2004 2.8L (LK5), 3.5L (L52)
ENGINE DIAGNOSTIC PARAMETERS

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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
Cam Phaser Solenoid Circuit Fault	P0013	Checks the cam phaser solenoid circuit for electrical integrity	Output state invalid		10/20 counts 100 msec/count Continuous check	DTC Type B
VCP System Performance (VCP = variable cam phaser)	P0014	Detects a VCP system error by comparing desired and actual VCP position through all operating ranges of VCP control	Actual position/desired position difference is greater than 3.75 degrees when VCP is commanded and stabilization time (based on oil temp model) of 3 secs is met	No cam phaser DTCs Engine speed > 1350 RPM VCP is commanded VCP commanded position is stable within 0.9 degrees for 1 sec System voltage ≥ 11 V	135/150 counts 100 msec/count Continuous check when VCP is commanded	DTC Type B

Camshaft Position Sensor-A Bank-1 Correlation
 	
(Non-Encoded Cam Sensor)
	P0016	Detects cam to crank misalignment by monitoring if cam sensor pulse occurs during the incorrect crank position
		
		(Cam to Crank Correlation Diagnostic)
			Cam sensor pulse occurs outside crank MedRes region:
			
			KaEPSD_Cnt_NE_CamPerf_Region_1 = 2
			KaEPSD_Cnt_NE_CamPerf_Region_2 = 3
			
			The crank MedRes region is a certain number of crank sensor pulses. ECM throughput prohibits using every crank sensor pulse. Typical crank MedRes region is twice per cylinder, but varies in each engine.
				IF[CAM_TYPE = NON_ENCODED_CAM AND
				CAM_TYPE ≠ CSI_CAM AND
				CKP_MedRes_Active = TRUE AND
				Crank_Sync_Flag = Crank_In_Sync AND
				Fault_Pending[CMP_CKT_Perf] = FALSE
				AND
				Fault_Active[CMP_CKT] = FALSE AND
				Fault_Active[CKP_SnsrA_Ckt] = FALSE
				AND
				Fault_Active[CKP_SnsrA_Perf] = FALSE
				AND
				Fault_Active[CKP_SnsrB_Ckt] = FALSE
				AND
				Fault_Active[CKP_SnsrB_Perf] = FALSE
				AND
				Fault_Active[CKP_SnsrAB_Corr] = FALSE]
				THEN
				ENABLE DIAGNOSTIC
				ELSE
				DISABLE DIAGNOSTIC
				ENDIF
					8 cam pulses out of the last 10 cam sensor pulses are outside malfunction criteria
					
					Continuous check
						DTC Type B

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Camshaft Position Sensor-B Bank-1 Correlation
 	
(Encoded Cam Sensor)
	P0017	Detects cam to crank misalignment by monitoring if cam sensor pulse occurs during the incorrect crank position
		
		(Cam to crank Correlation Diagnostic)
			Cam sensor pulse < 97.63 degrees or > 113.22 degrees before LoRes crank pulse	IF[CAM_TYPE = ENCODED_CAM AND
				CAM_TYPE ≠ CSI_CAM AND
				Engine_Running = TRUE AND
				Crank_Sync_Flag = Crank_In_Sync AND
				Cam_Phaser_Position = PARKED AND
				Fault_Pending[CMP_CKT_Perf] = FALSE
				AND
				Fault_Active [CMP_CKT] = FALSE AND
				Fault_Active [CKP_SnsrA_Ckt] = FALSE
				AND
				Fault_Active [CKP_SnsrA_Perf] = FALSE
				AND
				Fault_Active [CKP_SnsrB_Ckt] = FALSE
				AND
				Fault_Active [CKP_SnsrB_Perf] = FALSE
				AND
				Fault_Active [CKP_SnsrAB_Corr] = FALSE]
				THEN
				ENABLE DIAGNOSTIC
				ELSE
				DISABLE DIAGNOSTIC
				ENDIF
					25 out of the last 35 cam rotations occur with 2 cam sensor pulses outside of malfunction criteria window
					
					Continuous check
						DTC Type B

HO2S Heater Control Circuit Bank 1 Sensor 1	P0030	Output state invalid	Circuit fault indicated	11 V < System voltage < 18 V Engine speed > 425 RPM	10 fails out of 12 samples Continuous check	DTC Type B
HO2S Heater Control Circuit Bank 1 Sensor 2	P0036	Output state invalid	Circuit fault indicated	11 V < System voltage < 18 V Engine speed > 425 RPM	10 fails out of 12 samples Continuous check	DTC Type B
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 < 25 kPa 2. Difference between measured MAF and estimated MAF < 25 grams/sec	Engine running No PCM processor, throttle actuation DTCsBoth TPS circuits DTCs are set	187.5 msec Continuous in the main processor	DTC Type A
Mass Airflow (MAF) Sensor Performance	P0101	Determines if the MAF sensor is stuck within the normal operating range	1. Filtered airflow error > 10 grams/sec 2. Filtered manifold pressure 2 error > 20 kPa 3. Filtered throttle error < 350 kPa grams/sec	No MAF circuit, MAP circuit, EGR, ECT circuit, IAT circuit, crank sensor DTCs 400 RPM < Engine speed 70°C < ECT < 125°C -7°C < IAT < 125°C	Immediate <u>Frequency:</u> 12.5 msec loop Continuous check	DTC Type B
MAF Sensor Circuit Low Frequency	P0102	Detects a continuous short to low or open in either the signal circuit or the MAF sensor.	MAF sensor signal < 100 Hz	Engine run time > 5 secs Engine speed > 500 RPM System voltage > 11 V Enable criteria stable time > 2.5 secs	30/40 counts 80 counts/sec Continuous check	DTC Type B

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MAF Sensor Circuit High Frequency	P0103	Detects a continuous short to high in either the signal circuit or the MAF sensor.	MAF sensor signal > 11000 Hz	Engine run time > 5 secs Engine speed > 500 RPM System voltage > 11 V Enable criteria stable time > 2.5 secs	30/40 counts 80 counts/sec Continuous check	DTC Type B
Manifold Absolute Pressure (MAP) Sensor 1 Performance	P0106	Determines if the MAP sensor is stuck within the normal operating range.	1. Filtered manifold pressure 1 error > 20 kPa 2. Filtered manifold pressure 2 error > 20 kPa 3. Filtered throttle error < 350 kPa grams/sec	No MAF circuit, MAP circuit, EGR, ECT circuit, IAT circuit, crank sensor DTCs 400 RPM < Engine speed 70°C < ECT < 125°C -7°C < IAT < 125°C	Immediate Frequency: 12.5 msec loop Continuous check	DTC Type B
MAP Circuit Low Input	P0107	Detects a continuous short to low or open in either the signal circuit or the MAP sensor.	MAP < 1.0% of 5 V reference	No TPS, 5 V reference DTCs Controller State = RUN [(TPS ≥ 0% & Engine speed ≤ 1100 RPM) or (TPS ≥ 9.9% & Engine speed > 1100 RPM)]	30/40 counts 20 counts/sec Continuous check	DTC Type B
MAP Circuit High Input	P0108	Detects a continuous short to high or open in either the signal circuit or the MAP sensor.	MAP > 98.0% of 5 V reference	No TPS, 5 V reference DTCs Controller State = RUN Engine run time > table value based on start-up coolant temperature [(TPS < 89.9% & Engine speed ≤ 1000 RPM) or (TPS < 97.5% & Engine speed > 1000 RPM)]	320/400 counts 80 counts/sec Continuous check	DTC Type B
IAT Sensor Circuit Low Voltage	P0112	This DTC determines if the IAT sensor is shorted low by checking for an IAT sensor resistance below a threshold	IAT resistance < 25 Ω	No ECT, VSS DTCs ECT < 110°C VSS >= 40 KPH Engine run time > 10 sec	10/20 counts 4 counts/sec Continuous check	DTC Type B
IAT Sensor Circuit High Voltage	P0113	Determines if the IAT sensor is shorted high by checking for an IAT sensor resistance above a threshold	IAT resistance > 1800000 Ω	No ECT, VSS, MAF DTCs set ECT ≥ 50°C VSS < 1.6 KPH MAF < 12 grams/sec Engine run time > 10 sec	10/20 counts 4 counts/sec Continuous check	DTC Type B
ECT Sensor Circuit Low Voltage	P0117	Determines if the ECT sensor is shorted low by checking for an ECT sensor resistance below a threshold	ECT resistance < 25 Ω	No IAT DTCs IAT ≤ 70 °C or Engine run time ≥ 10 sec	10/100 counts 1 count/sec Continuous check	DTC Type B
ECT Sensor Circuit High Voltage	P0118	Determines if the ECT sensor is shorted high by checking for an ECT sensor resistance above a threshold	ECT resistance > 1800000 Ω	No IAT DTCs IAT ≥ -7 °C or Engine run time ≥ 60 sec	10/100 counts 1 count/sec Continuous check	DTC Type B
Throttle Position (TP) Sensor 1 Circuit	P0120	Detects a continuous or intermittent short or open in TP sensor #1 circuit	0.275 V > TPS > 4.725 V	Ignition in unlock/accessory, run or crank System voltage>5.23 V No PCM processor, 5 V reference DTCs	20/40 counts; 10 counts continuous; 12.5 msec /count in the motor processor	DTC Type A

