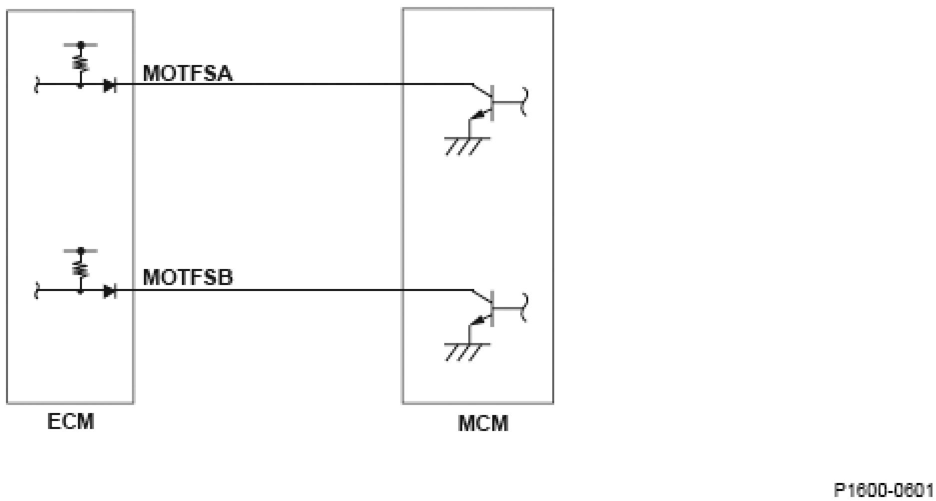


Fig. 183: IMA System - Circuit Diagram

General Description

This DTC is used to determine if a malfunction is on the engine side or the IMA side when checking with the HDS. When a device on the IMA side malfunctions, the motor control module (MCM) signals the engine control module (ECM) to turn on the MIL. If the ECM receives a signal from the MCM to turn on the MIL, the MIL is turned on and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	-
DTC Type	One drive cycle, MIL ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
Battery voltage	10.05 V	-
Ignition switch	ON	
No active DTCs	IMA System	

Malfunction Threshold

It depends on the "Enable Conditions" on IMA side.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs. The MIL,

the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery. P1600-0WR0-00

DTC P1635 (79): ADVANCED DIAGNOSTICS

DTC P1635 (79): BATTERY CONDITION MONITOR (BCM) MODULE PROBLEM

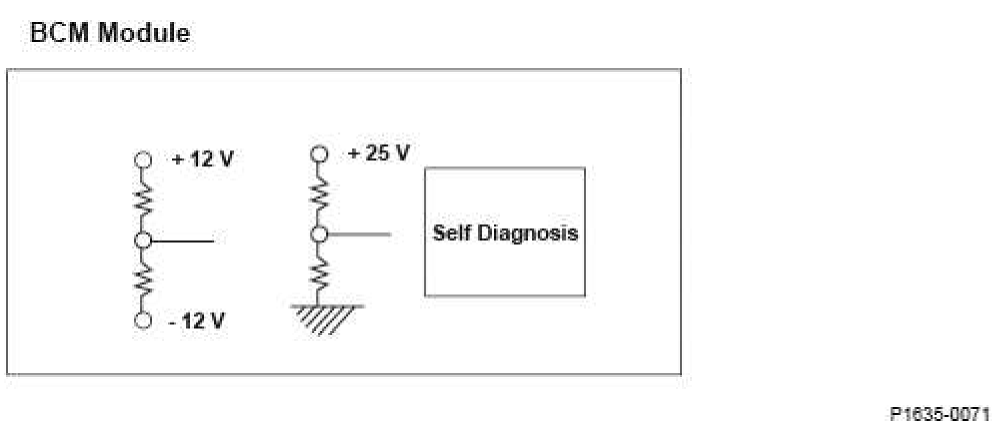


Fig. 184: Battery Condition Monitor (BCM) Module - Circuit Diagram

General Description

The self-diagnostic function in the BCM (battery condition monitor) module checks the divided voltage of the ±12 V powersupply and the divided voltage of the 25 V DC-DC converter. If it is beyond a set value, a malfunction in the power-supply voltage to the sensor is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous

Sequence	None
Duration	2 seconds or more
DTC Type	One drive cycle, MIL ON, IMA system indicator ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
MCM power-supply voltage	7.5 V	-

Malfunction Threshold

- The A/D value of the ±12 V DC/DC is 1.2 V or less, or 3.7 V or more, for at least 2 seconds.
- The A/D value of the 25 V DC/DC is 2.25 V or less, or 2.7 V or more, for at least 2 seconds.

Driving Pattern

Turn on the ignition switch, and wait for at least 10 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P1640 (88): ADVANCED DIAGNOSTICS

DTC P1640: ACTTRQ MOTOR TORQUE SIGNAL CIRCUIT LOW INPUT

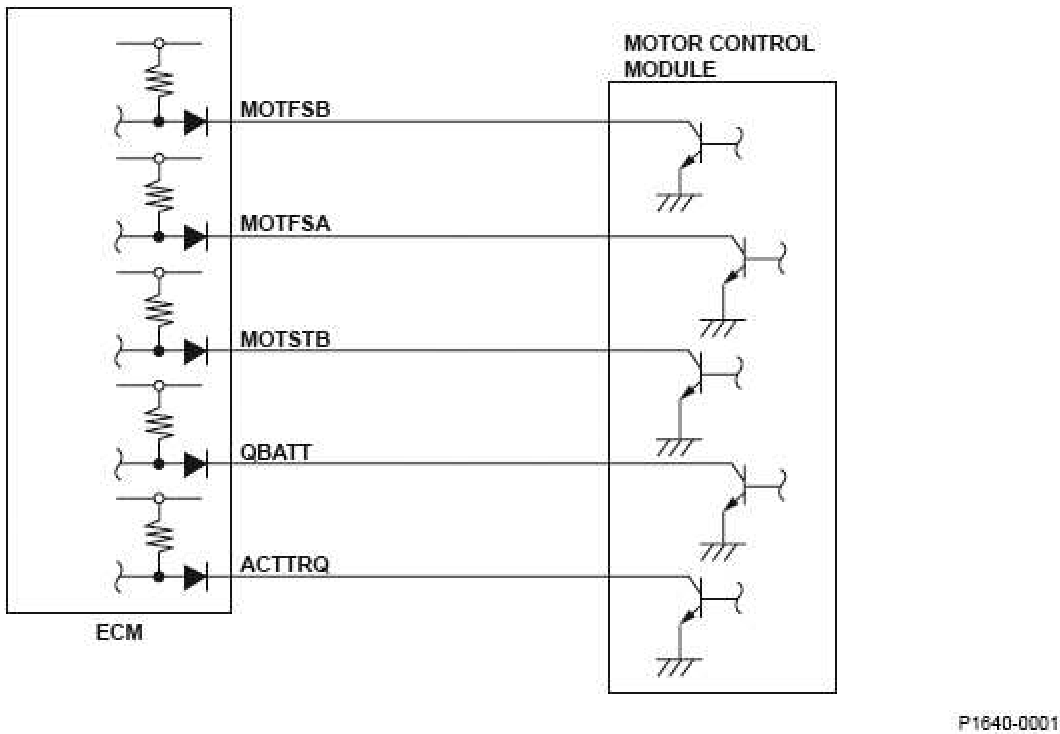


Fig. 185: ACTTRQ Motor Torque Signal Circuit Low Input - Circuit Diagram

General Description

The engine control module (ECM) sends a request for motor torque to the motor control module (MCM). The MCM sends back the motor torque value as duty signals to the MCM. The duty signals are converted into voltage in the ECM and used for various controls. If the ACTTRQ motor torque signal voltage is a set value or less, a malfunction is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	5 seconds or more
DTC Type	One drive cycle, MIL ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
Battery voltage	10.05 V	-

Ignition switch	ON
No active DTCs	ECM, IMA ACTTRQ motor, IMA MOTFSA

Malfunction Threshold

The ACTTRQ motor torque signal voltage is 0.27 V or less for at least 5 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P1641 (88): ADVANCED DIAGNOSTICS

DTC P1641: ACTTRQ MOTOR TORQUE SIGNAL CIRCUIT HIGH INPUT

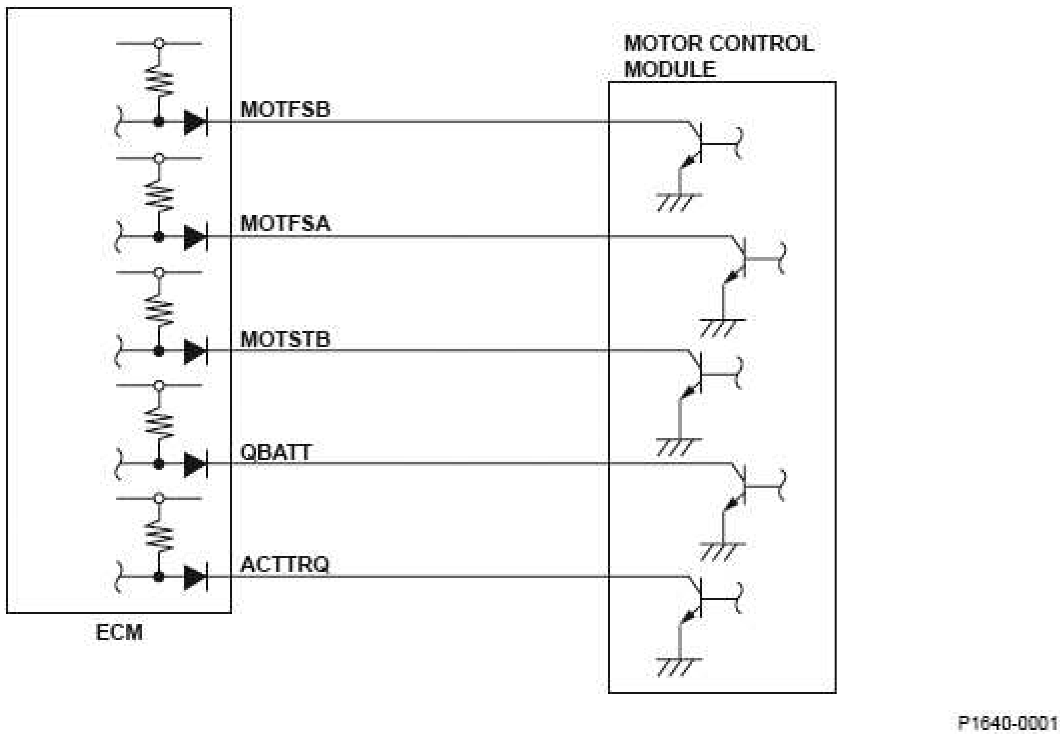


Fig. 186: ACTTRQ Motor Torque Signal Circuit Low Input - Circuit Diagram

General Description

The engine control module (ECM) sends a request for motor torque to the motor control module (MCM). The MCM sends back the motor torque value as duty signals to the MCM. The duty signals are converted into voltage in the ECM and used for various controls. If the ACTTRQ motor torque signal voltage is a set value or more, a malfunction is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	5 seconds or more
DTC Type	One drive cycle, MIL ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
Battery voltage	10.05 V	-

Ignition switch	ON
No active DTCs	ECM, IMA ACTTRQ motor, IMA MOTFSA

Malfunction Threshold

The ACTTRQ motor torque signal voltage is 4.75 V or more for at least 5 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P1642 (88): ADVANCED DIAGNOSTICS

DTC P1642: QBATT BATTERY SIGNAL CIRCUIT LOW INPUT

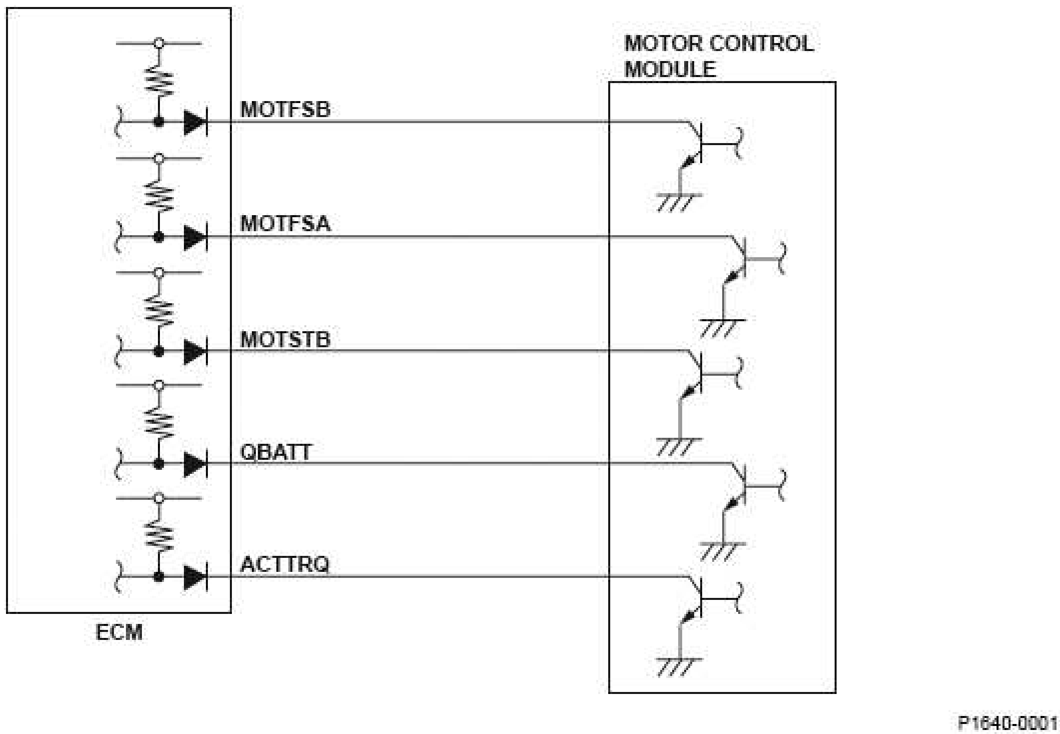


Fig. 187: ACTTRQ Motor Torque Signal Circuit Low Input - Circuit Diagram

General Description

The motor control module (MCM) sends the information about the battery's state of charge to the engine control module (ECM) via the QBATT signal line. If the QBATT battery signal voltage is a set value or less, a malfunction is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	5 seconds or more
DTC Type	One drive cycle, MIL ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
Battery voltage	10.05 V	-
Ignition switch	ON	

No active DTCs	ECM, IMA QBATT signal, IMA MOTFSA

Malfunction Threshold

The QBATT battery signal voltage is 0.27 V or less for at least 5 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P1643 (88): ADVANCED DIAGNOSTICS

DTC P1643: QBATT BATTERY SIGNAL CIRCUIT HIGH INPUT

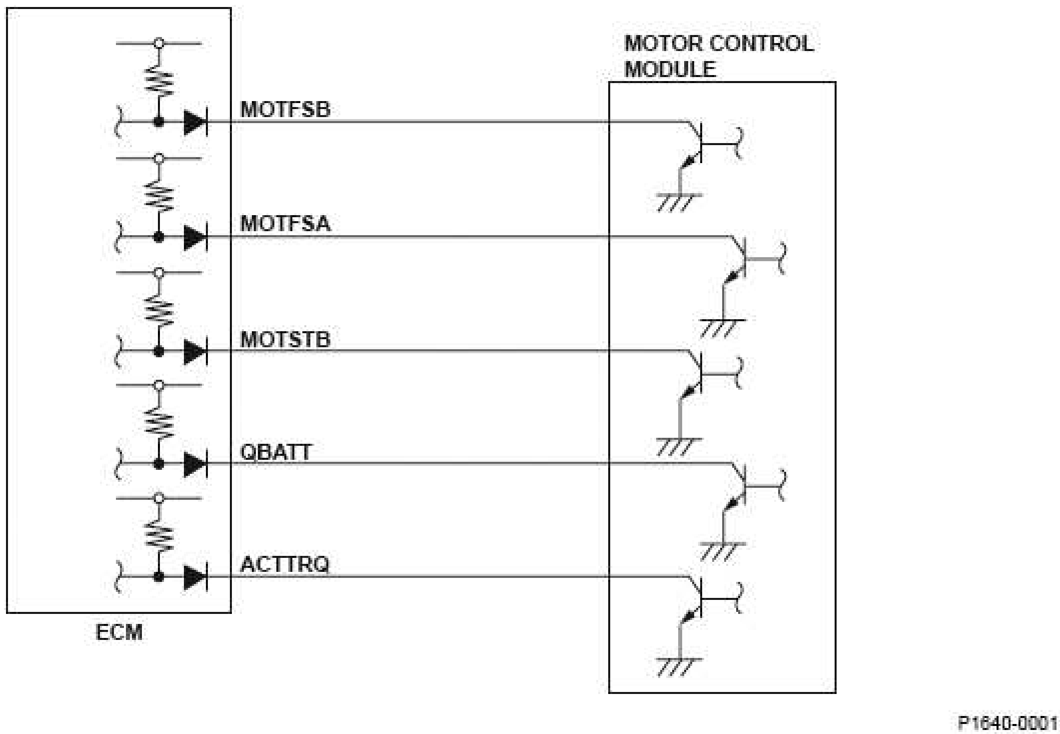


Fig. 188: ACTTRQ Motor Torque Signal Circuit Low Input - Circuit Diagram

General Description

The motor control module (MCM) sends the information about the battery's state of charge to the engine control module (ECM) via the QBATT signal line. If the QBATT battery signal voltage is a set value or more, a malfunction is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	5 seconds or more
DTC Type	One drive cycle, MIL ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
Battery voltage	10.05 V	-
Ignition switch	ON	

No active DTCs	ECM, IMA QBATT signal, IMA MOTFSA

Malfunction Threshold

The QBATT battery signal voltage is 4.75 V or more for at least 5 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P1644 (69): ADVANCED DIAGNOSTICS

DTC P1644: MOTFSA SIGNAL MALFUNCTION

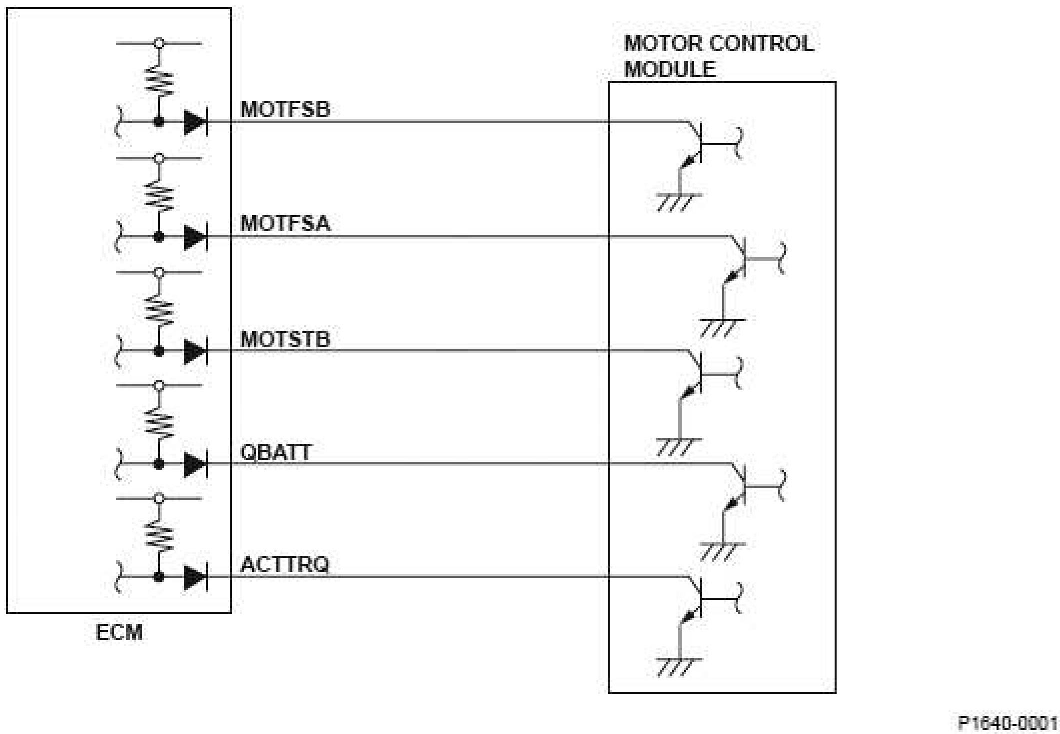


Fig. 189: ACTTRQ Motor Torque Signal Circuit Low Input - Circuit Diagram

General Description

The motor control module (MCM) sends various information about the IMA system to the engine control module (ECM) via the MOTFSA signal line. If no duty signals are input from the MCM for a set time, the ECM detects a malfunction and stores a DTC.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	5 seconds or more
DTC Type	One drive cycle, MIL ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
Battery voltage	10.05 V	-
Ignition switch	ON	

