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|------------|--------------|--|
| 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 |

CIRCUIT DESCRIPTION

HINT:

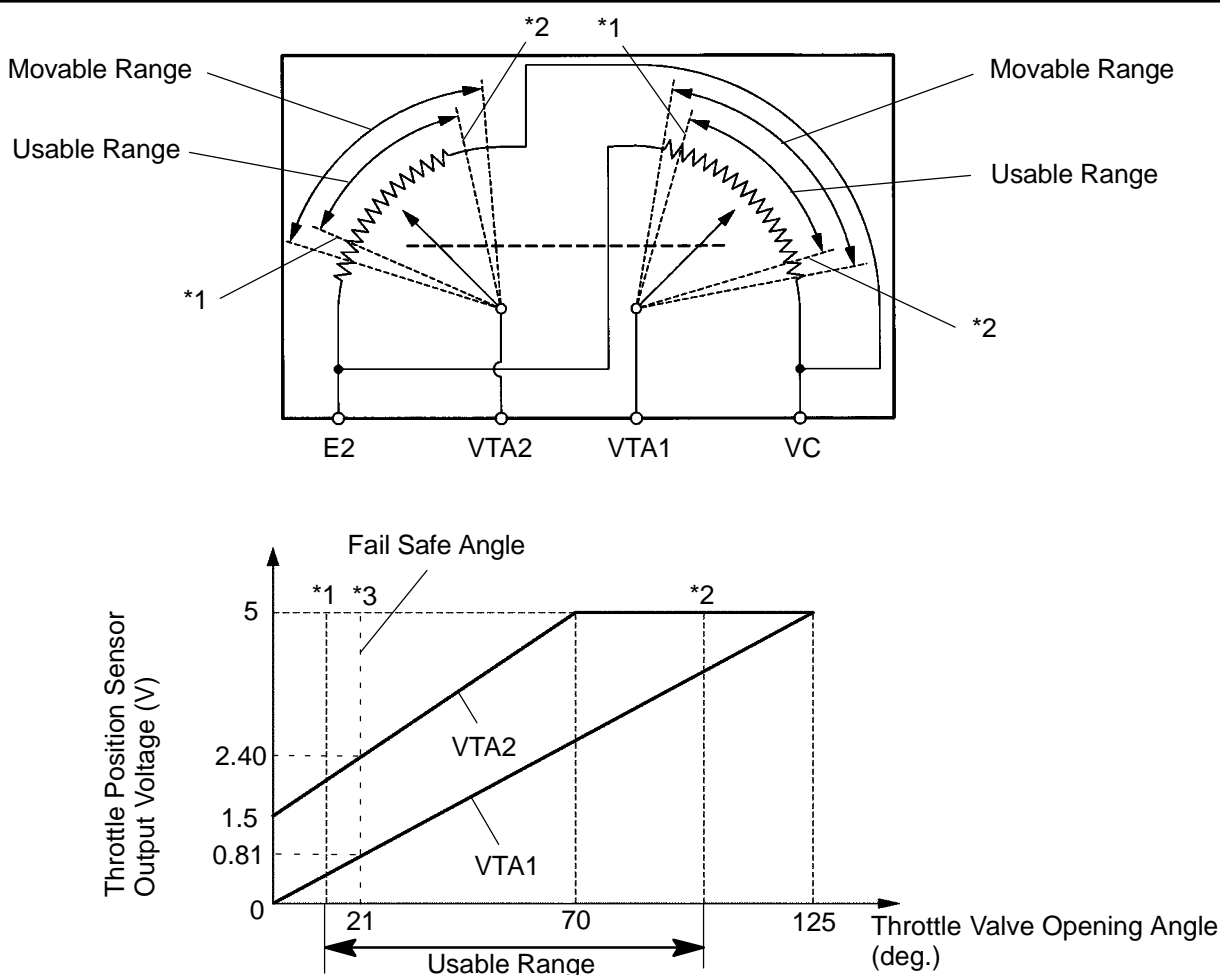
- This electrical throttle system does not use a throttle cable.
- This is the troubleshooting procedure of the throttle position sensor.

The throttle position sensor is mounted on the throttle body and it has 2 sensor terminals to detect the throttle opening angle and malfunction of the throttle position sensor itself.

The voltage applied to terminals VTA and VTA2 of the ECM changes between 0 V and 5 V in proportion to the opening angle of the throttle valve. The VTA is a signal to indicate the actual throttle valve opening angle which is used for the engine control, and the VTA2 is a signal to indicate the information about the opening angle which is used for detecting malfunction of the sensor.

The ECM judges the current opening angle of the throttle valve from these signals input from terminals VTA and VTA2, and the ECM controls the throttle motor to make the throttle valve angle properly in response to the driving condition.

