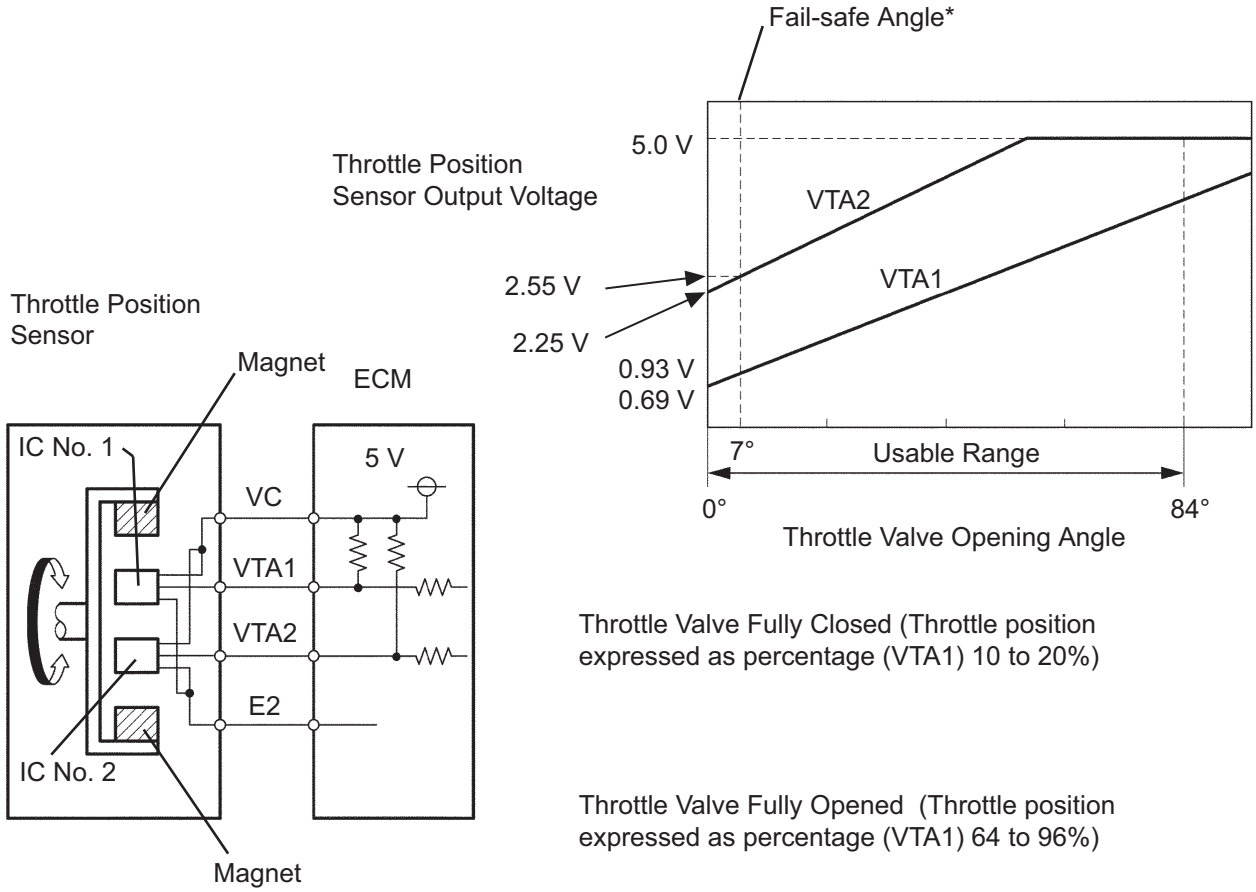
DTC	P0120	Throttle / Pedal Position Sensor / Switch "A" Circuit
DTC	P0122	Throttle / Pedal Position Sensor / Switch "A" Circuit Low Input
DTC	P0123	Throttle / Pedal Position Sensor / Switch "A" Circuit High Input
DTC	P0220	Throttle / Pedal Position Sensor / Switch "B" Circuit
DTC	P0222	Throttle / Pedal 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 for the "throttle position sensor".

