SFI SYSTEM (1ZZ–FE/3ZZ–FE)(From February, 2004)

05KNQ-02

PRECAUTION

NOTICE:

Perform the RESET MEMORY (AT initialization) operation after replacing the automatic transaxle assembly, engine assembly or ECM.

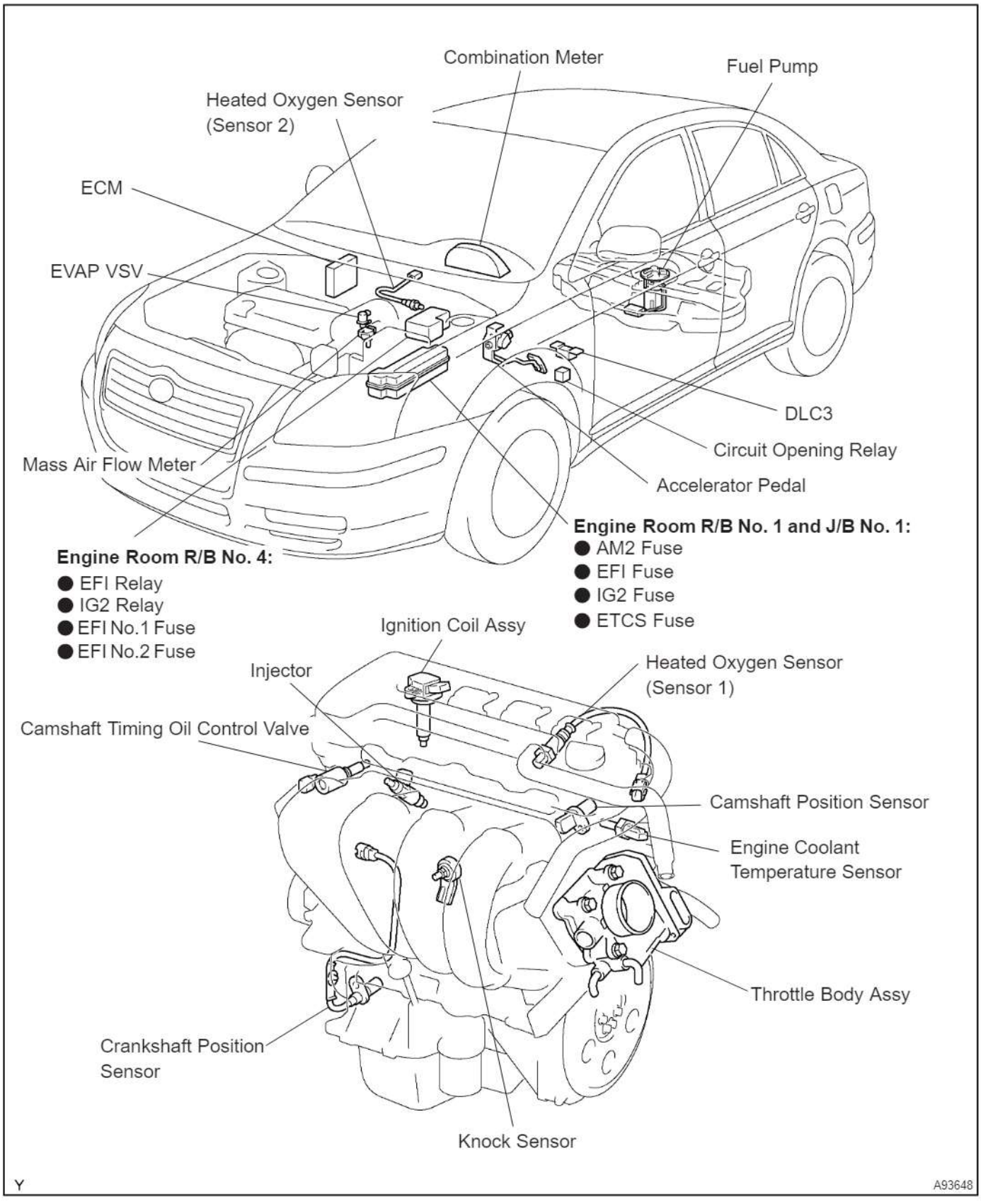
HINT:

Initialization cannot be completed by only removing the battery cable.

