SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
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 +12/- 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 • RPM > 400	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 • RPM > 400	20 failures out of 25 samples Frequency: 250ms loop Continuous	DTC Type B
HO2S Heater Resistance Bank 1 Sensor 1	P0053	Detects an oxygen sensor heater having an incorrect or out of range resistance value.nnn	2.6922 Ω < Calculated Heater resistance < 7.6922 Ω	Absolute Value (Coolant – IAT) < 8ºC Engine Soak Time > 36000 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
HO2S Heater Resistance Bank 1 Sensor 2	P0054	Detects an oxygen sensor heater having an incorrect or out of range resistance value.	6.7695 Ω< Calculated Heater resistance < 17.404 Ω	Absolute Value (Coolant – IAT) < 8ºC Engine Soak Time > 36000 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

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
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	1. Difference between measured MAP and estimated MAP > X kPa OR V5B OOR OR After Throt Blade MAP sensor TFTKO, then MAP leg failed 2. Difference between measured MAF and estimated MAF > Y grams/sec OR MAF sensor TFTKO OR Vbatt < 10 volts, then MAF leg failed. X, Y depend on throttle position, and maximum of X, and Y are 19.7266 (a/t) kPa, 21.6563 (a/t) gram/sec.	Engine running, engine speed > 800 rpm	Continuously fail MAP AND MAF legs for longer than 187.5 msec Continuous in the main processor	DTC Type A
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 gps AND (Measured Manifold Air Pressure – Manifold Model 2 pressure) Filtered > 20 kPa	Engine rpm =>400 and <= 8192 MAP sensor high/low DTCs not active MAF sensor high/low DTCs not active EGR Valve 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 < 125 deg C Intake Air Temp > -7 deg C and < 125 deg C	Continuous The diagnostic reports test results every 100 ms.	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 ≤ 900 Hz	Engine Running > 1 seconds Engine Speed ≥ 300 RPM System Voltage ≥ 10.5 volts The above must be present for a period of time greater than 1.0 seconds	50 test failures in 63 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 ≥ 11000 Hz	Engine Running > 1 seconds Engine Speed ≥ 300 RPM System Voltage ≥ 10.5 volts The above must be present for a period of time greater than 1.0 seconds	50 test failures in 63 test samples 1 sample every Lo Res event	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
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 kPa AND (Measured MAP – Manifold Model 2 pressure) filtered > 20 kPa	Engine rpm =>400and <= 8192 MAP sensor high/low DTCs not active MAF sensor high/low DTCs not active EGR Valve 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 < 125 deg C Intake Air Temp > -7 deg C and < 125 deg C	Continuous The diagnostic reports test results every 100 ms.	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 Running ≥ 400 RPM 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)	Cold Start Run Time – Table value in seconds based on Powerup Coolant Temperature ***Run Test*** TP sensor DTCs not active Engine Running 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 < 45 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 > 163,000 ohms	MAF sensor DTCs not active ECT sensor DTCs not active VS sensor DTCs not active Engine run time > 10 seconds Coolant Temperature > -40°C	50 test failures in 63 test samples 1 sample/100 msec	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
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 powerup > IAT at powerup by an IAT based table lookup value after a minimum 8 hour soak (fast fail). ECT at powerup > IAT at powerup by 15.75°C after a minimum 8-hour soak and a block heater has not been detected. ECT at powerup > IAT at powerup 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 powerup > IAT at powerup by 15.75°C Powerup IAT > -7°C Vehicle driven a minimum of 400 seconds above 24 kph and IAT drops more than 5° C from powerup 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	0.325 Volts > TPS > 4.75 Volts	Ignition in unlock/accessory, run or crank System voltage>5.23 V No 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

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Throttle Position (TP) Sensor 1 Performance	P0121	The DTC determines if a TPS sensor is stuck within the normal operating range	Filtered throttle error > 250 kPa/grams per second	Engine rpm =>400 and <= 8192 MAP sensor high/low DTCs not active MAF sensor high/low DTCs not active EGR valve 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 < 125 deg C Intake Air Temp > -7 deg C and < 125 deg C	Continuous The diagnostic reports test results every 100 ms.	DTC Type B
Throttle Position (TP) Sensor 1 Circuit Lo	P0122	Detects a continuous or intermittent OOR lo TPS	TPS < 0.325 Volts	Ignition in unlock/accessory, run or crank System voltage>5.23 V No 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 Hi	P0123	Detects a continuous or intermittent OOR lo TPS	TPS > 4.75 Volts	Ignition in unlock/accessory, run or crank System voltage>5.23 V No 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 = 80 deg C for IAT startup temperatures >10 deg C; 55 deg C for IAT startup temperatures <=10 deg C	• Average airflow > 1 gram/second • Engine runtime < 1800 seconds before test completes • Engine runtime > 30 seconds • 54.5 C > IAT > -7°C • Vehicle speed > 8 kph for 0.5 kilometers • Startup ECT<75 deg C for IAT startup temperatures >10 deg C; 50 deg C for IAT startup temperatures <=10 deg C No ECT, Throttle, IAT, VSS, MAF or MAP faults	Once per trip Time based on total airflow	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
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 Inj., and AIR Device controls = Not Active Specific Enable Criteria • 0.9912 ≤ Equivalence ratio ≤ 1.01367 • 15 % ≤ throttle position ≤ 50 % • 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	950 test failures in a 1000 samples Frequency: Continuous 100 ms loop	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
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 > 1000 millivolts to go fault pending O2 sensor voltage > 1000 millivolts to set DTC	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 Inj., and AIR Device controls = Not Active Specific Enable Criteria • 0.9912 ≤ Equivalence Ratio ≤ 1.01367 • 0 % ≤ throttle position 50 % • Fuel State = Closed loop All of the above met for at least 5 seconds	90 test failures in a 100 samples Frequency: Continuous 100 ms loop	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
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.	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 Inj., and AIR Device controls = Not Active Specific Enable Criteria • O2 Heater on for ≥ 0 seconds • B1S1 DTCs = Not Active • B1S1 learned heater resistance is valid • Misfire DTC = Not Active • ECT > 70 °C • IAT > -40 °C • Engine run time > 200 seconds • EVAP Canister purge duty cycle ≥ 0 % • 11 grams per second ≤ MAF ≤ 30 grams per second • 1000 ≤ RPM ≤ 3500 • Ethanol percentage < 84.899 % • Baro > 69.89 kPa • Throttle position ≥ 3.5 % • Fuel Level > 10 % • 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 seconds.	60 seconds Frequency: Once per trip	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
O2S Circuit Insufficient Activity Bank 1 Sensor 1	P0134	This DTC determines if the O2 sensor circuit is open.	400 millivolts < O2 sensor < 500 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 Inj., and AIR Device controls = Not Active Specific Enable Criteria • Engine run time > 200 seconds • Ethanol percentage > 84.899 % • No B1S1 heater related DTCs	480 test failures in a 600 test samples Frequency: Continuous for pre catalyst sensors 100 ms loop rate	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
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 < 0.25 amps or > 2.5 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 Inj., and AIR Device controls = Not Active Specific Enable Criteria • Engine Run Time ≥ 180 seconds • ECT ≥ 50° C • 500 ≤ Engine Rpm ≤ 3000 • 5 grams per second ≤ Mass Airflow ≤ 30 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 30 second execution rate	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
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 Inj., and AIR Device controls = Not Active Specific Enable Criteria • 0.9912 ≤ Equivalence ratio ≤ 1.01367 • 15 % ≤ throttle position ≤ 50 % • 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	950 test failures in a 1000-samples Frequency: Continuous 100 ms loop	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
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 > 1000 millivolts to go fault pending O2 sensor voltage > 1000 millivolts to set DTC	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 Inj., and AIR Device controls = Not Active Specific Enable Criteria • 0.9912 ≤ Equivalence ratio ≤ 1.01367 • 5.197 % ≤ throttle position ≤ 50 % • 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	320 test failures in a 400 samples Frequency: Continuous 100 ms loop	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
O2S Circuit Insufficient Activity Bank 1 Sensor 2	P0140	This DTC determines if the O2 sensor circuit is open.	425 millivolts < O2 sensor < 475 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 Inj., and AIR Device controls = Not Active Specific Enable Criteria • Engine run time > 200 seconds • Ethanol percentage > 84.899% • No B1S2 heater related DTCs • PCM State = run Fast Pass: • Engine run time ≤ 100 seconds (Fast pass cannot report a fail; if Fast pass fails, the regular open test is run) Regular Open Test • Engine run time > 200 seconds • Fuel state = closed loop	480 test failures in a 600 test samples Minimum of 3 occurrences of a delta TP sensor ≥ 1 % during diagnostic test (sample counts – failure counts) < 200 within 100 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

