05AD2–04

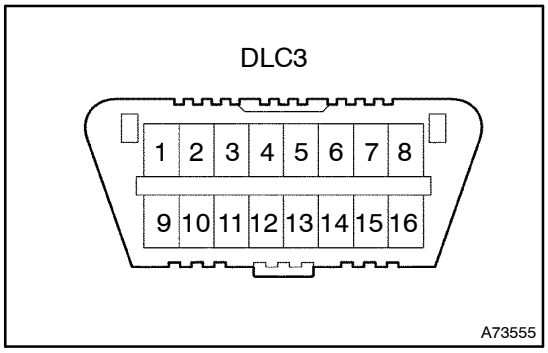
PRE–CHECK

1. DIAGNOSIS SYSTEM

(a) Description for M–OBD:

- When troubleshooting 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 ECM.
- The vehicle's on–board computer indicates 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 an indication of the CHK ENG when a malfunction is detected, the applicable Diagnosis Trouble Codes (DTCs) are recorded in the ECM memory (See page 05–94). When the malfunction does not reoccur, the CHK ENG is indicated until the ignition switch is turned off, and then the CHK ENG is not indicated when the ignition switch is turned on but the DTCs remain recorded in the ECM 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 freezed frame data and various forms of engine data. (for operating instructions, see the hand–held tester instruction book.)
- The diagnosis system operates in normal mode during normal vehicle use. It also has a check (test) mode for technician to simulate malfunction symptoms and troubleshoot. Most DTCs use 2 trip detection logic* to prevent an erroneous detection, and ensure thorough malfunction detection. By switching the ECM to check (test) mode using hand–held tester when troubleshooting, a technician can cause the 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 temporally stored in the ECM memory. If the same malfunction is detected again during the second drive test, this second detection causes the CHK ENG to light up (However, the IG switch must be turned OFF between the 1st trip and 2nd trip).

- Freeze frame data:
  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 was warmed up or not, the air–fuel ratio was lean or rich, etc. at the time of the malfunction.

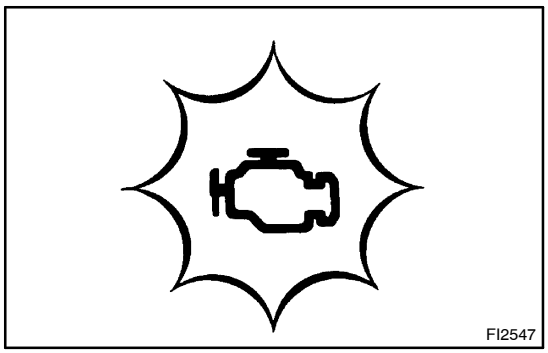


(b) Check the DLC3.
The vehicle's ECM uses the ISO 14230 (M–OBD) communication protocol. The terminal arrangement of DLC3 complies with ISO 15031–03 and matches the ISO 14230 format.

Terminal No.	Connection / Voltage or Residence	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 communication is normal when the tool is connected to another vehicle, inspect the DLC3 on the original vehicle.
- If communication is still not possible is when the tool is connected to another vehicle, the problem is probably in the tool itself, so consult the Service Debarment listed in the tool,s instruction manual.



2. INSPECT DIAGNOSIS (Normal Mode)

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

HINT:
If the check engine warning (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 hand–held tester.

NOTICE:

Hand–held tester only:

When the diagnosis system is switched from normal mode to check (test) mode, it erases all DTCs and freezed frame data recorded in normal mode. So before switching modes, always check the DTCs and freezed frame data, and note them down.

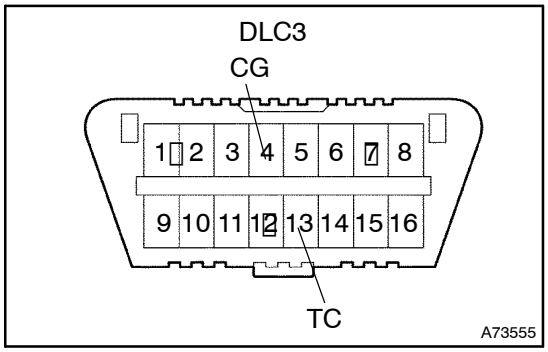
(1) Prepare the hand–held tester.