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Throttle Position (TP) Sensor 1 Performance	P0121	Determines if the TP sensor is stuck within the normal operating range	1. Filtered throttle error > 350 kPa grams/sec 2. Filtered manifold pressure 2 error < 20 kPa	No MAF circuit, MAP circuit, EGR, ECT circuit, IAT circuit, crank sensor DTCs 400 RPM < Engine speed 70°C < ECT < 125°C -7°C < IAT < 125°C	Immediate Frequency: 12.5 msec loop Continuous	DTC Type B
Engine Coolant Temperature (ECT) Insufficient for Closed Loop Fuel Control	P0125	Detects if the engine coolant temperature rises too slowly due to an ECT sensor or cooling system fault	Actual accumulated airflow > predicted accumulated airflow and engine coolant temperature > -7°C Airflow is accumulated every sec if 10 grams/sec < MAF < 75 grams/sec	No MAF, IAT, VSS, ECT circuit DTCs Start up ECT < 75°C Minimum average airflow > 30 grams/sec VSS > 5 MPH for 1 kilometer 30 secs < Engine run time < 1800 secs IAT ≥ 7 °C	30 secs 1 sec loop Frequency: Once per ignition cycle	DTC Type B
Engine Coolant Temperature (ECT) Below Thermostat Regulating Temperature	P0128	Detects if the engine coolant temperature rises too slowly due to an ECT sensor or cooling system fault	Actual accumulated airflow > predicted accumulated airflow and engine coolant temperature > 80°C Airflow is accumulated every sec if 20 grams/sec < MAF < 75 grams/sec	No MAF, IAT, VSS, ECT circuit DTCs Start up ECT < 80 °C Minimum average airflow > 5 grams/sec VSS > 5 MPH for 1 kilometer 30 secs < Engine run time < 1800 secs IAT ≥ -7 °C	30 secs 1 sec loop Frequency: Once per ignition cycle	DTC Type B
HO2S Closed Loop Rationality (bank 1 sensor 1)	P0130	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 mV or < 350 mV for 10 counts to set closed loop fuel O2 ready flag. Once set to "Ready," the O2 sensor voltage cannot be > 350 mV and < 550 mV for > 120 secs or the O2 ready flag will be reset to "Not Ready".	No injector, MAF, ETC, TPS, MAP, ECT, HO2S Bank 1 Sensor 1 DTCs Engine run time > 200 secs Coolant temp > 70 °C 11 V < System voltage < 18 V Traction control not active Catalyst protection mode not active 1000 RPM ≤ Engine speed ≤ 3400 RPM 10.0 grams/sec ≤ MAF ≤ 50.0 grams/sec Decel fuel cut off not active Power enrichment not active Engine metal overtemp not active Above conditions must be met for 2 secs	400 /500 counts 100 msec/count Continuous check	DTC Type B
HO2S Circuit Low Voltage (bank 1 sensor 1)	P0131	Determines if the O2 sensor or circuit is shorted to low by checking for a lean condition.	O2 sensor voltage < 50 mV OR O2 sensor voltage < 550 mV while in power enrichment	No injector, MAF, ETC, TPS, MAP, ECT, IAT, evap DTCs Catalyst diagnostic test not active Traction control not active Fuel level > 10% 11 V < System voltage < 18 V Lean Test Closed Loop Fuel Enabled 14.5 ≤ Air/Fuel ratio ≤ 14.8 15% ≤ TP ≤ 50 % Above conditions must be met for 2 secs Lean in PE Test Power enrichment mode enabled Above conditions must be met for 2 secs	Lean Test 950/1000 counts 10 counts/sec Continuous check Lean in PE Test 95/100 counts 10 counts/sec Runs during each occurrence of PE	DTC Type B

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HO2S Circuit High Voltage (bank 1 sensor 1)	P0132	Determines if the O2 sensor or circuit is shorted to high by checking for a rich condition.	O2 sensor voltage > 1000 mV OR O2 sensor voltage > 350 mV while in DFCO	No injector, MAF, ETC, TPS, MAP, ECT, IAT, evap DTCs Catalyst diagnostic test not active Traction control not active 11 V < System voltage < 18 V Fuel level > 10% Rich Test Closed loop fuel enabled 14.5 ≤ Air/Fuel ratio ≤ 14.8 0% ≤ TP ≤ 50 % Above conditions must be met for 2 secs Rich in DFCO Test Decel fuel cut-off mode enabled Above conditions must be met for 2 secs	Rich Test 140/150 counts 10 counts/sec Continuous check Rich in DFCO Test 95/100 counts 10 counts/sec Runs during each occurrence of DFCO	DTC Type B
HO2S Circuit Slow Response (bank 1 sensor 1)	P0133	Determines if the O2 sensor functioning properly by checking its response time.	O2 sensor average transition time: L/R > 75msec R/L > 135 msec for automatic R/L > 120 msec for manual 350 mV < O2 voltage < 650 mV Note that P0133 is deficient for 2004 model year (L52 and LK5 GMT355) at 2.7x NOx standard	No misfire, injector, MAF, ETC, TPS, evap, IAT, MAP, ECT DTC's set Catalyst diagnostic test not active Closed loop fuel enabled Traction control not active No injectors are disabled Fuel level > 10% 11 V < System voltage < 18 V Engine run time > 200 secs ECT > 70°C 1000 RPM < Engine speed< 3500 RPM 15.0 grams/sec < MAF < 50.0 grams/sec TP ≥ 5 % BLM cell number = 4, 5, 6, 8, 9, or 13 Transmission not in park, reverse or neutral Above conditions met for 2 secs	60 secs Once per key cycle	DTC Type B
HO2S Circuit Insufficient Activity (bank 1 sensor 1)	P0134	Determines if the O2 sensor or the O2 sensor circuit has developed an open.	400 mV< O2 sensor voltage < 500 mV	No injector, MAF, ETC, TPS, evap, IAT, MAP, ECT , front O2 heater DTC's set Catalyst diagnostic test not active Traction control not active 11 V < System voltage < 18 V Engine run time > 200 secs Minimum 3 occurrences of a delta TP sensor > 1 % during diagnostic test	950/1000 counts 10 counts/sec Continuous check	DTC Type B