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
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 < 0.25 amps or > 2.5 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 Inj., and AIR Device controls = Not Active Specific Enable Criteria • Engine Run Time ≥ 180 seconds • ECT ≥ 50° C • 500 ≤ Engine Rpm ≤ 3000 • 5 grams per second ≤ Mass Airflow ≤ 30 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 30 second execution rate	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Fuel System Too Lean Bank 1	P0171	Determines if the fuel control system is in a lean condition.	The EWMA of long term fuel trim (LTM) samples ≥ 1.285 (Note: EWMA stands for "Exponentially Weighted Moving Average") 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 O2 Sensor DTCs • No EVAP DTCs • No Fuel Injector DTCs • No Fuel Temperature or Composition 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 but < 7000 rpm • BARO > 70 kPa • ECT > -38°C but < 150°C • MAP > 10 kPa but < 255 kPa • IAT > -38 °C but < 150°C • Mass Airflow > 1.0g/s but < 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 least30 seconds to disable; default is to enable if fuel sender is broken)	<u>Frequency:</u> Continuous 100 ms loop	DTC Type B
Fuel System To Rich Bank 1	P0172	Determines if the fuel control system is in a rich condition.	The EWMA of long term fuel trim (LTM) samples ≤ 0.81 Once the above occurs, 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 ≤ 0.81 during 2 of 3 intrusive segments. General Notes:	• No Misfire DTCs • No O2 Sensor DTCs • No EVAP DTCs • No Fuel Injector DTCs • No Fuel Temperature or Composition 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 but < 7000 rpm • BARO > 70 kPa	If rich fail counter is ≥ 2 before pass counter ≥ 2, diagnostic fails. <u>Frequency:</u> Continuous 100 ms loop	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
			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. 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 6 grams of vapor. 2. A maximum of 3 completed segments are allowed for each intrusive test, and up to 30 intrusive attempts allowed per trip. 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 > 0.82 for at least 10 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.	• ECT > -38°C but < 150°C • MAP > 10 kPa but < 255 kPa • IAT > -38 °C but < 150°C • Mass Airflow > 1.0 g/s but < 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. Intrusive Enable Criteria • The EWMA of long term fuel trim (LTM) samples $\leq$ 0.75 • RPM > 400 • Mass Airflow > 1.0 g/s but < 510 g/s • MAP > 18 kPa but < 255 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 6 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 > 11 volts Condition stable > 1 seconds	20 failures out of 25 samples 250ms loop continuous	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
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 > 11 volts Condition stable > 1 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 > 11 volts Condition stable > 1 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 > 11 volts Condition stable > 1 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 Volts > TPS > 4.59 Volts	Ignition in Unlock/accessory, run, crank System voltage > 5.23 V No 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 MHC processor	DTC Type A
Throttle Position (TP) Sensor 2 Lo	P0222	Detects a continuous or intermittent short or open in TP sensor #2 circuit	TPS < 0.25 Volts	Ignition in Unlock/accessory, run, crank System voltage > 5.23 V No 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 Hi	P0223	Detects a continuous or intermittent short or open in TP sensor #2 circuit	TPS > 4.59 Volts	Ignition in Unlock/accessory, run, crank System voltage > 5.23 V No 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.	Engine speed > 0 rpm. Ignition voltage > 11 volts, but < 18 volts	8 failures out of 10 samples 250ms loop continuous	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Random Misfire Detected Cylinder 1 Misfire Detected Cylinder 2 Misfire Detected Cylinder 3 Misfire Detected Cylinder 4 Misfire Detected	P0300 P0301 P0302 P0303 P0304	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% through 22.5% depending on engine speed and load.	• 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. • Brake torque management not active. • Fuel level > 10% (disablement ends 500 after a low fuel level condition ceases, and fuel disable does not occur with a fuel sensor DTC). • -7°C < ECT < 125 °C. • If ECT at startup < -7°C, then disable until ECT > 21°C. • 450 RPM < Engine speed < 6100 RPM. • 9 volts < System voltage < 18 volts. • + Throttle position delta < 95% per 100 ms. • - Throttle position delta < 95% per 100 ms. • Abnormal engine speed is not present. • Not an abusive engine speed condition Abusive engine speed = 7000 RPM. Abusive engine speed delay = 1050 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) • Detectable engine speed and engine load region. • Misfire Diag. 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. <u>Frequency:</u> Continuous	DTC Type B (MIL Flashes with Catalyst Damaging Misfire)
Crankshaft Position System Variation Not Learned (CASE)	P0315	Determines if the Crankshaft Position System Variation has not been learned.	Sum of Compensation Factors ≤ 1.996 or 2.004	OBD Manufacturer Enable Counter = 0	<u>Frequency:</u> Continuous 100 ms loop	DTC Type A

