DTC	P0300	RANDOM/MULTIPLE CYLINDER MISFIRE DETECTED

DTC	P0301	CYLINDER 1 MISFIRE DETECTED

DTC	P0302	CYLINDER 2 MISFIRE DETECTED

DTC	P0303	CYLINDER 3 MISFIRE DETECTED

DTC	P0304	CYLINDER 4 MISFIRE DETECTED

DTC	P0305	CYLINDER 5 MISFIRE DETECTED

DTC	P0306	CYLINDER 6 MISFIRE DETECTED

CIRCUIT DESCRIPTION

Misfire: The ECM uses the crankshaft position sensor and the camshaft position sensor to monitor changes in the crankshaft rotation for each cylinder.

The ECM counts the number of times the engine speed change rate indicates that misfire has occurred. When the misfire rate equals to or exceeds the count of indicating that the engine condition has deteriorated, the MIL is illuminated.

If the misfire rate is high enough and the driving conditions will cause the catalyst to overheat, the CHK ENG blinks when misfiring occurs.

HINT:

- For any particular 200 revolutions of engine, misfiring which could result in overheating of catalyst is detected. This will cause CHK ENG to blink (1 trip detection logic).
- For any particular 1,000 revolutions of engine, misfiring which could result in a deterioration of emissions. This will cause CHK ENG to illuminate (2 trip detection logic).

DTC No.	DTC Detection Condition	Trouble Area
P0300	Misfiring of random cylinders is detected	• Open or short in engine wire • Connector connection • Vacuum hose connection • Ignition system • Injector • Fuel pressure • Mass air flow meter • Engine coolant temperature sensor • Compression pressure • Valve clearance • Valve timing • PCV hose connection • PCV hose • ECM
P0301 P0302 P0303 P0304 P0305 P0306	Misfiring of each cylinder is detected	

HINT:

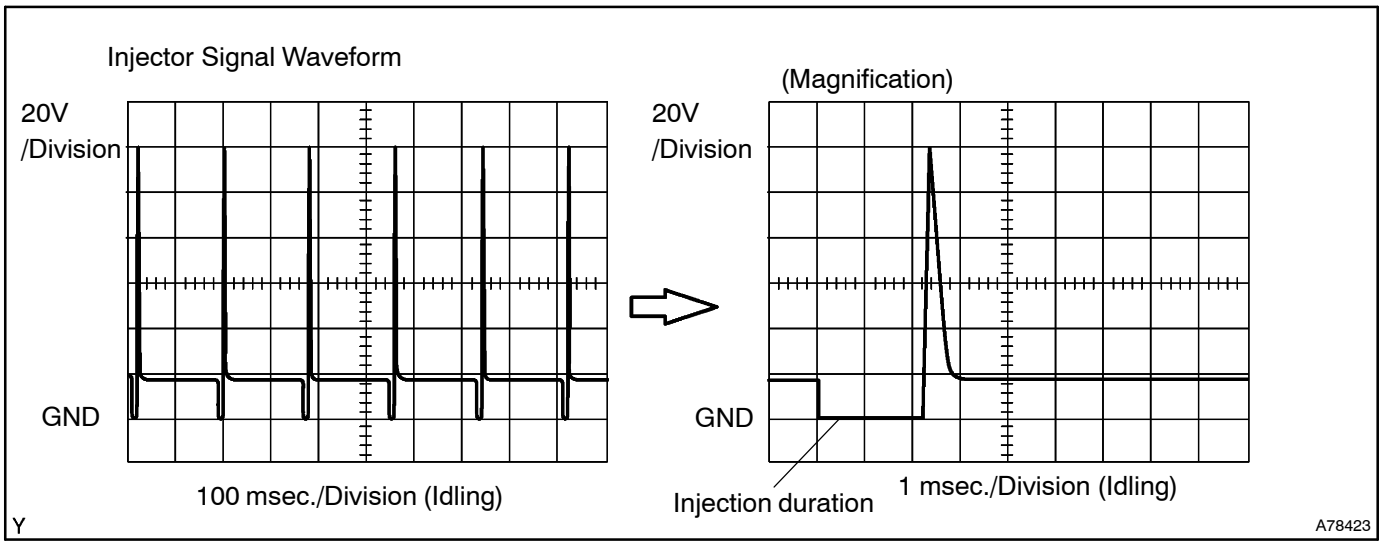
When codes for a misfiring cylinder are recorded repeatedly but no random misfire code is recorded, it indicates that the misfires have been detected and recorded at different times.

