

## FAIL-SAFE CHART

If any of the following codes are recorded, the ECM enters fail-safe mode.

DTC No.	Fail-Safe Operation	Fail Safe Deactivation Condition
P0031 P0032 P0037 P0038 P0051 P0052 P0057 P0058	Turn off heater	Ignition switch OFF
P0100 P0102 P0103	Ignition timing is calculated from engine RPM and TP (Throttle Position)	"Pass" condition detected
P0110 P0112 P0113	IAT (Intake Air Temperature) is fixed at 20°C (68°F)	"Pass" condition detected
P0115 P0117 P0118	ECT (Engine Coolant Temperature) is fixed at 80°C (176°F)	"Pass" condition detected
P0120 P0121 P0122 P0123 P0220 P0222 P0223 P0604 P0606 P0607 P0657 P2102 P2103 P2111 P2112 P2118 P2119 P2135	If the Electronic Throttle Control System (ETCS) has a malfunction, the ECM cuts off current to the throttle actuator. The throttle control valve returns to a predetermined opening angle (approximately 16°) by the force of the return spring. The ECM then adjusts the engine output by controlling the fuel injection (intermittent fuel-cut) and ignition timing in accordance with the accelerator pedal opening angle to enable the vehicle to continue at a minimal speed. If the accelerator pedal is depressed firmly and slowly, the vehicle can be driven slowly. If the accelerator pedal is depressed quickly, the vehicle may speed up and slow down erratically.	"Pass" condition is detected and then the ignition switch is turned OFF.
P0325 P0327 P0328 P0330 P0332 P0333	Maximum ignition timing retardation	Ignition switch OFF
P0351 P0352 P0353 P0354 P0355 P0356	Fuel is cut	"Pass" condition detected
P2120 P2121 P2122 P2123 P2125 P2127 P2128 P2138	The accelerator pedal position sensor has 2 (main and sub) sensor circuits. If a malfunction occurs in either of the sensor circuits, the ECM detects the abnormal signal voltage difference between the 2 sensor circuits and switches to fail-safe mode. In fail-safe mode, the functioning circuit is used to calculate the accelerator pedal opening angle to allow the vehicle to continue driving. If both circuits malfunction, the ECM regards the opening angle of the accelerator pedal to be fully closed. In this case, the throttle valve will remain closed as if the engine is idling.	"Pass" condition is detected and the ignition switch is turned OFF.

## DATA LIST / ACTIVE TEST

### 1. DATA LIST

#### HINT:

Using the intelligent tester's DATA LIST allows switch, sensor, actuator and other item values to be read without removing any parts. Reading the DATA LIST early in troubleshooting is one way to save time.

#### NOTICE:

**In the table below, the values listed under "Normal Condition" are reference values. Do not depend solely on these reference values when deciding whether a part is faulty or not.**

- (a) Warm up the engine.
- (b) Turn the ignition switch OFF.
- (c) Connect the intelligent tester or the OBD II scan tool to the DLC3.
- (d) Turn the ignition switch ON.
- (e) Turn ON the intelligent tester.
- (f) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / DATA LIST.
- (g) According to the display on tester, read the "DATA LIST".

