DTC	P0120	Throttle Pedal Position Sensor / Switch "A" Circuit Malfunction
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

DESCRIPTION

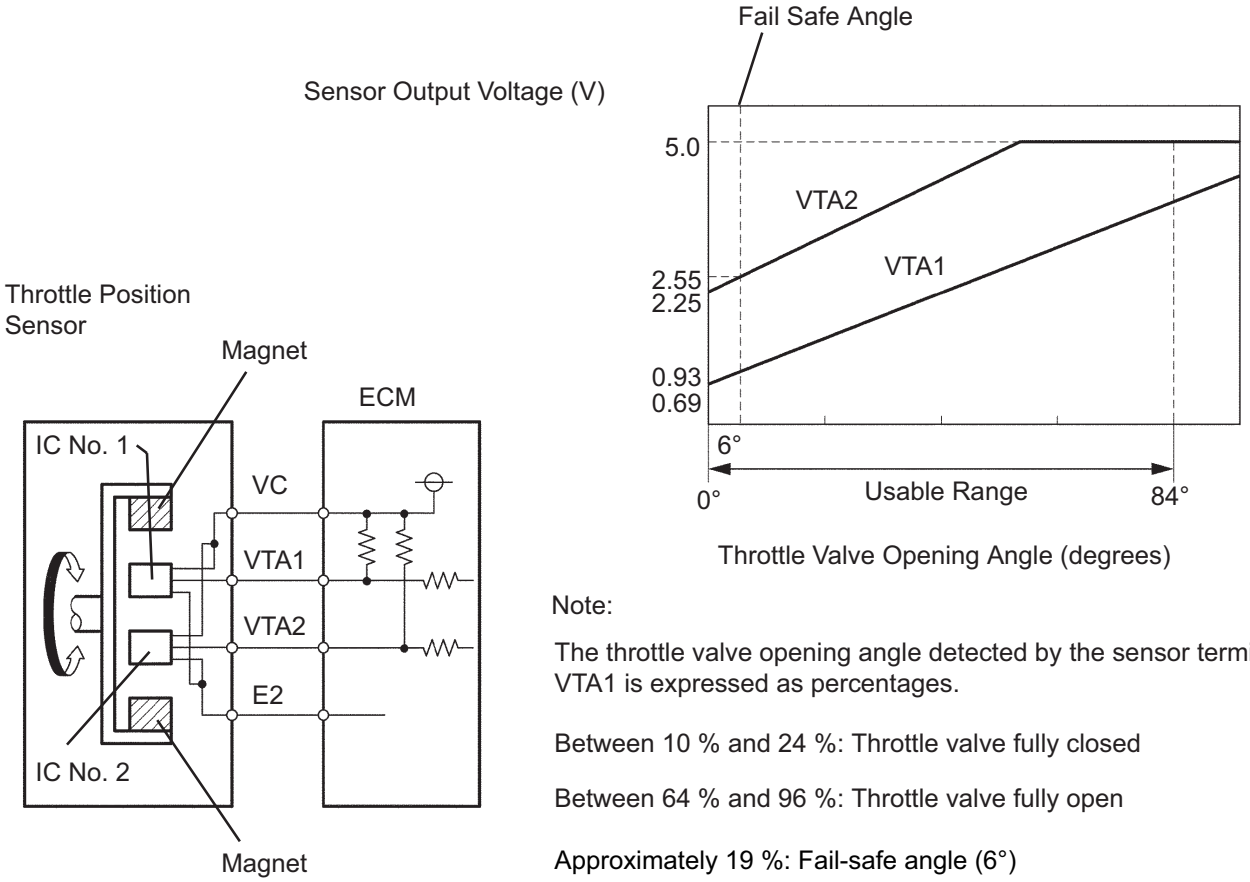
HINT:

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

The Throttle Position (TP) sensor is mounted on the throttle body, and detects the opening angle of the throttle valve. 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 TP sensor has two sensor circuits which each transmits a signal, VTA1 and VTA2. VTA1 is used to detect the throttle valve angle and VTA2 is used to detect malfunctions in VTA1. The sensor signal voltages vary between 0 V and 5 V in proportion to the throttle valve opening angle, and are transmitted to the VTA terminals of the ECM.

As the valve closes, the sensor output voltage decreases and as the valve opens, the sensor output voltage increases. The ECM calculates the throttle valve opening angle according to these signals and controls the throttle actuator in response to driver inputs. These signals are also used in calculations such as air-fuel ratio correction, power increase correction and fuel-cut control.



Note:

The throttle valve opening angle detected by the sensor terminal VTA1 is expressed as percentages.

