

<b>DTC</b>	<b>P0120/41</b>	<b>THROTTLE/PEDAL POSITION SENSOR/SWITCH "A" CIRCUIT</b>
<b>DTC</b>	<b>P0122/41</b>	<b>THROTTLE/PEDAL POSITION SENSOR/SWITCH "A" CIRCUIT LOW INPUT</b>
<b>DTC</b>	<b>P0123/41</b>	<b>THROTTLE/PEDAL POSITION SENSOR/SWITCH "A" CIRCUIT HIGH INPUT</b>
<b>DTC</b>	<b>P0220/41</b>	<b>THROTTLE/PEDAL POSITION SENSOR/SWITCH "B" CIRCUIT</b>
<b>DTC</b>	<b>P0222/41</b>	<b>THROTTLE/PEDAL POSITION SENSOR/SWITCH "B" CIRCUIT LOW INPUT</b>
<b>DTC</b>	<b>P0223/41</b>	<b>THROTTLE/PEDAL POSITION SENSOR/SWITCH "B" CIRCUIT HIGH INPUT</b>
<b>DTC</b>	<b>P2135/41</b>	<b>THROTTLE/PEDAL POSITION SENSOR/SWITCH "A"/"B" VOLTAGE CORRELATION</b>

**HINT:**

These DTCs are related to the throttle position sensor.

