DTC	P2120	THROTTLE/PEDAL POSITION SENSOR/SWITCH "D" CIRCUIT

DTC	P2122	THROTTLE/PEDAL POSITION SENSOR/SWITCH "D" CIRCUIT LOW INPUT

DTC	P2123	THROTTLE/PEDAL POSITION SENSOR/SWITCH "D" CIRCUIT HIGH INPUT

DTC	P2125	THROTTLE/PEDAL POSITION SENSOR/SWITCH "E" CIRCUIT

DTC	P2127	THROTTLE/PEDAL POSITION SENSOR/SWITCH "E" CIRCUIT LOW INPUT

DTC	P2128	THROTTLE/PEDAL POSITION SENSOR/SWITCH "E" CIRCUIT HIGH INPUT

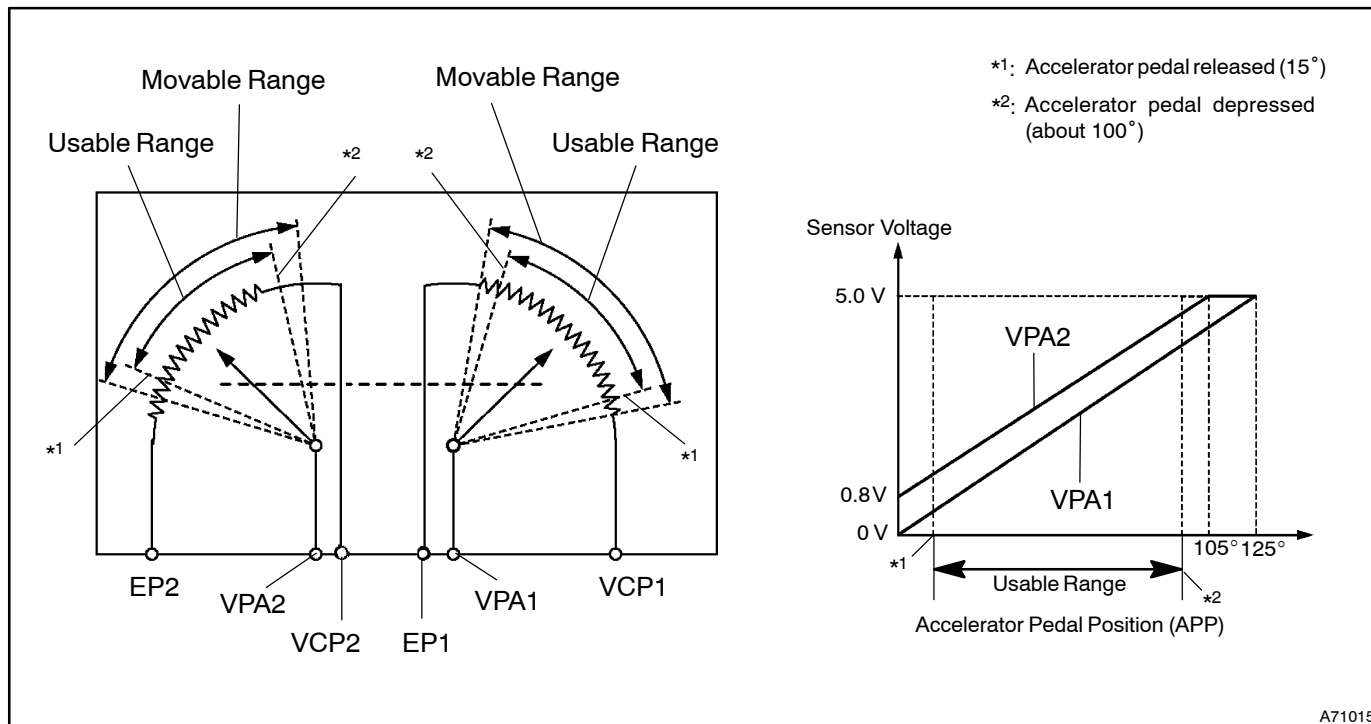| DTC	P2138	THROTTLE/PEDAL POSITION SENSOR/SWITCH "D"/"E" VOLTAGE CORRELATION

HINT:
This is the repair procedure for the Accelerator Pedal Position (APP) sensor.

CIRCUIT DESCRIPTION

A vehicle that is equipped with an Electronic Throttle Control System (ETCS) does not have a throttle cable. The APP sensor is mounted on the accelerator pedal bracket. The APP sensor has 2 sensor elements/signal outputs: VPA1 and VPA2. VPA1 is used to detect the actual accelerator pedal angle (used for engine control) and VPA2 is used to detect malfunctions in VPA1. Voltage applied to VPA1 and VPA2 changes between 0.2 V and 5 V in proportion to the accelerator pedal angle.