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Knock Sensor (KS) Module Performance (GMX357 Only)	P0324	This diagnostic will detect a failed internal ECM component associated with knock control	Any Cylinder's Avg Gain Signal > 4.99 V if RPM>1800 OR All Cylinder's Actual Signals < 0.01 V if RPM>1800	Air Per Cylinder >0.165 grams	50 fails out of 63 samples 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 > 1 sec PTO not active Temporarily disabled ('Indeterminate' state reported) for samples in which P0327 or P0328 report 'Failed' state.	50 fails out of 63 samples 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 ≥ 8 degrees	Engine Speed ≥ 1800 RPM MAP ≥ 55 kPa No throttle fault No PTO active Fast spark retard active	57 fails out of 63 samples 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 > 1 sec PTO not active	50 fails out of 63 samples 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 > 1 sec PTO not active	50 fails out of 63 samples 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 Engine is spinning and no 5V reference or cam position sensor DTCs set	1. While starter is engaged – 4s 2. Continuous – 1s 3. Continuous – 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. Unable to achieve crank sync 2. Twenty crank resyncs occur within 25 seconds 51 > number of crank pulses received in one engine revolution >65	1. Engine cranking and either CMP pulses being received or MAF >3 grams per second 2. Engine speed > 450 RPM Engine is spinning and no 5V reference or cam position sensor DTCs set	1. While starter engaged – 1.5s 2. Continuous – 100 ms Continuous – 8 test failures out of 10 samples	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
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 No Cam pulses received while starter is engaged.	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 Engine is spinning and no 5V ref DTCs set	1. One time while starter is engaged. 2. Continuous – 8 test failures out of 10 samples 3. Continuous – 3 seconds 1.5 seconds while starter is engaged.	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. 4 > number of cam pulses received in 12 MEDRES events > 10. 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 Continuous – 8 test failures out of 10 samples	DTC Type B
Ignition Control #1 Circuit	P0351	This DTC checks the circuit for electrical integrity during operation. Monitors EST for Cylinder 1	The ECM detects that the commanded state of the driver and the actual state of the control circuit do not match.	2 Volts ≥ Ignition voltage > 6 Volts	50 fails out of 63 samples 100ms sample rate Continuous	DTC Type B
Ignition Control #2 Circuit	P0352	This DTC checks the circuit for electrical integrity during operation. Monitors EST for Cylinder	The ECM detects that the commanded state of the driver and the actual state of the control circuit do not match.	2 Volts ≥ Ignition voltage > 6 Volts	50 fails out of 63 samples 100ms sample rate Continuous	DTC Type B
Ignition Control #3 Circuit	P0353	This DTC checks the circuit for electrical integrity during operation. Monitors EST for Cylinder	The ECM detects that the commanded state of the driver and the actual state of the control circuit do not match.	2 Volts ≥ Ignition voltage > 6 Volts	50 fails out of 63 samples 100ms sample rate Continuous	DTC Type B
Ignition Control #4 Circuit	P0354	This DTC checks the circuit for electrical integrity during operation. Monitors EST for Cylinder 4	The ECM detects that the commanded state of the driver and the actual state of the control circuit do not match.	2 Volts ≥ Ignition voltage > 6 Volts	50 fails out of 63 samples 100ms sample rate Continuous	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Secondary AIR Incorrect Airflow	P0411	Detects an insufficient flow condition This test is run during Phase 1 (SAI pump commanded On, Valve commanded Open)	Predicted System Pressure versus Actual System Pressure Error > 4kPa	No active MAF DTCs No active MAP DTCs No active SAI Pressure Sensor Performance DTCs No active SAI Pressure Sensor Circuit DTCs No active SAI pump relay DTCs No active SAI valve relay DTCs No active IAT DTCs No active ECT DTCs No active Misfire DTCs No active Catalyst Monitor DTCs No active P0606 DTC No active 5 Volt DTCs No active EST DTCs No active Fuel Injector DTCs BARO > 70 kPa Engine Airflow < 33 g/s 10V < System Voltage < 18V Stability Time > 5 seconds SAI System commanded On	Conditional test weight > 7 seconds Frequency: Once per trip when SAI pump commanded On	DTC Type B
Secondary AIR Solenoid Control Circuit	P0412	This DTC checks the SAI solenoid circuit for electrical integrity	Output state invalid	Ignition Voltage in Range	20/25 counts Frequency: 4 counts/second Continuous check	DTC Type A
Secondary AIR Pump Control Circuit	P0418	This DTC checks the SAI pump relay circuit for electrical integrity	Output state invalid	Ignition Voltage in Range	20/25 counts Frequency: 4 counts/second Continuous check	DTC Type A

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Catalyst System Low Efficiency Bank 1	P0420	Oxygen Storage	Normalized Ratio OSC Value < 0.35 (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 >= 1075 RPM for a minimum of 15 seconds since end of last idle period. • Engine run time >= 100 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 > 11 volts • Ethanol Estimation Is NOT in Progress • ECT >= 40° C • ECT <= 130 ° 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 ≥ 470°C for at least 15 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 ***Idle Stable Criteria :: Must hold true from after Catalyst Idle Conditions Met to the end of test*** • MAF >= 2 grams per second • MAF <=8.5 grams per second • EGR DC Multiplier <= 1 • Predicted catalyst temperature <= 1000 degC *Engine Fueling Criteria at Beginning of Idle Period* The following fueling related must also be met from	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 >= 0.69 • The current OSC Normalized Ratio value is <= 0.25 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