Reference: INSPECTION USING OSCILLOSCOPE

With the engine idling, check the waveform between terminals #10 to #60 and E01 of the ECM connectors.

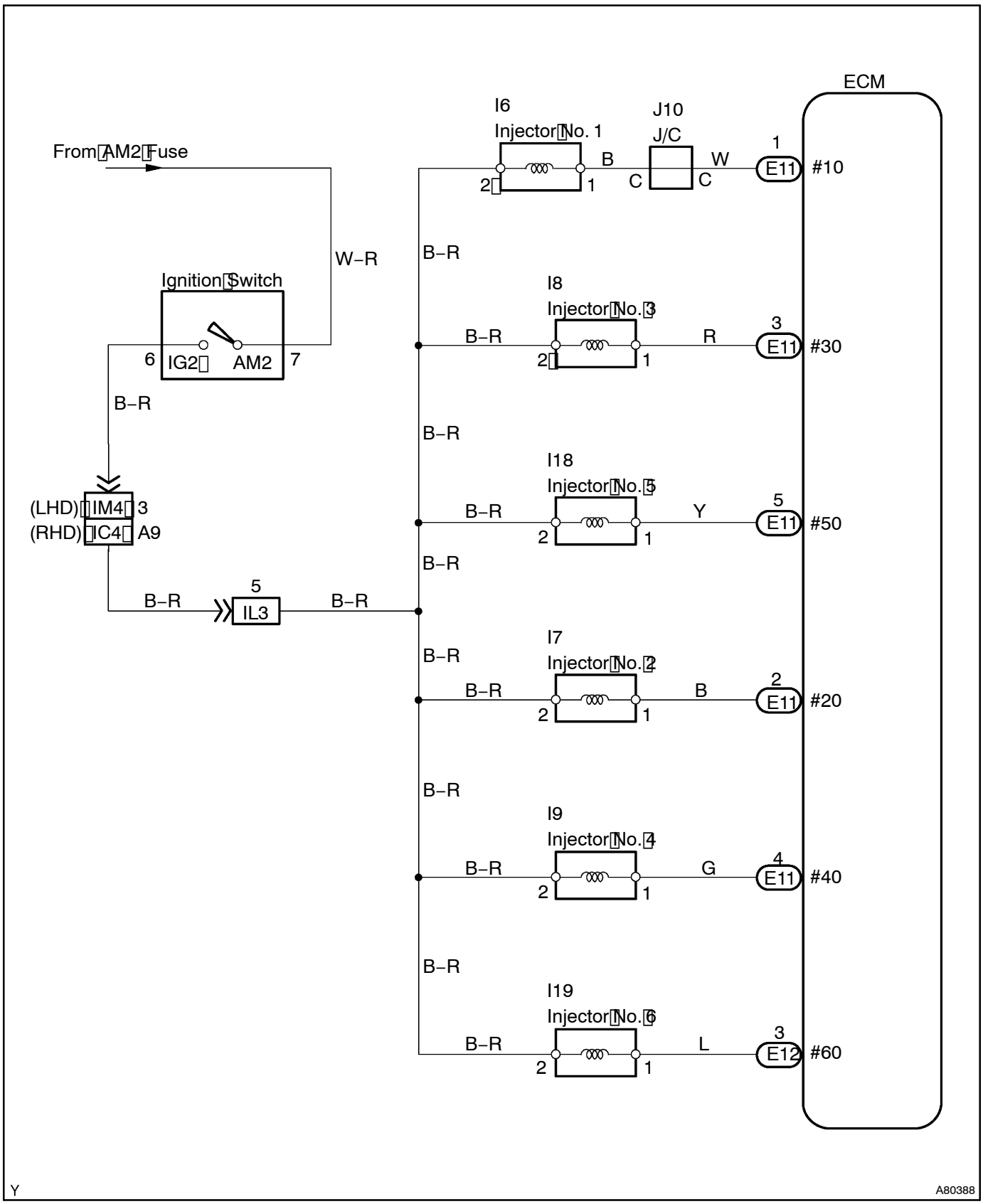
HINT:

The correct waveform is as shown.



