DTC	P0120	THROTTLE/PEDAL POSITION SENSOR/SWITCH "A" CIRCUIT

DTC	P0122	THROTTLE/PEDAL POSITION SENSOR/SWITCH "A" CIRCUIT LOW INPUT

DTC	P0123	THROTTLE/PEDAL POSITION SENSOR/SWITCH "A" CIRCUIT HIGH INPUT

DTC	P0220	THROTTLE/PEDAL POSITION SENSOR/SWITCH "B" CIRCUIT

DTC	P0222	THROTTLE/PEDAL POSITION SENSOR/SWITCH "B" CIRCUIT LOW INPUT

DTC	P0223	THROTTLE/PEDAL POSITION SENSOR/SWITCH "B" CIRCUIT HIGH INPUT

DTC	P2135	THROTTLE/PEDAL POSITION SENSOR/SWITCH "A"/"B" VOLTAGE CORRELATION

HINT:
This is the purpose of the "throttle position sensor".

CIRCUIT DESCRIPTION
Except PZEV

HINT:
- This Electronic Throttle Control System (ETCS) 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/signal outputs: VTA1 and VTA2. VTA1 is used to detect the throttle opening angle and VTA2 is used to detect malfunctions in VTA1 Voltage applied to VTA1 and VTA2 change between 0 V and 5 V 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 current 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 inputs.
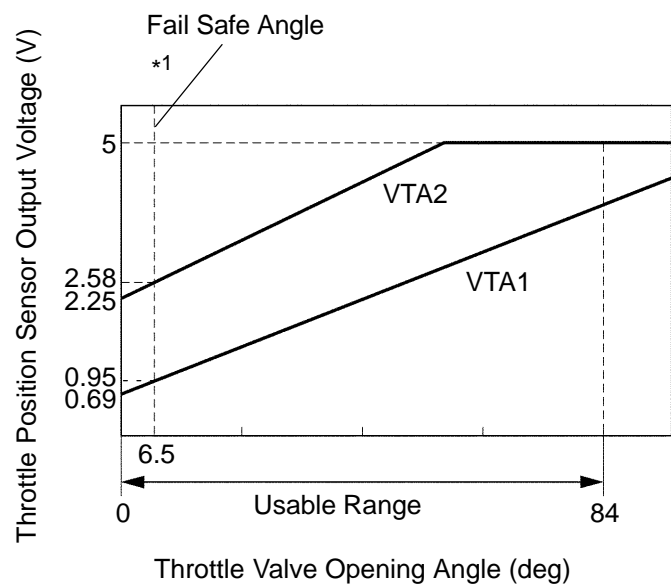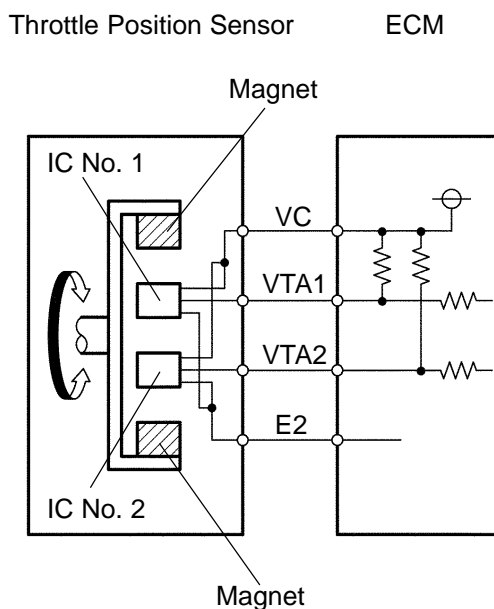
Throttle Valve Fully Closed
(Throttle Position expressed as percentage (VTA1) 10 to 24 %)

Throttle Valve Fully Opened
(Throttle Position expressed as percentage (VTA1) 64 to 96 %)

[1]: Fail Safe Angle 6.5°
(Throttle Position expressed as percentage (VTA1)[1]/ (VTA)[2] about 16 %)

A19755   A19802

PZEV

HINT:
- This electrical throttle system is no used throttle cable.
- This is procedure of throttle position sensor.

The throttle position sensor is mounted on the throttle body and it has 2 sensors to detect the throttle opening angle and a malfunction of the throttle position sensor.

