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

DESCRIPTION

HINT:

This ETCS (Electronic Throttle Control System) does not use a throttle cable.

The APP sensor is mounted on the accelerator pedal bracket and has 2 sensor circuits: VPA (main) and VPA2 (sub). This sensor is a non-contact type and uses Hall-effect elements in order to yield accurate signals even in extreme driving conditions, such as at high speeds as well as very low speeds. The voltage, which is applied to terminals VPA and VPA2 of the ECM, varies between 0.5 V and 4.5 V in proportion to the operating angle of the accelerator pedal (throttle valve). A signal from VPA 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 VPA 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 VPA and VPA2, and controls the throttle actuator according to these signals.

ES

APP Sensor Output Voltage (V)

APP Sensor   ECM

Magnet   VPA
IC No. 1
          EPA
          VCPA
          VPA2
          EPA2
IC No. 2   VCP2
Magnet

*1   *2
4.55
3.988
3.75
3.188
1.6
0.8

0.29

0   Usable Range   15.9
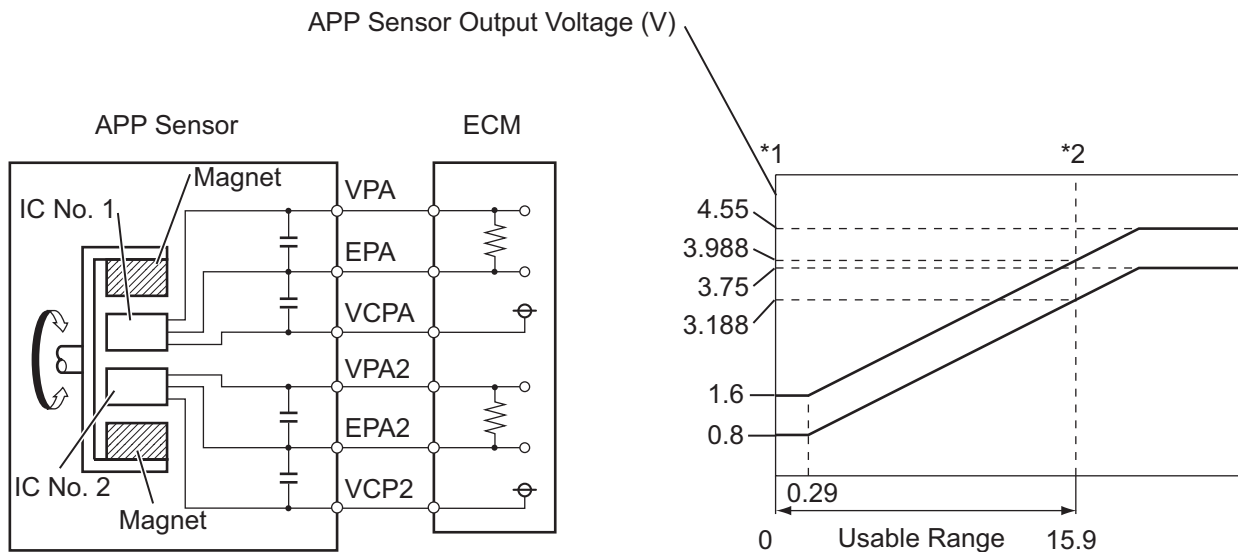
Accelerator Pedal Turning Angle (°)

*1: Accelerator Pedal Fully Released

*2: Accelerator Pedal Fully Depressed

Y   A112620E03

DTC No.	DTC Detection Condition	Trouble Area
P2120	VPA fluctuates rapidly beyond upper and lower malfunction thresholds for 0.5 seconds or more (1 trip detection logic)	• APP sensor • ECM
P2122	VPA 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 VPA circuit • ECM
P2123	VPA 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 (b) VPA 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 VPA and VPA2 0.02 V or less (b) VPA 0.4 V or less and VPA2 1.2 V or less	• Short between VPA 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 to 0.2 V	0 to 0.2 V	0 to 0.2 V	0 to 0.2 V
Open or ground short in VPA circuit	0 to 0.2 V	1.2 to 2.0 V	0 to 0.2 V	3.4 to 4.7 V
Open or ground short in VPA2 circuit	0.5 to 1.1 V	0 to 0.2 V	2.6 to 4.5 V	0 to 0.2 V
EPA circuit open	4.5 to 5.0 V	4.5 to 5.0 V	4.5 to 5.0 V	4.5 to 5.0 V
Normal condition	0.5 to 1.1 V	1.2 to 2.0 V	2.6 to 4.5 V	3.4 to 4.7 V

