Intake Camshaft Position Actuator Solenoid Control Circuit Bank 1	P0010	This DTC checks the circuit for electrical integrity during operation.	The ECM detects that the commanded state of the driver and the actual state of the control circuit do not match.	Output driver commanded on Ignition switch is in crank or run 9 volts < Ignition Voltage < 18 volts	20 failures out of 25 samples 250ms loop continuous	DTC Type B
Intake Camshaft Position System Performance Bank 1	P0011	Detects a VVT system error by comparing the desired and actual cam positions when VVT is activated	Camshaft position error [absolute value of (desired position - actual position)] > 8° (All Table Positions) Table is a function of Engine RPM and Oil Temperature	Engine is running VVT is enabled Desired camshaft position > 0 Δ Desired Camshaft position < 7.5° for 2.0 seconds (Table is a function of Engine RPM and Oil Temperature) System voltage ≥ 11 volts System voltage ≤ 18 volts Power Take Off (PTO) not active DTCs not active for the following sub-systems: Cam sensors Crank sensors Cam to crank rationality Cam phase output drivers	420 fail counts out of 1200 sample counts 100ms loop Continuous	DTC Type B
Crankshaft Position (CKP)-Camshaft Position (CMP) Correlation Bank 1 Sensor A	P0016	Detects cam to crank misalignment by monitoring if cam sensor pulse occurs during the incorrect crank position	Four cam sensor pulses more than +/- 9 crank degrees away from nominal position in crank degrees in one cam revolution.	• No 5 volt reference, camshaft position sensor circuit, or crankshaft position sensor circuit DTCs set • Engine speed < 1200 RPM • Engine is spinning • Crankshaft position signal is in sync. • Cam phase state is learned or default	25 failures out of 35 samples Frequency: 1x per cam rotation Continuous	DTC Type B
O2S Heater Control Circuit Bank 1 Sensor 1	P0030	This DTC checks the Heater Output Driver circuit for electrical integrity	Voltage low during driver open state (indicates short-to-ground or open circuit) or voltage high during driver closed state (indicates short to voltage).	• Ignition switch is in crank or run • 11 volts < Ignition Voltage < 18 volts • Engine speed ≥ 425 RPM	20 failures out of 25 samples Frequency: 250ms loop Continuous	DTC Type B
O2S Heater Control Circuit Bank 1 Sensor 2	P0036	This DTC checks the Heater Output Driver circuit for electrical integrity	Voltage low during driver open state (indicates short-to-ground or open circuit) or voltage high during driver closed state (indicates short to voltage).	• Ignition switch is in crank or run • 11 volts < Ignition Voltage < 18 volts • Engine speed ≥ 425 RPM	20 failures out of 25 samples Frequency: 250ms loop Continuous	DTC Type B
O2S Heater Control Circuit Bank 2 Sensor 1	P0050	This DTC checks the Heater Output Driver circuit for electrical integrity	Voltage low during driver open state (indicates short-to-ground or open circuit) or voltage high during driver closed state (indicates short to voltage).	• Ignition switch is in crank or run • 11 volts < Ignition Voltage < 18 volts • Engine speed ≥ 425 RPM	20 failures out of 25 samples Frequency: 250ms loop Continuous	DTC Type B (with Dual bank fuel control only)
HO2S Heater Resistance Bank 1 Sensor 1	P0053	Detects an oxygen sensor heater having an incorrect or out of range resistance value.	3.1309 Ω > Calculated Heater resistance > 9.3106 Ω	• Coolant – IAT < 8°C • Engine Soak Time > 28800 Seconds • -30 °C < Coolant Temp < 45°C • Coolant Fault = Not Active • Ignition Off Fault = Not Active • Intake Air Temp Fault = Not Active • Ignition Voltage < 18 volts	Once per valid cold start.	DTC Type B

HO2S Heater Resistance Bank 1 Sensor 2	P0054	Detects an oxygen sensor heater having an incorrect or out of range resistance value.	8.8203 Ω > Calculated Heater resistance > 21.1699 Ω	• Coolant – IAT < 8ºC • Engine Soak Time > 28800 Seconds • -30 ºC < Coolant Temp < 45ºC • Coolant Fault = Not Active • Ignition Off Fault = Not Active • Intake Air Temp Fault = Not Active • Ignition Voltage < 18 volts	Once per valid cold start.	DTC Type B
O2S Heater Control Circuit Bank 2 Sensor 2	P0056	This DTC checks the Heater Output Driver circuit for electrical integrity	Output state shorted or open Voltage low during driver open state (indicates short-to-ground or open circuit) or voltage high during driver closed state (indicates short to voltage).	• Ignition switch is in crank or run • 11 volts < Ignition Voltage < 18 volts • Engine speed ≥ 425 RPM	20 failures out of 25 samples Frequency: 250ms loop Continuous	DTC Type B (with Dual bank fuel control only)
HO2S Heater Resistance Bank 2 Sensor 1	P0059	Detects an oxygen sensor heater having an incorrect or out of range resistance value.	3.1309 Ω > Calculated Heater resistance > 9.3106 Ω	• Coolant – IAT < 8ºC • Engine Soak Time > 28800 Seconds • -30 ºC < Coolant Temp < 45ºC • Coolant Fault = Not Active • Ignition Off Fault = Not Active • Intake Air Temp Fault = Not Active • Ignition Voltage < 18 volts	Once per valid cold start.	DTC Type B (with Dual bank fuel control only)
HO2S Heater Resistance Bank 2 Sensor2	P0060	Detects an oxygen sensor heater having an incorrect or out of range resistance value.	8.8203 Ω > Calculated Heater resistance > 21.1699 Ω	• Coolant – IAT < 8ºC • Engine Soak Time > 28800 Seconds • -30 ºC < Coolant Temp < 45ºC • Coolant Fault = Not Active • Ignition Off Fault = Not Active • Intake Air Temp Fault = Not Active • Ignition Voltage < 18 volts	Once per valid cold start.	DTC Type B (with Dual bank fuel control only)
MAP/MAF/Throttle Position Correlation	P0068	Detect when manifold absolute pressure and measured airflow do not match estimated engine airflow as established by the TPS	Difference between measured MAP and estimated MAP < X kPa Difference between measured MAF and estimated MAF < Y grams/sec X, Y depend on throttle position, and maximum of X, and Y are 100kPa, 511gram/sec.	Engine running No PCM processor, throttle actuation DTCs Both TPS circuits DTCs are set	187.5 msec Continuous in the main processor	DTC Type A
MAP/Baro Correlation	P0069	Determines correlation between estimated Baro and Baro sensor reading	Difference between Baro sensor reading and Estimated baro > 10Kpa when distance since last estimated baro update < 23 kilometers	No Baro sensor circuit DTCs set No ECT, IAT, MAF, MAP, TP, or VSS DTCs set	25 of fail samples out of 30 samples Continuous 250 ms loop	DTC Type B (with Displacement on Demand only)
Mass Airflow (MAF) Sensor Performance	P0101	This DTC determines if the MAF sensor is stuck within the normal operating range	(Measured Flow – Modeled air Flow) Filtered > 15 AND (Measured Manifold Air Pressure – Manifold Model 2 pressure) Filtered > 20	Engine rpm =>400 and <= 6500 MAP sensor high/low DTCs not active MAF sensor high/low DTCs not active Crank sensor DTCs not active Engine Coolant DTCs not active Intake Air Temp. DTCs not active Engine Coolant > 70 deg C and < 126 deg C Intake Air Temp > -7 deg C and < 125 deg C	Continuous The Mass Air Flow reading and Mass Air Flow calculation are performed during the same 12.5 ms loop	DTC Type B

Mass Air Flow (MAF) Sensor Circuit Low	P0102	Detects a continuous short to low or a open in either the signal circuit or the MAF sensor	MAF ≤ 1200 Hz	Engine Running > 0 seconds Engine Speed ≥ 50 RPM System Voltage ≥ 8 volts The above must be present for a period of time greater than 0.5 seconds	395 test failures in 400 test samples 1 sample every Lo Res event	DTC Type B
Mass Air Flow (MAF) Sensor Circuit High	P0103	Detects a continuous short to high in either the signal circuit or the MAF sensor	MAF ≥ 14500 Hz	Engine Running > 0 seconds Engine Speed ≥ 50 RPM System Voltage ≥ 8 volts The above must be present for a period of time greater than 0.5 seconds	395 test failures in 400 test samples 1 sample every Lo Res event	DTC Type B
Manifold Absolute Pressure (MAP) Sensor Performance	P0106	This DTC determines if the MAP sensor is stuck within the normal operation range	(Measured MAP - Manifold Model 1 pressure) filtered > 20 AND (Measured MAP – Manifold Model 2 pressure) filtered > 20	Engine rpm =>400 and <= 6500 MAP sensor high/low DTCs not active MAF sensor high/low DTCs not active Crank sensor DTCs not active Engine Coolant DTCs not active Intake Air Temp. DTCs not active Engine Coolant > 70 deg C and < 126 deg C Intake Air Temp > -7 deg C and < 125 deg C	Continuous The MAP reading and the Manifold Model calculations are performed in the same Lo Res loop	DTC Type B

Manifold Absolute Pressure (MAP) Sensor Circuit Low	P0107	This DTC detects a continuous short to low or open in either the signal circuit or the MAP sensor.	MAP voltage < 1% of Vref (0.05 volts)	TP sensor DTCs not active
				Engine speed ≤ 400 RPM
				   Or
				Throttle Position is ≥ 0% when engine speed is ≤ 1000 RPM
				   Or
				Throttle Position is ≥ 12.5 % when engine speed is > 1000 RPM
				No 5v ref. DTCs
					320 test failures in 400 test samples
					
					1 sample/12.5 ms
						DTC Type B

Manifold Absolute Pressure (MAP) Sensor Circuit High	P0108	This DTC detects an open sensor ground or continuous short to high in either the signal circuit or the MAP sensor	MAP voltage > 98% of Vref (4.9 volts)	TP sensor DTCs not active Engine Running > run time based on power-up coolant temperature Throttle Position is ≤ 1 % when engine speed is ≤ 1200 RPM Or Throttle Position is ≤ 20 % when engine speed is > 1200 RPM	320 test failures in 400 test samples 1 sample/12.5 ms	DTC Type B
Intake Air Temperature (IAT) Sensor Circuit Low	P0112	This DTC detects a continuous short to ground in the IAT signal circuit or the IAT sensor	Raw IAT < 25 ohms	VS sensor DTCs not active ECT sensor DTCs not active Engine run time > 10 seconds Coolant Temperature < 150°C	50 test failures in 63 test samples 1 sample/100 msec	DTC Type B
Intake Air Temperature (IAT) Sensor Circuit High	P0113	This DTC detects a continuous open or short to high in the IAT signal circuit or the IAT sensor	Raw IAT > 1,800,000 ohms	MAF sensor DTCs not active ECT sensor DTCs not active VS sensor DTCs not active Engine run time > 10 seconds	50 test failures in 63 test samples 1 sample/100 msec	DTC Type B

Engine Coolant Temperature (ECT) Sensor Performance	P0116	Detects coolant temp sensor stuck in mid range	A failure will be reported if any of the following occur: ECT at power up > IAT at power up by an IAT based table lookup value after a minimum 8-hour soak (fast fail). ECT at power up > IAT at power up by 15.75°C after a minimum 8-hour soak and a block heater has not been detected. ECT at power up > IAT at power up by 15.75°C after a minimum 8 hour soak and the time spent cranking the engine without starting is greater than 10 seconds with the fuel level being above a minimum level of 10%.	No VSS DTCs No IAT DTCs No ECT sensor shorted DTCs ECM/PCM Internal Engine Off Timer Performance DTC not active Non-volatile memory failure has not been detected on power-up. Engine off time > 8 hours Test run this trip = false Test aborted this trip = false Block heater detection: ECT at power up > IAT at power up by 15.75°C Power up IAT > -7°C Vehicle driven a minimum of 400 seconds above 24 kph and IAT drops more than 5.25° C from power up IAT.	1 failure 500 ms loop	DTC Type B
Engine Coolant Temperature (ECT) Sensor Circuit Low	P0117	This DTC detects a continuous short to ground in the ECT signal circuit or the ECT sensor.	Raw ECT < 25 ohms	Engine run time > 10 seconds Or IAT ≤ 50° C	5 test failures in 6 test samples 1 sample/sec Continuous	DTC Type B
Engine Coolant Temperature (ECT) Sensor Circuit High	P0118	Circuit Continuity This DTC detects a continuous short to high or open in the ECT signal circuit or the ECT sensor.	Raw ECT > 1,800,000 ohms	Engine run time > 10 seconds Or IAT ≥ 0° C	5 test failures in 6 test samples 1 sample/sec Continuous	DTC Type B
Throttle Position (TP) Sensor 1 Circuit	P0120	Detects a continuous or intermittent short or open in TP sensor #1 circuit	TPS < 0.325 V OR TPS > 4.75 V	Ignition in unlock/accessory, run or crank System voltage>5.23 V No PCM processor, 5 V reference DTCs	79/159 counts; 52 counts continuous; 3.125 msec /count in the ECM main processor 19/39 counts or 13 counts continuous; 12.5 msec/count in the MHC processor	DTC Type A
Throttle Position (TP) Sensor 1 Performance	P0121	The DTC determines if a TPS sensor is stuck within the normal operating range	Filtered throttle error > 350 kPa/grams per second	Engine rpm =>400 and <= 6500 MAP sensor high/low DTCs not active MAF sensor high/low DTCs not active Crank sensor DTCs not active Engine Coolant DTCs not active Intake Air Temp. DTCs not active Engine Coolant > 70 deg C and < 126 deg C Intake Air Temp > -7 deg C and < 125 deg C	Continuous Calculations are performed every 12.5 ms	DTC Type B

Throttle Position (TP) Sensor 1 Circuit Low	P0122	Detects a continuous or intermittent OOR lo TPS1	TPS < 0.325 V (100% throttle = 0.6 V)	Ignition in unlock/accessory, run or crank System voltage>5.23 V No PCM processor, 5 V reference DTCs	79/159 counts; 52 counts continuous; 3.125 msec /count in the ECM main processor 19/39 counts or 13 counts continuous; 12.5 msec/count in the MHC processor	DTC Type A
Throttle Position (TP) Sensor 1 Circuit High	P0123	Detects a continuous or intermittent OOR high TPS1	TPS > 4.75 V (0% throttle = 4.38V)	Ignition in unlock/accessory, run or crank System voltage>5.23 V No PCM processor, 5 V reference DTCs	79/159 counts; 52counts continuous; 3.125 msec /count in the ECM main processor 19/39 counts or 13 counts continuous; 12.5 msec/count in the MHC processor	DTC Type A
Engine Coolant Temperature (ECT) Below Thermostat Regulating Temperature	P0128	Under driving conditions, target coolant temperature should be achieved based on amount of cumulative airflow ingested, and based on startup coolant temperature	A table defines maximum cumulative airflow based on startup coolant temperature and IAT at which target coolant temperature must have been reached Target = 74°C	• 2 grams /second < Airflow < 30 grams/second • Engine runtime < 1800seconds • Engine runtime > 30 seconds • IAT > -7°C • Vehicle speed > 8 kph for 0.5 kilometers • Startup ECT< 69°C • No ECT, Throttle, IAT, VSS, MAF or MAP faults	Once per trip Time based on flow	DTC Type B
O2S Circuit Low Voltage Bank 1 Sensor 1	P0131	This DTC determines if the O2 sensor circuit is shorted to low.	O2 sensor voltage < 50 millivolts	Common Enable Criteria • No TP Sensor, MAP, ECT, MAF, IAT, Evap, Fuel Injector DTCs • Catalyst monitor diagnostic Intrusive Test = Not Active • Post Oxygen Sensor Diagnostic Intrusive Test = Not Active • Traction Control, AIR, Fuel, Idle, EGR, and Engine Not Overspeed Intrusive Tests = Not Active • 10 volts < system voltage < 18 volts • EGR, Idle, Fuel Injector., and AIR Device controls = Not Active Specific Enable Criteria • $0.88 \leq$ Equivalence ratio ≤ 1.08 • $2.499\ \% \leq$ throttle position $\leq 45.001\ \%$ • Fuel state = closed loop with no fault pending • All fuel injectors = ON • Traction Control = not active All of the above met for at least 5 seconds	220 test failures in a 255-sample test Frequency: Continuous 100 ms loop	DTC Type B

| O2S Circuit High Voltage Bank 1 Sensor 1 | P0132 | This DTC determines if the O2 sensor or circuit is shorted to high. | O2 sensor voltage > 1050 millivolts | **Common Enable Criteria**
• No TP Sensor, MAP, ECT, MAF, IAT, Evap, Fuel Injector DTCs
• Catalyst monitor diagnostic Intrusive Test = Not Active
• Post Oxygen Sensor Diagnostic Intrusive Test = Not Active
• Traction Control, AIR, Fuel, Idle, EGR, and Engine Not Overspeed Intrusive Tests = Not Active
• 10 volts < system voltage < 18 volts
• EGR, Idle, Fuel Injector., and AIR Device controls = Not Active

Specific Enable Criteria
• $0.88 \leq$ Equivalence Ratio ≤ 1.08
• $2.499\,\% \leq$ throttle position $\leq 45.001\,\%$
• Fuel State = Closed loop with no fault pending

All of the above met for at least 2 seconds | 170 test failures in a 200 sample test

Frequency:
Continuous
100 ms loop | DTC Type B |

| O2S Slow Response Bank 1 Sensor 1 | P0133 | This DTC determines if the O2 sensor response time is degraded | Refer to **"O2S Slow Response Bank 1 Sensor 1 (P0133), O2S Slow Response Bank 2 Sensor 1 (P0153) Pass/Fail Thresholds."** In Lookup Tables section.

