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 of the Throttle Position (TP) sensor.

CIRCUIT DESCRIPTION

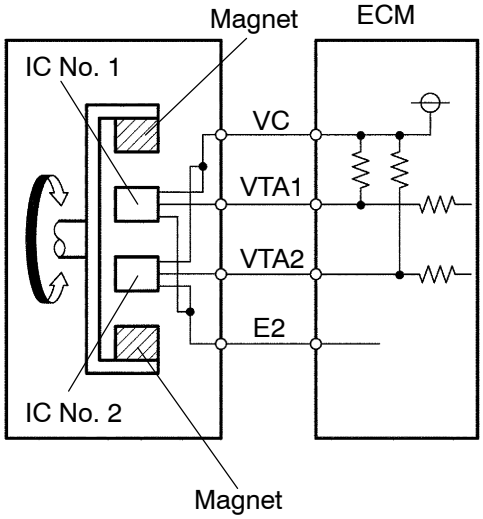
HINT:

- This Electronic Throttle Control System (ETCS) does not use a throttle cable.
- This TP sensor is a non–contact type.

The 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 TP 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 change 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 TP 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 opening angle properly in response to driver inputs.

Throttle Position Sensor



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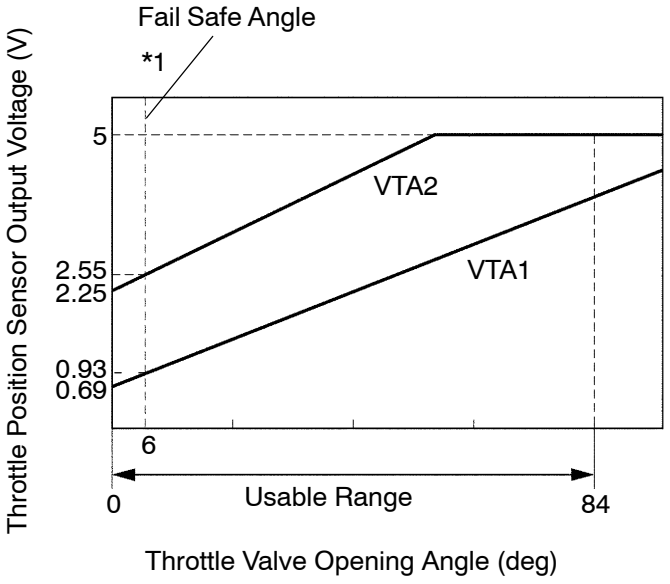


Throttle Valve Fully Closed
(Throttle Position expressed as percentage
(VTA1) 10 to 24 %)

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 No.	DTC Detection Condition	Trouble Area
P0120	VTA1 is 0.2 V or less, or VTA1 is 4.8 V or more (for 2 seconds) (1 trip detection logic)	• Throttle Position (TP) sensor (built in throttle body) • ECM
P0122	VTA1 is 0.2 V or less (for 2 seconds) (1 trip detection logic)	• TP sensor (built in throttle body) • Short in VTA1 circuit • Open in VC circuit • ECM
P0123	VTA1 is 4.8 V or more (for 2 seconds) (1 trip detection logic)	• TP sensor (built in throttle body) • Open in VTA1 circuit • Open in E2 circuit • VC and VTA1 circuit are shorted • ECM
P0220	VTA2 is 0.5 V or less, or VTA2 is 4.8 V or more VTA1 is 0.2 V or more, and VTA1 is 1.8 V or less (1 trip detection logic)	• TP sensor (built in throttle body) • ECM
P0222	VTA2 is 0.5 V or less (for 2 seconds) (1 trip detection logic)	• TPn sensor (built in throttle body) • Short in VTA2 circuit • Open in VC circuit • ECM
P0223	VTA2 is 4.8 V or more when VTA 1 is between 0.2 V to 1.8 V (for 2 seconds) (1 trip detection logic)	• TP sensor (built in throttle body) • Open in VTA2 circuit • Open in E2 circuit • VC and VTA2 circuit are shorted • ECM
P2135	Condition (a) continues for 0.5 seconds or more, or condition (b) continues for 0.4 seconds 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 0.5 V or less (1 trip detection logic)	• VTA1 and VTA2 circuit are shorted • TP sensor (built in throttle body) • ECM

HINT:

- After confirming DTCs, use the Intelligent Tester II to confirm the throttle valve opening percentage and closed TP sensor condition.
- Throttle Sensor Positioning is the VTA1 signal. Throttle POS No.2 is the VTA2 signal.