HINT:
• Accelerator pedal positions are expressed as voltages.
• AP stands for Accelerator Pedal.

ES

MONITOR DESCRIPTION

When either output voltage of VPA or VPA2 deviates from the standard range, or the difference between the output voltages 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 output voltage of VPA drops below 0.4 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.

MONITOR STRATEGY

Related DTCs	P2120: 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
Either of following conditions 1 or 2 met:	-
1. Ignition switch	ON
2. Throttle actuator power	ON

TYPICAL MALFUNCTION THRESHOLDS

P2120:

Either of following conditions 1 or 2 met:	-
1. VPA voltage when VPA2 voltage 0.04 V or more	0.4 V or less
2. VPA voltage	4.8 V or more

P2122:

VPA voltage when VPA2 voltage 0.04 V or more	0.4 V or less

P2123:

VPA voltage	4.8 V or more

P2125:

Either of following conditions 1 or 2 met:	-
1. VPA2 voltage when VPA voltage 0.04 V or more	1.2 V or less
2. VPA2 voltage when VPA voltage 0.4 to 3.45 V	4.8 V or more

P2127:

VPA2 voltage when VPA voltage 0.04 V or more	1.2 V or less

P2128:

VPA2 voltage when VPA voltage 0.4 to 3.45 V	4.8 V or more

P2138:

Either of following conditions A or B met:	-
Condition A	-
Difference between VPA and VPA 2 voltages	0.02 V or less
Condition B	-
VPA voltage	0.4 V or less
VPA2 voltage	1.2 V or less

