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| 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 Correlation |
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HINT:

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

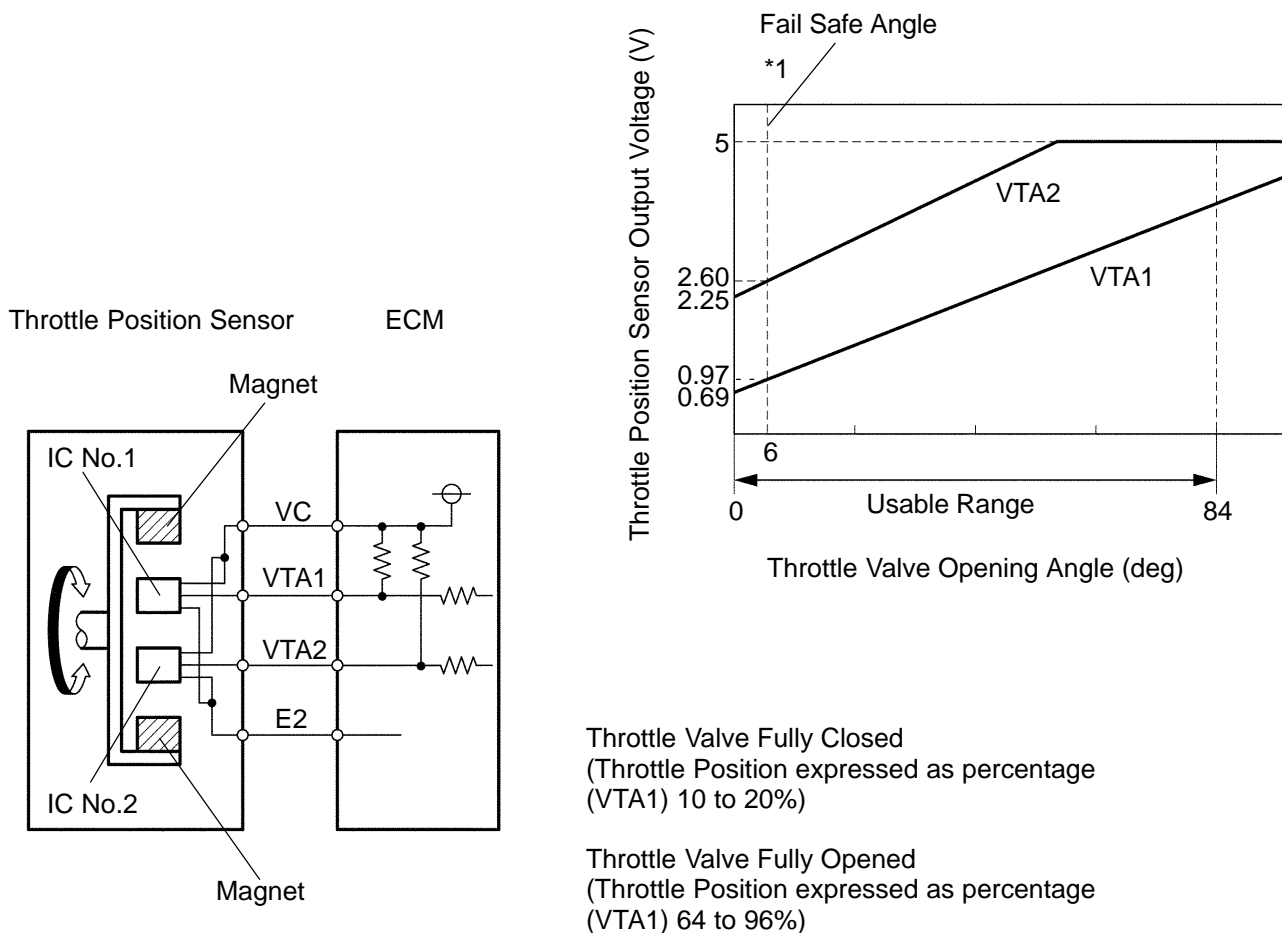
CIRCUIT DESCRIPTION

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. 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 0 V and 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 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.