Lean voltage threshold = 350 mV

Rich voltage threshold = 600 mV | Common Enable Criteria
• No TP Sensor, MAP, ECT, MAF, IAT, Evap, Fuel Injector DTCs
• Catalyst monitor diagnostic Intrusive Test = Not Active
• Post Oxygen Sensor Diagnostic Intrusive Test = Not Active
• Traction Control, AIR, Fuel, Idle, EGR, and Engine Not Overspeed Intrusive Tests = Not Active
• 10 volts < system voltage < 18 volts
• EGR, Idle, Fuel Injector., and AIR Device controls = Not Active

Specific Enable Criteria
• O2 Heater on for $\geq$ 40 seconds
• B1S1 green O2 sensor delay has expired
• B1S1 DTCs = Not Active
• B1S1 learned heater resistance is valid
• Misfire DTC = Not Active
• ECT > 65 °C
• IAT > -40 °C
• Engine run time > 60 seconds
• EVAP Canister purge duty cycle $\geq$ 0 %
• 16.6 grams per second $\leq$ MAF $\leq$ 37 grams per second
• 1300 $\leq$ RPM $\leq$ 2550
• Ethanol percentage < 87.199 %
• Baro > 69.801 kPa
• Throttle position $\geq$ 3.5 %
• Fuel Level > 9.9976 %
• Fuel state = closed loop
• No fuel level data faults
• Transmission (automatic) not in Park, Reverse or Neutral
• Transmission gear selection is not defaulted
• Baro is not defaulted

   All of the above met for at least 1 second | 80 seconds

Frequency:
Once per trip | DTC Type B |

O2S Circuit Insufficient Activity Bank 1 Sensor 1	P0134	This DTC determines if the O2 sensor circuit is open.	380 millivolts < O2 sensor < 525 millivolts	Common Enable Criteria • No TP Sensor, MAP, ECT, MAF, IAT, Evap, Fuel Injector DTCs • Catalyst monitor diagnostic Intrusive Test = Not Active • Post Oxygen Sensor Diagnostic Intrusive Test = Not Active • Traction Control, AIR, Fuel, Idle, EGR, and Engine Not Overspeed Intrusive Tests = Not Active • 10 volts < system voltage < 18 volts • EGR, Idle, Fuel Injector., and AIR Device controls = Not Active Specific Enable Criteria • Engine run time > 124 seconds • Ethanol percentage < 87.199 % • No B1S1 heater related DTCs	250 test failures in a 300 test samples Frequency: Continuous 100 ms loop rate	DTC Type B
O2S Heater Performance Bank 1 Sensor 1	P0135	This DTC determines if the O2 sensor heater is functioning properly by monitoring the current through the heater circuit.	O2 sensor heater current is < 0.3125 amps or > 1.5 amps	Common Enable Criteria • No TP Sensor, MAP, ECT, MAF, IAT, Evap, Fuel Injector DTCs • Catalyst monitor diagnostic Intrusive Test = Not Active • Post Oxygen Sensor Diagnostic Intrusive Test = Not Active • Traction Control, AIR, Fuel, Idle, EGR, and Engine Not Overspeed Intrusive Tests = Not Active • 10 volts < system voltage < 18 volts • EGR, Idle, Fuel Injector., and AIR Device controls = Not Active Specific Enable Criteria • Engine Run Time $\geq$ 180 seconds • ECT $\geq$ 65° C • 500 $\leq$ Engine Rpm $\leq$ 3000 • 4.9922 grams per second $\leq$ Mass Airflow $\leq$ 30.0078 grams per second • O2 heater not in Device control • B1S1 O2 heater resistance DTC not active All of the above met for at least 2 seconds	8 test failures in 10 test samples Frequency: 2 tests per trip 30 seconds delay between tests 1 second execution rate	DTC Type B

| O2S Circuit Low Voltage Bank 1 Sensor 2 | P0137 | This DTC determines if the O2 sensor circuit is shorted to low by checking for a lean condition during steady throttle. | O2 sensor voltage < 50 millivolts | Common Enable Criteria
• No TP Sensor, MAP, ECT, MAF, IAT, Evap, Fuel Injector DTCs
• Catalyst monitor diagnostic Intrusive Test = Not Active
• Post Oxygen Sensor Diagnostic Intrusive Test = Not Active
• Traction Control, AIR, Fuel, Idle, EGR, and Engine Not Overspeed Intrusive Tests = Not Active
• 10 volts < system voltage < 18 volts
• EGR, Idle, Fuel Injector., and AIR Device controls = Not Active

Specific Enable Criteria
• $0.88 \leq$ Equivalence ratio ≤ 1.08
• $2.499 \% \leq$ throttle position $\leq 45.001 \%$
• Fuel state = closed loop with no fault pending
• All fuel injectors = ON
• Traction Control = not active

All of the above met for at least 5 seconds | 1020 test failures in a 1200-sample test

Frequency:
Continuous
100 ms loop | DTC Type B |
| O2S Circuit High Voltage Bank 1 Sensor 2 | P0138 | This DTC determines if the O2 sensor or circuit is shorted to high | O2 sensor voltage > 1050 millivolts | Common Enable Criteria
• No TP Sensor, MAP, ECT, MAF, IAT, Evap, Fuel Injector DTCs
• Catalyst monitor diagnostic Intrusive Test = Not Active
• Post Oxygen Sensor Diagnostic Intrusive Test = Not Active
• Traction Control, AIR, Fuel, Idle, EGR, and Engine Not Overspeed Intrusive Tests = Not Active
• 10 volts < system voltage < 18 volts
• EGR, Idle, Fuel Injector., and AIR Device controls = Not Active

Specific Enable Criteria
• $0.88 \leq$ Equivalence ratio ≤ 1.08
• $2.499 \% \leq$ throttle position $\leq 45.001 \%$
• Fuel state = closed loop with no fault pending
• All fuel injectors = ON
• Traction Control = not active

All of the above met for at least 2 seconds | 820 test failures in a 960 sample test

Frequency:
Continuous
100 ms loop | DTC Type B |

O2S Circuit Insufficient Activity Bank 1 Sensor 2	P0140	This DTC determines if the O2 sensor circuit is open.	380 millivolts < O2 sensor < 525 millivolts for regular open test 350 millivolts < O2 sensor < 550 millivolts to fail the fast pass open test (must fail the regular open test in order to fail the DTC; regular open test is run if fast pass is not run or if fast pass fails)	Common Enable Criteria • No TP Sensor, MAP, ECT, MAF, IAT, Evap, Fuel Injector DTCs • Catalyst monitor diagnostic Intrusive Test = Not Active • Post Oxygen Sensor Diagnostic Intrusive Test = Not Active • Traction Control, AIR, Fuel, Idle, EGR, and Engine Not Overspeed Intrusive Tests = Not Active • 10 volts < system voltage < 18 volts • EGR, Idle, Fuel Injector., and AIR Device controls = Not Active Specific Enable Criteria • Engine run time > 124 seconds • Ethanol percentage > 87.199% • No B1S2 heater related DTCs • PCM State = run Fast Pass: • Engine run time ≤ 90 seconds (Fast pass cannot report a fail; if Fast pass fails, the regular open test is run) Regular Open Test • Engine run time > 124 seconds • Fuel state = closed loop	1080 test failures in a 1200 test samples Minimum of 1 occurrence of a delta TP sensor ≥ 3 % during diagnostic test (sample counts – failure counts) < 180 within 90 seconds of engine run time to fail the fast pass test (regular open test is run when fast pass fails; to fail DTC the regular open test must fail) Frequency: Once/trip for post catalyst sensors 100 ms loop	DTC Type B

O2S Heater Performance Bank 1 Sensor 2	P0141	This DTC determines if the O2 sensor heater is functioning properly by monitoring the current through the heater circuit.	O2 sensor heater current is < 0.2148 amps or > 0.949 amps	Common Enable Criteria • No TP Sensor, MAP, ECT, MAF, IAT, Evap, Fuel Injector DTCs • Catalyst monitor diagnostic Intrusive Test = Not Active • Post Oxygen Sensor Diagnostic Intrusive Test = Not Active • Traction Control, AIR, Fuel, Idle, EGR, and Engine Not Overspeed Intrusive Tests = Not Active • 10 volts < system voltage < 18 volts • EGR, Idle, Fuel Injector., and AIR Device controls = Not Active Specific Enable Criteria • Engine Run Time $\geq$ 180 seconds • ECT $\geq$ 65° C • 500 $\leq$ Engine Rpm $\leq$ 3000 • 4.9922 grams per second $\leq$ Mass Airflow $\leq$ 30.0078 grams per second • O2 heater not in Device control • B1S2 O2 heater resistance DTC not active All of the above met for at least 2 seconds	8 test failures in 10 test samples Frequency: 2 tests per trip 30 seconds delay between tests 1 second execution rate	DTC Type B
O2S Circuit Low Voltage Bank 2 Sensor 1	P0151	This DTC determines if the O2 sensor circuit is shorted to low	O2 sensor voltage < 50 millivolts	Common Enable Criteria • No TP Sensor, MAP, ECT, MAF, IAT, Evap, Fuel Injector DTCs • Catalyst monitor diagnostic Intrusive Test = Not Active • Post Oxygen Sensor Diagnostic Intrusive Test = Not Active • Traction Control, AIR, Fuel, Idle, EGR, and Engine Not Overspeed Intrusive Tests = Not Active • 10 volts < system voltage < 18 volts • EGR, Idle, Fuel Injector., and AIR Device controls = Not Active Specific Enable Criteria • 0.88 $\leq$ Equivalence ratio $\leq$ 1.08 • 2.499 % $\leq$ throttle position $\leq$ 45.001 % • Fuel state = closed loop with no fault pending • All fuel injectors = ON • Traction Control = not active All of the above met for at least 5 seconds	220 test failures in a 255-sample test Frequency: Continuous 100 ms loop	DTC Type B (with Dual bank fuel control only)

| O2S Circuit High Voltage Bank 2 Sensor 1 | P0152 | This DTC determines if the O2 sensor or circuit is shorted to high. | O2 sensor voltage > 1050 millivolts | Common Enable Criteria
• No TP Sensor, MAP, ECT, MAF, IAT, Evap, Fuel Injector DTCs
• Catalyst monitor diagnostic Intrusive Test = Not Active
• Post Oxygen Sensor Diagnostic Intrusive Test = Not Active
• Traction Control, AIR, Fuel, Idle, EGR, and Engine Not Overspeed Intrusive Tests = Not Active
• 10 volts < system voltage < 18 volts
• EGR, Idle, Fuel Injector., and AIR Device controls = Not Active

Specific Enable Criteria
• $0.88 \leq$ Equivalence Ratio ≤ 1.08
• $2.499\ \% \leq$ throttle position $\leq 45.001\ \%$
• Fuel State = Closed loop with no fault pending

All of the above met for at least 3 seconds | 170 test failures in a 200 sample test

Frequency:
Continuous
100 ms loop | DTC Type B

(with Dual bank fuel control only) |

| O2S Slow Response Bank 2 Sensor 1 | P0153 | This DTC determines if the O2 sensor response time is degraded | Refer to **"O2S Slow Response Bank 1 Sensor 1 (P0133), O2S Slow Response Bank 2 Sensor 1 (P0153) Pass/Fail Thresholds."** In Lookup Tables section.

Lean voltage threshold = 350 mV

Rich voltage threshold = 600 mV | Common Enable Criteria
• No TP Sensor, MAP, ECT, MAF, IAT, Evap, Fuel Injector DTCs
• Catalyst monitor diagnostic Intrusive Test = Not Active
• Post Oxygen Sensor Diagnostic Intrusive Test = Not Active
• Traction Control, AIR, Fuel, Idle, EGR, and Engine Not Overspeed Intrusive Tests = Not Active
• 10 volts < system voltage < 18 volts
• EGR, Idle, Fuel Injector., and AIR Device controls = Not Active

Specific Enable Criteria
• O2 Heater on for $\geq$ 40 seconds
• B2S1 green O2 sensor delay has expired
• B2S1 DTCs = Not Active
• B2S1 learned heater resistance is valid
• Misfire DTC = Not Active
• ECT > 65 °C
• IAT > -40 °C
• Engine run time > 60 seconds
• EVAP Canister purge duty cycle $\geq$ 0 %
• 16.6 grams per second $\leq$ MAF $\leq$ 37 grams per second
• 1300 $\leq$ RPM $\leq$ 2550
• Ethanol percentage < 87.199 %
• Baro > 69.801 kPa
• Throttle position $\geq$ 3.5 %
• Fuel Level > 9.9976
• Fuel state = closed loop
• No fuel level data faults
• Transmission (automatic) not in Park, Reverse or Neutral
• Transmission gear selection is not defaulted
• Baro is not defaulted

   All of the above met for at least 1 second | 80 seconds

Frequency:
Once per trip | DTC Type B

(with Dual bank fuel control only) |

| O2S Circuit Insufficient Activity Bank 2 Sensor 1 | P0154 | This DTC determines if the O2 sensor circuit is open. | 380 millivolts < O2 sensor < 525 millivolts | Common Enable Criteria
• No TP Sensor, MAP, ECT, MAF, IAT, Evap, Fuel Injector DTCs
• Catalyst monitor diagnostic Intrusive Test = Not Active
• Post Oxygen Sensor Diagnostic Intrusive Test = Not Active
• Traction Control, AIR, Fuel, Idle, EGR, and Engine Not Overspeed Intrusive Tests = Not Active
• 10 volts < system voltage < 18 volts
• EGR, Idle, Fuel Injector., and AIR Device controls = Not Active

Specific Enable Criteria
• Engine run time > 124 seconds
• Ethanol percentage > 87.199 %
• No B2S1 heater related DTCs | 250 test failures in a 300 test samples

Frequency:
Continuous for pre catalyst sensors
100 ms loop rate | DTC Type B

(with Dual bank fuel control only) |
| O2S Heater Performance Bank 2 Sensor 1 | P0155 | This DTC determines if the O2 sensor heater is functioning properly by monitoring the current through the heater circuit. | O2 sensor heater current is < 0.3125 amps or > 1.5 amps | Common Enable Criteria
• No TP Sensor, MAP, ECT, MAF, IAT, Evap, Fuel Injector DTCs
• Catalyst monitor diagnostic Intrusive Test = Not Active
• Post Oxygen Sensor Diagnostic Intrusive Test = Not Active
• Traction Control, AIR, Fuel, Idle, EGR, and Engine Not Overspeed Intrusive Tests = Not Active
• 10 volts < system voltage < 18 volts
• EGR, Idle, Fuel Injector., and AIR Device controls = Not Active

Specific Enable Criteria
• Engine Run Time $\geq$ 180 seconds
• ECT $\geq$ 65° C
• 500 $\leq$ Engine Rpm $\leq$ 3000
• 4.9922 grams per second $\leq$ Mass Airflow $\leq$ 30.0078 grams per second
• O2 heater not in Device control
• B2S1 O2 heater resistance DTC not active

All of the above met for at least 2 seconds | 8 test failures in 10 test samples

Frequency:
2 tests per trip
30 seconds delay between tests
1 second execution rate | DTC Type B

(with Dual bank fuel control only) |

| O2S Circuit Low Voltage Bank 2 Sensor 2 | P0157 | This DTC determines if the O2 sensor circuit is shorted to low by checking for a lean condition during steady throttle. | O2 sensor voltage < 50 millivolts | Common Enable Criteria
• No TP Sensor, MAP, ECT, MAF, IAT, Evap, Fuel Injector DTCs
• Catalyst monitor diagnostic Intrusive Test = Not Active
• Post Oxygen Sensor Diagnostic Intrusive Test = Not Active
• Traction Control, AIR, Fuel, Idle, EGR, and Engine Not Overspeed Intrusive Tests = Not Active
• 10 volts < system voltage < 18 volts
• EGR, Idle, Fuel Injector., and AIR Device controls = Not Active

Specific Enable Criteria
• $0.88 \leq$ Equivalence ratio ≤ 1.08
• $2.499\% \leq$ throttle position $\leq 45.001\%$
• Fuel state = closed loop with no fault pending
• All fuel injectors = ON
• Traction Control = not active

All of the above met for at least 5 seconds | 1020 test failures in a 1200-sample test

Frequency:
Continuous
100 ms loop | DTC Type B

(with Dual bank fuel control only) |
| O2S Circuit High Voltage Bank 2 Sensor 2 | P0158 | This DTC determines if the O2 sensor or circuit is shorted to high by checking for a rich condition during steady throttle. | O2 sensor voltage > 1050 millivolts | Common Enable Criteria
• No TP Sensor, MAP, ECT, MAF, IAT, Evap, Fuel Injector DTCs
• Catalyst monitor diagnostic Intrusive Test = Not Active
• Post Oxygen Sensor Diagnostic Intrusive Test = Not Active
• Traction Control, AIR, Fuel, Idle, EGR, and Engine Not Overspeed Intrusive Tests = Not Active
• 10 volts < system voltage < 18 volts
• EGR, Idle, Fuel Injector., and AIR Device controls = Not Active