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HO2S Heater Circuit (bank 1 sensor 1)	P0135	Determines if the O2 sensor heater is functioning properly by monitoring the current through the heater circuit.	RCOHT Learn Diagnostic Cold start 2.4 Ω < calculated heater resistance < 6.1 Ω Current Monitor Diagnostic During Warm Operation 1.0 amps < heater current < 3.0 amps	No injector, MAF, ETC, TPS, evap, IAT, MAP, ECT, catmonDTC's set 11 V < System voltage < 18 V Traction control not active RCOHT Learn Diagnostic Engine Off Time > 10 hours -30°C < ECT < 40°C Delta between Coolant and IAT < 140°C Current Monitor Diagnostic Engine run time > 100 secs ECT > 70°C 1000 RPM < Engine speed < 2500 RPM 15 grams/sec < MAF < 30 grams/sec O2 heater overtemp control not active. Above conditions must be met for 1 sec	RCOHT Learn Diagnostic Once per cold start Current Monitor Diagnostic 45/50 counts 10 counts/sec 2 tests per key cycle 20 sec delay between tests	DTC Type B
O2S Circuit (bank 1 sensor 2)	P0136	Determines if the post catalyst O2 sensor is stuck in a normal voltage range and thereby can no longer be used for post oxygen sensor fuel control or for catalyst monitoring. The diagnostic includes a passive (stage 1) test and an intrusive (stage 2) test. The stage 2 increases or reduces delivered fuel to achieve the required rich or lean threshold.	Post catalyst O2 sensor cannot achieve a maximum voltage of 650 mV or a minimum voltage of 300 mV	No TPS,MAF, ETC, ECT, MAP, IAT, evap, injector, fuel trim, AIR or other O2 DTCs 11 V ≤ system voltage ≤ 18 V Engine run time ≥ 2 secs Stage 2 Specific Enable Criteria Stage 1 portion of test not passed 1000 RPM ≤ Engine speed ≤ 5000 RPM 10 grams/sec ≤ MAF ≤ 100 grams/sec 30 KPH ≤ VSS ≤ 130 KPH All of the above met for at least 1 sec, and then: 0.95 ≤ Short term fuel trim ≤ 1.08 Fuel state = closed loop Evap diagnostic not in control of purge	Stage 1: Up to 720 secs Stage 2: Up to 10 secs for each threshold One test per trip	DTC Type B

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HO2S Circuit Low Voltage (bank 1 sensor 2)	P0137	Determines if the O2 sensor or circuit is shorted to low by checking for a lean condition during steady throttle	O2 sensor voltage < 50 mV OR O2 sensor voltage < 650 while in power enrichment	No injector, MAF, ETC, TPS, evap, IAT, MAP, ECT DTC's set Catalyst diagnostic test not active Traction control not active Fuel level > 10% 11 V < System voltage < 18 V <u>Lean Test</u> Closed loop fuel enabled 14.5 ≤ Air/Fuel ratio ≤ 14.8 15% ≤ TP ≤ 50 % Above conditions must be met for 2 secs <u>Lean in PE Test</u> Power enrichment mode enabled Above conditions must be met for 3 secs	<u>Lean Test</u> 950/1000 counts 10 counts/sec Continuous check <u>Lean in PE Test</u> 95/100 counts 10 counts/sec Runs during each occurrence of PE	DTC Type B
HO2S Circuit High Voltage (bank 1 sensor 2)	P0138	Determines if the O2 sensor or circuit is shorted to high by checking for a rich condition during steady throttle	O2 sensor voltage > 1000 mV OR O2 sensor voltage > 300 mV while in DFCO	No injector, MAF, ETC, TPS, evap, IAT, MAP, ECT DTC's set Catalyst diagnostic test not active Traction control not active Fuel level > 10% 11 V < System voltage < 18 V <u>Rich Test</u> Closed loop fuel enabled 14.5 ≤ Air/Fuel ratio ≤ 14.8 15% ≤ TP ≤ 50 % Above conditions must be met for 2 secs <u>Rich in DFCO Test</u> Decel fuel cut-off mode enabled Above conditions must be met for 3 secs	<u>Rich Test</u> 950/1000 counts 10 counts/sec Continuous check <u>Rich in DFCO Test</u> 95/100 counts 10 counts/sec Runs during each occurrence of DFCO	DTC Type B
HO2S Circuit Insufficient Activity (bank 1 sensor 2)	P0140	This DTC determines if the O2 sensor or the O2 sensor circuit has developed an open.	425 mV < O2 sensor < 475 mV	No injector, MAF, ETC, TPS, evap, IAT, MAP, ECT, rear O2 heater circuit DTC's set Closed Loop Fuel Enabled Catalyst diagnostic test not active Traction control not active 11 V < System voltage < 18 V Engine run time > 200 secs Minimum 3 occurrences of a delta TP sensor > 1 % during diagnostic test	950/1000 counts 10 counts/sec Once per key cycle	DTC Type B

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HO2S Heater Circuit (bank 1 sensor 2)	P0141	This DTC determines if the O2 sensor heater is functioning properly by monitoring the current through the heater circuit.	RCOHT Learn Diagnostic Cold start 9.6 Ω > calculated heater resistance > 20.2 Ω Current Monitor Diagnostic 0.2 amps < heater current < 1.5 amps	No injector, MAF, ETC, TPS, evap, IAT, MAP, ECT, catmonDTC's set 11 V < System voltage < 18 V Traction control not active RCOHT Learn Diagnostic Engine Off Time > 10 hours -30°C < ECT < 40°C Delta between Coolant and IAT < 140°C Current Monitor Diagnostic Engine run time > 100 secs ECT > 70°C 1000 RPM < Engine speed < 2500 RPM 15 grams/sec < MAF < 30 grams/sec O2 heater overtemp control not active. Above conditions must be met for 1 sec	45/50 counts 10 counts/sec 2 tests per key cycle; 20 sec delay between tests	DTC Type B
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 ≥ 1.185 for at least 2 secs (Note: EWMA stands for "Exponentially Weighted Moving Average") Notes: At least 35 secs of data must accumulate on each trip before the EWMA of LTM samples is considered usable and at least 14 secs 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, O2 sensor, evap, injector, fuel temperature, fuel composition, IAC, MAF, MAP, ECT, EGR, AIR , TPS, TAC system DTCs 400 RPM < Engine speed <5700 RPM Baro > 74 kPa -7°C < ECT < 125 °C 15 kPa < MAP <85 kPa -7°C < IAT < 145°C 1.0 grams/sec < MAF < 511 grams/sec VSS < 82 MPH Closed loop fueling Long term fuel trim learning enabled Not in device control EGR flow diagnostic intrusive test = Not Active Catalyst monitor intrusive test = Not Active Post O2 diagnostic intrusive test = Not Active Evap diagnostic is at any stage except the "tank pull down" portion of the test Fuel Level > 10 % (must be < 10% for at least 30 secs to disable; default is to enable if fuel sender is broken)	20 test failures Continuous check 100 msec loop	DTC Type B