No active DTCs	ECM

Malfunction Threshold

No duty signals are input from the MCM for at least 5 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P1645 (69): ADVANCED DIAGNOSTICS

DTC P1645: MOTFSB SIGNAL MALFUNCTION

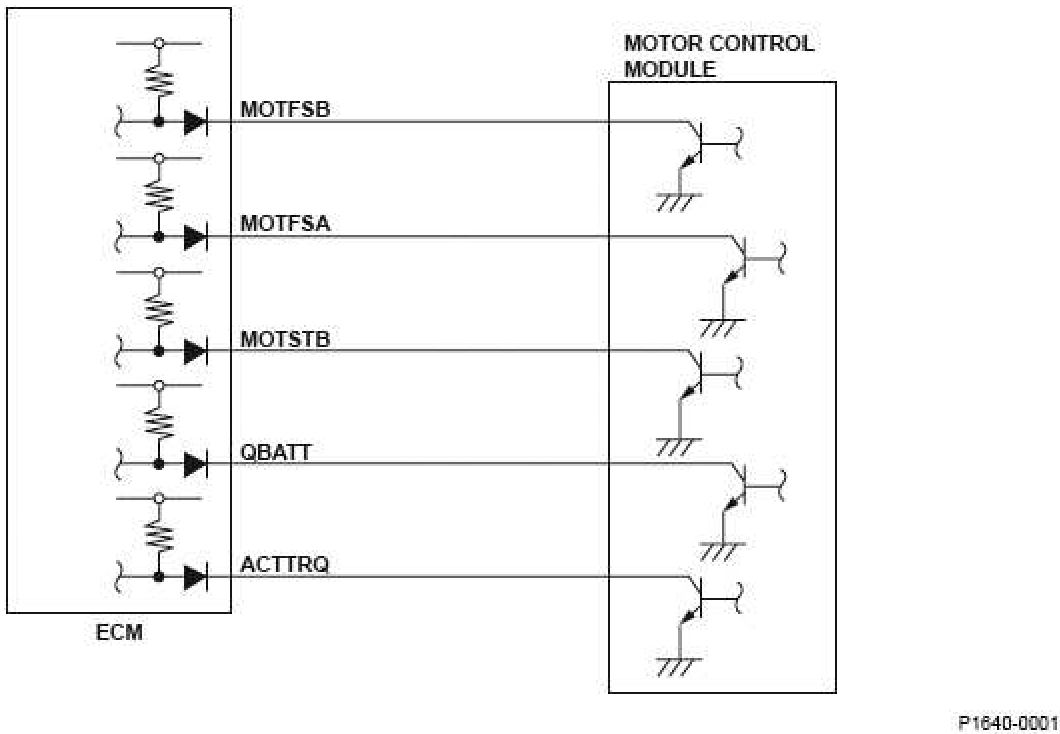


Fig. 190: ACTTRQ Motor Torque Signal Circuit Low Input - Circuit Diagram

General Description

The motor control module (MCM) sends information about the motor to the engine control module (ECM) via the MOTSTB signal line. If no duty signals are input from the MCM for a set time, the ECM detects a malfunction and stores a DTC.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	5 seconds or more
DTC Type	One drive cycle, MIL ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
Battery voltage	10.05 V	-
Ignition switch	ON	
No active DTCs	ECM, IMA MOTFSA	

Malfunction Threshold

No duty signals from the MCM are input for at least 5 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P1646 (36) : ADVANCED DIAGNOSTICS

DTC P1646: MOTSTB SIGNAL MALFUNCTION

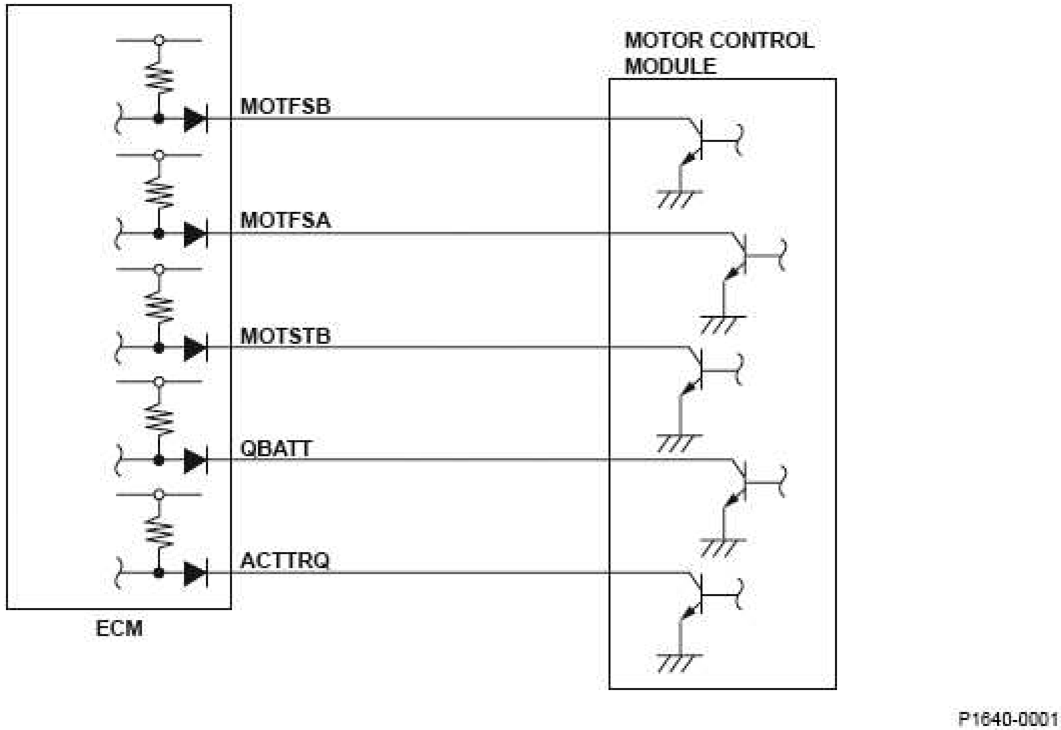


Fig. 191: ACTTRQ Motor Torque Signal Circuit Low Input - Circuit Diagram

General Description

The motor control module (MCM) sends information about the motor to the engine control module (ECM) via the MOTSTB signal line. If no duty signals are input from the MCM for a set time, the ECM detects a malfunction and stores a DTC.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	5 seconds or more
DTC Type	One drive cycle, MIL ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
Battery voltage	10.05 V	-
Ignition switch	ON	
No active DTCs	ECM, IMA MOTFSA	

Malfunction Threshold

No signals from the MCM are input for at least 5 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P1648 (64): ADVANCED DIAGNOSTICS

DTC P1648 (64): BATTERY CONDITION MONITOR (BCM) MODULE COMMUNICATION SIGNAL CIRCUIT PROBLEM

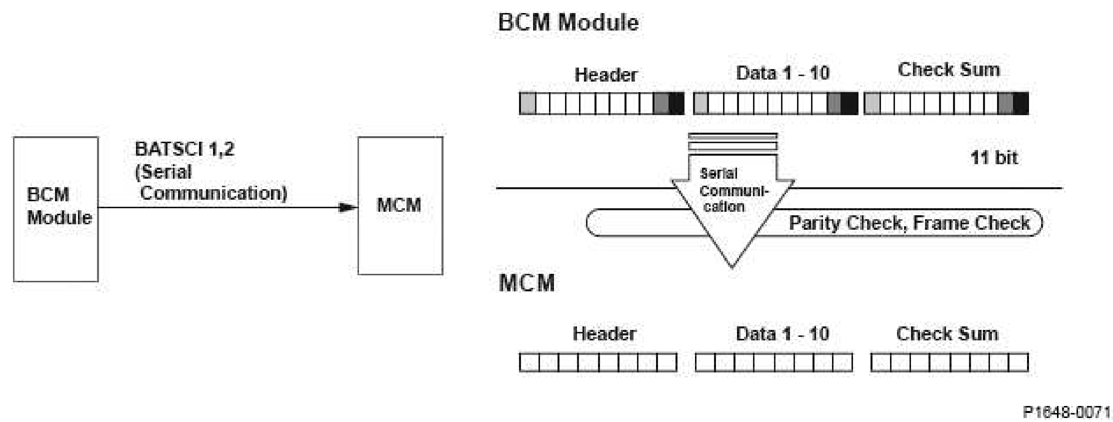


Fig. 192: Battery Condition Monitor (BCM) Module - Communication Diagram

General Description

Data is transmitted and received between the MCM (motor control module) and the BCM (battery condition monitor) module. Various commands are included in the data stream, and commands are not completed, which is normal, when there is an open in the line or a faulty circuit for the interface. The MCM confirms the validity of the data received according to the parity and check sum, and it measures a time interval during which the command update has not been executed based on updates by the internal timer. If no data update is executed over a set time, a malfunction is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	2 seconds or more
DTC Type	One drive cycle, MIL ON, IMA system indicator ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum

MCM power-supply voltage	10.5 V	-

Malfunction Threshold

No signals are received for at least 2 seconds.

Driving Pattern

Turn on the ignition switch, and wait for at least 5 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P1648 (75): ADVANCED DIAGNOSTICS

DTC P1648 (75): MOTOR CONTROL MODULE (MCM) COMMUNICATION SIGNAL CIRCUIT PROBLEM

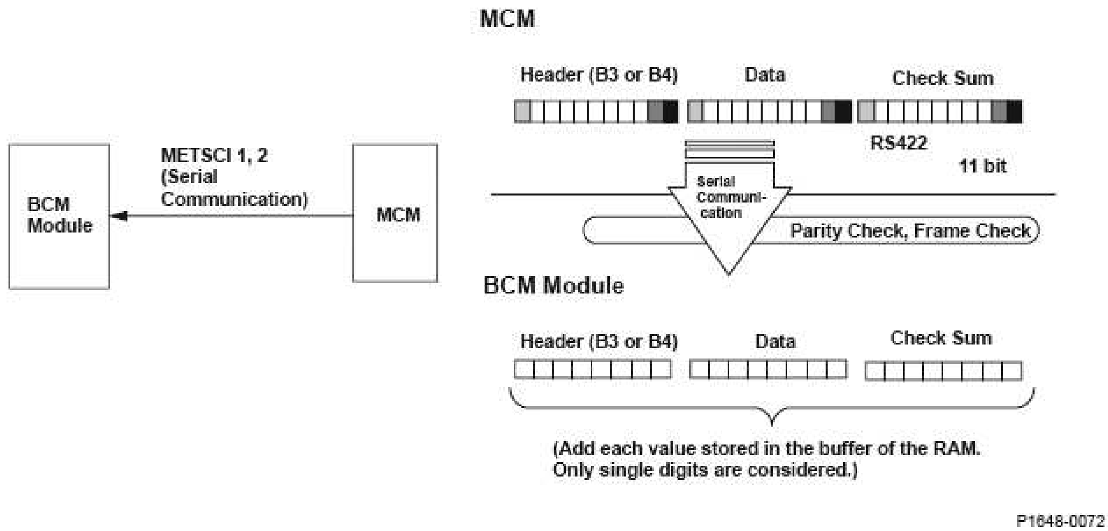


Fig. 193: Motor Control Module (MCM) - Communication Diagram

General Description

Data is transmitted and received between the MCM (motor control module) and the BCM (battery condition monitor) module. Various commands are included in the data stream, and commands are not completed, which is normal, when there is an open in the line or a faulty circuit for the interface. The BCM module measures a time interval during which the command update has not been executed based on updates by the internal timer. If the time interval is beyond a set time, the BCM uses a full-safe value, then provides timing for the MCM to signal a abnormality of the data received from the MCM. The data update is resumed when the normal data is received, and the fail-safe maintains the latest value. If no data updates are executed over a set time, a malfunction is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	4 seconds or more
DTC Type	One drive cycle, MIL ON, IMA system indicator ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
BCM power-supply voltage	7.5 V	-

Malfunction Threshold

No signals are received for at least 4 seconds.

Driving Pattern

Turn on the ignition switch, and wait for at least 10 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P16B3 (01): ADVANCED DIAGNOSTICS

DTC P16B3 (01): POWER COMMAND SIGNAL CIRCUIT LOW INPUT

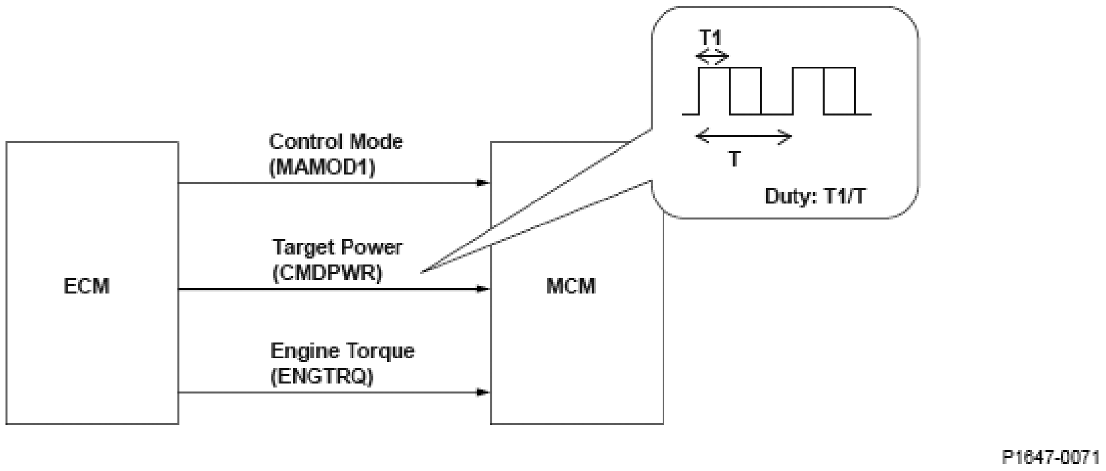


Fig. 194: Power Command Signal Circuit Low Input - Communication Diagram

General Description

The ECM (engine control module) sends signals that command the motor output (CMDPWR) to the MCM (motor control module) by the pulse width modulation (PWM) signal duty. The signal duty is converted into voltage via an integrator circuit in the MCM, and the CPU reads it as analog data. The duty that is used for control is set between 10 % - 90 % (equivalent to 0.5 V - 4.5 V), so it stays out of the range of a malfunction such as an open in the signal wire or a short to ground. If the MCM reads voltage lower than a set range, a short to ground in the signal wire is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	2 seconds or more
DTC Type	One drive cycle, MIL ON, IMA system indicator ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
MCM power-supply voltage	10.5 V	-
No active DTCs	MPI, Motor current sensor, Battery module, Battery module temperature sensor, MCM, MDM, Motor operation system, Bypass contactor, Motor commutation sensor, MDM voltage sensor, Battery current sensor, MPI module current sensor, MDM current sensor, BCM, Power command signal circuit	

Malfunction Threshold

The voltage converted in the MCM circuit is 0.249 V or less for at least 2 seconds.

Driving Pattern

Turn on the ignition switch, and wait for at least 5 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P16B4 (02): ADVANCED DIAGNOSTICS

DTC P16B4 (02): POWER COMMAND SIGNAL CIRCUIT HIGH INPUT

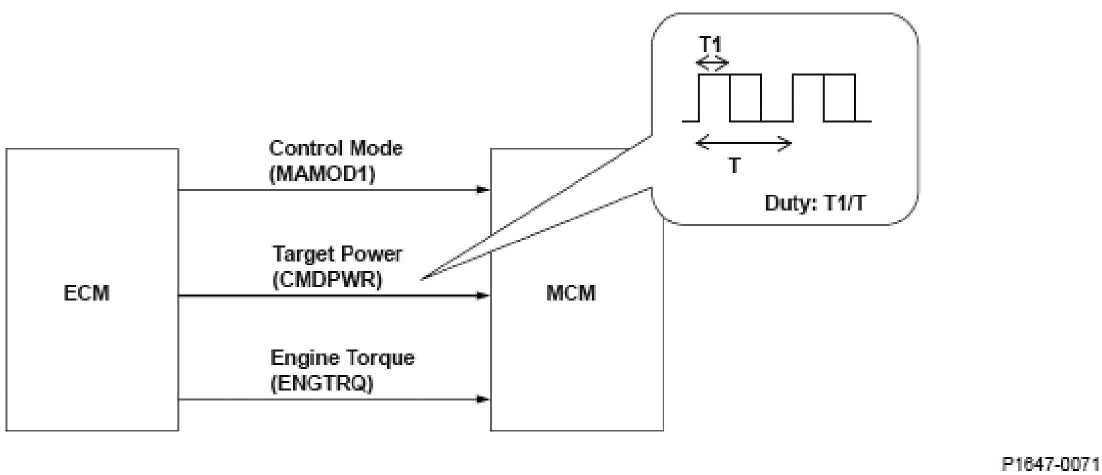


Fig. 195: Power Command Signal Circuit Low Input - Communication Diagram

General Description

The ECM (engine control module) sends signals that command the motor output (CMDPWR) to the MCM (motor control module) by the pulse width modulation (PWM) signal duty. The signal duty is converted into voltage via an integrator circuit in the MCM, and the CPU reads it as analog data. The duty that is used for control is set between 10 % - 90 % (equivalent to 0.5 V - 4.5 V), so it stays out of the range when a malfunction such as an open in the signal wire or a short to ground occurs. If the MCM reads voltage higher than a set range, an open in the signal wire is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	2 seconds or more
DTC Type	One drive cycle, MIL ON, IMA system indicator ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
MCM power-supply voltage	10.5 V	-
No active DTCs	MPI, Motor current sensor, Battery module, Battery module temperature sensor, MCM, MDM, Motor operation system, Bypass contactor, Motor commutation sensor, MDM voltage sensor, Battery current sensor, MPI module current sensor, MDM current sensor, BCM, Power command signal circuit	

Malfunction Threshold

The voltage converted in the MCM circuit is 4.741 V or more for at least 2 seconds.