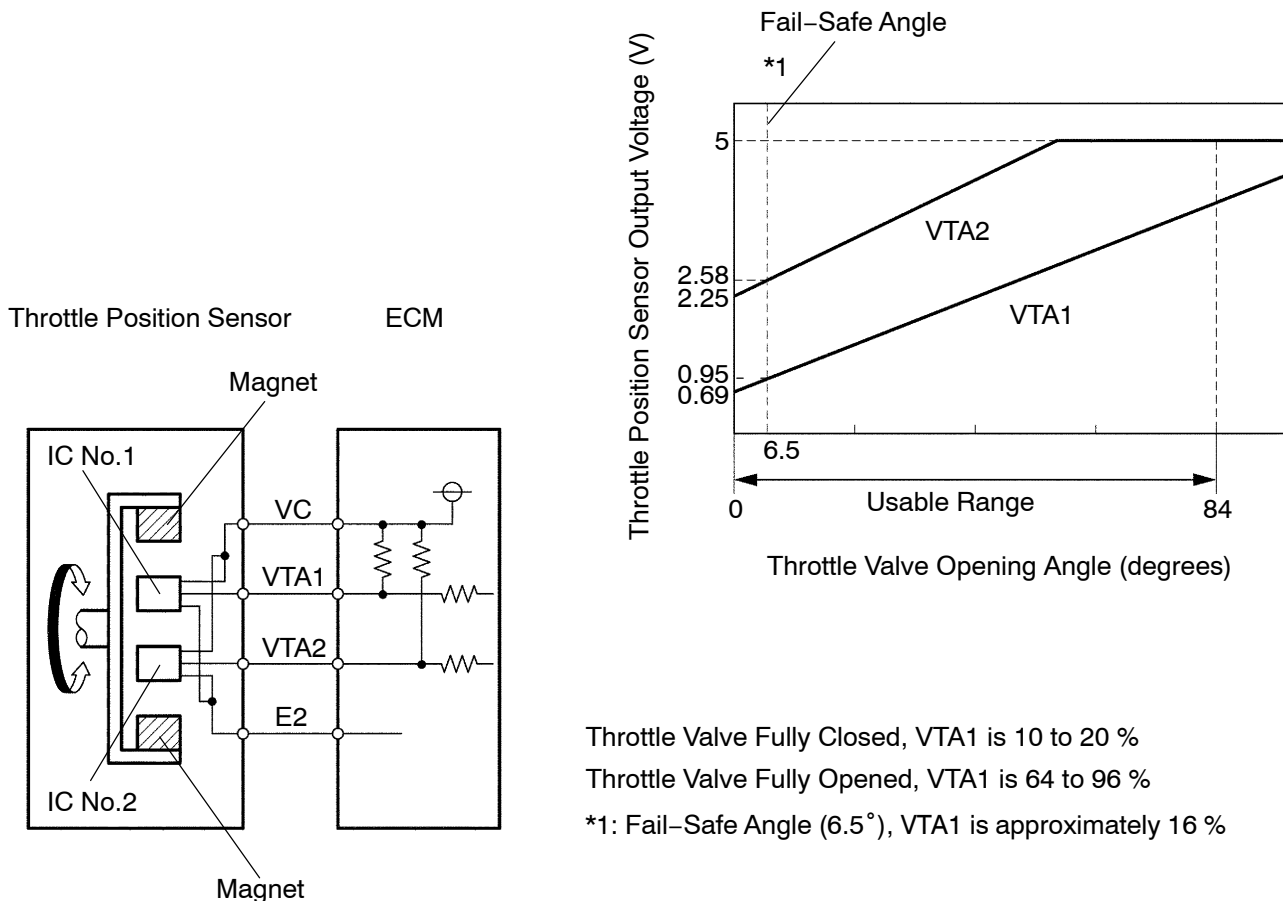
## CIRCUIT DESCRIPTION

### HINT:

- This ETCS (Electronic Throttle Control System) does not use a throttle cable.
- This throttle position sensor is a non-contact type.

The throttle position sensor is mounted on the throttle body and it detects the opening angle of the throttle valve. This sensor is electronically controlled and uses Hall-effect elements, so that accurate control and reliability can be obtained. The throttle position sensor has 2 sensor elements and signal output: VTA1 and VTA2. VTA1 is used to detect the throttle opening angle and VTA2 is used to detect a malfunction in VTA1. Voltage applied to VTA1 and VTA2 changes between 0V and 5V in proportion to the opening angle of the throttle valve. There are several checks that the ECM performs to confirm proper operation of the throttle position sensor and VTA1.

The ECM judges the actual opening angle of the throttle valve from these signals input from terminals VTA1 and VTA2, and the ECM controls the throttle motor to make the throttle valve angle properly in response to driver input.



NOTE: Throttle valve opening angle detected by the sensor terminal VTA1 is expressed as percentages.

DTC No.	DTC Detection Condition	Trouble Area
—	Conditions of DTC P0120/41, P0122/41, P0123/41, P0220/41, P0222/41 or P0223/41 continue for 2 seconds (Open or short in the throttle position sensor circuit)	—
P0120/41	Output voltage of VTA1 quickly fluctuates up and down beyond lower and upper malfunction thresholds	<ul style="list-style-type: none"> <li>• Throttle position sensor (built into throttle body)</li> <li>• ECM</li> </ul>
P0122/41	VTA1 is 0.2 V or less	<ul style="list-style-type: none"> <li>• Throttle position sensor (built into throttle body)</li> <li>• Short in VTA1 circuit</li> <li>• Open in VC circuit</li> <li>• ECM</li> </ul>
P0123/41	VTA1 is 4.8 V or more	<ul style="list-style-type: none"> <li>• Throttle position sensor (built into throttle body)</li> <li>• Open in VTA1 circuit</li> <li>• Open in E2 circuit</li> <li>• VC and VTA1 circuits are short-circuited</li> <li>• ECM</li> </ul>
P0220/41	Output voltages of VTA1 and VTA2 quickly fluctuate up and down beyond their respective lower and upper malfunction thresholds	<ul style="list-style-type: none"> <li>• Throttle position sensor (built into throttle body)</li> <li>• ECM</li> </ul>
P0222/41	VTA2 is 0.5 V or less	<ul style="list-style-type: none"> <li>• Throttle position sensor (built into throttle body)</li> <li>• Short in VTA2 circuit</li> <li>• Open in VC circuit</li> <li>• ECM</li> </ul>
P0223/41	VTA2 is 4.8 V or more, VTA1 is between 0.2 V and 1.8 V	<ul style="list-style-type: none"> <li>• Throttle position sensor (built into throttle body)</li> <li>• Open in VTA2 circuit</li> <li>• Open in E2 circuit</li> <li>• VC and VTA2 circuits are short-circuited</li> <li>• ECM</li> </ul>
P2135/41	Condition (a) continues for 0.5 second or more, or condition (b) continues for 0.4 second or more: (a) Difference between VTA1 and VTA2 is 0.02 V or less (b) VTA1 is 0.2 V or less and VTA2 is 0.5 V or less	<ul style="list-style-type: none"> <li>• VTA1 and VTA2 circuits are short-circuited</li> <li>• Throttle position sensor (built into throttle body)</li> <li>• ECM</li> </ul>

**NOTICE:**

**When a malfunction is detected, the throttle valve is locked at a certain opening angle. Also, the whole electronically controlled throttle operation is cancelled until the system returns to normal and the ignition switch is turned to OFF.**