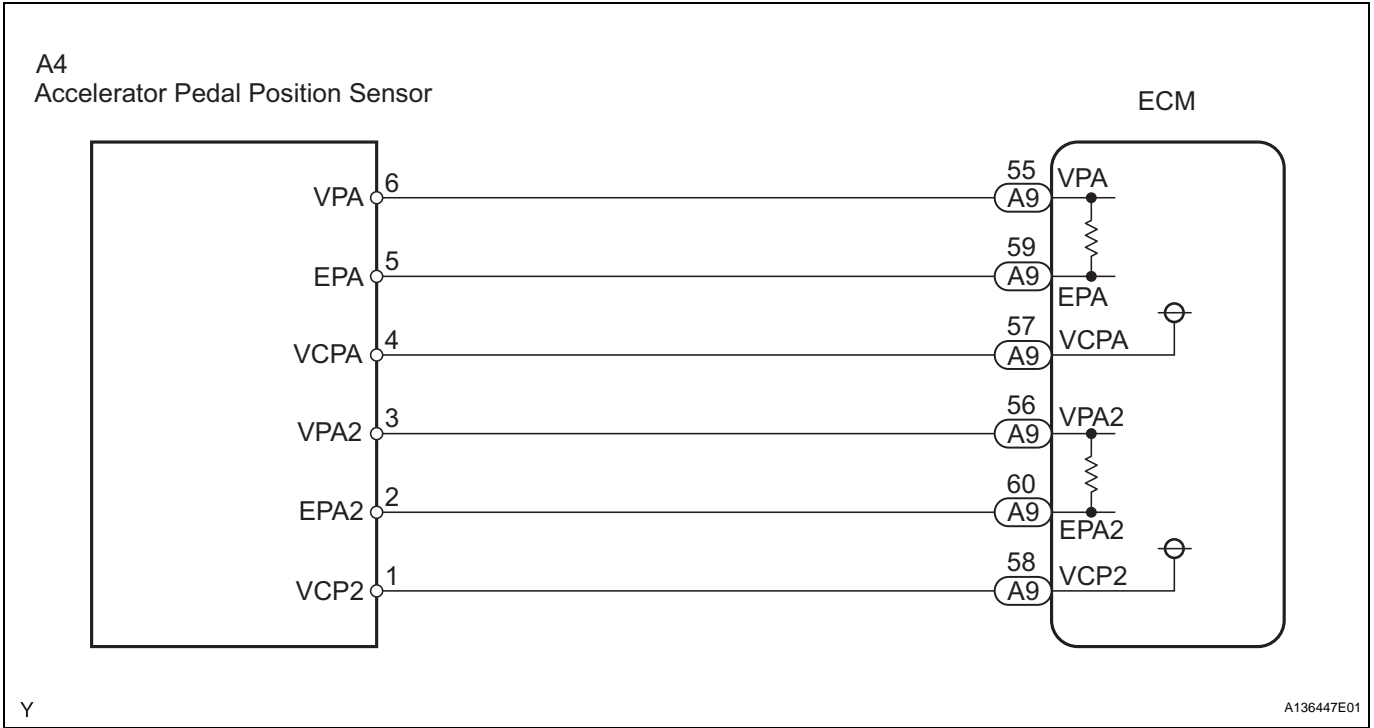## COMPONENT OPERATING RANGE

VPA voltage	0.5 to 4.7 V
VPA2 voltage	1.2 to 4.7 V
Difference between VPA and VPA2 voltages	More than 0.02 V

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 malfunctions, 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.

WIRING DIAGRAM

A4
Accelerator Pedal Position Sensor

ECM

VPA	6	55 A9	VPA
EPA	5	59 A9	EPA
VCPA	4	57 A9	VCPA
VPA2	3	56 A9	VPA2
EPA2	2	60 A9	EPA2
VCP2	1	58 A9	VCP2

Y

A136447E01

INSPECTION PROCEDURE

HINT:
• These DTCs relate to the Accelerator Pedal Position (APP) sensor.
• Read freeze frame data using the intelligent tester. Freeze frame data records the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, 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 USING INTELLIGENT TESTER (ACCEL POS #1 AND ACCEL POS #2)**
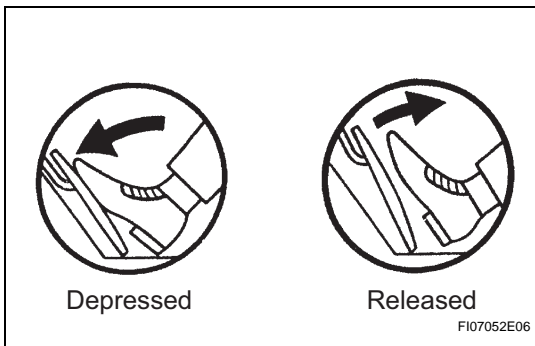
Depressed   Released

FI07052E06

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON and turn the tester ON.
(c) Select the following menu items: DIAGNOSIS / ENHANCED OBD II / DATA LIST / ETCS / ACCEL POS #1 and ACCEL POS #2.
(d) Read the value displayed on the tester.
Standard voltage

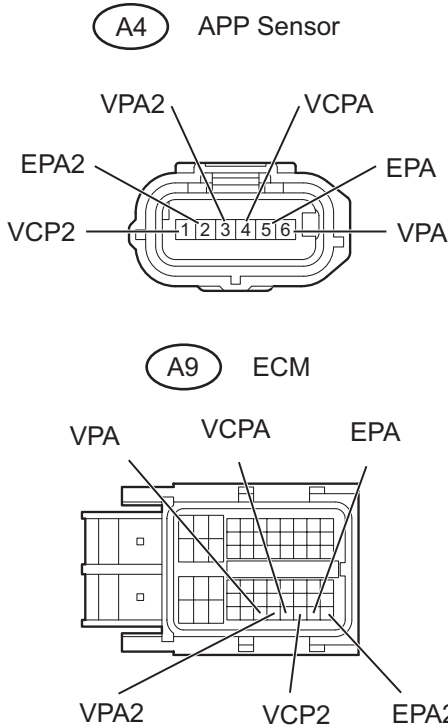| **Accelerator Pedal Operation**	**ACCEL POS #1**	**ACCEL POS #2**
Released → Depressed → Released	0.5 to 4.5 V	1.2 to 4.7 V
	Difference between ACCEL POS #1 and ACCEL POS #2 is greater than 0.02 V	Difference between ACCEL POS #1 and ACCEL POS #2 is greater than 0.02 V