*1: Fail Safe Angle 7°
(Throttle Position expressed as percentage (VTA1) about 10 to 24%)

DIAGNOSTICS – ENGINE (1GR-FE)

| 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 "4.535 V or more" | <ul style="list-style-type: none">• Open or short in throttle control motor and sensor circuit• Throttle control motor and sensor• ECM |
| P0122 | (a) VTA1 is 0.2 V or less | <ul style="list-style-type: none">• Short in throttle control motor and sensor circuit• Throttle control motor and sensor• Short in VTA1 circuit• Open in VC circuit• ECM |
| P0123 | (a) VTA1 is 4.535 V or more | <ul style="list-style-type: none">• Open in throttle control motor and sensor circuit• 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 "1.75 V or less" or VTA2 is "4.8 V or more" | <ul style="list-style-type: none">• Throttle control motor and sensor• ECM |
| P0222 | (a) VTA2 is 1.75 V or less | <ul style="list-style-type: none">• 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 "2.02 V or less" | <ul style="list-style-type: none">• 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 "1.75 V or less" | <ul style="list-style-type: none">• VTA1 and VTA2 circuit are short–circuited• Throttle control motor and sensor• ECM |

HINT:

- After confirming DTCs, use the hand-held tester to confirm the throttle valve opening percentage and closed throttle position switch condition.
- THROTTLE POS means the VTA1 signal and the THROTTLE POS #2 means 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 throttle position sensor to monitor the throttle valve opening angle.

- (a) There is an expected specific voltage difference 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 the range of ± 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 | Accelerator pedal ON: 2 sec. Accelerator pedal OFF: 10 sec. P2135: 0.5 sec. or 0.4 sec. | |
| MIL operation | Immediate | |
| Sequence of operation | None | |

TYPICAL ENABLING CONDITIONS

| | |
|--|--------------------------------|
| The monitor will run whenever these DTCs are not present | See page DI-18 |
| Throttle control motor power | ON |

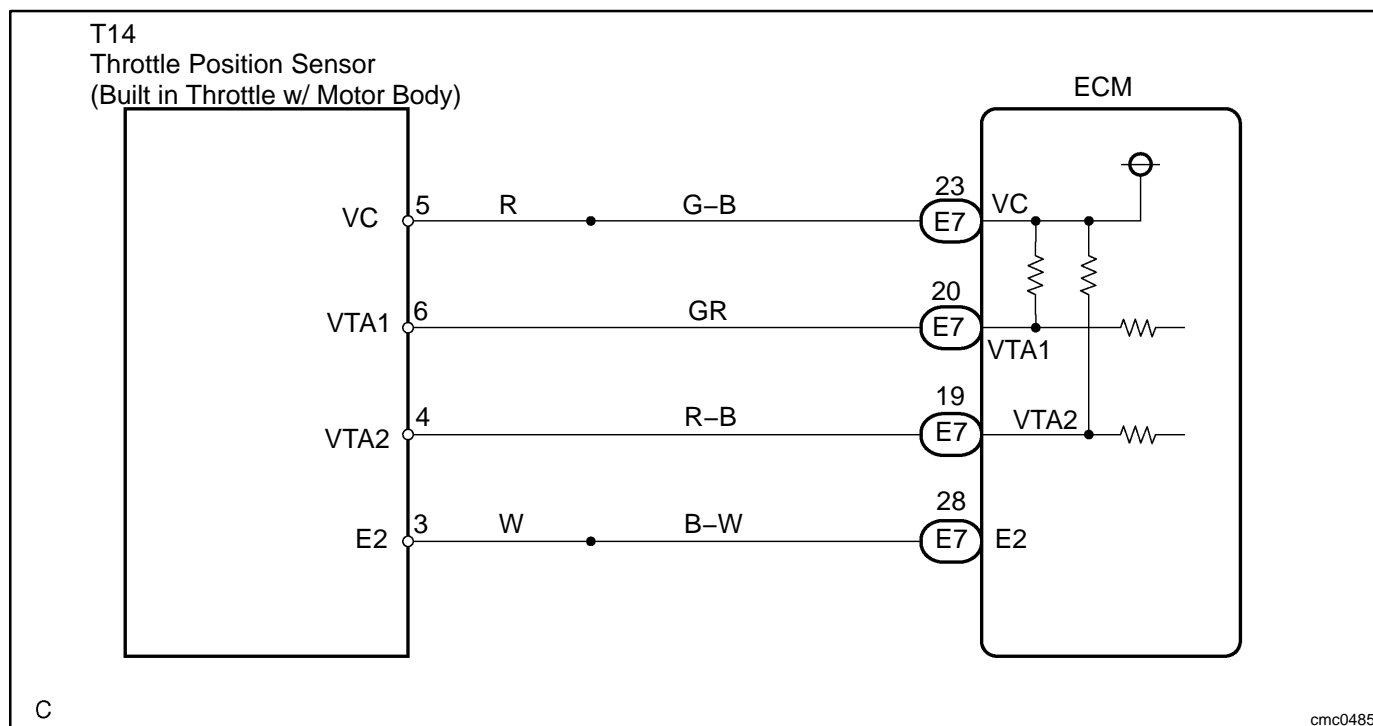
TYPICAL MALFUNCTION THRESHOLDS

| Detection Criteria | Threshold |
|--|-----------------------------------|
| 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: | |
| Both of the following conditions are met for 2 sec. or more: | Condition 1 and 2 |
| 1. VTA1 voltage | 0.2 to 2.02 V |
| 2. 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: | Condition 1 and 2 |
| 1. VTA1 voltage | 0.2 V or less |
| 2. VTA2 voltage | 1.75 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 |

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. 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.