DESCRIPTION

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 (TP) 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, VTA1 and VTA2, each with their own signal outputs. VTA1 is used to detect the throttle opening angle and VTA2 is used to detect malfunctions in VTA1. Voltage applied to VTA1 and VTA2 changes between 0 V to 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.
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 actuator to set the throttle valve angle properly in response to driver inputs.



Throttle Valve Fully Closed (Throttle position expressed as percentage (VTA1) 10 to 20%)

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

*: Fail-safe Angle 7° (Throttle position expressed as percentage (VTA1) about 10 to 16%)

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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 is "0.2 V or less" or VTA1 is "4.435 V or more"	• Throttle position sensor (built in throttle body) • ECM
P0122	(a) VTA1 is 0.2 V or less	• Throttle position sensor (built in throttle body) • Short in VTA1 circuit • Open in VC circuit • ECM
P0123	(a) VTA1 is 4.535 V or more	• Throttle position sensor (built in throttle body) • Open in VTA1 circuit • Open in E2 circuit • VC and VTA1 circuit are short-circuited • ECM

DTC No.	DTC Detection Condition	Trouble Area
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"	• Throttle position sensor (built in throttle body) • ECM
P0222	(a) VTA2 is 1.75 V or less	• Throttle position sensor (built in 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	• Throttle position sensor (built in throttle body) • Open in VTA2 circuit • Open in E2 circuit • VC and VTA2 circuits are short-circuited • ECM
P2135	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 1.75 V or less	• VTA1 and VTA2 circuits are short-circuited • Throttle position sensor (built in throttle body) • ECM

ES

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 OFF.
HINT:
- After confirming DTCs, use the intelligent tester to confirm the throttle valve opening percentage and closed throttle position switch condition.
- THROTTLE POS is the VTA1 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 and VTA2 for each throttle opening angle.
If the difference between VTA1 and VTA2 is incorrect, the ECM interprets this as a fault and will set a DTC.
(b) VTA1 and VTA2 each have a specific voltage operating range.
If VTA1 or VTA2 is out of the normal operating range, the ECM interprets this as a fault and will set a DTC.
(c) VTA1 and VTA2 should never be close to the same voltage levels.
If VTA1 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 ETCS (Electronic Throttle Control System) 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 infection (intermittent fuel-cut) and ignition timing in accordance with the accelerator pedal opening angle to enable the vehicle to continue at a minimum 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: Throttle position sensor 1 range check (fluttering) 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 P2135: 0.5 seconds or 0.4 seconds
MIL operation	Immediate
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

Monitor will run whenever these DTCs are not present	None
Throttle control motor power	ON
Ignition switch	ON

TYPICAL MALFUNCTION THRESHOLDS

P0120:

VTA1 voltage	0.2 V or less, or 4.435 V or more

P0122:

VTA1 voltage	0.2 V or less

P0123:

VTA1 voltage	4.535 V or more

P0220:

VTA1 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 is 0.2 to 2.02 V	4.8 V or more