Driving Pattern

Turn on the ignition switch, and wait for at least 5 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P16B5 (03): ADVANCED DIAGNOSTICS

DTC P16B5 (03): ENGINE TORQUE SIGNAL CIRCUIT LOW INPUT

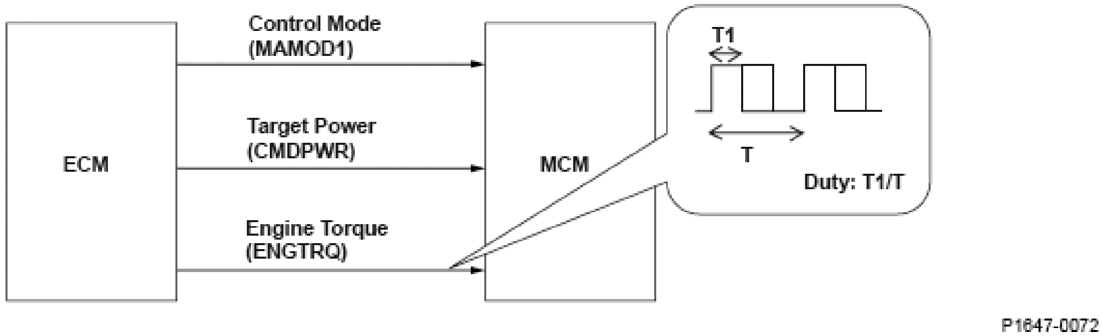


Fig. 196: Engine Torque Signal Circuit Low Input - Communication Diagram

General Description

The ECM (engine control module) signals the engine torque (ENGTRQ) to the MCM (motor control module) by the pulse width modulation (PWM) signal duty. The signal duty is converted into voltage via an integrator circuit in the MCM, and the CPU reads it as analog data. The duty that is used for control is set between 10 % - 90 % (equivalent to 0.5 V - 4.5 V), so it stays out of the range when a malfunction such as an open in the signal wire or a short to ground occurs. If the MCM reads voltage lower than a set range, a short to ground in the signal wire is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	2 seconds or more
DTC Type	One drive cycle, MIL ON, IMA system indicator ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
MCM power-supply voltage	10.5 V	-
No active DTCs	MPI, Motor current sensor, Battery module, Battery module temperature sensor, MCM, MDM, Motor operation system, Bypass contactor, Motor commutation sensor, MDM voltage sensor, Battery current sensor, MPI module current sensor, MDM current sensor, BCM, Engine torque signal circuit	

Malfunction Threshold

The voltage converted in the MCM circuit is 0.249 V or less for at least 2 seconds.

Driving Pattern

Turn on the ignition switch, and wait for at least 5 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P16B6 (04): ADVANCED DIAGNOSTICS

DTC P16B6 (04): ENGINE TORQUE SIGNAL CIRCUIT HIGH INPUT

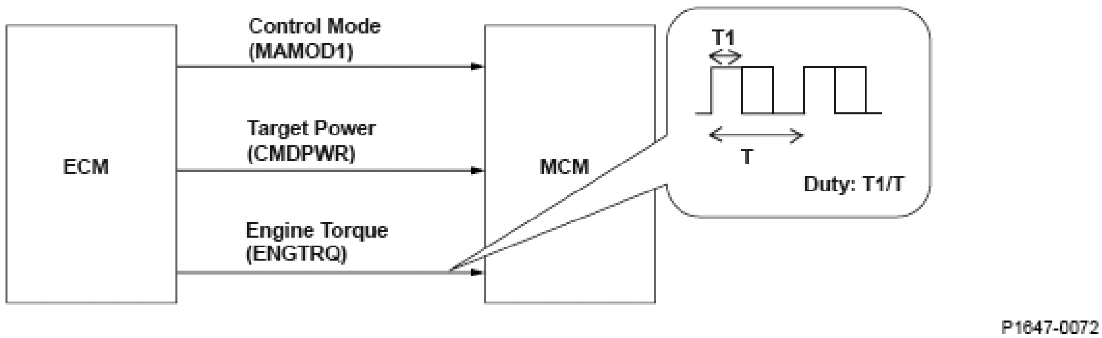


Fig. 197: Engine Torque Signal Circuit Low Input - Communication Diagram

General Description

The ECM (engine control module) signals the engine torque (ENGTRQ) to the MCM (motor control module) by the pulse width modulation (PWM) signal duty. The signal duty is converted into voltage via an integrator circuit in the MCM, and the CPU reads it as analog data. The duty that is used for control is set between 10 % - 90 % (equivalent to 0.5 V - 4.5 V), so it stays out of the range when a malfunction such as an open in the signal wire or a short to ground occurs. If the MCM reads voltage higher than a set range, an open in the signal wire is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	2 seconds or more
DTC Type	One drive cycle, MIL ON, IMA system indicator ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
MCM power-supply voltage	10.5 V	-
No active	MPI, Motor current sensor, Battery module, Battery module temperature sensor, MCM, MDM, Motor operation system, Bypass contactor, Motor commutation sensor, MDM voltage	

DTCs	sensor, Battery current sensor, MPI module current sensor, MDM current sensor, BCM, Engine torque signal circuit

Malfunction Threshold

The voltage converted in the MCM circuit is 4.741 V or more for at least 2 seconds.

Driving Pattern

Turn on the ignition switch, and wait for at least 5 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P16B7 (05): ADVANCED DIAGNOSTICS

DTC P16B7 (05): MODE SIGNAL CIRCUIT 1 LOW INPUT

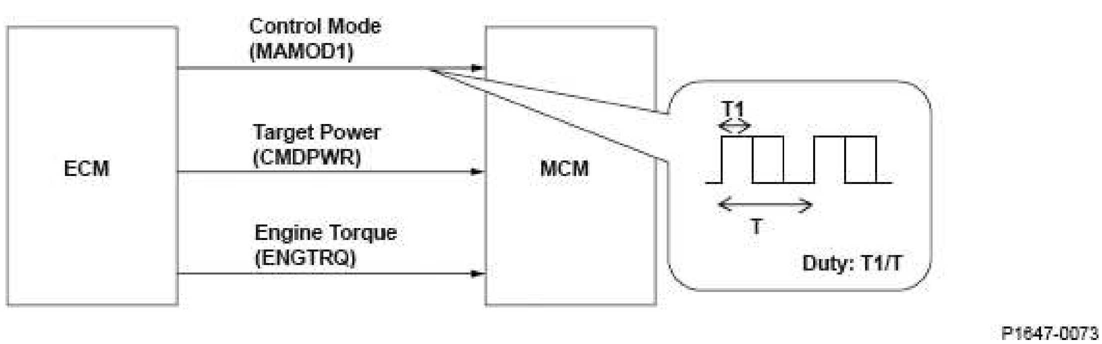


Fig. 198: Mode Signal Circuit 1 Low Input - Communication Diagram

General Description

The ECM (engine control module) sends the IMA control mode signals (MAMOD1) to the MCM (motor control module) by the pulse width modulation (PWM) signal duty. The signal duty is converted into voltage via an integrator circuit in the MCM, and the CPU reads it as analog data. The duty that is used for control is set between 10 % - 90 % (equivalent to 0.5 V - 4.5 V), so it stays out of the range when a malfunction such as an open in the signal wire or a short to ground occurs. If the MCM reads voltage lower than a set range, a short to ground in the signal wire is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	2 seconds or more
DTC Type	One drive cycle, MIL ON, IMA system indicator ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
MCM power-supply voltage	10.5 V	-
No active DTCs	MPI, Motor current sensor, Battery module, Battery module temperature sensor, MCM, MDM, Motor operation system, Bypass contactor, Motor commutation sensor, MDM voltage sensor, Battery current sensor, MPI module current sensor, MDM current sensor, BCM, Mode signal circuit 1	

Malfunction Threshold

The voltage converted in the MCM circuit is 0.249 V or less for at least 2 seconds.

Driving Pattern

Turn on the ignition switch, and wait for at least 5 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P16B8 (06): ADVANCED DIAGNOSTICS

DTC P16B8 (06): MODE SIGNAL CIRCUIT 1 HIGH INPUT

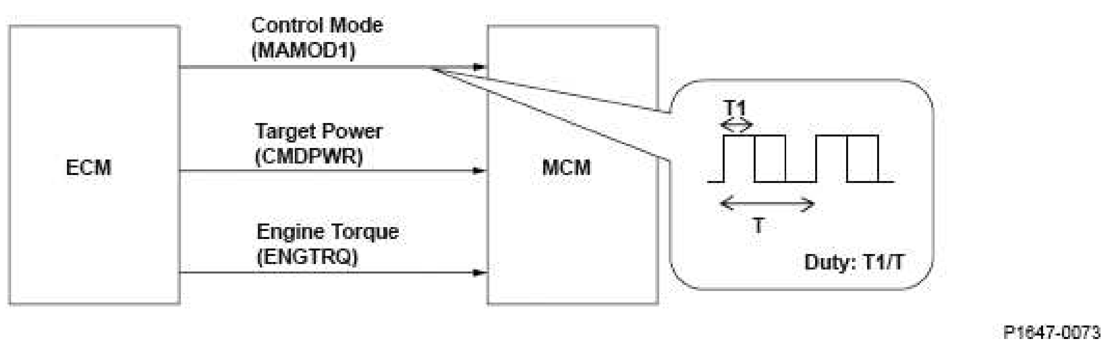


Fig. 199: Mode Signal Circuit 1 Low Input - Communication Diagram

General Description

The ECM (engine control module) sends the IMA control mode signals (MAMOD1) to the MCM (motor control module) by the pulse width modulation (PWM) signal duty. The signal duty is converted into voltage via an integrator circuit in the MCM, and the CPU reads it as analog data. The duty that is used for control is set between 10 % - 90 % (equivalent to 0.5 V - 4.5 V), so it stays out of the range when a malfunction such as an open in the signal wire or a short to ground occurs. If the MCM reads voltage higher than a set range, an open in the signal wire is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	2 seconds or more
DTC Type	One drive cycle, MIL ON, IMA system indicator ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
MCM power-supply voltage	10.5 V	-
No active DTCs	MPI, Motor current sensor, Battery module, Battery module temperature sensor, MCM, MDM, Motor operation system, Bypass contactor, Motor commutation sensor, MDM voltage sensor, Battery current sensor, MPI module current sensor, MDM current sensor, BCM, Mode signal circuit 1	

Malfunction Threshold

The voltage converted in the MCM circuit is 4.741 V or more for at least 2 seconds.

Driving Pattern

Turn on the ignition switch, and wait for at least 5 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

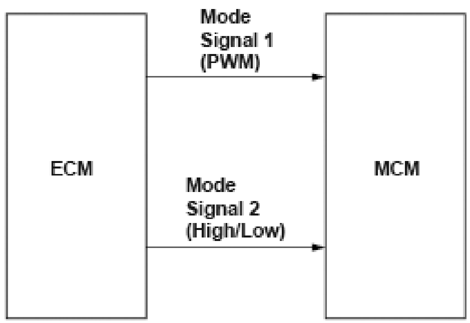
The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool

Clear command or by disconnecting the battery.

DTC P16B9 (07): ADVANCED DIAGNOSTICS

DTC P16B9 (07): MODE SIGNAL CIRCUIT 2 PROBLEM



ECM mode control	Mode Signal 1 PWM Duty	Mode Signal 2 (High/Low→0/1)
Acceleration	25 %	1
Unused	25 %	0
Deceleration	35 %	0
Unused	35 %	1

P1647-0074

Fig. 200: Mode Signal Circuit 2 - Communication Diagram

General Description

The MCM (motor control module) determines the motor assist control mode according to the mode signals (Mode signal 1, Mode signal 2) from the engine control module (ECM). The motor assist control mode is determined by the combination of Mode signal 1 (pulse width modulation (PWM) duty) and Mode signal 2 (High/Low voltage level). When Mode signal 2 is malfunctioning, it is contrary to the state in the table and stays High or Low. Therefore, the motor assist control mode is not determined if Mode signal 2 is malfunctioning.

If the combination of Mode signal 1 and Mode signal 2 differs from one specified for a set time, a malfunction in Mode signal 2 is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	Motor current U/V/W phase signal circuit, Battery module, Battery cell, IMA system, Bypass contactor, Motor commutation sensor, Battery cell temperature signal circuit, Detection signal circuit, Battery current circuit, Motor current signal circuit, MPI, MDM, BCM, MCM
Duration	2 seconds or more

DTC Type	One drive cycle, MIL ON, IMA system indicator ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
MCM power-supply voltage	10.5 V	-
No active DTCs	MPI, Motor current sensor, Battery module, Battery module temperature sensor, MCM, MDM, Motor operation system, Bypass contactor, Motor commutation sensor, MDM voltage sensor, Battery current sensor, MPI module current sensor, MDM current sensor, BCM, Mode signal circuit 1, Mode signal circuit 2	
Other	During of motor assist during acceleration, or during regeneration during deceleration	

Malfunction Threshold

Mode Signal 1 = 25 % and Mode Signal 2 = Low (1 V or less) for at least 2 seconds.

Mode Signal 1 = 35 % and Mode Signal 2 = High (4 V or more) for at least 2 seconds.

Driving Pattern

1. Connect the HDS.
2. Start the engine, and let it idle.
3. Then, accelerate the vehicle with IMA assist for at least 10 seconds.
4. Decelerate by applying the brakes for at least 10 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P16BA (71): ADVANCED DIAGNOSTICS

DTC P16BA (71): BATTERY CELL TEMPERATURE SIGNAL CIRCUIT HIGH INPUT

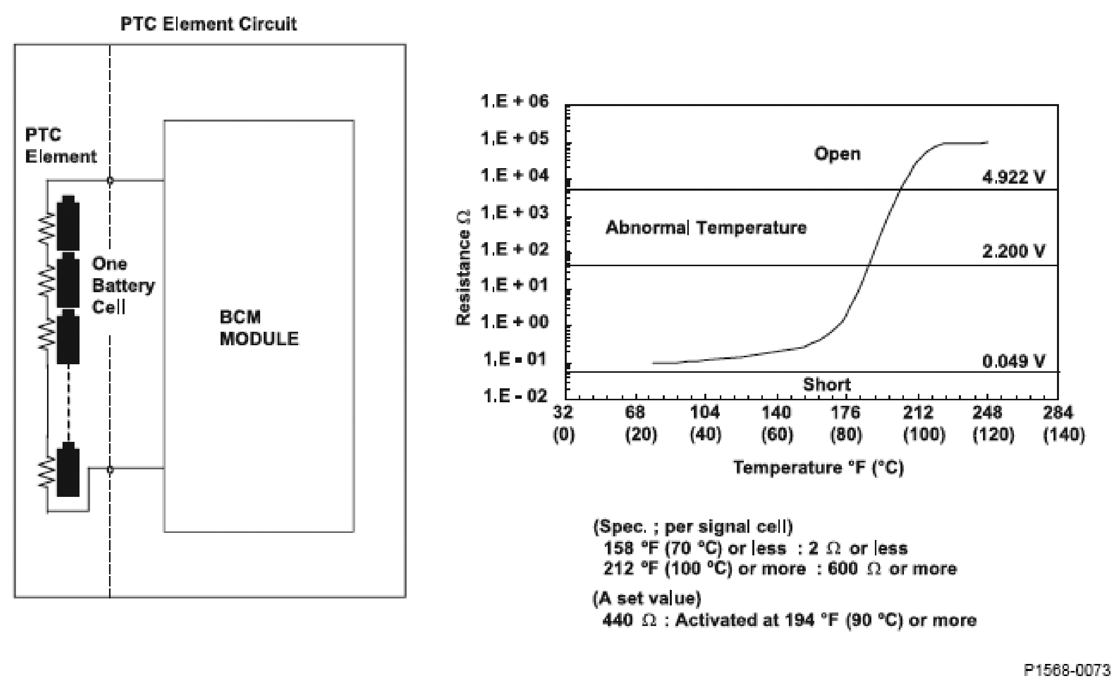


Fig. 201: Battery Cell Temperature Signal Circuit Low Input - Circuit Diagram

General Description

A PTC (positive temperature coefficient) element has the characteristics shown above (for example, the resistance increases drastically at a temperature between 158 - 212°F (70 - 100°C)), and it is used to determine if a monitored object temperature exceeds a set value. The PTC is installed in each of the 120 battery cells to detect overheating, an open, or a short. If the PTC input voltage is more than the upper threshold, a malfunction is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	2 seconds or more
DTC Type	One drive cycle, MIL ON, IMA system indicator ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
BCM power-supply voltage	7.5 V	-
Ignition switch	ON	
No active DTCs	Battery module, BCM	

Malfunction Threshold

The PTC output voltage is 4.922 V or more for at least 2 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P1782 (3): ADVANCED DIAGNOSTICS (CVT)

DTC P1782: THROTTLE POSITION (TP) SENSOR CIRCUIT LOW VOLTAGE

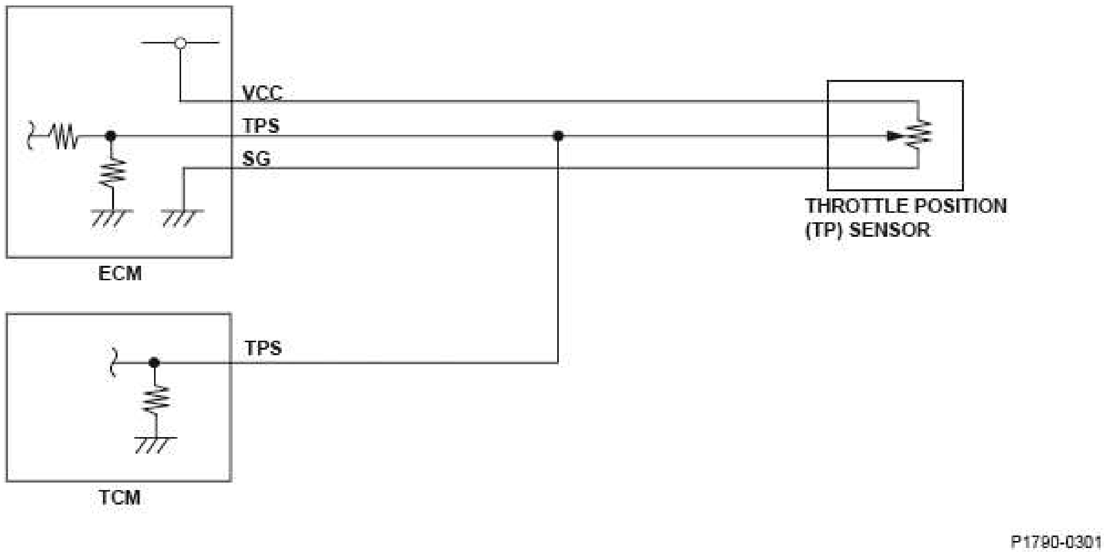


Fig. 202: Throttle Position (TP) Sensor Circuit Circuit Diagram

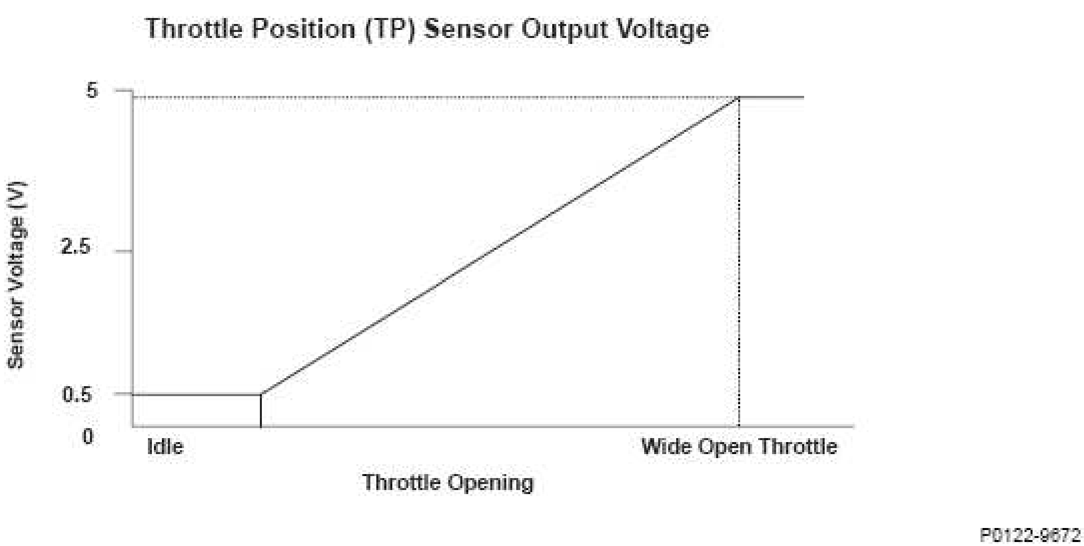


Fig. 203: Throttle Position Sensor Output Voltage Graph

General Description

The throttle position (TP) sensor is installed in the throttle body, and it detects the position of the throttle valve. This sensor includes a brush that moves with the throttle valve. The brush outputs voltage to the engine control module (ECM) that varies linearly with throttle position by sliding on a resistor. When accelerating or decelerating, the detection of intake airflow by the manifold absolute pressure (MAP) sensor tends to be inaccurate due to rapid changes in throttle position. The