When malfunction is detected, the throttle valve is locked at a certain opening angle. Also, the whole electronically controlled throttle operation is cancelled until the system returns to normal and the power switch is turned OFF.



*1: Throttle Valve Fully Closed (13.5°), VTA1 is 0%

*2: Throttle Valve Fully Open (97.5°), VTA1 is approx 100 %

*3: Fail Safe Angle (16.5°), VTA1 is 3.5%

Note: Throttle valve opening angle detected by the sensor terminal of VTA is expressed as percentage.

| DTC No. | DTC Detection Condition | Trouble Area |
|---------|---|--|
| — | Conditions of DTC P0120, P0122, P0123, P0220, P0222 or P0223 continues for 2 seconds or more when Idle is ON | — |
| P0120 | Detection conditions for DTCs P0122 and P0123 are not satisfied but condition (a) is satisfied (a) VTA is 0.2V or less, or 4.8 V or more | <ul style="list-style-type: none"> • Open or short in throttle position sensor circuit • Throttle position sensor • ECM |
| P0122 | VTA is 0.2 V or less | <ul style="list-style-type: none"> • Short in throttle position sensor circuit • Throttle position sensor • ECM |
| P0123 | VTA is 4.8 V or more | <ul style="list-style-type: none"> • Open in throttle position sensor circuit • Throttle position sensor • ECM |
| P0220 | Detection conditions for DTCs P0222 and P0223 are not satisfied but condition (a) and (b) are satisfied (a) VTA2 is 0.5 V or less, or VTA2 is 4.8 V or more (b) VTA is 0.2 V or more and 1.8 V or less | <ul style="list-style-type: none"> • Open or short in throttle position sensor circuit • Throttle position sensor • ECM |
| P0222 | VTA2 is 0.5 V or less | <ul style="list-style-type: none"> • Short in throttle position sensor circuit • Throttle position sensor • ECM |
| P0223 | VTA2 is 4.8 V or more when VTA is 0.2 or more and 1.8 V or less | <ul style="list-style-type: none"> • Open in throttle position sensor circuit • Throttle position sensor • ECM |
| P2135 | Condition (a) continues for 0.5 seconds or more, or condition (b) continues for 0.4 seconds or more: (a) Difference between VTA and VTA2 is 0.02 V or less (b) VTA is 0.2 V or less and VTA2 is 0.5 V or less | <ul style="list-style-type: none"> • Open or short in throttle position sensor circuit • Throttle position sensor • ECM |

HINT:

| DTC No. | Main Trouble Area |
|---------|---|
| P0122 | <ul style="list-style-type: none"> • Throttle position sensor • Open in VTA1 circuit • VC circuit open (when the VC circuit is open, DTCs P0222 and P2135 are also output simultaneously) • ECM |
| P0123 | <ul style="list-style-type: none"> • Throttle position sensor (built in throttle body) • Open in VTA circuit • Open in E2 circuit • VC and VTA circuits are short-circuited • ECM |
| P0222 | <ul style="list-style-type: none"> • Throttle position sensor • Open in VTA2 circuit • VC circuit open (when the VC circuit is open, DTCs P0122 and P2135 are also output simultaneously) |
| P0223 | <ul style="list-style-type: none"> • Throttle position sensor |
| P2135 | <ul style="list-style-type: none"> • VTA1 and VTA2 circuits are short-circuited • Open in VC circuit • Throttle position sensor |

NOTICE:

When a malfunction is detected, the throttle valve is locked at a certain opening angle. Also, the whole electronically controlled throttle operation is cancelled until the system returns to normal and the power switch is turned OFF.

HINT:

- After confirming DTCs, confirm condition of the throttle valve opening angle (THROTTLE POS) and the closed throttle position switch (THROTTLE POS #2) using the hand-held tester or the OBD II scan tool.
- THROTTLE POS means the VTA1 signal (expressed as percentage), and THROTTLE POS#2 means the VTA2 signal (expressed as volts).

Reference (Normal condition):

| Tester display | Accelerator pedal released | Accelerator pedal depressed |
|-----------------|----------------------------|-----------------------------|
| THROTTLE POS | 8 to 20 % | 64 to 96 % |
| THROTTLE POS #2 | 1.5 to 2.9 V | 3.5 to 5.5 V |

MONITOR DESCRIPTION

The ECM uses the throttle position sensor to monitor the throttle valve opening angle.

- There is a specific voltage difference between VTA1 and VTA2 for each throttle opening angle.
- VTA1 and VTA2 each have a specific voltage operating range.
- VTA1 and VTA2 should never be close to the same voltage level.

If the difference between VTA1 and VTA2 is incorrect (a), the ECM interprets this as a fault and will set a DTC.

