

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

HINT:

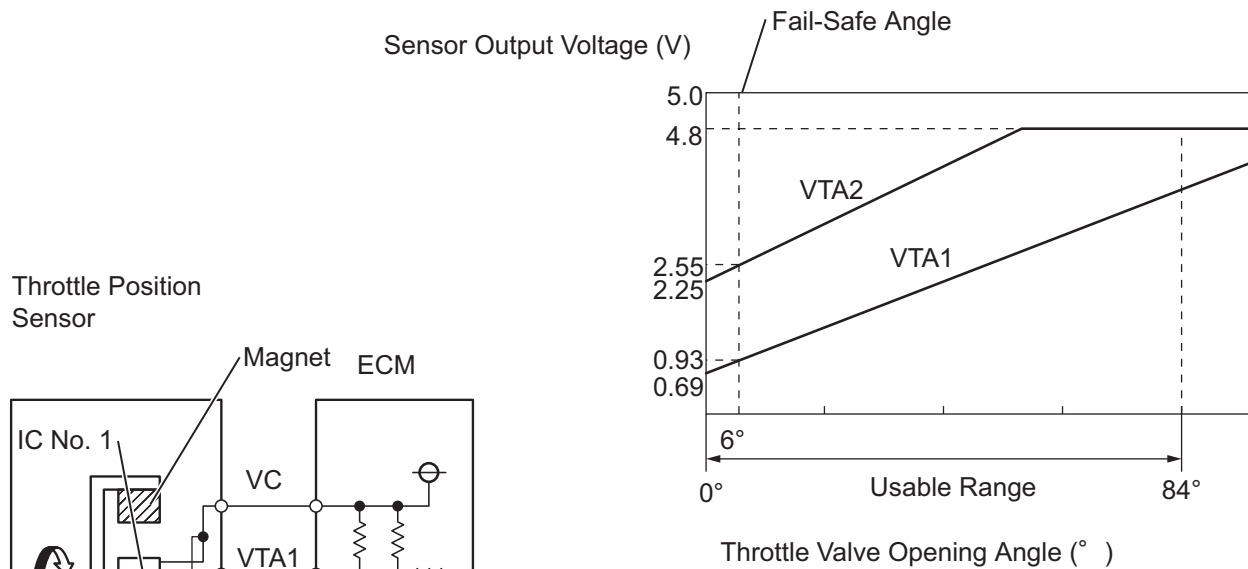
These DTCs relate to the Throttle Position (TP) sensor.

DESCRIPTION

The TP sensor is mounted on the throttle body, and detects the opening angle of the throttle valve. This sensor is a non-contact type. It 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 a percentage.

Between 10 % and 22 %: Throttle valve fully closed

Between 66 % and 98 %: Throttle valve fully open

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

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

DTC No.	DTC Detection Conditions	Trouble Areas
P0222	Output voltage of VTA2 1.75 V or less for 2 seconds when accelerator pedal depressed (1 trip detection logic)	<ul style="list-style-type: none"> TP sensor (built into throttle body) Short in VTA2 circuit Open in VC circuit ECM
P0223	Output voltage of VTA2 4.8 V or more, and VTA1 between 0.2 V and 2.02 V for 2 seconds when accelerator pedal depressed (1 trip detection logic)	<ul style="list-style-type: none"> 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 (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"> Short between VTA1 and VTA2 circuits TP sensor (built into throttle body) ECM

HINT:

- When any of these DTCs are set, check the throttle valve opening angle by selecting the following menu items the intelligent tester: DIAGNOSIS / ENHANCED OBD II / DATA LIST / ETCS / THROTTLE POS #1 AND THROTTLE POS #2.
- THROTTLE POS #1 denotes the VTA1 signal, and THROTTLE POS #2 denotes the VTA2 signal.