The ECM monitors the accelerator pedal angle from VPA1 and VPA2 signal outputs, and controls the throttle actuator based on these signals.

DTC No.	DTC Detection Condition	Trouble Area
P2120	VPA1 is below 0.2 V, or VPA1 is 4.8 V or more (for 0.5 seconds or more) (1 trip detection logic)	• Open or short in APP sensor circuit • APP sensor • ECM
P2122	VPA1 is below 0.2 V when accelerator pedal is opening (VPA2 is 0.97 degrees or more) (for 0.5 seconds or more) (1 trip detection logic)	Same as DTC No. P2120
P2123	VPA1 is 4.8 V or more (for 2 seconds or more) (1 trip detection logic)	Same as DTC No. P2120
P2125	VPA2 is below 0.5 V, or VPA2 is 4.8 V or more (for 0.5 seconds or more) (1 trip detection logic)	Same as DTC No. P2120
P2127	VPA2 is below 0.5 V when accelerator pedal is opening (VPA1 is 0.97 degrees or more) (for 0.5 seconds or more) (1 trip detection logic)	Same as DTC No. P2120
P2128	VPA2 is 4.8 V or more when VPA1 is 0.2 to 3.45 V (for 2 seconds or more) (1 trip detection logic)	Same as DTC No. P2120
P2138	Following condition (a) or (b) continues 2 seconds or more (1 trip detection logic): (a) Difference between VPA1 and VPA2 is below 0.02 V (b) VPA1 is below 0.2 V and VPA2 is below 0.5 V	Same as DTC No. P2120

HINT:
After confirming DTC P2120, P2122, P2123, P2125, P2127, P2128 and P2138, use the Intelligent Tester II to confirm the APP sensor output voltage.

Trouble Area	APP expressed as voltage output			
	Accelerator pedal released		Accelerator pedal depressed	
	Accelerator POS No.1	Accelerator POS No.2	Accelerator POS No.1	Accelerator POS No.2
VCP circuit open	0 V	0 V	0 V	0 V
VPA1 circuit open or ground short	0 V	1.0 to 2.2 V	0 V	3.9 to 5.0 V
VPA2 circuit open or ground short	0.4 to 1.4 V	0 V	3.1 to 4.6 V	0 V
EPA circuit open	4.8 V or more	4.8 V or more	4.8 V or more	4.8 V or more
Normal condition	0.4 to 1.4 V	1.0 to 2.2 V	3.01 to 4.6 V	3.9 to 5.0 V

MONITOR DESCRIPTION

When either voltage output VPA1 or VPA2, deviates from the standard range, or the difference between the voltage outputs of the two sensors is less than threshold, the ECM concludes that there is a defect in the APP sensor. The ECM turns on the MIL and set a DTC.
Example:
When the voltage output of the VPA1 below 0.2 V or exceeds 4.8 V.
This monitor runs for 2 seconds (the first 2 seconds of engine idle) after the engine is started (1 trip detection logic).

FAIL–SAFE

The APP sensor has two (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 two sensor circuits and changes to limp mode. In limp mode, the remaining 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.
If a "pass" condition is detected and then the ignition switch is turned OFF, the fail–safe operation will stop and the system will return to normal condition.