Specific Enable Criteria
• $0.88 \leq$ Equivalence ratio ≤ 1.08
• $2.499\% \leq$ throttle position $\leq 45.001\%$
• Fuel state = closed loop with no fault pending
• All fuel injectors = ON
• Traction Control = not active

All of the above met for at least 2 seconds | 820 test failures in a 960-sample test

Frequency:
Continuous
100 ms loop | DTC Type B

(with Dual bank fuel control only) |

| O2S Circuit Insufficient Activity Bank 2 Sensor 2 | P0160 | This DTC determines if the O2 sensor is open. | 380 millivolts < O2 sensor < 525 millivolts for regular open test

350 millivolts < O2 sensor < 550 millivolts to fail the fast pass open test (must fail the regular open test in order to fail the DTC; regular open test is run if fast pass is not run or if fast pass fails) | Common Enable Criteria
• No TP Sensor, MAP, ECT, MAF, IAT, Evap, Fuel Injector DTCs
• Catalyst monitor diagnostic Intrusive Test = Not Active
• Post Oxygen Sensor Diagnostic Intrusive Test = Not Active
• Traction Control, AIR, Fuel, Idle, EGR, and Engine Not Overspeed Intrusive Tests = Not Active
• 10 volts < system voltage < 18 volts
• EGR, Idle, Fuel Injector., and AIR Device controls = Not Active

Specific Enable Criteria
• Engine run time > 124 seconds
• Ethanol percentage > 87.199%
• No B2S2 heater related DTCs
• PCM State = run

Fast Pass:
• Engine run time ≤ 90 seconds

(Fast pass cannot report a fail; if Fast pass fails, the regular open test is run)

Regular Open Test
• Engine run time > 124 seconds
• Fuel state = closed loop | 1080 test failures in 1200 test samples

Minimum of 1 occurrence of a delta TP sensor ≥ 3 % during diagnostic test

(sample counts – failure counts) < 180 within 90 seconds of engine run time to fail the fast pass test (regular open test is run when fast pass fails; to fail DTC the regular open test must fail)

Frequency:
Once/trip for post catalyst sensors
100 ms loop | DTC Type B

(with Dual bank fuel control only) |
| O2S Heater Performance Bank 2 Sensor 2 | P0161 | This DTC determines if the O2 sensor heater is functioning properly by monitoring the current through the heater circuit. | O2 sensor heater current is < 0.2148 amps or > 0.949 amps | Common Enable Criteria
• No TP Sensor, MAP, ECT, MAF, IAT, Evap, Fuel Injector DTCs
• Catalyst monitor diagnostic Intrusive Test = Not Active
• Post Oxygen Sensor Diagnostic Intrusive Test = Not Active
• Traction Control, AIR, Fuel, Idle, EGR, and Engine Not Overspeed Intrusive Tests = Not Active
• 10 volts < system voltage < 18 volts
• EGR, Idle, Fuel Injector., and AIR Device controls = Not Active

Specific Enable Criteria
• Engine Run Time ≥ 180 seconds
• ECT ≥ 65° C
• 500 ≤ Engine Rpm ≤ 3000
• 4.9922 grams per second ≤ Mass Airflow ≤ 30.0078 grams per second
• O2 heater not in Device control
• B2S2 O2 heater resistance DTC not active

All of the above met for at least 2 seconds | 8 test failures in 10 test samples

Frequency:
2 tests per trip
30 seconds delay between tests
1 second execution rate | DTC Type B

(with Dual bank fuel control only) |

| Fuel System Too Lean Bank 1

Fuel System Too Lean Bank 2 | P0171

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P0174 | Determines if the fuel control system is in a lean condition, based on the EWMA of long term fuel trim (LTM).

(Note: EWMA stands for "Exponentially Weighted Moving Average") | The EWMA of long term fuel trim (LTM) samples $\geq$ 1.195

Notes:
1. At least 10 seconds of data must accumulate on each trip before the EWMA of LTM samples is considered usable and at least 35 seconds) of data in the current fuel trim cell must accumulate on each trip before the LTM for that cell is considered usable in the EWMA calculation. | • No Misfire DTCs
• No Pre-catalyst O2 Sensor DTCs
• No EVAP DTCs
• No Fuel Injector DTCs
• No Fuel Composition (Ethanol) DTCs
• No IAC, MAF, or MAP DTCs
• No ECT DTCs
• No EGR DTCs
• No A.I.R. DTCs
• No TP Sensor or TAC System DTCs
• Engine speed > 400 rpm and < 7000 rpm
• BARO > 70 kPa
• ECT > -38ºC and < 150°C
• MAP > 10 kPa and < 105 kPa
• IAT > -38 °C and < 150°C
• Mass Airflow > 1.0g/s and < 510 g/s
• Vehicle speed < 300 kph
• Closed Loop Fueling
• Long Term Fuel Trim Learning enabled
• Not in Device Control
• EGR Flow Diagnostic Intrusive Test = Not Active
• Catalyst Monitor Diagnostic Intrusive Test = Not Active
• Post O2 Diagnostic Intrusive Test = Not Active
• Evap diagnostic is at any stage except the "tank pull down" portion of the test.
• Fuel Level > 10 % (must be < 10% for at least 30 seconds to disable; default is to enable if fuel sender is faulty)

Note:
    At least 40 seconds of data must accumulate on each trip with at least 30 seconds of data in the current fuel trim cell before a pass or fail decision can be made. | Frequency:
Continuous
100 ms loop | DTC Type B

(P0174 on dual bank fuel control only) |

| Fuel System Too Rich Bank 1

Fuel System Too Rich Bank 2 | P0172

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P0175 | Determines if the fuel control system is in a rich condition, based on the EWMA of long term fuel trim (LTM).

(Note: EWMA stands for "Exponentially Weighted Moving Average") | Passive: The EWMA of long term purge off fuel trim (LTM) samples $\leq$ 0.82

Intrusive: If a passive decision cannot be made, and the EWMA of long term purge on fuel trim (LTM) $\leq$ 0.83, purge is ramped off to determine if excess purge is the cause. Therefore, the following must also occur to report a failure:

The EWMA of LTM samples with purge off $\leq$ 0.82 for at least 7.5 seconds during each of 3 intrusive segments.

Intrusive Notes:
1. Segments can last up to 60 seconds, and are separated by the smaller of a 20 second purge-on time or enough time to purge 10 grams of vapor.

2. A maximum of 5 completed segments or 20 intrusive attempts are allowed for each intrusive test.

3. After an intrusive test report is completed, another intrusive test cannot occur for 300 seconds to allow sufficient time to purge excess vapors from the canister. During this period, fuel trim will pass if the EWMA of LTM samples $\geq$ 0.83 for at least 12 seconds, indicating that the canister has been purged. Performing intrusive tests too frequently may also affect EVAP and FTP emissions, and the execution frequency of other diagnostics. | • No Misfire DTCs
• No Pre-catalyst O2 Sensor DTCs
• No EVAP DTCs
• No Fuel Injector DTCs
• No Fuel Composition (Ethanol) DTCs
• No IAC, MAF, or MAP DTCs
• No ECT DTCs
• No EGR DTCs
• No A.I.R. DTCs
• No TP Sensor or TAC System DTCs
• Engine speed > 400 rpm and < 7000 rpm
• BARO > 70 kPa
• ECT > -38°C and < 150°C
• MAP > 10 kPa and < 255 kPa
• IAT > -38 °C and < 150°C
• Mass Airflow > 1.0 g/s and < 510 g/s
• Vehicle speed < 300 kph
• Closed Loop Fueling
• Long Term Fuel Trim Learning enabled
• Not in Device Control
• EGR Flow Diagnostic Intrusive Test = Not Active
• Catalyst Monitor Diagnostic Intrusive Test = Not Active
• Post O2 Diagnostic Intrusive Test = Not Active
• Evap diagnostic is at any stage except the "tank pull down" portion of the test.

Notes:
1. At least 40 seconds of data must accumulate on each trip before the EWMA of LTM samples is considered usable and at least 30 seconds of data in the current fuel trim cell must accumulate on each trip before the LTM for that cell is considered usable in the EWMA calculation.
2. In addition to the above, the intrusive test requires at least 62.5 more seconds of LTM data before a pass or fail decision can be made. | Intrusive only:
If rich fail counter is $\geq$ 3 before pass counter $\geq$ 3, diagnostic fails.

Frequency:
Continuous
100 ms loop | DTC Type B

(P0175 on dual bank fuel control only) |
|---|---|---|---|---|---|

Fuel System Too Rich Bank 1 Fuel System Too Rich Bank 2 (Continued)				Intrusive Enable Criteria • Insufficient data to make a passive decision • The EWMA of long term fuel trim (LTM) samples $\leq$ 0.83 • RPM > 400 • Mass Airflow > 1.0 g/s and < 510 g/s • MAP > 18 kPa and < 105 kPa Temporary Intrusive Test Inhibit Criteria • If intrusive test segment exceeds 60 consecutive seconds. (In this case, purge valve is opened for the smaller of 20 seconds or enough time to purge 10 grams vapor)		
Injector 1 Control Circuit	P0201	This DTC checks the circuit for electrical integrity during operation.	The ECM detects that the commanded state of the driver and the actual state of the control circuit do not match.	Engine running 18 volts > Ignition voltage > 9 volts Condition stable > 5 seconds	20 failures out of 25 samples 250ms loop continuous	DTC Type B
Injector 2 Control Circuit	P0202	This DTC checks the circuit for electrical integrity during operation.	The ECM detects that the commanded state of the driver and the actual state of the control circuit do not match.	Engine running 18 volts > Ignition voltage > 9 volts Condition stable > 5 seconds	20 failures out of 25 samples 250ms loop continuous	DTC Type B
Injector 3 Control Circuit	P0203	This DTC checks the circuit for electrical integrity during operation.	The ECM detects that the commanded state of the driver and the actual state of the control circuit do not match.	Engine running 18 volts > Ignition voltage > 9 volts Condition stable > 5 seconds	20 failures out of 25 samples 250ms loop continuous	DTC Type B
Injector 4 Control Circuit	P0204	This DTC checks the circuit for electrical integrity during operation.	The ECM detects that the commanded state of the driver and the actual state of the control circuit do not match.	Engine running 18 volts > Ignition voltage > 9 volts Condition stable > 5 seconds	20 failures out of 25 samples 250ms loop continuous	DTC Type B
Injector 5 Control Circuit	P0205	This DTC checks the circuit for electrical integrity during operation.	The ECM detects that the commanded state of the driver and the actual state of the control circuit do not match.	Engine running 18 volts > Ignition voltage > 9 volts Condition stable > 5 seconds	20 failures out of 25 samples 250ms loop continuous	DTC Type B
Injector 6 Control Circuit	P0206	This DTC checks the circuit for electrical integrity during operation.	The ECM detects that the commanded state of the driver and the actual state of the control circuit do not match.	Engine running 18 volts > Ignition voltage > 9 volts Condition stable > 5 seconds	20 failures out of 25 samples 250ms loop continuous	DTC Type B
Throttle Position (TP) Sensor 2 Circuit	P0220	Detects a continuous or intermittent short or open in TP sensor #2 circuit	0.25 V > TPS > 4.59 V	Ignition in Unlock/accessory, run, crank System voltage > 5.23 V No PCM processor, 5 V reference DTCs	79/159 counts; 52 counts continuous; 3.125 msec /count in the motor processor 19/39 counts or 13 counts continuous; 12.5 msec/count in the MHCprocess79	DTC Type A

Throttle Position (TP) Sensor 2 Circuit Low	P0222	Detects a continuous or intermittent short or open in TP sensor #2 circuit	TPS < 0.25 V (0% throttle = 0.62 V)	Ignition in Unlock/accessory, run, crank System voltage > 5.23 V No PCM processor, 5 V reference DTCs	79/159 counts; 52 counts continuous; 3.125 msec /count in the ECM main processor 19/39 counts or 13 counts continuous; 12.5 msec/count in the MHC processor	DTC Type A
Throttle Position (TP) Sensor 2 Circuit High	P0223	Detects a continuous or intermittent short or open in TP sensor #2 circuit	TPS > 4.59 V (100% throttle = 4.4 V)	Ignition in Unlock/accessory, run, crank System voltage > 5.23 V No PCM processor, 5 V reference DTCs	79/159 counts; 52 counts continuous; 3.125 msec /count in the ECM main processor 19/39 counts or 13 counts continuous; 12.5 msec/count in the MHC processor	DTC Type A

Fuel Pump Primary Circuit	P0230	This DTC checks the circuit for electrical integrity during operation.	The ECM detects that the commanded state of the driver and the actual state of the control circuit do not match.	Ignition voltage $\geq$ 11 volts, and $\leq$ 18 volts	20 failures out of 25 samples 250ms loop continuous	DTC Type B

Random Misfire Detected	P0300	These DTCs will determine if a random or a cylinder specific misfire is occurring by monitoring crankshaft velocity.	Deceleration index Vs Engine speed Vs Load and Camshaft Position Emission Failure Threshold = 1.00% Catalyst Damage Threshold = 5%.	• Engine run time > 2 crankshaft revolutions. • DTCs not active for VSS, CKP, TP, MAP, ECT, IAT, and MAF sensors. • No engine protection faults. • P0315 (Crankshaft Position System Variation Not Learned) not active or engine speed < 1000 RPM. • Fuel cutoff not active. • Power management is not active. • Not an automatic transmission shift with a Throttle position>95% • Brake torque management not active. • Fuel level > 10% (disablement ends 500 seconds after a low fuel level condition ceases, and fuel disable does not occur with a fuel sensor DTC). • -7°C < ECT < 126°C. • If ECT at startup < -7°C, then disable until ECT > 21°C. • 525 RPM < Engine speed < 3600 RPM in Park/Neutral or 6000 RPM in Drive/Reverse. • 9 volts < System voltage < 18 volts. • Abnormal engine speed is not present. • ABS rough road not detected. • ABS is not active. • Not an abusive engine speed condition - abusive engine speed = 6900 RPM and abusive engine speed delay = 1250 cycles (Manual Trans only) • Positive and zero torque (except the CARB approved 3000 rpm to redline triangle). Positive and zero torque is detected when both is true: 1) engine load > zero torque cal (cal a function of engine speed and temperature), and 2) TPS > 1 or VSS < 48 KPH. • Detectable engine speed and engine load region. • Misfire Diagnostic. is not requesting to disable TCC when transmission is in hot mode. • Crankshaft Ring Filter inactive (after a low level misfire, another misfire may not be detectable until crankshaft ringing ceases)	Emission Exceedence = (5) failed 200 revolution blocks of 16. Failure reported with (1) Exceedence in 1st (16) 200-revolution block, or (4) Exceedences thereafter. 1st Catalyst Exceedence = Number of 200 revolution blocks as data supports for catalyst damage. 2nd and subsequent Catalyst Exceedences = (1) 200 revolution block with catalyst damage. Failure reported with (3) Exceedences in FTP, or (1) Exceedence outside FTP. Frequency: Continuous	DTC Type B (MIL Flashes with Catalyst Damaging Misfire)
Cylinder 1 Misfire Detected	P0301					
Cylinder 2 Misfire Detected	P0302					
Cylinder 3 Misfire Detected	P0303					
Cylinder 4 Misfire Detected	P0304					
Cylinder 5 Misfire Detected	P0305					
Cylinder 6 Misfire Detected	P0306					
Crankshaft Position System Variation Not Learned (CASE)	P0315	Determines if the Crankshaft Position System Variation has not been learned.	Sum of Compensation Factors $\leq$ 2.997009 or $\geq$ 3.004303	OBD Manufacturer Enable Counter = 0	Frequency: Continuous 100 ms loop	DTC Type A
Knock Sensor (KS) Module Performance	P0324	This diagnostic will detect a failed internal ECM component associated with knock control	Any Cylinder's Avg. Gain Signal > 5V if RPM > 2000 OR All Cylinder's Actual Signals < 0.00879V if RPM > 1500	APC > 50 mg Temporarily disabled ('Indeterminate' state reported) for samples in which P0325, P0327, P0328, P0330, P0332, or P0333 report 'Failed' state.	50 fail counts out of 63 sample counts 100ms sample rate Continuous	DTC Type B

