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”.

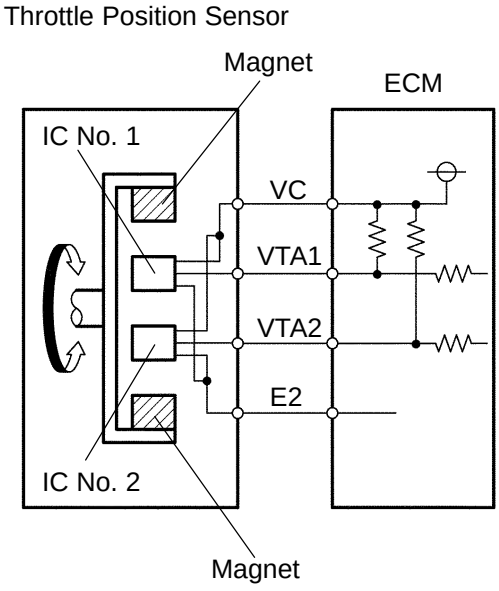
CIRCUIT DESCRIPTION

HINT:

- This Electronic Throttle Control System (ECTS) 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 changes between 0V and 5V 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.



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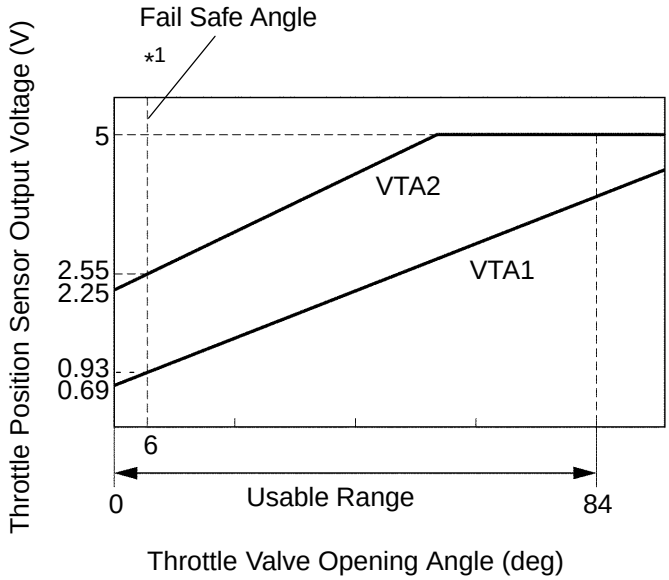


Throttle Valve Fully Closed
(Throttle Position expressed as percentage
(VTA1) 10 to 24 %)

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

*1 : Fail Safe Angle 6°
(Throttle Position expressed as percentage
(VTA1) about 16 %)

A19802

	DTC Detection Condition	
DTC No.	Condition (a) of DTC P0120, P0122, P0123, P0220, P0222 or P0223 continues for 2 seconds of accelerator pedal ON (10 seconds of accelerator pedal OFF) (open or short in the throttle position sensor circuit)	Trouble Area
P0120	Detection conditions for DTCs P0122 and P0123 are not satisfied but condition (a) is satisfied (1 trip detection logic) (a) VTA1 is 0.2 V or less or VTA1 is 4.5 V or more	• Throttle position sensor • ECM
P0122	(a) VTA1 is 0.2 V or less (1 trip detection logic)	• Throttle position sensor • Short in VTA1 circuit • Open in VC circuit • ECM
P0123	(a) VTA1 is 4.5 V or more (1 trip detection logic)	• Throttle position sensor • Open in VTA1 circuit • Open in E2 circuit • Short in VC and VTA1 circuit • ECM
P0220	Detection conditions for DTCs P0222 and P0223 are not satisfied but condition (a) is satisfied (1 trip detection logic) (a) VTA2 is 1.75 V or less or VTA2 is 4.8 V or more	• Throttle position sensor • ECM
P0222	(a) VTA2 is 1.75 V or less (1 trip detection logic)	• Throttle position sensor • Short in VTA2 circuit • Open in VC circuit • ECM
P0223	(a) VTA2 is 4.8 V or more and VTA1 is 0.2 V or more and VTA1 is 2.02 V or less (1 trip detection logic)	• 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: (1 trip detection logic) (a) Difference between VTA1 and VTA2 is 0.02 V or less (b) VTA1 is 0.2 V or less and VTA2 is 0.5 V or less	• Short in VTA1 and VTA2 circuit • Throttle position sensor • ECM

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 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 default 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 0.02V 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 (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.