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Fuel System Too Rich Bank 1	P0172	Determines if the fuel control system is in a rich condition.	The EWMA of long term fuel trim (LTM) samples < 0.85 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 < 0.85 for at least 7 secs during each of 3 intrusive segments. General Notes: 1. At least 35 secs of data must accumulate on each trip before the EWMA of LTM samples is considered usable and at least 14 secs 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: Segments can last up to 35 secs, and are separated by the smaller of a 30 sec purge-on time or enough time to purge 18 grams of vapor. A maximum of 5 completed segments are allowed for each intrusive test, and up to 30 intrusive attempts allowed per trip. After an intrusive test report is completed, another intrusive test cannot occur for 1200 secs to allow sufficient time to purge excess vapors from the canister. During this period, fuel trim will pass if the EWMA of LTM samples > 0.85 for at least 60 secs, indicating that the canister has been purged. Performing intrusive tests too frequently may also affect Evap and FTP emissions, and the execution frequency of other diagnostics.	No misfire, O2 sensor, evap, injector, fuel temperature, fuel composition, IAC, MAF, MAP, ECT, EGR, AIR , TPS, TAC system DTCs 400 RPM < Engine speed < 5700 RPM Baro > 74 kPa -7°C < ECT < 125°C 15 kPa > MAP < 85 kPa -7 °C < IAT < 145°C grams/sec < MAF < 511 grams/sec VSS < 82 MPH Closed loop fueling Long term fuel trim learning enabled Not in device control EGR flow diagnostic intrusive test = Not Active Catalyst monitor intrusive test = Not Active Post O2 diagnostic intrusive test = Not Active Evap diagnostic is at any stage except the “tank pull down” portion of the test Fuel Level > 10 % (must be < 10% for at least 30 secs to disable; default is to enable if fuel sender is broken) <u>Intrusive Enable Criteria</u> The EWMA LTM samples < 0.86 Engine speed > 400 RPM 2 grams/sec < MAF < 512 grams/sec 15 kPa < MAP <85 kPa <u>Temporary Intrusive Test Inhibit Criteria</u> If intrusive test segment exceeds 35 consecutive secs (in this case, purge valve is opened for the smaller of 30 secs or enough time to purge 18 grams vapor before attempting additional intrusive segments)	If rich fail counter is ≥ 3 before pass counter ≥ 3, diagnostic fails Continuous check 100 msec loop	DTC Type B
Fuel Injector 1 Control Circuit	P0201	Detects fuel injector circuit continuity	Injector driver feedback indication = fault	System voltage > 11 V for 5 secs	10/20 counts 4 counts/sec Continuous check	DTC Type B

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Fuel Injector 2 Control Circuit	P0202	Detects fuel injector circuit continuity	Injector driver feedback indication = fault	System voltage > 11 V for 5 secs	10/20 counts 4 counts/sec Continuous check	DTC Type B
Fuel Injector 3 Control Circuit	P0203	Detects fuel injector circuit continuity	Injector driver feedback indication = fault	System voltage > 11 V for 5 secs	10/20 counts 4 counts/sec Continuous check	DTC Type B
Fuel Injector 4 Control Circuit	P0204	Detects fuel injector circuit continuity	Injector driver feedback indication = fault	System voltage > 11 V for 5 secs	10/20 counts 4 counts/sec Continuous check	DTC Type B
Fuel Injector 5 Control Circuit	P0205	Detects fuel injector circuit continuity	Injector driver feedback indication = fault	System voltage > 11 V for 5 secs	10/20 counts 4 counts/sec Continuous check	DTC Type B
Throttle Position (TP) Sensor 2 Circuit	P0220	Detects a continuous or intermittent short or open in TP sensor #2 circuit	0.275 V > TPS > 4.725 V	Ignition in Unlock/accessory, run, crank System voltage > 5.23 V No PCM processor, 5 V reference DTCs	15/35 counts ; 10 counts continuous; 12.5 msec /count in the motor processor	DTC Type A
Fuel Pump Relay Circuit Fault	P0230	Checks the fuel pump relay circuit for electrical integrity	Output state invalid		10/12 counts 10 counts/sec Continuous check	DTC Type B

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Random Misfire Detected Cylinder 1 Misfire Cylinder 2 Misfire Cylinder 3 Misfire Cylinder 4 Misfire Cylinder 5 Misfire	P0300 P0301 P0302 P0303 P0304 P0305	Determine if a random misfire 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% misfire Catalyst Damage Threshold = 5% - 18% misfiredepending on engine speed and engine load.	Engine run time > 1 engine cycle No VSS, crank, TPS, MAP, ECT, MAF, ETC, PCM, cam, fuel sensing, throttle actuator, IAT DTCs Crankshaft position system variation must be learned or engine speed < 1000 RPM. Fuel cutoff not active Power management is not active Brake torque management not active Drag Control not active: N/A Fuel level > 2.5%. Disablement ends 88 engine cycles 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 disable until ECT > 21°C 450 RPM < Engine speed < 6200 RPM 9 V < System voltage < 18 V + TP delta < 20% per 100 msec - TP delta < 20% per 100 msec Abnormal engine speed is not present Excess engine acceleration is not present No rough road TCS is not active Positive and zero torque. Detectable engine speed and engine load region EGR intrusive test not active: N/A AIR intrusive test not active: N/A Cam sensor is in sync with crank sensor. Misfire diagnostic is not requesting to disable TCC when transmission is in hot mode Crankshaft ring filter inactive (after a low level misfire, another misfire may not be detectable until crankshaft ringing ceases)	Emission Exceedence = 5 failed 200 revolution blocks of 16. Failure reported with 1 exceedence in first 16*200 revolution block, or 4 exceedences thereafter 1st Catalyst Exceedence = Number of 200 revolution blocks as data supports for catalyst damage. 2nd and subsequent Catalyst Exceedences = 1 200 revolution block with catalyst damage. Failure reported with 3 exceedences in FTP, or 1 exceedence outside FTP. Frequency: Continuous	DTC Type B
Crankshaft Position System Variation Not Learned	P0315	Determine if the crankshaft position system variation has not been learned	Sum of compensation factors between 163709 and 163971	PCM state = Run Manufacturers enable counter must be 0	0.5 sec 100msec loop Continuous check	DTC Type A
Knock Sensor Circuit	P0325	Checks for knock sensor rationality	Knock sensor average voltage > 4.9 V or < 0.01 V	Engine speed > 1800 RPM Air per Cylinder (load) > 65 grams	60/80 counts 10 counts/sec Continuous check	DTC Type B
Knock Sensor Circuit Excessive Spark Retard	P0326	Checks for knock sensor performance	Knock total retard ≥ a value that is a function of MAP and RPM	Knock detection = Enabled Engine speed > 1800 RPM MAP > 55 kPa	60/80 counts 10 counts/sec Continuous check	DTC Type B