**ES**

Intelligent Tester Display	Measurement: Range (Display)	Normal Condition*1	Diagnostic Note
INJECTOR	Injection period of No.1 cylinder: Min.:0 ms, Max.:32.64 ms	1.5 to 2.8 ms: Idling (Inspection mode)	-
IGN ADVANCE	Ignition timing advance for No. 1 cylinder/ Min.: -64 deg., Max.: 63.5 deg.	BTDC 5 to 25° : Idling (Inspection mode)	-
CALC LOAD	Calculated load by ECM: Min.: 0 %, Max.: 100 %	<ul style="list-style-type: none"> <li>10.4 to 15.6 %: Idling</li> <li>Running without load (2,500 rpm): 12.1 to 18.2 %</li> </ul>	-
MAF	Air flow rate from MAF meter: Min.: 0 g/s , Max.: 655 g/s	<ul style="list-style-type: none"> <li>2.0 to 3.7 gm/s: Idling</li> <li>Running without load (2,500 rpm): 2.4 to 4.3 gm/s</li> </ul>	If value approximately 0.0 g/s: <ul style="list-style-type: none"> <li>Mass air flow meter power source circuit open</li> <li>VG circuit open or short</li> <li>If valve is 160.0 g/s or more: E2G circuit open</li> </ul>
ENGINE SPD	Engine speed: Min.: 0 rpm, Max.: 16,383 rpm	Idling: 580 to 750 rpm	-
COOLANT TEMP	Engine coolant temperature: Min.: -40°C, Max.: 140°C	After warming up: 80 to 97°C (176 to 207°F)	<ul style="list-style-type: none"> <li>If value -40°C (-40°F): sensor circuit open</li> <li>If value 140°C (284°F): sensor circuit shorted</li> </ul>
INTAKE AIR	Intake air temperature: Min.: -40°C, Max.: 140°C	Equivalent to ambient temp. (after cold soak)	
THROTTLE POS	Absolute throttle position sensor/ Minimum: 0 %, Maximum: 100 %	<ul style="list-style-type: none"> <li>Throttle fully closed: 10 to 24 %</li> <li>Throttle fully open: 64 to 96 %</li> </ul>	Read value with ignition switch ON (do not start engine)
CTP SW	Closed throttle position switch/ ON or OFF	<ul style="list-style-type: none"> <li>Throttle fully closed: ON</li> <li>Throttle open: OFF</li> </ul>	-
VEHICLE SPD	Vehicle speed/ Minimum: 0 km/h, Maximum: 255 km/h	Actual vehicle speed	Speed indicated on speedometer
ACCEL POS #1	Accelerator pedal position sensor No.1 output voltage/ Minimum: 0 V, Maximum: 5 V	<ul style="list-style-type: none"> <li>Accelerator pedal released: 0.5 to 1.1 V</li> <li>Accelerator pedal depressed: 2.6 to 4.5 V</li> </ul>	Read value with ignition switch ON (do not start engine)

Intelligent Tester Display	Measurement: Range (Display)	Normal Condition*1	Diagnostic Note
ACCEL POS #2	Accelerator pedal position sensor No. 2 output voltage/ Minimum: 0 V, Maximum: 5 V	<ul style="list-style-type: none"> <li>Accelerator pedal released: 1.2 to 2.0 V</li> <li>Accelerator pedal depressed: 3.4 to 5.3 V</li> </ul>	Read value with ignition switch ON (do not start engine)
THROTTLE POS #2	Throttle position No. 2: Min.: 0 V, Max.: 5 V	<ul style="list-style-type: none"> <li>2.1 to 3.1 V: Throttle fully closed</li> <li>4.5 to 5.5 V: Throttle fully open</li> </ul>	Read value with intrusive operation (active test)
THROTTLE TARGT	Target position of throttle valve/ Minimum: 0 V, Maximum: 5 V	Idling: 0.4 to 1.1 V	-
THROTTLE OPN DUTY	Throttle motor opening duty ratio/ Minimum: 0 %, Maximum: 100 %	Throttle fully closed: 0 %	<ul style="list-style-type: none"> <li>When accelerator pedal is depressed, duty ratio is increased</li> <li>Read value with ignition switch ON (do not start engine)</li> </ul>
THROTTLE CLS DUTY	Throttle motor closed duty ratio/ Minimum: 0 %, Maximum: 100 %	Throttle fully open: 0 %	<ul style="list-style-type: none"> <li>When accelerator pedal is released quickly, duty ratio is increased</li> <li>Read the value with ignition switch ON (do not start engine)</li> </ul>
THROTTLE MOT	Whether or not throttle actuator control is permitted/ ON or OFF	Idling: ON	Read value with ignition switch ON (do not start engine)
+BM	Whether or not accelerator pedal position sensor is detecting idle/ ON or OFF	Idling: ON	-
ACCEL IDL POS	Whether or not accelerator pedal position sensor is detecting idle/ ON or OFF	Idling: ON	-
THROTTLE IDL POS	Whether or not throttle position sensor is detecting idle/ ON or OFF	Idling: ON	-
FAIL #1	Whether or not fail safe function is executed/ ON or OFF	ETCS has failed: ON	-
FAIL #2	Whether or not fail safe function is executed/ ON or OFF	ETCS has failed: ON	-
THROTTLE INITIAL	Throttle fully closed (learned value) Minimum: 0 V, Maximum: 5 V	0.5 to 0.9 V	-
ACCEL LEARN VAL	Accelerator fully closed (learned value) Minimum: 0 V, Maximum: 5 V	0.4 to 0.8 V	-
THROTTLE MOT	Throttle actuator current Minimum: 0 A, Maximum: 20 A	Idling: 0 to 3.0 A	-
O2S B1 S2	Heated oxygen sensor output voltage for bank 1 sensor 2/ Minimum: 0 V, Maximum: 1.0 V	Driving (50 km/h, 31 mph): 0.1 to 0.9 V	Performing INJ VOL or A/F CONTROL function of ACTIVE TEST enables the technician to check voltage output of each sensor
O2S B2 S2	Heated oxygen sensor output voltage for bank 2 sensor 2/ Minimum: 0 V, Maximum: 1.0 V	Driving (50 km/h, 31 mph): 0.1 to 0.9 V	Performing INJ VOL or A/F CONTROL function of ACTIVE TEST enables the technician to check voltage output of each sensor
AFS B1 S1	A/F sensor output voltage for bank 1 sensor 1/ Minimum: 0 V, Maximum: 7.999 V	Idling 2.8 to 3.8 V	Performing INJ VOL or A/F CONTROL function of ACTIVE TEST enables the technician to check voltage output of each sensor