MONITOR STRATEGY

Related DTCs	P0120: Throttle Position Sensor 1 Range Check (Chattering) 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 (Chattering) 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
MIL operation	Immediate
Sequence operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever these DTCs are not present	See page 05−507

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 the VTA1 is 0.2 to 1.8 V	4.8 V or more

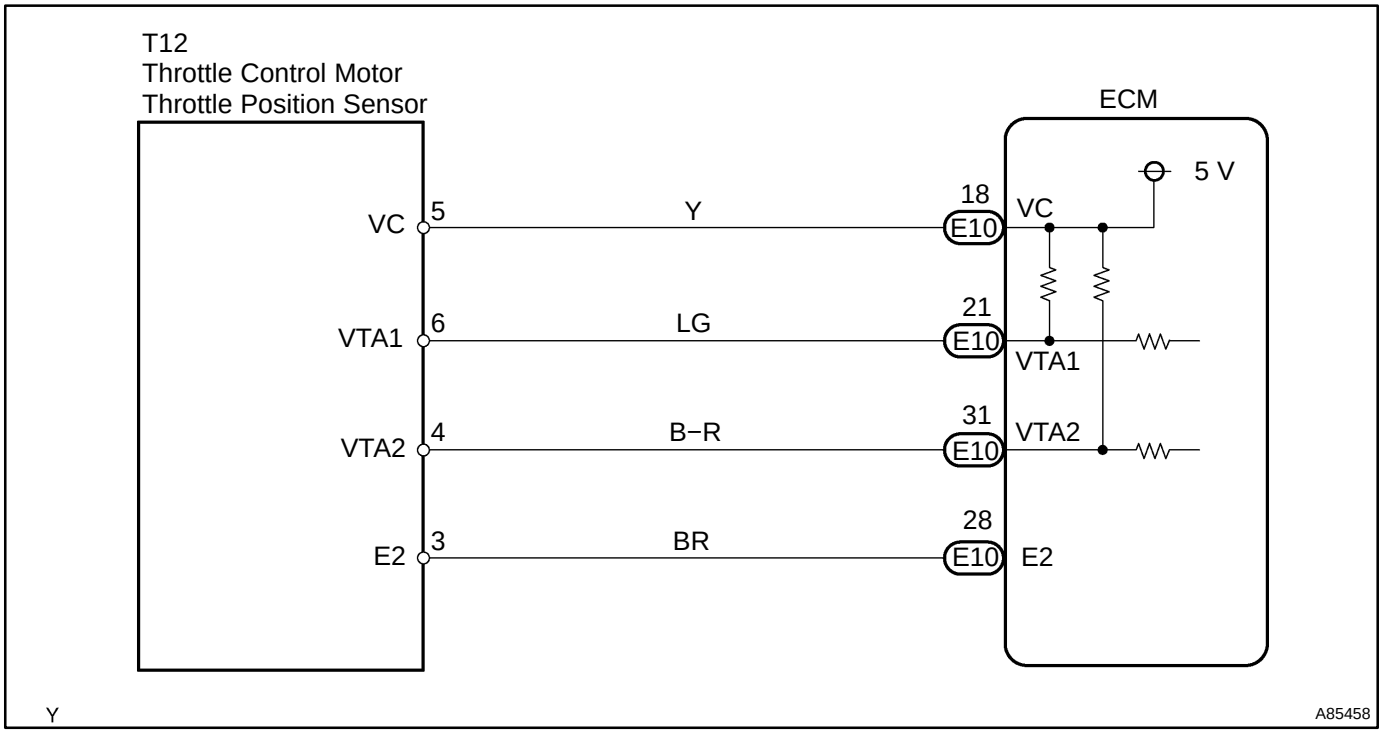
P2135:

Either of the following conditions is met:	Condition 1 or 2
1. Difference between VTA1 and VTA2 voltage	0.02 V or less
2. Both of the following conditions are met:	Condition (a) and (b)
(a) VTA1 voltage	0.2 V or less
(b) 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

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

- If DTCs related to different system that have terminal E2 as the ground terminal are output simultaneously, 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.

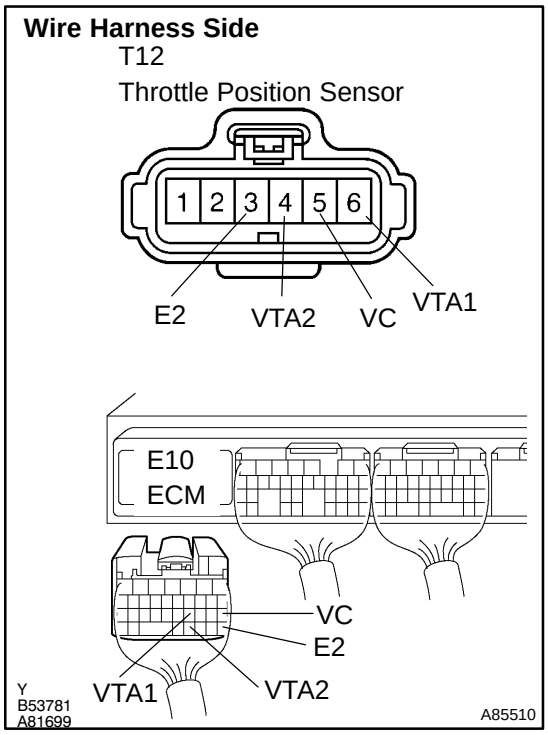
Result:

Throttle position expressed as percentage and voltage	Throttle position expressed as percentage and voltage	Throttle position expressed as percentage and voltage	Throttle position expressed as percentage and voltage		
Accelerator pedal released	Accelerator pedal released	Accelerator pedal depressed	Accelerator pedal depressed	Trouble Area	Proceed to
THROTTLE POS (VTA1)	THROTTLE POS #2 (VTA2)	THROTTLE POS (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 5.5 V	100 %	4.5 to 5.5 V	E2 circuit open	A
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	A
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)



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

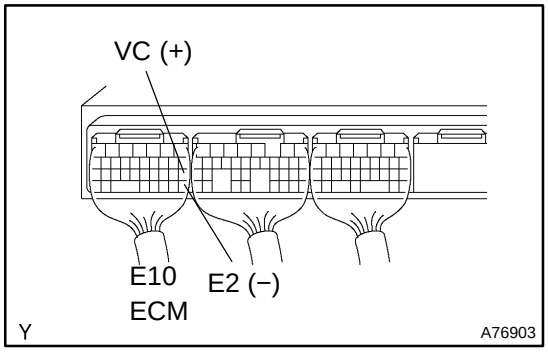
Standard:

Tester Connection	Specified Condition
T12−5 (VC) − E10−18 (VC) T12−6 (VTA1) − E10−21 (VTA1) T12−4 (VTA2) − E10−31 (VTA2) T12−3 (E2) − E10−28 (E2)	Below 1 Ω
T12−5 (VC) or E10−18 (VC) − Body ground T12−6 (VTA1) or E10−21 (VTA1) − Body ground T12−4 (VTA2) or E10−31 (VTA2) − Body ground	10 kΩ or higher

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

OK

3 INSPECT ECM (VC VOLTAGE)



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

Standard:

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

NG → **REPLACE ECM (See page 10−25)**

OK

4	REPLACE THROTTLE BODY ASSY (See page 10−16)

GO

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

(a) Clear the DTC (see page 05−531).
(b) Start the engine.
(c) Run the engine at idle for 15 seconds or more.
(d) Read the DTC (see page 05−531).

Result:

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

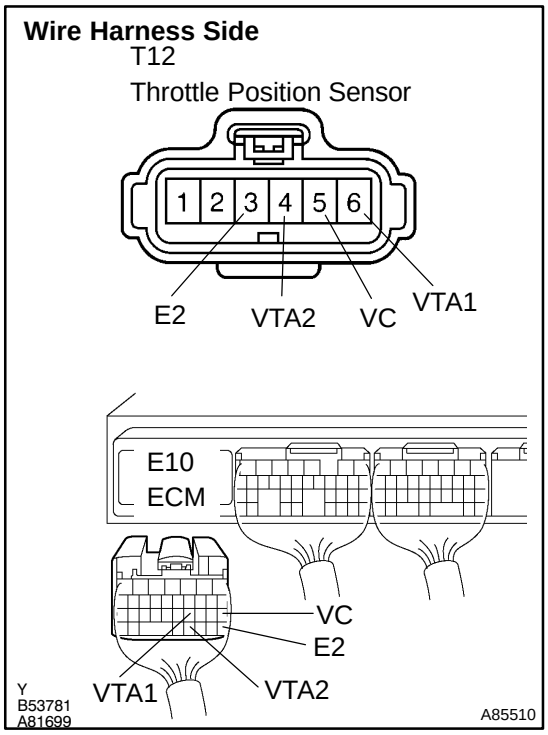
B → **SYSTEM OK**

A

REPLACE ECM (See page 10−25)

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

1	CHECK WIRE HARNESS (THROTTLE POSITION SENSOR − ECM)



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

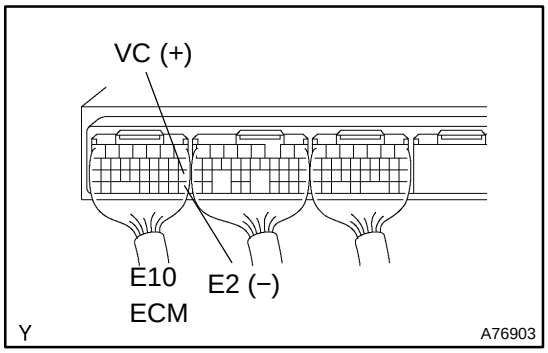
Standard:

Tester Connection	Specified Condition
T12−5 (VC) − E10−18 (VC) T12−6 (VTA1) − E10−21 (VTA1) T12−4 (VTA2) − E10−31 (VTA2) T12−3 (E2) − E10−28 (E2)	Below 1 Ω
T12−5 (VC) or E10−18 (VC) − Body ground T12−6 (VTA1) or E10−21 (VTA1) − Body ground T12−4 (VTA2) or E10−31 (VTA2) − Body ground	10 kΩ or higher

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

OK

2 INSPECT ECM (VC VOLTAGE)



(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 01−32)**

OK

3 REPLACE THROTTLE BODY ASSY (See page 10−16)

GO

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

(a) Clear the DTC (see page 05−531).
(b) Start the engine.
(c) Run the engine at idle for 15 seconds or more.
(d) Read the DTC (see page 05−531).

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 10−25)