

DTC	P2120	Throttle/Pedal Position Sensor/Switch "D" Circuit
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DTC	P2122	Throttle/Pedal Position Sensor/Switch "D" Circuit Low Input
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DTC	P2123	Throttle/Pedal Position Sensor/Switch "D" Circuit High Input
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DTC	P2125	Throttle/Pedal Position Sensor/Switch "E" Circuit
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DTC	P2127	Throttle/Pedal Position Sensor/Switch "E" Circuit Low Input
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DTC	P2128	Throttle/Pedal Position Sensor/Switch "E" Circuit High Input
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DTC	P2138	Throttle/Pedal Position Sensor/Switch "D"/"E" Voltage Correlation
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HINT:

This is the repair procedure for the "accelerator pedal position sensor".

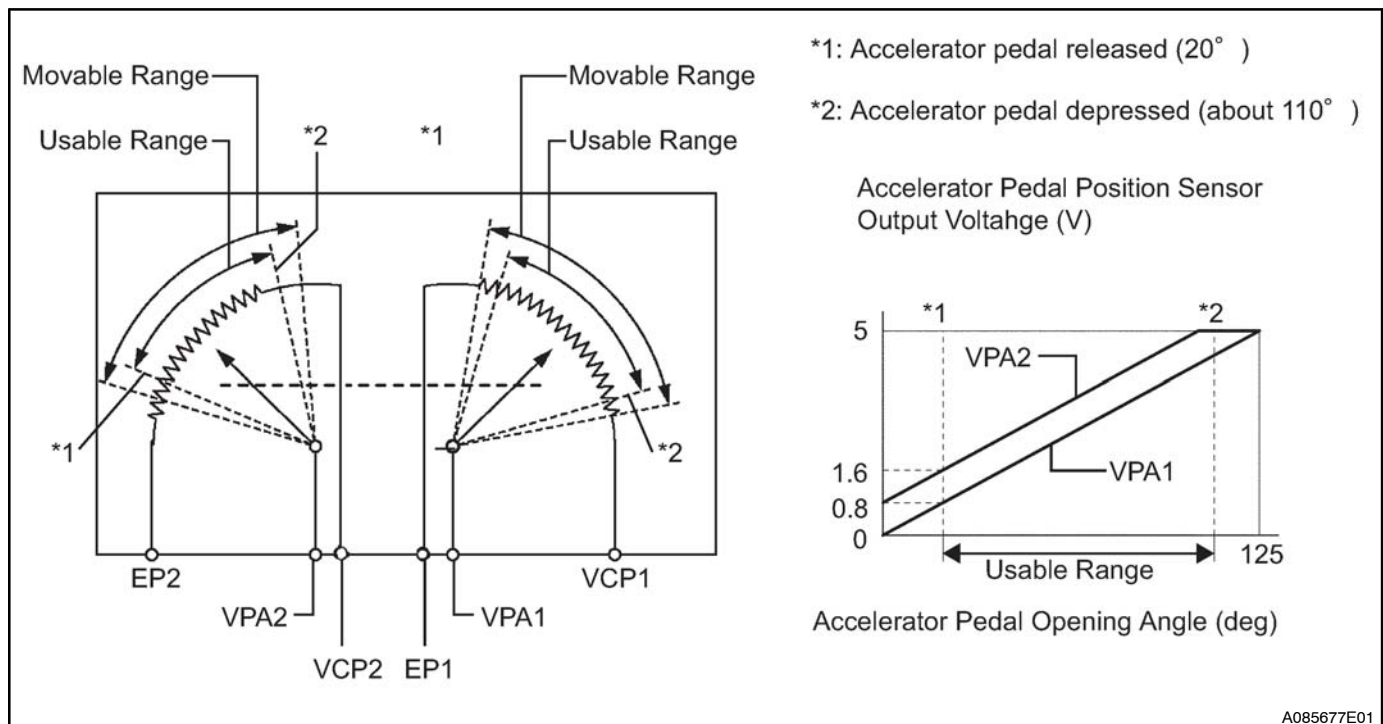
CIRCUIT DESCRIPTION

HINT:

- These DTCs relate to the Accelerator Pedal Position (APP) sensor.
- This ETCS (Electronic Throttle Control System) does not use a throttle cable.

The Accelerator Pedal Position (APP) sensor is mounted on the accelerator pedal bracket and has 2 sensor circuits: VPA1 (main) and VPA2 (sub). The voltage, which is applied to terminals VPA1 and VPA2 of the ECM, varies between 0 V and 5 V in proportion to the operating angle of the accelerator pedal (throttle valve). A signal from VPA1 indicates the actual accelerator pedal opening angle (throttle valve opening angle) and is used for engine control. A signal from VPA2 conveys the status of the VPA1 circuit and is used to check the APP sensor itself.