WIRING DIAGRAM

Refer to DTC P0351/14 on page 05–129 for the wiring diagram of the ignition system.



CONFIRMATION DRIVING PATTERN

(a) Connect the hand–held tester to the DLC3.
(b) Record DTC and the freeze frame data.
(c) Use the hand–held tester to set the check mode (See page 05–7).
(d) Read the value on the misfire counter for each cylinder when idling. If the value is displayed on the misfire counter, skip the following procedure of confirmation driving.
(e) Drive the vehicle several times with the engine speed, load and its surrounding range shown with ENGINE SPD, CALC LOAD in the freeze frame data or MISFIRE RPM, MISFIRE LOAD in the data list.

If you have no hand–held tester, turn the ignition switch OFF after the symptom is simulated once. Then repeat the simulation process again.

HINT:

In order to memorize the DTC of misfire, it is necessary to drive around MISFIRE RPM, MISFIRE LOAD in the data list for the following period of time. Take care not to turn the ignition switch OFF. Turning the ignition switch OFF switches the diagnosis system from check (test) mode to normal mode. So all DTCs, etc., are erased.

Engine Speed	Time
Idling	3 minutes 30 seconds or more
1,000 rpm	3 minutes or more
2,000 rpm	1 minute 30 seconds or more
3,000 rpm	1 minute or more

(f) Check whether there is misfire or not by monitoring DTC and the freeze frame data. After that, record them.
(g) Turn the ignition switch OFF and wait at least 5 seconds.

INSPECTION PROCEDURE

HINT:

- If DTCs besides misfire are memorized simultaneously, first perform the troubleshooting for them.
- Read freeze frame data using the hand–held tester, as freeze frame data records the engine conditions when a 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.
- If the misfire does not occur when the vehicle is brought to the workshop, the misfire can be confirmed by reproducing the condition of the freeze frame data. Also, after finishing the repair, confirm that there is no misfire (See confirmation driving pattern).
- On 6 and 8 cylinder engines, misfiring cylinder identification is disabled at high engine speed and only an general misfire fault code P0300 is stored instead of a cylinder specific misfire fault code (i. e., P0301 – P0308). Under the following conditions, only P0300 code may be stored.
  Misfire starts in the high engine speed area or misfire occurs only in the high engine speed area.
  Therefore, when a general misfire fault code (i.e., P0300) is only stored, erase the DTCs after read freeze frame data with the hand–held tester. Start the engine and drive the confirmation patten (See the CONFIRMATION DRIVING PATTERN) and read the value of the misfire ratio for each cylinder (or DTC). Perform the repair correspond to the high misfire ratio cylinder (or the misfiring cylinder indicated by DTC). After completing the repair, confirm no misfire is occurring by driving the confirmation pattern.
- When either of SHORT FT #1, LONG FT #1, SHORT FT #2 or LONG FT #2 in the freeze frame data is over the range of ±20 %, there is a possibility that the air–fuel ratio is inclining either to RICH (–20 % or less) or LEAN (+20 % or more).
- When COOLANT TEMP in the freeze frame data is less than 80°C (176°F), there is a possibility of misfire only during engine warm up.

- If the misfire cannot be reproduced, the reason may be because of the driving the vehicle with lack of fuel, the use of improper fuel, a stain on the ignition plug, etc.
- Be sure to check the value on the misfire counter after the repair.

1	CHECK OTHER DTC OUTPUT (BESIDES MISFIRE DTCS)

(a) Read the DTC using the hand–held tester.