The voltage applied to terminals VTA and VTA2 of the ECM changes between 0 V and 5 V in proportion to the opening angle of the throttle valve. The VTA is a signal to indicate the actual throttle valve opening angle which is used for the engine control, and the VTA2 is a signal to indicate the information about the opening angle which is used for detecting a malfunction.

The ECM judges the current opening angle of the throttle valve from these signals input from terminals VTA and VTA2, and the ECM controls the throttle motor to make the throttle valve angle properly in response to the driving condition.

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 OFF.
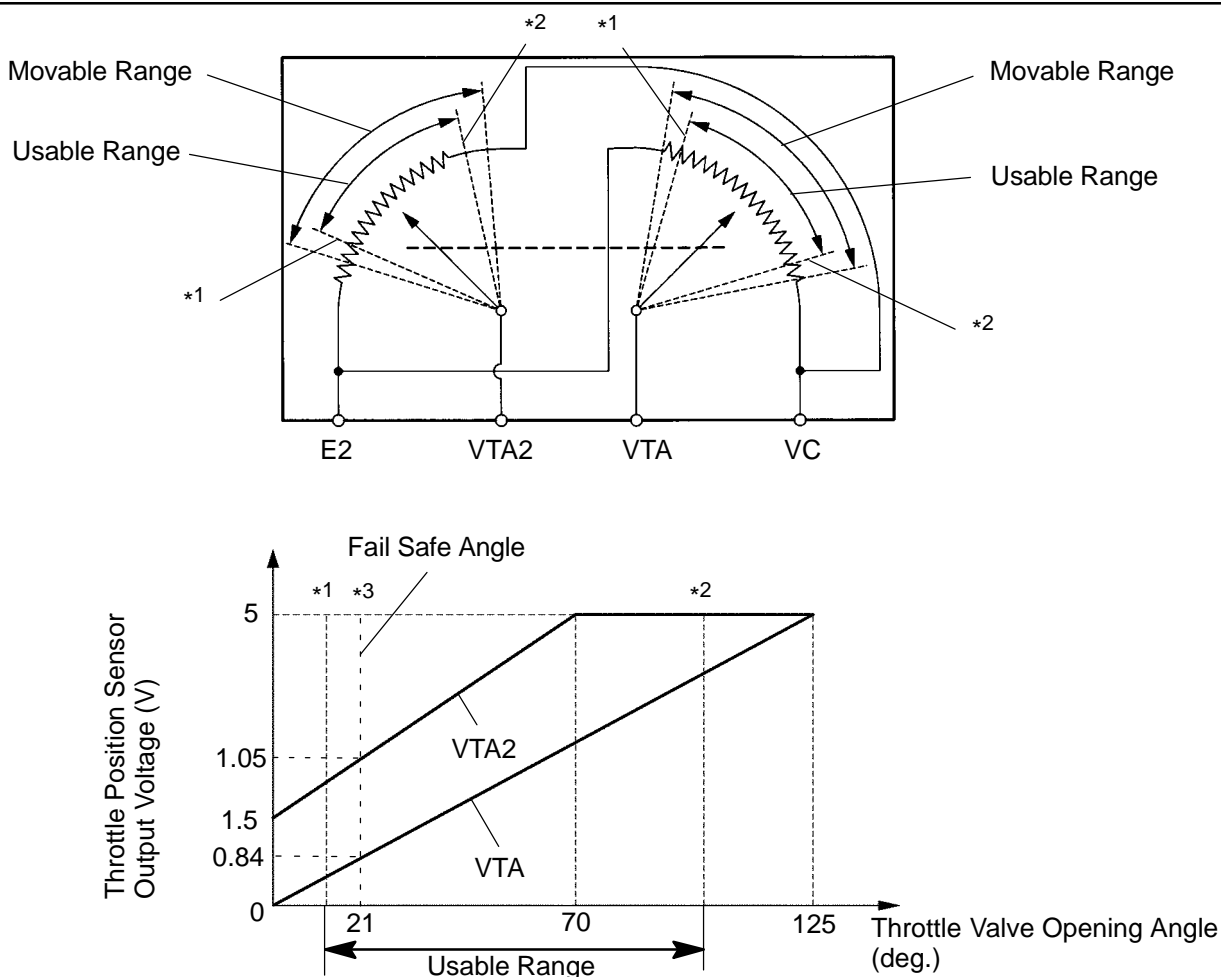
*1: Throttle Valve Fully Closed 15°
    (Throttle Position Opening Position Expressed as Percentage (VAT) 0 %)