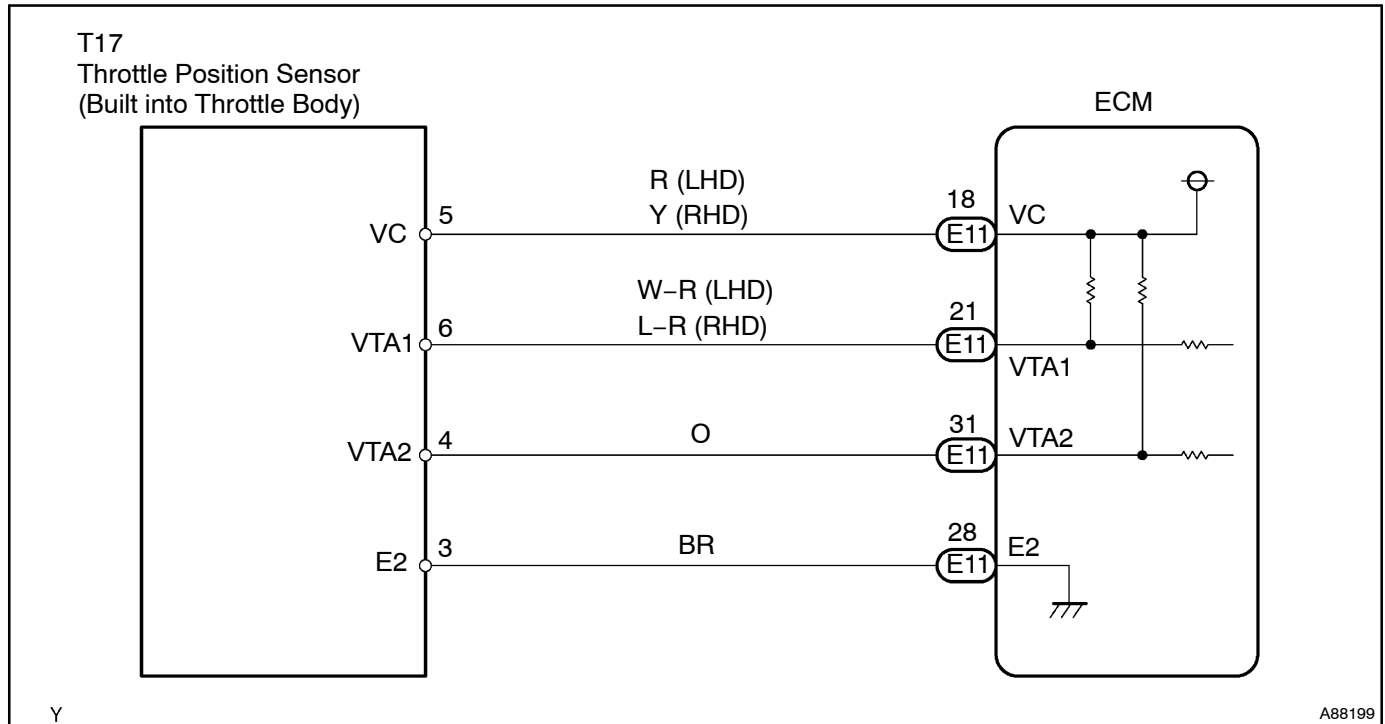
**HINT:**

- When any of these DTCs is detected, check the throttle valve opening angle (Throttle POS and Throttle POS No. 2) using the intelligent tester II.
- The Throttle POS means VTA1 signal (expressed in percentage), and Throttle POS No. 2 means the VTA2 signal (expressed in voltage).

**Reference (Normal condition):**

Tester Display	Accelerator Pedal Fully Released	Accelerator Pedal Fully Depressed
Throttle Position	10 to 24 %	64 to 96 %
Throttle Position No. 2	2.1 to 3.1 V	4.5 to 5.5 V

## WIRING DIAGRAM



## INSPECTION PROCEDURE

### HINT:

- If DTCs related to different systems that have terminal E2 as the ground terminal are output simultaneously, terminal E2 may have an open circuit.
- Read freeze frame data using the intelligent tester II. Freeze frame data record 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.