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
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. The engine off natural vacuum method (EONV) is used.	***SMALL LEAK TEST FAIL:*** Engine Off Natural Vacuum (EONV) while the engine is off. The total pressure change achieved during the test is normalized against a target value that is based upon fuel level and ambient temperature. (The pressure change for this application is set to 497 Pa for all fuel level and ambient conditions). 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 = 0.50 Re-Pass threshold = 0.35	***TEST ENABLE :*** No MAP DTC's No Thermostat Rationality DTC's VS Sensor DTC's not active No Fuel Tank Pressure Sensor circuit DTC's No EVAP Canister Purge Solenoid circuit DTC's No EVAP Canister Vent Solenoid circuit DTC's No Fuel Level DTC's Coolant Sensor DTC's not active IAT Sensor DTC's not active EVAP CCP stuck open DTC not active. EVAP large leak DTC not active. Ignition off timer DTC not active. Canister Vent restriction DTC is not active Fuel Level >15.0% but < 85.0% Drive time >= 600 seconds. Drive length >= 5 kilometers. Coolant >= 70°C. No fuel filling (fuel level increment >= 10%) During EONV test. BARO > 74.0kPa Estimated ambient temperature at end of drive > 0°C but < 34°C. Estimate of Ambient Air Temperature Valid Conditions to be valid • Cold Start Startup Δ°C (ECT-IAT) < 8°C if ECT > IAT OR • Hot Restart Sufficient drive length to get accurate estimate of ambient air temperature (at least a minimum of 4 minutes and 3 kilometers)	Once per trip, 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 is 4 under normal conditions Run length is 2 to 6 trips after code clear or non-volatile 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 > 11 volts, but < 18 volts	20 Failures out of 25 samples 250 msec / sample Continuous	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Evaporative Emission (EVAP) Vent System Performance	P0446	This DTC will determine if a restriction is present in the vent solenoid, vent filler, vent hose or EVAP canister	Tank Vacuum > 2983 Pa for 5 seconds BEFORE Purge Volume > 10 liters OR Vented Vacuum < -621 Pa or Vented Vacuum > 1243 Pa 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 % < Fuel Level < 85. % • 11.00 V < System Voltage < 18.00 V • 4 °C < Startup IAT < 30°C • Startup ECT < 35 °C BARO > 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 > 11 volts, but < 18 volts	20 failures out of 25 samples 250 msec /test Continuous.	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
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 = 0.730 Re-Pass threshold = 0.400	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 Used on EONV Applications
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	Frequency: Continuous 100ms loop If 80 samples fail out of 100 samples total, then a fail will be reported to the DTC.	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	Frequency: Continuous 100ms loop If 80 samples fail out of 100 samples total, then a fail will be reported to the DTC.	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
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 Pa 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.	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 are failures.	DTC Type A

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
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 > 10.00 liters BEFORE Tank vacuum < 2735 Pa 2 liters of fuel must be consumed after setting the DTC active the first time to the DTC active the second time. <u>Weak Vacuum Follow-up Test</u> (fuel cap replacement test) Weak Vacuum Test failed previous trip and this trip. Passes if tank vacuum > 2735 Pa. Note: Weak vacuum Follow-up Test can only report a pass.	<u>General Test Enable</u> • No MAP DTC's • No TP Sensor DTC's • No VSS DTC's • No IAT DTC's • No ECT DTC's • No Fuel Tank Pressure circuit Sensor DTC's • No Evap Canister Purge solenoid circuit DTC's • No EVAP Canister Vent Solenoid circuit DTC's • No Thermostat Rationality DTC's • 15 % < Fuel Level < 85. % • 11.00 V < System Voltage < 18.00 V • 4 °C < IAT < 30°C • ECT < 35 °C • BARO > 74.00 kPa (8000 ft) <u>Cold Start Test</u> • IAT < 30°C • Cold temperature Δ(ECT-IAT): < 8 °C if ECT > IAT • Cold Test Timer < 1000 seconds	Once per cold start Time is dependent on driving conditions Max. before test abort is 1000 seconds <u>Weak Vacuum Follow-up Test</u> On 2nd trip with 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.	IF Delta Fuel Volume change less than 10 liters over an accumulated 240 Kilometers.	No VSS DTC's set Engine Running	<u>Frequency:</u> 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 Sender % of 5V range <10 %	Runs continuously	<u>Frequency:</u> Continuous 100ms loop 240 failures out of 300 samples 1 sample = 100 ms	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 Sender % of 5V range > than 70%	Runs continuously	<u>Frequency:</u> Continuous 100ms loop 240 failures out of 300 samples 1 sample = 100 ms	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
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. .	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 are failures	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 greater than 400 rpm Ignition voltage > 11 volts, but < 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 greater than 400 rpm Ignition voltage > 11 volts, but < 18 volts	20 failures out of 25 samples 250msec /test Continuous	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
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 > 249 Pa for 5.00 sec BEFORE Test time > 60 seconds (cold start)	General Test Enable • No MAP DTC's • No TP Sensor DTC's • No VSS DTC's • No IAT DTC's • No ECT DTC's • No Fuel Tank Pressure Sensor circuit DTC's • No EVAP canister purge solenoid circuit DTC's • No EVAP Canister Vent Solenoid circuit DTC's • No Thermostat Rationality DTC's • 15 % < Fuel Level < 85. % • 11.00 V < System Voltage < 18.00 V • 4 °C < IAT < 30°C • ECT < 35 °C • BARO > 74.00 kPa (8000 ft)	Once per cold start. Cold start: max time is 1000 seconds	DTC Type B
Vehicle Speed Sensor Circuit Low Voltage (Manual transmission)	P0502	Detects the lack of activity on the VSS circuit	Transmission Output Speed ≤ 52 RPM	No TP or VSS intermittent DTCs TP ≥ 8 % Transmission Fluid Temperature ≥ -40º C. 1500 RPM ≤ Engine Speed ≤ 6500 RPM 50 N-m ≤ Engine Torque ≤ 8192 N-m 9 V ≤ System Voltage ≤ 18 V	4.5 sec. Continuous check	DTC Type B
Vehicle Speed Sensor Circuit Intermittent (Manual transmission)	P0503	Detects an intermittent fault on the VSS circuit	Transmission Output Speed must drop by at least 312 RPM in 0.025 sec.	400 ≤ Engine Speed ≤ 7500 for at least 5.0 sec. Engine Speed change ≤ 500 RPM in 2.0 sec. Transmission Output Speed > 260 RPM for 2.0 sec. Change in Output Speed ≤ 130 RPM for at least 2.0 sec. 9 V ≤ System Voltage ≤ 18 V Time since last range change > 6 sec.	3.25 sec. Continuous check 25 msec. loop	DTC Type B
Idle Air Control (IAC) System - RPM Too Low	P0506	Determines if a low idle is a result of an engine mechanical problem	Idle Error from desired – Table value in RPM based on Coolant Temperature	No MAF, MAP, IAT, ECT, TP, Injector, Fuel System, Misfire, VSS or Purge DTC Engine Run > 60 sec. Engine Speed error > 100 RPM ECT ≥ 60° C BARO > 65 kPa IGN. voltage > 9 & < 18 volts IAT > -10 ° C Idle condition present	Must be outside the fail criteria continuously for three 8-second tests. Must be within pass criteria for 12 seconds continuously.	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Idle Air Control (IAC) System - RPM Too High	P0507	Determines if a high idle is a result of an engine mechanical problem	Idle Error from desired – Table value in RPM based on Coolant Temperature	No MAF, MAP, IAT, ECT, TP, Injector, Fuel System, Misfire, VSS or Purge DTC Engine Run > 60 sec. Engine Speed error > 200 RPM ECT ≥ 60° C BARO > 65 kPa IGN. voltage > 9 & < 18 volts IAT > -10° C Idle condition present	Must be outside the fail criteria continuously for three 12-second tests. Must be within pass criteria for 12 seconds continuously.	DTC Type B
System Voltage Low	P0562	This DTC is a check to determine if the current system voltage is below the minimum required voltage for proper ECM operation	System voltage < 10 volts	Ignition is "ON" Engine speed > 1200	5 failures in a 6 sample test 1 second / sample	DTC Type C
System Voltage High	P0563	This DTC is a check to determine if the current system voltage is above the maximum allowed voltage for proper ECM operation	System voltage > 18 volts	Ignition is "ON" Engine speed > 1200	5 failures in a 6 sample test 1 second / sample	DTC Type C
Control Module Read Only Memory (ROM)	P0601	This DTC will be stored if any software or calibration check sum is incorrect	Calculated Checksum does not match stored checksum	Ignition voltage ≥ 5 volts	1 failure if it occurs during the first ROM test of the ignition cycle, otherwise 5 failures <u>Frequency:</u> 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.	Output state invalid	• PCM state = crank or run PCM is identified through calibration as a Service PCM	Test is run at Powerup	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 voltage ≥ 5 volts	1 failure <u>Frequency:</u> Once at power-up	DTC Type A
ECM RAM FAILURE	P0604	Indicates that ECM is unable to correctly write and read data to and from RAM	Data read does not match data written	Ignition in Run or Crank	Should finish within 30 seconds at all engine conditions.	DTC Type A