Intelligent Tester Display	Measurement: Range (Display)	Normal Condition*1	Diagnostic Note
AFS B2 S1	A/F sensor output voltage for bank 2 sensor 1/ Minimum: 0 V, Maximum: 7.999 V	Idling 2.8 to 3.8 V	Performing INJ VOL or A/F CONTROL function of ACTIVE TEST enables the technician to check voltage output of each sensor
VAPOR PRESS	Vapor Pressure/ Minimum: -4.125 kPa, Maximum: 2.125 kPa	Fuel tank cap removed: 0 kPa	Pressure inside of fuel tank as read by the vapor pressure sensor
SHORT FT #1	Short term fuel trim of bank 1/ Minimum: -100 %, Maximum: 100 %	0 +- 20 %	This item is short-term fuel compensation used to maintain air-fuel ratio at stoichiometric air-fuel ratio
LONG FT #1	Long term fuel trim of bank 1/ Minimum: -100 %, Maximum: 100 %	0 +- 20 %	This item is overall, long-term fuel compensation that helps to maintain air-fuel ratio at stoichiometric air-fuel ratio (steadies long term deviations of short-term fuel trim from central value)
TOTAL FT #1	Total fuel trim of bank 1: Average value for fuel trim system of bank 1/ Minimum: 0.5, Maximum: 1.496	Idling: 0.5 to 1.4	-
SHORT FT #2	Short term fuel trim of bank 2/ Minimum: -100 %, Maximum: 100 %	0 +- 20 %	This item is short-term fuel compensation used to maintain air-fuel ratio at stoichiometric air-fuel ratio
LONG FT #2	Long term fuel trim of bank 2/ Minimum: -100 %, Maximum: 100 %	0 +- 20 %	This item is overall, long-term fuel compensation that helps to maintain air-fuel ratio at stoichiometric air-fuel ratio (steadies long term deviation of short-term fuel trim from central value)
TOTAL FT #2	Total fuel trim of bank 2: Average value for fuel trim system of bank 2/ Minimum: 0.5, Maximum: 1.496	Idling: 0.5 to 1.4	-
O2FT B1 S2	Short term fuel trim associated with the bank 1 sensor 2/ Minimum: -100 %, Maximum: 100 %	0 +- 20 %	Same as SHORT FT #1
O2FT B2 S2	Short term fuel trim associated with the bank 2 sensor 2/ Minimum: -100 %, Maximum: 100 %	0 +- 20 %	Same as SHORT FT #2
AF FT B1 S1	Short term fuel trim associated with bank 1 sensor 1/ Minimum: 0, Maximum: 1.999	<ul style="list-style-type: none"> <li>Value less than 1 (0.000 to 0.999) = Lean</li> <li>Stoichiometric air-fuel ratio = 1</li> <li>Value greater than 1 (1.001 to 1.999) = Rich</li> </ul>	-
AF FT B2 S1	Short term fuel trim associated with bank 2 sensor 1/ Minimum: 0, Maximum: 1.999	<ul style="list-style-type: none"> <li>Lean: 0 more than AF FT B2 S1 less than 1</li> <li>Stoichiometric air-fuel ratio = 1</li> <li>Rich: 1 more than AF FT B2 S1 less than 1.999</li> </ul>	-