Knock Sensor (KS) Circuit Bank 1	P0325	This diagnostic checks for an open to the knock sensor	Gated Low Pass Filter Voltage > 4V or < 1.24 V	Coolant > -40°C and Engine Run Time > 2 seconds PTO not active Temporarily disabled ('Indeterminate' state reported) for samples in which P0327 or P0328 report 'Failed' state.	50 fail counts out of 63 sample counts 100ms sample rate Continuous	DTC Type B
Knock Sensor (KS) Performance Bank 1	P0326	This diagnostic checks for an overactive knock sensor caused by noisy engine components (e.g. lifters)	Fast Retard ≥ 15°	Engine Speed ≥ 800 MAP ≥ 40 No throttle fault No PTO active Fast spark retard active	50 fail counts out of 63 sample counts 100ms sample rate Continuous	DTC Type B
Knock Sensor (KS) Circuit Low Bank 1	P0327	This diagnostic checks for an out of range low knock sensor signal	Sensor Input Signal Line > 2.86 V or Sensor Return Signal Line < 1.48 V	Coolant > -40°C and Engine Run Time > 2 seconds PTO not active	50 fail counts out of 63 sample counts 100ms sample rate Continuous	DTC Type B
Knock Sensor (KS) Circuit High Bank 1	P0328	This diagnostic checks for an out of range high knock sensor signal	Sensor Input Signal Line < 2.02 V or Sensor Return Signal Line > 3.76 V	Coolant > -40°C and Engine Run Time > 2 seconds PTO not active	50 fail counts out of 63 sample counts 100ms sample rate Continuous	DTC Type B
Knock Sensor (KS) Circuit Bank 2	P0330	This diagnostic checks for an open to the knock sensor	Gated Low Pass Filter Voltage > 4V or < 1.24 V	Coolant > -40°C and Engine Run Time > 2 seconds PTO not active. Temporarily disabled ('Indeterminate' state reported) for samples in which P0332 or P0333 report 'Failed' state.	50 fail counts out of 63 sample counts 100ms sample rate Continuous	DTC Type B
Knock Sensor (KS) Circuit Low Bank 2	P0332	This diagnostic checks for an out of range low knock sensor signal	Sensor Input Signal Line > 2.86 V or Sensor Return Signal Line < 1.48 V	Coolant > -40°C and Engine Run Time > 2 seconds PTO not active	50 fail counts out of 63 sample counts 100ms sample rate Continuous	DTC Type B
Knock Sensor (KS) Circuit High Bank 2	P0333	This diagnostic checks for an out of range high knock sensor signal	Sensor Input Signal Line < 2.02 V or Sensor Return Signal Line > 3.76 V	Coolant > -40°C and Engine Run Time > 2 seconds PTO not active	50 fail counts out of 63 sample counts 100ms sample rate Continuous	DTC Type B
Crankshaft Position (CKP) Sensor A Circuit	P0335	This diagnostic determines whether a fault exists with crank position sensor signal	1. No crankshaft position sensor pulses received for 4 seconds 2. No crankshaft position sync 3. No crankshaft position sensor pulses received	1. Engine cranking and either CMP pulses being received or MAF > 3 grams per second 2. Engine is spinning and no 5V reference DTCs set 3. Engine is spinning and no 5V reference or cam position sensor DTCs set	1. Continuous - 12.5 ms 2. Continuous - 12.5 ms 3. Continuous - 12.5 ms 2 test failures out of 10 samples	DTC Type B

Crankshaft Position (CKP) Sensor A Performance	P0336	This diagnostic determines whether a performance fault exists with crank position sensor signal	1. Twenty crank resyncs occur within 25 seconds 2. 51 > number of crank pulses received in one engine revolution >65	1. Engine speed > 450 RPM 2. Engine is spinning and no 5V reference or cam position sensor DTCs set	1. Continuous – 4 test failures 2. Continuous – 8 test failures out of 10 samples	DTC Type B
Camshaft Position (CMP) Sensor Circuit Bank 1 Sensor A	P0340	This diagnostic will detect if a fault exists on the camshaft position sensor signal.	1. No Cam pulses received during first 12 MEDRES events 2. No Cam pulses received for 100 engine cycles 3. No Cam pulses received 4. No Cam pulses received	1. Crank is synchronized and no 5V ref DTCs set 2. Crank is synchronized and no 5V ref DTCs set 3. Engine is cranking and either crank pulses are received or MAF > 3 grams per second 4. Engine is spinning and no 5V ref DTCs set	1. Continuous 2. Continuous – 8 test failures out of 10 samples 3. Continuous – 4 seconds 4. Continuous – 1.5 seconds	DTC Type B
Camshaft Position (CMP) Sensor Performance Bank 1 Sensor A	P0341	Detects cam sensor performance malfunctions by monitoring for the incorrect number of cam sensor pulses in a given number of crank sensor pulses	1. 6 > number of cam pulses received in 12 MEDRES events > 6 (automatic trans) or 8 (manual trans) 2. 398 > number of cam pulses received in 100 engine cycles > 402	1. Crank is synchronized and no 5V ref DTCs set 2. Crank is synchronized and no 5V ref DTCs set Footnote: MEDRES events typically occur twice per cylinder event.	1. Continuous 2. Continuous – 8 test failures out of 10 samples	DTC Type B
Ignition Coil 1 Control Circuit	P0351	This DTC checks the circuit for electrical integrity during operation. EST channel A (Cylinder 1 and 4)	The ECM detects that the commanded state of the driver and the actual state of the control circuit do not match.	Ignition voltage > 6.0 volts	50 fail counts out of 63 sample counts 100ms sample rate Continuous	DTC Type B
Ignition Coil 2 Control Circuit	P0352	This DTC checks the circuit for electrical integrity during operation. EST channel B (Cylinder 2 and 5)	The ECM detects that the commanded state of the driver and the actual state of the control circuit do not match.	Ignition voltage > 6.0 volts	50 fail counts out of 63 sample counts 100ms sample rate Continuous ms / sample	DTC Type B
Ignition Coil 3 Control Circuit	P0353	This DTC checks the circuit for electrical integrity during operation. EST channel C (Cylinder 3 and 6)	The ECM detects that the commanded state of the driver and the actual state of the control circuit do not match.	Ignition voltage > 6.0 volts	50 fail counts out of 63 sample counts 100ms sample rate Continuous	DTC Type B

Exhaust Gas Recirculation (EGR) Flow Insufficient	P0401	During a closed throttle decel condition; the EGR valve is normally closed. This diagnostic opens the valve to a pre-determined position, and the change in MAP is computed. This change in MAP correlates to the flow rate of the EGR system.	With EGR valve open, the peak + MAP Δ is monitored over a period of time. This value is compared with a threshold from Engine Speed vs BARO table and the difference computed. The result is statistically filtered (EWMA) and compared to a decision limit. DTC is set when the filtered result exceeds the decision limit of 0.7275 kPa.	Test Enables No fuel injector DTCs set, No CKP DTCs set, No TP sensor DTC's set, No MAP DTC's set, No VSS DTC's set, No ETC DTC's set, No 5 volt reference DTC's set, No IAT sensor DTC's set No ECT sensor DTC's set, No IAC DTC's set, No EGR Pintle Position DTC set, No Misfire DTC's set No MAF DTC's set, No CPP (Clutch) DTC's set, Not in device control, EGR valve icing not occurring, EGR Engine run time expired, Not in Power Enrichment, ECT > 75° C ECT < 151.9531° C BARO > 74 kPa (8,000 ft) BARO data is valid IAT < 100° C IAT > 5° C Ignition Voltage < 18 volts Ignition Voltage > 11 volts Transmission is in 3rd, 4th or 5th gear Decel Fuel Cutoff is either inactive (mode 0) or at a commanded spark value of 0 (mode 2) for at least 6.25 ms. Vehicle speed < 70 MPH Vehicle Speed > 28 MPH Throttle Position is < 0.9% Transmission status is unchanged for 1.5 seconds. Throttle Area Delta < 100 % **Stability Mode Enables** EGR Position < 1% 1000 RPM < Engine Speed < 1800 RPM MAP Δ < 1.294 kPa 17 kPa < Compensated MAP < 43 kPa Throttle Area Delta < 100% Difference between desired & actual airflow < 1.2 Grams/sec. **Intrusive Mode Enables** Vehicle Speed Δ < 3 MPH + RPM Δ < 100 RPM - RPM Δ < 200 RPM Max EGR Position > 75 % Max EGR Position < 95 % EGR Duty Cycle On Time < 25 Throttle Area Delta < 100%	Test Time 800 ms Frequency 6.26 ms loop Once per trip (typically) **Rapid Step Response feature will initiate multiple tests:** IF the difference between the current EWMA and the current map difference is > 1.76 to 2.61 kPa (depends on Baro) AND current map difference is > 0.542 to 0.811 kPa (depends on Baro) THEN 5 to 7 tests (depends on Baro) may be run per trip until 28 to 37 tests (depends on Baro) have been completed Fast Initial Response feature will initiate multiple tests upon code clear or a non-volatile memory failure: Several tests per trip will run until 13 to 20 tests (depends on Baro) have been completed.	DTC Type A (with EGR only)

Exhaust Gas Recirculation (EGR) Solenoid Control Circuit	P0403	This DTC checks the Linear EGR circuit for electrical integrity	Output state invalid	• Ignition switch is in crank or run • 9 volts < Ignition Voltage < 18 volts • Desired EGR = 0	20.00 seconds OR chip protection logic indicates a short failure 1 time Frequency: Continuous 100 ms loop Chip protection logic: 5 failures out of 10 samples indicate a short Frequency of this logic is 12.5 ms loop Continuous Once the chip protection logic detects 5 failures out of 10 samples, the driver is turned off for the rest of the trip.	DTC Type B (with EGR only)
Exhaust Gas Recirculation (EGR) Open Position Performance	P0404	This diagnostic detects if the pintle position error is too large	Pintle position error [absolute value of (desired position - actual position)] > 20.00 %	Enable Stability Limit Time > 0.2 sec. 5 Volt reference DTC's not active Engine is running Off-board device not active Pintle cleaning not active P0401 not intrusive Ignition voltage $\geq$ 11 volts EGR valve icing or over temperature not occurring EGR is enabled Desired EGR position > 0% Δ Desired EGR position < 19.5 % for 1 sec.	Frequency: 280 fail counts out of 800 sample counts 100ms loop Continuous LNJ Not Calibration Not Complete	DTC Type B (with EGR only)
Exhaust Gas Recirculation (EGR) Position Sensor A Circuit Low Voltage	P0405	This diagnostic detects if the pintle position feedback circuit is open or shorted to ground	EGR feedback sensor signal < 4.0% of 5 volt reference voltage	Enable Stability Limit Time > 0.2 sec. 5 Volt reference DTC's not active Engine is running Off-board device not active Pintle cleaning not active P0401 not intrusive Ignition voltage $\geq$ 11 volts EGR valve icing or over temperature not occurring.	Frequency: 50 fail counts out of 55 sample counts 100ms loop Continuous	DTC Type B (with EGR only)
Exhaust Gas Recirculation (EGR) Position Sensor A Circuit High Voltage	P0406	This diagnostic detects if the pintle position feedback circuit is shorted to high voltage or the 5V return is open.	EGR feedback sensor signal > 94.7% of 5 volt reference voltage	Enable Stability Limit Time > 0.2 sec. 5 Volt reference DTC's not active Engine is running Off-board device not active Pintle cleaning not active P0401 not intrusive Ignition voltage $\geq$ 11 volts EGR valve icing or over temperature not occurring.	180 fail counts out of 200 sample counts 100ms loop Continuous	DTC Type B (with EGR only)

Secondary Air Injection (AIR) System Incorrect Air Flow Detected	P0411	This DTC detects a Secondary AIR system incorrect flow condition. This test is run when the SAI pump is commanded on and the SAI control valve is commanded open.	AIR normalized pressure error > 5.0 kPa OR AIR normalized pressure error < -3.4 kPa AIR normalized pressure error is the difference between the actual SAI normalized pressure and the calculated SAI pressure as a function of Baro, MAF, and system voltage.	No active MAP, MAF, IAT, ECT, misfire, catalyst monitor, fuel injector, cam, crank, or 5 volt reference DTCs set. No active SAI pressure sensor DTCs set. No active SAI pump relay circuit DTC set. No active SAI control valve relay circuit DTC set. No active DTC P0606 set. AIR pressure sensor circuit fault pending = False. AIR operation is allowed this start. 60 kPa < BARO < 110 kPa. 3 g/sec < Mass Air Flow < 33 g/sec. 9 volts < System voltage < 18 volts. Stability Time > 4 sec.	Conditional test weight > 4 seconds Conditional test weight is based on Baro, MAF, and system voltage. Once per trip where SAI pump operation is requested at startup.	DTC Type B (with AIR only)
Secondary Air Injection (AIR) Solenoid Control Circuit Bank 1	P0412	This DTC checks the output driver for electrical integrity	Output state is invalid	11 volts ≤ Ignition Voltage ≤ 18 volts	50/63 counts <u>Frequency:</u> Continuous 100 ms loop	DTC Type B (with AIR only)
Secondary Air Injection (AIR) Pump Control Circuit Bank 1	P0418	This DTC checks the output driver for electrical integrity	Output state is invalid	11 volts ≤ Ignition Voltage ≤ 18 volts	50/63 counts <u>Frequency:</u> Continuous 100 ms loop	DTC Type B (with AIR only)

| Catalyst System Low Efficiency Bank 1 | P0420 | Oxygen Storage | Normalized Ratio OSC Value < 0.3 (EWMA filtered)

Normalized Ratio OSC Value Calculation Information and Definitions =
1. Raw OSC Calculation = (post cat O2 Resp time - pre cat O2 Resp time)
2. BestFailing OSC value from a calibration table (based on temp and exhaust gas flow)
3. WorstPassing OSC value (based on temp and exhaust gas flow)

Normalized Ratio Calculation = (1-2) / (3-2)

A Normalized Ratio of 1 essentially represents a good part and a ratio of 0 essentially represents a very bad part. | *General Enable*
• No EVAP, PTO not active, TAC system, MAF, CAM, ECT, CKP, EGR, BARO, AIR, EST, Fuel Injector, Fuel Trim, Idle Air, MAP, IAT, Misfire, O2 Sensor, TP Sensor, VSS or Engine Overtemp Protection Mode DTCs
Valid Idle Period Criteria
• Throttle Position < 2%
• Vehicle Speed <= 3.2kph
• Engine speed >= 1000 RPM for a minimum of 18 seconds since end of last idle period.
• Engine run time >= 350 seconds
• Tests attempted this trip < 18.00
• The catalyst diagnostic has not yet completed for the current trip.
Catalyst Idle Conditions Met Criteria
General Enable met and the Valid Idle Period Criteria met
• Green Converter Delay = Not Active
• Induction Air> -20° C
• Induction Air < 250° C
• FASD and/ or POS Diagnostic Intrusive Test and/or AIR Diagnostic Intrusive Test not Active
• RunCrank Voltage > 10.7 volts
• Ethanol Estimation Is NOT in Progress
• ECT >= 50° C
• ECT <= 126 ° C
• Barometric Pressure > 70 KPA
• Idle Time is <= 60 seconds
⇒ Idle time is incremented if the vehicle speed <= vehicle speed cal and the throttle position <= TPS cal as identified in the Valid Idle Period Criteria section.
• Short Term Fuel Trim < 1.10
• Short Term Fuel Trim > 0.90
• Predicted catalyst temp ≥ 490°C for at least 75 seconds with a closed throttle time ≤ 180 seconds consecutively (closed throttle consideration involves having the TPS < the value as stated in the Valid Idle Period Criteria Section)
• Closed loop fueling
• PRNDL is in Drive Range
• | 1 test attempted per valid idle period

Minimum of 1 test per trip

Maximum of 6 tests per trip

Frequency:
• Fueling Related : 12.5 ms
• OSC Measurements: 100 ms
• Temp Prediction: 1000ms

Rapid Step Response (RSR) feature will initiate multiple tests:
• If the difference between current EWMA value and the current OSC Normalized Ratio value is >= 0.5192
• The current OSC Normalized Ratio value is <= 0.5
Maximum of 6 tests per trip. Maximum of 18 tests to detect failure when RSR is enabled.

Green Converter Delay Criteria
This is part of the check for the Catalyst Idle Conditions Met Criteria section
• The diagnostic will not be enabled until the following has been met: Predicted catalyst temperature >= 500° C for 3600 seconds non-continuously.
• Note: this feature is only enabled when the vehicle is new and cannot be enabled in service | DTC Type A |

Catalyst System Low Efficiency Bank 1 (Continued)				*Idle Stable Criteria :: Must hold true from after Catalyst Idle Conditions Met to the end of test* • MAF >= 2.5 grams per second • MAF <=16 grams per second • CCP DC Multiplier <= 1 • Predicted catalyst temperature <= 825 degC *Engine Fueling Criteria at Beginning of Idle Period* The following fueling related must also be met from between 4 and 7 seconds after the Catalyst Idle Conditions Met Criteria has been met for at least 4 seconds prior to allowing intrusive control • Number of pre-O2 switches >= 4 • Short Term Fuel Trim Avg >= 0.96 Short Term Fuel Trim Avg <= 1.04		
Exhaust Gas Recirculation Control Stuck Open	P042E	This diagnostic detects if the valve is stuck open when commanded closed.	Actual pintle position >= 4.5% of 5 volt reference voltage from learned closed position	Enable Stability Limit Time > 0.2 sec. 5 Volt reference DTC's not active Engine is running Off-board device not active Pintle cleaning not active P0401 not intrusive Ignition voltage $\geq$ 11 volts EGR valve icing or over temperature not occurring. EGR is enabled Desired EGR position = 0%, for 1 sec.	4 failure detections of: 360 fail counts out of 400 sample counts with pintle movement between failure detections of 40% for at least 1 second open time Frequency: 100ms loop Continuous	DTC Type B (with EGR only)

| Catalyst System Low Efficiency Bank 2 | P0430 | Oxygen Storage | Normalized Ratio OSC Value < 0.2 (EWMA filtered)

Normalized Ratio OSC Value Calculation Information and Definitions =
1. Raw OSC Calculation = (post cat O2 Resp time - pre cat O2 Resp time)
2. BestFailing OSC value from a calibration table (based on temp and exhaust gas flow)
3. WorstPassing OSC value (based on temp and exhaust gas flow)

Normalized Ratio Calculation = (1-2) / (3-2)

A Normalized Ratio of 1 essentially represents a good part and a ratio of 0 essentially represents a very bad part. | *General Enable*
• No EVAP, PTO not active, TAC system, MAF, CAM, ECT, CKP, EGR, BARO, AIR, EST, Fuel Injector, Fuel Trim, Idle Air, MAP, IAT, Misfire, O2 Sensor, TP Sensor, VSS or Engine Overtemp Protection Mode DTCs
Valid Idle Period Criteria
• Throttle Position < 2%
• Vehicle Speed <= 3.2kph
• Engine speed >= 1100 RPM for a minimum of 27 seconds since end of last idle period.
• Engine run time >= 300 seconds.
• Tests attempted this trip < 18.00
• The catalyst diagnostic has not yet completed for the current trip.
Catalyst Idle Conditions Met Criteria
General Enable met and the Valid Idle Period Criteria met
• Green Converter Delay = Not Active
• Induction Air> -20° C
• Induction Air < 250° C
• FASD and/ or POS Diagnostic Intrusive Test and/or AIR Diagnostic Intrusive Test not Active
• RunCrank Voltage > 10.7 volts
• Ethanol Estimation Is NOT in Progress
• ECT >= 50° C
• ECT <= 123 ° C
• Barometric Pressure > 70 KPA
• Idle Time is <= 60 seconds
⇒ Idle time is incremented if the vehicle speed <= vehicle speed cal and the throttle position <= TPS cal as identified in the Valid Idle Period Criteria section.
• Short Term Fuel Trim < 1.10
• Short Term Fuel Trim > 0.90
• Predicted catalyst temp ≥ 540°C for at least 70 seconds with a closed throttle time ≤ 120 seconds consecutively (closed throttle consideration involves having the TPS < the value as stated in the Valid Idle Period Criteria Section)
• Closed loop fueling
• PRNDL is in Drive Range | 1 test attempted per valid idle period

Minimum of 1 test per trip

Maximum of 6 tests per trip

Frequency:
• Fueling Related : 12.5 ms
• OSC Measurements: 100 ms
• Temp Prediction: 1000ms

Rapid Step Response (RSR) feature will initiate multiple tests:
• If the difference between current EWMA value and the current OSC Normalized Ratio value is >= 0.6184
• The current OSC Normalized Ratio value is <= 0.5
Maximum of 6 tests per trip. Maximum of 18 tests to detect failure when RSR is enabled.

