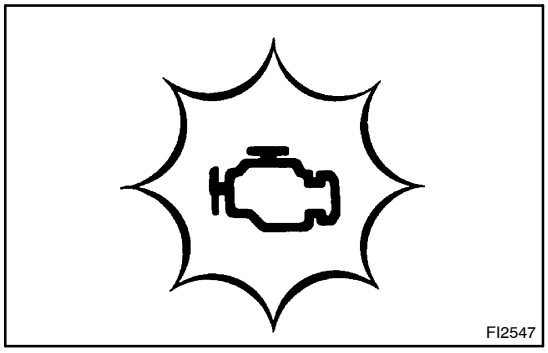
DI9TK–01

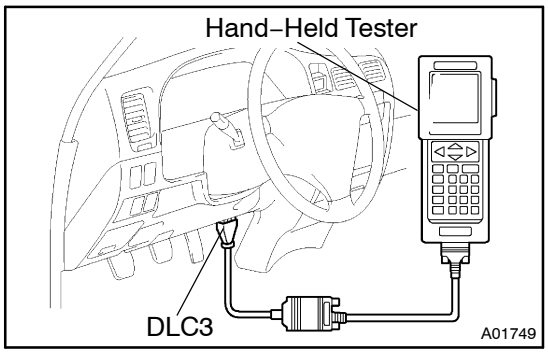

FI2547

PRE–CHECK

1. DIAGNOSIS SYSTEM

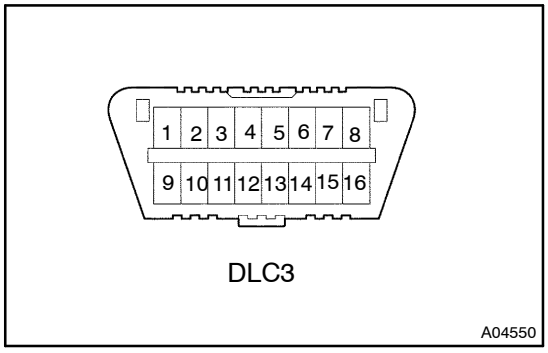
(a) Description

- When troubleshooting the Multiplex OBD (M–OBD) vehicles, the only difference from the usual troubleshooting procedure is that you connect the hand–held tester to the vehicle, and read off various data output from the vehicle's ECU.
- The vehicle's on–board computer lights up the check engine warning light (CHK ENG) on the instrument panel when the computer detects a malfunction in the computer itself or in drive system components. In addition to the check engine warning light lighting up when a malfunction is detected, the applicable Diagnosis Trouble Code (DTC) are recorded in the ECU memory (See page DI–151). If the malfunction has been repaired, the check engine warning light goes off automatically but the DTCs remain recorded in the ECU memory.



- To check the DTCs, connect the hand–held tester to Data Link Connector 3 (DLC3) on the vehicle. or read the number of blinks of the check engine warning light when TC and CG terminals on the DLC3 are connected. The hand–held tester also enables you to erase the DTCs and activate the several actuators and check freeze frame data and various forms of engine data (For operating instructions, see the hand–held tester instruction book.)
- The diagnosis system operates in the normal mode during normal vehicle use. It also has the check (test) mode for technicians to simulate malfunction symptoms and make a troubleshooting. Most DTCs use 2 trip detection logic* to prevent an erroneous detection and ensure thorough malfunction detection. By switching the ECU to the check (test) mode using hand–held tester when troubleshooting, the technician can cause the check engine warning (CHK ENG) to light up for a malfunction that is only detected once or momentarily. (Hand–held tester only) (See step 3.)

- * 2 trip detection logic
  When a logic malfunction is fist detected, the malfunction is temporarily stored in the ECU memory. If the same malfunction is detected again during the second drive test, this second detection cases the check engine warning (CHK ENG) to light up.
  The 2 trip repeats the same mode for 2 times. (However, the IG switch must be turned OFF between the 1st trip and 2nd trip)
- Freeze frame data:
  Freeze frame data records the engine condition when malfunction is detected.
  Because freeze frame data records the engine conditions (fuel system, calculator load, water temperature, fuel trim, engine speed, vehicle speed, etc.) When the malfunction is detected.
  When troubleshooting it is useful for determining whether the vehicle was running or stopped, the engine warmed up or not, the air–fuel ratio lean or rich, etc. at the time of the malfunction.



