

<b>DTC</b>	<b>P0120</b>	<b>Throttle / Pedal Position Sensor / Switch "A" Circuit</b>
<b>DTC</b>	<b>P0122</b>	<b>Throttle / Pedal Position Sensor / Switch "A" Circuit Low Input</b>
<b>DTC</b>	<b>P0123</b>	<b>Throttle / Pedal Position Sensor / Switch "A" Circuit High Input</b>
<b>DTC</b>	<b>P0220</b>	<b>Throttle / Pedal Position Sensor / Switch "B" Circuit</b>
<b>DTC</b>	<b>P0222</b>	<b>Throttle / Pedal Position Sensor / Switch "B" Circuit Low Input</b>
<b>DTC</b>	<b>P0223</b>	<b>Throttle / Pedal Position Sensor / Switch "B" Circuit High Input</b>
<b>DTC</b>	<b>P2135</b>	<b>Throttle / Pedal Position Sensor / Switch "A" / "B" Voltage Correlation</b>

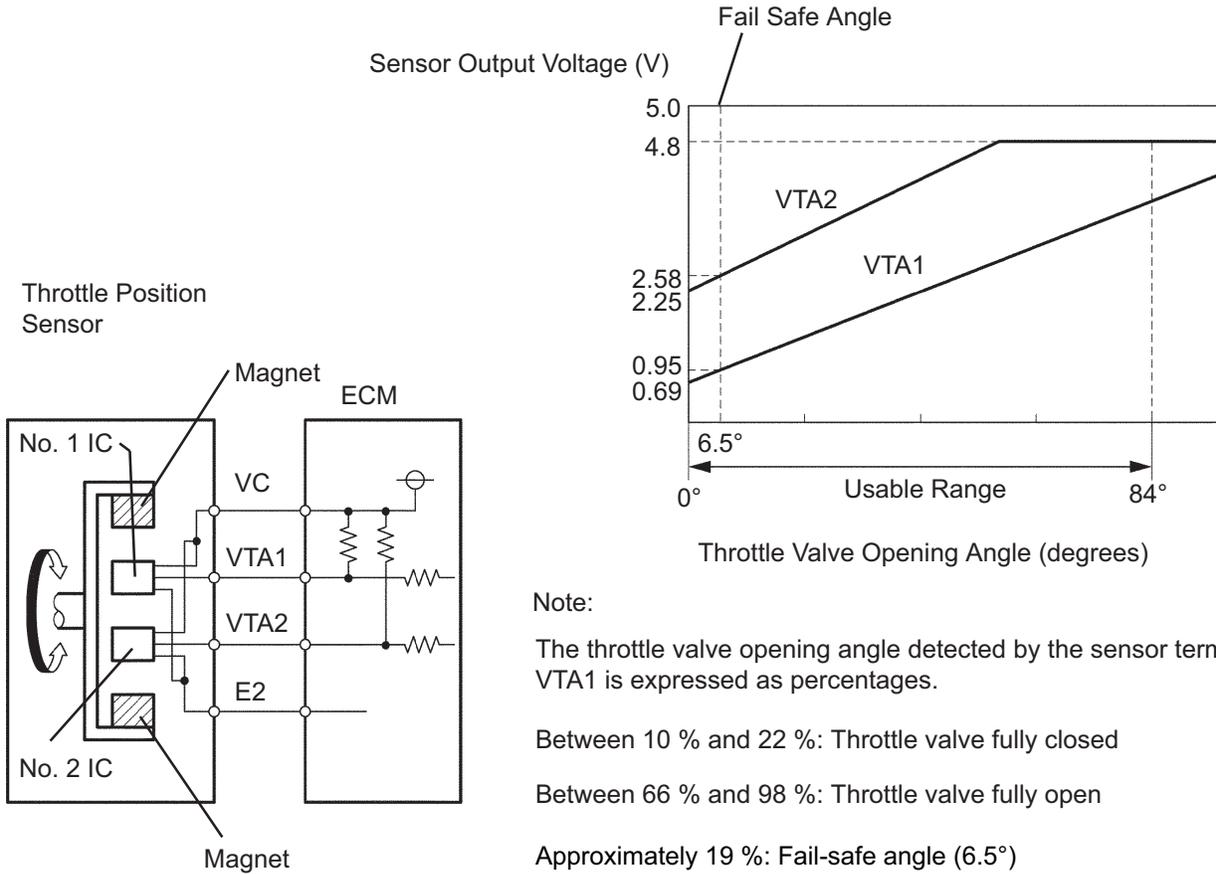
**HINT:**

These DTCs relate to the Throttle Position (TP) sensor.