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Knock Sensor Circuit Low Voltage – Bank 1	P0327	Checks for knock sensor range	Knock sensor max cylinder voltage – min cylinder voltage < 0.0586V	Engine speed > 1800 RPM Air per Cylinder (load) > 65 grams	79/80 counts 10 counts/sec Continuous check	DTC Type B
Knock Sensor Circuit Low Voltage – Bank 2	P0332	Checks for knock sensor range	Knock sensor max cylinder voltage – min cylinder voltage < 0.0586V	Engine speed > 1800 RPM Air per Cylinder (load) > 65 g	60/80 counts 10 counts/sec Continuous check	DTC Type B
Crankshaft Position Sensor-A Circuit	P0335	Crank Sensor Event Test Incorrect number of crank sensor pulses in a given number of cam sensor pulses Crank Time Without Match Test Excessive time without crank sensor match	Crank Sensor Event Test 90 > number of crank pulses > 110 Crank Time Without Match Test See 'TIME LENGTH AND FREQUENCY' column	Crank Sensor Event Test IF[(Engine_Running = TRUE OR Engine_Cranking = TRUE) AND (Primary_Cam_Sync_Flag = CAM_SIDE OR Primary_Cam_Sync_Flag = CAM_CYLINDER) AND PRIMARY_CAM_TYPE ≠ CSI_CAM) AND Fault_Active[Primary_Cam-Ckt] = FALSE AND Fault_Active[Primary_Cam-Perf] = FALSE] THEN Enable diagnostic ELSE Disable diagnostic ENDIF Crank Time Without Match Test IF[(Engine_Running = TRUE OR Engine_Cranking = TRUE) AND (Engine_Speed_Defaulted < 2000 RPM) AND { (Cranking_Motor_Is_Engaged = TRUE AND MAF ≥ 0) OR (MAF ≥ 3) }] THEN Enable diagnostic ELSE Disable diagnostic ENDIF	Crank Sensor Event Test • One test = 10 cam sensor pulses • Fail report = 8/10 tests exceed malfunction criteria Crank Time Without Match Test • During engine crank = match has not occurred within the last 4 secs • During engine run = match has not occurred within the last 2 secs	DTC Type B
Crankshaft Position Sensor-A Performance	P0336	Detects an excessive number of crank sensor resyncs	See 'TIME LENGTH AND FREQUENCY' column	IF[Engine_Running = TRUE AND Engine Speed > 450 RPM] THEN Enable diagnostic ELSE Disable diagnostic ENDIF	20 crank resyncs occur within 25 secs	DTC Type B

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Camshaft Position Sensor-A Bank-1 Circuit	P0340	Detects cam sensor circuit malfunctions by monitoring for the absence of cam sensor pulses	See 'TIME LENGTH AND FREQUENCY' column	IF[MAF ≥ 0 AND [(Engine_Cranking = TRUE AND Cam_Sync_Flag ≠ CAM_CYLINDER) OR Engine_Running = TRUE]]
				THEN
				Enable diagnostic
				ELSE
				Disable diagnostic
				ENDIF
					1 cam pulse does not occur within 3 secs	DTC Type B

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Camshaft Position Sensor-A Bank-1 Performance	P0341	Detects cam sensor performance malfunctions by monitoring for the incorrect number of cam sensor pulses in a given number of crank sensor pulses	After Engine Start (slow event based)
			275 > cam sensor pulses > 325
			
			<u>Near Engine Start (fast event based)</u>
			2 > cam pulses > 4
				After Engine Start (slow event based)
				IF[{ (CAM_TYPE ≠ CSI AND) } AND
				CKP_MedRes_Active = TRUE AND
				Crank_Sync_Flag = Crank_In_Sync AND
				Fault_Active[CMP_Ckt] = FALSE AND
				Fault_Active[CKP_SnsrA_Ckt] = FALSE
				AND
				Fault_Active[CKP_SnsrA_Perf] = FALSE
				AND
				Fault_Active[CKP_SnsrB_Ckt] = FALSE
				AND
				Fault_Active[CKP_SnsrB_Perf] = FALSE
				AND
				Fault_Active[CKP_SnsrAB_Corr] = FALSE
				THEN
				Enable diagnostic
				ELSE
				Disable diagnostic
				ENDIF
				
				<u>Near Engine Start (fast event based)</u>
				IF[MedRes_CKP_Counter ≤ 10 AND
				CKP_MedRes_Active = TRUE AND
				Crank_Sync_Flag = Crank_In_Sync AND
				CAM_TYPE ≠ CSI_CAM AND
				Fault_Active[CMP-Ckt] = FALSE]
				THEN
				ENABLE DIAGNOSTIC
				ELSE
				DISABLE DIAGNOSTIC
				ENDIF
				
				Footnote: the crank MedRes counter increments when the diagnostic is enabled and counts the number of crank MedRes software interrupts. ECM throughput prohibits interrupting on every crank sensor pulse. Typical crank MedRes software interrupts occur twice per cylinder, but varies in each engine.
					After Engine Start
					One Test = 1000 MedRes software interrupts
					
					8 failed tests out of the last 10 tests
					
					Near Engine Start
					One Test = 10 MedRes software interrupts
					
					Fail Report = 1 failed test
						DTC Type B

Ignition Coil 1 Control Circuit	P0351	Checks the ignition coil control circuit for electrical integrity	Output state invalid	Ignition 1 is powered	30 failures for 100 cylinder events	DTC Type B
Ignition Coil 2 Control Circuit	P0352	Checks the ignition coil control circuit for electrical integrity	Output state invalid	Ignition 1 is powered	30 failures for 100 cylinder events	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
Ignition Coil 3 Control Circuit	P0353	Checks the ignition coil control circuit for electrical integrity	Output state invalid	Ignition 1 is powered	30 failures for 100 cylinder events	DTC Type B
Ignition Coil 4 Control Circuit	P0354	Checks the ignition coil control circuit for electrical integrity	Output state invalid	Ignition 1 is powered	30 failures for 100 cylinder events	DTC Type B
Ignition Coil 5 Control Circuit	P0355	Checks the ignition coil control circuit for electrical integrity	Output state invalid	Ignition 1 is powered	30 failures for 100 cylinder events	DTC Type B

Camshaft Position Sensor-B Bank-1 Circuit	P0365	Detects cam sensor circuit malfunctions by monitoring for the absence of cam sensor pulses	See 'TIME LENGTH AND FREQUENCY' column	IF[MAF ≥ 0 AND
				[(Engine_Cranking = TRUE AND
				Cam_Sync_Flag ≠ CAM_CYLINDER) OR
				Engine_Running = TRUE]]
				THEN
				Enable diagnostic
				ELSE
				Disable diagnostic
				ENDIF
					5 cam pulses do not occur within 3 secs	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 Sensor-B Bank-1 Performance	P0366	Detects cam sensor performance malfunctions by monitoring for the incorrect number of cam sensor pulses in a given number of crank sensor pulses	After Engine Start (slow event based)
			475 > cam sensor pulses > 525
			
			<u>Near Engine Start (fast event based)</u>
			4 > cam pulses > 6
				After Engine Start (slow event based)
				IF[{ (CAM_TYPE ≠ CSI AND) } AND
				CKP_MedRes_Active = TRUE AND
				Crank_Sync_Flag = Crank_In_Sync AND
				Fault_Active[CMP_Ckt] = FALSE AND
				Fault_Active[CKP_SnsrA_Ckt] = FALSE
				AND
				Fault_Active[CKP_SnsrA_Perf] = FALSE
				AND
				Fault_Active[CKP_SnsrB_Ckt] = FALSE
				AND
				Fault_Active[CKP_SnsrB_Perf] = FALSE
				AND
				Fault_Active[CKP_SnsrAB_Corr] = FALSE
				THEN
				Enable diagnostic
				ELSE
				Disable diagnostic
				ENDIF
				
				<u>Near Engine Start (fast event based)</u>
				IF[MedRes_CKP_Counter ≤ 10 AND
				CKP_MedRes_Active = TRUE AND
				Crank_Sync_Flag = Crank_In_Sync AND
				CAM_TYPE ≠ CSI_CAM AND
				Fault_Active[CMP-Ckt] = FALSE]
				THEN
				ENABLE DIAGNOSTIC
				ELSE
				DISABLE DIAGNOSTIC
				ENDIF
				