WIRING DIAGRAM

A87374
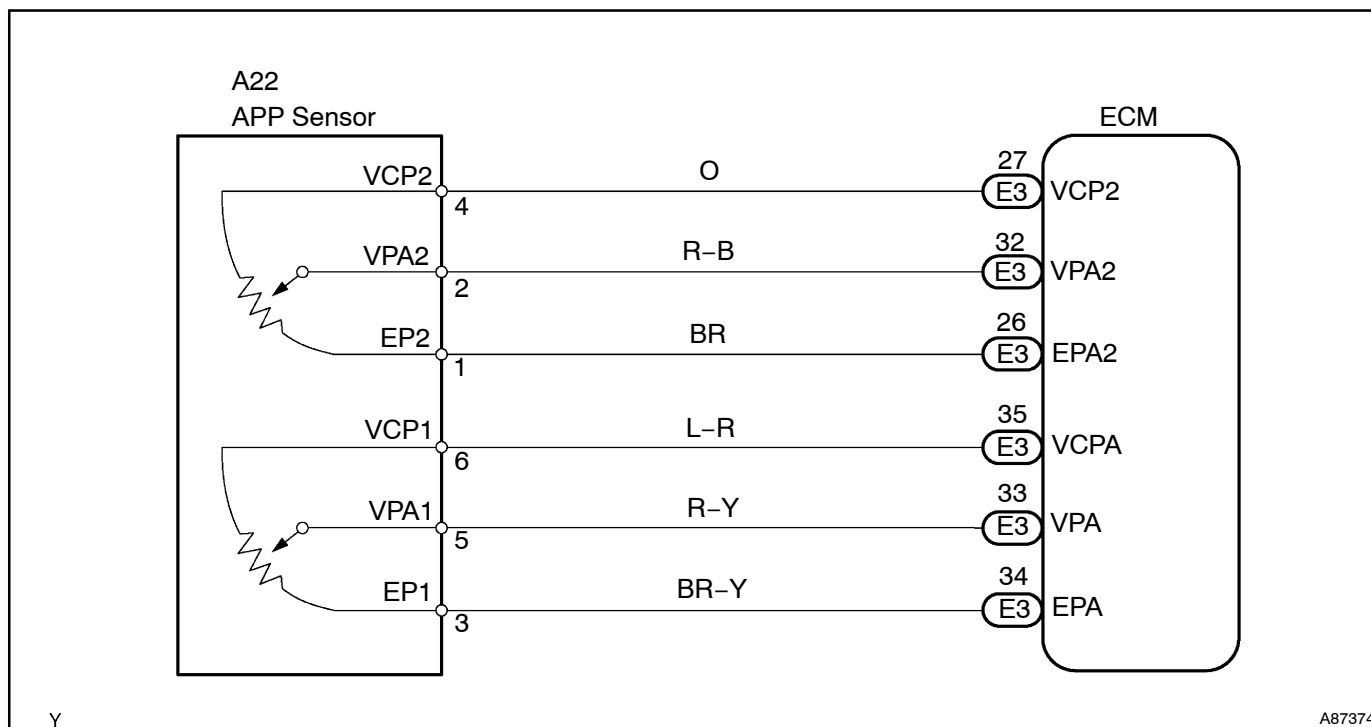
INSPECTION PROCEDURE

HINT:

Read freeze frame data using the Intelligent Tester II. Freeze frame data records the engine conditions when a malfunction is detected. When troubleshooting, freeze frame data can help determine if the vehicle was running or stopped, if the engine was warmed up or not, if the air–fuel ratio was lean or rich, and other data from the time the malfunction occurred.

1	READ VALUE OF INTELLIGENT TESTER II

Depressed Released

FI7052
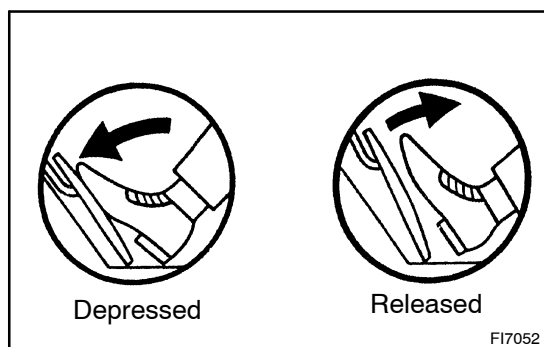
(a) Connect the Intelligent Tester II to the DLC3.

(b) Turn the ignition switch ON.

(c) Enter the following menus: Enter/ Diagnosis/ OBD·MOBD/ Power train/ Engine and ECT/ Data List/ All Data/ Accelerator POS No. 1 and No. 2.
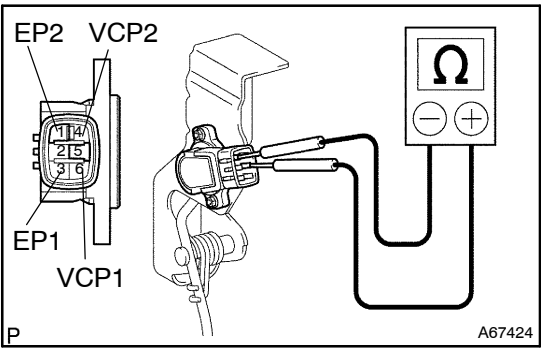
Standard:

Accelerator Pedal	Accelerator POS No. 1	Accelerator POS No. 2
Released → Depressed → Released	0.2 to 4.8 V	0.5 to 4.8 V
Released → Depressed → Released	Difference between Accelerator POS No. 1 and No. 2 is greater than 0.02 V	Difference between Accelerator POS No. 1 and No. 2 is greater than 0.02 V

OK Go to step 5

NG

2	INSPECT ACCELERATOR PEDAL ROD ASSY (APP SENSOR)

(a) Disconnect the APP sensor connector.