TP sensor is used to correct the amount of airflow as it detects the throttle position. Also, the sensor is used for fuel cut-off operation to improve fuel economy and exhaust emissions when the throttle is fully closed during deceleration. The ECM monitors the throttle position (in degrees). If the output signal voltage from the TP sensor is excessively low, the ECM detects a malfunction and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	10 seconds or more
DTC Type	One drive cycle, MIL ON, D indicator blinks

ENABLE CONDITIONS CHART

Condition	
State of the engine	Running

Malfunction Threshold

The TP sensor output voltage is 0.9 V or less for at least 10 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P1783 (3): ADVANCED DIAGNOSTICS (CVT)

DTC P1783: THROTTLE POSITION (TP) SENSOR CIRCUIT HIGH VOLTAGE

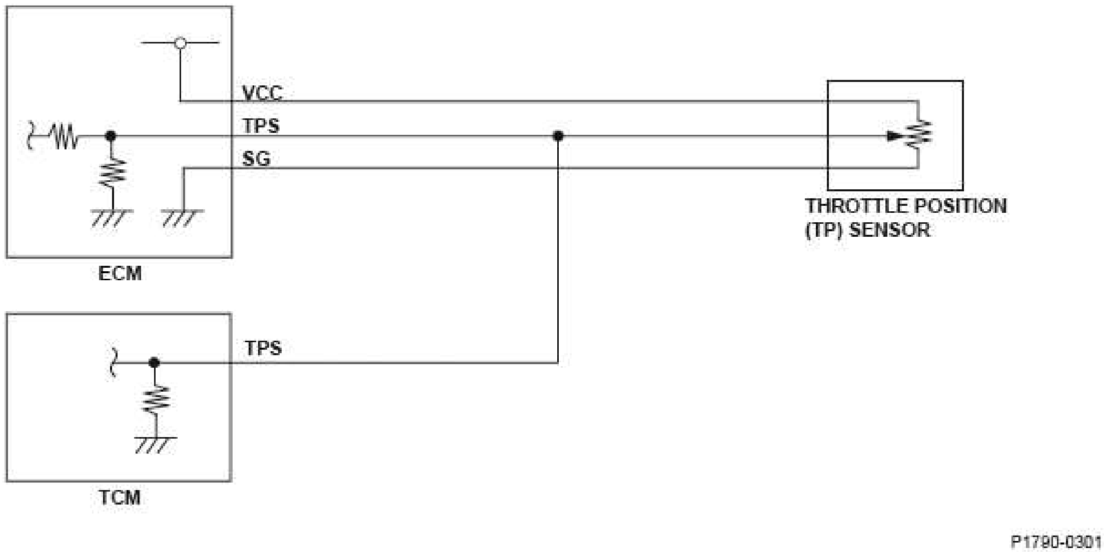


Fig. 204: Throttle Position (TP) Sensor Circuit Circuit Diagram

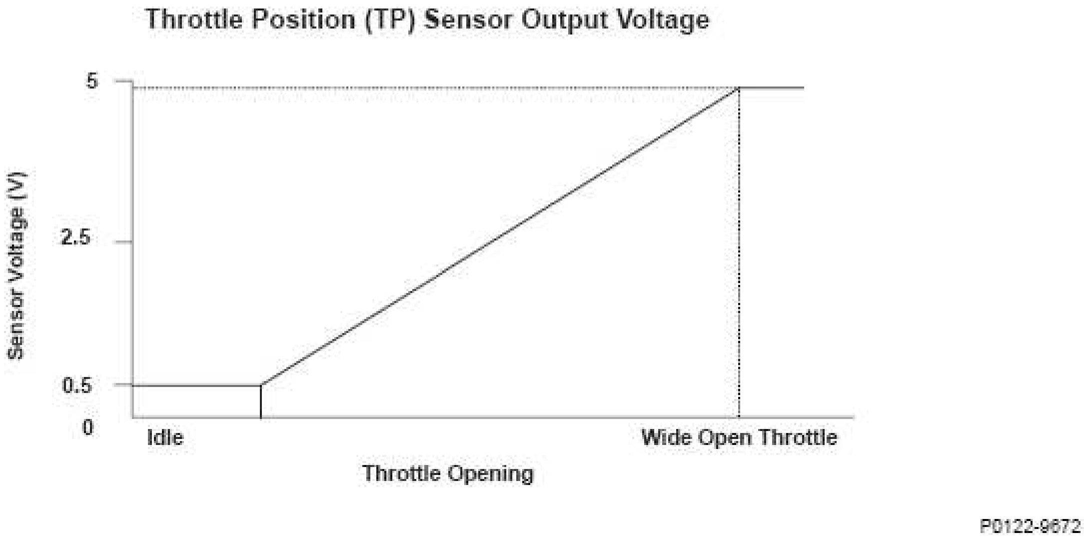


Fig. 205: Throttle Position Sensor Output Voltage Graph

General Description

The throttle position (TP) sensor is installed in the throttle body, and it detects the position of the throttle valve. This sensor includes a brush that moves with the throttle valve. The brush outputs voltage to the engine control module (ECM) that varies linearly with throttle position by sliding on a resistor. When accelerating or decelerating, the detection of intake airflow by the manifold absolute pressure (MAP) sensor tends to be inaccurate due to rapid changes in throttle position. The

TP sensor is used to correct the amount of airflow as it detects the throttle position. Also, the sensor is used for fuel cut-off operation to improve fuel economy and exhaust emissions when the throttle is fully closed during deceleration. The ECM monitors the throttle position (in degrees). If the output signal voltage from the TP sensor is excessively high, the ECM detects a malfunction and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	10 seconds or more
DTC Type	One drive cycle, MIL ON, D indicator blinks

ENABLE CONDITIONS CHART

Condition	
State of the engine	Running

Malfunction Threshold

The TP sensor output voltage is 4.93 V or more for at least 10 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P1784 (12): ADVANCED DIAGNOSTICS (CVT)

DTC P1784: MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR CIRCUIT LOW VOLTAGE

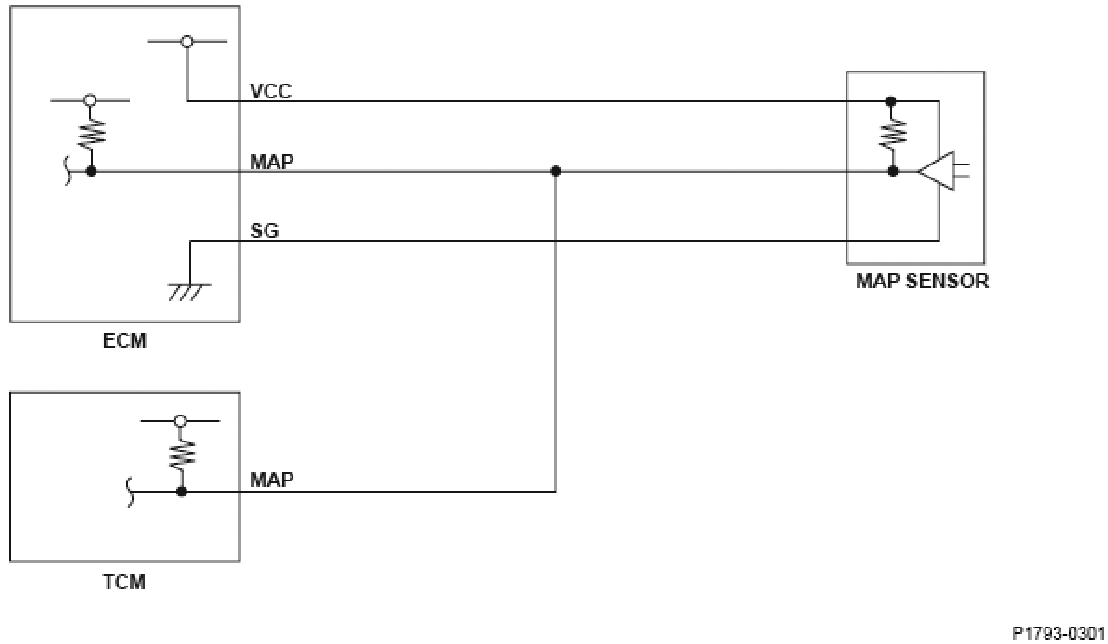


Fig. 206: Manifold Absolute Pressure (MAP) Sensor Circuit Circuit Diagram

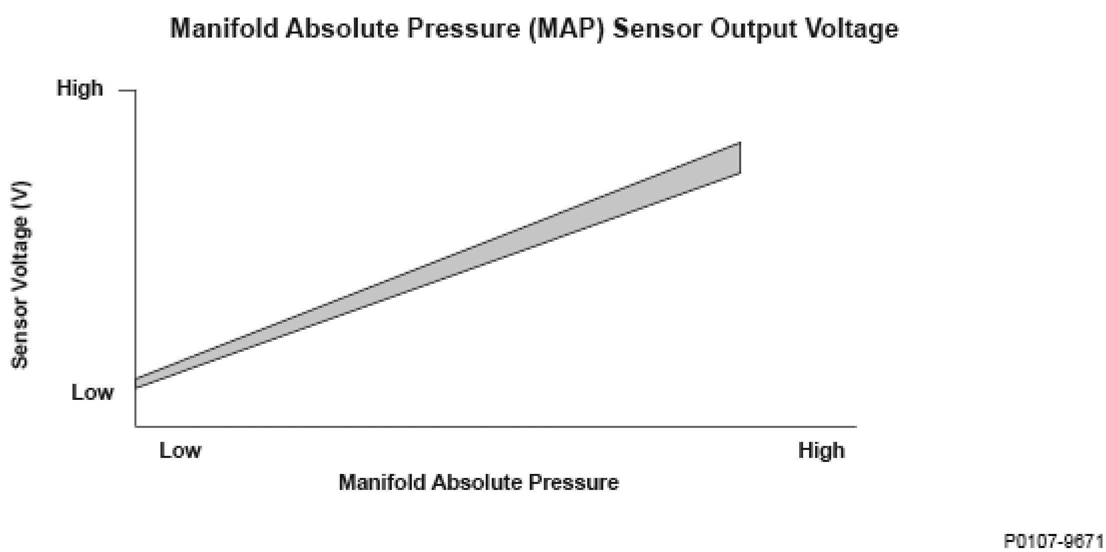


Fig. 207: Manifold Absolute Pressure (MAP) Sensor Output Voltage - Graph

General Description

The manifold absolute pressure (MAP) sensor senses manifold absolute pressure (vacuum) and converts it into electrical signals. The MAP sensor outputs low signal voltage at high-vacuum (throttle valve closed) and high signal voltage at low-vacuum (throttle valve wide open).

If a signal voltage from the MAP sensor is a set value or less, the engine control module (ECM) detects a malfunction and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	10 seconds or more
DTC Type	One drive cycle, MIL ON, D indicator blinks

ENABLE CONDITIONS CHART

Condition	
State of the engine	Running

Malfunction Threshold

The MAP sensor output voltage is 0.23 V or less for at least 10 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P1785 (12): ADVANCED DIAGNOSTICS (CVT)

DTC P1785: MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR CIRCUIT HIGH VOLTAGE

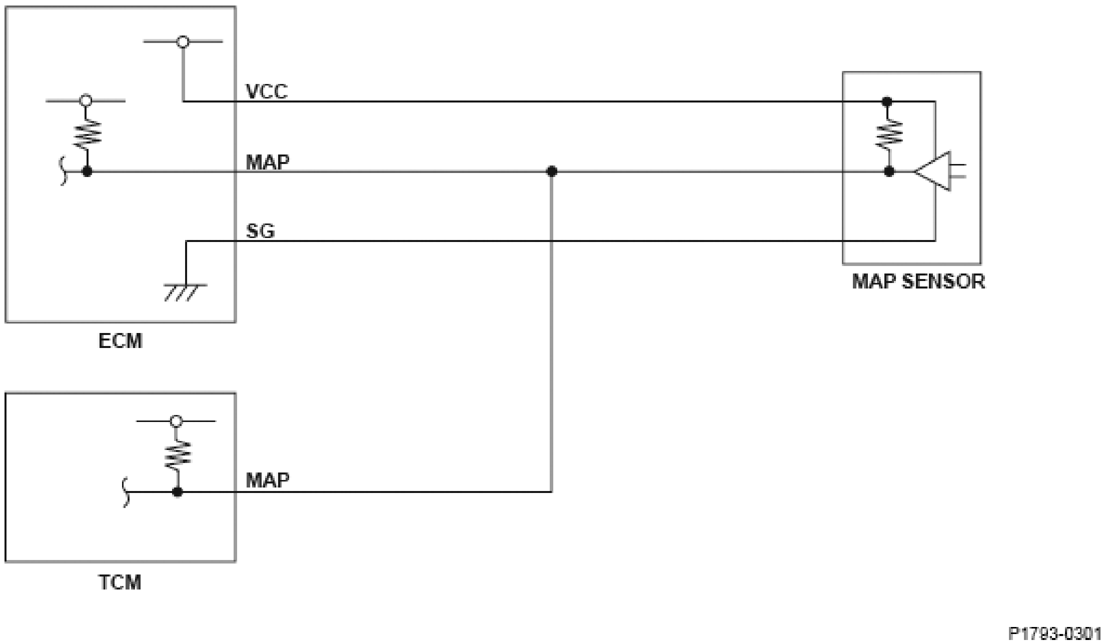


Fig. 208: Manifold Absolute Pressure (MAP) Sensor Circuit Circuit Diagram

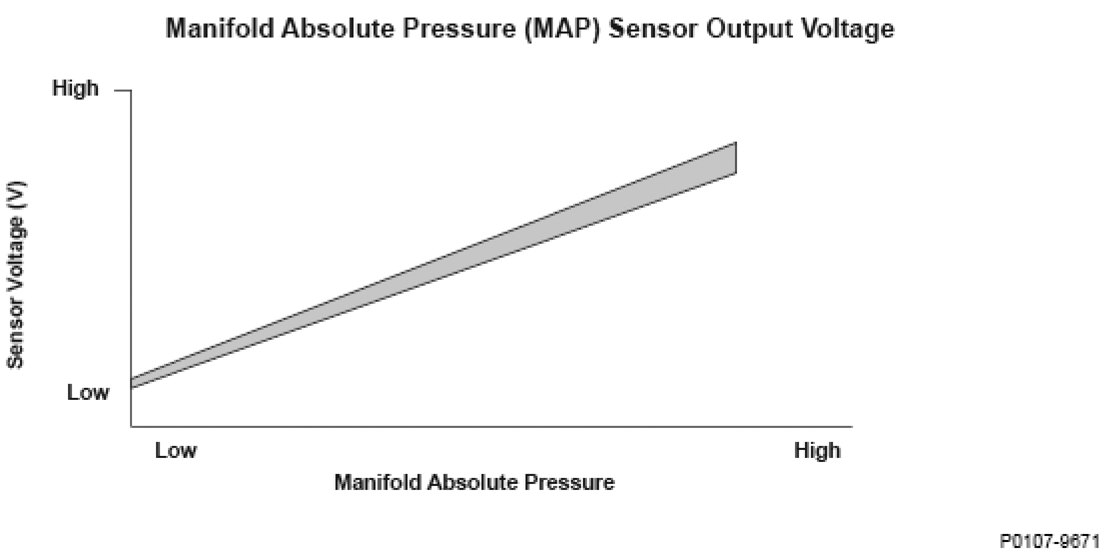


Fig. 209: Manifold Absolute Pressure (MAP) Sensor Output Voltage - Graph

General Description

The manifold absolute pressure (MAP) sensor senses manifold absolute pressure (vacuum) and converts it into electrical signals. The MAP sensor outputs low signal voltage at high-vacuum (throttle valve closed) and high signal voltage at low-vacuum (throttle valve wide open). If a signal voltage from the MAP sensor is a set value or more, the engine control module (ECM) detects a malfunction and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	10 seconds or more
DTC Type	One drive cycle, MIL ON, D indicator blinks

ENABLE CONDITIONS CHART

Condition	
State of the engine	Running

Malfunction Threshold

The MAP sensor output voltage is 4.50 V or more for at least 10 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P2000 (105): ADVANCED DIAGNOSTICS (M/T)

DTC P2000: NOX ADSORPTIVE CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD (M/T MODEL)

