Catalyst and HO2S Layout

ITSW01111137-01

[A]:	Federal spec. model
[B]:	California spec. model

DTC Description / Detecting Condition / Confirmation Procedure

P0420

Refer to "DTC P0420: Catalyst System Efficiency below Threshold".

Catalyst Monitor

Operation

DTCs	P0420
Monitor execution	Once per driving cycle
Sensors / components OK	ECT, Primary HO2S heater, IAT, Fuel level sensor, BARO sensor, MAP sensor, VSS
Monitoring Duration	45 s

Enable conditions

Parameter	Minimum	Maximum
Engine coolant temp.	70 (158) °C (°F)	110 (230) °C (°F)
Intake air temp.	–10 (14) °C (°F)	70 (158) °C (°F)
Barometric pressure	560 mmHg	
Fuel level	15%	
Time from engine start	360 s	
Engine speed	1750 rpm (MT) 1700 rpm (AT)	3000 rpm (MT) 3500 rpm (AT)
Calculated MAF	4.0 g/s	12 g/s
Fuel system status	Closed loop mode	
Catalyst	Warmed-up	

Typical malfunction thresholds

Delay of rear oxygen sensor response > 688 – 844 ms (According to Calculated MAF)

MODE $06 Data

Self diagnostic test item	Test value		Description	Scaling
	TID	CID		
Three-way catalyst Function (P0420)	$02	$00	Response time	*8.19/256 msec
	$02	$10	Counter of secondary HO2S voltage change	*1/256 times

OBD System Description - Misfire Monitor

SWSW011111010 (03(01)

System Description / Monitoring Procedure

ECM (PCM) measures the angle speed of the crankshaft based on the pulse signal from the CKP sensor and CMP sensor for each cylinder. If it detects a large change in the angle speed of the crankshaft, it concludes occurrence of a misfire. When the number of misfire is counted by the ECM (PCM) beyond the DTC detecting condition, it determines the cylinder where the misfire occurred and outputs it as DTC.

DTC Description / Detecting Condition / Confirmation Procedure

P0300, P0301, P0302, P0303

Refer to "DTC P0300 / P0301 / P0302 / P0303: Random Misfire (Misfire Detected at 2 or More Cylinders) / Cylinder 1 Misfire / Cylinder 2 Misfire / Cylinder 3 Misfire Detected".

Misfire Monitor

Operation

DTCs	P0300, P0301, P0302, P0303
Monitor execution	Continuous

Enable conditions

Parameter	Minimum	Maximum
Engine coolant temp.	70 (158) °C (°F)	110 (230) °C (°F)
Intake air temp.	–10 (14) °C (°F)	70 (158) °C (°F)
Barometric pressure	560 mmHg	
Calculated MAF		30 g/s
Fuel level		85%
Purge accumulation time	200 s	
Fuel system status	Closed loop mode	

Typical malfunction thresholds

P0440
Tank pressure change during depressurized condition > 7.4 – 12.5 mmHg (According to Fuel Level)
P0455
Tank pressure during depressurizing > –15 mmHg

MODE $06 Data

Self diagnostic test item	Test value		Description	Scaling
	TID	CID		
EVAP Control System (P0440 / P0455)	$04	$00	Differential rising pressure	*125/256/256 – 62.5 mmHg
	$04	$10	Tank pressure	*125/256/256 – 62.5 mmHg
	$04	$11	Tank pressure	*125/256/256 – 62.5 mmHg
	$04	$20	Tank pressure	*125/256/256 – 62.5 mmHg
	$04	$30	Differential pressure	*125/256/256 – 62.5 mmHg
	$04	$40	Differential pressure	*125/256/256 – 62.5 mmHg
	$04	$41	Change of fuel level	*50/256/256 L

OBD System Description - Fuel System Monitor

SWSW011111012 (03(01)

System Description / Monitoring Procedure

The fuel system is equipped with fuel trim circuitry which includes short-term and long-term fuel trim. Short-term fuel trim is instantaneous feedback adjustment to maintain air-fuel ratio at its theoretical value. Long-term fuel trim is more gradual adjustment than short-term fuel trim to compensate continuous deviation from central value of the short-term fuel trim due to changing of the usage environment and aging of the engine.
The ECM monitors continuously the short-term and long-term fuel trim values whether the values are out of the specification limit.

