

DTC	P0120	Throttle/Pedal Position Sensor/Switch "A" Circuit
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DTC	P0122	Throttle/Pedal Position Sensor/Switch "A" Circuit Low Input
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DTC	P0123	Throttle/Pedal Position Sensor/Switch "A" Circuit High Input
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DTC	P0220	Throttle/Pedal Position Sensor/Switch "B" Circuit
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DTC	P0222	Throttle/Pedal Position Sensor/Switch "B" Circuit Low Input
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DTC	P0223	Throttle/Pedal Position Sensor/Switch "B" Circuit High Input
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DTC	P2135	Throttle/Pedal Position Sensor/Switch "A"/"B" Voltage Correction
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HINT:

This is the purpose for the "throttle position sensor".

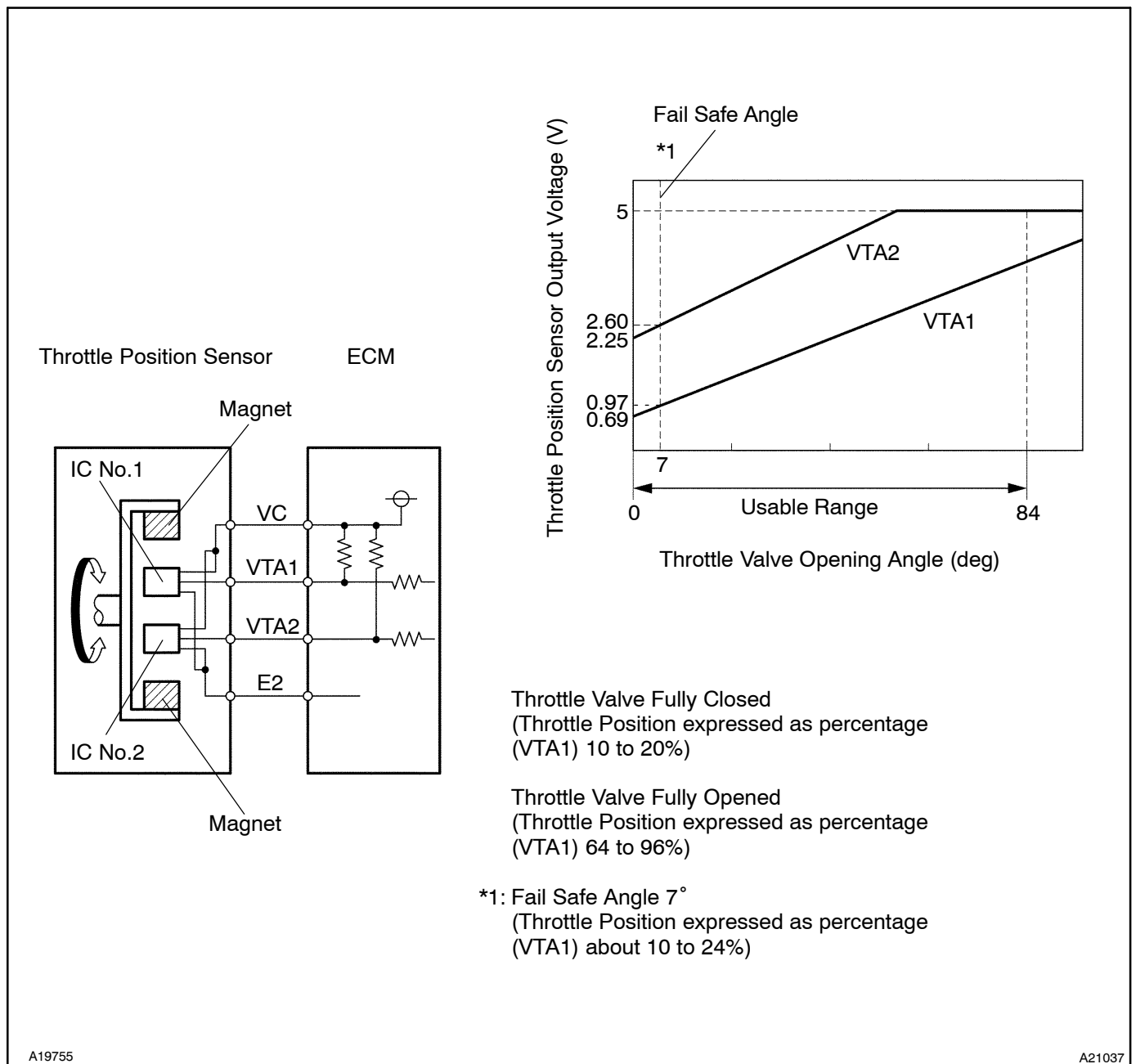
CIRCUIT DESCRIPTION

HINT:

- This Electrical Throttle Control System (ETCS) 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 used to detect the throttle opening angle and VTA2 is used to detect malfunctions in VTA1. Voltage applied to VTA1 and VTA2 change 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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DTC No.	DTC Detection Condition	Trouble Area
Condition (a) of DTC P0120, P0122, P0123, P0220, P0222 or P0223 continues for 2 sec. (Open or short in the throttle control motor and 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 "4.8 V or more"	• Throttle control motor and sensor • ECM
P0122	(a) VTA1 is 0.2 V or less	• Throttle control motor and sensor • Short in VTA1 circuit • Open in VC circuit • ECM
P0123	(a) VTA1 is 4.8 V or more	• Throttle control motor and sensor • Open in VTA1 circuit • Open in E2 circuit • VC and VTA1 circuit are short-circuited • ECM
P0220	Detection conditions for DTCs P0222 and P0223 are not satisfied but condition (a) is satisfied (a) VTA2 is "0.5 V or less" or VTA2 is "4.8 V or more" and VTA1 is "0.2 V or more" and VTA1 is "1.8 V or less"	• Throttle control motor and sensor • ECM
P0222	(a) VTA2 is 0.5 V or less	• Throttle control motor and 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 "1.8 V or less"	• Throttle control motor and sensor • Open in VTA2 circuit • Open in E2 circuit • VC and VTA2 circuit are short-circuited • ECM
P2135	Condition (a) continues for 0.5 sec. or more, or condition (b) continues for 0.4 sec. 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"	• VTA1 and VTA2 circuit are short-circuited • Throttle control motor and 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 means VTA1 signal as well as the THROTTLE POS #2 for the VTA2 signal.

Reference (Normal condition):

Tester display	Accelerator pedal fully released	Accelerator pedal fully depressed
THROTTLE POS	10 to 24 %	66 to 98%
THROTTLE POS #2	2.1 to 3.1 V	4.5 to 5.5 V

MONITOR DESCRIPTION

The ECM uses 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 injection (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 (sensor 1) range check (Fluttering)
	P0122	Throttle position sensor (sensor 1) range check (Low voltage)
	P0123	Throttle position sensor (sensor 1) range check (High voltage)
	P0220	Throttle position sensor (sensor 2) range check (Fluttering)
	P0222	Throttle position sensor (sensor 2) range check (Low voltage)
	P0223	Throttle position sensor (sensor 2) range check (High voltage)
	P2135	Throttle position sensor range check (Correlation)
Required sensors/components	Throttle position sensor	
Frequency of operation	Continuous	
Duration	2 sec. (Accelerator pedal ON) 10 sec. (Accelerator pedal OFF)	
MIL operation	Immediate	
Sequence of operation	None	

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	See "List of disable a monitor" (on page DI-3).
Throttle control motor power	ON

TYPICAL MALFUNCTION THRESHOLDS

Detection Criteria	Threshold
P0120:	
VTA1 voltage	0.35 V or less or 4.8 V or more (2 sec. or more)
P0122:	
VTA1 voltage	0.35 V or less (2 sec. or more)
P0123:	
VTA1 voltage	4.8 V or more (2 sec. or more)
P0220:	
VTA2 voltage	0.5 V or less or 4.8 V or more (2 sec. or more)
P0222:	
VTA2 voltage	0.5 V or less (2 sec. or more)
P0223:	
Both of the following conditions are met for 2 sec. or more:	A and B
A. VTA1 voltage	0.35 V or more and 2 V or less
B. VTA2 voltage	4.8 V or more
P2135:	
Different between VTA1 and VTA2 voltage	0.02 V or less
Both of the following conditions are met:	A and B
A. VTA1 voltage	0.35 V or less
B. VTA2 voltage	0.5 V or less

COMPONENT OPERATING RANGE

Parameter	Standard Value
Throttle position sensor VTA1 voltage	0.6 to 3.96 V
Throttle position sensor VTA2 voltage	2.25 to 5.0 V

T24 Throttle Control Motor and Sensor

ECM

Wiring connections:

- Motor/Sensor E2 (3) → BR → J17 J/C (D) → BR → ECM E8 (28)
- Motor/Sensor VC (5) → L-R → J17 J/C (A) → L-R → ECM E8 (18)
- Motor/Sensor VTA2 (4) → J17 J/C (Y-B) → ECM E8 (31)
- Motor/Sensor VTA (6) → R-Y → ECM E8 (21)
- Motor/Sensor M- (1) → W → ECM E6 (2)
- Motor/Sensor M+ (2) → R → ECM E6 (3)
- Motor/Sensor M+ (2) → (Shielded) → ECM E6 (17)

ECM internal components:

- E2 connected to a common rail with resistors to VC, VTA2, and VTA1.
- VC connected to a common rail with resistors to VTA2 and VTA1.
- VTA2 connected to a common rail with resistors to VTA1 and VTA2.
- VTA1 connected to a common rail with resistors to VTA2 and VTA1.
- M- connected to a common rail with resistors to M+ and M+.
- M+ connected to a common rail with resistors to M- and M+.
- GE01 connected to a common rail with resistors to M- and M+.

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, as well as other data from the time when a malfunction occurred.

Hand-held tester:

1	Connect hand-held tester, and read the voltage for throttle position sensor data.
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PREPARATION:

- (a) Connect the hand-held tester or the OBD II scan tool to the DLC3.
- (b) Turn the ignition switch ON and push the hand-held tester or OBD II scan tool main switch ON.
- (c) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / DATA LIST / ALL / THROTTLE POS and THROTTLE POS #2.

CHECK:

Read voltage value displayed on the hand-held tester.

OK:**RESULT:**

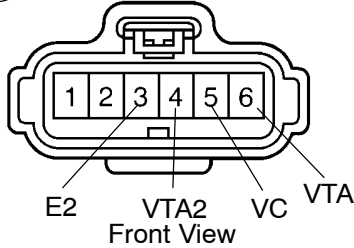
Throttle position expressed as percentage and voltage				Trouble area	Proceed to
Accelerator pedal released		Accelerator pedal depressed			
THROTTLE POS (VTA1)	THROTTLE POS #2 (VTA2)	THROTTLE POS (VTA1)	THROTTLE POS #2 (VTA2)		
0 %	0 to 0.2 V	0 %	0 to 0.2 V	VC circuit open	A
100 %	4.5 to 5.5 V	100 %	4.5 to 5.5 V	E2 circuit open	
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	
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	
10 to 24 %	2.15 to 3.05 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 for open and short in harness and connector between ECM and throttle position sensor.

Wire Harness Side

T24 Throttle Body Connector



PREPARATION:

- (a) Disconnect the T24 throttle control motor and sensor connector.
- (b) Disconnect the E8 ECM connector.

CHECK:

Check the resistance between the wire harness side connectors.

OK:

Tester Connection	Specified Condition
VC (T24-5) - VC (E8-18)	Below 1 Ω
VTA (T24-6) - VTA1 (E8-21)	
VTA2 (T24-4) - VTA2 (E8-31)	
E2 (T24-3) - E2 (E8-28)	
VC (T24-5) or VC (E8-18) - Body ground	10 k Ω or higher
VTA (T24-6) or VTA1 (E8-21) - Body ground	
VTA2 (T24-4) or VTA2 (E8-31) - Body ground	

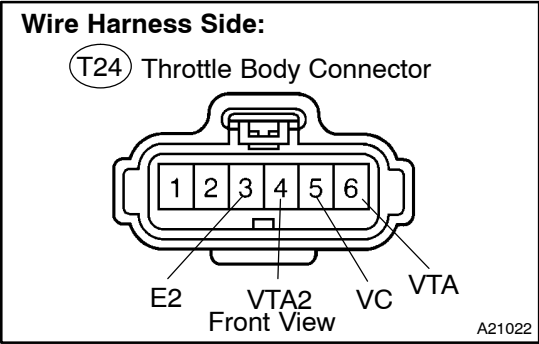
NG

Repair or replace harness or connector.

OK

3

Check voltage between terminals VC and E2 of ECM connector.



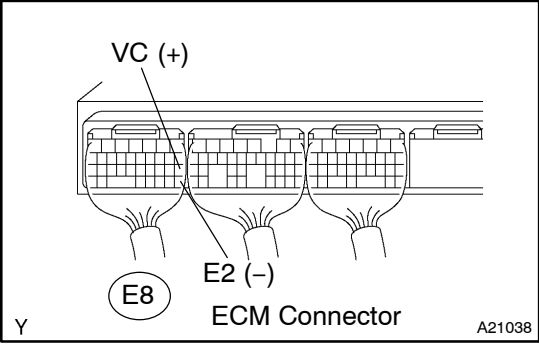
- PREPARATION:**
- (a) Disconnect the T24 throttle control motor and sensor connector.
 - (b) Turn the ignition switch ON.