Green Converter Delay Criteria
This is part of the check for the Catalyst Idle Conditions Met Criteria section
• The diagnostic will not be enabled until the following has been met: Predicted catalyst temperature >= 500° C for 3600 seconds non-continuously.
Note: this feature is only enabled when the vehicle is new and cannot be enabled in service | DTC Type A

(with Dual catalyst only) |

Catalyst System Low Efficiency Bank 2 (Continued)				_Idle Stable Criteria :: Must hold true from after Catalyst Idle Conditions Met to the end of test_ • MAF >= 4 grams per second • MAF <=16 grams per second • CCP DC Multiplier <= 1 • Predicted catalyst temperature <= 840 degC _Engine Fueling Criteria at Beginning of Idle Period_ The following fueling related must also be met from between 4 and 7 seconds after the Catalyst Idle Conditions Met Criteria has been met for at least 4 seconds prior to allowing intrusive control • Number of pre-O2 switches >= 4 • Short Term Fuel Trim Avg >= 0.96 Short Term Fuel Trim Avg <= 1.04		

Evaporative Emission (EVAP) System Small Leak Detected (EONV)	P0442	This DTC will detect a small leak (>= 0.020") in the EVAP system between the fuel fill cap and the purge solenoid.	***SMALL LEAK TEST FAIL:*** Engine Off Natural Vacuum (EONV) The total pressure change achieved during the test is normalized against a target value that is based upon fuel level and ambient temperature. (values range from 249 to 747 Pascals). The normalized value is entered into EWMA (with 0= perfect pass and 1=perfect fail). Once EWMA exceeds the fail threshold, the DTC light is illuminated. The DTC light can be turned off if the EWMA falls below the re-pass threshold for 3 consecutive trips. Fail threshold = 0.70 Re-Pass threshold = 0.35	***TEST ENABLE:*** No MAP Sensor DTCs VS Sensor DTCs not active No Fuel Tank Pressure Sensor DTCs No EVAP Canister Purge Solenoid DTCs No EVAP Canister Vent Solenoid DTCs No Canister Vent Restriction DTCs Coolant Sensor DTCs not active IAT Sensor DTCs not active EVAP Vacuum Sensor Performance DTC not active. EVAP CCP stuck open DTC not active. EVAP large leak DTC not active. Ignition off timer DTC not active. Fuel Level >15.0% and < 85.0% No thermostat rationality DTCs No Fuel level DTCs Valid Cold Start Startup ECT > 4°C and < 30° C Startup IAT > 4°C and < 30° C Startup Δ°C (ECT-IAT) < 8°C if ECT > IAT Estimated ambient temperature at end of drive > 0°C and < 34°C. Drive time >= 600 seconds. Drive length >= 8.3 km. Coolant >= 70°C. Fuel level change < 10% during EONV test. BARO $\geq$ 74.0kPa OR Hot Restart Sufficient drive length to get accurate estimate of ambient air temperature(at least 3 minutes running and 3 kilometers traveled) (EONV_EstAmbientAirTemp_Valid must equal true) Estimated ambient temperature at end of drive > 0°C and < 34°C. Drive time >= 600 seconds. Drive length >= 8.3 km. Coolant >= 70°C. Fuel level change < 10% during EONV test. BARO $\geq$ 74.0kPa	Once per cold start, during hot soak (up to 2400 sec.). Time since last complete test >= 17 hours if EWMA is passing, or >= 10 hours if EWMA is failing. No more than 2 attempts per day.	DTC Type A EWMA Average run length: 8 normally, 2-6 after code clear or non-volatile memory reset
Evaporative Emission (EVAP) Purge Solenoid Control Circuit	P0443	This DTC checks the circuit for electrical integrity during operation.	The ECM detects that the commanded state of the driver and the actual state of the control circuit do not match.	Ignition voltage $\geq$ 11 volts, and $\leq$ 18 volts	20 Failures out of 25 samples 250 msec / sample Continuous	DTC Type B

Evaporative Emission (EVAP) Vent System Performance	P0446	This DTC determines if a restriction is present in the vent solenoid, vent filler, vent hose or EVAP canister	Tank Vacuum > 2989 Pascals for 5 seconds BEFORE Purge Volume $\geq$ 6 liters OR Vented Vacuum < -622.7 Pascals or Vented Vacuum > 1245 Pascals for 60 seconds 2 liters of fuel must be consumed after setting the DTC active the first time to set the DTC active the second time.	General Test Enable • No MAP DTCs • No TP Sensor DTCs • No VSS DTCs • No IAT DTCs • No ECT DTCs • No Fuel Tank Pressure Sensor DTCs • No Evap Canister Purge solenoid DTCs • No EVAP Canister Vent Solenoid DTCs • No Thermostat Rationality DTCs • 15 % $\leq$ Fuel Level $\leq$ 85. % • 11 V $\leq$ System Voltage $\leq$ 18 V • 4 °C < Startup IAT < 30°C • Startup ECT $\leq$ 35 °C • BARO $\geq$ 74.00 kPa (8000 ft)	Once per trip Time is dependent on driving conditions Max. before test abort is 1000 seconds	DTC Type B
Evaporative Emission (EVAP) Vent Solenoid Control Circuit	P0449	This DTC checks the circuit for electrical integrity during operation.	The ECM detects that the commanded state of the driver and the actual state of the control circuit do not match.	Ignition voltage $\geq$ 11 volts, and $\leq$ 18 volts	20 failures out of 25 samples 250 msec /test Continuous.	DTC Type B
Fuel Tank Pressure (FTP) Sensor Circuit Performance	P0451	The DTC will be set if the fuel tank vacuum sensor is out of range when it tries to re-zero prior to the phase-1 or phase-2 portions of the engine-off natural vacuum small leak test.	The tank vacuum sensor voltage is compared to a window about the nominal sensor voltage offset (~1.5 volts) Upper voltage threshold (voltage addition above the nominal voltage): 0.2 volts Lower voltage threshold (voltage subtraction below the nominal voltage): 0.2 volts The difference between tank vacuum sensor voltage and the nominal offset voltage is then normalized against the appropriate threshold listed above to produce a ratio between 0.0 and 1.0. This normalized re-zero ratio is then filtered with an EWMA (with 0= perfect pass and 1=perfect fail). Once EWMA exceeds the fail threshold, the DTC light is illuminated. The DTC light can be turned off if the EWMA falls below the re-pass threshold for 3 consecutive trips. Fail threshold = 0.73 Re-Pass threshold = 0.40	This test will execute whenever the engine-off natural vacuum small leak test (P0442) executes	This test is executed during an engine-off natural vacuum small leak test. The number of times that it executes can range from zero to two per engine-off period. The length of the test is determined by the refueling rationality test that can take up to 600 seconds to complete.	DTC Type A Average run length: 6

Fuel Tank Pressure (FTP) Sensor Circuit Low Voltage	P0452	This DTC will detect a fuel tank pressure sensor signal that is too low out of range.	Fuel tank pressure sensor signal < 0.1 volts produces a failing sample. Otherwise, the sample is considered passing.	• 0.10 second delay after sensor power up for sensor warm-up • PCM State ≠ crank	80 fails out of 100 samples Frequency: Continuous 100ms loop	DTC Type B
Fuel Tank Pressure (FTP) Sensor Circuit High Voltage	P0453	This DTC will detect a fuel tank pressure sensor signal that is too high out of range.	Fuel tank pressure sensor signal > 4.90 volts produces a failing sample. Otherwise, the sample is considered passing.	• 0.10 second delay after sensor power up for sensor warm-up • PCM state ≠ crank	80 fails out of 100 samples Frequency: Continuous 100ms loop	DTC Type B
Fuel Tank Pressure (FTP) Sensor Circuit Intermittent	P0454	This DTC will detect intermittent tank vacuum sensor signals that would have caused the engine-off natural vacuum small leak test to abort due to an apparent re-fueling event.	If an abrupt change in tank vacuum is detected the engine-off natural vacuum test is aborted due to an apparent refueling event. Subsequent to the abort, a refueling rationality test is executed to confirm that a refueling event occurred. If a refueling is confirmed, then the test sample is considered passing. Otherwise, the sample is considered failing indicating an intermittent signal problem. The abrupt change is defined as a change > 112 and < 249 Pascals vacuum in the span of 1.0 seconds. A refueling event is confirmed if the fuel level has a persistent change of 10.0 % for 30 seconds. The test will report a failure if 2 out of 3 samples are failures.	This test will execute whenever the engine-off natural vacuum small leak test (P0442) executes	This test is executed during an engine-off natural vacuum small leak test. The test can only execute once per engine-off period. The length of the test is determined by the refueling rationality test that can take up to 600 seconds to complete. The test will report a failure if 2 out of 3 samples fail.	DTC Type A

Evaporative Emission (EVAP) System Large Leak Detected	P0455	This DTC will detect a weak vacuum condition (large leak or purge blockage) in the Evap system.	Purge volume > 17 liters BEFORE Tank vacuum $\leq$ 2740 Pascals 2 liters of fuel must be consumed after setting the DTC active the first time to set the DTC active the second time. Weak Vacuum Follow-up Test Weak Vacuum Test failed previous trip and this trip. Passes if tank vacuum $\geq$ 2740 Pascals Note: Weak vacuum Follow-up Test can only report a pass.	General Test Enable • No MAP DTCs • No TP Sensor DTCs • No VSS DTCs • No IAT DTCs • No ECT DTCs • No Fuel Tank Pressure Sensor DTCs • No Evap Canister Purge solenoid DTCs • No EVAP Canister Vent Solenoid DTCs • No Thermostat Rationality DTCs • 15 % $\leq$ Fuel Level $\leq$ 85. % • 11 V $\leq$ System Voltage $\leq$ 18 V • 4 °C $\leq$ IAT $\leq$ 30°C • ECT $\leq$ 35 °C • BARO $\geq$ 74.00 kPa (8000 ft) Cold Start Test • Startup IAT < 30°C • Startup temperature Δ (ECT-IAT): $\leq$ 8 °C if ECT > IAT • Cold Test Timer $\leq$ 1000 seconds	Once per cold start Time is dependent on driving conditions Max. before test abort is 1000 seconds Weak Vacuum Follow-up Test With a large leak detected, the follow-up test is limited to 1300 seconds. Once the MIL is on, the follow-up test runs indefinitely.	DTC Type B
Fuel Level Sensor 1 Stuck in Range	P0461	This DTC will detect a fuel sender stuck in range.	270 kilometers is traveled without a 10 liter change in fuel level	No VSS DTCs set Engine Running	Continuous 100ms loop	DTC Type B
Fuel Level Sensor 1 Circuit Low Voltage	P0462	This DTC will detect a fuel sender stuck out of range low.	Fuel level sensor signal < 10%	Ignition voltage $\geq$ 11 volts, and $\leq$ 18 volts	240 fails out of 300 samples Continuous 100ms loop	DTC Type B
Fuel Level Sensor 1 Circuit High Voltage	P0463	This DTC will detect a fuel sender stuck out of range high.	Fuel level sensor signal > 70%	Ignition voltage $\geq$ 11 volts, and $\leq$ 18 volts	240 fails out of 300 samples Continuous 100ms loop	DTC Type B
Fuel Level Sensor 1 Circuit Intermittent	P0464	This DTC will detect intermittent fuel level sensor signals that would have caused the engine-off natural vacuum small leak test to abort due to an apparent re-fueling event.	If a change in fuel level is detected the engine-off natural vacuum test is aborted due to an apparent refueling event. Subsequent to the abort, a refueling rationality test is executed to confirm that a refueling event occurred. If a refueling is confirmed, then the test sample is considered passing. Otherwise, the sample is considered failing indicating an intermittent signal problem. The refuel event is defined as a change of 10.0 % fuel level during the engine-off test. A refueling event is confirmed if the fuel level has a persistent change of 10.0 % for 30 seconds. The test will report a failure if 2 out of 3 samples are failures.	This test will execute whenever the engine-off natural vacuum small leak test (P0442) executes	This test is executed during an engine-off natural vacuum small leak test. The test can only execute once per engine-off period. The length of the test is determined by the refueling rationality test that can take up to 600 seconds to complete. The test will report a failure if 2 out of 3 samples fail.	DTC Type A

Cooling Fan 1 Control Circuit	P0480	This DTC checks the circuit for electrical integrity during operation.	The ECM detects that the commanded state of the driver and the actual state of the control circuit do not match	Engine speed $\geq$ 425 RPM Ignition voltage $\geq$ 11 volts, and $\leq$ 18 volts	20 failures out of 25 samples 250msec /test Continuous	DTC Type B
Cooling Fan 2 Control Circuit	P0481	This DTC checks the circuit for electrical integrity during operation.	The ECM detects that the commanded state of the driver and the actual state of the control circuit do not match	Engine speed $\geq$ 425 RPM Ignition voltage $\geq$ 11 volts, and $\leq$ 18 volts	20 failures out of 25 samples 250msec /test Continuous	DTC Type B
Evaporative Emission (EVAP) System Flow During Non-Purge	P0496	This DTC will determine if the purge solenoid is leaking to engine manifold vacuum.	Tank Vacuum > 2491 Pascals for 5 sec before test time > 60 seconds	General Test Enable • No MAP DTCs • No TP Sensor DTCs • No VSS DTCs • No IAT DTCs • No ECT DTCs • No Fuel Tank Pressure Sensor DTCs • No EVAP canister purge valve solenoid DTCs • No EVAP Canister Vent Solenoid DTCs • No Thermostat Rationality DTCs • 15 % $\leq$ Fuel Level $\leq$ 85. % • 11 V $\leq$ System Voltage $\leq$ 18 V • 4 °C $\leq$ Startup IAT $\leq$ 30°C • Startup ECT $\leq$ 35 °C • BARO $\geq$ 74 kPa (8000 ft) Cold Start Test • Startup IAT < 30°C • Startup temperature Δ (ECT-IAT): $\leq$ 8 °C if ECT > IAT • Cold Test Timer $\leq$ 1000 seconds	Once per cold start.	DTC Type B
Vehicle Speed Sensor Circuit Low Voltage	P0502	Detects the lack of activity on the VSS circuit	Transmission output speed $\leq$ 70 RPM	No ISS, TP, or VSS intermittent DTCs No torque inaccurate state Engine running TP $\geq$ 8 % 1500 RPM < Engine speed < 6500 RPM 50 Nm < Engine torque < 1492 Nm 9 V < System Voltage < 16 V	4.5 seconds Continuous check	DTC Type B (with Manual transmission)
Vehicle Speed Sensor Circuit Intermittent	P0503	Detects an intermittent fault on the VSS circuit	Transmission output speed must drop by 420 RPM in 0.025 secs	Engine running 1500 RPM < Engine speed < 6500 RPM Engine speed change < 500 RPM in 2 seconds Output speed > 282 RPM for 2 seconds Positive OSS change < 141 RPM for 2 seconds 9 V < System Voltage < 16 V Time since last gear change > 6 seconds	3.25 seconds Continuous 25 msec loop	DTC Type B (with Manual transmission)