DTC Description / Detecting Condition / Confirmation Procedure

P0171, P0172

Refer to “DTC P0171 / P0172: Fuel System Too Lean / Rich”.

Fuel System Monitor

Operation

DTCs	P0171, P0172
Monitor execution	Continuous
Sensors / components OK	IAT, ECT, Fuel level sensor, BARO
Monitoring Duration	30 s

Enable conditions

Parameter	Minimum	Maximum
Intake air temp.	–10 (14) °C (°F)	
Barometric pressure	560 mmHg	
Fuel level	15%	
Fuel system status	Closed loop mode	

Typical malfunction thresholds

P0171: Long + short term > 30 – 35%, short term > 20%
P0172: Long + short term < –34 – –30%, short term < –20%

Enable conditions

Parameter	Minimum	Maximum
Intake air temp.	–10 (14) °C (°F)	70 (158) °C (°F)
Barometric pressure	560 mmHg	
Fuel level	15%	
Preconditioning drive	20 s (at > 32 km/h)	
Fuel system status	Idle with closed loop mode	

Typical malfunction thresholds

P0131: Min. voltage > 0.3 V
P0132: Max voltage < 0.6 V

Secondary HO2S Circuit Monitor

Operation

DTCs	P0136
Monitor execution	Once per driving cycle
Sensors / components OK	ECT, IAT, MAP, Fuel level sensor, BARO sensor, Primary HO2S, Secondary HO2S heater
Monitoring Duration	Min. 5 min (phase 1) / 10 s (phase 2)

Enable conditions

Parameter	Minimum	Maximum
Phase 1		
Intake air temp.	–10 (14) °C (°F)	70 (158) °C (°F)
Barometric pressure	560 mmHg	
Fuel level	15%	
Engine speed	1000 rpm	
Driving counter	5 times (2 – 32 km/h)	
Heater operative time	60 s	
Fuel system status	Closed loop mode	
MAP	Steady state value	
Phase 2		
Heater operative time	60 s	

Typical malfunction thresholds

Phase 1: Maximum voltage < 0.49 V, Minimum voltage > 0.41 V
Phase 2: Pull-up voltage > 4.5 V

MODE $06 Data

Self diagnostic test item	Test value TID	Test value CID	Description	Scaling
O2S 1 circuit low volt (P0131)	$06	$00	Minimum voltage	*5/256/256 V
O2S 1 circuit high volt (P0132)	$06	$01	Maximum voltage	*5/256/256 V
Slow response (P0133)	$06	$02	Min switch time for rich to lean	*8.19/256 msec
	$06	$03	Min switch time for lean to rich	*8.19/256 msec
	$06	$04	Mean period of feed back	*32.76/256 msec
No activity detect (P0134)	$07	$00	Count of irregular volt detected	*1/256 times
	$07	$01	Count of irregular volt detected	*1/256 times
O2S 2 circuit volt (P0136)	$09	$00	Minimum terminal voltage	*5/256/256 V
	$09	$01	Maximum voltage	*5/256/256 V
	$09	$02	Time of irregular volt detected	*1.049/256 S

OBD System Description - HO2S Heater Monitor

SWSW011111014 (03(01)

System Description / Monitoring Procedure

For both HO2S–1 and –2 heaters, the system monitors proper current and loaded voltage.

DTC Description / Detecting Condition / Confirmation Procedure

P0135

Refer to "DTC P0135: Heated Oxygen Sensor (HO2S) Heater Circuit Malfunction (Sensor-1)".

P0141

Refer to "DTC P0141: Heated Oxygen Sensor (HO2S) Heater Circuit Malfunction (Sensor-2)".