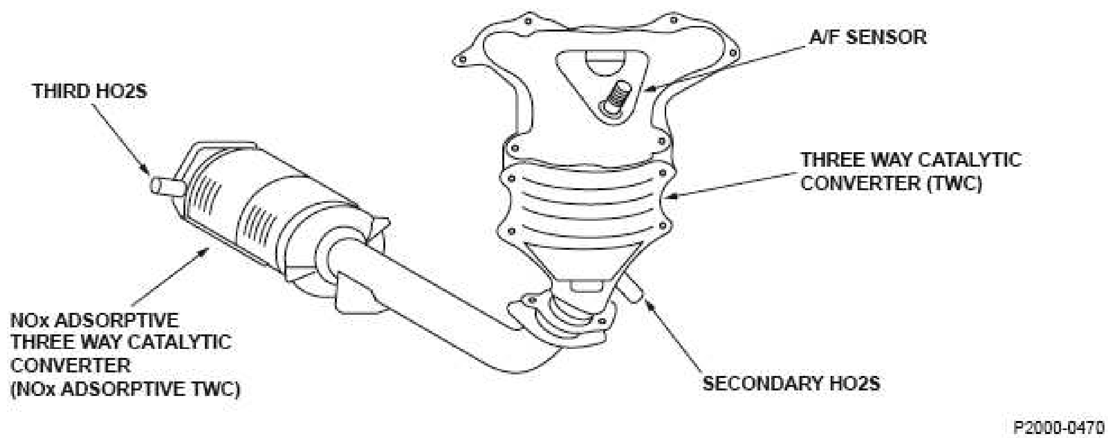


Fig. 210: Identifying NOX Adsorptive Catalyst System Components

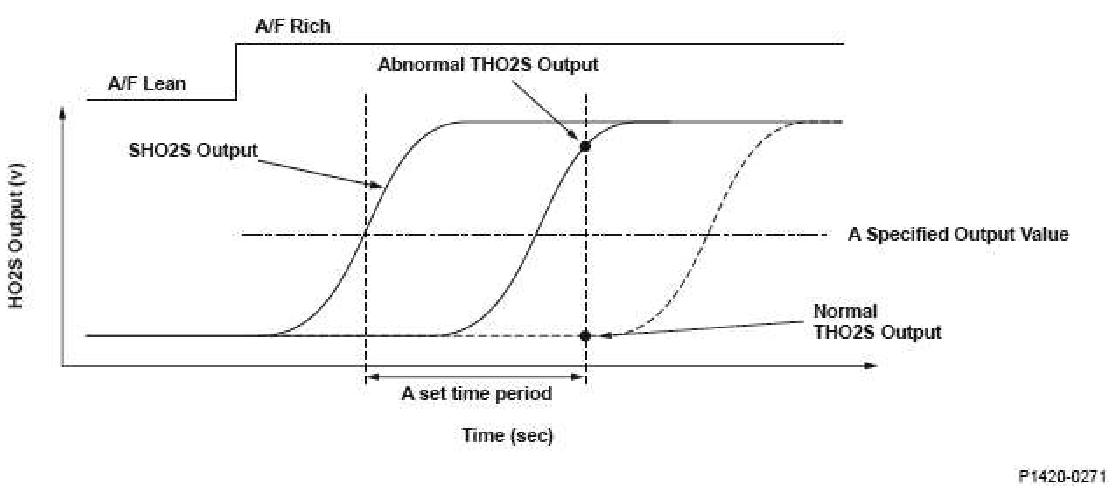


Fig. 211: NOX Adsorptive Catalyst System Voltage Graph

General Description

The NOx adsorptive three way catalyst (TWC) absorbs NO2 when the oxygen concentration is high (lean), and it releases absorbed NO2 to oxidize the remaining elements (HC, CO, etc.) in the exhaust gas when the oxygen concentration is low (rich). The NOx adsorptive TWC is considered faulty if the capacity of the NOx adsorbent has deteriorated. The NOx adsorptive TWC absorbs NO2 during lean-burn running. The absorbed NO2 is released when the air/fuel ratio becomes rich, then eventually, the air/fuel ratio downstream of the NOx adsorptive TWC is rich. Based on the third HO2S output after a set time has elapsed since the secondary HO2S indicates "rich", the engine control module (ECM) detects a malfunction and stores a DTC.

MONITOR DESCRIPTION CHART

Execution	Once per driving cycle
Sequence	Secondary HO2S
Duration	50 seconds(1) or less
DTC Type	Two drive cycles, MIL ON
(1) At 2,000 rpm	

ENABLE CONDITIONS CHART

<table>
<tr><th colspan="2">Condition</th><th>Minimum</th><th>Maximum</th></tr>
<tr><td colspan="2">Elapsed time after starting the engine</td><td>10 minutes, 5 seconds</td><td>-</td></tr>
<tr><td colspan="2">Engine coolant temperature</td><td>168°F (76°C)</td><td>-</td></tr>
<tr><td colspan="2">Engine speed</td><td>1,500 rpm</td><td>2,600 rpm</td></tr>
<tr><td colspan="2">MAP value</td><td>35 kPa (260 mmHg, 10.3 in.Hg)</td><td>99 kPa (736 mmHg, 29.0 in.Hg)</td></tr>
<tr><td rowspan="2">The difference between atmospheric pressure and manifold absolute pressure</td><td>1,500 rpm</td><td>8 kPa (54 mmHg, 2.2 in.Hg)</td><td rowspan="2">-</td></tr>
<tr><td>2,600 rpm</td><td>11 kPa (81 mmHg, 3.2 in.Hg)</td></tr>
<tr><td colspan="2">Vehicle speed</td><td>25 mph (40 km/h)</td><td>-</td></tr>
<tr><td colspan="2">Short term fuel trim</td><td>-</td><td>0.98</td></tr>
<tr><td colspan="2">Secondary HO2S output voltage</td><td>-</td><td>0.29 V</td></tr>
<tr><td colspan="2">Fuel feedback</td><td colspan="2">During lean burn running</td></tr>
<tr><td colspan="2">Monitoring priority</td><td colspan="2">EVAP</td></tr>
<tr><td colspan="2">No active DTCs</td><td colspan="2">ECM, A/F Sensor, A/F Sensor Heater, Secondary HO2S Heater, Third HO2S Heater, MAP, CKP, ECT, TP, EGR, BARO, VSS, VTEC System, Fuel System, EVAP</td></tr>
<tr><td colspan="2" rowspan="2"></td><td colspan="2">Must be in 3rd, 4th, or 5th gear</td></tr>
<tr><td colspan="2">The duration of lean burn running must be sufficient (at least 1 minute)</td></tr>
</table>

Others	The IMA battery indicates at least 25 %
	The NOx adsorptive TWC is not contaminated by sulfur in the gasoline

Malfunction Threshold

The third HO2S output voltage is 0.60 V or more during a rich running mode for at least 50 seconds.

Driving Pattern

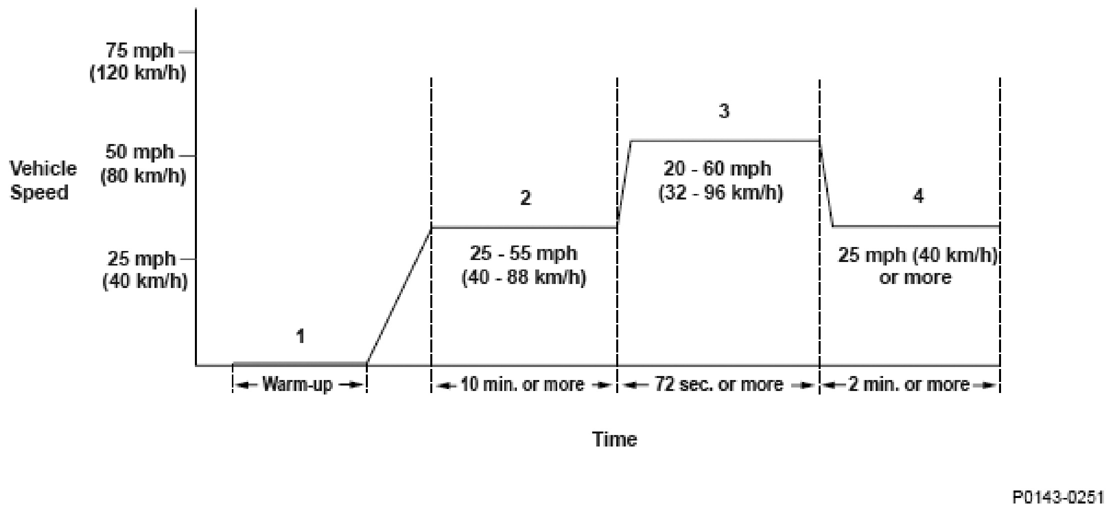


Fig. 212: Identifying Driving Pattern

1. Start the engine. Hold the engine speed at 3,000 rpm without load (in Park or neutral) until the radiator fan comes on.
2. Drive the vehicle at a speed between 25 - 55 mph (40 - 88 km/h) for at least 10 minutes to warm up the engine and the NOx adsorptive TWC.
3. Drive the vehicle at a speed between 20 - 60 mph (32 - 96 km/h) for at least 72 seconds.
4. Then, drive at a steady speed of 25 mph (40 km/h) or more in the lean burn running mode for at least 2 minutes.
   - If the NOx adsorptive TWC is contaminated by sulfur in the gasoline, the detection may be incorrect. If the detection is not complete in the first driving cycle, retest after driving with the engine in a richer running mode (for 10 minutes) to counteract the effects of the sulfur.

- If you have difficulty duplicating the DTC, retest after turning off electrical components such as the audio system and A/C, and try a different gear position.
- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the ECM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P2159 (36): ADVANCED DIAGNOSTICS (CVT)

DTC P2159: RANGE/PERFORMANCE PROBLEM IN CVT SPEED SENSOR CIRCUIT

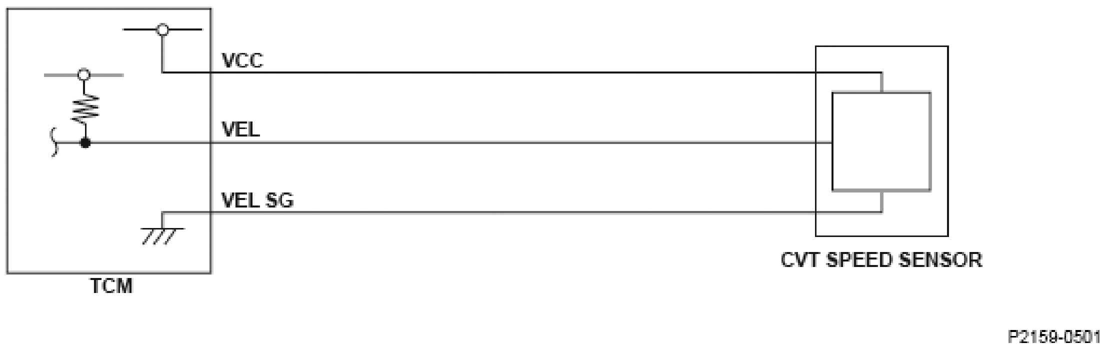


Fig. 213: Range/Performance Problem In CVT Speed Sensor - Circuit Diagram

General Description

The CVT speed sensor detects the number of revolutions of the secondary drive gear and sends a pulsing signal to the transmission control module (TCM). The TCM converts the pulsing signal into a vehicle speed.

If the vehicle speed measured by the CVT speed sensor is lower than the value that is estimated based on the vehicle speed measured by the vehicle speed sensor (VSS), a malfunction in the CVT speed sensor is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	10 seconds or more
DTC Type	One drive cycle, MIL ON, D indicator blinks

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
Vehicle speed measured by the vehicle speed sensor (VSS)	8 mph (13 km/h)	-
No active DTCs	Vehicle speed sensor	

Malfunction Threshold

Vehicle speed measured by the CVT speed sensor < vehicle speed measured by the vehicle speed sensor (VSS) by a factor of 1.8 for at least 10 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool

Clear command or by disconnecting the battery.

DTC P2160 (36): ADVANCED DIAGNOSTICS (CVT)

DTC P2160: PROBLEM IN CVT SPEED SENSOR CIRCUIT (NO SIGNAL INPUT)

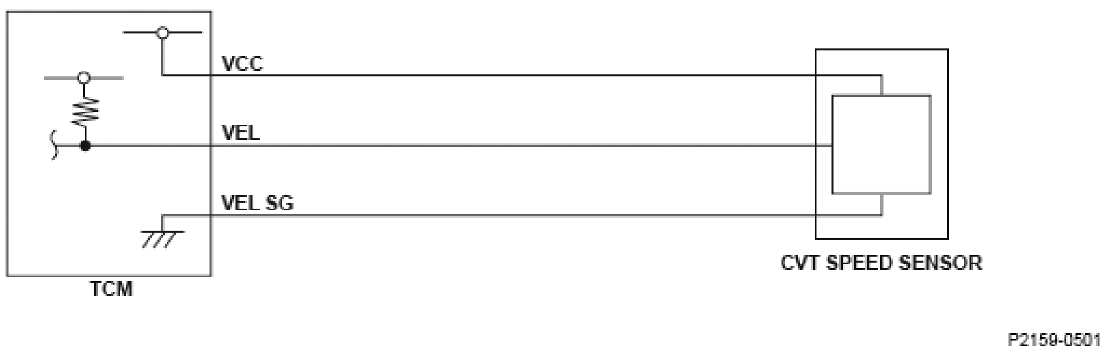


Fig. 214: Range/Performance Problem In CVT Speed Sensor - Circuit Diagram

General Description

The CVT speed sensor detects the number of revolutions of the secondary drive gear and sends a pulsing signal to the transmission control module (TCM). The TCM converts the pulsing signal into a vehicle speed.

If there is no input signal from the CVT speed sensor when the vehicle speed detected by the vehicle speed sensor (VSS) is a specified value or more, a malfunction is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	10 seconds or more
DTC Type	One drive cycle, MIL ON, D indicator blinks

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
Vehicle speed measured by the vehicle speed sensor (VSS)	8 mph (13 km/h)	-

No active DTCs	Vehicle speed sensor

Malfunction Threshold

The vehicle speed detected by the CVT speed sensor is 1 mph (2 km/h) or less for at least 10 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P2227 (13): ADVANCED DIAGNOSTICS

DTC P2227: BAROMETRIC PRESSURE (BARO) SENSOR RANGE/PERFORMANCE PROBLEM

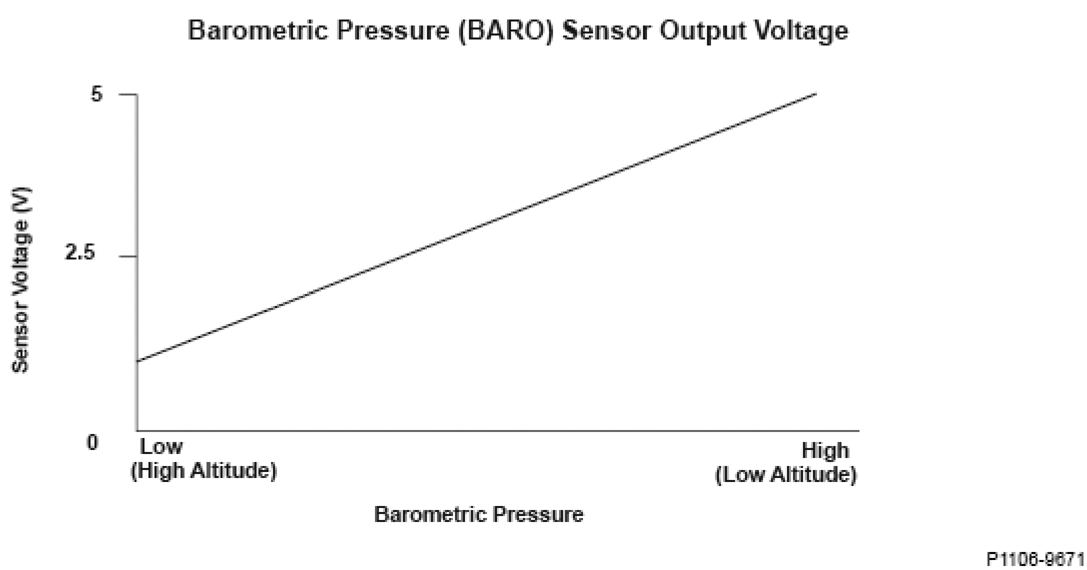


Fig. 215: Barometric Pressure (BARO) Sensor Voltage - Graph

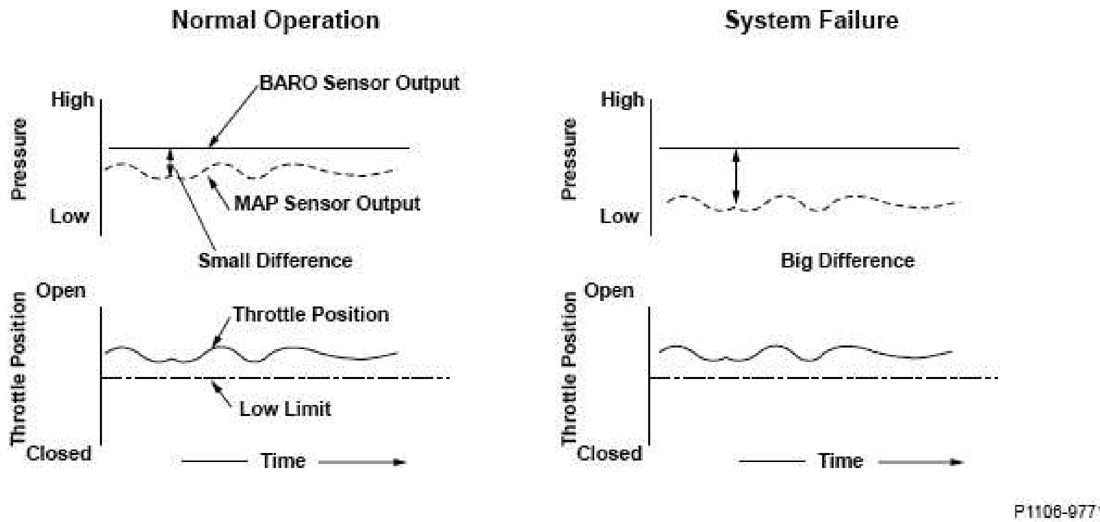


Fig. 216: Barometric Pressure (BARO) Sensor Throttle Position - Graph

General Description

The barometric pressure (BARO) sensor is built into the engine control module (ECM) and monitors atmospheric pressure. When the throttle valve is wide open, the manifold absolute pressure (MAP) sensor output is nearly equal to the BARO sensor output. Making use of this characteristic, a malfunction can be detected in the BARO sensor output.

If the throttle position is beyond a value stored in the ECM that is used to detect "wide-open throttle," and if the difference between the MAP sensor output and the BARO sensor output is equal to or greater than a set value, a malfunction in the BARO sensor output is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Under the Enable Conditions
Sequence	None
Duration	3 seconds or more
DTC Type	Two drive cycles, MIL ON

ENABLE CONDITIONS CHART

Condition		Minimum	Maximum
	1,000	13.4°	

Throttle position	rpm		-
	3,000 rpm	25.6°	
No active DTCs		MAP, ECT, TP, EGR, BARO, IAC, Fuel System, Misfire, Intake Air System	

Malfunction Threshold

The difference between the BARO sensor output and the MAP sensor output is 21 kPa (153 mmHg, 6.1 in.Hg) or more for at least 3 seconds.