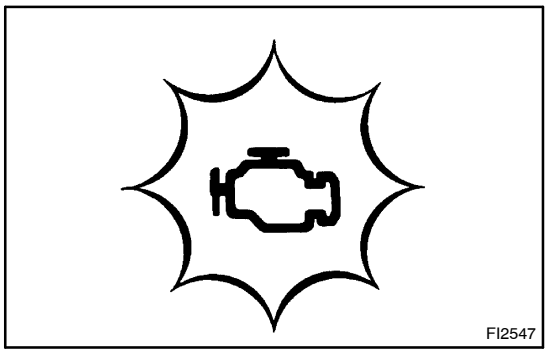
DLC3

(b) Check the DLC3.
The vehicle's ECU uses the ISO 14230 for communication. The terminal arrangement of the DLC3 complies with the SAE J1962 and matches the ISO 14230 format.

Terminal No.	Connection / Voltage or Resistance	Condition
7	Bus ⊕ Line / Pulse generation	During transmission
4	Chassis Ground / ↔ Body Ground 1 Ω or less	Always
16	Battery Positive / ↔ Body Ground 9 ~ 14 V	Always

HINT:
If the display shows ”UNABLE TO CONNECT TO VEHICLE” when you have connected the cable of the hand–held tester to the DLC3, turned the ignition switch ON and operated the hand–held tester, there is a problem on the vehicle side or tool side.

- If the communication is normal when the tool is connected to another vehicle, inspect the DLC3 of the original vehicle.
- If the communication is still impossible when the tool is connected to another vehicle, the problem is probably in the tool itself, so consult the Service department listed in the tool’s instruction manual.


FI2547

2. Normal Mode:
INSPECT DIAGNOSIS

(a) Check the check engine warning light.
(1) The check engine warning light (CHK ENG) comes on when the ignition switch is turned ON and the engine is not running.

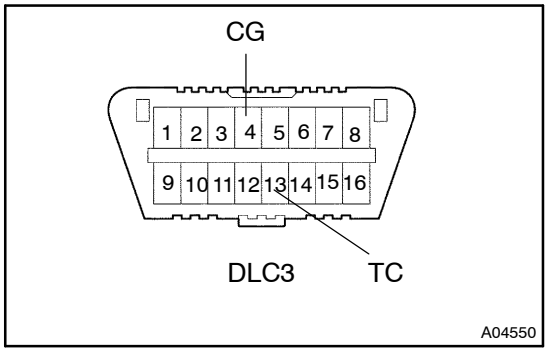
HINT:
If the check engine warning light (CHK ENG) does not light up, troubleshoot the combination meter.

(2) When the engine is started, the check engine warning light should go off. If the lamp remains on, the diagnosis system has detected a malfunction or abnormality in the system

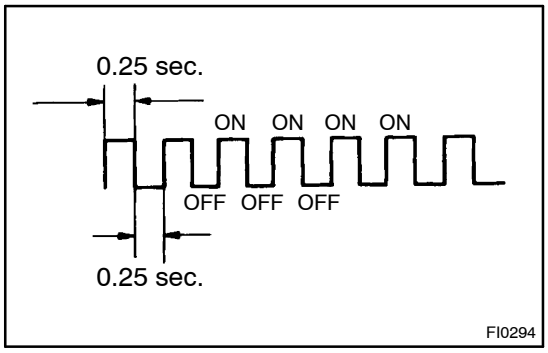
(b) Check the DTC, using the hand–held tester.

NOTICE:
(Hand–held tester only): When the diagnosis system is switched from the normal mode to the check (test) mode, it all the DTCs and freeze frame data recorded in the normal mode. So before switching modes, always check the DTCs and freeze frame data, and note them down.

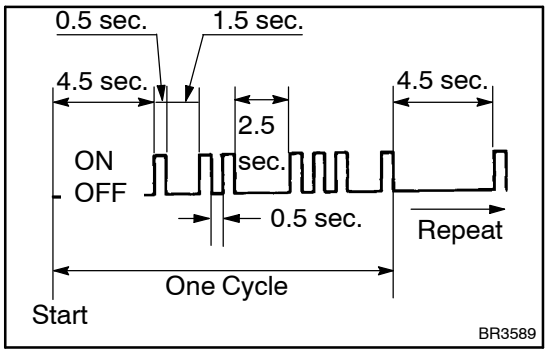
(1) Prepare the hand–held tester.
(2) Connect the hand–held tester to the DLC3.
(3) Turn the ignition switch ON and switch the hand–held tester main switch ON.
(4) Using the hand–held tester, check the DTCs and freeze frame data, and note them down. (For operating instructions, see the hand–held tester’s instruction book.)
(5) See page DI–151 to confirm the details of the DTCs.