				Footnote: the crank MedRes counter increments when the diagnostic is enabled and counts the number of crank MedRes software interrupts. ECM throughput prohibits interrupting on every crank sensor pulse. Typical crank MedRes software interrupts occur twice per cylinder, but varies in each engine.
					After Engine Start
					One Test = 1000 MedRes software interrupts
					
					8 failed tests out of the last 10 tests
					
					Near Engine Start
					One Test = 10 MedRes software interrupts
					
					Fail Report = 1 failed test
						DTC Type B

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Catalyst Low Efficiency - Bank 1	P0420	Oxygen Storage	OSC Time Difference ≥ 0.11 sec OSC Time Difference = OSC Worst Pass Thresh – OSC Compensation Factor * (Post Cat O2 Resp Time - Pre Cat O2 Resp Time) OSC Worst Pass Thresh = 1.5 sec	Trip Enable Criteria No misfire, cam, ECT, VSS, fuel trim, TPS, IAC, MAP, IAT, MAF, O2 sensor, evap, crank, idle system DTCs Valid Idle Period Criteria Engine speed ≥ 900 RPM for minimum of 45 secs since end of last idle period Engine run time ≥ 600 secs VSS ≤ 4 MPH Test Enable Conditions Closed loop fuel control Fan clutch is stable A/C clutch is stable No other intrusive diagnostics running 475 °C ≤ Predicted catalyst temperature ≤ 700°C Baro ≥ 72 kPa -20°C < IAT< 80°C 69°C ≤ ECT ≤ 125°C System voltage > 9 V 0 < Idle time ≤ 60 sec: idle Time is incremented if: VSS < 4 mph and TP (without IAC) ≤ 5 % 2 grams/sec ≤ MAF ≤ 12 grams/sec Delta TP (with IAC) ≤ 15 % Load Change ≤ 6.5 % 0.85 ≤ Short term integrator multiplier ≤ 1.15 Delta engine speed ≤ 80 RPM HO2S (bank1 sensor1) RtoL+LtoR transitions (450mv transition pt.) ≥ 4 Engine speed (Actual-Desired) ≤ 150 RPM Engine speed (Desired-Actual) ≤ 100 RPM CCP DC multiplier ≤ 1 Fuel ethanol percent ≤ NA Tests attempted this idle period < 1 Green Converter Delay Criteria Predicted catalyst temperature ≥ 500°C for 3600 secs (non-continuously) when vehicle is new. The diagnostic will not be enabled until the next ignition cycle after this criterion has been met. In addition, all other enable criteria must be met on the next ignition cycle for the test to run on that ignition cycle. Note: This feature is only enabled when the vehicle is new and cannot be enabled in service. Rapid Step Response Enable Criteria OSC Time Difference Step ≥ 0.370 sec OSC Time Difference ≥ 0 sec	1 test attempted per valid idle period Minimum of 1 test per trip Rapid Step Response Maximum of 6 tests per trip Maximum of 18 tests to detect failure when Rapid Step Response is enabled Frequency: 12.5 msec	DTC Type A (EWMA)

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Evap Emission System Leak Detection (Small Leak)	P0442	This DTC will detect a small leak (>= 0.020") in the Evap system between the fuel fill cap and the purge solenoid. The DTC will also be set if the fuel tank vacuum sensor is out of range when it tries to re-zero prior to test phase-1 or test phase-2 of the EONV test. The DTC will also be set if the refueling rationality test during EONV is failed.	Small Leak Test Fail Engine Off Natural Vacuum (EONV) The total pressure change achieved during the test is normalized against a target value = 1.5" water. 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 = 0.630 Re-Pass threshold = 0.45 Vacuum sensor out of range <1.2 V or >1.8 V: vacuum sensor out of range is reported as a perfect fail to the EWMA	Test Enable No VSS, ECT, IAT, evap vacuum, CCP stuck open, evap large leak. ignition off timer DTCs 15% < Fuel level < 85% No fuel filling during EONV • Increase of fuel level of 10% • Increase of tank pressure of 1 inch of H_2O per second • Maximum tank pressure of 3 inches of H_2O while engine is running and vent is open Valid Cold Start 4°C < ECT < 30°C 4°C < IAT < 30°C ECT-IAT< 8°C Baro > 74.0 kPa Estimated ambient temperature at end of drive > 2°C but < 32°C Drive time >= 10 minutes Drive length >= 5 km Coolant >= 70°C No fuel filling (fuel level increment >= 10%)	Once per cold start, during hot soak up to 2500 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
Canister Purge Circuit Fault	P0443	This DTC checks the canister purge solenoid circuit for electrical integrity	Output state invalid		100/120 counts 10 counts/sec Continuous check	DTC Type B
Evap Emission Control System - Vent Control Malfunction	P0446	This DTC will determine if a restriction is present in the vent solenoid, vent filter, vent hose or canister.	Excess Vacuum Test Vent solenoid commanded open Fuel Tank Vacuum $\geq$ 10 inches of H_2O for 2 seconds as monitored during initial purge ramp Cold Start Key-Up Test Vented Vacuum =< -2.5 inches of H_2O or Vented Vacuum => 5.0 inches of H_20 for 3 secs after cold-start key-up	Test Enable No MAP, voltage, TPS, VSS, ECT, O2 sensor, IAT DTCs 15% < Fuel level < 85% 11 V < System voltage < 18 V Cold Start Test 4°C < ECT < 30°C 4°C < IAT < 30°C ECT-IAT< 8°C Baro > 74.0 kPa	Test must complete within 780 secs from when vehicle is started Excess Vacuum Test – Stage II 180 secs Once per cold start	DTC Type B
Fuel Tank Vent Circuit Fault	P0449	This DTC checks the fuel tank vent solenoid circuit for electrical integrity	Output state invalid		100/120 counts 10 counts/sec Continuous check	DTC Type B
Evap Fuel Tank Pressure Sensor Circuit Low Voltage	P0452	This DTC will detect a vacuum sensor stuck low	Tank vacuum raw voltage < 0.1 V for 5 secs	1 sec delay after ignition on	Continuous check	DTC Type B

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Evap Fuel Tank Pressure Sensor Circuit High Voltage	P0453	This DTC will detect a vacuum sensor stuck high	Tank vacuum raw voltage >4.9 V for 5 secs	1 sec delay after ignition on	Continuous check	DTC Type B
Evap Emission Control System – Malfunction	P0455	This DTC will detect a weak vacuum condition (large leak or purge restriction) in the Evap system	Weak Vacuum Test- Stage I (Cold) Tank vacuum < 8 inches of H_2O after the displaced purge volume has reached 6 liters. Weak Vacuum Test- Stage II (Warm) Stage I test failed previous trip and this trip Passes if Tank vacuum > 8 inches of H_2O for 5 secs Note: Stage II can only report a pass	Test Enable No MAP, voltage, TPS, VSS, ECT, O2 sensor, IAT DTCs 15% < Fuel level < 85% 11 V < System voltage < 18 V Power-up Vacuum Test Fail = False Cold Start Test 4°C < ECT < 30°C 4°C < IAT < 30°C ECT-IAT< 8°C Baro > 74.0 kPa	Weak Vacuum Test- Stage I: Test must complete within 780 secs after the vehicle is started Weak Vacuum Test- Stage II: Fault present for a time ≥ 600 secs; this is the maximum test time length. Once per cold start	DTC Type B
Fuel Level Sensor Circuit Performance	P0461	Fuel sender rationality check	Fuel level delta < 2 liters within 60 km		Continuous check	DTC Type C
Fuel Level Sensor Circuit Low Input	P0462	Detects a fuel sender failed to a low voltage level	Output voltage amplitude < 0.5 V	11 V< System voltage < 18 V	10 secs 12.5 msec loop Continuous check	DTC Type C
Fuel Level Sensor Circuit High Input	P0463	Detects a fuel sender failed to a high voltage level	Output voltage amplitude > 2.9 V	11 V< System voltage < 18 V	10 secs 12.5 msec loop Continuous check	DTC Type C
Evap. Emission Control System - Continuous Open Purge Flow	P0496	Determines if the purge solenoid is leaking to engine manifold vacuum.	Purge Valve Leak Test Purge valve closed Fuel Tank Vacuum > 4.5 – 6 inches of H_2O for 5 secs before purge time > 60 sec s (Fuel Tank Vacuum level dependent on fuel level)	Test Enable No MAP, voltage, TPS, VSS, ECT, O2 sensor, IAT DTCs 15% < Fuel level < 85% 11 V < System voltage < 18 V Power-up Vacuum Test Fail = False Cold Start Test 4°C < ECT < 30°C 4°C < IAT < 30°C ECT-IAT< 8°C Baro > 74.0 kPa	Once per trip Max engine run time is 65 secs	DTC Type B