Primary HO2S Heater Monitor

Operation

DTCs	P0135
Monitor execution	Continuous
Monitoring Duration	5 s

Enable conditions

Parameter	Minimum	Maximum
Phase 1 (Heater resistance)		
Heater control	Off	
Phase 2 (Circuit continuity)		
Heater control	On	

Typical malfunction thresholds

Phase 1: Resistor voltage < 2.5 V
Phase 2: Resistor voltage > 0.488 V

Secondary HO2S Heater Monitor

Operation

DTCs	P0141
Monitor execution	Continuous
Monitoring Duration	5 s

Enable conditions

Parameter	Minimum	Maximum
Phase 1 (Heater resistance)		
Heater control	Off	
Phase 2 (Circuit continuity)		
Heater control	On	

Typical malfunction thresholds

Phase 1: Resistor voltage < 2.5 V
Phase 2: Resistor voltage > 0.488 V

MODE $06 Data

Self diagnostic test item (related DTC)	Test value TID	Test value CID	Description	Scaling
O2S 1 heater circuit malfunction (P0135)	$0B	$00	Heater voltage at heater on	*5/256/256 V
	$0B	$10	Heater voltage at heater off	*5/256/256 V
	$0B	$20	Heater voltage at heater on	*5/256/256 V
	$0B	$21	Heater voltage at heater off	*5/256/256 V
O2S 2 heater circuit malfunction (P0141)	$0C	$00	Heater voltage at heater on	*5/256/256 V
	$0C	$10	Heater voltage at heater off	*5/256/256 V
	$0C	$20	Heater voltage at heater on	*5/256/256 V
	$0C	$21	Heater voltage at heater off	*5/256/256 V

OBD System Description - EGR System Monitor

SWSW011111015 (03(01)

System Description / Monitoring Procedure

The EGR system consists of an EGR valve, an EGR pressure transducer, and an EGR solenoid vacuum valve. To detect EGR system malfunction, a MAP sensor and an EGR solenoid vacuum valve (for system check) are added to the EGR system.

The intake pressure changes are measured by two kinds of procedure. One method is the measuring of the pressure change during the steady state condition switching the EGR solenoid vacuum valve on and off to detect entire system leak. Another method is the measuring of the pressure change during deceleration condition switching the EGR solenoid vacuum valve (for system check) on and off to detect EGR valve failure.

EGR System Monitoring System

ITSW01111140-01

DTC Description / Detecting Condition / Confirmation Procedure

P0400

Refer to “DTC P0400: Exhaust Gas Recirculation Flow Malfunction”.

EGR System Monitor

Operation

DTCs	P0400
Monitor execution	Once per driving cycle
Monitoring Duration	1.5 s (phase 1) / 1 s (phase 2)

Enable conditions

Parameter	Minimum	Maximum
Phase 1 (Functional check)		
Engine coolant temp.	70 (158) °C (°F)	110 (230) °C (°F)
Intake air temp.	–10 (14) °C (°F)	70 (158) °C (°F)
Barometric pressure	560 mmHg	
Engine speed	2000 rpm	2800 rpm
Vehicle speed	32 km/h	
TP change		0.244 ° / 16 firings
Time from engine start	230 s	
EGR system status	EGR control mode	
Phase 2 (EGR valve flow check)		
Engine coolant temp.	70 (158) °C (°F)	110 (230) °C (°F)
Intake air temp.	–10 (14) °C (°F)	70 (158) °C (°F)
Barometric pressure	560 mmHg	
Engine speed	1700 rpm	3000 rpm
Vehicle speed	32 km/h	
Time from engine start	290 s	
Fuel system status	Fuel shut off mode	

Typical malfunction thresholds

Phase 1
Insufficient EGR Flow: 0 – 7.0 mmHg (According to Engine Speed (rpm))
Excessive EGR Flow: 45 – 75 mmHg (According to Engine Speed (rpm))
Phase 2
Insufficient EGR Flow: 10.8 – 23.4 mmHg (According to Engine Speed (rpm))
Excessive EGR Flow: 95 – 220 mmHg (According to Engine Speed (rpm))

MODE $06 Data

Self diagnostic test item (related DTC)	Test value		Description	Scaling
	TID	CID		
EGR (P0400)	$0E	$00	Counter of low EGR flow	*1/256 times
	$0E	$10	Counter of high EGR flow	*1/256 times
	$0E	$20	Differential pressure	*1250/256/256 mmHg
	$0E	$20	Differential pressure	*1250/256/256 mmHg
EGR (P0400)	$0F	$00	Differential pressure	*1250/256/256 mmHg
	$0F	$00	Differential pressure	*1250/256/256 mmHg

OBD System Description - Comprehensive Component (Engine Input) Monitor

SWSW011111016 (03(01)