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
PCM Processor 1. Processor Performance Check - Throttle limiting Fault 2. Processor Performance Check - ETC software is not executed in proper order 3. Processor Performance Check 4. Processor Performance Check - SPI failed 5. Processor Performance Check - motor processor state of health (Main) 6. Processor Performance Check - Learn Corruption Fault (Main&motor processor) 7. Processor Performance Check - Learn Corruption Fault MAIN & motor processor 8. Processor Performance Check - motor processor state of health (Main) Processor Performance Check - MAIN state of health (motor processor)	P0606	Indicates that the ECM has detected an ETC internal processor integrity fault	1. MHC processor detects throttle limiting fault 2. Software tasks loops > schedule tasks loop 3. Loss of SPI communication from the motor processor 4. 1.5 msec < Average motor processor state of health toggle > 2.5 msec 5. TPS or APPS minimum learned values fail compliment check 6. TPS or APPS minimum learned values fail range check 7. 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	1. 187.5 ms in the MHC processor 2. Error > 5 times of loop time; loop time are 12.5, 25,50,100 and 250 ms in the main processor 3. In the main processor, 159/400 counts intermittent or 15 counts continuous; 39 counts continuous @ initialization 4. In the MHC processor 475 ms at initialization, 175 msec continuous or 20/200 intermittent. 5. 187.5ms continuous/100 ms intermittent in the main processor 6. 187.5ms continuous/100 msec intermittent in the main processor	DTC Type A
Main & MHC state of health fault	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, No 5 V reference DTCs	487.5 ms	DTC Type C

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Control Module Accelerator Pedal Position (APP) System Performance	P060D	Verify that the indicated accelerator pedal position calculation is correct	1. PPS sensor switch fault 2. Difference between Main processor indicated accelerator pedal position and MHC processor indicated accelerator pedal position > 2.5%	1. Ignitions in unlock/ accessory and run, 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, No Comm Fault w/ Main	39 counts continuous; 12.5 msec/count in the MHC processor	DTC Type A
Control Module EEPROM Error	P062F	Indicates that the NVM Error flag has not been cleared	Last EEPROM write did not complete	Ignition voltage ≥ 5 volts	1 failure <u>Frequency:</u> Once at 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 < 4.432 or > 4.659 volts	Ignition in unlock/accessory, run or crank System voltage > 5.23 V No ECM processor DTCs	19/39 counts or 187.5 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, but < 18 volts	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	Vref1 < 4.432 or > 4.659 volts	Ignition in unlock/accessory, run or crank System voltage > 5.23 V No ECM processor DTCs	19/39counts or 187.5 msec continuous; 12.5 msec/count in main/MHC processor	DTC Type A
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, but < 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	10 fail counts / 12 sample counts 1 count per second	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
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 Stuck Test: The Powertrain relay feedback voltage is > 2 volts when it has been commanded "OFF" for longer than 1 seconds	Powertrain relay commanded "ON" No Powertrain Relay Control output driver fault	10 fail counts / 12 sample counts 1 count per second Stuck Test: 100 msec / sample Continuous failures ≥ 2 seconds	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	Time since power-up > 3 seconds	Continuous	DTC Type A No MIL
Clutch Pedal Switch B Circuit (Manual only)	P0833	Clutch switch state is monitored during vehicle operation.	The ECM detects that a clutch switch state transition has not occurred when the vehicle speed indicates a vehicle drove from Cycle 1 to Cycle 2 and returns to Cycle 3	No VSS codes present Cycle 1: VSS < 6 kph Cycle 2: VSS >65 kph Cycle 3: VSS < 6 kph	4 test failures in a 5 test sample size 100ms Continuous	DTC Type B
Park/Neutral Position Switch Circuit Low Voltage (Automatic transmission GMX380 only)	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 Type C
Park/Neutral Position Switch Circuit High Voltage (Automatic transmission GMX380 only)	P0852	Check for P/N switch closed malfunction (in Park/Neutral when indicating Drive)	TPS > 10% Torque ≥ 60 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 Type C