Reference (Normal condition):

Tester Display	Accelerator Pedal Fully Released	Accelerator Pedal Fully Depressed
Throttle Sensor Positioning	10 to 24 %	64 to 96 %
Throttle POS No.2	2.1 to 3.1 V	4.5 to 5.0 V

MONITOR DESCRIPTION

The ECM uses the TP 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.

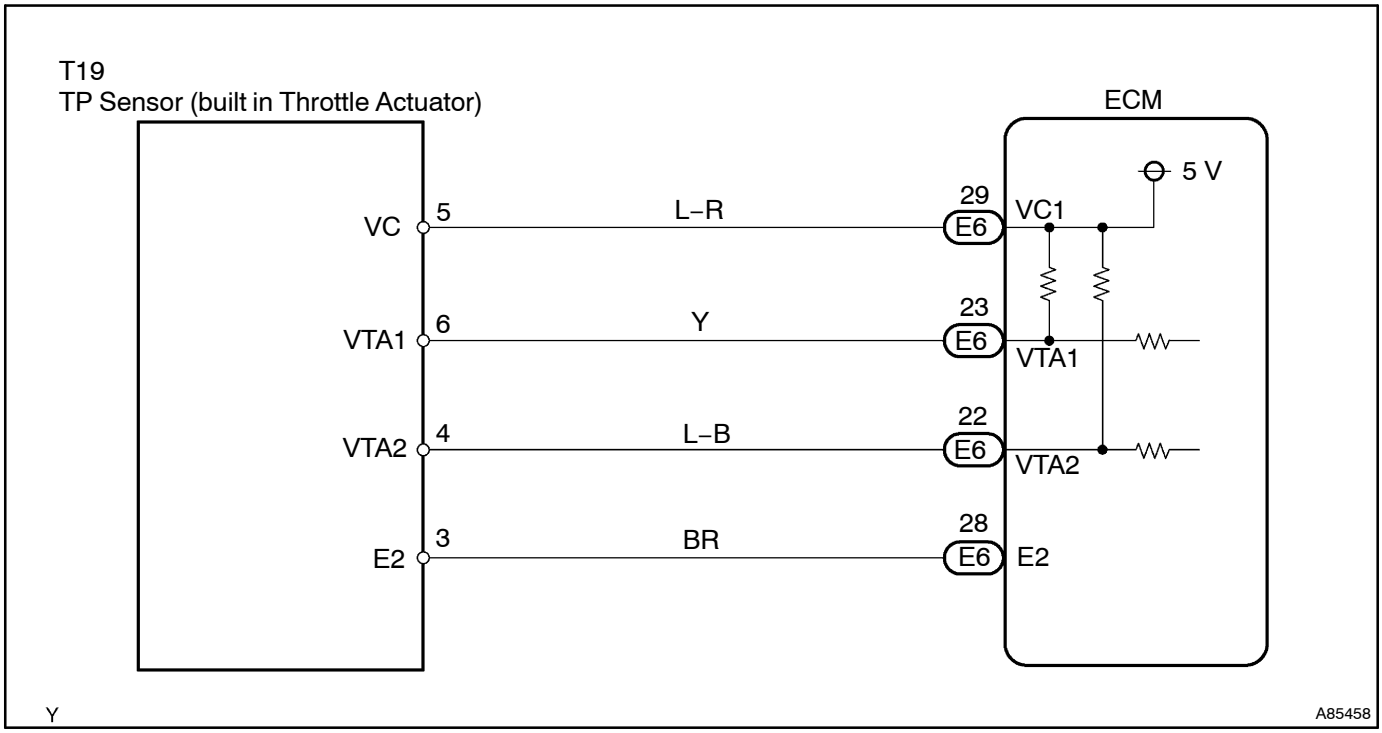
If VTA1 is within 0.02 V of VTA2, the ECM interprets this as a short circuit in the TP sensor system and will set a DTC.

This monitor runs for 2 seconds (the first 2 seconds of engine idle) after the engine is started (1 trip detection logic).

FAIL–SAFE

If the 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



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 II. 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.

1 READ VALUE OF INTELLIGENT TESTER II

(a) Select the item ”Enter / Diagnosis / OBD·MOBD / Power train / Engine and ECT / Data List / All Data / Throttle Sensor Positioning (and Throttle POS No.2)” on the Intelligent Tester II.