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054JE–19

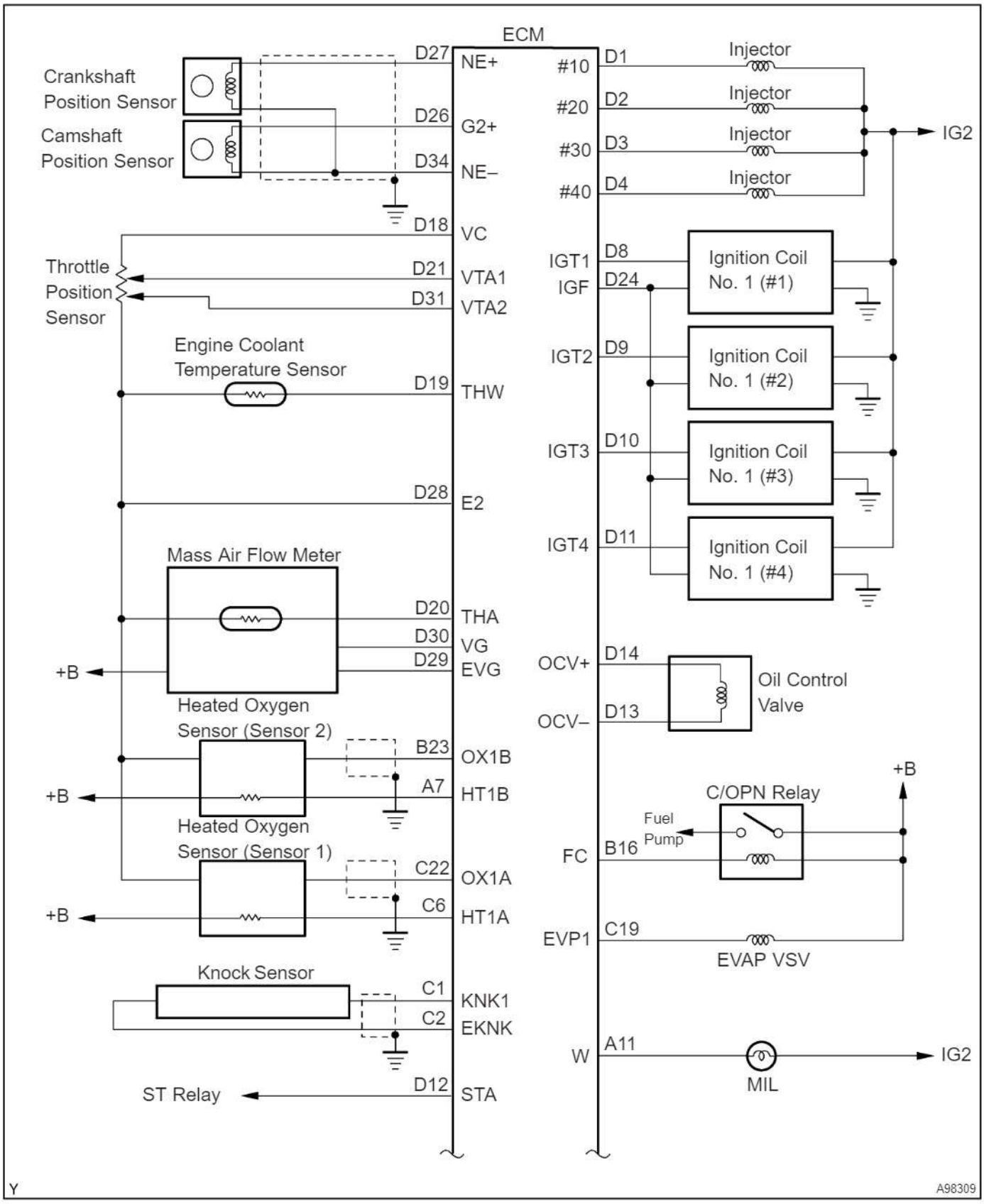
LOCATION



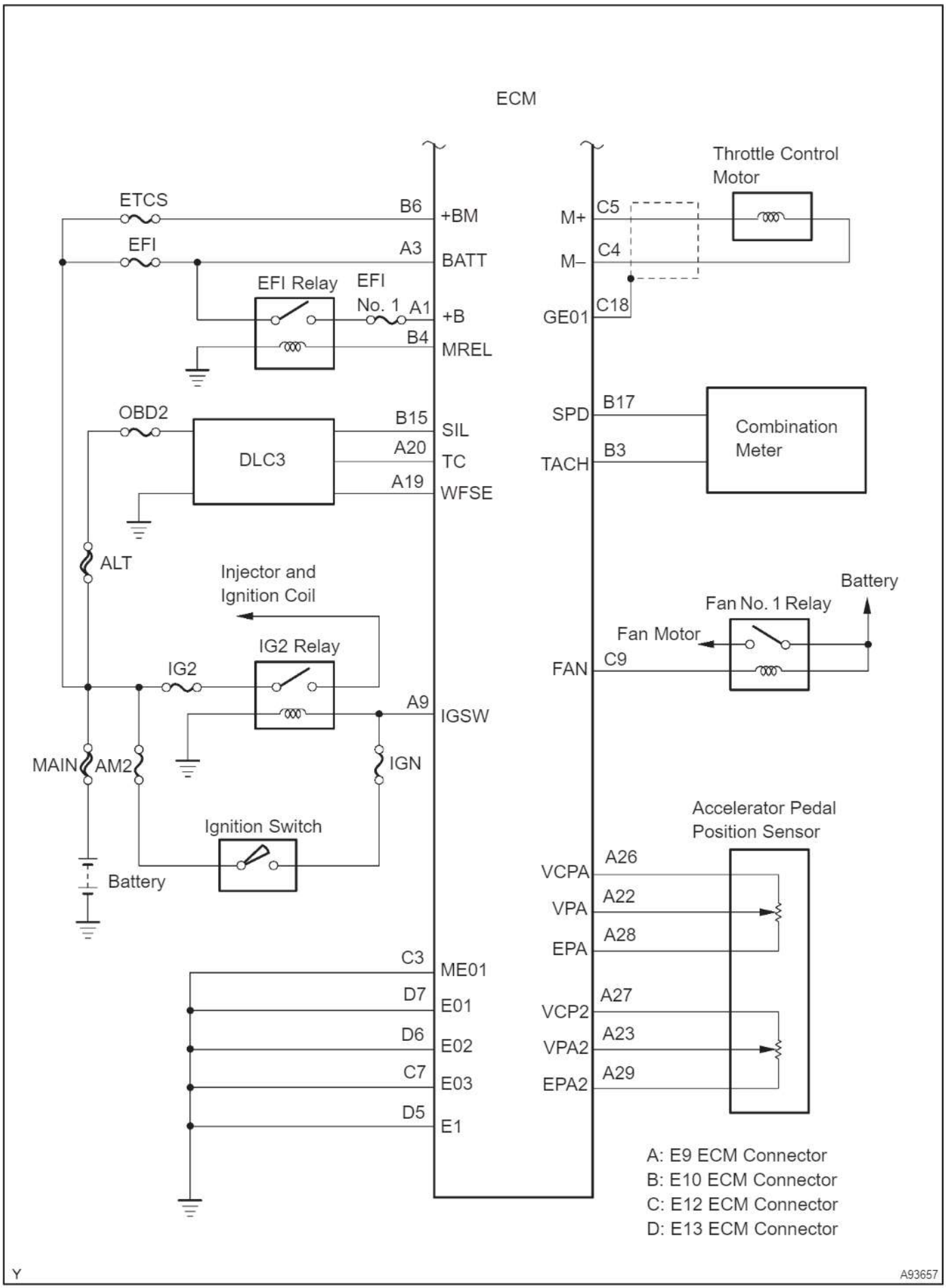
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05KNR-02

SYSTEM DIAGRAM



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054JB–23

HOW TO PROCEED WITH TROUBLESHOOTING

The intelligent tester II is used in steps 3, 4, 5, 7 and 10.