Idle Air Control (IAC) System - RPM Too Low	P0506	Determines if a low idle is a result of an engine mechanical problem	Desired idle speed – actual idle speed > RPM calibration as a function of ECT for 8 seconds	No MAF, MAP, IAT, ECT, TP, Injector, Fuel System, Misfire, ETC, VSS or Purge DTCs set TCM communications fault not active Engine Run > 60 sec. ECT ≥ 60 °C BARO > 65 kPa IGN. voltage > 9 & < 18 volts IAT > -10 ° C Time since last gear state change > 3 seconds Time since last TCC mode change > 3 seconds Idle conditions present >2 seconds	3 consecutive failures with off-idle conditions in between Continuous 100 ms loop	DTC Type B
Idle Air Control (IAC) System - RPM Too High	P0507	Determines if a high idle is a result of an engine mechanical problem	Actual idle speed – desired idle speed > RPM calibration as a function of ECT for 8 seconds	No MAF, MAP, IAT, ECT, TP, Injector, Fuel System, Misfire, ETC, VSS or Purge DTCs set TCM communications fault not active Engine Run > 60 sec. ECT ≥ 60 °C BARO > 65 kPa IGN. voltage > 9 & < 18 volts IAT > -10 ° C Time since last gear state change > 3 seconds Time since last TCC mode change > 3 seconds Idle conditions present >2 seconds	3 consecutive failures with off-idle conditions in between Continuous 100 ms loop	DTC Type B
Engine Oil Pressure (EOP) Sensor Performance	P0521	Determines if the oil pressure sensor is stuck/biased in range	If test is currently passing: 30 kpa > Filtered Weighted Residual > −30 kpa If test is currently failing: 20 kpa > Filtered Weighted Residual > -20	Engine Oil Pressure Rationality is enabled Engine speed is between 700 rpm and 3500 rpm Oil temperature is less than 150C Engine Load stability is less than 250 kPa And engine Predicted Pressure is between 50 and 400kPa No Crank Sensor DTCs set No Coolant Sensor DTCs set No Intake Air Temp Sensor DTCs set No MAF DTCs set No Oil Pressure Sensor Circuit DTCs set	Continuous every 100ms	DTC Type B (with Displacement on Demand only)
Engine Oil Pressure (EOP) Sensor/Switch Circuit Low Voltage	P0522	Determines if the oil pressure sensor circuit has low voltage	Oil pressure sensor signal < 5%	Ignition in Run or Crank	50 counts out of 63 samples 100 ms continuous	DTC Type B (with Displacement on Demand only)
Engine Oil Pressure (EOP) Sensor/Switch Circuit High Voltage	P0523	Determines if the oil pressure sensor circuit has high voltage	Oil pressure sensor signal >95%	Ignition in Run or Crank	50 counts out of 63 samples 100 ms continuous	DTC Type B (with Displacement on Demand only)

Brake Booster Pressure Sensor Performance	P0556	This DTC determines if the Brake Booster Vacuum sensor is stuck or skewed within the normal operating range by comparing the engine vacuum to the brake booster vacuum when the engine is producing a large amount of vacuum	The engine vacuum value is compared to the brake booster vacuum sensor value when the throttle has been below a calibrated value for a calibrated period of time. When the throttle once again exceeds the calibrated value, the min and max vacuum sensor values are normalized and subtracted from a first order lag value of 1. A properly operating vacuum sensor would have a normalized result of 1 or greater. If the normalized result is greater than 1 it is considered 1. The first order lag value would be 0 in a passing system First order lag fail threshold > 0.69 First order lag re-pass threshold < 0.6	System voltage is >11 & < 18 volts Throttle position with idle $\leq$ 1% Above condition present for > 3 seconds	100 msec Continuous	DTC Type B (with Displacement on Demand only)
Brake Booster Pressure Sensor Circuit Low Voltage	P0557	This DTC detects a continuous short to low or open in either the signal circuit or the Brake Booster Vacuum sensor.	Brake Booster Vacuum sensor voltage < 0.04 volts	System voltage is >11 & < 18 volts	320 / 400 counts 12.5 msec / count Continuous	DTC Type B (with Displacement on Demand only)
Brake Booster Pressure Sensor Circuit High Voltage	P0558	This DTC detects an open sensor ground or continuous short to high in either the signal circuit or the Brake Booster Vacuum sensor	Brake Booster Vacuum sensor voltage > 4.89 volts	System voltage is >11 & < 18 volts	320 / 400 counts 12.5 msec / count Continuous	DTC Type B (with Displacement on Demand only)
Control Module Read Only Memory (ROM)	P0601	This DTC will be stored if the calibration check sum is incorrect	Calculated checksum does not match stored checksum	• PCM state = crank or run • Ignition voltage $\geq$ 5 volts	1 failure if it occurs during the first ROM test of the ignition cycle, otherwise 5 failures Frequency: Runs continuously in the background	DTC Type A
Control Module Not Programmed	P0602	This DTC will be stored if the PCM is a service PCM that has not been programmed.	Service calibration installed	• Ignition on • PCM is identified through calibration as a Service PCM	1 test failure Tested once on controller power-up	DTC Type A
Control Module Long Term Memory Reset	P0603	Non-volatile memory checksum error at controller power-up	Checksum at power-up does not match checksum at power-down	Ignition on	1 test failure Tested once on controller power-up	DTC Type A

Control Module Random Access Memory (RAM)	P0604	Indicates that PCM is unable to correctly write and read data to and from RAM	Data read does not match data written	Ignition in Run or Crank	1 failure if it occurs during the first RAM test of the ignition cycle, otherwise 5 failures Frequency: Runs continuously in the background	DTC Type A
Control Module Processor	P0606	Indicates that the ECM has detected an ETC internal processor integrity fault	MHC processor detects throttle limiting fault Software tasks loops > schedule tasks loop Loss of SPI communication from the motor processor 1.5 msec < Average motor processor state of health toggle > 2.5 msec TPS or APPS minimum learned values fail compliment check TPS or APPS minimum learned values fail range check Motor processor integrity check error occurs Motor processor integrity check error of main processor occurs	Ignition in unlock/accessory, run or crank System voltage>5.23 V	187.5 ms in the MHC processor Error > 5 times of loop time; loop time are 12.5, 25,50,100 and 250 ms in the main processor 159 fails out of 400 counts non-consecutive or 15 counts consecutive; 39 counts consecutive during initialization. 475 ms at initialization 20 fails out of 200 counts non-consecutive or 175 ms consecutive in MHC processor 187.5ms continuous in the main processor	DTC Type A
Control Module Performance	P0607	Main & MHC state of health (SOH) discrete line is not toggling	Loss of discrete toggle for 500ms continuously	Ignition in unlock/accessory, run or crank System voltage>5.23 V No PCM processor, 5 V reference DTCs	487.5 ms	DTC Special Type C (engine is shut down with P0606 also set)
Control Module Accelerator Pedal Position Performance	P060D	Verify that the indicated accelerator pedal position calculation is correct	Difference between Main processor indicated accelerator pedal position and MHC processor indicated accelerator pedal position > 2.5%	Ignitions in unlock/ accessory and run, not during TPS minimum learn active during intrusive portion of diagnostic execution System voltage > 5.23 V No PCM processor DTC Ignition in unlock, accessory, run or crank System voltage > 5.23 V No PCM processor DTC	39 counts continuous; 12.5 msec/count in the MHC processor	DTC Type A
Control Module EEPROM Error	P062F	Indicates that there is an EEPROM error	EEPROM write will not complete	Ignition on.	1 test failure Tested once on controller power-up	DTC Type A

5 Volt Reference 1 Circuit	P0641	Detects a continuous or intermittent short on the #1 5 V sensor reference circuit	Vref1 < 4.75 or > 5.00 v	Ignition in unlock/accessory, run or crank System voltage > 5.23 V No ECM processor DTCs	19/39 counts or 200 msec continuous; 12.5 msec/count in main /MHC processor	DTC Type A
Malfunction Indicator Lamp (MIL) Control Circuit	P0650	This DTC checks the circuit for electrical integrity during operation.	The ECM detects that the commanded state of the driver and the actual state of the control circuit do not match.	Ignition voltage ≥ 11 volts, and ≤ 18 volts Remote start is not active	20 failures out of 25 samples 250ms loop continuous	DTC Type B No MIL
5 Volt Reference 2 Circuit	P0651	Detects a continuous or intermittent short on the #2 5 V sensor reference circuit	Vref2 < 4.75 or > 5.00 v	Ignition in unlock/accessory, run or crank System voltage > 5.23 V No ECM processor DTCs	19/39counts or 200 msec continuous; 12.5 msec/count in main/MHC processor	DTC Type A
Intake Manifold Tuning Valve Solenoid Control Circuit Bank 1	P0660	This DTC checks the circuit for electrical integrity during operation.	The ECM detects that the commanded state of the driver and the actual state of the control circuit do not match.	Engine speed > 425 rpm. Ignition voltage > 9 volts, and < 18 volts	400 failures out of 500 samples 250ms loop continuous	DTC Type B (with Tuning Valve only)
Control Module Power Relay Control Circuit	P0685	This DTC checks the circuit for electrical integrity during operation.	The ECM detects that the commanded state of the driver and the actual state of the control circuit do not match.	Ignition voltage ≥ 11 volts, and ≤ 18 volts	8 failures out of 10 samples 250ms loop continuous	DTC Type B
Control Module Power Relay Feedback Circuit Low Voltage	P0689	This DTC is a check to determine if the powertrain relay is functioning properly	Powertrain relay feedback voltage is ≤ 5volts	Powertrain relay commanded "ON" No Powertrain Relay Control output driver fault	5 fails out of 6samples 1 count per second	DTC Type B
Control Module Power Relay Feedback Circuit High Voltage	P0690	This DTC is a check to determine if the Powertrain relay is functioning properly	Powertrain relay feedback voltage is ≥ 18 volts when the relay is commanded "ON" OR ≥ 2 volts when the relay has been commanded "OFF" for longer than 1 second	No Powertrain Relay Control output driver fault	Relay "ON" test: 5 fails out of 6 samples 1 second continuous Relay "OFF" test: 2 seconds continuous	DTC Type B
Transmission Control Module (TCM) Requested MIL Illumination	P0700	Monitors the TCM MIL request line to determine when the TCM has detected a MIL illuminating fault.	Transmission Emissions-Related DTC set	Ignition in run or crank Time since power-up > 3 seconds	Continuous	DTC Type A No MIL
Clutch Position Sensor Circuit Range/Performance	P0806	This DTC determines if the Clutch Position Sensor is stuck within the normal operation range	Clutch Position Error is greater than 5%	No Clutch Pedal Position DTC active No VSS DTC active No Crank Sensor DTC active N/V ratio must match actual gear Vehicle in gear	25 msec/test Continuous	DTC Type A (with Manual Transmission only)
Clutch Position Sensor Circuit Low (Manual transmission)	P0807	This DTC detects a continuous short to low or open in either the signal circuit or the Clutch position sensor.	Clutch Pedal Position < 0.0045% of Vref	Ignition Voltage > 9.0 volts Vref in range Engine not cranking	200 failures out of 250 samples 25msec / sample Continuous	DTC Type A (with Manual Transmission only)

Clutch Position Sensor Circuit High	P0808	This DTC detects an open sensor ground or continuous short to high in either the signal circuit or the Clutch Pedal Position sensor	Clutch Pedal Position > 99.984% of Vref	Ignition Voltage > 9.0 volts Vref in range Engine not cranking	200 failures out of 250 samples 25msec / sample Continuous	DTC Type A (with Manual Transmission only)
Clutch Pedal Position Not Learned	P080A	Monitor for valid clutch pedal position learn factors	Factors are considered NOT valid if the fully released position factor is greater than 94% of Vref or less than 67% of Vref	OBD Manufacturer Enable Counter = 0 Clutch pedal position not learned	25msec / test	DTC Type B (with Manual Transmission only)
Park/Neutral Position Switch Circuit Low Voltage	P0851	Check for P/N switch open malfunction (in Drive when indicating P/N)	Gear selector in Park or Neutral AND P/N switch is open	Ignition voltage ≥ 9 and ≤ 18 V No Transmission Serial Data DTC(s) Transmission Gear Selector Serial Data Message received and valid Engine Speed ≤ 8192 RPM	254 failures out of 255 samples Continuous Monitor 12.5 msec/ sample	DTC Special Type C (defaults to D/R indication)
Park/Neutral Position Switch Circuit High Voltage	P0852	Check for P/N switch closed malfunction (in Park/Neutral when indicating Drive)	TPS > 10% Torque ≥ 75 Nm VSS ≥ 10 kph P/N switch is closed	Ignition voltage ≥9 and ≤ 18V Transmission Gear Selector Serial Data Message valid No Transmission Serial Data DTC(s) No Vehicle speed DTC(s) No Engine Torque DTC(s) No TP DTC(s) Engine Speed ≥ 400RPM	254 failures out of 255 samples Continuous Monitor 12.5 msec / sample	DTC Special Type C (defaults to D/R indication)
Traction Control Torque Request Circuit	P0856	Determines if torque request from the EBTCM (Electronic Brake Traction Control Module) is valid	Serial communication 2's complement not equal OR Serial communication rolling count value is not one greater than the previous	• No serial communication loss to TCM • Engine Running = TRUE • Power Mode = Run • Traction Control System present	2's complement errors ≥ 10 Rolling count errors ≥ 3 in 10 samples Frequency: 25 ms loop continuous	DTC Special Type C (defaults to ignore EBTCM torque requests)
Intake Air Flow System Performance	P1101	This DTC determines if there are multiple air induction problems affecting airflow and/or manifold pressure.	Filtered Throttle Error > 350 kPa/grams per second And Filtered Manifold2 Error > 20 kPa And Filtered Pressure1 Error > 20 kPa OR Filtered Airflow Error > 15 grams per second	Engine rpm =>400 and <= 6500 MAP sensor high/low DTCs not active EGR circuit/performance DTCs not active MAF sensor high/low DTCs not active Crank sensor DTCs not active Engine Coolant DTCs not active Intake Air Temp. DTCs not active Engine Coolant > 70 deg C and < 126 deg C Intake Air Temp > -7 deg C and < 125 deg C	Continuous Evaluated every 12.5 ms	DTC Type B

| O2S Insufficient Switching Bank 1 Sensor 1 | P1133 | This DTC determines if the O2 sensor is no longer sufficiently switching. | Half cycle L/R switches < 35 OR Half cycle R/L switches < 35

 OR

 Slope Time L/R switches < 3 OR Slope Time R/L switches < 3 | Common Enable Criteria
• No TP Sensor, MAP, ECT, MAF, IAT, Evap, Fuel Injector DTCs
• Catalyst monitor diagnostic Intrusive Test = Not Active
• Post Oxygen Sensor Diagnostic Intrusive Test = Not Active
• Traction Control, AIR, Fuel, Idle, EGR, and Engine Not Overspeed Intrusive Tests = Not Active
• 10 volts < system voltage < 18 volts
• EGR, Idle, Fuel Injector and AIR Device controls = Not Active

Specific Enable Criteria
• O2 Heater on for $\geq$ 40 seconds
• B1S1 green O2 sensor delay has expired
• B1S1 DTCs = Not Active
• B1S1 learned heater resistance is valid
• Misfire DTC = Not Active
• ECT > 65 °C
• IAT > -40 °C
• Engine run time > 60 seconds
• EVAP Canister purge duty cycle $\geq$ 0 %
• 16.6 grams per second $\leq$ MAF $\leq$ 37 grams per second
• 1300 $\leq$ RPM $\leq$ 2550
• Ethanol percentage < 87.199 %
• Baro > 69.801 kPa
• Throttle position $\geq$ 3.5 %
• Fuel Level > 9.9976 %
• Fuel state = closed loop
• No fuel level data faults
• Transmission (automatic) not in Park, Reverse or Neutral
• Transmission gear selection is not defaulted
• Baro is not defaulted

All of the above met for at least 1 second. | 80 seconds

Frequency:
Once per trip | DTC Type B |

| O2S Insufficient Switching Bank 2 Sensor 1 | P1153 | This DTC determines if the O2 sensor is no longer sufficiently switching. | Half cycle L/R switches < 35 OR
Half cycle R/L switches < 35

OR

Slope Time L/R switches < 3 OR
Slope Time R/L switches < 3 | Common Enable Criteria
• No TP Sensor, MAP, ECT, MAF, IAT, Evap, Fuel Injector DTCs
• Catalyst monitor diagnostic Intrusive Test = Not Active
• Post Oxygen Sensor Diagnostic Intrusive Test = Not Active
• Traction Control, AIR, Fuel, Idle, EGR, and Engine Not Overspeed Intrusive Tests = Not Active
• 10 volts < system voltage < 18 volts
• EGR, Idle, Fuel Injector., and AIR Device controls = Not Active

Specific Enable Criteria
• O2 Heater on for ≥ 40 seconds
• B2S1 green O2 sensor delay has expired
• B2S1 DTCs = Not Active
• B2S1 learned heater resistance is valid
• Misfire DTC = Not Active
• ECT > 65 °C
• IAT > -40 °C
• Engine run time > 60 seconds
• EVAP Canister purge duty cycle ≥ 0 %
• 16.6 grams per second ≤ MAF ≤ 37 grams per second
• 1300 ≤ RPM ≤ 2550
• Ethanol percentage < 87.199 %
• Baro > 69.801 kPa
• Throttle position ≥ 3.5 %
• Fuel Level > 9.9976 %
• Fuel state = closed loop
• No fuel level data faults
• Transmission (automatic) not in Park, Reverse or Neutral
• Transmission gear selection is not defaulted
• Baro is not defaulted

All of the above met for at least 1 second. | 80 seconds

Frequency:
Once per trip | DTC Type B

(with Dual Bank fuel control only) |

| Air Fuel Imbalance Bank 1 | P1174 | Determines if the air-fuel delivery system is imbalanced by monitoring the pre-catalyst O2 sensor voltage characteristics | The Bank 1 AFIM Filtered Length Ratio (EWMA) variable exceeds a value of .486

AND

Post O2 voltage < 600 mV or > 700 mV

Notes:
1. The AFIM Filtered Length Ratio is determined by calculating the difference between the measured O2 voltage length (accumulated O2 voltage over a 2.5 second period) and an emissions-correlated threshold value, divided by the threshold value. The resulting ratio is then filtered utilizing an Exponentially Weighted Moving Average (EWMA).