*2: Throttle Valve Fully Opened 104°
    (Throttle Position Opening Position Expressed as Percentage (VAT) about 100 %)

*3: Fail Safe Angle 21°
    (Throttle Position Opening Position Expressed as Percentage (VAT) 16 %)

A02395 A02396   A71013

DTC No.	DTC Detection Condition	Trouble Area
Condition (a) of DTC P0120, P0122, P0123, P0220, P0222 or P0223 continues for 2 seconds (open or short in the throttle position sensor circuit)		
P0120	Detection conditions for DTCs P0122 and P0123 are not satisfied but condition (a) is satisfied (a) VTA1[*1]/VTA[*2] is "0.2 V or less" or VTA1[*1]/VTA[*2] is "4.535 V or more"	• Throttle position sensor • ECM
P0122	(a) VTA1[*1]/VTA[*2] is 0.2 V or less	• Throttle position sensor • Short in VTA1[*1]/VTA[*2] circuit • Open in VC circuit • ECM
P0123	(a) VTA1[*1]/VTA[*2] is 4.535 V or more	• Throttle position sensor • Open in VTA1[*1]/VTA[*2] circuit • Open in E2 circuit • Short in VC and VTA1[*1]/VTA[*2] circuit • ECM
P0220	Detection conditions for DTCs P0222 and P0223 are not satisfied but condition (a) is satisfied (a) VTA2 is "1.75 V or less" or VTA2 is "4.8 V or more" and VTA1[*1]/VTA[*2] is "0.2 V or more" and VTA1[*1]/VTA[*2] is "1.75 V or less"	• Throttle position sensor • ECM
P0222	(a) VTA2 is 1.75 V or less	• Throttle position sensor • Short in VTA2 circuit • Open in VC circuit • ECM
P0223	(a) VTA2 is "4.8 V or more" and VTA1[*1]/VTA[*2] is "0.2 V or more" and VTA1[*1]/VTA[*2] is "1.75 V or less"	• Throttle position sensor • Open in VTA2 circuit • Open in E2 circuit • Short in VC and VTA2 circuit • ECM
P2135	Condition (a) continues for 0.5 seconds or more, or condition (b) continues for 0.4 seconds or more: (a) Difference between VTA1[*1]/VTA[*2] and VTA2 is 0.02 V or less (b) VTA1[*1]/VTA[*2] is "0.2 V or less" and VTA2 is "0.5 V or less"	• Short in VTA1[*1]/VTA[*2] and VTA2 circuit • Throttle position sensor • ECM

[*1]: Except PZEV

[*2]: PZEV

HINT:

• After confirming DTCs, use the hand−held tester or the OBD II scan tool to confirm the throttle valve opening percentage and closed throttle position switch condition.

• "THROTTLE POS" is the VTA1[*1]/VTA[*2] signal. "THROTTLE POS #2" is the VTA2 signal.

Reference (Normal condition):

Tester display	Accelerator pedal fully released	Accelerator pedal fully depressed
THROTTLE POS	10 to 24 %	64 to 96 %
THROTTLE POS #2	2.1 to 3.1 V	4.5 to 5.5 V

MONITOR DESCRIPTION

The ECM uses the throttle position sensor to monitor the throttle valve opening angle.

(a) There is a specific voltage difference expected between VTA1[1]/VTA[2] and VTA2 for each throttle opening angle.

- If the difference between VTA1[1]/VTA[2] and VTA2 is incorrect, the ECM interprets this as a default and will set a DTC.

(b) VTA1[1]/VTA[2] and VTA2 each have a specific voltage operating range.

- If VTA1[1]/VTA[2] or VTA2 is out of the normal operating range, the ECM interprets this as a fault and will set a DTC.

(c) VTA1[1]/VTA[2] and VTA2 should never be close to the same voltage levels.

- If VTA1[1]/VTA[2] is within 0.02 V of VTA2, the ECM interprets this as a short circuit in the throttle position sensor system and will set a DTC.

FAIL SAFE

If the Electronic Throttle Control System (ETCS) has a malfunction, the ECM cuts off current to the throttle control motor. 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 (inter-mittent 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 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.