1	VEHICLE BROUGHT TO WORKSHOP

2	CUSTOMER PROBLEM ANALYSIS (See page 05–8)

3	CONNECT INTELLIGENT TESTER II TO DLC3

HINT:
If the display indicates a communication fault in the tester, inspect the DLC3.

4	CHECK DTC AND FREEZE FRAME DATA (See page 05–18)

HINT:
Record or print DTCs and freeze frame data, if needed.

5	CLEAR DTC AND FREEZE FRAME DATA (See page 05–18)

6	CONDUCT VISUAL INSPECTION

7	SET CHECK MODE DIAGNOSIS (See page 05–20)

8	CONFIRM PROBLEM SYMPTOMS

HINT:
If the engine does not start, perform steps 10 and 12 first.

Result	Proceed To
Malfunction does not occur	A
Malfunction occurs	B

B → GO TO STEP 10

A

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9	SIMULATE SYMPTOMS

10	CHECK DTC (See page 05–18)

Result	Proceed To
Malfunction code	A
No code	B

B → GO TO STEP 12

A

11	REFER TO DTC CHART (See page 05–27)

GO TO STEP 14

12	CONDUCT BASIC INSPECTION (See page 05–10)

Result	Proceed To
Wrong parts not confirmed	A
Wrong parts confirmed	B

B → GO TO STEP 17

A

13	REFER TO PROBLEM SYMPTOMS TABLE (See page 05–12)

Result	Proceed To
Wrong circuit confirmed	A
Wrong parts confirmed	B

B → GO TO STEP 17

A

14	CHECK ECM POWER SOURCE CIRCUIT (See page 05–195)

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15	CONDUCT CIRCUIT INSPECTION

Result	Proceed To
Malfunction not confirmed	A
Malfunction confirmed	B

B → GO TO STEP 18

A

16	CHECK FOR INTERMITTENT PROBLEMS (See page 05–9)

GO TO STEP 18

17	CONDUCT PARTS INSPECTION

18	IDENTIFY PROBLEM

19	ADJUST AND/OR REPAIR

20	CONDUCT CONFIRMATION TEST

END

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054JC–24

CUSTOMER PROBLEM ANALYSIS CHECK

ENGINE CONTROL SYSTEM Check Sheet

Inspector's Name _____

Driver's Name		VIN	
Date Vehicle Brought in		Production Date	
License Plate No.		Odometer Reading	km miles

Problem Symptoms	☐ Engine does not Start	☐ Engine does not crank ☐ No initial combustion ☐ No complete combustion
	☐ Difficult to Start	☐ Engine cranks slowly ☐ Other _____
	☐ Poor Idling	☐ Incorrect first idle ☐ Idling rpm is abnormal ☐ High (rpm) ☐ Low (rpm) ☐ Rough idling ☐ Other _____
	☐ Poor Driveability	☐ Hesitation ☐ Back fire ☐ Muffler explosion (after–fire) ☐ Surging ☐ Knocking ☐ Other _____
	☐ Engine Stalling	☐ Soon after starting ☐ After accelerator pedal depressed ☐ After accelerator pedal released ☐ During A/C operation ☐ Shifting from N to D ☐ Other _____
	☐ Others	

Data Problem Occurred		
Problem Frequency		☐ Constant ☐ Sometimes (times per day/month) ☐ Once only ☐ Other _____
Condition When Problem Occurs	Weather	☐ Fine ☐ Cloudy ☐ Rainy ☐ Snowy ☐ Various/Other _____
	Outdoor Temperature	☐ Hot ☐ Warm ☐ Cool ☐ Cold (approx.____ °C/____ °F)
	Place	☐ Highway ☐ Suburbs ☐ Inner city ☐ Uphill ☐ Downhill ☐ Rough road ☐ Other _____
	Engine Temp.	☐ Cold ☐ Warming up ☐ After warming up ☐ Any temp. ☐ Other _____
	Engine Operation	☐ Starting ☐ Just after starting (min.) ☐ Idling ☐ Rev–up ☐ Driving ☐ Constant speed ☐ Acceleration ☐ Deceleration ☐ A/C switch ON/OFF ☐ Other _____