## When using intelligent tester II:

### 1 READ VALUE OF INTELLIGENT TESTER II(THROTTLE POS AND THROTTLE POS NO. 2)

- Connect the intelligent tester II to the DLC3.
- Turn the ignition switch to ON and turn the intelligent tester II ON.
- Select the following menu items: Powertrain / Engine and ECT / Data List / Throttle POS and Throttle POS No. 2.
- Check the values displayed on the intelligent tester II.

#### Result:

TP (VTA1) When AP Released	TP No.2 (VTA2) When AP Released	TP (VTA1) When AP Depressed	TP No.2 (VTA2) When AP Depressed	Trouble Area	Proceed To
0 %	0 to 0.2 V	0 %	0 to 0.2 V	VC circuit open	A
100 %	4.5 to 5.5 V	100 %	4.5 to 5.5 V	E2 circuit open	A
0 or 100 %	2.1 to 3.1 V (Fail-safe)	0 % or 100 %	2.1 to 3.1 V (Fail-safe)	VTA1 circuit open or ground short	A
10 to 24 % (Fail-safe)	0 to 0.2 V or 4.5 to 5.5 V	10 to 24 % (Fail-safe)	0 to 0.2 V or 4.5 to 5.5 V	VTA2 circuit open or ground short	A
10 to 24 %	2.1 to 3.1 V	64 to 96 % (Not fail-safe)	4.5 to 5.5 V (Not fail-safe)	Throttle position sen- sor circuit is normal	B

#### HINT:

- TP stands for Throttle Position, and AP stands for Accelerator Pedal.
- VTA1 is expressed as percentages, and VTA2 is expressed as voltages.

B

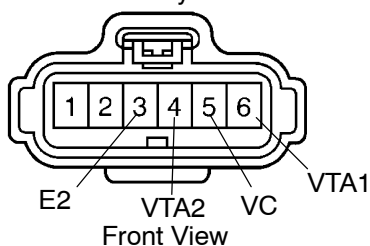
Go to step 5

A

### 2 CHECK HARNESS AND CONNECTOR(THROTTLE POSITION SENSOR - ECM)

#### Wire Harness Side:

(T17) Throttle Body Connector



- Disconnect the T17 throttle body connector.
- Disconnect the E11 ECM connector.
- Check the resistance.

#### Standard (Check for open):

Tester Connection	Specified Condition
VC (T17-5) - VC (E11-18)	Below 1 $\Omega$
VTA1 (T17-6) - VTA1 (E11-21)	Below 1 $\Omega$
VTA2 (T17-4) - VTA2 (E11-31)	Below 1 $\Omega$
E2 (T17-3) - E2 (E11-28)	Below 1 $\Omega$

#### Standard (Check for short):

Tester Connection	Specified Condition
VC (T17-5) or VC (E11-18) - Body ground	10 k $\Omega$ or higher
VTA1 (T17-6) or VTA1 (E11-21) - Body ground	10 k $\Omega$ or higher
VTA2 (T17-4) or VTA2 (E11-31) - Body ground	10 k $\Omega$ or higher

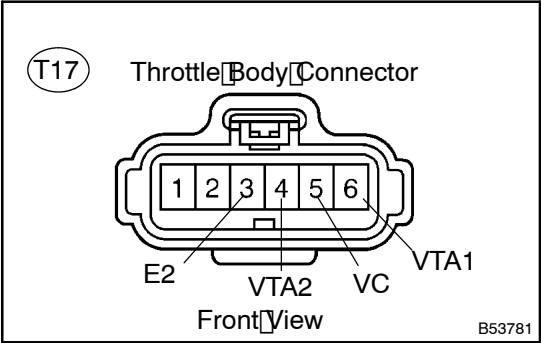
- Reconnect the throttle body connector.
- Reconnect the ECM connector.

NG

REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

3 INSPECT ECM (VC VOLTAGE)

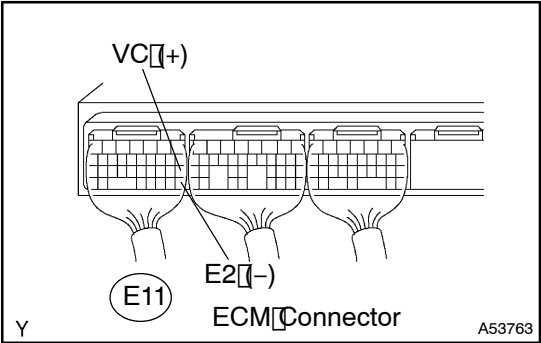


- (a) Disconnect the T17 Throttle Body Connector.
- (b) Turn the Ignition Switch to ON and turn the Intelligent Tester II ON.
- (c) Measure the voltage between the specified terminals of the E11 ECM connector.