Between 10 % and 24 %: Throttle valve fully closed

Between 64 % and 96 %: Throttle valve fully open

Approximately 19 %: Fail-safe angle (6°)

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DTC No.	DTC Detection Condition	Trouble Area
P0120	Detection conditions for DTCs P0122 and P0123 are not satisfied but condition (a) is satisfied (a) VTA1 is 0.2 V or less or VTA1 is 4.535 V or more (*1)	• Throttle Position (TP) sensor (built into throttle body) • ECM
P0122	(a) VTA1 is 0.2 V or less (*1)	• TP sensor (built into throttle body) • Short in VTA1 circuit • Open in VC circuit • ECM
P0123	(a) VTA1 is 4.535 V or more (*1)	• TP sensor (built into throttle body) • Open in VTA1 circuit • Open in E2 circuit • Short between VC and VTA1 circuits • 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 is 0.2 V or more and VTA1 is 2.02 V or less (*1)	• TP sensor (built into throttle body) • ECM

DTC No.	DTC Detection Condition	Trouble Area
P0222	(a) VTA2 is 1.75 V or less	• TP sensor (built into throttle body) • Short in VTA2 circuit • Open in VC circuit • ECM
P0223	(a) VTA2 is 4.8 V or more, and VTA1 is between 0.2 V and 2.02 V (*1)	• TP sensor (built into throttle body) • Open in VTA2 circuit • Open in E2 circuit • Short between VC and VTA2 circuits • ECM
P2135	Either condition (a) or (b) met: (a) Voltage difference between VTA1 and VTA2 is 0.02 V or less for 0.5 seconds or more (b) VTA1 is 0.2 V or less, and VTA2 1.75 V or less, for 0.4 seconds or more	• Short between VTA1 and VTA2 circuits • TP sensor (built into throttle body) • ECM

*1: Condition (a) of DTC P0120, P0122, P0123, P0220, P0222 or P0223 continues for 2 seconds. (Open or short in the throttle position sensor circuit)

HINT:

- When any of these DTCs are set, check the throttle valve opening angle by entering the following menus on an intelligent tester: DIAGNOSIS / ENHANCED OBD ll / DATA LIST / ETCS / THROTTLE POS AND THROTTLE POS #2.
- THROTTLE POS denotes the VTA1 signal (expressed in percentages), and THROTTLE POS #2 denotes the VTA2 signal (expressed in voltages).

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 (TP) sensor to monitor the throttle valve opening angle. There are several checks that the ECM performs to confirm the proper operation of the TP sensor.

- A specific voltage difference is expected between the sensor terminals, VTA1 and VTA2, for each throttle valve opening angle. If the difference between VTA1 and VTA2 is incorrect, the ECM interprets this as a malfunction in the sensor, and sets a DTC.
- VTA1 and VTA2 each have a specific voltage range. If VTA1 or VTA2 is outside the normal operating range, the ECM interprets this as a malfunction in the sensor, and sets a DTC.
- VTA1 and VTA2 should never be close to the same voltage level. If VTA1 is within 0.02 V of VTA2, the ECM determines that there is a short circuit in the sensor, and sets a DTC.

MONITOR STRATEGY

Related DTCs	P0120: Throttle position sensor 1 range check (Fluctuating) P0122: Throttle position sensor 1 range check (Low voltage) P0123: Throttle position sensor 1 range check (High voltage) P0220: Throttle position sensor 2 range check (Fluctuating) P0222: Throttle position sensor 2 range check (Low voltage) P0223: Throttle position sensor 2 range check (High voltage) P2135: Throttle position sensor range check (Correlation)
Required Sensors/Components (Main)	Throttle position 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 of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs not present	None

TYPICAL MALFUNCTION THRESHOLDS

P0120:

VTA1 voltage	0.2 V or less, or 4.535 V or more

P0122:

VTA1 voltage	0.2 V or less

P0123:

VTA1 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 VTA1 0.2 V or more, and 2.02 V or less	4.8 V or more

P2135:

Either of following conditions A or B met:	Condition A or B
Condition A	-
Difference between VTA1 and VTA2 voltages	0.02 V or less
Condition B	-
VTA1 voltage	0.2 V or less
VTA2 voltage	1.75 V or less