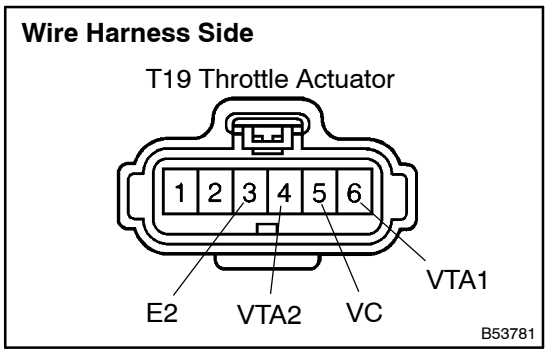
Result:

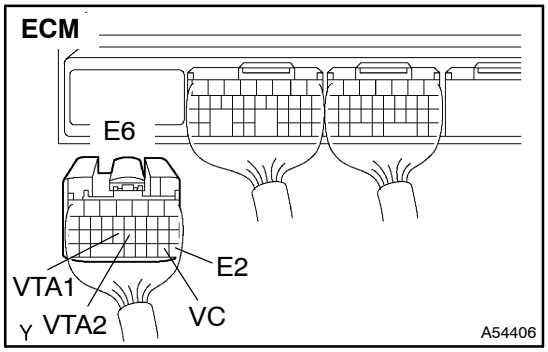
Throttle position expressed as percentage and voltage				Trouble area	Proceed to
Accelerator pedal released		Accelerator pedal depressed			
Throttle Sensor (VTA1)	Throttle POS #2 (VTA1)	Throttle Sensor (VTA1)	Throttle POS #2 (VTA2)		
0 %	0 to 0.2V	0 %	0 to 0.2V	VC circuit open	A
100 %	4.5 to 5.0 V	100 %	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 16 % (fail safe)	0 to 0.2 or 4.5 to 5.0 V	about 16 % (fail safe)	0 to 0.2 or 4.5 to 5.0 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 5.0 V (does not fail safe)	TP sensor circuit is normal	B

B → **Go to step 5**

A

2 CHECK WIRE HARNESS (THROTTLE ACTUATOR – ECM)





(a) Disconnect the T19 throttle actuator connector.
(b) Disconnect the E6 ECM connector.
(c) Measure the resistance between the wire harness side connectors.

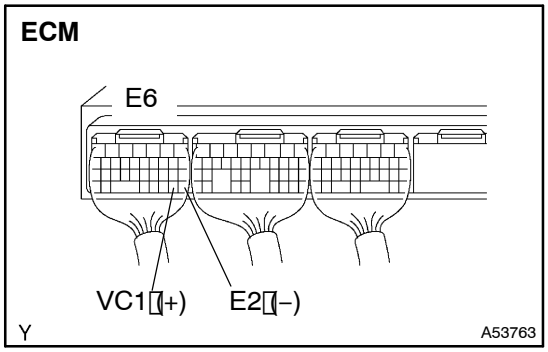
Standard:

Tester Connection	Specified Condition
T19–5 (VC) – E6–29 (VC1)	Below 1 Ω
T19–6 (VTA1) – E6–23 (VTA1)	Below 1 Ω
T19–4 (VTA2) – E6–22 (VTA2)	Below 1 Ω
T19–3 (E2) – E6–28 (E2)	Below 1 Ω
T19–5 (VC) or E6–29 (VC1) – Body ground	10 kΩ or higher
T19–6 (VTA1) or E6–23 (VTA1) – Body ground	10 kΩ or higher
T19–4 (VTA2) or E6–22 (VTA2) – Body ground	10 kΩ or higher
T19–5 (E2) or E6–29 (E2) – Body ground	10 kΩ or higher

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

OK

3	INSPECT ECM (VC VOLTAGE)



(a) Turn the ignition switch ON.
(b) Measure the voltage between the terminals of the E6 ECM connector.

Standard:

Tester Connection	Specified Condition
E6–29 (VC1) – E6–28 (E2)	4.5 to 5.5 V

NG → REPLACE ECM (See page 10–21)

OK

4	REPLACE THROTTLE BODY ASSY (See page 10–9)

NEXT

5	READ OUTPUT DTC (TP SENSOR DTCS ARE OUTPUT AGAIN)

(a) Clear the DTC. Enter the following menus: Enter/ Power train/ Engine and ECT/ DTC/ Clear.
(b) Start the engine.
(c) Run the engine at idle for 15 seconds or more.
(d) Read DTC. Enter the following menus: DTC/ Current.

Result:

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

B → SYSTEM OK

A

REPLACE ECM (See page 10–21)