Intelligent Tester Display	Measurement: Range (Display)	Normal Condition*1	Diagnostic Note
FUEL SYS #1	Fuel system status (Bank 1) / OL or CL or OL DRIVE or OL FAULT or CL FAULT	Idling after warming up: CL	<ul style="list-style-type: none"> <li>OL (Open Loop): Has not yet satisfied conditions to go closed loop</li> <li>CL (Closed Loop): Using heated oxygen sensor(s) as feed back for fuel control</li> <li>OL DRIVE: Open loop due to driving conditions (fuel enrichment)</li> <li>OL FAULT: Open loop due to detected system fault</li> <li>CL FAULT: Closed loop but one of heated oxygen sensors, which is used for fuel control, is malfunctioning</li> </ul>
FUEL SYS #2	Fuel system status (Bank 2) / OL or CL or OL DRIVE or OL FAULT or CL FAULT	Idling after warming up: CL	<ul style="list-style-type: none"> <li>OL (Open Loop): Has not yet satisfied conditions to go closed loop</li> <li>CL (Closed Loop): Using heated oxygen sensor(s) as feed back for fuel control</li> <li>OL DRIVE: Open loop due to driving conditions (fuel enrichment)</li> <li>OL FAULT: Open loop due to detected system fault</li> <li>CL FAULT: Closed loop but one of heated oxygen sensors, which is used for fuel control, is malfunctioning</li> </ul>
FC IDL	Fuel cut idle/ ON or OFF	Fuel cut operation: ON	FC IDL = ON when throttle valve is fully closed and engine speed is over 1,500 rpm
MIL	MIL status/ ON or OFF	MIL ON: ON	-
STARTER SIG	Starter signal/ ON or OFF	Cranking: ON	-
A/C SIG	A/C signal/ ON or OFF	A/C ON: ON	-
PNP SW [NSW]	PNP switch signal/ ON or OFF	P or N position: ON	-
ELECT LOAD SIG	Electrical load signal/ ON or OFF	<ul style="list-style-type: none"> <li>Taillight switch ON: ON</li> <li>Defogger switch ON: ON</li> </ul>	-
STOP LIGHT SW	Stop light switch/ ON or OFF	<ul style="list-style-type: none"> <li>Brake pedal depressed: ON</li> <li>Brake pedal released: OFF</li> </ul>	-
PS OIL PRESS SW	Power steering oil pressure switch signal/ ON or OFF	<ul style="list-style-type: none"> <li>While turning the steering wheel: ON</li> <li>While not turning the steering wheel: OFF</li> </ul>	Idle-up control is performed when PS is ON
PS SIGNAL	Power steering signal/ ON or OFF	When steering wheel is turned	This signal is usually ON until the Ignition switch is turned OFF
INTAKE CTL VSV1	VSV status for intake control (bank 1)/ ON or OFF	VSV operation: ON	-
INTAKE CTL VSV 2	VSV status for intake control (bank 2)/ ON or OFF	VSV operation: ON	-
FUEL PUMP / SPD	Fuel pump/speed status/ ON/H or OFF/M,L	Idling: ON	-
A/C MAG CLUTCH	A/C magnet clutch status/ ON or OFF	A/C magnet clutch ON: ON	-
EVAP VSV	VSV status for EVAP control/ ON or OFF	VSV operating: ON	EVAP VSV is controlled by the ECM (ground side duty control)
BOOST PRESS VSV	VSV status for boost pressure control/ ON or OFF	VSV operating: ON	-
IGNITION	Ignition counter/ Minimum: 0, Maximum: 600	0 to 600	-