2. The AFIM Filtered Length Ratio is initialized to it's value at the end of the previous trip between the bounds of –1 and 0.25.

3. The first report is delayed for 100 seconds to allow time for the AFIM Filtered Length Ratio variable to saturate. This minimizes the possibility of reporting a pass before a potential failure could be detected. | • No Misfire, Fuel Injector, A.I.R., or EVAP DTCs
• No ECT, MAF, MAP, or pre-cat O2 Sensor DTCs
• Device Control = Not Active
• Intrusive Diagnostics = Not Active
• Engine Overspeed Protection = Not Active
• Reduced Power Mode (ETC DTC) = Not Active
• PTO = Not Active
• Traction Control = Not Active
• Fuel Control in A/F Closed Loop or Learn-Enabled
• System Voltage < 10.0 V or > 18.0 V for > 4.0 seconds
• Engine Run Time > 50 seconds
• ECT > 10°C
• Engine speed > 1000 rpm and < 4000 rpm
• Mass Airflow > 7 g/s and < 400 g/s
• Cumulative change in airflow < 75 g/s
• Percent Ethanol < 85 %
• Delta O2 voltage during previous 12.5ms > +5/-5 mV
• O2 sensor voltages crosses 450mV > 1 time during current 2.5 second sample period | EWMA variable is updated after every 2.5 seconds of valid data.

Frequency:
Continuous Monitoring of O2 voltage signal in 12.5ms loop | DTC Type B |

Air Fuel Imbalance Bank 2	P1175	Determines if the air-fuel delivery system is imbalanced by monitoring the pre-catalyst O2 sensor voltage characteristics	The Bank 2 AFIM Filtered Length Ratio (EWMA) variable exceeds a value of 0.942 AND Post O2 voltage < 600 mV or > 700 mV Notes: 1. The AFIM Filtered Length Ratio is determined by calculating the difference between the measured O2 voltage length (accumulated O2 voltage over a 2.5 second period) and an emissions-correlated threshold value, divided by the threshold value. The resulting ratio is then filtered utilizing an Exponentially Weighted Moving Average (EWMA). 2. The AFIM Filtered Length Ratio is initialized to it's value at the end of the previous trip between the bounds of –1 and 0.5. 3. The first report is delayed for 100 seconds to allow time for the AFIM Filtered Length Ratio variable to saturate. This minimizes the possibility of reporting a pass before a potential failure could be detected.	• No Misfire, Fuel Injector, A.I.R., or EVAP DTCs • No ECT, MAF, MAP, or pre-cat O2 Sensor DTCs • Device Control = Not Active • Intrusive Diagnostics = Not Active • Engine Overspeed Protection = Not Active • Reduced Power Mode (ETC DTC) = Not Active • PTO = Not Active • Traction Control = Not Active • Fuel Control in A/F Closed Loop or Learn-Enabled • System Voltage < 10 V or > 18 V for > 4 seconds • Engine Run Time > 50 seconds • ECT > 10°C • Engine speed > 1000 rpm and < 4000 rpm • Mass Airflow > 7 g/s and < 400 g/s • Cumulative change in airflow < 75 g/s • Percent Ethanol < 85 % • Delta O2 voltage during previous 12.5ms > +5/-5 mV • O2 sensor voltages crosses 450mV > 1 time during current 2.5 second sample period	EWMA variable is updated after every 2.5 seconds of valid data. Frequency: Continuous Monitoring of O2 voltage signal in 12.5ms loop	DTC Type B (with Dual Bank fuel control only)
Engine Coolant Over Temperature - Protection Mode Active	P1258	Monitor for engine protection mode active.	Coolant temperature >= 131°C for more than 7 seconds.	No coolant sensor DTCs.	Set immediately upon engine protection mode active.	DTC Type A
Misfire Detected – Rough Road Data Not Available	P1380	This diagnostic detects if the ABS controller is indicating a fault. When this occurs, misfire will STILL run.	ABS controller sends a message to ECM indicating that a failure has occurred in the ABS module	Engine Speed <7000 Engine Load < 60 % VSS > 8 KPH	40 failures out of 80 samples	DTC Special Type C (DTC can only set if a P0300 is lighting the MIL – with Manual Transmission only)

Misfire Detected – No Communication with Brake Control Module	P1381	This diagnostic detects if the rough road information is no longer being received from the ABS module. When this occurs, misfire will STILL run.	Serial data messages are lost	Engine Speed <7000 Engine Load < 60 % VSS > 8 KPH	40 failures out of 80samples	DTC Special Type C (DTC can only set if a P0300 is lighting the MIL – with Manual Transmission only)
Cold Start Emissions Reduction System Fault	P1400	Model based test computes power from exhaust flow and thermal energy resulting from elevated idle speed and retarded spark advance. Detects if the cold start emission reduction system has failed resulting in the delivered power being out of range.	(Average desired accumulated exhaust energy - Average estimated accumulated exhaust energy) < -5 kJ/s OR (Average desired accumulated exhaust energy - Average estimated accumulated exhaust energy) > 0.3 kJ/s	• Cold start emission reduction strategy is active. • Vehicle speed < 2 kph. • Throttle position < 0.1%. • Airflow per cylinder > 40 mg. • No DTCs set for the following systems: MAP, MAF, IAT, ECT, Misfire, Electronic Spark Timing, Crank sensor, Idle, Fuel Injection, ETC, VS sensor, 5 volt reference, Intake Flow Rationality, ECM Memory	100 ms loop Runs once per trip when the cold start emission reduction strategy is active. Test completes after 15 seconds of accumulated qualified data.	DTC Type A
Throttle Actuator Control (TAC) Module Throttle Actuator Position Performance	P1516	Detect a throttle positioning error. Determine if the actuator has been miswired.	|Throttle error| >= 2% for more than 500 ms after > 4 sec stability OR |Throttle error| > 10%	• Ignition in run or crank • RPM>0 or (RPM=0 and not in battery saver mode and system voltage > 11.0 volts) • No airflow actuation or throttle actuation DTCs • Engine running = true or system voltage > 6.5 V • Minimum TPS learn active state = false	487.5 ms in the MHC processor	DTC Type A
Ignition 1 Switch Circuit 2	P1682	Detect a continuous or intermittent OOC in the Run/Crank Ignition Voltage & ETC Run/Crank Ignition Voltage	|Run/Crank – ETC Run/Crank| > 3 V	• Ignition in unlock/accessory, run or crank • System voltage >5.23 V • Powertrain Relay Commanded on.	15 counts, 12.5msec loop time, in main processor	DTC Type B
Intake Manifold Tuning Valve Stuck Open	P2070	This DTC check for valve stuck open in normal operation range	160 Hz ≥ Valve frequency outside normal range ≤ 140 Hz OR Valve learn period ≥ 0.75sec and Engine running OR Number of learn attempts ≥ 5	Intake Manifold Tuning sensor present No power up reset > 5 times 11 volts ≥ Ignition volt ≤ 18 volts Engine Run Time > 2 seconds Intake Manifold Tuning Valve self test completed and passed No IMTV DTC fault No Engine coolant DTC fault No IAT DTC fault No TP DTC fault No Engine Overtemperature DTC fault Engine running Engine Coolant – Table value in degrees C based on minimum induction air temperature current key-on Engine Load present 1000 ≤Engine Speed ≤ 3600	12.5 ms Continuous	DTC Type B (with Tuning Valve only)

Intake Manifold Tuning Valve Stuck Closed	P2071	This DTC check for valve stuck closed in normal operation range	Commanded valve position not = actual valve position	Intake Manifold Tuning sensor present No power up reset > 5 times 11 volts ≥ Ignition volt ≤ 18 volts Engine Run Time > 2 seconds Intake Manifold Tuning Valve self test completed and passed No IMTV DTC fault No Engine coolant DTC fault No IAT DTC fault No TP DTC fault No Engine Overtemperature DTC fault Engine running Engine Coolant – Table value in degrees C based on minimum induction air temperature current key-on Engine Load present 1000 ≤Engine Speed ≤ 3600	12.5 ms Continuous	DTC Type B (with Tuning Valve only)
Intake Manifold Tuning Valve Position Sensor Circuit Low	P2077	This DTC detects a continuous short to low or open in either the signal circuit or the sensor.	95% ≤ valve position	9 volts ≥ Ignition volt ≤ 18 volts	12.5 ms Continuous	DTC Type B (with Tuning Valve only)
Intake Manifold Tuning Valve Position Sensor Circuit High	P2078	This DTC detects an open sensor ground or continuous short to high in either the signal circuit or the sensor	Valve position ≤ 5%	9 volts ≥ Ignition volt ≤ 18 volts	12.5 ms Continuous	DTC Type B (with Tuning Valve only)
Control Module Throttle Actuator Position Performance	P2101	Detect a throttle positioning error	Difference between measured throttle position and modeled throttle position > 10%	• Ignition in run or crank • RPM>0 or (RPM=0 and not in battery saver mode) • No airflow actuation or throttle actuation DTCs • Engine running • System voltage > 11 V	15 fails out of 15 samples 12.5 msec in the main processor	DTC Type A
Throttle Closed Position Performance	P2119	Throttle unable to return to default after de-energizing	When throttle is de-energizing, throttle is out of default range	Ignition in unlock/accessory, run or crank System voltage>5.23 V Throttle de-energized	500 ms	DTC Special Type C (engine is shut down if throttle actuation fault also occurs)
Accelerator Pedal Position (APP) Sensor 1 Circuit	P2120	Detect a continuous or intermittent short or open in the APP sensor #1	0.325 V < Raw APP 1 < 4.75V	Ignition in unlock/accessory, run or crank System voltage >5.23 V No 5V reference DTCs	19/39counts or 13counts continuous; 12.5 msec/count in the main processor 19/39counts or 13counts continuous; 12.5 msec/count in the motor processor	DTC Type A

Accelerator Pedal Position (APP) Sensor 1 Circuit Low Voltage	P2122	Detect a continuous or intermittent short or open in the APP sensor #1	Raw APP 1 < 0.325V	Ignition in unlock/accessory, run or crank System voltage >5.23 V No 5V reference DTCs	19/39counts or 13 counts continuous; 12.5 msec/count in the main processor 19/39counts or 13counts continuous; 12.5 msec/count in the motor processor	DTC Type A
Accelerator Pedal Position (APP) Sensor 1 Circuit High Voltage	P2123	Detect a continuous or intermittent short or open in the APP sensor #1	Raw APP 1 > 4.75V	Ignition in unlock/accessory, run or crank System voltage >5.23 V No 5V reference DTCs	19/39counts or 13 counts continuous; 12.5 msec/count in the main processor 19/39 counts or 13counts continuous; 12.5 msec/count in the motor processor	DTC Type A
Accelerator Pedal Position (APP) Sensor 2 Circuit	P2125	Detect a continuous or intermittent short or open in the APP sensor #2	0.325 V < Raw APP 1 < 4.75v	Ignition in unlock/accessory, run or crank System voltage >5.23 V No 5V reference DTCs	19/39counts or 13counts continuous; 12.5 msec/count in the main processor 19/39 counts or 13counts continuous; 12.5 msec/count in the motor processor	DTC Type A
Accelerator Pedal Position (APP) Sensor 2 Circuit Low Voltage	P2127	Detect a continuous or intermittent short or open in the APP sensor #2	Raw APP 2 < 0.325V	Ignition in unlock/accessory, run or crank System voltage >5.23 V No 5V reference DTCs	19/39 counts or 13 counts continuous; 12.5 msec/count in the main processor 19/39 counts or 13 counts continuous; 12.5 msec/count in the motor processor	DTC Type A
Accelerator Pedal Position (APP) Sensor 2 Circuit High Voltage	P2128	Detect a continuous or intermittent short or open in the APP sensor #2	Raw APP 2 > 4.75V	Ignition in unlock/accessory, run or crank System voltage >5.23 V No 5V reference DTCs	19/39 counts or 13 counts continuous; 12.5 msec/count in the main processor 19/39counts or 13 counts continuous; 12.5 msec/count in the motor processor	DTC Type A
Throttle Position (TP) Sensor 1-2 Correlation	P2135	Detects a continuous or intermittent correlation fault between TP sensors #1 and #2	Difference between displaced throttle sensor #1 and #2 > 7% offset at min. throttle position with an increasing to 10% at max. throttle position Difference between raw min. TPS1 and raw min. TPS2 > 0.125 volts	Ignition in unlock/accessory, run or crank System voltage >5.23 V No 5V reference DTCs	79/159 counts or 52 counts continuous; 3.125 msec/count in the main processor 19/39 counts or 15 counts continuous; 12.5 msec/count in the MHC processor	DTC Type A

Accelerator Pedal Position (APP) Sensor 1-2 Correlation	P2138	Detect an invalid minimum mechanical position correlation between APP sensor #1 and #2	Difference between displaced pedal position sensor #1 and #2 > 10%	Ignition in unlock/accessory, run or crank System voltage >5.23 V No 5V reference DTCs	19/399 counts intermittent or 15 counts continuous, 12.5 msec/count in the main processor	DTC Type A
		Detect a short between APP sensors #1 and #2 circuits.	Difference between min. learned pedal position sensor #1 and #2 >5%	Ignition in unlock/accessory, run or crank System voltage >5.23 V No 5V reference DTCs	19/39 counts intermittent or 15 counts continuous, 12.5 msec/count in the motor processor	
					2 counts 156.25 msec w/ immediate test on an error, performed in the main processor	
Minimum Throttle Position Not Learned	P2176	TP minimum learning not completed	TPS > 0.935V	Minimum TPS learn active state Stable throttle position reading for 40 msec Ignition in run or crank No TPS circuit DTCs	1.8secs	DTC Type A
Barometric Pressure (BARO) Sensor Performance	P2227	Determines stability of Barometric pressure sensor	Difference between the current Baro sensor reading and the previous Baro sensor reading is >5 Kpa	No Baro circuit DTCs set No ECT, IAT, MAF, MAP, TP, or VSS DTCs set Engine running > 10 seconds Vehicle speed < 100KPH	25 Fail samples out of 30 samples Continuous 250 ms loop	DTC Type B (with Displacement on Demand only)
Barometric Pressure (BARO) Sensor Circuit Low Voltage	P2228	This DTC detects a continuous short to low or open in either the signal circuit or the Baro sensor.	Baro sensor voltage < 1% of Vref (0.05 volts)		25 Fail samples out of 30 samples Continuous 250 ms loop	DTC Type B (with Displacement on Demand only)
Barometric Pressure (BARO) Sensor Circuit High Voltage	P2229	This DTC detects an open sensor ground or continuous short to high in either the signal circuit or the Baro sensor	Baro sensor voltage > 98% of Vref (4.9 volts)		25 Fail samples out of 30 samples Continuous 250 ms loop	DTC Type B (with Displacement on Demand only)
Secondary Air Injection System Pressure Sensor A Circuit	P2430	This DTC detects a stuck-in-range Secondary AIR pressure sensor signal.	Stuck in Range Average Error < 0.5 AND Stuck in Range Variance < 1.0	No active DTC P0412 set. No active DTC P0418 set. No active DTC P0606 set. No active AIR pressure sensor circuit DTCs set. No active 5 volt reference DTCs set. AIR pressure sensor circuit fault pending = False. AIR pump is commanded ON	Stuck in Range Cumulative Info > 5 sec. Once per trip where SAI pump operation is requested at startup.	DTC Type B (with AIR only)