Result:

Display (DTC output)	Proceed to
Only "P0300, P0301, P0302, P0303, P0304, P0305 and/or P0306" are output	A
"P0300, P0301, P0302, P0303, P0304, P0305 or P0306" and other DTCs are output	B

HINT:

If any other codes besides "P0300, P0301, P0302, P0303, P0304, P0305 or P0306" are output, perform the troubleshooting for those DTCs.

B → **GO TO RELEVANT DTC CHART (See page 05–22)**

A

2	CHECK WIRE HARNESS, CONNECTOR AND VACUUM HOSE IN ENGINE ROOM

(a) Check the connection conditions of the wire harness and the connector.
(b) Check for the disconnection, piping and break of the vacuum hose.

NG → **REPAIR OR REPLACE, THEN CONFIRM THAT THERE IS NO MISFIRE**

OK

3	CHECK CONNECTION OF PCV HOSE

NG → **REPAIR OR REPLACE PCV HOSE**

OK

4	READ VALUE OF HAND–HELD TESTER (NUMBER OF MISFIRE)

(a) Connect the hand–held tester to the DLC3.
(b) Turn the ignition switch ON and push the hand–held tester main switch ON.
(c) Start the engine.
(d) Select the item "DIAGNOSIS / OBD/MOBD / DATA LIST / ALL / CYL#1 – CYL#6".
(e) Read the number of misfire on the hand–held tester.

HINT:

When a misfire is not reproduced, be sure to branch below based on the stored DTC.

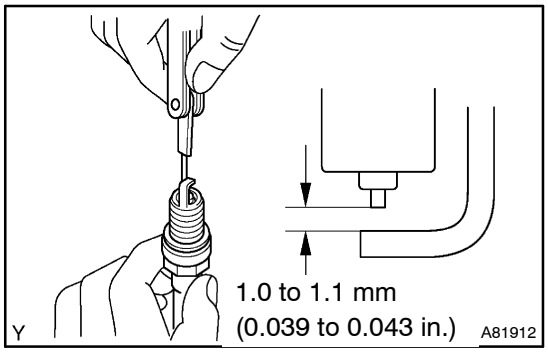
Result:

High Misfire Rate Cylinder	Proceed to
1 or 2 cylinders	A
More than 3 cylinders	B

B	Go to step 15

A

5 CHECK SPARK PLUG AND SPARK OF MISFIRING CYLINDER



(a) Remove the ignition coil assy.
(b) Remove the spark plug.
(c) Check the spark plug type.
Recommended spark plug:

DENSO made	K20HR–U11
NGK made	LFR6C–11

(d) Check the spark plug electrode gap.
Electrode gap: 1.0 to 1.1 mm (0.039 to 0.043 in.)
Maximum electrode gap: 1.46 mm (0.057 in.)
(e) Check the electrode for carbon deposits.
(f) Perform a spark test.

CAUTION:
Absolutely disconnect the each injector connectors.
NOTICE:
To prevent excess fuel from being injected from the injectors during this test, do not crank the engine for more than 5 to 10 seconds at a time.

(1) Install the spark plug to the ignition coil, and connect the ignition coil connector.
(2) Disconnect the injector connector.
(3) Ground the spark plug.
(4) Check if spark occurs while the engine is being cranked.

Standard: Spark jumps across electrode gap.

OK	Go to step 8

NG

6	CHANGE NORMAL SPARK PLUG AND CHECK SPARK OF MISFIRING CYLINDER

(a) Change to the normal spark plug.
(b) Perform a spark test.

CAUTION:
Absolutely disconnect each injector connector.
NOTICE:
To prevent excess fuel from being injected from the injectors during this test, do not crank the engine for more than 5 to 10 seconds at a time.