(c) If you have no hand–held tester, perform the following step (1) to (6).
(1) Turn the ignition switch ON.
(2) Using SST, connect between terminals 13 (TC) and 4 (CG) of the DLC3.
SST 09843 – 18040



(3) Read the DTC from the check engine warning light (CHK ENG).



(4) As an example, the blinking patterns of codes for normal, 12 and 31 are as shown on the illustration.
(5) Check the details of the malfunction using the DTC chart on page DI–151.
(6) After completing the check, disconnect terminals 13 (TC) and 4 (CG), and then turn off the display.

HINT:
If of 2 or more malfunction cords are output simultaneously, indication will begin from the smaller numbered cord and continue in order to the larger humdered cord.

NOTICE:

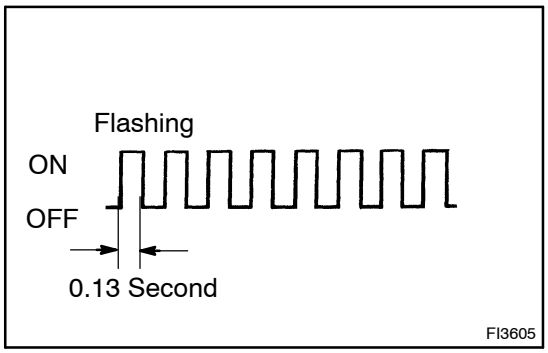
- **When simulating symptoms without the hand–held tester to check the DTC use the normal mode. For codes on the DTCs, chart subject to ”2 trip detection logic”, perform the following either action.**
- **Turn the ignition switch OFF after the symptom is simulated once. Then repeat the simulation process again. When the problem has been simulated twice, the check engine warning light lights up and the DTC, are recorded in the ECU**

3. Check (Test) Mode:
INSPECT DIAGNOSIS

HINT:
Hand–held tester only:
Compared to the normal mode, the check mode has an increased sensitivity to detect malfunctions.
Furthermore, the same diagnostic items which are detected in the normal mode can also be detected in the check (test) mode.

(a) Check the DTC.
(1) Initial conditions
- Battery positive voltage 11V or more.
- Throttle valve fully closed.
- Transmission in ”P” or ”N” position.
- Air conditioning switched OFF.

(2) Turn the ignition switch OFF.
(3) Prepare the hand–held tester.
(4) Connect the hand–held tester to the DLC3 on the lower left of the instrument panel.
(5) Turn the ignition switch ON and push the hand–held tester main switch ON.



(6) Switch the hand–held tester from normal mode to the check (test) mode. (Check that the check engine warning light (CHK ENG) flashes.)
(7) Start the engine. (The check engine warning (CHK ENG) light goes off after the engine is started.)
(8) Simulate the conditions of the malfunction described by the customer.

NOTICE:
Leave the ignition switch ON until you have checked the DTC, etc.

(9) After simulating the malfunction conditions, use the hand–held tester diagnosis selector to check the DTCs and freeze frame data, etc.

HINT:
Take care not to turn the ignition switch OFF. Turning the ignition switch OFF switches the diagnosis system from check (test) mode to the normal mode, so all DTCs, etc. will be erased.

(10) After checking the DTCs, inspect the applicable circuit.

(b) Clear the DTC.
The following actions will erase the DTCs and freeze frame data.
- Operating the hand–held tester to erase the codes. (See the hand–held tester’s instruction book for operating instructions.)
- Disconnecting the battery terminals or EFI fuse.

NOTICE:
If the hand–held tester switches the ECU from the normal mode to the check mode or vice–versa, or if the ignition switch is turned from ON to ACC or OFF during check mode, the DTCs and freeze frame data will be erased.

4. FAIL–SAFE CHART

If any of the following codes is recorded, the ECU enters into the fail–safe mode.