(2) Connect the hand–held tester to the DLC3.

(3) Turn the ignition switch ON and push the hand–held tester main switch ON.

(4) Use the hand–held tester to check the DTCs and freezed frame data; note them down. (for operating instructions, see the hand–held tester's instruction book.)

(5) See page 05–94 to confirm the details of the DTCs.

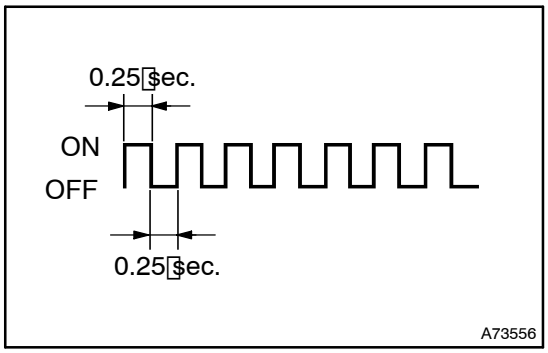


(c) If you have no hand–held tester, perform the following step (1) to (6).

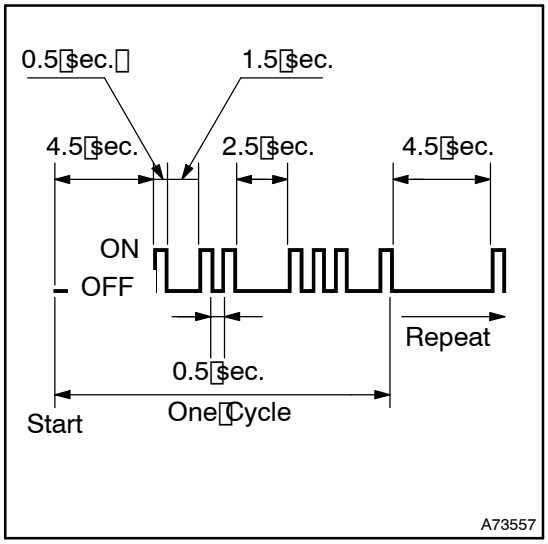
(1) Turn the ignition switch ON.

(2) Using SST, connect between the terminals 13 (TC) and 4 (CG) of the DLC3.

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



(4) As an example, the blinking patterns for codes, normal, 12 and 31 are as shown on the illustration.

(5) Check the details of the malfunction using the DTC chart on page 05–94.

(6) After completing the check, disconnect the terminals 13 (TC) and 4 (CG) and turn off the display.

HINT:

In the event of 2 or more malfunction cords, indication will begin from the smaller numbered cord and continue in order to the larger.

NOTICE:

- **When simulating symptoms without a hand–held tester to check the DTCs, use normal mode. For codes on the DTCs, chart subject to ”2 trip detection logic”, turn the ignition switch OFF after the symptom is simulated the first time. Then repeat the simulation process again. When the problem has been simulated twice, the check engine warning light (CHK ENG) lights up and the DTCs are recorded in the ECM.**
- **Check the 1st trip DTC using Mode 7 for ISO 15031 (Continuous Test Results of EURO–OBD) function hand–held tester).**

3. INSPECT DIAGNOSIS (Check (Test) Mode)

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.