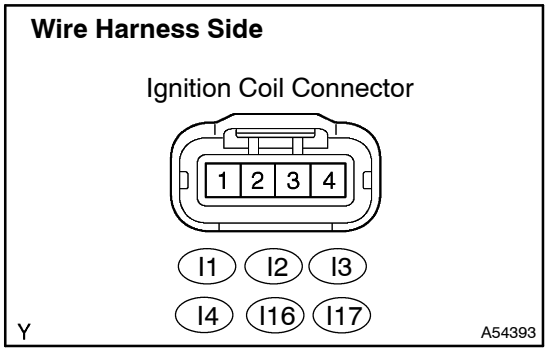
(1) Install the spark plug to the ignition coil, and connect the ignition coil connector.
(2) Disconnect the injector connector.
(3) Ground the spark plug.
(4) Check if spark occurs while the engine is being cranked.

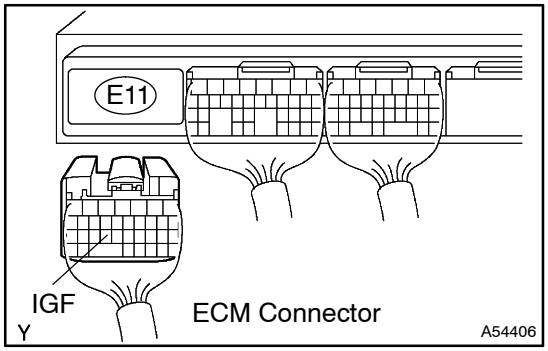
Standard: Spark jumps across electrode gap.

OK → **REPLACE SPARK PLUG**

NG

7	CHECK HARNESS AND CONNECTOR OF MISFIRING CYLINDER(IGNITION COIL – ECM)





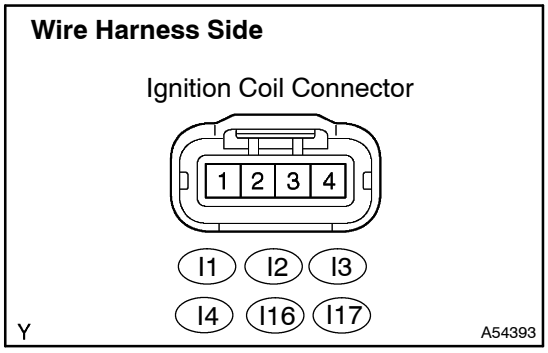
(a) Check the harness and connector between the ignition coil and the ECM (IGF terminal) connectors.
(1) Disconnect the I1, I2, I3, I4, I16 or I17 ignition coil connector.
(2) Disconnect the ECM E11 connector.
(3) Check for continuity between the wire harness side connectors.

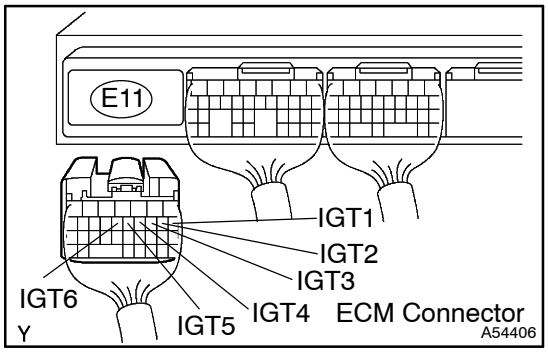
Standard (Check for open):

Symbols (Terminal No.)	Specified condition
Ignition coil (I1–2) – IGF (E11–24)	Continuity
Ignition coil (I2–2) – IGF (E11–24)	
Ignition coil (I3–2) – IGF (E11–24)	
Ignition coil (I4–2) – IGF (E11–24)	
Ignition coil (I16–2) – IGF (E11–24)	
Ignition coil (I17–2) – IGF (E11–24)	

Standard (Check for short):

Symbols (Terminal No.)	Specified condition
Ignition coil (I1–2) or IGF (E11–24) – Body ground	No continuity
Ignition coil (I2–2) or IGF (E11–24) – Body ground	
Ignition coil (I3–2) or IGF (E11–24) – Body ground	
Ignition coil (I4–2) or IGF (E11–24) – Body ground	
Ignition coil (I16–2) or IGF (E11–24) – Body ground	
Ignition coil (I17–2) or IGF (E11–24) – Body ground	





(b) Check the harness and the connector between the ignition coil and the ECM (IGT terminal) connectors.
(1) Disconnect the I1, I2, I3, I4, I16 or I17 ignition coil connector.
(2) Disconnect the ECM E11 connector.
(3) Check for continuity between the wire harness side connectors.