DTC No.	Fail–Safe Operation	Fail–Safe Deactivation Conditions
P0100/31	• Ignition timing fixed at 5°BTDC • Injection time fixed Starting – – – – – – – –11.6 msec. CTP switch ON – – – – 3.2 msec. CTP switch OFF – – – – 6.0 msec.	Returned to normal condition
P0110/24	Intake air temp. is fixed at 20°C(68°F)	Returned to normal condition
P0115/22	Water temp. is fixed at 80°(176°F)	Returned to normal condition
P0120/41	VTA is fixed at 0°	The following condition must be repeated at least 2 times consecutively When closed throttle position switch is ON: 0.1 V ≦ VTA and 0.95 V
P0500/42	High RPM for cut is prohibited ISC control prohibited	Returned to normal condition
P1300/14,15 P1310/14,15	Fuel cut	Returned to normal condition

5. CHECK FOR INTERMITTENT PROBLEMS

HAND–HELD TESTER only:

By putting the vehicle's ECU in the check (test) mode, 1 trip detection logic can be used instead of 2 trip detection logic and sensitivity to detect open circuits is increased. This makes it easier to detect intermittent problems.

(1) Clear the DTC (See step 3.).
(2) Set the check (test) mode (See step 3.).
(3) Perform a simulation test (See page IN–9).
(4) Check the connector and terminal (See page IN–19).
(5) Do a the visual check and contact pressure check (See page IN–19).
(6) Connect the connector (See page IN–19).

6. BASIC INSPECTION

When on malfunction code can be confirmed in the DTC check, troubleshoot all the possible circuits considered as a cause of the problems. In many cases, by carrying out the basic engine check shown in the following flow chart, the location causing the problem can be found quickly and efficiently. Therefore, use of this check is essential in the engine troubleshooting.

1	**Is battery positive voltage 11V or more when engine is stopped ?**

NO → **Charge or replace battery.**

YES

2	**Is engine cranked ?**

NO → **Proceed to problem symptoms table (See page DI–92 of Pub. No. RM584E).**

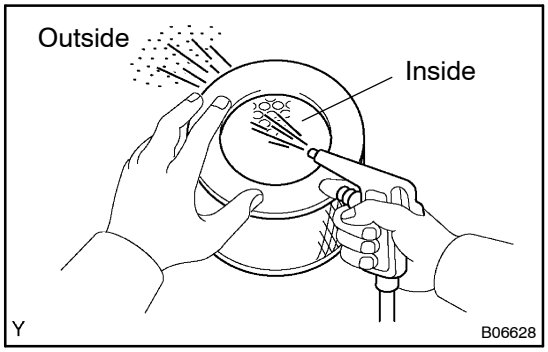
YES

3	**Does engine start ?**

NO → **Go to step 7**

YES

4	**Check air filter.**

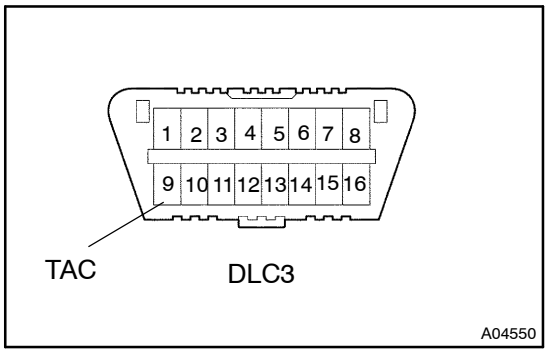


PREPARATION:
Remove the air filter.
CHECK:
Visually check that the air filter is not excessively dirty or oily.
HINT:
If necessary, clean the filter with compressed air. First blow from the inside thoroughly, then blow from the outside of the filter.

NG → **Repair or replace**

OK

5	Check engine idle speed.



PREPARATION:

(a) Warm up the engine to the normal operating temperature.
(b) Switch off all the accessories.
(c) Switch off the air conditioning.
(d) Shift the transmission into the ”N” position.
(e) Connect the hand–held tester to DLC3 of the vehicle.
(f) If you have no hand–held tester, connect tachometer test probe to terminal 9 (TAC) of the DLC3.
SST 09843–18030

NOTICE:

As some tachometer are not compatible with this ignition system, we recommend that you confirm the compatibility of yours before use.

CHECK:

Check the idle speed.