The ECM monitors the actual accelerator pedal opening angle (throttle valve opening angle) through the signals from VPA1 and VPA2, and controls the throttle actuator according to these signals.



DTC No.	DTC Detection Condition	Trouble Area
P2120	VPA1 fluctuates rapidly beyond upper and lower malfunction thresholds for 0.5 seconds or more (1 trip detection logic)	• Accelerator Pedal Position (APP) sensor • ECM
P2122	VPA1 0.4 V or less for 0.5 seconds or more when accelerator pedal fully released (1 trip detection logic)	• APP sensor • Open in VCP1 circuit • Open or ground short in VPA1 circuit • ECM
P2123	VPA1 4.8 V or more for 2.0 seconds or more (1 trip detection logic)	• APP sensor • Open in EPA circuit • ECM
P2125	VPA2 fluctuates rapidly beyond upper and lower malfunction thresholds for 0.5 seconds or more (1 trip detection logic)	• APP sensor • ECM
P2127	VPA2 1.2 V or less for 0.5 seconds or more when accelerator pedal fully released (1 trip detection logic)	• APP sensor • Open in VCP2 circuit • Open or ground short in VPA2 circuit • ECM
P2128	Conditions (a) and (b) continue for 2.0 seconds or more (1 trip detection logic): (a) VPA2 4.8 V or more (a) VPA1 between 0.4 V and 3.45 V	• APP sensor • Open in EPA2 circuit • ECM
P2138	Condition (a) or (b) continues for 2.0 seconds or more (1 trip detection logic): (a) Difference between VPA1 and VPA2 0.02 V or less (b) VPA1 0.4 V or less and VPA2 1.2 V or less	• Short between VPA1 and VPA2 circuits • APP sensor • ECM

HINT:

When any of these DTCs are set, check the APP sensor voltage by selecting the following menu items on the intelligent tester: DIAGNOSIS / ENHANCED OBD II / DATA LIST / PRIMARY / ACCEL POS #1 and ACCEL POS #2.

Trouble Area	ACCEL POS #1 When AP Released	ACCEL POS #2 When AP Released	ACCEL POS #1 When AP Depressed	ACCEL POS #2 When AP Depressed
VCP circuit open	0 V to 0.4 V	0 V to 0.4 V	0 V to 0.4 V	0 V to 0.4 V
Open or ground short in VPA circuit	0 V to 0.4 V	1.2 V to 2.0 V	0 V to 0.4 V	3.4 V to 5.0 V
Open or ground short in VPA2 circuit	0.5 V to 1.1 V	0 V to 0.4 V	2.6 V to 4.5 V	0 V to 0.2 V
EPA circuit open	4.5 V to 5.0 V	4.5 V to 5.0 V	4.5 V to 5.0 V	4.5 V to 5.0 V
Normal condition	0.5 V to 1.1 V	1.2 V to 2.0 V	2.6 V to 4.5 V	3.4 V to 5.0 V

HINT:

- Accelerator pedal positions are expressed as voltages.
- AP stands for Accelerator Pedal.

MONITOR DESCRIPTION

When either of the voltage outputs of VPA1 or VPA2 deviates from the standard range, or the difference between the voltage outputs of the 2 sensor circuits is less than the threshold, the ECM determines that there is a malfunction in the APP sensor. The ECM then illuminates the MIL and sets a DTC.

Example:

When the voltage output of VPA1 drops below 0.2 V for more than 0.5 seconds when the accelerator pedal is fully depressed, DTC P2122 is set.

If the malfunction is not repaired successfully, a DTC is set 2 seconds after the engine is next started.

FAIL SAFE

When any of DTCs P2120, P2121, P2122, P2123, P2125, P2127, P2128 and P2138 are set, the ECM enters fail-safe mode. If either of the 2 sensor circuits malfunction, the ECM uses the remaining circuit to calculate the accelerator pedal position to allow the vehicle to continue driving. If both of the circuits malfunction, the ECM regards the accelerator pedal as being released. As a result, the throttle valve is closed and the engine idles.

Fail-safe mode continues until a pass condition is detected, and the ignition switch is turned OFF.