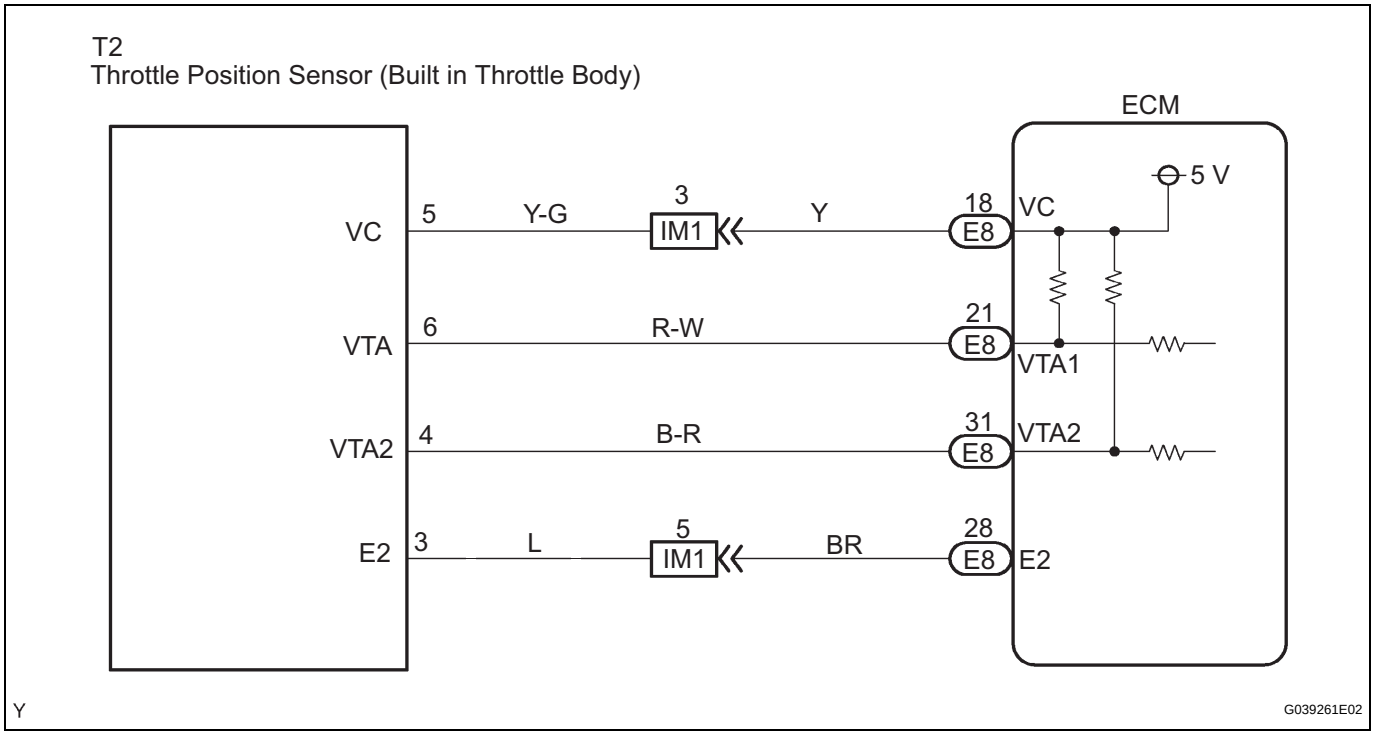
COMPONENT OPERATING RANGE

VTA1 voltage	0.6 to 3.96 V
VTA2 voltage	2.25 to 4.8 V

FAIL-SAFE

If the Electronic Throttle Control System (ETCS) has a malfunction, the ECM cuts off current to the throttle actuator. 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 (intermittent 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.

WIRING DIAGRAM



HINT:

- If other DTCs relating 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. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. 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.
- These DTCs relate to the Throttle Position (TP) sensor.

1	READ VALUE OF INTELLIGENT TESTER (THROTTLE POS AND THROTTLE POS #2)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON and turn the intelligent tester ON.
(c) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / DATA LIST / ETCS / THROTTLE POS and THROTTLE POS #2.
(d) Check the values displayed on the tester.

Result

TP#1 (VTA1) When AP Released	TP#2 (VTA2) When AP Released	TP#1 (VTA1) When AP Depressed	TP#2 (VTA2) When AP Depressed	Trouble Area	Proceed to
0 %	Between 0 V and 0.2 V	0 %	Between 0 V and 0.2 V	VC circuit open	A
100 %	Between 4.5 V and 5.0 V	100 %	Between 4.5 V and 5.0 V	E2 circuit open	A
0 % or 100 %	Between 2.1 V and 3.1 V (Fail-safe)	0 % or 100 %	Between 2.1 V and 3.1 V (Fail-safe)	VTA1 circuit open or ground short	A