Malfunction Indicator Lamp (MIL)		☐ Remains on	☐ Sometimes lights up ☐ Does not light up
DTC Inspection	Normal mode (Pre–check)	☐ Normal	☐ Malfunction code(s) (code) ☐ Freeze frame data ( )
	Check Mode	☐ Normal	☐ Malfunction code(s) (code) ☐ Freeze frame data ( )

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05JO6-03

CHECK FOR INTERMITTENT PROBLEMS

HINT:

Intelligent tester II only:

Inspect the vehicle's ECM using check mode. Intermittent problems are easier to detect with the intelligent tester II when the ECM is in check mode. In check mode, the ECM uses 1 trip detection logic, which has a higher sensitivity to malfunctions than normal mode (default) using 2 trip detection logic.

(a) Clear the DTCs (see page 05–18).
(b) Switch the ECM from normal mode to check mode using the intelligent tester II (see page 05–20).
(c) Perform a simulation test (see page 01–22).
(d) Check the connector(s) and terminal(s) (see page 01–32).
(e) Wiggle the harness(es) and connector(s) (see page 01–32).

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05JO7–03

BASIC INSPECTION

When a malfunction is not confirmed in the DTC check, troubleshooting should be carried out in all the circuits considered possible causes of the problem. In many cases, by carrying out the basic engine check shown in the following flowchart, the location of the problem can be found quickly and efficiently. Therefore, using this check is essential in engine troubleshooting.

1	CHECK BATTERY VOLTAGE

NOTICE:
Carry out this check with the engine stopped and ignition switch OFF.

Result	Proceed To
11 V or more	OK
Below 11 V	NG

NG → CHARGE OR REPLACE BATTERY

OK →

2	CHECK IF ENGINE WILL CRANK

NG → PROCEED TO PROBLEM SYMPTOMS TABLE ON PAGE 05–12

OK →

3	CHECK IF ENGINE STARTS

NG → GO TO STEP 7

OK →

4	CHECK AIR FILTER

(a) Visually check if the air filter is not contaminated with dirt or oil.

NG → REPLACE AIR FILTER

OK →

5	CHECK IDLING SPEED (See page 14–1 of Pub. No. RM1018E AVENSIS)

NG → PROCEED TO PAGE 14–1 of Pub. No. RM1018E AVENSIS AND CONTINUE TO TROUBLESHOOT

OK →

PROCEED TO PROBLEM SYMPTOMS TABLE ON PAGE 05–12

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6	CHECK FUEL PRESSURE (See page 11–5 of Pub. No. RM1018E AVENSIS)

NG → PROCEED TO PAGE 11–5 of Pub. No. RM1018E AVENSIS AND CONTINUE TO TROUBLESHOOT

OK

7	CHECK FOR SPARK (See page 18–3 of Pub. No. RM1018E AVENSIS)

NG → PROCEED TO PAGE 18–3 of Pub. No. RM1018E AVENSIS AND CONTINUE TO TROUBLESHOOT

OK

PROCEED TO PROBLEM SYMPTOMS TABLE ON PAGE 05–12

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054JF–24

PROBLEM SYMPTOMS TABLE

When the malfunction is not confirmed in the diagnostic trouble code check and the problem still cannot be confirmed in the basic inspection, use this table and troubleshoot according to the priority order given below.

Symptom	Suspect Area	See Page
Engine does not crank (Does not start)	1. Starter signal circuit 2. Starter 3. ST relay	05–171 *1 *1
No initial combustion (Does not start)	1. ECM power source circuit 2. Fuel pump control circuit 3. ECM	05–195 05–199 *2
No complete combustion (Does not start)	1. Fuel pump control circuit	05–199
Engine cranks normally but difficult to start	1. Starter signal circuit 2. Fuel pump control circuit 3. Compression	05–171 05–199 *3
Difficult to start with cold engine	1. Starter signal circuit 2. Fuel pump control circuit	05–171 05–199
Difficult to start with hot engine	1. Starter signal circuit 2. Fuel pump control circuit	05–171 05–199
High engine idling speed (Poor idling)	1. A/C signal circuit (Compressor circuit) 2. ECM power source circuit	— 05–195
Low engine idling speed (Poor idling)	1. A/C signal circuit (Compressor circuit) 2. Fuel pump control circuit	— 05–199
Rough idling (Poor idling)	1. Compression 2. Fuel pump control circuit	*3 05–199
Hunting (Poor idling)	1. ECM power source circuit 2. Fuel pump control circuit	05–195 05–199
Hesitation/Poor acceleration (Poor driveability)	1. Fuel pump control circuit 2. Automatic transmission assembly	05–199 05–229
Surging (Poor driveability)	1. Fuel pump control circuit	05–199
Engine stalls soon after starting	1. Fuel pump control circuit	05–199
Engine stalls during A/C operation	1. A/C signal circuit (Compressor circuit) 2. ECM	— *2