Intelligent Tester Display	Measurement: Range (Display)	Normal Condition*1	Diagnostic Note
CYL #1, #2, #3, #4, #5, #6	Misfire ratio of cylinder 1 to 6/ Minimum: 0 %, Maximum: 50 %	0 %	This item is displayed in only idling
MISFIRE LOAD	Engine load for first misfire range/ Minimum: 0 g/rev, Maximum: 3.98 g/rev.	Misfire 0: 0 g/rev.	-
MISFIRE RPM	Engine RPM for first misfire range/ Minimum: 0 rpm, Maximum: 6,375 rpm	Misfire 0: 0 rpm	-
FC TAU	Fuel Cut TAU: Fuel cut during very light load/ ON or OFF	Fuel cut operating: ON	Fuel cut is being performed under very light load to prevent engine combustion from becoming incomplete
CHECK MODE	Check mode/ ON or OFF	Check mode ON: ON	-

**HINT:**

\*1: If no idling conditions are specified, the transmission gear selector lever should be in the N or P position, and the A/C switch and all accessory switches should be OFF.

**2. ACTIVE TEST****HINT:**

Performing the intelligent tester's ACTIVE TEST allows relay, VSV, actuator and other items to be operated without removing any parts. Performing the ACTIVE TEST early in troubleshooting is one way to save time. The DATA LIST can be displayed during the ACTIVE TEST.

- Warm up the engine.
- Turn the ignition switch OFF.
- Connect the intelligent tester or the OBD II scan tool to the DLC3.
- Turn the ignition switch ON.
- Turn ON the intelligent tester or the OBD II scan tool.
- Enter the following menus: DIAGNOSIS / ENHANCED OBD II / ACTIVE TEST.
- According to the display on tester, perform the "ACTIVE TEST".

Intelligent Tester Displays	Test Details	Diagnostic Note
INJ VOL	[Test Details] Control injection volume Minimum: -12.5 %, Maximum: 25 % [Vehicle Condition] Engine speed: 3,000 rpm or less	<ul style="list-style-type: none"> <li>All injectors are tested at once</li> <li>Injection volume is gradually changed between -12.5 and 25 %</li> </ul>
A/F CONTROL	[Test Details] Control injection volume -12.5 or 25 % (change injection volume -12.5 % or 25 %) [Vehicle Condition] Engine speed: 3,000 rpm or less	Following A/F CONTROL procedure enables technician to check and graph voltage outputs of both the A/F sensor and heated oxygen sensor For displaying graph, enter "ACTIVE TEST / A/F CONTROL / USER DATA", select "AFS B1S1 and O2S B1S2" by pressing "YES" and push "ENTER". Then press "F4"
INTAKE CTL VSV1	[Test Details] Activate VSV for intake control ON or OFF	-
CAN CTRL VSV	[Test Details] Activate VSV for canister control ON or OFF	-
EVAP VSV (ALONE)	[Test Details] Activate EVAP VSV for canister control ON or OFF	-
A/C MAG CLUTCH	[Test Details] Control A/C magnet clutch ON or OFF	-

Intelligent Tester Displays	Test Details	Diagnostic Note
FUEL PUMP / SPD	[Test Details] Control the fuel pump ON or OFF	-
VVT CTRL B1	[Test Details] Active VVT system (Bank 1) ON or OFF	<ul style="list-style-type: none"><li>ON: Rough idle or engine stall</li><li>OFF: Normal engine speed</li></ul>
VVT CTRL B2	[Test Details] Active VVT system (Bank 2) ON or OFF	<ul style="list-style-type: none"><li>ON: Rough idle or engine stall</li><li>OFF: Normal engine speed</li></ul>
ACM INHIBIT	[Test Details] Control ACM inhibit ON or OFF	-
TC/TE1	[Test Details] Connect TC and TE1 ON or OFF	-
FC IDL PROHBT	[Test Details] Control idle fuel cut prohibit ON or OFF	-