Driving Pattern

1. Start the engine. Hold the engine speed at 3,000 rpm without load (in Park or neutral) until the radiator fan comes on.
2. Drive the vehicle with the specified throttle position for at least 3 seconds.
    - If you have difficulty duplicating the DTC, retest after turning off electrical components such as the audio system and A/C, and try a different gear position.
    - Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the ECM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P2228 (13): ADVANCED DIAGNOSTICS

DTC P2228: BAROMETRIC PRESSURE (BARO) SENSOR CIRCUIT LOW VOLTAGE

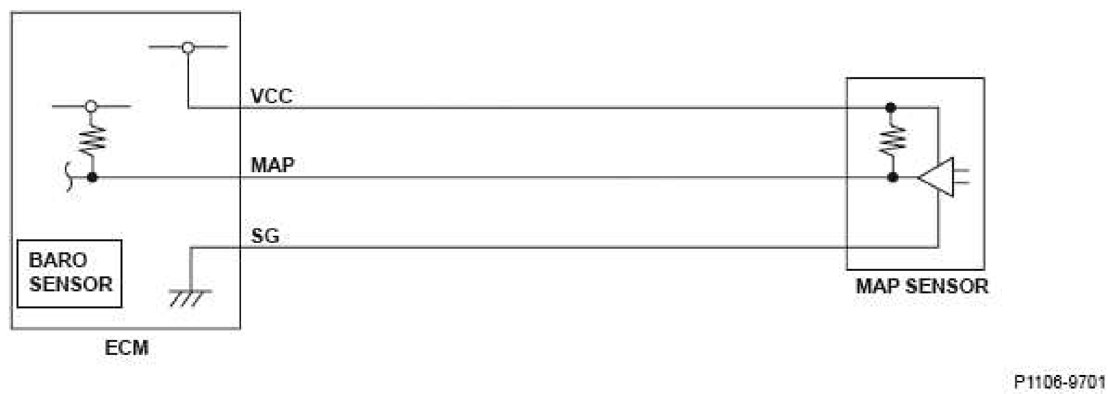


Fig. 217: Barometric Pressure (BARO) Sensor Circuit Out Of Range-High - Circuit Diagram

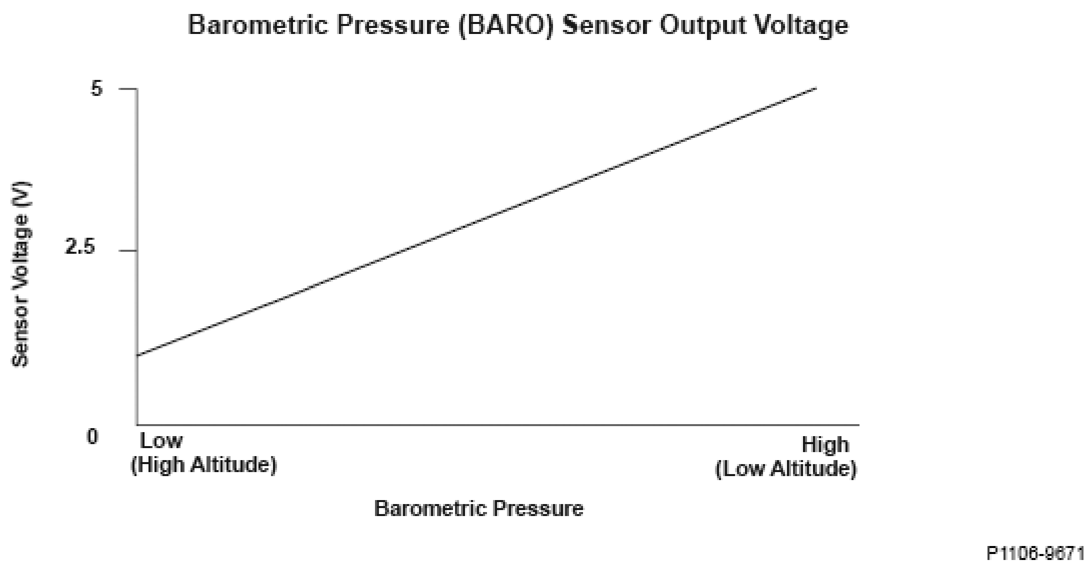


Fig. 218: Barometric Pressure (BARO) Sensor Voltage - Graph

General Description

The barometric pressure (BARO) sensor is built into the engine control module (ECM) and monitors atmospheric pressure. The ECM estimates appropriate intake airflow from the manifold absolute pressure (MAP) sensor output voltage and BARO sensor output voltage. If the BARO sensor output voltage is a specified value or less, the ECM detects a malfunction and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	2 seconds or more
DTC Type	One drive cycle, MIL ON

ENABLE CONDITIONS CHART

Condition	
Ignition switch	ON

Malfunction Threshold

The BARO sensor output voltage is 1.58 V or less for at least 2 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P2229 (13): ADVANCED DIAGNOSTICS

DTC P2229: BAROMETRIC PRESSURE (BARO) SENSOR CIRCUIT HIGH VOLTAGE

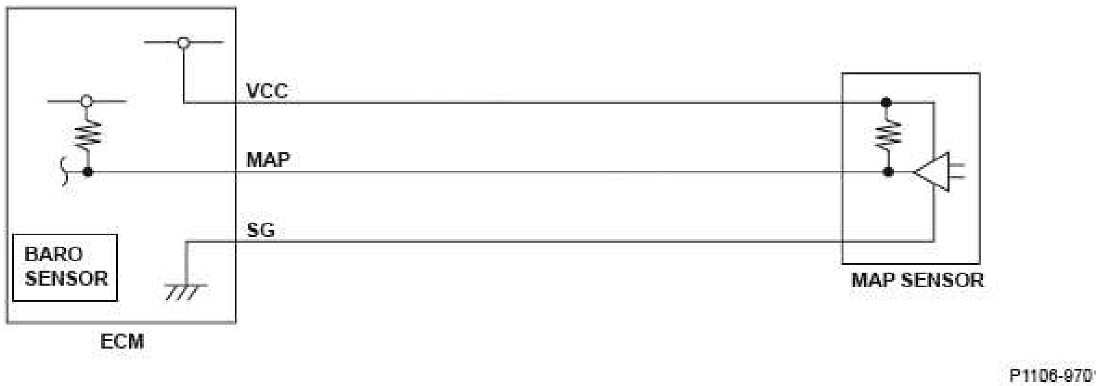


Fig. 219: Barometric Pressure (BARO) Sensor Circuit Out Of Range-High - Circuit Diagram

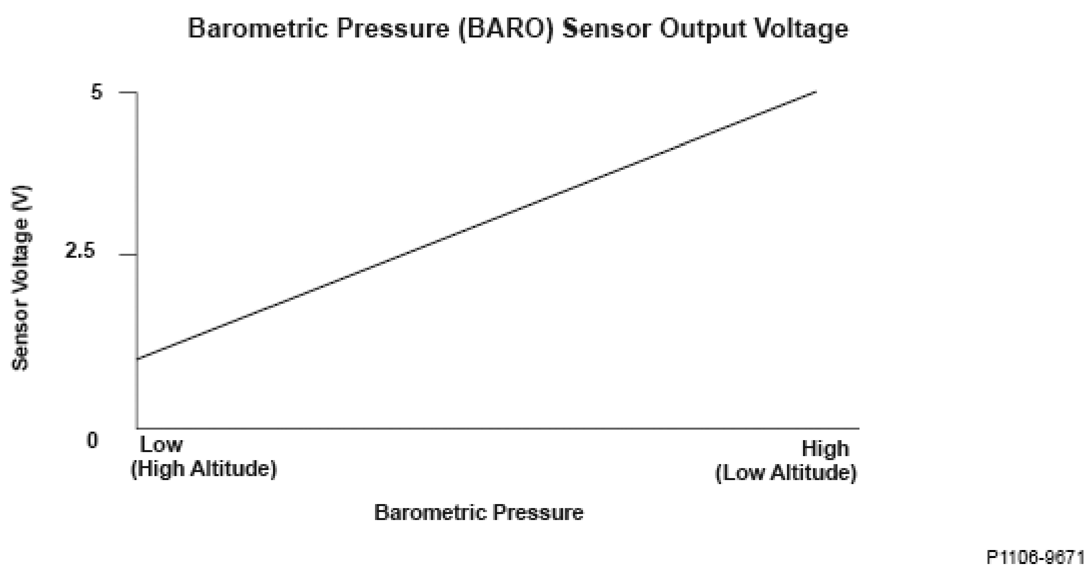


Fig. 220: Barometric Pressure (BARO) Sensor Voltage - Graph

General Description

The barometric pressure (BARO) sensor is built into the engine control module (ECM) and monitors atmospheric pressure. The ECM estimates appropriate intake airflow from the manifold absolute pressure (MAP) sensor output voltage and BARO sensor output voltage. If the BARO sensor output voltage is a specified value or more, the ECM detects a malfunction and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous

Sequence	None
Duration	2 seconds or more
DTC Type	One drive cycle, MIL ON

ENABLE CONDITIONS CHART

Condition	
Ignition switch	ON

Malfunction Threshold

The BARO sensor output voltage is 4.5 V or more for at least 2 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P2238 (48): ADVANCED DIAGNOSTICS

DTC P2238: AIR/FUEL RATIO (A/F) SENSOR (SENSOR 1) AFS+ CIRCUIT LOW VOLTAGE

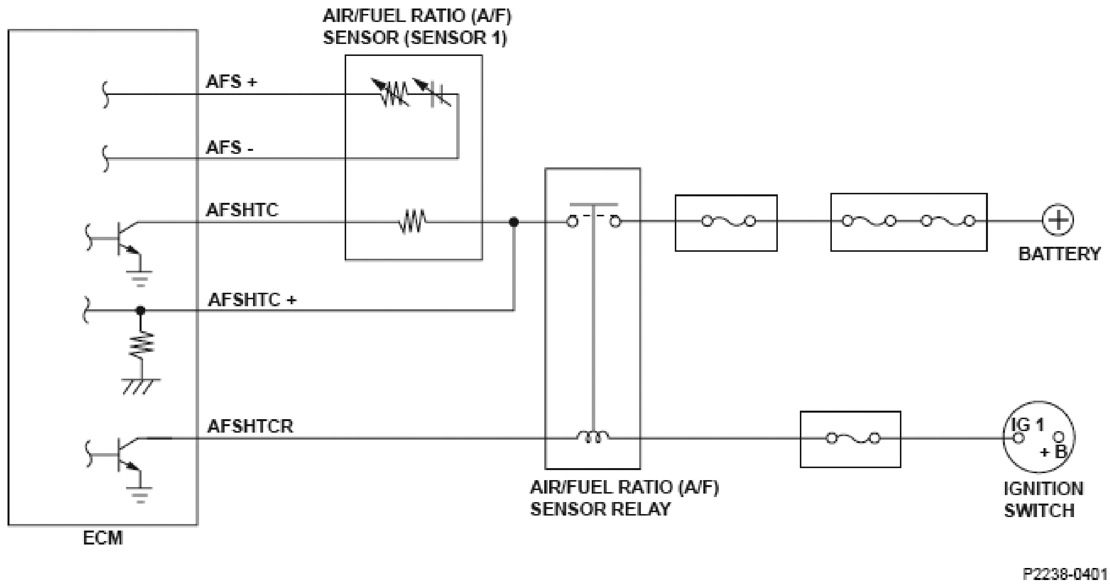


Fig. 221: Air/Fuel Ratio (A/F) Sensor (Sensor 1) Heater Circuit Malfunction Diagram

General Description

The air/fuel ratio (A/F) sensor (sensor 1) is installed in the exhaust system and detects oxygen content in the exhaust gas. The A/F sensor transmits output voltage to the engine control module (ECM). A heater for the sensor element is embedded in the A/F sensor (sensor 1). It heats the sensor to stabilize and speed the detection of oxygen content. The increase in current through the heater levels off as the voltage applied to the electrode reaches a certain range because the amount of oxygen that goes through the diffusion layer is limited. The current is proportional to oxygen content in the exhaust gas, so the air/fuel ratio is detected by the measurement of the current. The ECM compares a set target air/fuel ratio with the detected air/fuel ratio and controls the fuel injection duration.

If the A/F sensor (sensor 1) voltage is low, the air/fuel ratio is lean, and the ECM uses A/F feedback control to issue a Rich command. If the A/F sensor (sensor 1) voltage is high, the air/fuel ratio is rich, and the ECM uses A/F feedback control to issue a Lean command.

If the element is not activated or the ECM terminal voltage is a set value or less for a set time when power is drawn to the A/F sensor (sensor 1) heater, a malfunction is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	3.9 seconds or more
DTC Type	One drive cycle, MIL ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
Engine coolant temperature	14°F (10°C)	-
State of the engine	Running	
No active DTCs	ECM, A/F Sensor (Sensor 1), A/F Sensor Heater (Sensor 1), ECT	

Malfunction Threshold

The AFS+ terminal voltage is 0.4 V or less for at least 3.9 seconds.

Driving Pattern

Start the engine. Hold the engine speed at 3,000 rpm without load (in Park or neutral) until the radiator fan comes on, then let it idle.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P2252 (48): ADVANCED DIAGNOSTICS

DTC P2252: AIR/FUEL RATIO (A/F) SENSOR (SENSOR 1) AFS-CIRCUIT LOW VOLTAGE

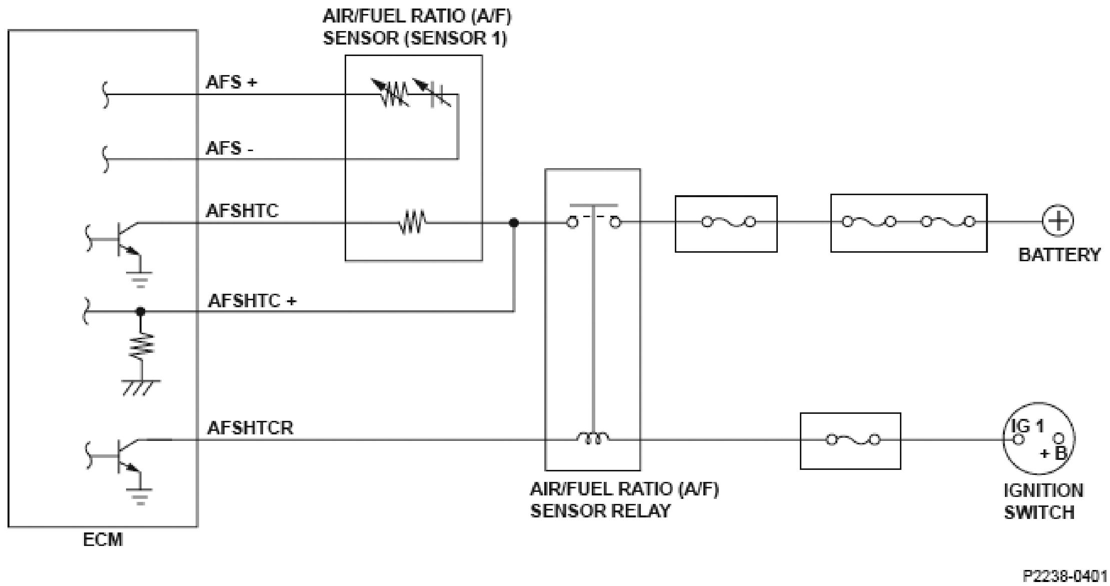


Fig. 222: Air/Fuel Ratio (A/F) Sensor (Sensor 1) Heater Circuit Malfunction Diagram

General Description

The air/fuel ratio (A/F) sensor (sensor 1) is installed in the exhaust system and detects oxygen content in the exhaust gas. The A/F sensor transmits output voltage to the engine control module (ECM). A heater for the sensor element is embedded in the A/F sensor (sensor 1). It heats the sensor to stabilize and speed the detection of oxygen content. The increase in the current through the heater levels off as the voltage applied to the electrode reaches a certain range because the amount of oxygen that goes through the diffusion layer is limited. The current is proportional to oxygen content in the exhaust gas, so the air/fuel ratio is detected by the measurement of the current. The ECM compares a set target air/fuel ratio with the detected air/fuel ratio and controls the fuel injection duration.

If the A/F sensor (sensor 1) voltage is low, the air/fuel ratio is lean, and the ECM uses A/F feedback control to issue a Rich command. If the A/F sensor (sensor 1) voltage is high, the air/fuel ratio is rich, and the ECM uses A/F feedback control to issue a Lean command.

If the element is not activated or the ECM terminal voltage is a set value or less for a set time when power is drawn to the A/F sensor (sensor 1) heater, a malfunction is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	3.9 seconds or more
DTC Type	One drive cycle, MIL ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
Engine coolant temperature	14°F (10°C)	-
State of the engine	Running	
No active DTCs	ECM, A/F Sensor (Sensor 1), A/F Sensor Heater (Sensor 1), ECT	

Malfunction Threshold

The AFS-terminal voltage is 0.3 V or less for at least 3.9 seconds.

Driving Pattern

Start the engine. Hold the engine speed at 3,000 rpm without load (in Park or neutral) until the radiator fan comes on, then let it idle.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool

Clear command or by disconnecting the battery.

DTC P2270 (63): ADVANCED DIAGNOSTICS

DTC P2270: SECONDARY HEATED OXYGEN SENSOR (SECONDARY HO2S (SENSOR 2)) CIRCUIT SIGNAL STUCK LEAN

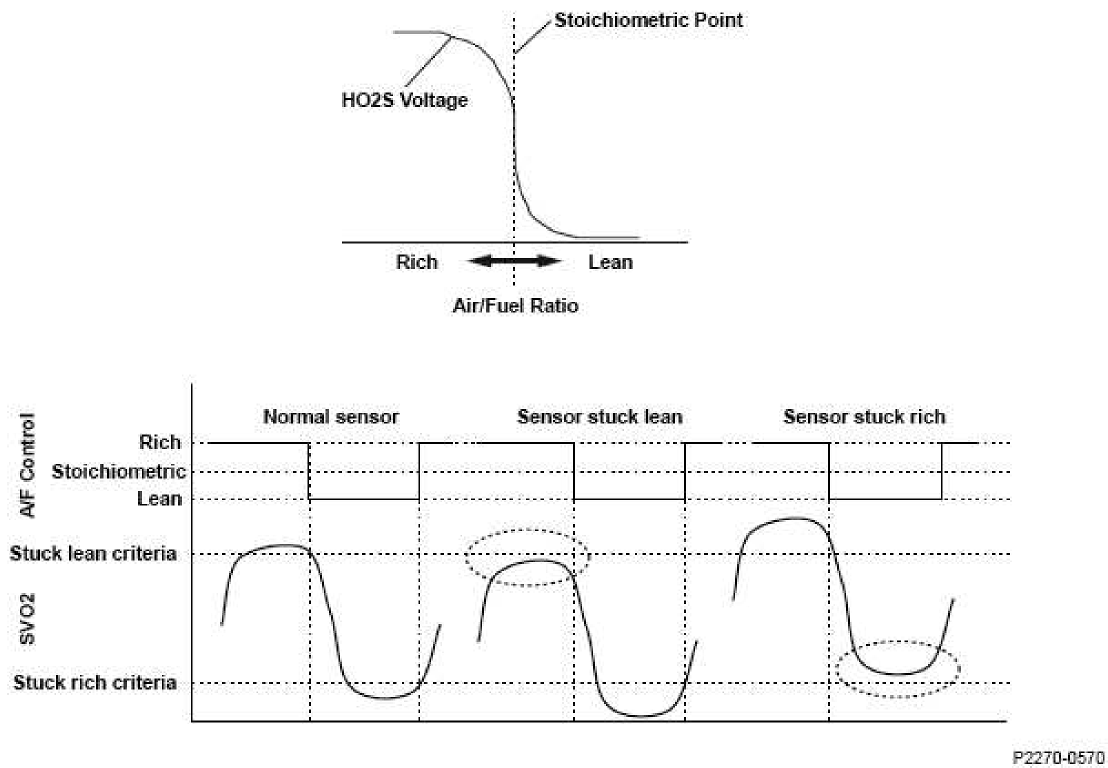


Fig. 223: Air Fuel Ratio - Graph

General Description

The secondary HO2S detects the oxygen concentration in the exhaust gas downstream of the three-way catalyst (TWC). The sensor output voltage characteristics are similar to the air/fuel ratio (A/F) sensor. The oxygen concentration condition is detected after the TWC during fuel feedback control using the A/F sensor, and it optimizes the fuel feedback control to maximize the effect of the TWC. If, after current is applied to the secondary HO2S heater, the secondary HO2S does not fluctuate and the output is stuck within the specified area, a malfunction is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Once per driving cycle
Sequence	None
Duration	25[1], 35[2] seconds or less
DTC Type	Two drive cycles, MIL ON
(1) M/T model (2) CVT model	

ENABLE CONDITIONS CHART

Condition		Minimum	Maximum
Engine coolant temperature		158°F (70°C)	-
Intake air temperature		-14°F (-25°C)	-
Engine speed	CVT	1,200 rpm	2,700 rpm
	M/T	1,300 rpm	
MAP value	CVT	35 kPa (258 mmHg, 10.2 in.Hg)	91 kPa (680 mmHg, 26.8 in.Hg)
	M/T	42 kPa (312 mmHg, 12.3 in.Hg)	
Vehicle speed		30 mph (48 km/h)	-
Fuel trim		1.35	0.70
Fuel feedback		Closed loop	
No active DTCs		A/F Sensor, A/F Sensor Heater, Secondary HO2S, MAP, ECT, EGR, Fuel System, CMP, Misfire	

Malfunction Threshold

The secondary HO2S output voltage is 0.68 V or less.