CHECK:

Measure the voltage between the specified terminals of the E8 ECM connector.

OK:

Tester Connection	Specified Condition
VC (E8-18) - E2 (E8-28)	4.5 to 5.5 V



NG Replace ECM (See page [SF-60](#)).

OK

4

Replace throttle body (See page [SF-36](#)).

Go

5	Check if DTC output recur.
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PREPARATION:

- (a) Clear the DTC (See page [DI-3](#)).
- (b) Start the engine.
- (c) Run the engine at idle for 15 seconds or more.

CHECK:

Read the DTC (See page [DI-3](#)).

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 is OK.

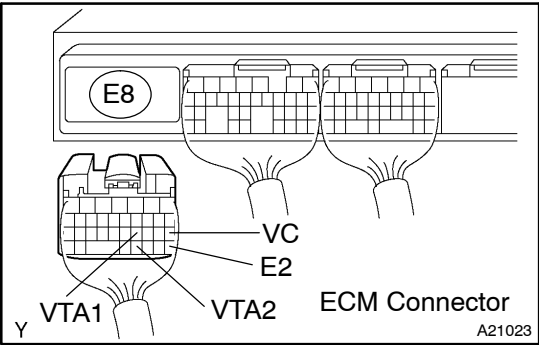
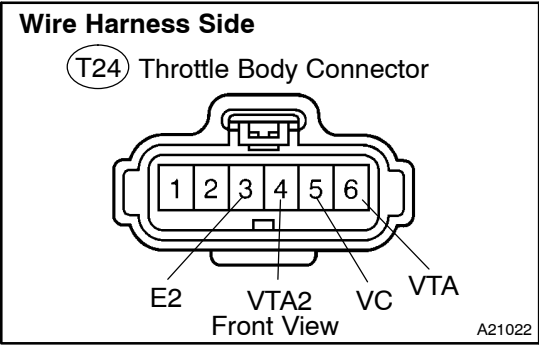
A

Replace ECM (See page [SF-60](#)).

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

1

Check for open and short in harness and connector between ECM and throttle position sensor.



PREPARATION:

- (a) Disconnect the T24 throttle control motor and sensor connector.
- (b) Disconnect the E8 ECM connector.

CHECK:

Check the resistance between the wire harness side connectors.

OK:

Tester Connection	Specified Condition
VC (T24-5) – VC (E8-18)	Below 1 Ω
VTA (T24-6) – VTA1 (E8-21)	
VTA2 (T24-4) – VTA2 (E8-31)	
E2 (T24-3) – E2 (E8-28)	
VC (T24-5) or VC (E8-18) – Body ground	10 kΩ or higher
VTA (T24-6) or VTA1 (E8-21) – Body ground	
VTA2 (T24-4) or VTA2 (E8-31) – Body ground	

NG

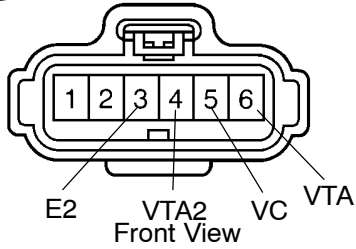
Repair or replace harness or connector.

OK

2 Check voltage between terminals VC and E2 of ECM connector.

Wire Harness Side:

(T24) Throttle Body Connector



PREPARATION:

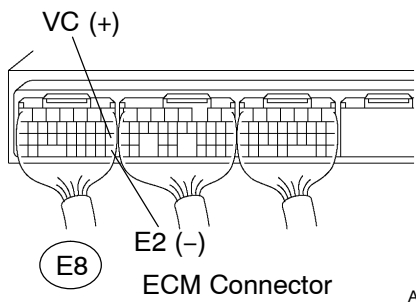
- (a) Disconnect the T24 throttle control motor and sensor connector.
- (b) Turn the ignition switch ON.

CHECK:

Measure the voltage between the specified terminals of the E8 ECM connector.

OK:

Tester Connection	Specified Condition
VC (E8-18) - E2 (E8-28)	4.5 to 5.5 V



NG

Replace ECM (See page [SF-60](#)).

OK

3 Replace throttle body (See page [SF-36](#)).

Go

4	Check if DTC output recur.
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PREPARATION:

- (a) Clear the DTC (See page [DI-3](#)).
- (b) Start the engine.
- (c) Run the engine at idle for 15 seconds or more.

CHECK:

Read the DTC (See page [DI-3](#)).

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 is OK.****A****Replace ECM (See page [SF-60](#)).**