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VSS Circuit No Activity (Manual transmission)	P0502	Detects the lack of activity on the VSS circuit	Transmission output speed ≤ 50 RPM (This corresponds to a vehicle speed of less than 1.3 MPH for a 3.42 axle ratio and the smallest tire) (This corresponds to a vehicle speed of less than 0.924 MPH when using a 4.10 axle ratio and the largest tire)	TP ≥ 12 % 8 V < System voltage < 18 V 1500 RPM < Engine speed < 5000 RPM None of the following DTCs set: P0503, P0716, P0717	3 seconds Continuous check	DTC Type B
VSS Circuit Intermittent (Manual Transmission)	P0503	Detects an intermittent fault on the VSS circuit	Transmission output speed must drop by 1500 RPM in 0.5 secs	Engine running Time since the last gear change > 6 secs Transmission not in P/N No Input speed sensor or trans range malfunctions DTC's	25 msec loop	DTC Type B
Idle System Low	P0506	Functional check of idle speed	Idle RPM > 75 RPM below desired RPM based on coolant temperature	General Test Enable No VSS DTC's 11 < System voltage < 18 V IAT > -7 °C Baro > 75 kPa ECT > -7°C Engine run time > 5 secs Closed loop fueling enabled Idle test: General conditions met Idle conditions present > 2 secs Time since park/neutral state change > 3 secs Time since TCC mode change > 3 secs	3 failed tests required to set fault ; 5 secs per test Frequency: 250 msec Continuous check	DTC Type B
Idle System High	P0507	Functional check of idle speed	Idle RPM > 150 RPM above desired RPM based on coolant temperature	General Test Enable No VSS DTC's 11 < System voltage < 18 V IAT > -7 °C Baro > 75 kPa ECT > -7°C Engine run time > 22 secs Closed loop fueling enabled Idle test: General conditions met Idle conditions present > 2 secs Time since park/neutral state change > 3 secs Time since TCC mode change > 3 secs	1 failed test required to set fault ; 15 secs per test Frequency: 250 msec Continuous check	DTC Type A
PCM Memory	P0601	Checks for proper function of the PCM memory	Computed EPROM checksum not equal to expected		1 failure during the first execution; 5 failures thereafter Background loop Continuous check	DTC Type A

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PCM not Programmed	P0602	Checks for proper programmed state of the PCM	Calibration parameter not equal to expected value		1 failure Frequency 250 msec Continuous check	DTC Type A
PCM Memory - RAM	P0604	Checks for proper function of the PCM memory	Bad RAM location found		100 failures if found during first test in ignition cycle 2 failures if found during subsequent tests in the ignition cycle Continuous check	DTC Type A

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PCM Processor 1. Processor Performance Check - Throttle limiting Fault (motor processor) 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) 9. Processor Performance Check - MAIN state of health (motor processor)	P0606	Indicates that the ECM has detected an ETC internal processor integrity fault	1. Motor processor desired throttle limiting occurring 2. ETC software is not executed in proper order 3. Software tasks loops > schedule tasks loop 4. Loss of SPI communication from the motor processor 5. 1.5 msec < Average motor processor state of health toggle > 2.5 msec 6. TPS or APPS minimum learned values fail compliment check 7. TPS or APPS minimum learned values fail range check 8. Motor processor integrity check error occurs 9. Motor processor integrity check error of main processor occurs	Ignition in unlock/accessory, run or crank System voltage>5.23 V	1. 99 counts continuous, 2 msec/count in the motor processor 2. 1 count continuous; 12.5 msec/count in the main processor 3. Error > 3 counts; 100 msec/count in the main processor 4. 160/400 counts or 15 counts continuous; 39 counts continuous @ initialization., 12.5 msec/count in the main processor 5. 3 counts continuous; 50 msec/count in the main processor 6. 100 msec in the main processor 7. 10 msec in the main processor 8. 4 counts continuous, 50 msec /count in the main processor 9. 2 count continuous, 12.5 msec/count in the main motor processor	DTC Type A