MONITOR STRATEGY

Related DTCs	P0120: TP Sensor (VTA1) Range Check (Chattering) P0122: TP Sensor (VTA1) Range Check (Low voltage) P0123: TP Sensor (VTA1) Range Check (High voltage) P0220: TP Sensor (VTA2) Range Check (Chattering) P0222: TP Sensor (VTA2) Range Check (Low voltage) P0223: TP Sensor (VTA2) Range Check (High voltage) P2135: TP Sensor Range Check (Correlation)
Required sensors/components (Main)	TP sensor
Required sensors/components (Related)	–
Frequency of operation	Continuous
Duration	Accelerator pedal ON: 2 seconds Accelerator pedal OFF: 10 seconds 0.5 seconds or 0.4 seconds (P2135)
MIL operation	Immediate
Sequence operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever these DTCs are not present	See page

TYPICAL MALFUNCTION THRESHOLDS

P0120:

VTA1[1]/VTA[2] voltage	0.2 V or less, or 4.535 V or more

P0122:

VTA1[1]/VTA[2] voltage	0.2 V or less

P0123:

VTA1[1]/VTA[2] voltage	4.535 V or more

P0220:

VTA2 voltage	1.75 V or less, or 4.8 V or more

P0222:

VTA2 voltage	1.75 V or less

P0223:

VTA2 voltage when the VTA1[1]/VTA[2] is 0.2 to 2.02 V	4.8 V or more

P2135:

Either of the following conditions is met:	Condition 1 or 2
Condition 1	–
Difference between VTA1[1]/VTA[2] and VTA2 voltage	0.02 V or less
Condition 2	–
Both of the following conditions is met:	Condition (a) or (b)
(a) VTA1[1]/VTA[2] voltage	0.2 V or less
(b) VTA2 voltage	1.75 V or less