TP#1 (VTA1) When AP Released	TP#2 (VTA2) When AP Released	TP#1 (VTA1) When AP Depressed	TP#2 (VTA2) When AP Depressed	Trouble Area	Proceed to
About 16% (Fail-safe)	Between 0 V and 0.2 V, or 4.5 V and 5.0 V	About 16% (Fail-safe)	Between 0 V and 0.2 V, or 4.5 V and 5.0 V	VTA2 circuit open or ground short	A
Between 10 % and 24 %	Between 2.1 V and 3.1 V	Between 64 % and 96 % (Not fail-safe)	Between 4.5 V and 5.0 V (Not fail-safe)	TP sensor circuit normal	B

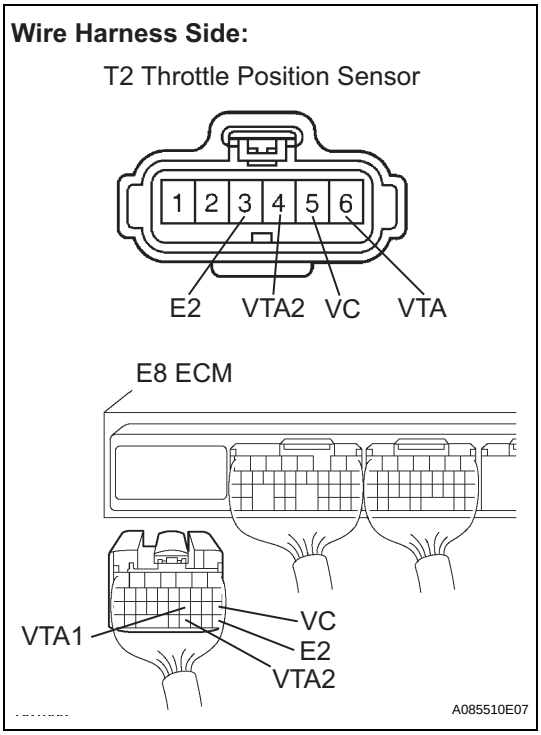
HINT:
- TP#1 denotes THROTTLE POS, and TP#2 denotes THROTTLE POS#2.
- AP denotes Accelerator Pedal.
- VTA1 is expressed as percentages, and VTA2 is expressed as voltages.

ES

B → **Go to step 5**

A

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



(a) Disconnect the T2 throttle body connector.
(b) Disconnect the E8 ECM connector.
(c) Measure the resistance between the terminals of the throttle body and ECM.

Standard resistance (Check for open)

Tester Connection	Specified Condition
VC (T2-5) - VC (E8-18)	Below 1 Ω
VTA (T2-6) - VTA (E8-21)	Below 1 Ω
VTA2 (T2-4) - VTA2 (E8-31)	Below 1 Ω
E2 (T2-3) - E2 (E8-28)	Below 1 Ω

Standard resistance (Check for short)

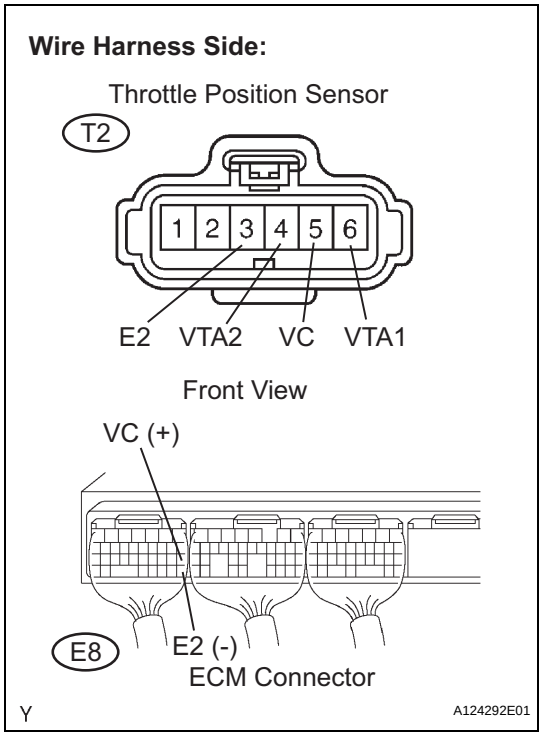
Tester Connection	Specified Condition
VC (T2-5) or VC (E8-18) - Body ground	10 kΩ or higher
VTA (T2-6) or VTA (E8-21) - Body ground	10 kΩ or higher
VTA2 (T2-4) or VTA2 (E8-31) - Body ground	10 kΩ or higher

(d) Reconnect the throttle body connector.
(e) Reconnect the ECM connector.

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

3	INSPECT ECM (VC VOLTAGE)



(a) Disconnect the T2 throttle body connector.
(b) Turn the ignition switch ON.
(c) Measure the voltage between the terminals VC and E2 of the E8 ECM connector.