MONITOR STRATEGY

Related DTCs	P2120: Accelerator Pedal Position (APP) sensor 1 range check (fluctuating) P2122: APP sensor 1 range check (low voltage) P2123: APP sensor 1 range check (high voltage) P2125: APP sensor 2 range check (fluctuating) P2127: APP sensor 2 range check (low voltage) P2128: APP sensor 2 range check (high voltage) P2138: APP sensor range check (correlation)
Required Sensors/Components (Main)	APP sensor
Required Sensors/Components (Related)	–
Frequency of Operation	Continuous
Duration	0.5 seconds: P2120, P2122, P2125 and P2127 2.0 seconds: P2123, P2128 and P2138
MIL Operation	Immediate
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs not present	None
Ignition switch	ON
Throttle actuator power	ON

TYPICAL MALFUNCTION THRESHOLDS

P2120:

Either of the following conditions is met:	Condition 1 or 2
1. VPA1 voltage when VPA2 voltage is 0.04 V or more	0.4 V or less
2. VPA1 voltage	4.8 V or more

P2122:

VPA1 voltage when VPA2 voltage is 0.04 V or more	0.4 V or less
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P2123:

VPA1 voltage	4.8 V or more
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P2125:

Either of the following conditions is met:	Condition 1 or 2
1. VPA2 voltage when VPA1 is 0.04 V or more	1.2 V or less
2. VPA2 voltage when VPA1 is 0.4 to 3.45 V	4.8 V or more

P2127:

VPA2 voltage when VPA1 0.04 V or more	1.2 V or less
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P2128:

VPA2 voltage when VPA1 0.4 to 3.45 V	4.8 V or more
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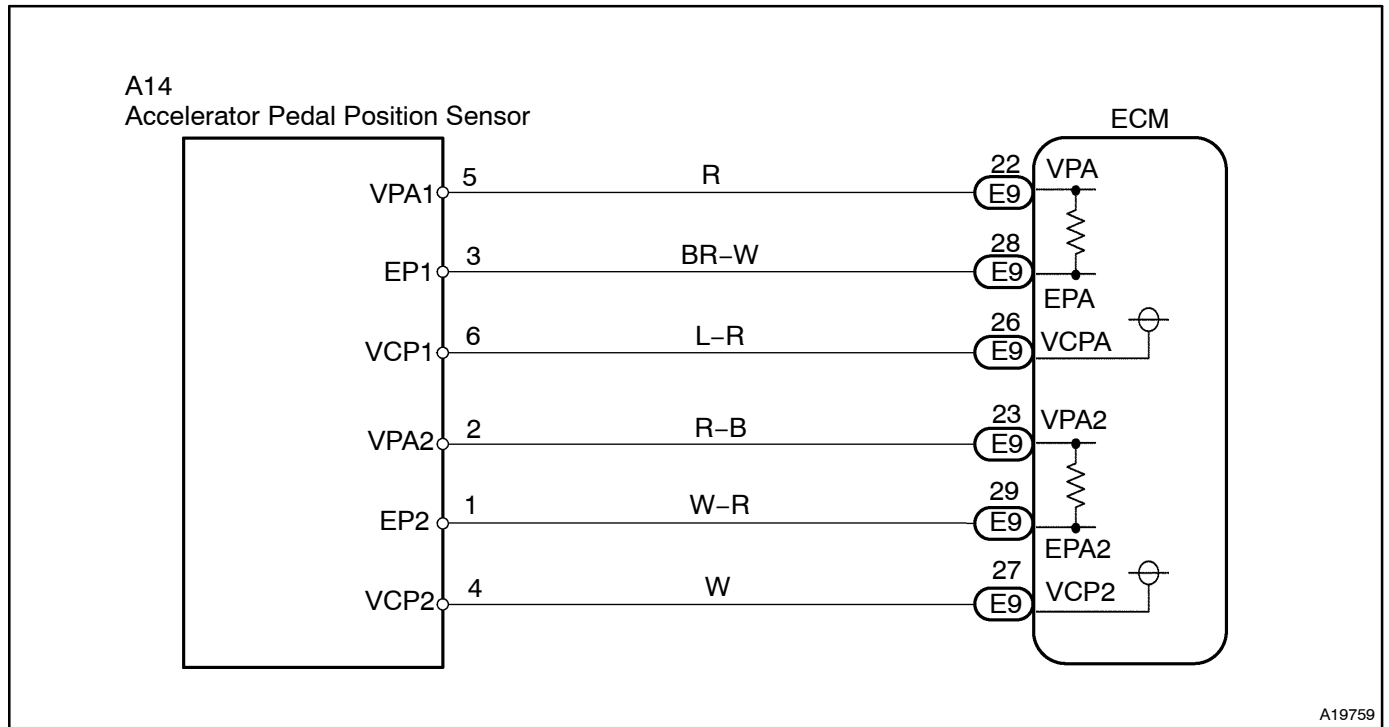
P2138:

Either of following conditions A or B is met:	–
Condition A	–
Difference between VPA1 and VPA2 voltages	0.02 V or less
Condition B	–
VPA1 voltage	0.4 V or less
VPA2 voltage	1.2 V or less

COMPONENT OPERATING RANGE

VPA1 voltage	0.4 to 4.8 V
VPA2 voltage	1.2 to 4.8 V

WIRING DIAGRAM

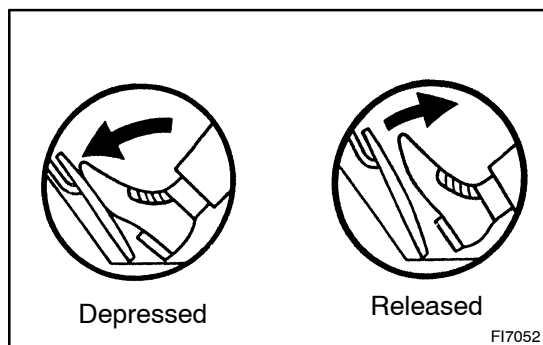


INSPECTION PROCEDURE

HINT:

Read freeze frame data using the hand-held tester or the OBD II scan tool. 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, as well as other data from the time when a malfunction occurred.

1 Connect hand-held tester, and read the voltage for accelerator pedal position sensor data.



PREPARATION:

- Connect the hand-held tester to the DLC3.
- Turn the ignition switch ON and push the hand-held tester main switch ON.
- Enter the following menus: DIAGNOSIS / ENHANCED OBD II / DATA LIST / ETCS / ACCEL POS #1 and ACCEL POS #2.

CHECK:

Read the voltage for the accelerator pedal position sensor data.

OK:

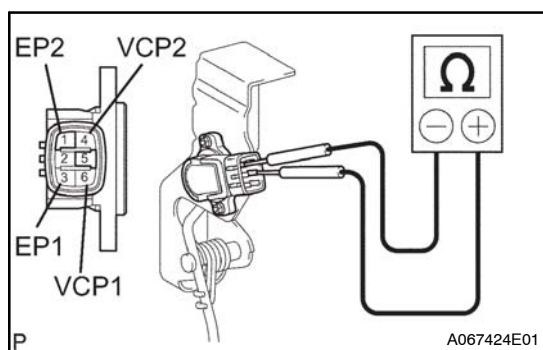
Accelerator Pedal Operations	ACCEL POS #1 (AP#1)	ACCEL POS #2 (AP#2)	Difference between AP#1 and AP#2
1. Released	0.5 V to 4.5 V	1.2 V to 5.0 V	More than 0.02 V
2. Depressed			
3. Released			

OK

Go to step 6.

NG

2 Inspect accelerator pedal assembly (Accelerator pedal position sensor)



PREPARATION:

Disconnect the A14 Accelerator Pedal Position (APP) sensor connector.

CHECK:

Measure the resistance between each terminal.

Standard resistance:

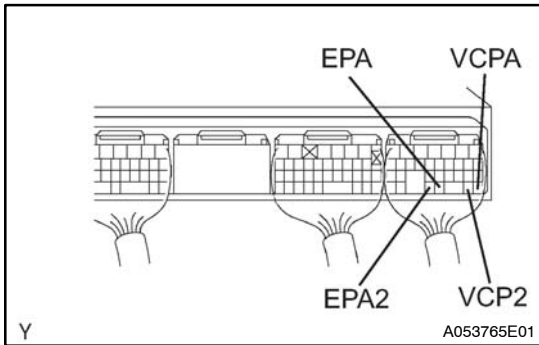
Tester Connection	Specified Condition
3 - 6	Between 1.5 kΩ and 6.0 kΩ at 20°C (68°F)
1 - 4	Between 1.5 kΩ and 6.0 kΩ at 20°C (68°F)

Reconnect the APP sensor connector.

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Replace accelerator pedal assembly

OK

3 Inspect ECM (VCPA and VCP2 voltage)**PREPARATION:**

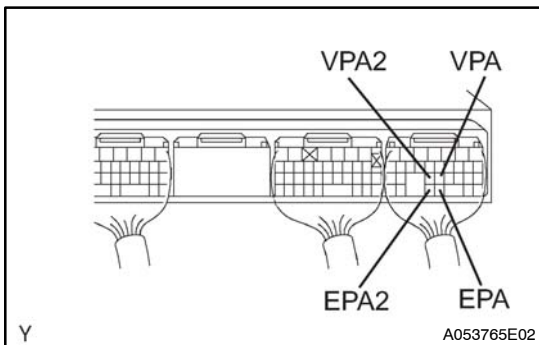
- (a) Disconnect the A14 APP sensor connector.
- (b) Turn the ignition switch ON.