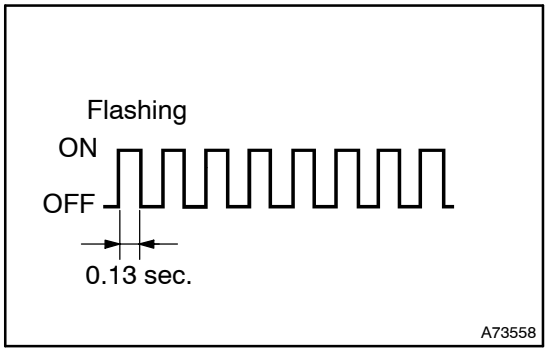
(1) Initial conditions
- Battery positive voltage 11V or more.
- Throttle valve fully closed.
- Transmission in ”P” or ”N” position.
- Air conditioning switched OFF.

(2) Turn ignition switch OFF.

(3) Prepare the hand–held tester.

(4) Connect the hand–held tester to the DLC3 on the at the lower left/right of the instrument panel.

(5) Turn the ignition switch ON and push the push the hand–held tester ON.



(6) Switch the hand–held tester from the normal mode to the check (test) mode. (Check that the check engine warning light (CHK ENG) flashes.)

NOTICE:

If the hand–held tester switches the ECM 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 DTC and freezed frame data will be erased.

(7) Start the engine. (The check engine warning (CHK ENG) light goes out after the engine start.)

(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 freezed frame data, etc.

HINT:

Be careful not to turn the ignition switch OFF. Turning the ignition switch OFF switches the diagnosis system converts from the check (test) mode to the normal mode, so all the DTCs, etc. are erased.

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

(b) Clear the DTC.

The following actions will erase the DTCs and freezed 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 remove the EFI fuse more than 60 sec..

4. FAIL–SAFE CHART

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

DTC No.	Fail–Safe Operation	Fail–Safe Deactivation Conditions
P0100/31	Ignition timing is fixed at 5° BTDC	Returned to normal condition
P0110/24	Intake air temp. is fixed at 20°C (68°F)	Returned to normal condition
P0115/22	Coolant temp. is fixed at 80°C (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
P0351/14 P0352/15 P0353/14 P0354/14	Fuel cut	Returned to normal condition
P0500/42	High RPM for cut is prohibited ISC control prohibited	Returned to normal condition

5. CHECK FOR INTERMITTENT PROBLEMS

HINT:

Hand–held tester only:

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

(a) Clear the DTCs (See step 3).

(b) Set the check (Test) mode (See step 3).

(c) Perform a simulation test (See page 01–26).

(d) Check the connector and terminal (See page 01–36).

(e) Handle the connector (See page 01–36).

6. ENGINE OPERATING CONDITION

NOTICE:

The values given below for "Normal Condition" are representative values, So, a vehicle may still be normal even if its value differs from those listed here. So, do not solely depend on the "Normal Condition" here when deciding whether a part is faulty or not.

HINT:

The ECM data can be monitored by hand–held tester.

(a) Connect the hand–held tester to the DLC3.

(b) Monitor the ECM data by following the prompts on the tester screen. Please refer to the hand–held tester operator's manual for further detail.