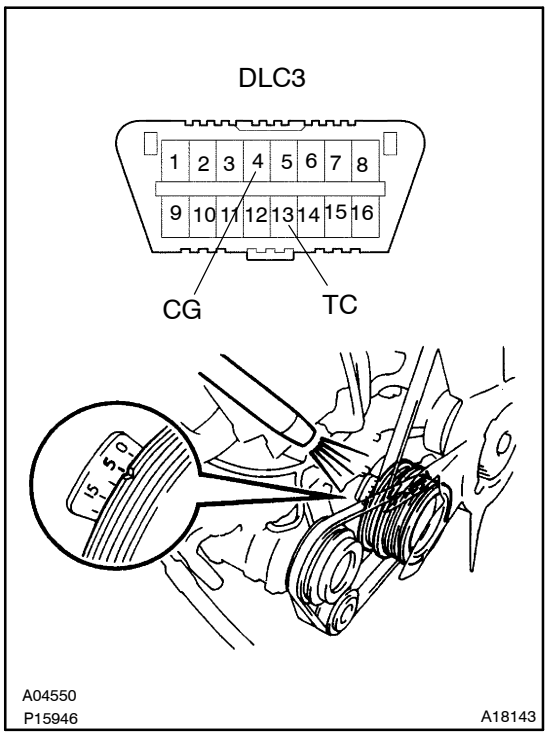
OK:

Idle speed: 650 – 750 rpm

NG	Proceed to problem symptoms table (See page DI–92 of Pub. No. RM584E).

OK

6	Check ignition timing.



PREPARATION:

(a) Warm up the engine to the normal operating temperature.
(b) Switch off all the accessories.
(c) Switch off the air conditioning
(d) Shift the transmission into the ”N” position.
(e) Using SST, connect terminals 13 (TC) and 4 (CG) of the DLC3.
SST 09843–18020
(f) Using a timing light, connect a tester to the No.1 high–tension cord.

CHECK:

Check the ignition timing.

OK:

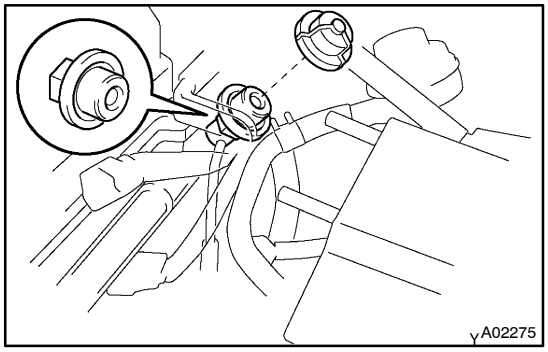
Ignition timing: 5° BTDC at idle

NG → **Proceed to page IG–1 (Pub. No. RM584E) and continue to troubleshoot.**

OK

Proceed to problem symptoms table (See page DI–92 of Pub. No. RM584E).

7	**Check fuel pressure.**



PREPARATION:

(a) Be sure that enough fuel is in the tank.
(b) Turn the ignition switch ON.
(c) Connect the hand–held tester to the DLC3.
(d) Use the ACTIVE TEST mode to operate the fuel pump.
(e) If you have no hand–held tester, connect the positive (+) and negative (–) leads from the battery to the fuel pump connector (See page FI–1 of Pub. No. RM584E).

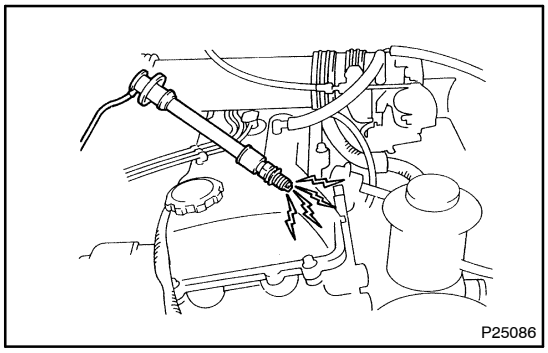
CHECK:

Check that the pulsation damper screw rises up when the fuel pump operates.

NG → **Proceed to page FI–1 (Pub. No. RM584E) and continue to troubleshoot.**

OK

8	**Check for spark.**



PREPARATION:

(a) Remove the ignition coil.
(b) Remove the spark plug.
(c) Install the spark plug to the ignition coil, and connect the ignition coil connector.
(d) Hold the end at about 12.5 mm (0.5 in.) from the ground.
(e) Disconnect the injector connector.

CHECK:

Check if spark occurs while the engine is being cranked.

NOTICE:

To prevent excess fuel being injected from the injectors during this test, do not crank the engine for more than 5 ~ 10 seconds at a time.

NG → **Proceed to page IG–1 (Pub. No. RM584E) and continue to troubleshoot.**

OK

Proceed to problem symptoms table (See page DI–92 of Pub. No. RM584E).

7. ENGINE OPERATING CONDITION

NOTICE:

The values given below for "Normal Condition" are representative values, so a vehicle may still be normal even if its values differ from those listed here. So do not decide whether a part is faulty or not solely according to the "Normal Condition" here.