If VTA1 or VTA2 is out of the normal operating range (b), the ECM interprets this as a fault and will set a DTC.

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

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 seconds |
| MIL operation | Immediately |
| Sequence of operation | None |

TYPICAL ENABLING CONDITIONS

| | |
|--|--------------------------------|
| The monitor will run whenever the following DTCs are not present | See page 05-20 |
|--|--------------------------------|

TYPICAL MALFUNCTION THRESHOLDS

P0120:

| | |
|--------------|--------------------------------|
| VTA1 voltage | 0.2 V or less or 4.8 V or more |
|--------------|--------------------------------|

P0122:

| | |
|--------------|---------------|
| VTA1 voltage | 0.2 V or less |
|--------------|---------------|

P0123:

| | |
|--------------|---------------|
| VTA1 voltage | 4.8 V or more |
|--------------|---------------|

P0220:

| | |
|--------------|--------------------------------|
| VTA2 voltage | 0.5 V or less or 4.8 V or more |
|--------------|--------------------------------|

P0222:

| | |
|--------------|---------------|
| VTA2 voltage | 0.5 V or less |
|--------------|---------------|

P0223:

| | |
|--------------|---------------|
| VTA2 voltage | 4.8 V or more |
|--------------|---------------|

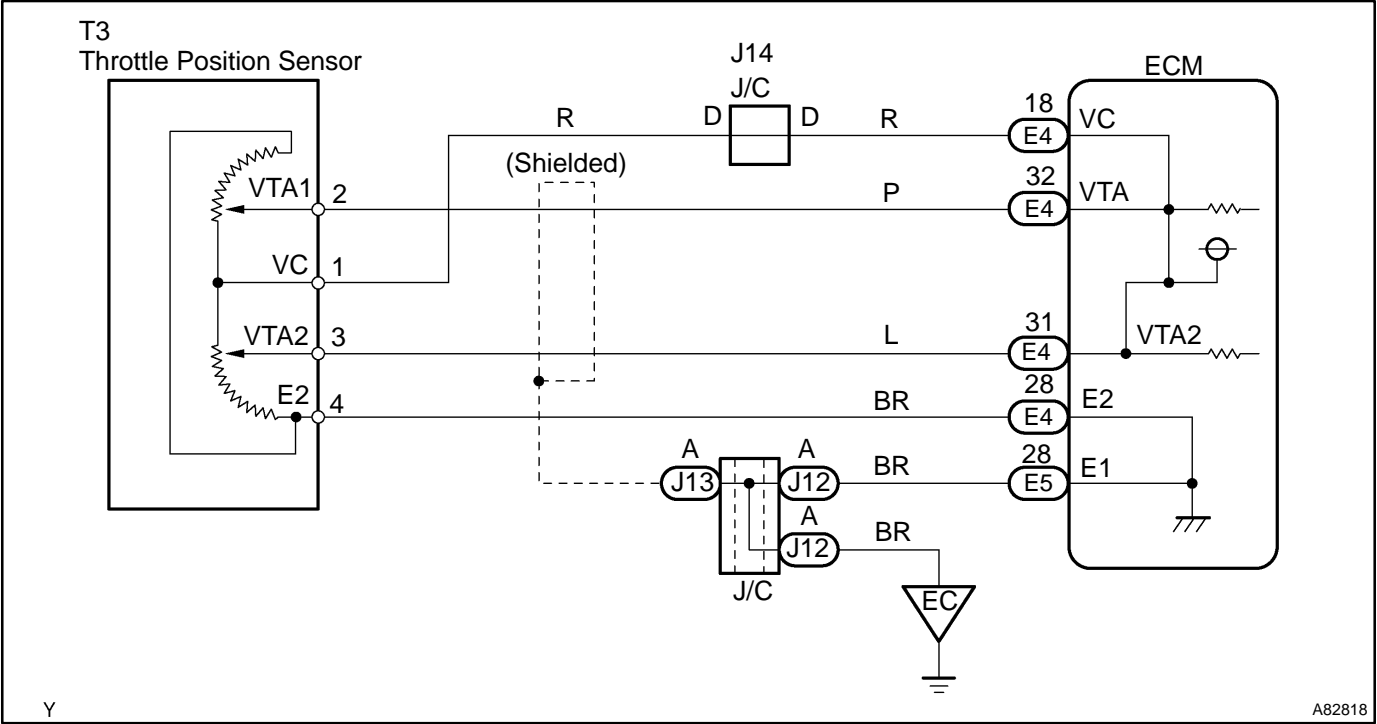
P2135:

| | |
|---|----------------|
| Different between VTA1 and VTA2 voltage | 0.02 V or less |
| Both of the following conditions are met: | (a) and (b) |
| (a) VTA1 voltage | 0.2 V or less |
| (b) VTA2 voltage | 0.5 V or less |