COMPONENT OPERATING RANGE

VTA1[1]/VTA[2] voltage	0.6 to 3.96 V
VTA2 voltage	2.25 to 4.8 V

WIRING DIAGRAM
Except PZEV
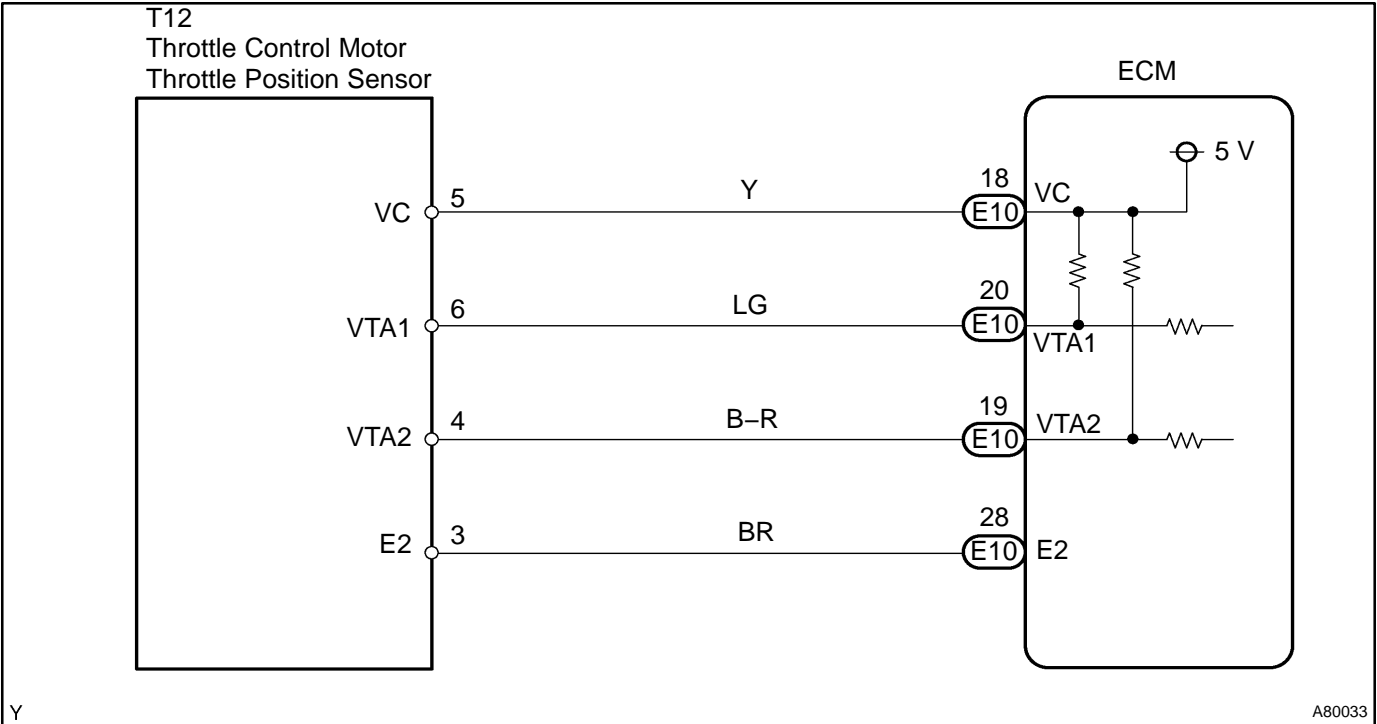
PZEV
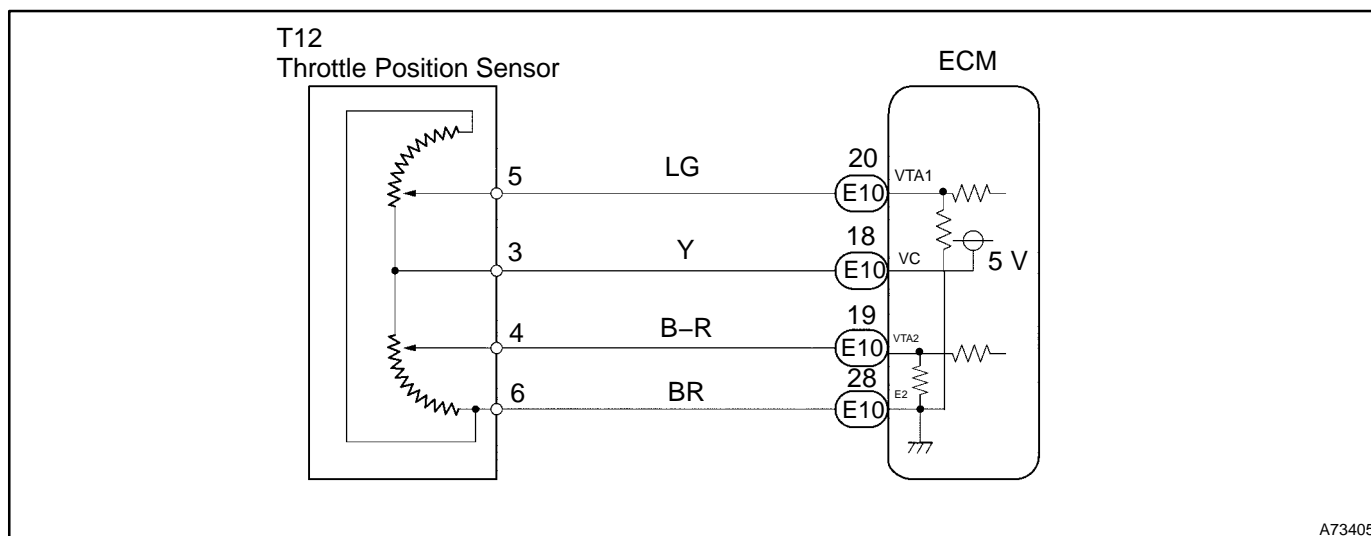
A73405

INSPECTION PROCEDURE

HINT:
- If DTCs that are related to different systems are output simultaneously while terminal E2 is used as a ground terminal, terminal E2 may have an open circuit.
- 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, and other data from the time the malfunction occurred.

Hand–held tester:

1	READ VALUE OF HAND–HELD TESTER (THROTTLE POS AND THROTTLE POS #2)

(a) On the hand–held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / DATA LIST / ALL / THROTTLE POS and THROTTLE POS #2. Read the values.