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5 Volt Reference 1 Circuit	P0641	Detects a continuous or intermittent short on the #1 5 V sensor reference circuit	Vref1 voltage -Vcc voltage > 0.125 V OR Vcc voltage -Vref1 voltage > 0.175 V	Ignition in unlock/accessory, run or crank System voltage > 5.23 V No ECM processor DTCs	20/40 counts or 200 msec continuous; 12.5 msec/count in main processor 125/250 counts or 99 counts continuous; 2 msec/count in motor processor	DTC Type A
Malfunction Indicator Lamp (MIL) Control Circuit	P0650	This DTC checks the malfunction indicator lamp circuit for electrical integrity	Output state invalid		100/120 counts 10 counts/sec Continuous check	DTC Type B
5 Volt Reference 2 Circuit	P0651	Detects a continuous or intermittent short on the #2 5 V sensor reference circuit	Vref2 voltage -Vcc voltage> 0.125 V OR Vcc voltage –Vref2 voltage > 0.175 V	Ignition in unlock/accessory, run or crank System voltage > 5.23 V No ECM processor DTCs	20/40 counts or 200 msec continuous; 12.5 msec/count in main processor 125/250 counts or 99 counts continuous; 2 msec/count in main processor	DTC Type A
Intake Rationality Cross-check Out of Range	P1101	This DTC determines if there are multiple air induction system problems affecting airflow and/or manifold pressure.	1. Filtered throttle error > 350 kPa grams/sec 2. Filtered manifold pressure 2 error > 20 kPa 3. [Filtered manifold pressure 1 error > 20 kPa or Filtered airflow error > 10 grams/sec]	No MAF circuit, MAP circuit, EGR, ECT circuit, IAT circuit, crank sensor DTCs 400 RPM < Engine speed 70°C < ECT < 125°C -7°C < IAT < 125°C	Immediate <u>Frequency:</u> 12.5 msec 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
HO2S Circuit Insufficient Switching (bank 1 sensor 1)	P1133	This DTC determines if the O2 sensor functioning properly by monitoring the number of L/R and R/L switches. Half cycle (HC) switch count is reported if a minimum number of slope time (ST) Switches are counted.	Slope Time L/R switches < 2 OR Slope Time R/L switches < 2 OR Half Cycle L/R switches < 60 to 80 depending on average airflow OR Half Cycle R/L switches < 60 to 80 depending on average airflow O2 voltage between 500 mV and 600 mV	No misfire, injector, MAF, ETC, TPS, evap, IAT, MAP, ECT DTC's set Catalyst diagnostic test not active Closed loop fuel enabled Traction control not active Fuel level > 10% 11 V < System voltage < 18 V Engine run time > 200 secs ECT > 70°C 1000 RPM < Engine speed < 3500 RPM 15 grams/sec < MAF < 50 grams/sec TP $\geq$ 5 % BLM cell number = 4, 5, 6, 8, 9, or 13 Transmission not in park, reverse or neutral Above conditions met for 2 secs	60 secs of response data after enable Once per key cycle	DTC Type B
Throttle Actuator Control (TAC) Module - Throttle Actuator Position Performance	P1516	1. Detect a throttle positioning error. 2. Detect a throttle positioning error. 3. Detect excessive current draw on the actuator circuit. 4. Determine if the actuator has been miswired.	|throttle error| >= |2%| after > 5 sec stability with no change in error sign, after 4 sec stable command. |throttle error| > 10% I(actuator) > 9A TPS1< 2.36V	1-3. Ignition in run or crank [RPM>0 or (RPM=0 and not in battery saver mode)]. No airflow actuation, throttle actuation DTCs Engine running = true or System voltage > 6.5 V 4. Minimum TPS learn active state	249 counts continuous; 2 msec/count in the motor processor 99 counts continuous; 2 msec/count in the motor processor 50 counts continuous; 2 msec/count in the motor processor 99 counts continuous; 2 msec/count in the motor processor	DTC Type A
A/C Clutch Relay Circuit Fault	P1545	Checks the A/C clutch relay circuit for electrical integrity	Output state invalid	Engine speed > 425 RPM	100/120 counts 10 counts/sec Continuous check	DTC Type B
PCM - EEPROM General Failure	P1621	Checks for a PCM non-volatile memory write error	Incorrect checksum	Ignition in unlock/accessory, run, or crank System voltage > 5.23 V	Immediately on next key up if flagged on previous key down Once at key down	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
Control Module Accelerator Pedal Position (APP) System Performance	P1680	1. Verify the PCM´s ability to detect a short between the APPS 1 & 2 circuits 2. Verify that the indicated accelerator pedal position calculation is correct	1. APPS #2 signal voltage > 2.05V 2. Difference between Main processor indicated accelerator pedal position and motor processor indicated accelerator pedal position > 0V	1. Ignitions in unlock/ accessory and run, not during TPS minimum learn active during intrusive portion of diagnostic execution System voltage > 5.23 V No PCM processor DTC 2. Ignition in unlock, accessory, run or crank System voltage > 5.23 V No PCM processor DTC	1. 2 counts; 156.25 msec w/immediate retest on an error, performed in the main processor 2. 99 counts continuous; 12.5 msec/count in the motor processor	DTC Type A
Control Module Throttle Position (TP) System Performance	P1681	1. Verify the PCM´s ability to detect a short between the TPS 1 & 2 circuits 2. Verify that the throttle control system position sensor short diagnostic is functioning	1. TPS #2 Signal voltage>2.05 V 2. No detection of the sensor short diagnostic active state	System voltage > 5.23 V No PCM processor DTC Ignition in unlock/accessory or run, not during TPS minimum learn active during intrusive portion of diagnostic execution	1. 2 counts; 156.25 msec w/immediate retest on an error, performed in the main processor 2. No sensor short diagnostic activity for 498 msec; detected by the motor 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
Control Module Throttle Actuator Position Performance	P2101	Detect a throttle positioning error	Difference between measured throttle position and modeled throttle position > 10%	Ignition in run or crank [RPM>0 or (RPM=0 and not in battery saver mode)] No airflow actuation, throttle actuation DTC.s Engine running or System voltage > 8 V	<u>Positive error counter</u> Increments by 3 if TP error > 10%; decrements by 2 if 0% < TP error< 10%; decrements by 2 if -10% < TP error < 0%; clears if TP error < -10%. <u>Negative error counter</u> Increments by 3 if TP error< -10%; decrements by 2 if -10%< TP error < 0%; decrements by 2 if 0% < TP error < 10%; clears if TP error > 10%. Thresholds are 45 Check runs every 12.5 msec in the main processor	DTC Type A
Accelerator Pedal Position (APP) Sensor 1	P2120	Detect a continuous or intermittent short or open in the APP sensor #1	0.75 V < Raw APP 1 < 4.65V	Ignition in unlock/accessory, run or crank System voltage >5.23 V No PCM processor, 5 V reference DTCs	1. 20/40 counts or 10 counts continuous; 12.5 msec/count in the main processor 2. 92/217 counts or 67 counts continuous; 2 msec/count in the motor 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
Accelerator Pedal Position (APP) Sensor 2 Circuit	P2125	Detect a continuous or intermittent short or open in the APP sensor #2	0.75 V < Raw APP 2 < 4.65V	Ignition in unlock/accessory, run or crank System voltage >5.23 V No PCM processor, 5 V reference DTCs	1. 15/35 counts or 10 counts continuous; 12.5 msec/count in the main processor 2. 92/217 counts or 67 counts continuous; 2 msec/count in the motor processor	DTC Type A
Throttle Position (TP) Sensor 1-2 Correlation	P2135	Detects a continuous or intermittent correlation fault between TP sensors #1 and #2	Difference between (raw min. learned TPS#1 voltage-raw min. TPS#1 voltage) and (raw TPS#2 voltage - raw min. learned TPS#2 voltage) < 5% offset at min. throttle position with an increasing to 10% at max. throttle position	Ignition in unlock/accessory, run or crank System voltage >5.23 V No PCM processor, TPS circuit DTCs	1. 15/35 counts or 12 counts continuous; 12.5 msec/count in the main processor 2. 92/217 counts or 67 counts continuous; 2 msec/count in the motor 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
Accelerator Pedal Position (APP) Sensor 1-2 Correlation	P2138	Detect an invalid minimum mechanical position correlation between APP sensor #1 and #2 Detect a short between APP sensors #1 and #2 circuits.	Difference between (5V-raw learned min. APPS#2 voltage)*2 and (raw learned min. APPS#1 voltage) > 0.25 V at min throttle position to 0.5 V at max throttle position Difference between APP#1 and APP#2 < 1 V	Ignition in unlock/accessory, run or crank System voltage >5.23 V No PCM processor, APP sensor, 5 V reference DTCs Ignition in unlock/accessory, run or crank System voltage >5.23 V No PCM processor DTCs	1. 15/35 counts or 12 counts continuous, 12.5 msec/count in the main processor 2. 92/217 counts or 80 counts continuous, 2 msec/count in the motor processor 3. 2 counts 156.25 msec w/ immediate test on an error, performed in the main processor	DTC Type A
Minimum Throttle Position Not Learned	P2176	TP minimum learning not completed	TPS > 0.82 V	Minimum TPS learn active state Stable throttle position reading for 40 msec Ignition in run or crank No TPS circuit DTCs	3 secs	DTC Type A
Control Module Ignition Off Timer Performance	P2610	Determines if the ignition off timer has failed	1. A failure will be reported if the following occurs 3 times: Ignition off time < 0 Or Ignition off time > 10 2. A failure will be reported if any of the following occur 15 times out of 20 tests: • Time since last ignition off timer increment > 1.39375 • Current ignition off time < Old ignition off time • Time between ignition off timer increments < 0.575 • Time between ignition off timer increments > 1.39375 • Current ignition off time - old ignition off Time =1	Test run this trip = FALSE Ignition off timer enabled = TRUE -40°C < IAT < 125°C	<u>Frequency</u> 100 msec loop Continuous check	DTC Type B