**DESCRIPTION****HINT:**

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.



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DTC No.	DTC Detection Condition	Trouble Area
P0120	Output voltage of VTA1 quickly fluctuates beyond lower and upper malfunction thresholds for 2 seconds (1 trip detection logic)	<ul style="list-style-type: none"> <li>• Throttle position (TP) sensor (built into throttle body)</li> <li>• ECM</li> </ul>
P0122	Output voltage of VTA1 0.2 V or less for 2 seconds (1 trip detection logic)	<ul style="list-style-type: none"> <li>• Throttle position (TP) sensor (built into throttle body)</li> <li>• Short in VTA1 circuit</li> <li>• Open in VC circuit</li> <li>• ECM</li> </ul>
P0123	Output voltage of VTA1 4.535 V or more for 2 seconds (1 trip detection logic)	<ul style="list-style-type: none"> <li>• Throttle position (TP) sensor (built into throttle body)</li> <li>• Open in VTA1 circuit</li> <li>• Open in E2 circuit</li> <li>• Short between VC and VTA1 circuit</li> <li>• ECM</li> </ul>
P0220	Output voltage of VTA2 quickly fluctuates beyond lower and upper malfunction thresholds for 2 seconds (1 trip detection logic)	<ul style="list-style-type: none"> <li>• Throttle position (TP) sensor (built into throttle body)</li> <li>• ECM</li> </ul>

DTC No.	DTC Detection Condition	Trouble Area
P0222	Output voltage of VTA2 1.75 V or less for 2 seconds (1 trip detection logic)	<ul style="list-style-type: none"> <li>Throttle position (TP) sensor (built into throttle body)</li> <li>Short in VTA2 circuit</li> <li>Open in VC circuit</li> <li>ECM</li> </ul>
P0223	Output voltage of VTA2 4.8 V or more when VTA1 between 0.2 V and 2.02 V (1 trip detection logic)	<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>Short between VC and VTA2 circuit</li> <li>ECM</li> </ul>
P2135	Either condition (a) or (b) met (1 trip detection logic): (a) Difference between output voltages of VTA1 and VTA2 0.02 V or less for 0.5 seconds or more (b) Output voltage of VTA1 0.2 V or less, and VTA2 1.75 V or less, for 0.4 seconds or more	<ul style="list-style-type: none"> <li>Short between VTA1 and VTA2 circuit</li> <li>Throttle position sensor (built into throttle body)</li> <li>ECM</li> </ul>

**HINT:**

- When any of these DTCs are set, check the throttle valve opening angle by selecting the following menu items on an intelligent tester: DIAGNOSIS / ENHANCED OBD II / 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 22%	66 to 99%
THROTTLE POS #2	2.1 to 3.1 V	4.5 to 5.0 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.

If the malfunction is not repaired successfully, a DTC is set 10 seconds after the engine is next started.

**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	2 seconds: P0120, P0122, P0123, P0220, P0222 and P0223 (Accelerator pedal ON) 10 seconds: P0120, P0122, P0123, P0220, P0222 and P0223 (Accelerator pedal OFF) Within 0.5 seconds: P2135
MIL operation	Immediate
Sequence of operation	None

**TYPICAL ENABLING CONDITIONS**

Monitor runs whenever following DTCs not present	None
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**TYPICAL MALFUNCTION THRESHOLDS****P0120:**

VTA1 voltage	0.2 V or less or 4.535 V or more
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**P0122:**

VTA1 voltage	0.2 V or less
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**P0123:**

VTA1 voltage	4.535 V or more
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**P0220:**

VTA2 voltage	1.75 V or less or 4.8 V or more
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**P0222:**

VTA2 voltage	1.75 V or less
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**P0223:**

VTA2 voltage when the VTA1 is 0.2 to 2.02 V	4.8 V or more
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**P2135:**

Either of the following condition A or B is met	-
Condition A	-
Difference between VTA1 and VTA2 voltage	0.02 V or less
Condition B	-
VTA1 voltage	0.2 V or less
VTA2 voltage	1.75 V or less