Hand–held tester display	Measurement Item	Normal Condition*
FUEL SYS #1	Fuel System Bank 1 OPEN: Air–fuel ratio feedback stopped CLOSED: Air–fuel ratio feedback operating	Idling after warming up: CLOSED
CALC LOAD	Calculator Load: Current intake air volume as a proportion of max. intake air volume	Idling: 15.3 ~ 22.4% Racing without load (2,500rpm): 14.0 ~ 20.2%
WATER TEMP.	Water Temp. Sensor Value	After warming up: 80 ~ 95°C (176 ~ 203°F)
SHORT FT #1	Short–term Fuel Trim Bank 1	0 ± 20%
LONG FT #1	Long–term Fuel Trim Bank 1	0 ± 20%
ENGINE SPD	Engine Speed	Idling: 650 ~ 750 rpm
VEHICLE SPD	Vehicle Speed	Vehicle Stopped: 0 km/h (0 mph)
IGN ADVANCE	Ignition Advance: Ignition Timing of Cylinder No. 1	Idling: BTDC 7 ~ 13°
INTAKE AIR	Intake Air Temp. Sensor Value	Equivalent to Ambient Temp.
AIR FLOW	Air Flow Rate Through Mass Air Flow Meter	Idling: 2.7 ~ 3.8 gm/sec. Racing without load (2,500 rpm): 9.2 ~ 13.3 gm/sec.
THROTTLE POS	Output Voltage of Throttle Position Sensor Calculated as a percentage: 0 V → 0%, 5 V → 100%	Throttle Fully Closed: 7 ~ 11% Throttle Fully Open: 65 ~ 75%
O2S B1, S1	Output Voltage of Oxygen Sensor Bank 1, Sensor 1	Idling: 0.1 ~ 0.9 V
O2FT B1, S1	Oxygen Sensor Fuel Trim Bank 1, Sensor 1 (Same as SHORT FT #1)	0 ± 20%

*: If no conditions are specifically stated for "Idling", it means the shift lever is at N or P position, the A/C switch is OFF and all accessory switches are OFF.

Hand–held tester display	Measurement Item	Normal Condition*
INJECTOR	Fuel injection time for cylinder No.1	Idling: 2.5 ~ 4.3 ms
ISC DUTY RATIO	Intake Air Control Valve Duty Ratio Opening ratio rotary solenoid type IAC valve	Idling: 24.8 ~ 50.0%
STARTER SIG	Starter Signal	Cranking: ON
CTP SW	Closed Throttle Position Switch Signal	Throttle fully closed: ON
A/C SIG	A/C Switch Signal	A/C ON: ON
STOP LIGHT SW	Stop Light Switch Signal	Stop light switch ON: ON
FC IDL	Fuel Cut Idle: Fuel cut when throttle valve fully closed, during deceleration	Fuel cut operating: ON
NSW*1	Neutral start switch signal	P or N position: ON
ELECT LOAD SIG*1	Electrical Load Signal	Taillight switch ON: ON
FC TAU	Fuel Cut TAU: Fuel cut during very light load	Fuel cut operating: ON
CYL#1, CYL#2, CYL#3, CYL#4	Abnormal revolution variation for each cylinder	0%
IGNITION	Total number of ignition for every 1,000 revolutions	0 ~ 2,000 rpm
EGRT GAS	EGR Gas Temp. Sensor Value	EGR not operating: Temp. between intake air temp. and engine coolant temp.
EGR SYSTEM	EGR System Operating Condition	Idling: OFF
A/C CUT SIG	A/C Cut Signal	A/C S/W OFF: ON
FUEL PUMP	Fuel Pump Signal	Idling: ON
EVAP (PURGE) VSV	EVAP VSV Signal	Idling: OFF
TOTAL FT B1	Total Fuel Trim Bank 1: Average value for fuel trim system of bank 1	Idling: 0.8 ~ 1.2 V
O2 LR B1, S1	Oxygen Sensor Lean Rich Bank 1, Sensor 1 Response time for oxygen sensor output to switch from lean to rich	Idling after warmed up: 0 ~ 1,000 msec.
O2 RL B1, S1	Oxygen Sensor Rich Lean Bank 1, Sensor 1 Response time for oxygen sensor output to switch from rich to lean	Idling after warmed up: 0 ~ 1,000 msec.

*: If no conditions are specifically stated for "Idling", it means the shift lever is at N or P position, the A/C switch is OFF and all accessory switches are OFF.
*1 A/T only