Secondary Air Injection System Pressure Sensor A Circuit Range/Performance	P2431	This DTC detects a skewed Secondary AIR pressure sensor signal	Difference between SAI Pressure Sensor and Barometric pressure > 10 kPa with AIR pump commanded OFF. OR Difference between SAI Pressure Sensor and Barometric pressure > 50 kPa with AIR pump commanded ON.	No active DTC P0606 set. No active DTC P0412 set. No active DTC P0418 set. No active AIR pressure sensor circuit DTCs set. No active 5 volt reference DTCs set. No active MAP sensor DTCs set.	Air Pressure Sensor Performance cumulative info > 15 seconds. Cumulative info is updated at a rate determined by Baro quality. Baro quality is determined by distance traveled since last Baro update. Frequency: Continuous 100 ms loop	DTC Type B (with AIR only)
Secondary Air Injection System Pressure Sensor A Circuit Low	P2432	This DTC detects a low out-of-range Secondary AIR pressure sensor signal	SAI Pressure Sensor signal < 5% of 5V ref.	No active DTC P0606 set. No active 5 volt reference DTCs set.	400/500 counts Frequency: Continuous 12.5 ms loop	DTC Type B (with AIR only)
Secondary Air Injection System Pressure Sensor A Circuit High	P2433	This DTC detects a high out-of-range Secondary AIR pressure sensor signal	SAI Pressure Sensor signal > 94% of 5V ref.	No active DTC P0606 set. No active 5 volt reference DTCs set.	400/500 counts Frequency: Continuous 12.5 ms loop	DTC Type B (with AIR only)
Secondary Air Injection System Switching Valve A Stuck Open	P2440	This DTC detects a Secondary AIR system control valve stuck open condition. This test is run during the phase 2 (SAI pump commanded on, SAI control valve commanded shut) portion of the Secondary Air Injection Diagnostic (SAID).	AIR normalized pressure error < -3 kPa (lower than predicted pressure) during SAID phase 2 test	No active MAP sensor DTCs set. No active MAF sensor DTCs set. No active SAI pressure sensor circuit DTCs set. No active SAI pressure sensor performance DTCs set. No active SAI pump relay circuit DTC set. No active SAI control valve relay circuit DTC set. No active 5 volt reference DTCs set. No active IAT sensor DTCs set. No active ECT sensor DTCs set. No active Misfire DTCs set. No active catalyst monitor DTCs set. No active fuel injector DTCs set. No active EST DTCs set. No active DTC P0411 set. No active DTC P0606 set. AIR pressure sensor circuit fault pending = False. AIR operation is allowed this start. 60 kPa < BARO < 110 kPa. 3 g/sec < Mass Air Flow < 33 g/sec. 9 volts < System voltage > 18 volts.	SAID phase 2 conditional test weight > 1.5 seconds Conditional test weight is based on Baro, Mass air flow & System voltage. Once per trip where SAI pump operation is requested at startup.	DTC Type B (with AIR only)

Secondary Air Injection System Pump A Stuck On	P2444	Detects an AIR pump stuck ON condition. This test is run during the phase 3 (SAI pump commanded off, SAI control valve commanded shut) portion of the Secondary Air Injection Diagnostic (SAID).	AIR normalized pressure error > 2.5 kPa (higher than predicted pressure) during SAID phase 3 test	No active MAP sensor DTCs set. No active MAF sensor DTCs set. No active SAI pressure sensor circuit DTCs set. No active SAI pressure sensor performance DTCs set. No active SAI pump relay circuit DTC set. No active SAI control valve relay circuit DTC set. No active 5 volt reference DTCs set. No active IAT sensor DTCs set. No active ECT sensor DTCs set. No active Misfire DTCs set. No active catalyst monitor DTCs set. No active fuel injector DTCs set. No active EST DTCs set. No active DTC P0411 set. No active DTC P0606 set.bb No active DTC P2440 set. AIR pressure sensor circuit fault pending = False. AIR operation is allowed this start. 60 kPa < BARO < 110 kPa. 3 g/sec < Mass Air Flow < 33 g/sec. 9 volts < System voltage > 18 volts. SAID post control time < 25 seconds	Within (7) seconds of the AIR pump being commanded OFF. Once per trip where SAI pump operation is requested at startup.	DTC Type A (with AIR only)
Torque Management Request Input Signal A	P2544	Determines if torque request from the TCM is valid	1. Serial Communication 2's complement not equal 2. Serial Communication rolling count value is not +1 from previous message 3. 2's complement not equal of torque requested value or torque requested type when stored in ECM 4. TCM Requested Torque > 8191.75 nM	No Serial communication loss to TCM Engine is Running Ignition is in Run or Crank	1. # of Protect Errors >16 fails 2. # of Alive Rolling Errors > 6 fails in 10 samples 3. # of RAM errors > 3 fails 4. # of range errors > 3 fails in 10 samples If any the above exist for > 2 sec seconds, increment fail counter. Else fail counter is reset. If the fail counter is > 2 count, fault is active Pass diagnostic if none of the above conditions are present for > 2 seconds Frequency: 12.5ms loop continuous	DTC Type B

ECM/PCM Internal Engine Off Timer Performance	P2610	This DTC determines if the engine off timer does not initialize or count accurately and properly	Initial value test: Ignition off timer < 1 sec OR Ignition off timer > 15 sec Clock rate test: • Time since last ignition off timer increment $\geq$ 1.375 seconds • Current ignition off time < old ignition off time • Time between ignition off timer increments < 0.8 • Time between ignition off timer increments > 1.2 • Current ignition off time minus old ignition off time $\neq$ 1.0	ECM is powered down DTC sets on next key cycle if failure detected -40°C $\leq$ IAT $\leq$ 125°C	Initial value test: 3 consecutive fails Clock rate test: 8 fails out of 10 samples Up to 1.375 seconds/sample Once every key down	DTC Type B
O2 Sensor Circuit Range/Performance Bank 1 Sensor 1	P2A00	This DTC determines if the O2 sensor voltage is not meeting the voltage criteria to enable closed loop fueling.	Closed loop fuel control O2 sensor Ready flag set to "Not Ready." O2 sensor voltage must be > 550 millivolts or < 350 millivolts to set closed loop fuel O2 Ready flag. Once set to "Ready," the O2 sensor voltage cannot be > 350 millivolts and < 550 millivolts for > 2 seconds or the O2 Ready flag will be reset to "Not Ready."	• No TP Sensor, MAF, MAP, IAT, ECT, EVAP, Secondary Air, Injector DTCs • No B1S1 or B2S1 O2 DTCs • Engine Run Time $\geq$ 100 seconds • ECT $\geq$ 75° C • Engine Metal Overtemp = Not Active • Traction Control = Not Active • No default throttle action • Not in Catalyst Protection Mode • 10 volts $\leq$ Ignition Voltage $\leq$ 18 volts • 500 $\leq$ Engine Speed $\leq$ 3000 • 5 grams per second $\leq$ Mass Airflow $\leq$ 30 grams per second • Not in Decel Fuel Cutoff Mode • Not in Power Enrichment • Predicted O2 temp $\geq$ 0 °C All of the above met for 5 seconds.	250 test failures in a 300 test sample Frequency: Continuous 100ms loop	DTC Type B

| O2 Sensor Circuit Range/Performance Bank 1 Sensor 2 | P2A01 | This DTC determines if the post catalyst O2 sensor is stuck in a normal voltage range and thereby can no longer be used for post oxygen sensor fuel control or for catalyst monitoring. The diagnostic includes an intrusive test. The increases or reduces delivered fuel to achieve the required rich or lean threshold. | Post catalyst O2 sensor cannot achieve voltage $\geq$ 740 millivolts and voltage $\leq$ 250 millivolts | Common Enable Criteria
• No O2 circuit, heater, response or heater driver DTCs active
• No TP Sensor, ETC, MAF, ECT, MAP, IAT, EVAP, Secondary Air, Fuel Injector DTCs
• Engine Runtime $\geq$ 300 seconds
• Green converter delay = not active

Specific Enable Criteria:
• No Fuel Trim or Misfire DTCs active
• 625 rpm $\leq$ Engine Speed $\leq$ 1650 rpm
• 4 grams per second $\leq$ Airflow $\leq$ 15 grams per second
• 40 kph $\leq$ Vehicle Speed $\leq$ 132 kph
• In Purge On or Purge Off Decel Cell

All of the above met for at least 2 seconds, and then:

• 0.954 $\leq$ Short term fuel trim $\leq$ 1.046
• Fuel state = closed loop
• O2 sensor circuit range/performance diagnostic has exclusive control of purge

If all of the above are met for 4 seconds, the intrusive portion of the test will be performed. Once the test is intrusive, it cannot be aborted except by a power enrichment event. | Accumulated Mass Air Flow > 400 grams without achieving B1S2 sensor voltage $\leq$ 250 mV during lean portion of test

OR

Accumulated Mass Air Flow > 688 grams without achieving B1S2 sensor voltage $\geq$ 740 mV during rich portion of test

Frequency:
Once per trip | DTC Type B |
| O2 Sensor Circuit Range/Performance Bank 2 Sensor 1 | P2A03 | This DTC determines if the O2 sensor voltage is not meeting the voltage criteria to enable closed loop fueling. | Closed loop fuel control O2 sensor Ready flag set to "Not Ready."

O2 sensor voltage must be > 550 millivolts or < 350 millivolts to set closed loop fuel O2 Ready flag. Once set to "Ready," the O2 sensor voltage cannot be > 350 millivolts and < 550 millivolts for > 2 seconds or the O2 Ready flag will be reset to "Not Ready." | • No TP Sensor, MAF, MAP, IAT, ECT, EVAP, Secondary Air, Injector DTCs
• No B1S1 or B2S1 O2 DTCs
• Engine Run Time $\geq$ 100 seconds
• ECT $\geq$ 75° C
• Engine Metal Overtemp = Not Active
• Traction Control = Not Active
• No default throttle action
• Not in Catalyst Protection Mode
• 10 volts $\leq$ Ignition Voltage $\leq$ 18 volts
• 500 $\leq$ Engine Speed $\leq$ 3000
• 5 grams per second $\leq$ Mass Airflow $\leq$ 30 grams per second
• Not in Decel Fuel Cutoff Mode
• Not in Power Enrichment
• Predicted O2 temp $\geq$ 0 °C

All of the above met for 5 seconds. | 250 test failures in a 300 test sample

Frequency:
Continuous
100ms loop | DTC Type B

(with Dual bank fuel control only) |

O2 Sensor Circuit Range/Performance Bank 2 Sensor 2	P2A04	This DTC determines if the post catalyst O2 sensor is stuck in a normal voltage range and thereby can no longer be used for post oxygen sensor fuel control or for catalyst monitoring. The diagnostic includes an intrusive test. The test increases or reduces delivered fuel to achieve the required rich or lean threshold.	Post catalyst O2 sensor cannot achieve voltage $\geq$ 740 millivolts and voltage $\leq$ 250 millivolts	<u>Common Enable Criteria</u> • No O2 circuit, heater, response or heater driver DTCs active • No TP Sensor, ETC, MAF, ECT, MAP, IAT, EVAP, Secondary Air, Fuel Injector DTCs • Engine Runtime $\geq$ 300 seconds • Green converter delay = not active <u>Specific Enable Criteria:</u> • No Fuel Trim or Misfire DTCs active • 625 rpm $\leq$ Engine Speed $\leq$ 1650 rpm • 4 grams per second $\leq$ Airflow $\leq$ 15 grams per second • 40 kph $\leq$ Vehicle Speed $\leq$ 132 kph • In Purge On or Purge Off Decel Cell All of the above met for at least 2 seconds, and then: • 0.954 $\leq$ Short term fuel trim $\leq$ 1.046 • Fuel state = closed loop • O2 sensor circuit range/performance diagnostic has exclusive control of purge If all of the above are met for 4 seconds, the intrusive portion of the test will be performed. Once the test is intrusive, it cannot be aborted except by a power enrichment event.	Accumulated Mass Air Flow > 400 grams without achieving B1S2 sensor voltage $\leq$ 250 mV during lean portion of test OR Accumulated Mass Air Flow > 688 grams without achieving B1S2 sensor voltage $\geq$ 740 mV during rich portion of test <u>Frequency:</u> Once per trip	DTC Type B (with Dual bank fuel control only)
Cylinder Deactivation System Bank 1	P3400	Detects the failure of a cylinder to deactivate	Filtered Cylinder Deactivation Error > 10 kPa And Filtered Manifold2 Error > 12 kPa	Engine rpm =>400 and <= 6500 MAP sensor high/low DTCs not active EGR circuit/performance DTCs not active MAF sensor high/low DTCs not active Crank sensor DTCs not active Engine Coolant DTCs not active Intake Air Temp. DTCs not active Engine Coolant > 70 deg C and < 126 deg C Intake Air Temp > -7 deg C and < 125 deg C Time in last all cylinder operation mode $\geq$ 2 seconds Time in this cylinder deactivation operation mode $\geq$ 2 seconds	Continuous Evaluated every 12.5 ms	DTC Type B (with Displacement on Demand only)
Cylinder 1 Deactivation Solenoid Control Circuit	P3401	Detects a Solenoid Control Circuit fault - Short/Open	Cylinder deactivation diagnostic is enabled	Engine speed > 800 RPM Ignition Voltage > 11 volts and < 18 volts	30 fails out of 100 samples 250ms loop time Continuous	DTC Type B (with Displacement on Demand only)
Cylinder 3 Deactivation Solenoid Control Circuit	P3417	Detects a Solenoid Control Circuit fault - Short/Open	Cylinder deactivation diagnostic is enabled	Engine speed > 800 RPM Ignition Voltage > 11 volts and < 18 volts	30 fails out of 100 samples 250ms loop time Continuous	DTC Type B (with Displacement on Demand only)

Cylinder 5 Deactivation Solenoid Control Circuit	P3433	Detects a Solenoid Control Circuit fault - Short/Open	Cylinder deactivation diagnostic is enabled	Engine speed > 800 RPM Ignition Voltage > 11 volts and < 18 volts	30 fails out of 100 samples 250ms loop time Continuous	DTC Type B (with Displacement on Demand only)
Control Module Communication Bus Off	U0073	Detects that a CAN serial data bus shorted condition has occurred to force the CAN device driver to enter a bus-off state.	CAN device driver has reported that it has entered a bus-off state.	Ignition in the RUN or ACCESSORY position	5 fails out of 5 samples Frequency: Continuous 1 second loop	DTC Type B
Lost Communication with TCM	U0101	Detects that CAN serial data communication has been lost with the TCM.	Lost communication with the TCM	Ignition in the RUN or ACCESSORY position	12 fails out of 12 samples Frequency: Continuous 1 second loop	DTC Type B

P0101: MAF Rationality Weighting Factors

Engine Speed (RPM)	Weighting
0	1
1500	1
2200	1
2500	1
2800	1
3100	1
3200	1
3300	1
3500	1
3700	1
4000	1
4200	1
4500	1
5000	0.8
5500	0.6
6500	0
8000	0

TABLE - O2S Slow Response Bank 1 Sensor 1 (P0133), O2S Slow Response Bank 2 Sensor 1 (P0153)

Lean to Rich Average Time (seconds)

Rich to Lean Average Time (seconds)

	0.000	0.024	0.036	0.048	0.060	0.072	0.084	0.096	0.108	0.120	0.132	0.144	0.156	0.168	0.180	0.192	1.000
0.000	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Fail	Fail	Fail	Fail	Fail	Fail	Fail	Fail	Fail
0.036	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Fail	Fail	Fail	Fail	Fail	Fail	Fail	Fail
0.048	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Fail	Fail	Fail	Fail	Fail	Fail	Fail
0.060	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Fail	Fail	Fail	Fail	Fail	Fail
0.072	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Fail	Fail	Fail	Fail	Fail
0.084	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Fail	Fail	Fail	Fail
0.096	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Fail	Fail	Fail
0.108	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Fail	Fail
0.120	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Fail	Fail
0.132	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Fail	Fail
0.144	Fail	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Fail	Fail
0.156	Fail	Fail	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Fail	Fail
0.168	Fail	Fail	Fail	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Fail	Fail
0.180	Fail	Fail	Fail	Fail	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Fail	Fail
0.192	Fail	Fail	Fail	Fail	Fail	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Fail	Fail
0.204	Fail	Fail	Fail	Fail	Fail	Fail	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Fail	Fail
1.000	Fail	Fail	Fail	Fail	Fail	Fail	Fail	Fail	Fail	Fail	Fail	Fail	Fail	Fail	Fail	Fail	Fail

P0300: Misfire Zero Torque Threshold

Engine Speed (RPM)	Torque (%)
400	16.72
500	15.40
600	13.62
700	13.48
800	13.69
900	13.84
1000	13.87
1100	13.89
1200	13.82
1400	13.89
1600	13.64
1800	13.71
2000	14.01
2200	14.28
2400	14.78
2600	14.73
2800	14.61
3000	14.40
3500	18.92
4000	23.45
4500	27.98
5000	32.50
5500	37.03
6000	41.56
6500	46.08
7000	50.61

P0401: Delay after coolant and intake air temperature enable criteria first met before allowing EGR

Coolant Temperature at Start-Up	Delay (seconds)
-40	240
-20	240
0	90
20	45
40	35
60	25
80	10
100	10
120	10

P0506/7: Idle Speed Error Thresholds

Coolant Temp	High Idle Speed Error Threshold	Coolant Temp	Low Idle Speed Error Threshold
-40	200	-40	-100
-28	200	-28	-100
-16	200	-16	-100
-4	200	-4	-100
8	200	8	-100
20	200	20	-100
32	200	32	-100
44	200	44	-100
56	200	56	-100
68	200	68	-100
80	200	80	-100
92	200	92	-100
104	200	104	-100
116	200	116	-100
128	200	128	-100
140	3200	140	-3200
152	3200	152	-3200

P0521: Engine Oil Pressure Rationality Weighting Factors

Load Stability	Weighting	Engine Speed	Weighting	Engine Oil Pressure	Weighting	Engine Oil Temp.	Weighting
0	1.00	700	0.25	50	0.00	30	0.75
10	1.00	1000	0.25	100	0.00	45	1.00
20	0.10	1500	0.90	150	0.25	60	1.00
50	0.01	1700	1.00	200	1.00	75	1.00
100	0.01	1800	1.00	225	1.00	90	1.00
200	0.01	2000	1.00	250	1.00	105	1.00
250	0.00	2500	0.50	275	1.00	120	1.00
400	0.00	3000	0.30	300	1.00	135	0.50
600	0.00	3500	0.10	400	0.25	150	0.25