Standard (Check for open):

Symbols (Terminal No.)	Specified condition
Ignition coil (I1–3) – IGT1 (E11–8)	Continuity
Ignition coil (I2–3) – IGT2 (E11–9)	
Ignition coil (I3–3) – IGT3 (E11–10)	
Ignition coil (I4–3) – IGT4 (E11–11)	
Ignition coil (I16–3) – IGT5 (E11–12)	
Ignition coil (I17–3) – IGT6 (E11–13)	

Standard (Check for short):

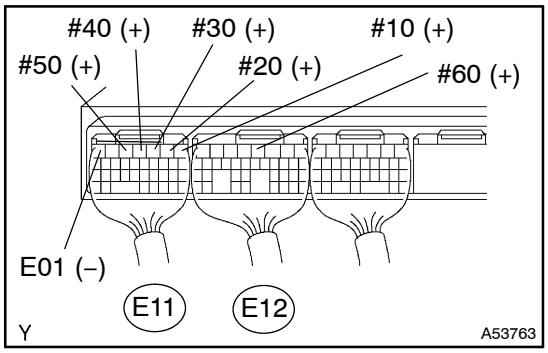
Symbols (Terminal No.)	Specified condition
Ignition coil (I1–3) or IGT1 (E11–8) – Body ground	No continuity
Ignition coil (I2–3) or IGT2 (E11–9) – Body ground	
Ignition coil (I3–3) or IGT3 (E11–10) – Body ground	
Ignition coil (I4–3) or IGT4 (E11–11) – Body ground	
Ignition coil (I16–3) or IGT5 (E11–12) – Body ground	
Ignition coil (I17–3) or IGT6 (E11–13) – Body ground	

OK → **REPLACE IGNITION COIL ASSY**

NG

REPAIR OR REPLACE HARNESS OR CONNECTOR

8 INSPECT ECM TERMINAL OF MISFIRING CYLINDER(#10, #20, #30, #40, #50 OR #60 VOLTAGE)



(a) Turn the ignition switch ON.
(b) Measure the voltage between the applicable terminals of the E11 and E12 ECM connectors.

Standard:

Symbols (Terminal No.)	Specified condition
#10 (E11–1) – E01 (E11–7)	9 to 14 V
#20 (E11–2) – E01 (E11–7)	
#30 (E11–3) – E01 (E11–7)	
#40 (E11–4) – E01 (E11–7)	
#50 (E11–5) – E01 (E11–7)	
#60 (E12–3) – E01 (E11–7)	

OK → **Go to step 11**

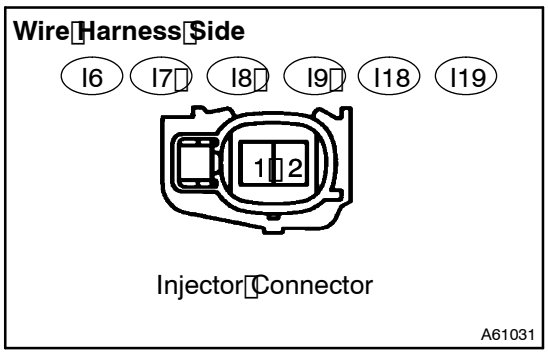
NG

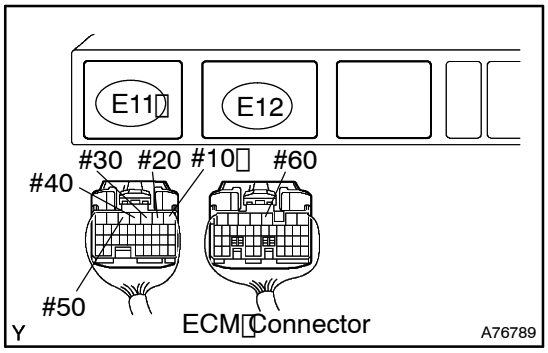
9	INSPECT FUEL INJECTOR RESISTANCE OF MISFIRING CYLINDER (See page 11–7)