Result:

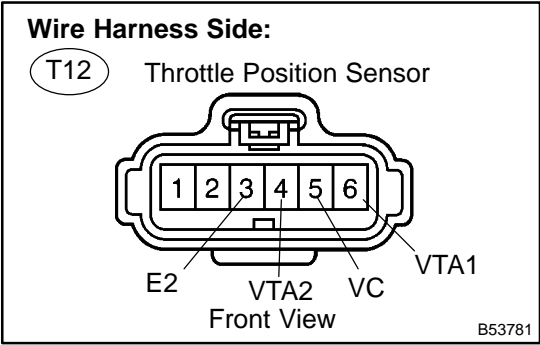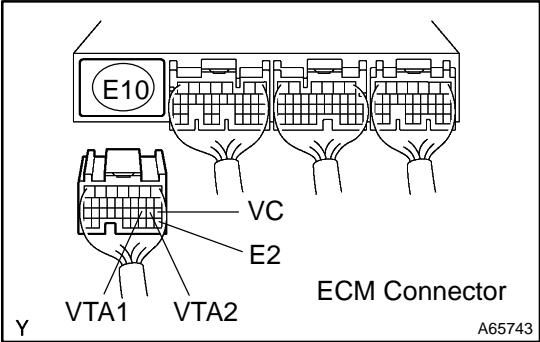| Throttle position expressed as percentage and voltage				Trouble Area	Proceed to
Accelerator pedal released		Accelerator pedal depressed			
THROTTLE POS (VTA1)*1/(VTA)*2	THROTTLE POS #2 (VTA2)	THROTTLE POS (VTA1)*1/(VTA)*2	THROTTLE POS #2 (VTA2)		
0 %	0 to 0.2 V	0 %	0 to 0.2 V	VC circuit open	A
100 %	4.5 to 5.5 V	100 %	4.5 to 5.5 V	E2 circuit open	
0 % or 100 %	2.1 to 3.1 V (fail safe)	0 % or 100 %	2.1 to 3.1 V (fail safe)	VTA1*1/VTA*2 circuit open or ground short	
about 16 % (fail safe)	0 to 0.2 or 4.5 to 5.5 V	about 16 % (fail safe)	0 to 0.2 or 4.5 to 5.5 V	VTA2 circuit open or ground short	
10 to 24 %	2.1 to 3.1 V	64 to 96 % (does not fail safe)	4.5 to 5.5 V (does not fail safe)	Throttle position sensor circuit is normal	B

B	Go to step 5

A

2	CHECK WIRE HARNESS (THROTTLE POSITION SENSOR – ECM)

Wire Harness Side:

T12   Throttle Position Sensor

E2   VTA2   VC   VTA1
Front View   B53781

(a) Disconnect the T12 throttle position sensor connector.
(b) Disconnect the E10 ECM connector.
(c) Check the resistance of the wire harness side connectors.
Standard:

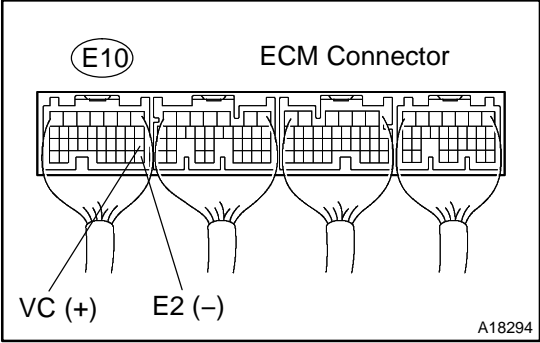| Tester Connection	Specified Condition
T12–5 (VC) – E10–18 (VC) T12–6 (VTA1) – E10–20 (VTA1) T12–4 (VTA2) – E10–19 (VTA2) T12–3 (E2) – E10–28 (E2)	Below 1 Ω
T12–5 (VC) or E10–18 (VC) – Body ground T12–6 (VTA1) or E10–20 (VTA1) – Body ground T12–4 (VTA2) or E10–19 (VTA2) – Body ground	10 kΩ or higher

E10

VC
E2
VTA1   VTA2   ECM Connector
Y   A65743

NG ▷ | REPAIR OR REPLACE HARNESS AND CONNECTOR |

OK

3	INSPECT ECM (VC VOLTAGE)

E10   ECM Connector

VC (+)   E2 (–)
A18294

(a) Disconnect the T12 throttle position sensor connector.
(b) Turn the ignition switch ON.
(c) Check the voltage of the E10 ECM connector.
Standard:

Tester Connection	Specified Condition
E10–18 (VC) – E10–28 (E2)	4.5 to 5.5 V

NG ▷ | REPLACE ECM (See page **10–9**) |

OK

| 4	REPLACE THROTTLE BODY ASSY (See page **10–18**)