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

Enter the following menu: DIAGNOSIS / ENHANCED OBD II / DATA LIST / ALL / THROTTLE POS and THROTTLE POS #2.

CHECK:

Read voltage value displayed on the hand-held tester.

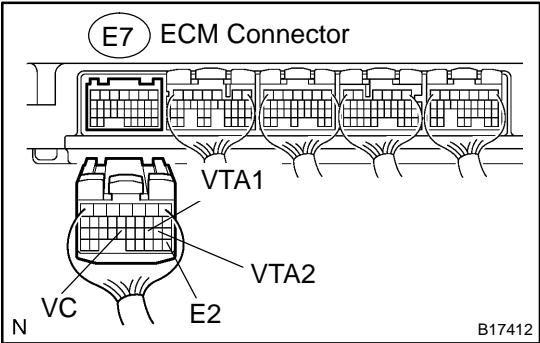
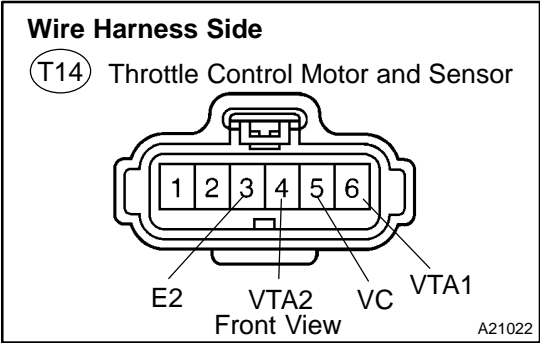
OK:**RESULT:**

| 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.



PREPARATION:

- (a)
- Disconnect the T14 throttle control motor and sensor connector.
- (b)
- Disconnect the E7 ECM connector.

CHECK:

Check the resistance between the wire harness side connectors.

OK:

Standard:

| Tester Connection | Specified Condition |
|--|---------------------|
| VC (T14-5) – VC (E7-23) | Below 1 Ω |
| VTA1 (T14-6) – VTA1 (E7-20) | Below 1 Ω |
| VTA2 (T14-4) – VTA2 (E7-19) | Below 1 Ω |
| E2 (T14-3) – E2 (E7-28) | Below 1 Ω |
| VC (T14-5) or VC (E7-23) – Body ground | 10 kΩ or higher |
| VTA1 (T14-6) or VTA1 (E7-20) – Body ground | 10 kΩ or higher |
| VTA2 (T14-4) or VTA2 (E7-19) – Body ground | 10 kΩ or higher |

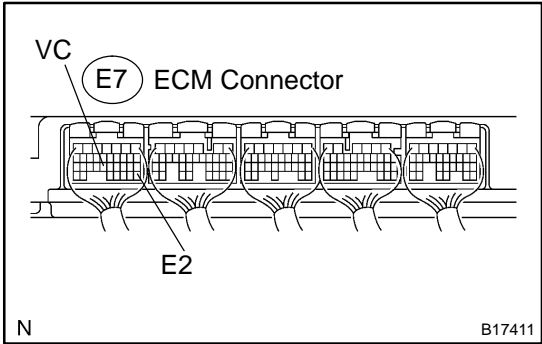
NG

Repair or replace harness or connector.

OK

3

Check voltage between terminals VC and E2 of ECM connector.



PREPARATION:

- (a) Disconnect the T14 throttle control motor and sensor connector.
- (b) Turn the ignition switch to ON.

CHECK:

Measure the voltage between the specified terminals of the E7 ECM connector.

OK:

Standard:

| Tester Connection | Specified Condition |
|-------------------------|---------------------|
| VC (E7-23) - E2 (E7-28) | 4.5 to 5.5 V |

NG

Replace ECM (See page [SF-66](#)).

OK

4

Replace throttle body (See page [SF-40](#)).

NEXT

| | |
|---|----------------------------|
| 5 | Check if DTC output recur. |
|---|----------------------------|

PREPARATION:

- (a) Clear the DTC (See page [DI-42](#)).
- (b) Start the engine.
- (c) Run the engine at idle for 15 seconds or more.

CHECK:

Read the DTC.

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-66](#)).**