Standard:

Tester Connection	Specified Condition
VC (E11-18) - E2 (E11-28)	4.5 to 5.5 V

- (d) Reconnect the Throttle Body Connector.



NG REPLACE ECM (See page 10-30)

OK

4 REPLACE THROTTLE BODY ASSY (See page 10-11)

GO

5 CHECK IF DTC OUTPUT RECURS (THROTTLE POSITION SENSOR DTCs)

- (a) Clear the DTC(s) (see page 05-20).
- (b) Start the engine.
- (c) Run the engine idling for 15 seconds or more.
- (d) Connect the Intelligent Tester II to the DLC3.
- (e) Turn the Ignition Switch to ON and turn the Intelligent Tester II ON.
- (f) Select the following menu items: Powertrain / Engine and ECT / DTC.
- (g) Read DTCs.

Result:

Display (DTC Output)	Proceed To
P0120/41, P0122/41, P0123/41, P0220/41, P0222/41, P0223/41 and/or P2135/41	A
No output	B

B SYSTEM OK

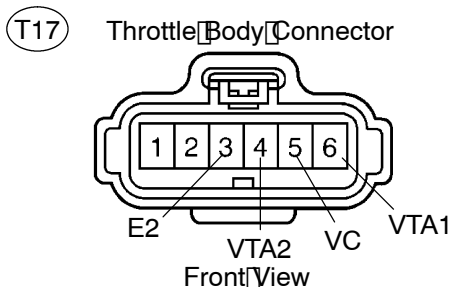
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REPLACE ECM (See page 10-30)

## When not using intelligent tester II:

### 1 CHECK HARNESS AND CONNECTOR (THROTTLE POSITION SENSOR - ECM)

#### Wire Harness Side:



- Disconnect the T17 throttle body connector.
- Disconnect the E11 ECM connector.
- Check the resistance.

#### Standard (Check for open):

Tester Connection	Specified Condition
VC (T17-5) - VC (E11-18)	Below 1 $\Omega$
VTA1 (T17-6) - VTA1 (E11-21)	Below 1 $\Omega$
VTA2 (T17-4) - VTA2 (E11-31)	Below 1 $\Omega$
E2 (T17-3) - E2 (E11-28)	Below 1 $\Omega$

#### Standard (Check for short):

Tester Connection	Specified Condition
VC (T17-5) or VC (E11-18) - Body Ground	10 k $\Omega$ or higher
VTA1 (T17-6) or VTA1 (E11-21) - Body Ground	10 k $\Omega$ or higher
VTA2 (T17-4) or VTA2 (E11-31) - Body Ground	10 k $\Omega$ or higher

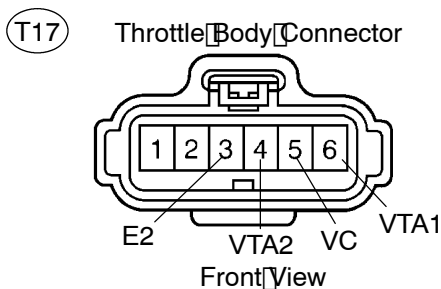
- Reconnect the throttle body connector.
- Reconnect the ECM connector.

NG

**REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

### 2 INSPECT ECM (VC VOLTAGE)



- Disconnect the T17 throttle body connector.
- Turn the ignition switch to ON.
- Measure the voltage between the specified terminals of the E11 ECM connector.

#### Standard:

Tester Connection	Specified Condition
VC (E11-18) - E2 (E11-28)	4.5 to 5.5 V

- Reconnect the throttle body connector.

NG

**REPLACE ECM (See page 10-30)**

OK

**3** REPLACE THROTTLE BODY ASSY (See page 10-11)**GO****4** CHECK IF DTC OUTPUT RECURS (THROTTLE POSITION SENSOR DTCS)

- (a) Clear the DTC(s) (see page 05-20).  
(b) Start the engine.  
(c) Run the engine is idling for 15 seconds or more.  
(d) Read DTCs (see page 05-20).

**Result:**

Display (DTC Output)	Proceed To
P0120/41, P0122/41, P0123/41, P0220/41, P0222/41, P0223/41 and/or P2135/41	A
No output	B

**B****SYSTEM OK****A****REPLACE ECM (See page 10-30)**