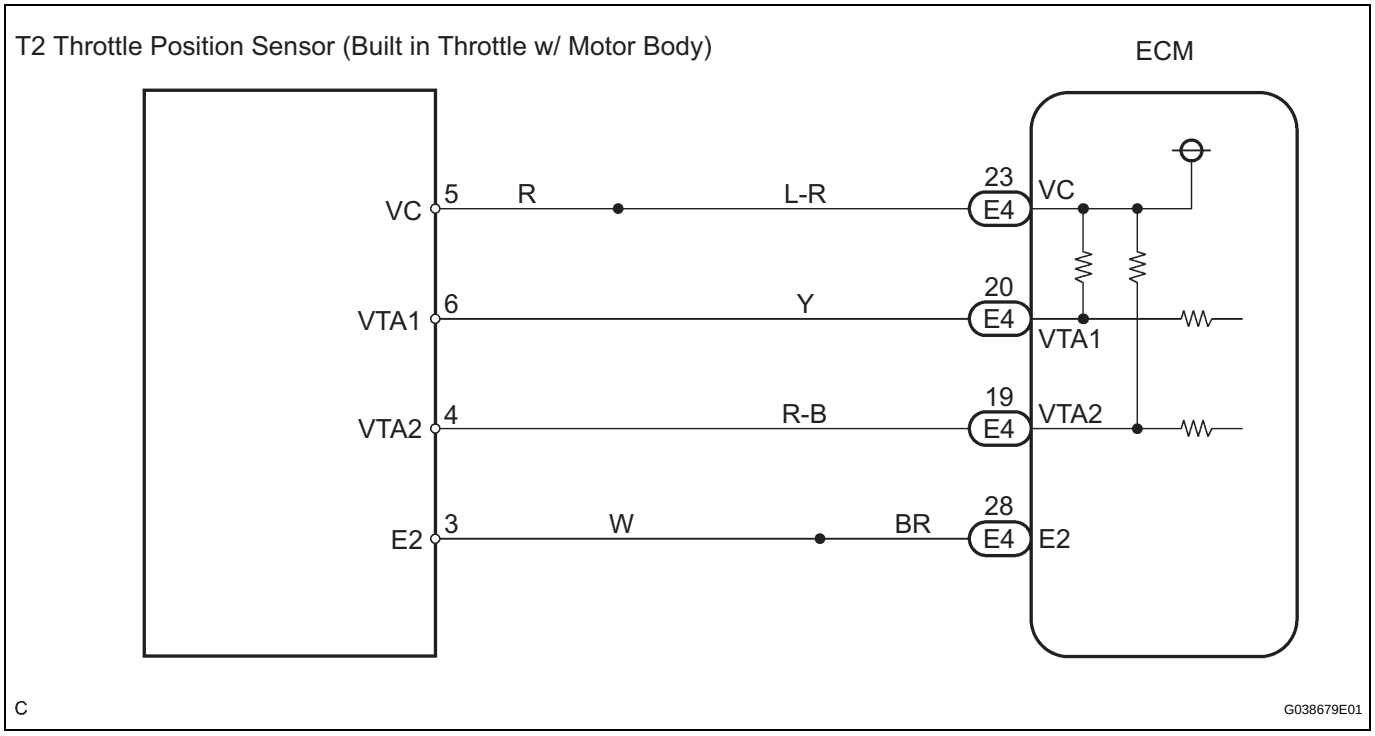
P2135:

Either of the following condition A or B is met	-
Condition A	-
Difference between VTA and VTA2 voltage	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 5.0 V

WIRING DIAGRAM

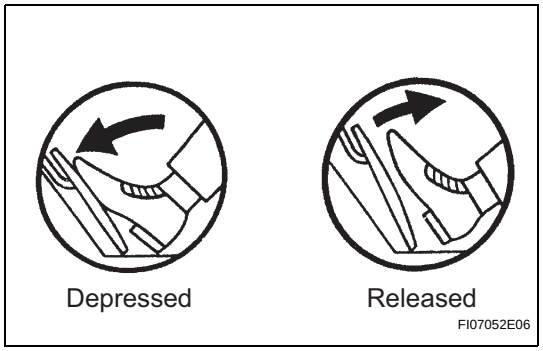


INSPECTION PROCEDURE

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. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air/fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

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



(a) Connect the intelligent tester to the DLC3 with CAN VIM.
(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) Read the value.

Result

Throttle position expressed as percentage and voltage				Trouble Area	Proceed to
Accelerator pedal depressed		Accelerator pedal released			
THROTTLE POS (VTA1)	THROTTLE POS #2 (VTA2)	THROTTLE POS (VTA1)	THROTTLE POS #2 (VTA2)		