COMPONENT OPERATING RANGE

| | |
|---------------------------------------|---------------|
| Throttle position sensor VTA1 voltage | 0.6 to 3.96 V |
| Throttle position sensor VTA2 voltage | 2.25 to 5.0 V |

WIRING DIAGRAM

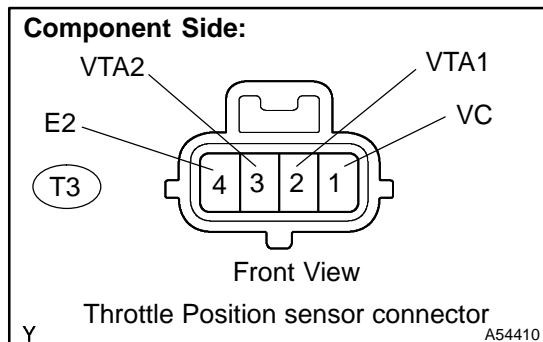


INSPECTION PROCEDURE

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 hand-held tester or the OBD II scan tool. Freeze frame data records the engine condition when 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 INSPECT THROTTLE POSITION SENSOR(RESISTANCE)



- Disconnect the T3 throttle position sensor connector.
- Measure the resistance between the terminals of the throttle position sensor.

Standard:

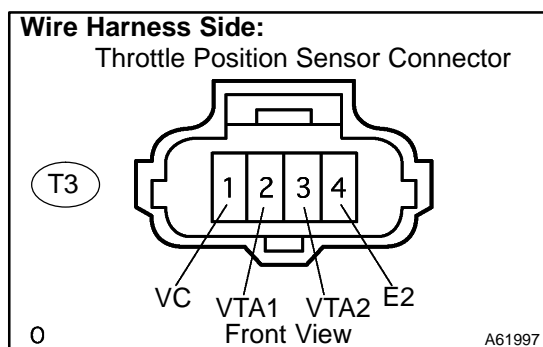
| Throttle Position Sensor Terminal | Resistance |
|-----------------------------------|-------------------------------|
| VC (1) - E2 (4) | 1.2 to 3.2 kΩ at 20°C (68°F) |
| VTA1 (2) - E2 (4) | 1.8 to 10.5 kΩ at 20°C (68°F) |
| VTA2 (3) - E2 (4) | 1.8 to 10.5 kΩ at 20°C (68°F) |

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REPLACE THROTTLE W/MOTOR BODY ASSY
(See page 10-13)

OK

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



- Disconnect the T3 throttle position sensor connector.
- Disconnect the ECM E4 connector.
- Check the resistance between the wire harness side connectors.

Standard: Check for open

| Tester Connection | Specified Condition |
|----------------------------|---------------------|
| VC (T3-1) - VC (E4-18) | Below 1 Ω |
| VTA1 (T3-2) - VTA (E4-32) | Below 1 Ω |
| VTA2 (T3-3) - VTA2 (E4-31) | Below 1 Ω |
| E2 (T3-4) - E2 (E4-28) | Below 1 Ω |

Standard: Check for short

| Tester Connection | Specified Condition |
|---------------------------|---------------------|
| VC (E4-18) - E2 (E4-28) | 10 kΩ or higher |
| VTA (E4-32) - E2 (E4-28) | 10 kΩ or higher |
| VTA2 (E4-31) - E2 (E4-28) | 10 kΩ or higher |

- Reconnect the ECM connector.

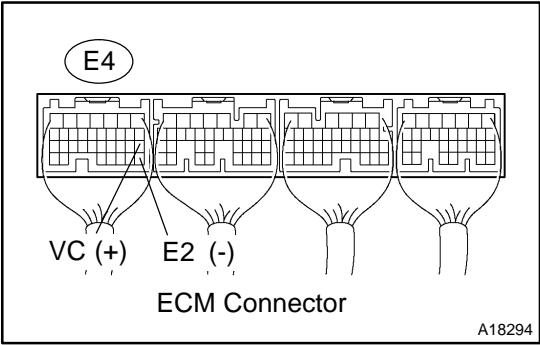
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REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

3

INSPECT ECM(VC - E2)



- (a) Turn the power switch ON (IG).
- (b) Measure the voltage between terminals VC and E2 of the ECM connector.

Standard:

| Tester Connection | Specified Condition |
|-------------------------|---------------------|
| VC (E4-18) - E2 (E4-28) | 4.5 to 5.5 V |

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REPLACE ECM (See page 10-24)

OK

REPLACE THROTTLE W/MOTOR BODY ASSY (See page 10-13)