OK	**Go to step 5**

NG

ES

| 2 | CHECK WIRE HARNESS (ACCELERATOR PEDAL POSITION SENSOR - ECM) |

Wire Harness Side:

A4   APP Sensor

VPA2   VCPA
EPA2   EPA
VCP2   1 2 3 4 5 6   VPA

A9   ECM

VPA   VCPA   EPA

VPA2   VCP2   EPA2

A115665E08

(a) Disconnect the A4 Accelerator Pedal Position (APP) sensor connector.
(b) Disconnect the A9 ECM connector.
(c) Measure the resistance.
Standard resistance

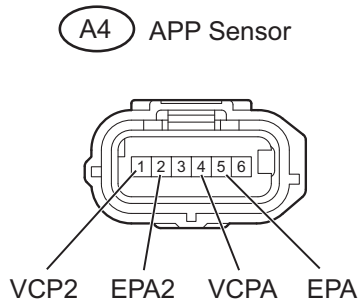| Tester Connection	Specified Condition
A4-6 (VPA) - A9-55 (VPA)	Below 1 Ω
A4-5 (EPA) - A9-59 (EPA)	Below 1 Ω
A4-4 (VCPA) - A9-57 (VCPA)	Below 1 Ω
A4-3 (VPA2) - A9-56 (VPA2)	Below 1 Ω
A4-2 (EPA2) - A9-60 (EPA2)	Below 1 Ω
A4-1 (VCP2) - A9-58 (VCP2)	Below 1 Ω
A4-6 (VPA) or A9-55 (VPA) - body ground	10 kΩ or higher
A4-5 (EPA) or A9-59 (EPA) - body ground	10 kΩ or higher
A4-4 (VCPA) or A9-57 (VCPA) - body ground	10 kΩ or higher
A4-3 (VPA2) or A9-56 (VPA2) - body ground	10 kΩ or higher
A4-2 (EPA2) or A9-60 (EPA2) - body ground	10 kΩ or higher
A4-1 (VCP2) or A9-58 (VCP2) - body ground	10 kΩ or higher

(d) Reconnect the APP sensor connector.
(e) Reconnect the ECM connector.

| NG > | **REPAIR OR REPLACE HARNESS AND CONNECTOR** |

| OK |

| 3 | CHECK ECM (VCPA AND VCP2 VOLTAGE) |

Wire Harness Side:

A4   APP Sensor

1 2 3 4 5 6

VCP2   EPA2   VCPA   EPA

A115666E10

(a) Disconnect the A4 APP sensor connector.
(b) Turn the ignition switch ON.
(c) Measure the voltage between the terminals of the A4 APP sensor connector.
Standard voltage

Tester Connection	Specified Condition
A4-4 (VCPA) - A4-5 (EPA)	4.5 to 5.5 V
A4-1 (VCP2) - A4-2 (EPA2)	4.5 to 5.5 V

(d) Reconnect the APP sensor connector.

| NG > | **REPLACE ECM** |

OK

4	REPLACE ACCELERATOR PEDAL ASSEMBLY

NEXT

5	CHECK WHETHER DTC OUTPUT RECURS (ACCELERATOR PEDAL POSITION SENSOR DTCS)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON and turn the tester ON.
(c) Clear DTCs (see page ES-39).
(d) Start the engine.
(e) Allow the engine to idle for 15 seconds.
(f) Select the following menu items: DIAGNOSIS / ENHANCED OBD II / DTC INFO / CURRENT CODES.
(g) Read DTCs.

Result

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

B	SYSTEM OK

A

REPLACE ECM