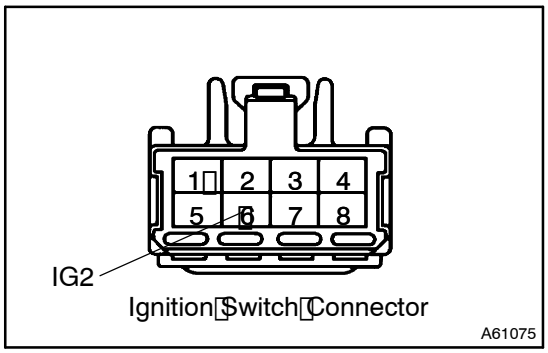
NG → REPLACE FUEL INJECTOR ASSY (See page 14–7)

OK

10	CHECK HARNESS AND CONNECTOR OF MISFIRING CYLINDER(INJECTOR – ECM, INJECTOR – IGNITION SWITCH)







(a) Check the harness and the connector between the injector connector and the ECM connector.

(1) Disconnect the I6, I7, I8, I9, I18 or I19 injector connector.

(2) Disconnect the E11 or E12 ECM connector.

(3) Check for continuity between the wire harness side connectors.

Standard (Check for open):

Symbols (Terminal No.)	Specified condition
Injector (I6–1) – #10 (E11–1)	Continuity
Injector (I7–1) – #20 (E11–2)	
Injector (I8–1) – #30 (E11–3)	
Injector (I9–1) – #40 (E11–4)	
Injector (I18–1) – #50 (E11–5)	
Injector (I19–1) – #60 (E12–3)	

Standard (Check for short):

Symbols (Terminal No.)	Specified condition
Injector (I6–1) or #10 (E11–1) – Body ground	No continuity
Injector (I7–1) or #20 (E11–2) – Body ground	
Injector (I8–1) or #30 (E11–3) – Body ground	
Injector (I9–1) or #40 (E11–4) – Body ground	
Injector (I18–1) or #50 (E11–5) – Body ground	
Injector (I19–1) or #60 (E12–3) – Body ground	

(b) Check the harness and the connector between the injector connector and the ignition switch connector.

(1) Disconnect the I6, I7, I8, I9, I18 or I19 injector connector.

(2) Disconnect the ignition switch connector.

(3) Check for continuity between the wire harness side connectors.

Standard (Check for open):

Symbols (Terminal No.)	Specified condition
Injector (I6–2) – IG2 (6)	Continuity
Injector (I7–2) – IG2 (6)	
Injector (I8–2) – IG2 (6)	
Injector (I9–2) – IG2 (6)	
Injector (I18–2) – IG2 (6)	
Injector (I19–2) – IG2 (6)	

Standard (Check for short):

Symbols (Terminal No.)	Specified condition
Injector (I6–2) or ECM G2 (6) – Body ground	No continuity
Injector (I7–2) or ECM G2 (6) – Body ground	
Injector (I8–2) or ECM G2 (6) – Body ground	
Injector (I9–2) or ECM G2 (6) – Body ground	
Injector (I18–2) or ECM G2 (6) – Body ground	
Injector (I19–2) or ECM G2 (6) – Body ground	

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

11	**INSPECT FUEL INJECTOR INJECTION AND VOLUME OF MISFIRING CYLINDER (See page 11–7)**

NG → **REPLACE FUEL INJECTOR ASSY**

OK

12	**CHECK CYLINDER COMPRESSION PRESSURE OF MISFIRING CYLINDER (See page 14–1)**

NG → **REPAIR OR REPLACE**

OK

13	**CHECK VALVE CLEARANCE OF MISFIRING CYLINDER (See page 14–7)**

NG → **ADJUST VALVE CLEARANCE (See page 14–7)**

OK

14	**SWITCH STEP BY NUMBER OF MISFIRE CYLINDER (REFER RESULT OF STEP 4)**

High Misfire Rate Cylinder	Proceed to
1 or 2 cylinders	A
More than 3 cylinders	B

B → **CHECK FOR INTERMITTENT PROBLEMS (See page 05–7)**

A

15	CHECK VALVE TIMING (CHECK FOR LOOSE AND JUMPING TEETH OF TIMING CHAIN) (See page 14–7)

NG → ADJUST VALVE TIMING (See page 14–7)