Driving Pattern

1. Start the engine. Let it idle until the radiator fan comes on.
2. Drive the vehicle at a steady speed of 35 mph (57 km/h) or more, for at least

25*1, 35*2 seconds.

- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the ECM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P2271 (63): ADVANCED DIAGNOSTICS

DTC P2271: SECONDARY HEATED OXYGEN SENSOR (SECONDARY HO2S (SENSOR 2)) CIRCUIT SIGNAL STUCK RICH

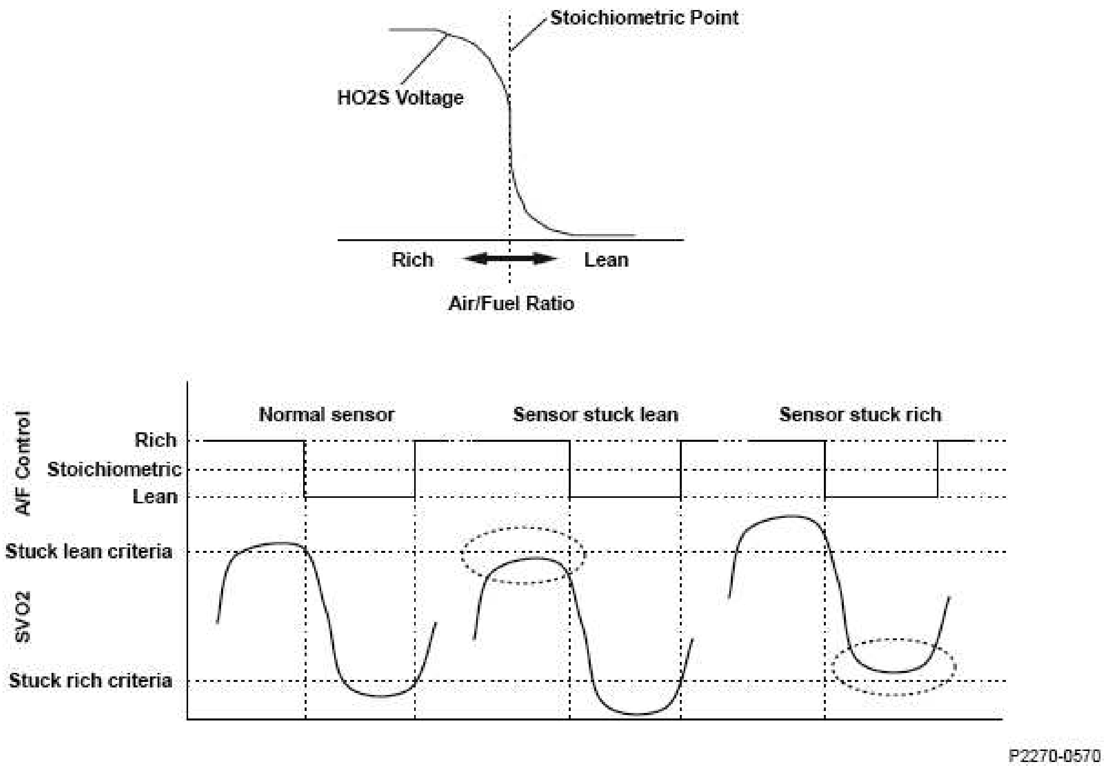


Fig. 224: Air Fuel Ratio - Graph

General Description

The secondary HO2S detects the oxygen concentration in the exhaust gas downstream of the three-way catalyst (TWC). The sensor output voltage characteristics are similar to the air/fuel ratio (A/F) sensor. The oxygen concentration condition is detected after the TWC during fuel feedback control using the A/F sensor, and it optimizes the fuel feedback control to maximize the effect of the TWC. If, after current is applied to the secondary HO2S heater, the secondary HO2S does not fluctuate and the output is stuck within the specified area, a malfunction is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Once per driving cycle
Sequence	None
Duration	25[(1)], 35[(2)] seconds or less
DTC Type	Two drive cycles, MIL ON

(1) M/T model

(2) CVT model

ENABLE CONDITIONS CHART

Condition		Minimum	Maximum
Engine coolant temperature		158°F (70°C)	-
Intake air temperature		-14°F (-25°C)	-
Engine speed	CVT	1,200 rpm	2,700 rpm
	M/T	1,300 rpm	
MAP value	CVT	35 kPa (258 mmHg, 10.2 in.Hg)	91 kPa (680 mmHg, 26.8 in.Hg)
	M/T	42 kPa (312 mmHg, 12.3 in.Hg)	
Vehicle speed		30 mph (48 km/h)	-
Fuel trim		1.35	0.70
Fuel feedback		Closed loop	
No active DTCs		A/F Sensor, A/F Sensor Heater, Secondary HO2S, MAP, ECT, EGR, Fuel System, CMP, Misfire	

Malfunction Threshold

The secondary HO2S output voltage is 0.29 V or more.

Driving Pattern

1. Start the engine. Let it idle until the radiator fan comes on.
2. Drive the vehicle at a steady speed of 35 mph (57 km/h) or more, for at least 25*1, 35*2 seconds.
    - Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the ECM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P2279 (109): ADVANCED DIAGNOSTICS

DTC P2279: INTAKE AIR SYSTEM LEAK

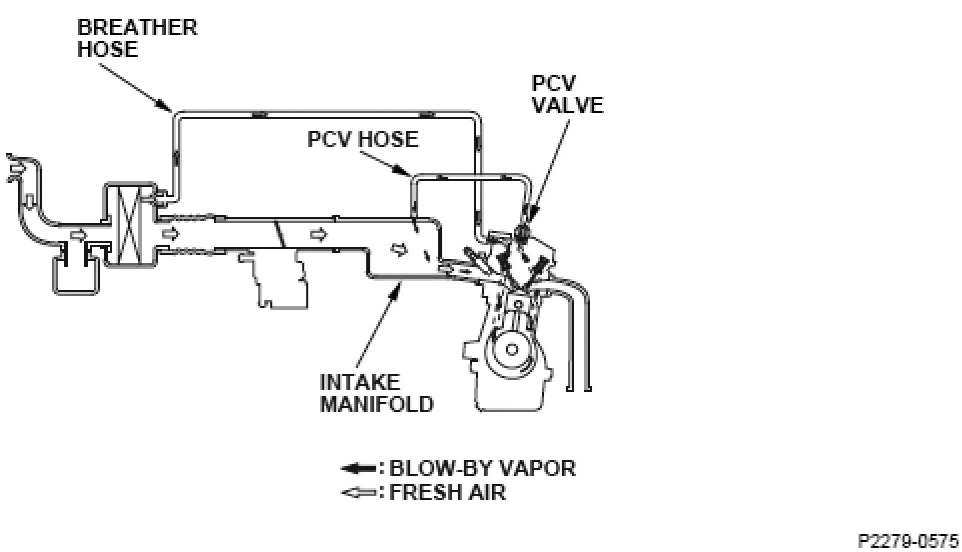


Fig. 225: Intake Air System Leak - System Diagram

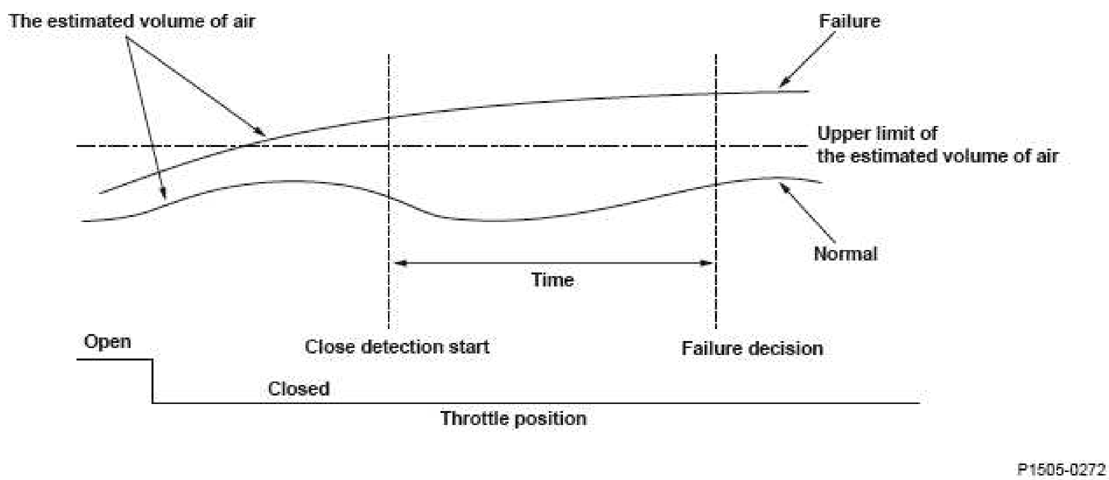


Fig. 226: Estimated Volume Of Air - Graph

General Description

The positive crankcase ventilation (PCV) system reduces hydrocarbons (HC). The PCV system recirculates the unburned air/fuel mixture (blow-by vapor) into the intake manifold where it is drawn into the engine and burned, thus reducing HC. If the PCV hose comes off while air is supplied mainly via the idle air control (IAC) valve with the throttle closed, the amount of air supplied to the engine is considerably more than the amount of air the IAC valve supplies.

The engine control module (ECM) estimates the amount of air supplied to the engine while the throttle valve is fully closed, and if the estimated amount is more than the upper limit, it detects a malfunction and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Once per driving cycle
Sequence	None
Duration	22 seconds or more
DTC Type	Two drive cycles, MIL ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
Elapsed time after starting the engine	15 seconds	-

Engine coolant temperature	158°F (70°C)	-
Intake air temperature	20°F (-6°C)	-
MAP value	-	81 kPa (610 mmHg, 24.0 in.Hg)
Battery voltage	10.5 V	-
Fuel trim	0.63	1.35
Fuel feedback	Closed loop	
Throttle position	Fully closed	
No active DTCs	MAP, ECT, BARO, Fuel System, CKP, TP, EGR, Misfire	
Other	At idle	

Malfunction Threshold

The estimated volume of air that is calculated in the ECM is shown in the table.

MALFUNCTION THRESHOLD CHART

MAP value	The volume of air
47 kPa (360 mmHg, 14.1 in.Hg)	158 l/min (167.0 US qt/min, 139.1 lmp qt/min) or more
61 kPa (459 mmHg, 18.0 in.Hg)	144 l/min (152.2 US qt/min, 126.8 lmp qt/min) or more

Driving Pattern

1. Start the engine. Hold the engine speed at 3,000 rpm without load (in Park or neutral) until the radiator fan comes on.
2. Let the engine idle for at least 22 seconds.
    - If you have difficulty duplicating the DTC, retest after turning off electrical components such as the audio system and A/C, and try a different gear position.
    - Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the ECM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P2422 (117): ADVANCED DIAGNOSTICS

DTC P2422: EVAPORATIVE EMISSION (EVAP) CANISTER VENT SHUT VALVE STUCK CLOSED MALFUNCTION

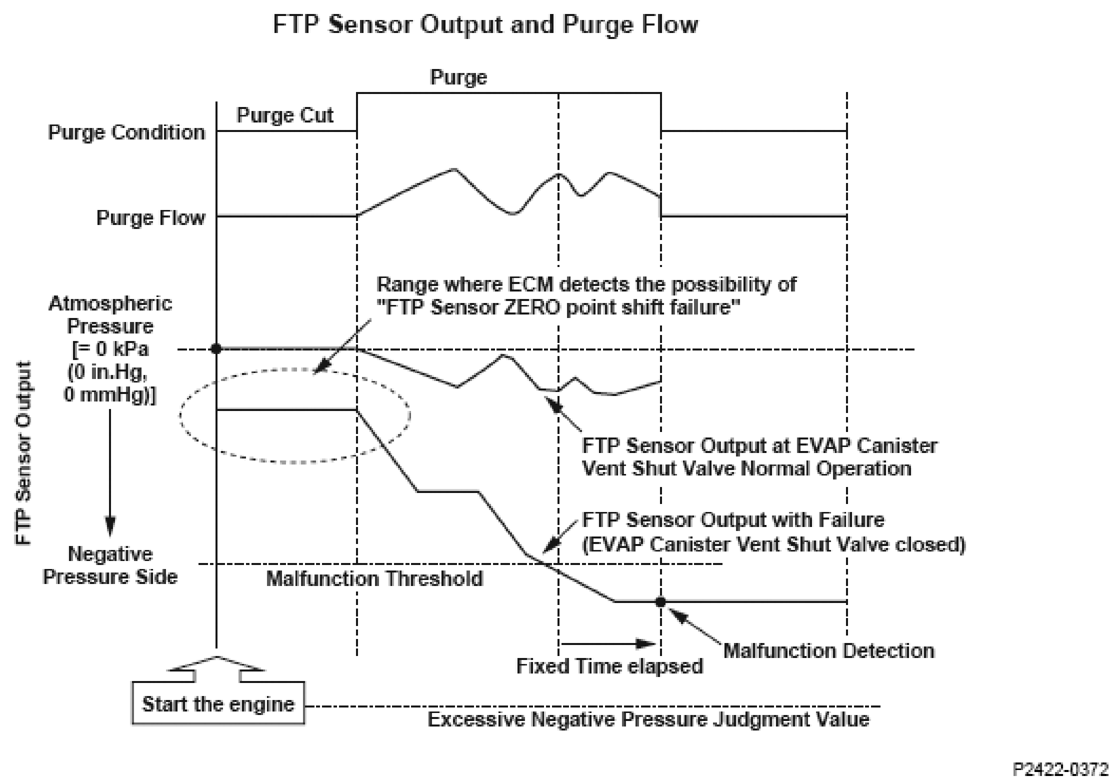


Fig. 227: FTP Sensor Output And Purge Flow - Diagram

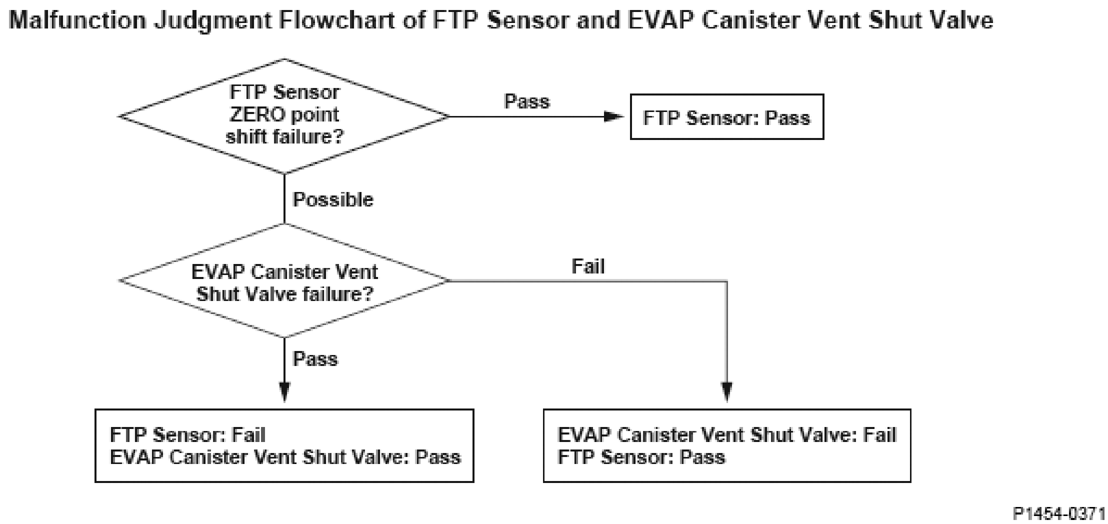


Fig. 228: Flow Chart

General Description

The fuel tank pressure (FTP) sensor output indicates about atmospheric pressure 0 kPa (0 in.Hg, 0 mmHg) before purge starts since the evaporative emission (EVAP) canister vent shut valve is normally open (open to the atmosphere). The sensor indicates a negative pressure value (vacuum) during purging.

When the FTP sensor indicates vacuum after starting the engine, there is the possibility of an FTP sensor zero point shift failure or an EVAP canister vent shut valve stuck closed failure. So the engine control module (ECM) monitors the FTP sensor output after purge starts. The ECM detects a malfunction of the EVAP canister vent shut valve if the output indicates excessive vacuum.

However, if the fuel tank internal pressure is below the specified value (excessive vacuum is detected) when starting the engine, the malfunction detection should be done as follows because it is difficult to distinguish the FTP sensor range problem (P1454) from the EVAP canister vent shut valve stuck closed (P2422).

1. If neither Temporary DTC (P1454 nor P2422) is stored, both DTCs are stored.
2. If both Temporary DTCs (P1454 and P2422) are stored and excessive vacuum is detected, both DTCs are stored.
3. If either Temporary DTC (P1454 or P2422) is stored and excessive vacuum is detected, the ECM stores the DTC of the Temporary DTC that was stored.

MONITOR DESCRIPTION CHART

Execution	Once per driving cycle
Sequence	None
Duration	3.04 seconds or more(1)
DTC Type	Two drive cycles, MIL ON
(1) Elapsed time after the FTP sensor output exceeds the malfunction threshold.	

ENABLE CONDITIONS CHART

Condition		Minimum	Maximum
Elapsed time after starting the engine(1)		20 seconds	-
Time to judge excessive negative pressure(1)		3 seconds	-
Engine coolant temperature (2)		149°F (65°C)	-
Fuel tank pressure(1)		-	-2 kPa (-0.4 in.Hg, -10 mmHg)
Battery voltage		10.5 V	-
Fuel trim	CVT	0.63	1.40
	M/T		1.35
Fuel feedback		Closed loop	
Monitoring priority		EVAP	
No active DTCs		A/F Sensor, A/F Sensor Heater, MAP, ECT, CKP, BARO, EVAP, FTP	
(1) Excessive negative pressure is detected. (2) Condition to start the purge control.			

Malfunction Threshold

The output from the fuel tank pressure sensor is -6 kPa (-1.6 in.Hg, -40 mmHg) or less for at least 3.04 seconds.