Reference (Normal Condition)

Tester Display	Accelerator Pedal Fully Released	Accelerator Pedal Fully Depressed
THROTTLE POS #1	0.5 to 1.1 V	3.3 to 4.9 V
THROTTLE POS #2	2.1 to 3.1 V	4.6 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) 0.5 seconds: P2135 Case 1 0.4 seconds: P2135 Case 2
MIL Operation	Immediate
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs not present	None
Either of following condition A or B met	-
A. Ignition switch ON	0.012 seconds or more
B. Electronic throttle actuator power	ON

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 VTA1 0.2 V or more, and 2.02 V or less	4.8 V or more
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P2135 Case 1:

Difference between VTA1 and VTA2 voltages	0.02 V or less
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P2135 Case 2:

VTA1 voltage	0.2 V or less
VTA2 voltage	1.75 V or less

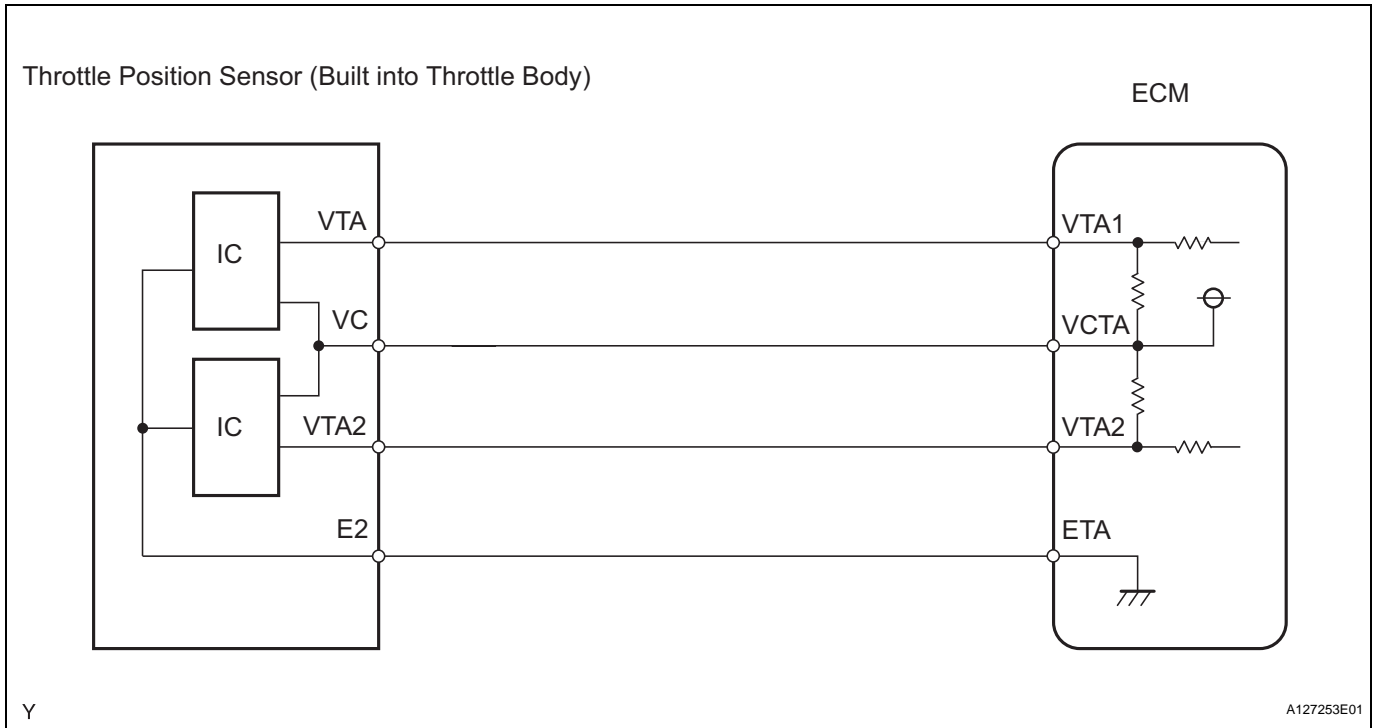
COMPONENT OPERATING RANGE

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° 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 OFF.