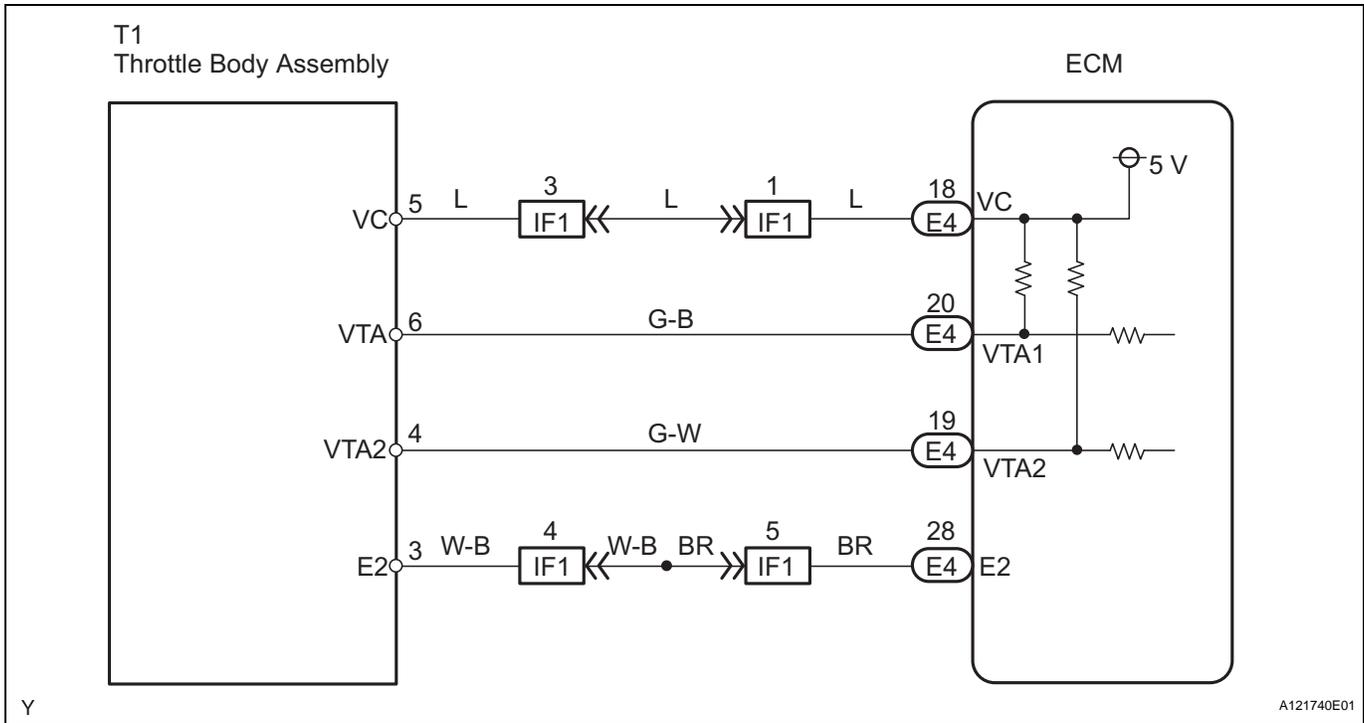
**COMPONENT OPERATING RANGE**

VTA1 voltage	0.69 to 4.05 V
VTA2 voltage	2.25 to 4.8 V

**FAIL-SAFE**

When any of these DTCs, as well as other DTCs relating to ETCS (Electronic Throttle Control System) malfunctions, are set, the ECM enters fail-safe mode. During fail-safe mode, the ECM cuts the current to the throttle actuator off, and the throttle valve is returned to a 6.5° throttle angle by 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 allow the vehicle to continue at a minimal speed. If the accelerator pedal is depressed firmly and gently, the vehicle can be driven slowly. Fail-safe mode continues until a pass condition is detected, and the ignition switch is then turned to OFF.

**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 an intelligent tester. 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.

**1 READ DATA LIST (THROTTLE POS #1, THROTTLE POS #2)**

- Connect the intelligent tester to the DLC3.
- Turn the ignition switch to ON and turn the intelligent tester ON.
- Select the following menu items: DIAGNOSIS / ENHANCED OBD II / DATA LIST / ETCS / THROTTLE POS #1 and THROTTLE POS #2.
- Check the values displayed on the tester.

**Result**

Throttle position expressed as percentage and voltage				Trouble Area	Proceed to
Accelerator pedal released		Accelerator pedal depressed			
THROTTLE POS #1 (VTA1)	THROTTLE POS #2 (VTA2)	THROTTLE POS #1 (VTA1)	THROTTLE POS #2 (VTA2)		
0%	0 to 0.2 V	0%	0 to 0.2 V	VC circuit open	A
100%	4.5 to 5.0 V	100%	4.5 to 5.0 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
about 19% (fail-safe)	0 to 0.2 or 4.5 to 5.0 V	about 19% (fail-safe)	0 to 0.2 or 4.5 to 5.0 V	VTA2 circuit open or ground short	A
10 to 22%	2.1 to 3.1 V	66 to 98% (does not fail-safe)	4.5 to 5.0 V (does not fail-safe)	TP sensor circuit is normal	B