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Traction Control Torque Request Circuit	P0856	Determines if torque request from the EBTCM is valid	1. Serial Communication 2's complement not equal for message $140 (PPEI2) 2. Serial Communication rolling count value shall be + 1 from previous $140 message (PPEI2)	Torque Reduction Signal Diagnostic Enabled (KeTCSD_b_GMLAN_DiagEnable == TRUE) No Serial communication loss to TCM (U0108) Engine Running == TRUE Power Mode = Run Traction Control System == Present for GMLAN $380 (PPEI2) or $4E9 (PPEI3) message	1. # of Protect Errors >= KcTCSI_Cnt_ProtectErrThresh (=10) 2. # of Alive Rolling Errors >= KcTCSI_Cnt_RollCntErrThresh (=10) in KcTCSI_Cnt_RollCntErr SampleSize # (=CeTCSI_ElementSize10) of Samples performed in the 25ms loop	DTC Type C
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 > 250 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 <= 8192 MAP sensor high/low DTCs not active EGR circuit/performance DTCs not active MAF sensor high/low DTCs not active EGR valve 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 < 125 deg C Intake Air Temp > -7 deg C and < 125 deg C	Continuous The diagnostic reports test results every 100 ms.	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
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 < 30 OR Half cycle R/L switches < 30 OR Slope Time L/R switches < 5 OR Slope Time R/L switches < 5	<u>Common Enable Criteria</u> • 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 Inj., and AIR Device controls = Not Active <u>Specific Enable Criteria</u> • O2 Heater on for ≥ 0 seconds • B1S1 DTCs = Not Active • B1S1 learned heater resistance is valid • Misfire DTC = Not Active • ECT > 70 °C • IAT > -40 °C • Engine run time > 200 seconds • EVAP Canister purge duty cycle ≥ 0 % • 11 grams per second ≤ MAF ≤ 30 grams per second • 1000 ≤ RPM ≤ 3500 • Ethanol percentage < 84.899 % • Baro > 69.89 kPa • Throttle position ≥ 3.5 % • Fuel Level > 10 % • 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 seconds.	60 seconds <u>Frequency:</u> Once per trip	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
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 1.0 (automatic transmission) or 1.0 (manual transmission). 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 0.0, if at the end of the previous key cycle, the AFIM Filtered Length Ratio was equal to or less than 0.0. The AFIM Filtered Length Ratio is initialized to 0.0, if at the end of the previous key cycle, the AFIM Filtered Length Ratio was equal to or greater than 0.0. The AFIM Filtered Length Ratio is initialized to its key-down value, if at the end of the previous key cycle, the AFIM Filtered Length Ratio was greater than 0.0 and less than 0.0. 3. The first report is delayed for 90 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 • No Fuel Composition (Ethanol) 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 but < 4000 rpm • Mass Airflow > 7 g/s but < 400 g/s • Percent Ethanol < 85 % • Delta O2 voltage during previous 12.5ms > +5/-5 mV • O2 sensor voltages crosses 450mV > 4 times during current 2.5 second sample period	EWMA variable is updated after every 2.5 seconds of valid data. <u>Frequency:</u> Continuous Monitoring of O2 voltage signal in 12.5ms loop	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Cold Start Emissions Reduction System Fault	P1400	Model based test computes exhaust thermal energy from elevated idle speed and retarded spark advance. Detects if the cold start emission reduction system has failed resulting in the delivered thermal energy being out of range.	(If RPM in Park/Neutral < 600 and 800 {f(ECT and engine run time)}, or If RPM in Gear < 600 and 800 {f(ECT and engine run time)}, then the model tends to make a fail decision. If Spark Advance in Park/Neutral > 15 degrees {f(RPM and air per cylinder)} Or If Spark Advance in Gear > 15 degrees {f(RPM and air per cylinder)}, then the model tends to make a fail decision. The DTC will set when: (Average desired accumulated power - Average estimated accumulated power) > 0.2 kJ/s Or (Average desired accumulated power - Average estimated accumulated power) < -5 kJ/s	• Cold start emission reduction strategy is active. • Vehicle speed < 2 kph. • Throttle position < .1%. • Airflow per cylinder > 0.080 grams • 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	1. Detect a throttle positioning error. Determine if the actuator has been miswired.	1. |throttle error| >= |2%| after > 0.488sec stability with no change in error sign, OR |throttle error| > 9.94 % TPS1< 2.181Volts	Ignition in run or crank [(RPM>0 and system voltage > 5.4 Volts) OR (RPM=0 and not in battery saver mode and System voltage > 11.0 Volts)] No comm. Fault w/ Main TPS min learn not active No ignition correlation DTC active.	187.5ms in the MHC processor	DTC Type A

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Ignition Correlation	P1682	Detect a continuous or intermittent OOC between the Run/Crank Ignition Voltage & ETC Run/Crank Ignition Voltage	|Run/Crank – ETC Run/Crank| > 3.00 V	Ignition in unlock/accessory, run or crank System voltage > 5.23 V & Powertrain Relay Commanded on. Run/Crank Ignition ≥ voltage required to engage relay at the current IAT temperature, or ETC Run/Crank > voltage required to hold relay in once engaged. Pull-In Voltage — Hold-In Voltage 23° C = 7.00 volts — 5.50 volts 85° C = 8.70 volts 95° C = 9.00 volts 105° C = 9.20 volts 125° C = 10.00 volts	14 / 14 counts , 12.5msec loop time, in main processor	DTC Type A
Control Module Throttle Actuator Position Performance	P2101	1. Detect a throttle positioning error 2. Detect excessive motor driver current (PWM)	1. Difference between measured throttle position and modeled throttle position > 9.94% Motor driver PWM output > Thresh. Thresh based on system voltage.	1. Ignition in run or crank [(RPM>0 and system voltage > 5.5 Volts) OR (RPM=0 and not in battery saver mode and System voltage > 11.0Volts)] Throttle not at default position 2. NA No ignition correlation DTC active.	1. 15/15 counts continuous Check runs every 12.5 msec in the main processor	DTC Type A
Throttle return to default	P2119	Throttle unable to return to default throttle position after de-energizing ETC motor.	TPS1 > 1.97 Volts AND TPS2> 1.97 Volts On the Main processor OR TPS1 > 1.97 Volts AND TPS2> 1.97 Volts On the MHC processor	Ignition in unlock/accessory, run or crank System voltage>5.23 V Throttle de-energized	487.5 ms	DTC Type C

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Accelerator Pedal Position (APP) Sensor 1	P2120	1. Detect a continuous or intermittent short or open in the APP sensor #1 on Main processor 2. Detect a continuous or intermittent short or open in the APP sensor #1 on MHC processor	1. APP1 < 0.325 OR APP1 > 4.75 2. APP1< 0.325 OR APP1 > 4.75	Ignition in unlock/accessory, run or crank System voltage >5.23 V No 5 Volt reference DTCs	1. 19/39counts or 13counts continuous; 12.5 msec/count in the main processor 19/39counts or 13counts continuous; 12.5 msec/count in the MHC processor	DTC Type A
Accelerator Pedal Position (APP) Sensor 1 Lo	P2122	Detect a continuous or intermittent short or open in the APP sensor #1 on Main processor	APP 1 < 0.325 V	Ignition in unlock/accessory, run or crank System voltage >5.23 V No 5 Volt reference DTCs	19/39counts or 13 counts continuous; 12.5 msec/count in the Main processor	DTC Type A
Accelerator Pedal Position (APP) Sensor 1 Hi	P2123	Detect a continuous or intermittent short or open in the APP sensor #1 on Main processor	APP 1 > 4.75 V	Ignition in unlock/accessory, run or crank System voltage >5.23 V No 5 Volt reference DTCs	19/39counts or 13 counts continuous; 12.5 msec/count in the Main processor	DTC Type A
Accelerator Pedal Position (APP) Sensor 2	P2125	1. Detect a continuous or intermittent short or open in the APP sensor #1 on Main processor Detect a continuous or intermittent short or open in the APP sensor #1 on MHC processor	1. APP2 < 0.325 V OR APP2 > 4.75 V 2. APP2< 0.325 V OR APP2 > 4.75 V	Ignition in unlock/accessory, run or crank System voltage >5.23 V No 5 Volt reference DTCs	1. 19/39counts or 13counts continuous; 12.5 msec/count in the main processor 19/39counts or 13counts continuous; 12.5 msec/count in the MHC processor	DTC Type A
Accelerator Pedal Position (APP) Sensor 2 Lo	P2127	Detect a continuous or intermittent short or open in the APP sensor #2 on Main processor	APP 2 < 0.325 V	Ignition in unlock/accessory, run or crank System voltage >5.23 V No 5 Volt reference DTCs	19/39counts or 13 counts continuous; 12.5 msec/count in the Main processor	DTC Type A
Accelerator Pedal Position (APP) Sensor 2 Hi	P2128	Detect a continuous or intermittent short or open in the APP sensor #2 on Main processor	APP 2 > 4.75 V	Ignition in unlock/accessory, run or crank System voltage >5.23 V No 5 Volt reference DTCs	19/39counts or 13 counts continuous; 12.5 msec/count in the Main processor	DTC Type A