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

Read freeze frame data using the intelligent tester. Freeze frame data records 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 VALUE USING INTELLIGENT TESTER (THROTTLE POS #1 AND THROTTLE POS #2)

- Connect the intelligent tester to the DLC3.
- Turn the ignition switch ON and turn the 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

TP#1 (VTA1) When Accelerator Pedal Released	TP#2 (VTA2) When Accelerator Pedal Released	TP#1 (VTA1) When Accelerator Pedal Depressed	TP#2 (VTA2) When Accelerator Pedal Depressed	Trouble Areas	Proceed To
0 V to 0.2 V	0 V to 0.2 V	0 V to 0.2 V	0 V to 0.2 V	VC circuit open	A
4.5 V to 5.0 V	4.5 V to 5.0 V	4.5 V to 5.0 V	4.5 V to 5.0 V	E2 circuit open	
0 V to 0.2 V, or 4.5 V to 5.0 V	2.4 V to 3.4 V (Fail-safe)	0 V to 0.2 V, or 4.5 V to 5.0 V	2.4 V to 3.4 V (Fail-safe)	VTA1 circuit open or ground short	
0.7 V to 1.3 V (Fail-safe)	0 V to 0.2 V, or 4.5 V to 5.0 V	0.7 V to 1.3 V (Fail-safe)	0 V to 0.2 V, or 4.5 V to 5.0 V	VTA2 circuit open or ground short	
0.5 V to 1.1 V	2.1 V to 3.1 V	3.3 V to 4.9 V (Not fail-safe)	4.6 V to 5.0 V (Not fail-safe)	TP sensor circuit normal	B

HINT:
TP#1 denotes THROTTLE POS #1, and TP#2 denotes THROTTLE POS #2.

B

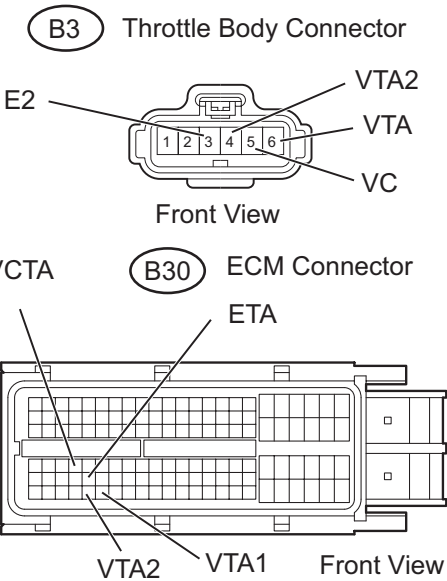
Go to step 5

A

2

CHECK HARNESS AND CONNECTOR (THROTTLE POSITION SENSOR - ECM)

Wire Harness Side:



- (a) Disconnect the B3 throttle body connector.
- (b) Disconnect the B30 ECM connector.
- (c) Measure the resistance.

Standard resistance (Check for open)

Tester Connections	Specified Conditions
B3-5 (VC) - B30-67 (VCTA)	Below 1 Ω
B3-6 (VTA) - B30-115 (VTA1)	Below 1 Ω
B3-4 (VTA2) - B30-114 (VTA2)	Below 1 Ω
B3-3 (E2) - B30-91 (ETA)	Below 1 Ω

Standard resistance (Check for short)

Tester Connections	Specified Conditions
B3-5 (VC) or B30-67 (VCTA) - Body ground	10 kΩ or higher
B3-6 (VTA) or B30-115 (VTA1) - Body ground	10 kΩ or higher
B3-4 (VTA2) or B30-114 (VTA2) - Body ground	10 kΩ or higher

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

NG

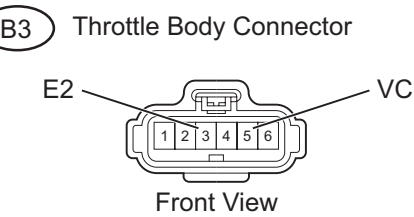
REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

3

INSPECT ECM (VC VOLTAGE)

Wire Harness Side:



- (a) Disconnect the B3 throttle body connector.
- (b) Turn the ignition switch ON.
- (c) Measure the voltage between the terminals of the throttle body connector.

Standard voltage

Tester Connections	Specified Conditions
B3-5 (VC) - B3-3 (E2)	4.5 to 5.5 V

- (d) Reconnect the throttle body connector.

NG

REPLACE ECM

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 ON and turn the tester ON.
- (c) Clear DTCs (see page [ES-35](#)).
- (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****A****REPLACE ECM****ES**