*1: See page 19–1 of Pub. No. RM1018E AVENSIS

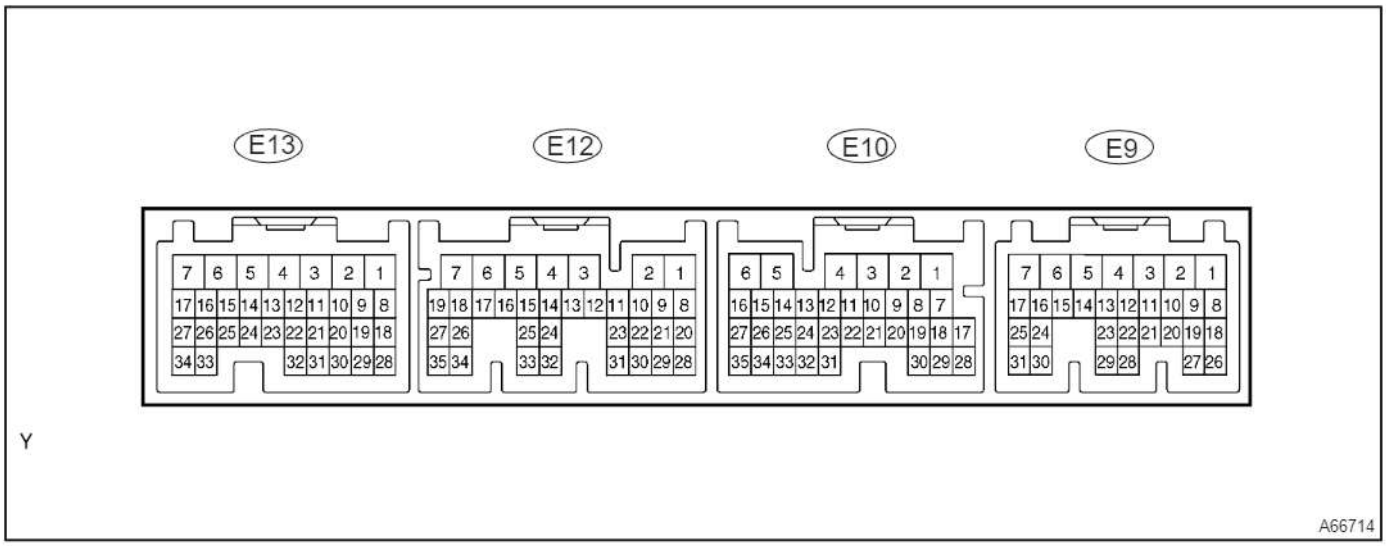
*2: See page 10–65 of Pub. No. RM1018E AVENSIS

*3: See page 14–1 of Pub. No. RM1018E AVENSIS

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054KK-23

TERMINALS OF ECM



HINT:
Each ECM terminal's standard normal voltage is shown in the table below.
In the table, first follow the information under "Condition." Look under "Symbols (Terminals No.)" for the terminals to be inspected. The standard normal voltage between the terminals is shown under "STD Voltage."
Use the illustration above as a reference for the ECM terminals.