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Throttle Position (TP) Sensor 1-2 Correlation	P2135	1. Detects a continuous or intermittent correlation fault between TP sensors #1 and #2 on Main processor 2. Detects a continuous or intermittent correlation fault between TP sensors #1 and #2 on MHC processor	1. Difference between TPS1 displaced and TPS2 displaced > 7.266% offset at min. throttle position with an increasing to 10% at max. throttle position 2. Different between (raw min TPS1) and (raw_min TPS2) > 4.99% of Vref	Ignition in unlock/accessory, run or crank System voltage >5.23 V No 5 Volt reference DTCs	1. 79/159 counts or 63 counts continuous; 3.125 msec/count in the main processor 19/39 counts or 15 counts continuous; 12.5 msec/count in the MHCprocessor	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	1. Difference between (raw min. learned PPS#1 voltage-raw min. PPS#1 voltage) and (raw PPS#2 voltage - raw min. learned PPS#2 voltage) > 10.0% offset at min. throttle position with an increasing to 10% (0.5v)at max. throttle position for Main processor. OR 2. Difference between the learned PPS1 min and PPS2 min > 5.00% of Vref	1. Ignition in unlock/accessory, run or crank System voltage >5.23 V No 5 Volt reference DTC's 2. Ignition in unlock/accessory, run or crank System voltage >5.23 V No 5 Volt reference DTC's	1. 19/39 counts intermittent or 15 counts continuous, 12.5 msec/count in the main processor 2. 19/39 counts intermittent or 15 counts continuous, 12.5 msec/count in the MHC processor	DTC Type A
Minimum Throttle Position Not Learned	P2176	TP minimum learning not completed	1. TPS > 0.86 Volts during TPS min learn on the Main processor OR TPS > 0.86 Volts during TPS min learn on the MHC processor	Minimum TPS learn active state Stable throttle position reading for 40 msec Ignition in run or crank No TPS circuit DTCs No ignition correlation DTC active.	1.8secs	DTC Type A

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Secondary Air Injection System Pressure Sensor Circuit Bank 1	P2430	This DTC determines a stuck in range pressure sensor signal	Average Error < 0.5 kPa And Signal Variation < 1	No active P0412 DTC No active P0418 DTC No active DTC P0606 No active DTC P2432 No active DTC P2433 No active 5 Volt DTCs SAI pump commanded On	Stuck in range cumulative info > 5 seconds Frequency: Once per trip when SAI pump commanded On	DTC Type B
Secondary Air Injection System Pressure Sensor Performance Bank 1	P2431	This DTC determines a skewed pressure sensor signal	Difference between SAI pressure sensor and BARO sensor > 10kPa with SAI pump commanded Off OR Difference between SAI pressure sensor and BARO sensor > 50kPa with SAI pump commanded On	No active P0412 DTC No active P0418 DTC No active DTC P0606 No active DTC P2432 No active DTC P2433 No active 5 Volt DTCs No active MAP DTCs	Skewed sensor cumulative info > 30 seconds Cumulative info is depending on BARO quality BARO quality is determined based on distance traveled since last BARO update Frequency: Continuous 100ms loop	DTC Type B
Secondary Air Injection System Pressure Sensor Circuit Low Voltage Bank 1	P2432	This DTC determines an out of range low SAI pressure sensor signal	SAI Pressure Sensor signal < 5% of 5V Ref	No active DTC P0606 No active 5 Volt DTCs	400 failures out of 500 samples frequency: 12.5ms cont.	DTC Type B
Secondary Air Injection System Pressure Sensor Circuit High Voltage Bank 1	P2433	This DTC determines an out of range high SAI pressure sensor signal	SAI Pressure Sensor signal > 94% of 5V Ref	No active DTC P0606 No active 5 Volt DTCs	400 failures out of 500 samples frequency: 12.5ms cont.	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Secondary Air Injection System Shut-off Valve Stuck Open	P2440	This DTC determines if the SAI system control valve is stuck open Phase 2 test (Pump commanded On, valve commanded closed)	SAI pressure error < -7.5kPa (actual pressure lower than predicted during Phase 2)	No active MAF DTCs No active MAP DTCs No active SAI Pressure Sensor Performance DTCs No active SAI Pressure Sensor Circuit DTCs No active SAI pump relay DTCs No active SAI valve relay DTCs No active IAT DTCs No active ECT DTCs No active Misfire DTCs No active Catalyst Monitor DTCs No active P0606 DTC No active 5 Volt DTCs No active EST DTCs No active Fuel Injector DTCs BARO > 70 kPa Engine Airflow < 33 g/s 10V < System Voltage < 18V Stability Time > 5 seconds SAI System commanded On	Phase 2 Test cumulative info > 1.5 seconds Frequency: Once per trip when SAI pump commanded On	DTC Type B
Secondary Air Injection System Pump Stuck On	P2444	This DTC determines if the SAI pump is stuck On Phase 3 test (Pump commanded Off)	SAI Pressure Error > 2.5kPa (actual pressure higher than predicted during Phase 3 test)	No active MAF DTCs No active MAP DTCs No active SAI Pressure Sensor Performance DTCs No active SAI Pressure Sensor Circuit DTCs No active SAI pump relay DTCs No active SAI valve relay DTCs No active IAT DTCs No active ECT DTCs No active Misfire DTCs No active Catalyst Monitor DTCs No active P0606 DTC No active 5 Volt DTCs No active EST DTCs No active Fuel Injector DTCs BARO > 70 kPa Engine Airflow < 33 g/s 10V < System Voltage < 18V Stability Time > 5 seconds SAI System commanded On	Phase 3 Test cumulative info > 4 seconds Frequency: Once per trip when SAI pump commanded On	DTC Type A