Standard voltage

Tester Connection	Specified Condition
VC (E8-18) - E2 (E8-28)	4.5 to 5.5 V

(d) Reconnect the throttle body connector.

NG → **REPLACE ECM**

OK

4	REPLACE THROTTLE BODY ASSEMBLY

NEXT

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

(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-28).
(d) Start the engine.
(e) Allow the engine to idle for 15 seconds or more.
(f) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / DTC INFO / CURRENT CODES.
(g) Read DTCs.

Result

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

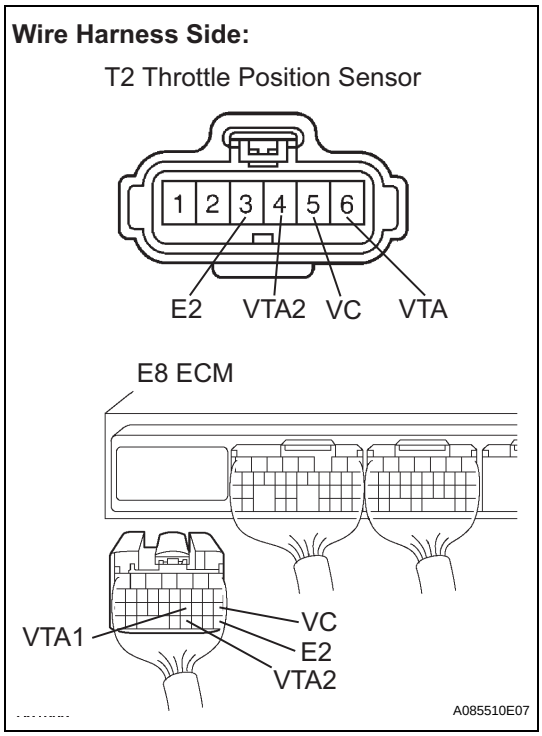
B → **SYSTEM OK**

ES

A

REPLACE ECM

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



(a) Disconnect the T2 throttle position sensor connector.
(b) Disconnect the E8 ECM connector.
(c) Measure the resistance of the wire harness side connectors.

Standard resistance

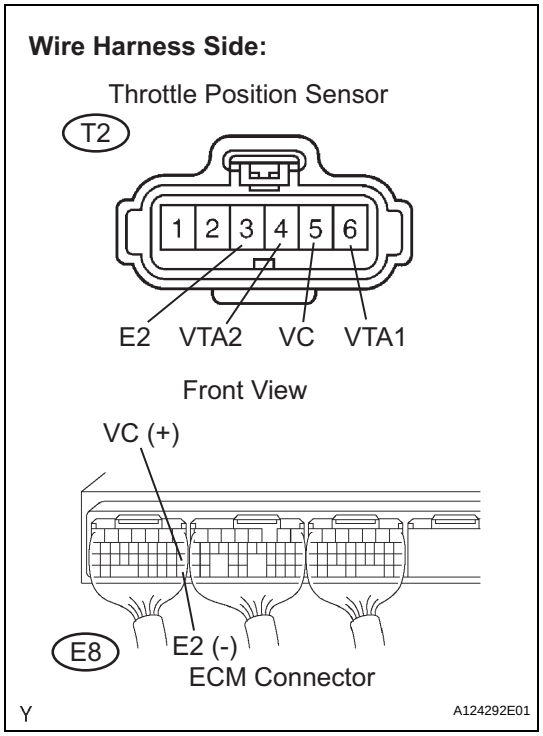
Tester Connection	Specified Condition
T2-5 (VC) - E8-18 (VC) T2-6 (VTA1) - E8-21 (VTA1) T2-4 (VTA2) - E8-31 (VTA2) T2-3 (E2) - E8-28 (E2)	Below 1 Ω
T2-5 (VC) or E8-18 (VC) - Body ground T2-6 (VTA1) or E8-21 (VTA1) - Body ground T2-4 (VTA2) or E8-31 (VTA2) - Body ground	10 kΩor higher

(d) Reconnect the throttle position sensor connector and ECM connector.

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

2	INSPECT ECM (VC VOLTAGE)



(a) Disconnect the T2 throttle position sensor connector.
(b) Turn the ignition switch ON.
(c) Measure the voltage of the ECM connector.

Standard voltage

Tester Connection	Specified Condition
E8-18 (VC) - E8-28 (E2)	4.5 to 5.5 V

NG → REPLACE ECM

ES

OK

3	REPLACE THROTTLE BODY ASSEMBLY

NEXT

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

(a) Clear the DTC (See page ES-28).
(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