CHECK:

Measure the voltage of the E9 ECM connector.

Standard voltage:

Tester Connection	Specified Condition
E9-26 (VCPA) - E9-28 (EPA)	4.5 to 5.0 V
E9-27 (VCP2) - E9-29 (EPA2)	4.5 to 5.0 V

NG**Replace ECM (See page [SF-60](#)).****OK****4 Inspect ECM (VPA and VPA2 voltage)****PREPARATION:**

Turn the ignition switch ON.

CHECK:

Measure the voltage of the E9 ECM connector.

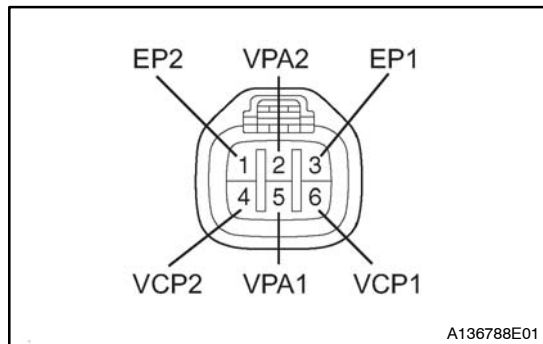
Standard voltage:

Tester Connection	Accelerator Pedal Operation	Specified Condition
E9-22 (VPA) - E9-28 (EPA)	Released	0.5 to 1.1 V
E9-22 (VPA) - E9-28 (EPA)	Depressed	2.6 to 4.5 V
E9-23 (VPA2) - E9-29 (EPA2)	Released	1.2 to 2.0 V
E9-23 (VPA2) - E9-29 (EPA2)	Depressed	3.4 to 5.3 V

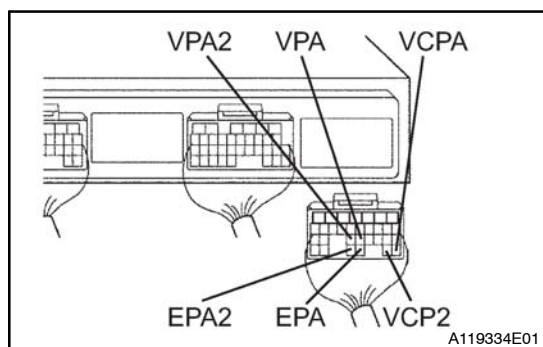
NG**Go to step 5.****OK****Replace ECM (See page [SF-60](#)).**

5

Check for open and short in harness and connector in VCPA, VCP2, VPA, VPA2 EPA and EPA2 circuit between ECM and accelerator pedal position sensor.

**PREPARATION:**

(a) Disconnect the A14 accelerator pedal position sensor connector.



(b) Disconnect the E9 ECM connector.

CHECK:

Measure the resistance between the wire harness side connectors.

Standard resistance:

Tester Connection	Specified Condition
VPA1 (A14-5) - VPA (E9-22)	Below 1 Ω
EP1 (A14-3) - EPA (E9-28)	Below 1 Ω
VCP1 (A14-6) - VCPA (E9-26)	Below 1 Ω
VPA2 (A14-2) - VPA2 (E9-23)	Below 1 Ω
EP2 (A14-1) - EPA2 (E9-29)	Below 1 Ω
VCP2 (A14-4) - VCP2 (E9-27)	Below 1 Ω
VPA1 (A14-5) or VPA (E9-22) - Body ground	10 k Ω or higher
EP1 (A14-3) or EPA (E9-28) - Body ground	10 k Ω or higher
VCP1 (A14-6) or VCPA (E9-26) - Body ground	10 k Ω or higher
VPA2 (A14-2) or VPA2 (E9-23) - Body ground	10 k Ω or higher
EP2 (A14-1) or EPA2 (E9-29) - Body ground	10 k Ω or higher
VCP2 (A14-4) or VCP2 (E9-27) - Body ground	10 k Ω or higher

NG

Repair or replace harness or connector.

OK

6 Check whether DTC output recurs (Accelerator pedal position sensor DTCs)**PREPARATION:**

- (a) Connect the intelligent tester to the CAN VIM. Then connect the CAN VIM to the DLC3.
- (b) Turn the ignition switch ON and turn the tester ON.
- (c) Clear DTCs (see page [DI-3](#)).
- (d) Allow the engine to idle for 15 seconds.
- (e) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / DTC INFO / CURRENT CODES.

CHECK:

Read DTCs.

Result:

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

B**Check for intermittent problems****A****Replace ECM (See page [SF-60](#)).**

-MEMO-

-MEMO-

-MEMO-