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
Transmission Control Torque Request Circuit	P2544	Determines if torque request from the TCM is valid	1. Serial Communication 2's complement not equal for message $199 (PTEI3) 2. Serial Communication rolling count value shall be + 1 from previous $199 message (PTEI3) 3. 2's complement not equal of torque requested value or torque requested type when stored in ECM 4. If TCM Requested Torque in message $199 (PTEI3) > KeTTQN_M_TransTorqReqMax (=8191.75) or for PPEI2 1. Serial Communication 2's complement not equal for message $150 (PTEI2) Serial Communication rolling count value shall be + 1 from previous $150 message (PTEI2)	Torque Reduction Signal Diagnostic Enabled (KeTTQI_b_TorqRdctDiagEnbl == TRUE) No TCM Serial communication DTC's Engine Running == TRUE Power Mode = Run Crank Active	1. # of Protect Errors >= KeTTQC_Cnt_ProtectErrFailThrsh (=16) 2. # of Alive Rolling Errors >= KeTTQC_Cnt_AliveErrFailThrsh in 10 samples (=6) 3. # of RAM errors >= KeTTQC_Cnt_RAM_ErrFailThrsh (=3) 4. # of range errors >= KeTTQC_Cnt_TorqExcd (=3) MaxRange in 10 samples If any the above exist for > KeTTQI_t_TorqRdctCktPendFail (= 2) seconds then increment fail counter else fail counter is reset If the fail counter is => KcTTQI_Cnt_TorqRdctCktFailCntr (=2) fault is active Pass diagnostic if none of the above conditions are present for => KeTTQI_t_TorqRdctCktPass seconds (=2) 12.5ms loop	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
ECM/PCM Internal Engine Off Timer Performance	P2610	This DTC determines if the engine off timer does not meet specification	Phase 1: A failure will be reported if the following occurs 3 times: Ignition off timer < 1 sec OR Ignition off timer > 10 sec Phase 2: A failure will be reported if any of the following occurs 8 times out of 10 test: • Time since last ignition off timer increment > 1.375 seconds • Current ignition off time < old ignition off time • Time between ignition off timer increments < 0.575 s • Time between ignition off timer increments > 1.39375 s Current ignition off timer minus old ignition off timer ≠ 1.0	ECM is powered down DTC sets on next key cycle if failure detected Test has not run during current key cycle -40°C ≤ IAT ≤ 125°C	Once every key down 12.5ms loop rate 8 failures out of 10 samples Reports 1 sample / second	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 > 5 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 ≥ 100 seconds • ECT ≥ 75° C • Engine Metal Overtemp = Not Active • Traction Control = Not Active • No default throttle action • Not in Catalyst Protection Mode • 10 volts ≤ Ignition Voltage ≤ 18 volts • 1000 ≤ Engine Speed ≤ 3400 • 10 grams per second ≤ Mass Airflow ≤ 30 grams per second • Not in Decel Fuel Cutoff Mode • Not in Power Enrichment • Predicted O2 temp ≥ 0 °C All of the above met for 5 seconds.	240 test failures in a 300 test sample <u>Frequency:</u> Continuous 100ms loop	DTC Type B

SENSED PARAMETER	FAULT CODE	MONITOR STRATEGY DESCRIPTION	MALFUNCTION CRITERIA AND THRESHOLD VALUE(S)	SECONDARY PARAMETERS AND ENABLE CONDITIONS	TIME LENGTH AND FREQUENCY	MIL ILLUMINATION TYPE
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 is an intrusive test which increases or reduces delivered fuel to achieve the required rich or lean threshold.	Post catalyst O2 sensor cannot achieve voltage ≥ 740 millivolts and voltage ≤ 250 millivolts	Common Enable Criteria • Engine Runtime ≥ 300 seconds • No O2 circuit, response, heater current, or heater resistance DTC's active • No TP Sensor, ETC, MAF, ECT, MAP, IAT, EVAP, Secondary Air, Fuel Injector DTC's • 10 volts < system voltage < 18 volts • Learned heater resistance is valid • ICAT MAT Burnoff delay is not active Specific Enable Criteria: • No Fuel Trim or Misfire DTC's active • 400 rpm ≤ Engine Speed ≤ 1900 rpm • 3 gps ≤ Airflow ≤ 12 gps • 40 kph ≤ Vehicle Speed ≤ 130 kph • 0.954 ≤ Short term fuel trim ≤ 1.04599 • Fuel state = closed loop • EVAP diagnostic not in control of purge • Ethanol Estimate is not in progress • Fuel Level > 10 % • Post Cell Enabled • PTO is not active • EGR diagnostic is not in control of EGR All of the above met for at least 2 seconds, and then: Purge Solenoid = 0 % For 4 seconds	Up to 400 grams of accumulated air flow for the Lean Test and 600 grams of accumulated air flow for the Rich Test. Frequency: Once per trip	DTC Type B
Control Module Communication Bus Off (Automatic transmission)	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.		5 seconds Frequency: Continuous 1 second loop	DTC Type B
Lost Communication with TCM (Automatic transmission)	U0101	Detects that CAN serial data communication has been lost with the TCM.	Lost communication with the TCM while the ignition switch is in the RUN power mode.		12 seconds Frequency: Continuous 1 second loop	DTC Type B

TABLE - O2S Slow Response Bank 1 Sensor 1 (P0133)

Lean-Rich Ave

Rich-Lean Ave \ Seconds	0.000	0.020	0.030	0.040	0.050	0.060	0.070	0.080	0.900	0.100	0.110	0.120	0.130	0.140	0.150	0.160	1.000
0.000	PASS	PASS	PASS	PASS	PASS	PASS	PASS	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
0.020	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
0.030	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
0.040	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
0.050	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	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
0.070	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
0.080	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
0.090	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
0.100	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
0.110	FAIL	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
0.120	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
0.130	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
0.140	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
0.150	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
0.160	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
1.000	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL

Table MAP/MAF/Throttle Position Correlation (P0068)									
	Throttle Position								
	5	10	15	20	25	30	35	40	100
MAF	7.6328	10.4844	11.3828	12.4219	17.6382	15.5156	21.6563	255	255
MAP	39.3984	30.3984	27.8672	25.3847	28.2813	20.3359	19.722	100	100

Table Difference Between IAT and ECT at Start up for Enabling the Fast-Fail Condition (P0116)																	
	IAT																
	-40	-28	-16	-4	8	20	32	44	56	68	80	92	104	116	128	140	152
Difference	79.5	79.5	79.5	60	60	39.75	39.75	30	30	30	30	30	30	30	30	30	30

Table Engine Coolant Temperature Below Thermostat Regulating Temperature (P0128)											
	Startup IAT <= 10C, Target temp 55C										
	Start up ECT										
	-40	-28	-16	-4	8	20	32	44	56	68	80
Total Airflow	7568	6776	5984	5192	4400	3608	2816	2024	1232	440	440
	Startup IAT > 10C, Target temp 80C										
	Start up ECT										
	-40	-28	-16	-4	8	20	32	44	56	68	80
Total Airflow	9538	8734	7930	7126	6322	5518	4714	3910	3106	2302	1498