Driving Pattern

Start the engine. Hold the engine speed at 3,000 rpm without load (in Park or neutral) until the radiator fan comes on, then let it idle.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the ECM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P2610 (132): ADVANCED DIAGNOSTICS

DTC P2610: ENGINE CONTROL MODULE (ECM) IGNITION OFF INTERNAL TIMER MALFUNCTION

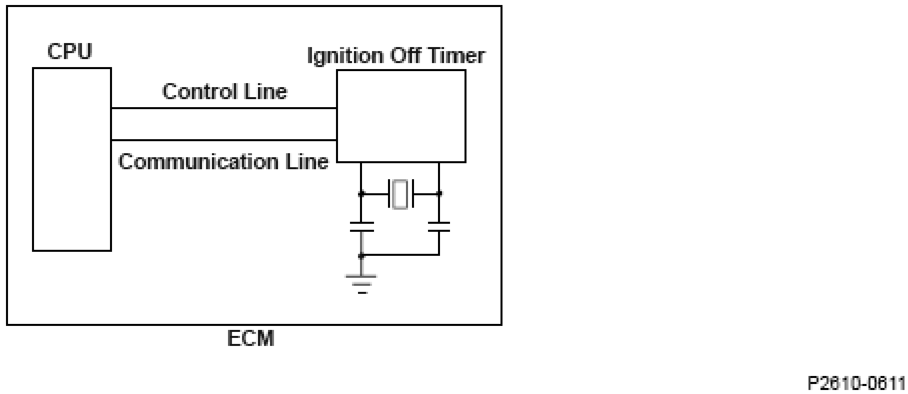


Fig. 229: Engine Control Module (ECM) Ignition Off Internal Timer - Communication Diagram

General Description

The engine control module (ECM) has a built-in ignition off timer that measures the duration of time from ignition off to the next ignition on. The measured duration is used for evaporative emission (EVAP) leak detection and temperature assumption of the catalytic converter.

The CPU in the ECM accesses the ignition off timer when reading the measured duration. When the access process fails, a malfunction is detected and a DTC is stored. When an abnormality is found in the read data, a malfunction is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	10 seconds or more
DTC Type	One drive cycle, MIL ON

ENABLE CONDITIONS CHART

Condition	
Ignition switch	ON(1)
(1) Ignition switch on when a battery is disconnected and connected again is excluded.	

Malfunction Threshold

The access process to the ignition off timer fails, or a malfunction is found in the read data for at least 10 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P2646 (22): ADVANCED DIAGNOSTICS

DTC P2646: ROCKER ARM OIL PRESSURE SWITCH (VTEC OIL PRESSURE SWITCH) CIRCUIT LOW VOLTAGE

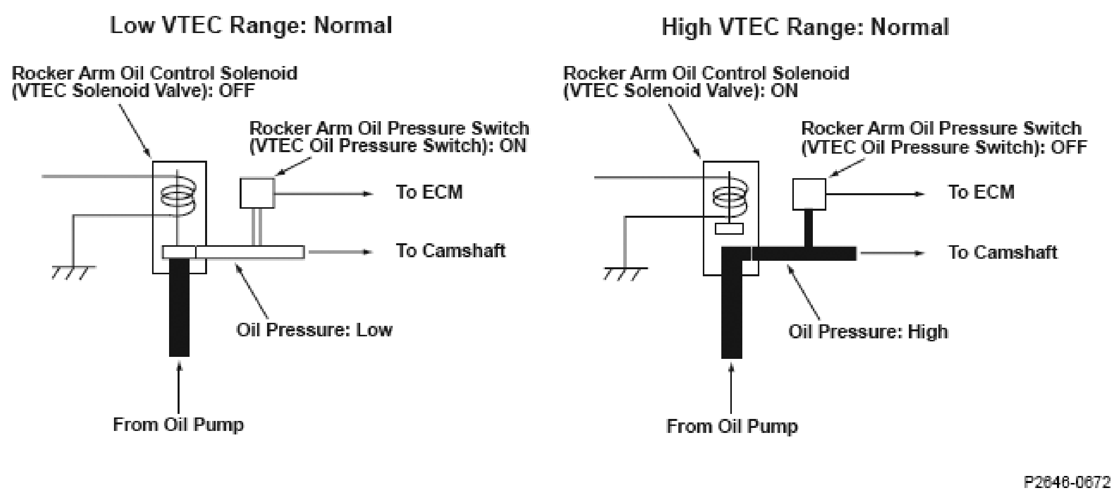


Fig. 230: Rocker Arm Oil Pressure Switch (VTEC Oil Pressure Switch) Circuit Diagram

ROCKER ARM OIL PRESSURE SWITCH CHART

Logic Decision	Rocker Arm Oil Pressure Switch (VTEC Oil Pressure Switch)	
	'ON'	'OFF'
Rocker Arm Oil Control Solenoid (VTEC Solenoid Valve) Command 'ON'	Failure	Normal
Rocker Arm Oil Control Solenoid (VTEC Solenoid Valve) Command 'OFF'	Normal	Failure

General Description

The VTEC system activates the rocker arm oil control solenoid (VTEC solenoid valve) by command from the engine control module (ECM), and it charges/discharges the hydraulic circuit of the VTEC mechanism that switches valve timing between Low and High. The ECM monitors oil pressure in the hydraulic circuit of the VTEC mechanism using the rocker arm oil pressure switch (VTEC oil pressure switch) downstream of the rocker arm oil control solenoid (VTEC solenoid valve). If there is a difference between the oil pressure condition in the hydraulic circuit that is determined by the ECM command and the oil pressure condition that is determined by the status of the rocker arm oil pressure switch (VTEC oil pressure switch), the system is considered faulty, and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Once per driving cycle
Sequence	None
Duration	10 seconds or more
DTC Type	One drive cycle, MIL ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
Engine coolant temperature	86°F (30°C)	-
Engine speed (High lift cam operation)	3,500 rpm	-
Battery voltage	10.5 V	-
Gear position	Other than P or N position	
No active DTCs	BARO	

Malfunction Threshold

When the rocker arm oil control solenoid (VTEC solenoid valve) is ON, the rocker arm oil pressure switch (VTEC oil pressure switch) remains ON.

Driving Pattern

1. Start the engine. Hold the engine speed at 3,000 rpm without load (in Park or neutral) until the radiator fan comes on.
2. Drive the vehicle in a lower gear at 3,500 rpm or more for at least 10 seconds.

- Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P2647 (22): ADVANCED DIAGNOSTICS

DTC P2647: ROCKER ARM OIL PRESSURE SWITCH (VTEC OIL PRESSURE SWITCH) CIRCUIT HIGH VOLTAGE

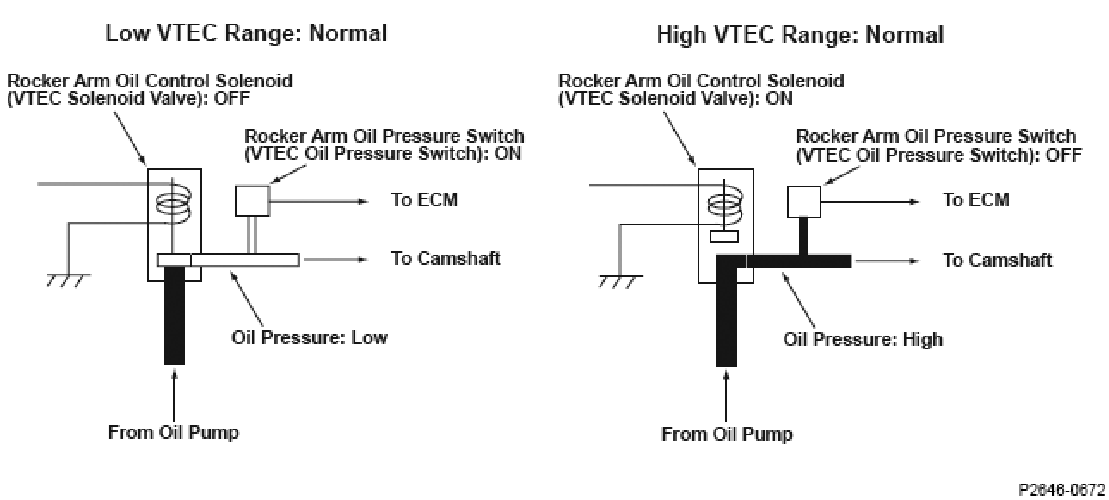


Fig. 231: Rocker Arm Oil Pressure Switch (VTEC Oil Pressure Switch) Circuit Diagram

ROCKER ARM OIL PRESSURE SWITCH CHART

	Rocker Arm Oil Pressure Switch

Logic Decision	(VTEC Oil Pressure Switch)	
	'ON'	'OFF'
Rocker Arm Oil Control Solenoid (VTEC Solenoid Valve) Command 'ON'	Failure	Normal
Rocker Arm Oil Control Solenoid (VTEC Solenoid Valve) Command 'OFF'	Normal	Failure

General Description

The VTEC system activates the rocker arm oil control solenoid (VTEC solenoid valve) by command from the engine control module (ECM), and it charges/discharges the hydraulic circuit of the VTEC mechanism that switches valve timing between Low and High. The ECM monitors oil pressure in the hydraulic circuit of the VTEC mechanism using the rocker arm oil pressure switch (VTEC oil pressure switch) downstream of the rocker arm oil control solenoid (VTEC solenoid valve). If there is a difference between the oil pressure condition in the hydraulic circuit that is determined by the ECM command and the oil pressure condition that is determined by the status of the rocker arm oil pressure switch (VTEC oil pressure switch), the system is considered faulty, and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Once per driving cycle
Sequence	None
Duration	10 seconds or more
DTC Type	One drive cycle, MIL ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
Battery voltage	10.5 V	-
No active DTCs	BARO	
Other	At idle	

Malfunction Threshold

Low lift cam operation

When the rocker arm oil control solenoid (VTEC solenoid valve) is OFF, the rocker arm oil pressure switch (VTEC oil pressure switch) remains OFF.

Driving Pattern

Start the engine, and let it idle for at least 10 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC P2A00 (61): ADVANCED DIAGNOSTICS

DTC P2A00: AIR/FUEL RATIO (A/F) SENSOR (SENSOR 1) RANGE/PERFORMANCE PROBLEM

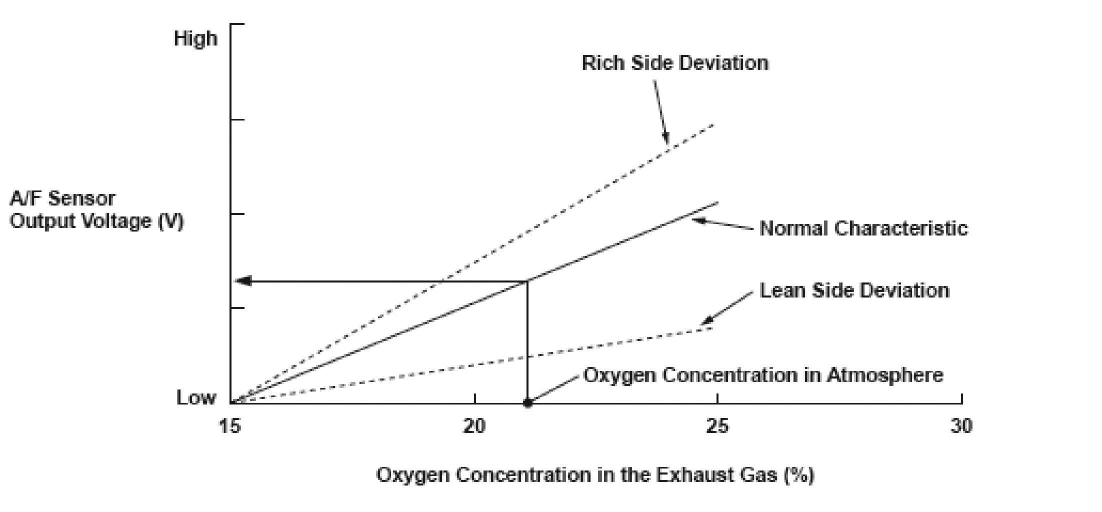


Fig. 232: A/F Sensor Voltage - Graph

General Description

The air/fuel ratio (A/F) sensor has a linear signal output in relation to the oxygen concentration. The engine control module (ECM) computes the air/fuel ratio from A/F sensor output voltage and uses the fuel feedback control to improve exhaust emissions. The ECM monitors A/F sensor output voltage during deceleration with the throttle fully closed, and it detects a malfunction and stores a DTC if the output voltage deviates greatly from normal oxygen concentration levels.

* Output to the scan tool exhibits a relationship between the A/F sensor output and oxygen concentration, which is opposite to the characteristic shown in the graph. That is, a deviation toward the rich side increases the output voltage and one toward the lean side decreases the output voltage as the stoichiometric ratio is 0.

MONITOR DESCRIPTION CHART

Execution	Once per driving cycle
Sequence	None
Duration	3.1 seconds or more(1)
	3.15 - 6.45 seconds(2)
DTC Type	Two drive cycles, MIL ON
(1) CVT model (2) M/T model	

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
Elapsed time after starting the engine	60 seconds	-
Engine coolant temperature	158°F (70°C)	-
Intake air temperature	-14°F (-25°C)	-
	-(1)	

Engine speed	1,050 rpm[2]	2,700 rpm
Vehicle speed	30 mph (48 km/h)[1]	-
	16 mph (10 km/h)[2]	
Fuel feedback	During deceleration	
Monitoring priority	Catalyst System[1], EVAP[1]	
No active DTCs	ECM, A/F Sensor[2], A/F Sensor Heater[2], CKP, TP[1], BARO, VSS, Fuel System, EVAP, A/T System[1]	
Other	Other than when there is excessive vapor generation (fuel level is 40 - 80%)	

(1) CVT model

(2) M/T model

Malfunction Threshold

The A/F sensor output voltage is 3.01 V*1, 3.02 V*2 or less (rich side), or 4.18 V*2, 4.51 V*1 or more (lean side).

Driving Pattern

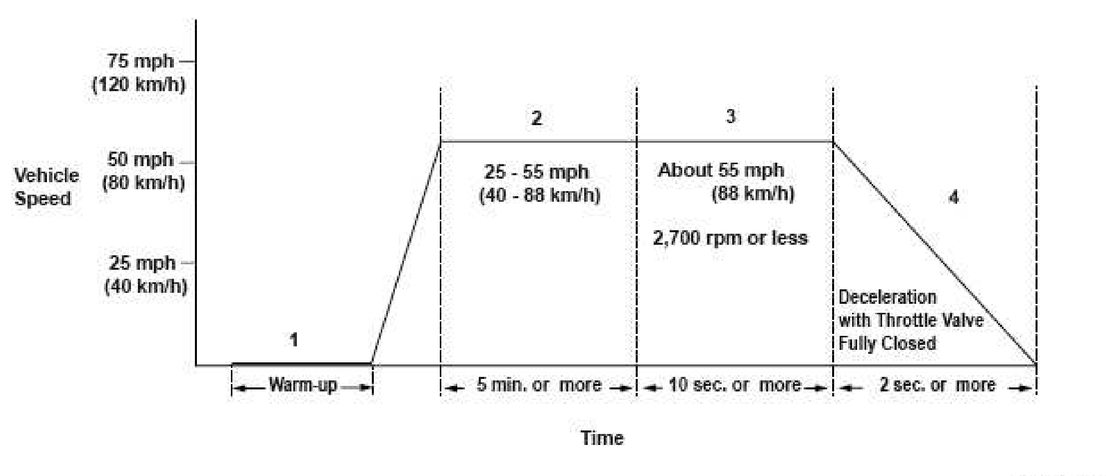


Fig. 233: Identifying Driving Pattern

1. Start the engine. Hold the engine at 3,000 rpm with no load (in park or neutral)

until the radiator fan comes on.

2. Drive the vehicle at a speed between 25 - 55 mph (40 - 88 km/h) for at least 5 minutes.
3. Drive the vehicle at about 55 mph (88 km/h) with an engine speed of 2,700 rpm or less for at least 5 seconds.
4. Decelerate with the throttle fully closed for at least 2 seconds.
    - If the EVAP monitor runs instead of the HO2S monitor, turn the engine off, then restart it, and the HO2S monitor will restart.
    - If you have difficulty duplicating the DTC, retest after turning off electrical components such as the audio system and A/C, and try a different gear position.
    - Drive the vehicle in this manner only if the traffic regulations and ambient conditions allow.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected during the first drive cycle, a Temporary DTC is stored in the ECM memory. If the malfunction recurs during the next (second) drive cycle, the MIL comes on and the DTC and the freeze frame data are stored.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, the Temporary DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.

DTC U0101 (30): ADVANCED DIAGNOSTICS

DTC U0101: A/T FI SIGNAL A/B CIRCUIT MALFUNCTION (CVT MODEL)

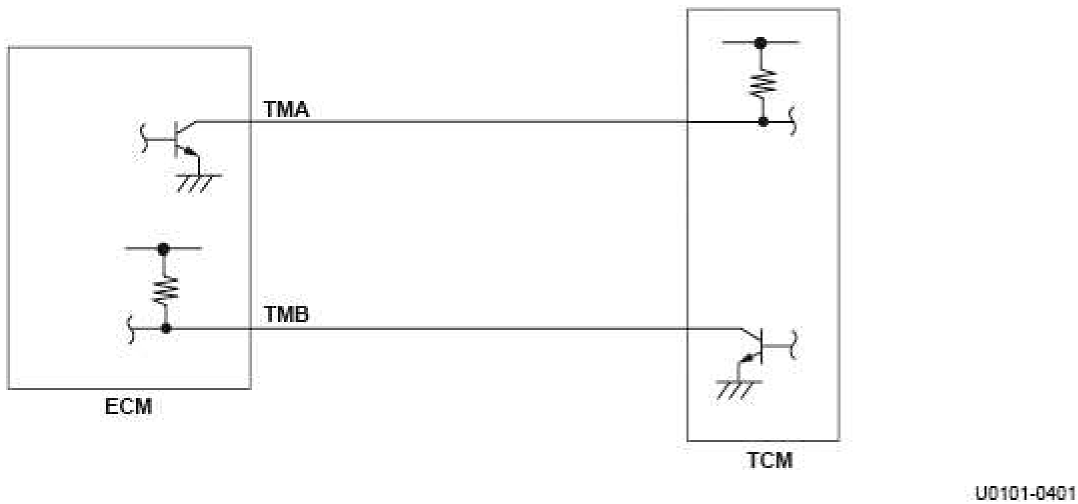


Fig. 234: A/T FI Signal A/B Circuit Malfunction (CVT Model) - Circuit Diagram

General Description

The engine control module (ECM) sends various signals to the transmission control module (TCM) via the TMA signal line. The TCM sends signals used for engine control to the ECM via the TMB signal line. If no signals to or from the ECM are input or output for a set time, a malfunction is detected and a DTC is stored.

MONITOR DESCRIPTION CHART

Execution	Continuous
Sequence	None
Duration	5 seconds or more
DTC Type	One drive cycle, MIL ON

ENABLE CONDITIONS CHART

Condition	Minimum	Maximum
Battery voltage	10.1 V	-
No active DTCs	ECM	

Malfunction Threshold

No communication signals from the TCM are detected for at least 5 seconds.

Diagnosis Details

Conditions for illuminating the MIL

When a malfunction is detected, the MIL comes on and the DTC and the freeze frame data are stored in the ECM memory.

Conditions for clearing the MIL

The MIL will be cleared if the malfunction does not recur during three consecutive trips in which the diagnostic runs.

The MIL, the DTC, and the freeze frame data can be cleared by using the scan tool Clear command or by disconnecting the battery.