OK

16	CHECK FUEL PRESSURE (See page 11–5)

NG → CHECK AND REPLACE FUEL PUMP, PRESSURE REGULATOR, FUEL PIPE LINE AND FILTER

OK

17	READ VALUE OF HAND–HELD TESTER (INTAKE AIR TEMPERATURE AND MASS AIR FLOW RATE)

(a) Connect the hand–held tester to the DLC3.
(b) Turn the ignition switch ON.
(c) Check the intake air temperature.
  (1) Select the item "DIAGNOSIS / OBD/MOBD / DATA LIST / ALL / INTAKE AIR" and read its value displayed on the hand–held tester.

  Temperature: Equivalent to ambient temperature

(d) Check the mass air flow rate.
  (1) Select the item "DIAGNOSIS / OBD/MOBD / DATA LIST / ALL / MAF" and read its value displayed on the hand–held tester.

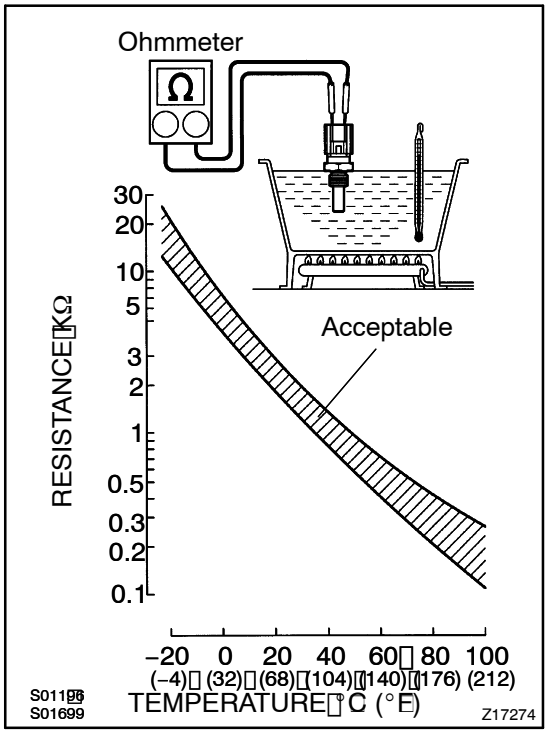
  Standard:

Condition	Mass air flow rate (gm/s)
Ignition switch On (do not start engine)	0
Idling	3.2 to 4.7
Racing without load (2,500 rpm)	13.1 to 18.9
Idling – Racing	Mass air flow rate fluctuates

NG → REPLACE MASS AIR FLOW METER

OK

18	INSPECT ENGINE COOLANT TEMPERATURE SENSOR (RESISTANCE)



(a) Measure the resistance between the terminals.

Resistance:

2.32 to 2.59 kΩ at 20°C (68°F)

0.310 to 0.326 kΩ at 80°C (176°F)

NOTICE:

In case of checking the engine coolant temperature sensor in the water, be careful not to allow water to go into the terminals, and after checking, wipe out the sensor.

NG → **REPLACE ENGINE COOLANT TEMPERATURE SENSOR**

OK

19	SWITCH STEP BY NUMBER OF MISFIRE CYLINDER (REFER RESULT OF STEP 4)

High Misfire Rate Cylinder	Proceed to
1 or 2 cylinders	A
More than 3 cylinders	B

B → **AGAIN GO TO STEP 5**

A

CHECK FOR INTERMITTENT PROBLEMS (See page 05–7)