ES

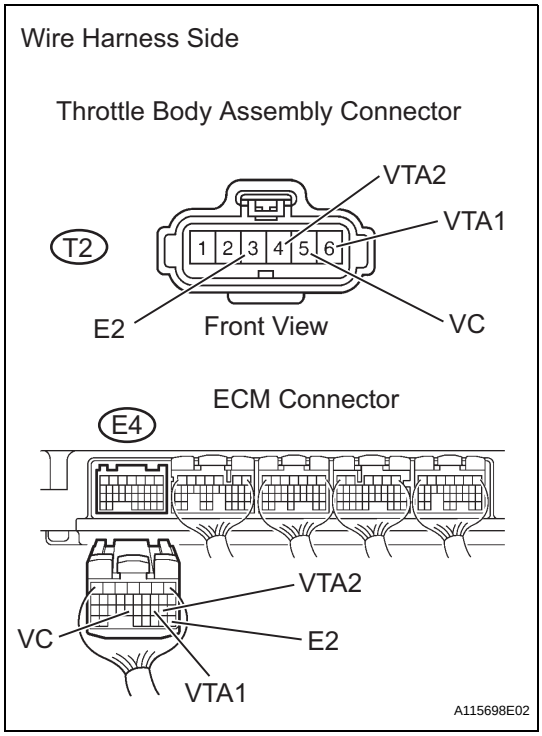
0 %	0 to 0.2 V	0 %	0 to 0.2 V	VC circuit open	A
100 %	4.5 to 5.5 V	100 %	4.5 to 5.5 V	E2 circuit open	
0 % or 100 %	2.1 to 3.1 V (fail-safe)	0 % or 100 %	2.1 to 3.1 V (fail-safe)	VTA1 circuit open or ground short	
10 to 24 % (fail-safe)	0 to 0.2 or 4.5 to 5.5 V	10 to 24 % (Fail safe)	0 to 0.2 or 4.5 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)	TP sensor circuit is normal	B

B → **Go to step 5**

A

ES

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



(a) Disconnect the T2 throttle body connector.
(b) Disconnect the E4 ECM connector.
(c) Measure the resistance between the wire harness side connectors.

Standard resistance

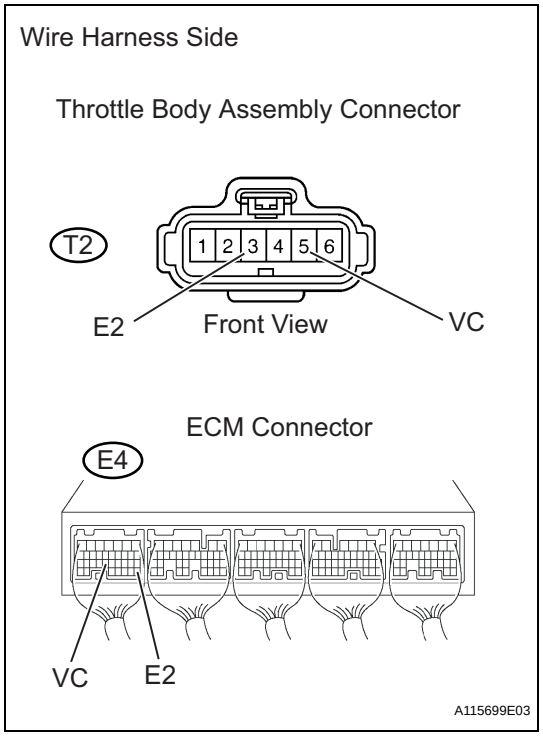
Tester Connection	Specified Condition
VC (T2-5) - VC (E4-23)	Below 1 Ω
VTA1 (T2-6) - VTA1 (E4-20)	
VTA2 (T2-4) - VTA2 (E4-19)	
E2 (T2-3) - E2 (E4-28)	
VC (T2-5) or VC (E4-23) - Body ground	10 kΩ or higher
VTA1 (T2-6) or VTA1 (E4-20) - Body ground	
VTA2 (T2-4) or VTA2 (E4-19) - Body ground	

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

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

OK

3 CHECK ECM (VC VOLTAGE)



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

Tester Connection	Specified Condition
VC (E4-23) - E2 (E4-28)	4.5 to 5.5 V

(d) Reconnect the throttle body connector.

NG → **REPLACE ECM**

OK

4 REPLACE THROTTLE BODY

(a) Replace the throttle body (See page ES-495).

NEXT

5 CHECK WHETHER DTC OUTPUT RECURS (THROTTLE POSITION SENSOR DTCS ARE OUTPUT AGAIN)

(a) Connect the intelligent tester to the DLC3 with CAN VIM.
(b) Turn the ignition switch ON and turn the intelligent tester ON.
(c) Clear the DTC (See page ES-35).
(d) Start the engine and allow the engine to idle for 15 seconds or more.
(e) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / DTC INFO / CURRENT CODES.
(f) Read the DTC.

Result

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

B → **SYSTEM OK**

ES

A

REPLACE ECM