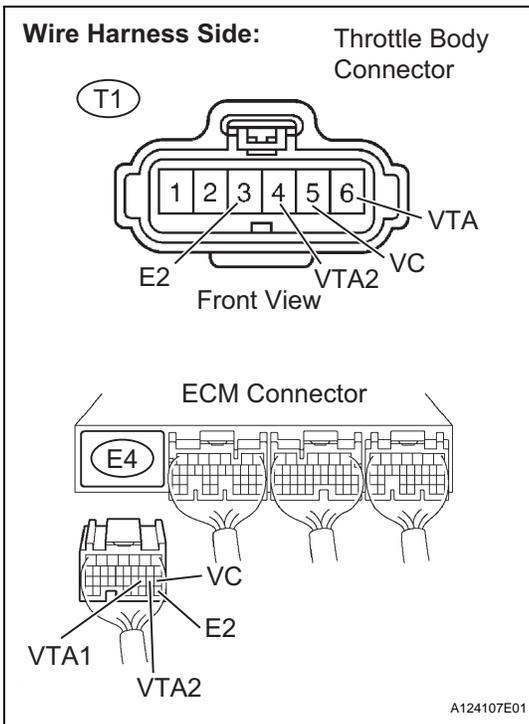
HINT:

- 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.

**B** → **Go to step 5**

**A**

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



- Disconnect the T1 throttle body connector.
- Disconnect the E4 ECM connector.
- Check the resistance.

**Standard Resistance (Check for open)**

Tester Connection	Specified Condition
T1-5 (VC) - E4-18 (VC)	Below 1 Ω
T1-6 (VTA) - E4-20 (VTA1)	Below 1 Ω
T1-4 (VTA2) - E4-19 (VTA2)	Below 1 Ω
T1-3 (E2) - E4-28 (VTA2)	Below 1 Ω

**Standard Resistance (Check for short)**

Tester Connection	Specified Condition
T1-5 (VC) or E4-18 (VC) - Body ground	10 kΩ or higher
T1-6 (VTA1) or E4-20 (VTA1) - Body ground	10 kΩ or higher
T1-4 (VTA2) or E4-19 (VTA2) - Body ground	10 kΩ or higher

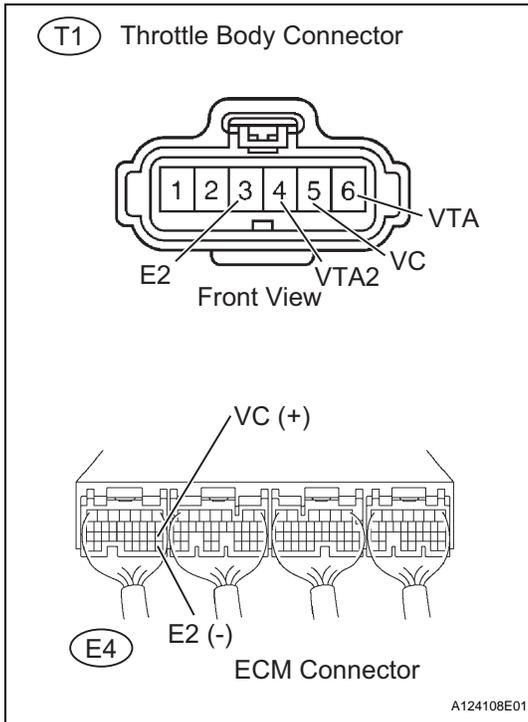
- Reconnect the throttle body connector.
- Reconnect the ECM connector.

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

**OK**

**ES**

**3 INSPECT ECM (VC VOLTAGE)**



- (a) Disconnect the T1 throttle body connector.
- (b) Turn the ignition switch to ON.
- (c) Measure the voltage between the terminals of the ECM connector.

**Standard Voltage**

Tester Connections	Specified Conditions
E4-18 (VC) - E4-28 (E2)	4.5 to 5.5 V

- (d) Reconnect the throttle body connector.

**NG**

**REPLACE ECM**

**ES**

**OK**

**4 REPLACE THROTTLE BODY ASSEMBLY**

**NEXT**

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

- (a) Connect the intelligent tester to the DLC3.
- (b) Turn the ignition switch to ON and turn the intelligent tester ON.
- (c) Clear the DTC.
- (d) Start the engine.
- (e) Allow the engine to idle for 15 seconds or more.
- (f) Select the following menu items: 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**



REPLACE ECM