GO

5	READ OUTPUT DTC (THROTTLE POSITION SENSOR DTCS ARE OUTPUT AGAIN)

(a) Clear the DTC (see page 05–41).
(b) Start the engine.
(c) Run the engine at idle for 15 seconds or more.
(d) Read the DTC.
Result:

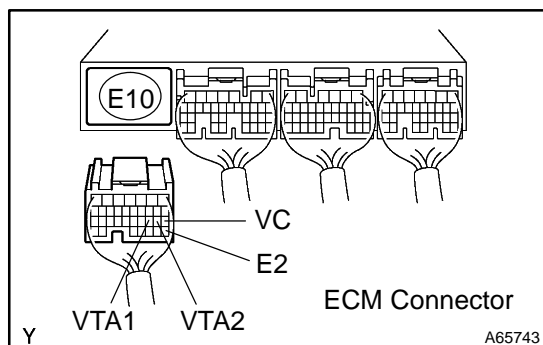| Display (DTC Output)	Proceed to
P0120, P0122, P0123, P0220, P0222, P0223 and/or P2135 are output again	A
No DTC output	B

> **B** > SYSTEM OK

> **A**

REPLACE ECM (See page 10–9)

OBD II scan tool (excluding hand–held tester):

1	CHECK WIRE HARNESS (THROTTLE POSITION SENSOR – ECM)

Wire Harness Side:

(T12) Throttle Position Sensor

1 2 3 4 5 6

E2 VTA2 VC VTA1
Front View

B53781
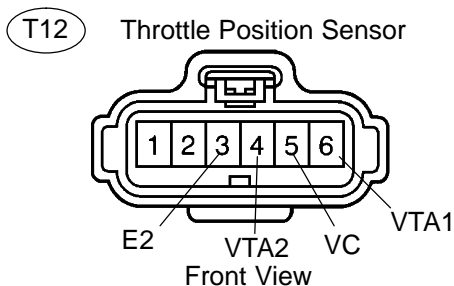
(a) Disconnect the T12 throttle position connector.
(b) Disconnect the E10 ECM connector.
(c) Check the resistance of the wire harness side connectors.
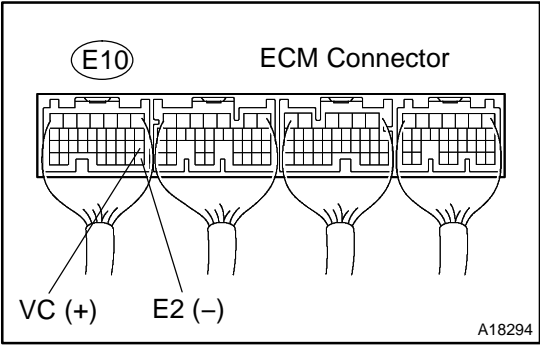**Standard:**

Tester Connection	Specified Condition
T12–5 (VC) – E10–18 (VC) T12–6 (VTA1) – E10–20 (VTA1) T12–4 (VTA2) – E10–19 (VTA2) T12–3 (E2) – E10–28 (E2)	Below 1 Ω
T12–5 (VC) or E10–18 (VC) – Body ground T12–6 (VTA1) or E10–20 (VTA1) – Body ground T12–4 (VTA2) or E10–19 (VTA2) – Body ground	10 kΩ or higher

(E10)

VC
E2
VTA1 VTA2
Y
ECM Connector
A65743

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

> **OK**

2	INSPECT ECM (VC VOLTAGE)

E10   ECM Connector

VC (+)   E2 (−)

A18294

(a) Disconnect the T12 throttle position sensor connector.
(b) Turn the ignition switch ON.
(c) Check the voltage of the E10 ECM connector.
    Standard:

Tester Connection	Specified Condition
E10–18 (VC) – E10–28 (E2)	4.5 to 5.5 V

NG ▷ **REPLACE ECM (See page 10–9)**

OK

3	REPLACE THROTTLE BODY ASSY (See page 10–18)

GO

4	READ OUTPUT DTC (THROTTLE POSITION SENSOR DTCS ARE OUTPUT AGAIN)

(a) Clear the DTC (see page 05–41).
(b) Start the engine.
(c) Run the engine at idle for 15 seconds or more.
(d) Read the DTC.
    Result:

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

B ▷ **SYSTEM OK**

A

REPLACE ECM (See page 10–9)