(b) Measure the resistance between each terminal.
   Standard:

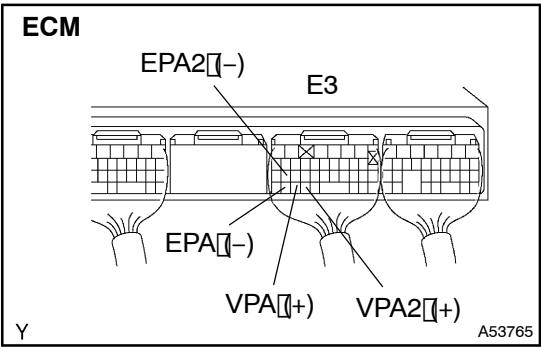| Tester Connection	Specified Condition
3 – 6	1.5 to 6.0 kΩ at 20°C (68°F)
1 – 4	1.5 to 6.0 kΩ at 20°C (68°F)

(c) Reconnect the APP sensor connector.

NG > **REPLACE ACCELERATOR PEDAL ROD ASSY (See page 10–23)**

OK

3	INSPECT ECM (VCPA, VCP2 VOLTAGE)

(a) Turn the ignition switch ON.

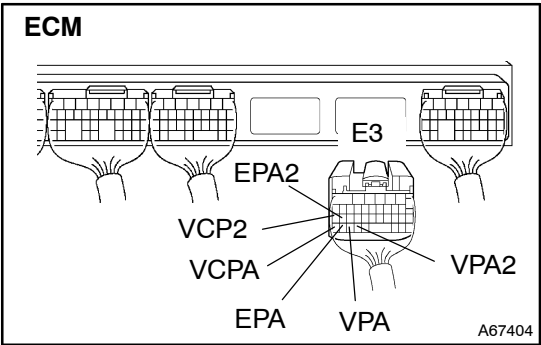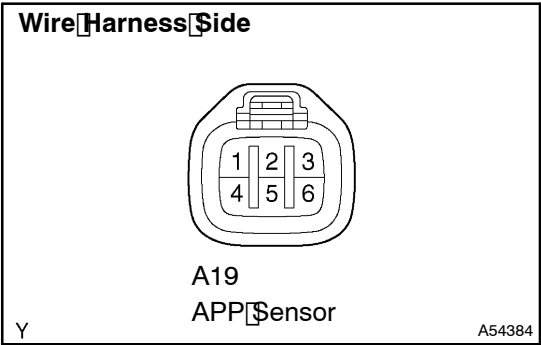(b) Measure the voltage of the ECM connector.
   Standard:

Tester Connection	Specified Condition
E3–35 (VCPA) – E3–34 (EPA)	4.5 to 5.5 V
E3–27 (VCP2) – E3–26 (EPA2)	4.5 to 5.5 V

NG > **REPLACE ECM (See page 10–21)**

OK

| 4 | CHECK WIRE HARNESS (APP SENSOR – ECM) |

Wire Harness Side

A19

APP Sensor

Y   A54384

ECM

E3

EPA2

VCP2

VCPA   VPA2

EPA   VPA   A67404

(a) Disconnect the A19 APP sensor connector.

(b) Disconnect the E3 ECM connector.

(c) Measure the resistance of the wire harness side connectors.

Standard:

Tester Connection	Specified Condition
A19–1 – E3–34 (EPA)	Below 1 Ω
A19–2 – E3–32 (VPA2)	Below 1 Ω
A19–3 – E3–26 (EPA2)	Below 1 Ω
A19–4 – E3–35 (VCPA)	Below 1 Ω
A19–5 – E3–33 (VPA)	Below 1 Ω
A19–6 – E3–27 (VCP2)	Below 1 Ω
A19–1 or E3–34 (EPA) – Body ground	10 kΩ or higher
A19–2 or E3–32 (VPA2) – Body ground	10 kΩ or higher
A19–3 or E3–26 (EPA2) – Body ground	10 kΩ or higher
A19–4 or E3–35 (VCPA) – Body ground	10 kΩ or higher
A19–5 or E3–33 (VPA) – Body ground	10 kΩ or higher
A19–6 or E3–27 (VCP2) – Body ground	10 kΩ or higher

(d) Reconnect the ECM connector.

(e) Reconnect the APP sensor connector.

| NG > | REPAIR OR REPLACE HARNESS AND CONNECTOR |

| OK |

| REPLACE ACCELERATOR PEDAL ROD ASSY (See page 10–23) |

| 5 | READ OUTPUT DTC (ACCELERATOR PEDAL POSITION SENSOR DTCS ARE OUTPUT AGAIN) |

(a) Clear the DTC. Enter the following menus: Enter/ Power train/ Engine and ECT/ DTC/ Clear.

(b) Allow the engine to idle for 15 seconds.

(c) Read the DTCs. Enter the following menus: DTC/ Current.

Result:

Display (DTC Output)	Proceed to
P2120, P2122, P2123, P2125, P2127, P2128 or P2138	A
No DTC	B

| B > | CHECK FOR INTERMITTENT PROBLEM (See page 05–11) |

| A |

| REPLACE ECM (See page 10–21) |