(c) Reference Value

Hand–held tester display	Measurement Item	Normal Condition*1
FUEL SYS	Fuel System Bank 1 Open: Air–fuel ratio feedback stopped Closed: Air–fuel ratio feed back operating	Idling after warming up: CLOSED
INJECTOR	Fuel injection time for cylinder No. 1	Idling 2.3 – 3.8 ms
IGN ADVANCE	Ignition Advance: Ignition Timing of Cylinder No. 1	Idling: BTDC 3 – 7°
IAC DUTY RATIO	Intake Air Control Valve Duty Ratio Opening ratio rotary solenoid type IAC valve	Idling: 23 – 48 %
CALC LOAD	Calculator Load: Current intake air volume as a proportion of max. intake air volume	Idling: 15.3 – 22.4 % Racing without load (2,500 rpm): 14.0 – 20.2 %
MAF	Air Flow Rate Through Mass Air Flow Meter	Idling: 2.2 – 5.6 gm/sec. Racing without load (2,500 rpm): 8.3 – 18.7 gm/sec.
ENGINE SPD	Engine Speed	Idling: 650 – 750 rpm
COOLANT TEMP	Engine Coolant Temperature Sensor Value	After warming up: 80 – 95°C (176 – 203°F)
INTAKE AIR	Inlet Air Temperature Sensor Value	Equivalent Almost Ambient Temp.
THROTTLE POS	Voltage Output of Throttle Position Sensor Calculated as a percentage: 0 V → 0 %, 5 V → 100 %	Throttle Fully Closed: 6 – 21 % Throttle Fully Open: 71 – 87 %
VEHICLE SPD	Vehicle Speed	Vehicle Stopped: 0 km/h (0 mph)
O2S B1 S1	Voltage Output of Heated Oxygen Sensor Bank 1 Sensor 1	Idling: 0.1 – 0.9 V
SHORT FT #1	Short–term Fuel Trim Bank 1	0 ± 20 %
LONG FT #1	Long–term Fuel Trim Bank 1	0 ± 20 %
O2FT B1 S1	Heated Oxygen Sensor Fuel Trim Bank 1 Sensor 1 (Same as SHORT FT #1)	0 ± 20 %
PS SIGNAL	Power Steering Signal	After engine start: OFF After steer the steering: ON

A/C CUT SIG	A/C Cut Signal	A/C Switch OFF: ON
EGR SYSTEM	EGR System Operating Condition	Idling: ON
FUEL PMP/SPD	Fuel Pump Signal	Idling: ON

HINT:
*1: 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.
*2: A/T

7. BASIC INSPECTION

When the malfunction code is not confirmed in the DTC check, troubleshooting should be carried out in the order for all possible circuits to be considered as the causes 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, using of this check is essential in engine troubleshooting.

1 CHECK BATTERY VOLTAGE

NOTICE:
Carry out this check under the engine stoppage condition.

	OK	NG
Voltage	11V or more	Less than 11V

NO → CHARGE OR REPLACE BATTERY

OK

2 CHECK IF ENGINE IS CRANKED

NG → PROCEED TO PROBLEM SYMPTOMS TABLE (See page 05–99)

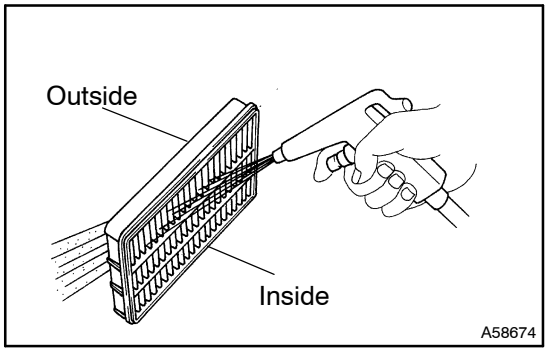
OK

3 CHECK IF ENGINE STARTS

NG → GO TO STEP 7

OK

4 CHECK AIR FILER



(a) Visually check that the air filter is not excessively dirty or oily.

NOTICE:
If necessary, clean the filter with compressed air. First blow from inside thoroughly, then blow from outside of filter.

NG → REPAIR OR REPLACE

OK

5	CHECK IDLE SPEED (See page 14–1)

NG → PROCEED TO PROBLEM SYMPTOMS TABLE (See page 05–99)

OK

6	CHECK IGNITION TIMING (See page 14–1)

NG → PROCEED TO PAGE 18–1 AND CONTINUE TO TROUBLESHOOT

OK

PROCEED TO PROBLEM SYMPTOMS TABLE (See page 05–99)

7	CHECK FUEL PRESSURE (See page 11–4)

NG → PROCEED TO PAGE 11–4 AND CONTINUE TO TROUBLESHOOT

OK

8	CHECK FOR SPARK (See page 18–1)

NG → PROCEED TO PAGE 18–1 AND CONTINUE TO TROUBLESHOOT

OK

PROCEED TO PROBLEM SYMPTOMS TABLE (See page 05–99)