Symbols (Terminals No.)	Wiring Color	Terminal Description	Condition	STD Voltage
BATT (E9–3) – E1 (E13–5)	B–Y – BR	Battery (for measuring the battery voltage and for the ECM memory)	Always	9 to 14 V
+BM (E10–6) – ME01 (E12–3)	G–Y – W–B	Power source of throttle motor	Always	9 to 14 V
IGSW (E9–9) – E1 (E13–5)	B–W – BR	Ignition switch	Ignition switch ON	9 to 14 V
+B (E9–1) – E1 (E13–5)	B–R – BR	Power source of ECM	Ignition switch ON	9 to 14 V
MREL (E10–4) – E01 (E13–7)	GR – W–B	EFI relay	Ignition switch ON	9 to 14 V
VC (E13–18) – E2 (E13–28)	R–W – BR	Power source of sensor (a specific voltage)	Ignition switch ON	4.5 to 5.5 V
VTA1 (E13–21) – E2 (E13–28)	L–W – BR	Throttle position sensor (for engine control)	Ignition switch ON, Accelerator pedal fully released	0.4 to 1.0 V
VTA1 (E13–21) – E2 (E13–28)	L–W – BR	Throttle position sensor (for engine control)	Ignition switch ON, Accelerator pedal fully depressed	3.2 to 4.8 V
VTA2 (E13–31) – E2 (E13–28)	B–R – BR	Throttle position sensor (for sensor malfunction detection)	Ignition switch ON, Accelerator pedal fully released	2.1 to 3.1 V
VTA2 (E13–31) – E2 (E13–28)	B–R – BR	Throttle position sensor (for sensor malfunction detection)	Ignition switch ON, Accelerator pedal fully depressed	4.5 to 5.0 V
VPA (E9–22) – EPA (E9–28)	G – Y	Accelerator pedal position sensor (for engine control)	Ignition switch ON, Accelerator pedal fully released	0.5 to 1.1 V
VPA (E9–22) – EPA (E9–28)	G – Y	Accelerator pedal position sensor (for engine control)	Ignition switch ON, Accelerator pedal fully depressed	2.6 to 4.5 V
VPA2 (E9–23) – EPA2 (E9–29)	W – Y	Accelerator pedal position sensor (for sensor malfunction detection)	Ignition switch ON, Accelerator pedal fully released	1.2 to 2.0 V
VPA2 (E9–23) – EPA2 (E9–29)	W – Y	Accelerator pedal position sensor (for sensor malfunction detection)	Ignition switch ON, Accelerator pedal fully depressed	3.4 to 5.0 V

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Symbols (Terminals No.)	Wiring Color	Terminal Description	Condition	STD Voltage
VCPA (E9–26) – EPA (E9–28)	B – Y	Power source of accelerator pedal position sensor (for VPA)	Ignition switch ON	4.5 to 5.0 V
VCP2 (E9–27) – EPA2 (E9–29)	B – Y	Power source of accelerator pedal position sensor (for VPA2)	Ignition switch ON	4.5 to 5.0 V
VG (E13–30) – EVG (E13–29)	G – L–Y	Mass air flow meter	Idling, Shift position P or N, A/C switch OFF	0.5 to 3.0 V
THA (E13–20) – E2 (E13–28)	G–R – BR	Intake air temperature sensor	Idling, Intake air temperature 20°C (68°F)	0.5 to 3.4 V
THW (E13–19) – E2 (E13–28)	B–W – BR	Engine coolant temperature sensor	Idling, Engine coolant temperature 80°C (176°F)	0.2 to 1.0 V
#10 (E13–1) – E01 (E13–7) #20 (E13–2) – E01 (E13–7) #30 (E13–3) – E01 (E13–7) #40 (E13–4) – E01 (E13–7)	B–R – W–B Y – W–B W – W–B B – W–B	Injector	Ignition switch ON	9 to 14 V
#10 (E13–1) – E01 (E13–7) #20 (E13–2) – E01 (E13–7) #30 (E13–3) – E01 (E13–7) #40 (E13–4) – E01 (E13–7)	B–R – W–B Y – W–B W – W–B B – W–B	Injector	Idling	Pulse generation (See page 05–118)
IGT1 (E13–8) – E1 (E13–5) IGT2 (E13–9) – E1 (E13–5) IGT3 (E13–10) – E1 (E13–5) IGT4 (E13–11) – E1 (E13–5)	R–W – BR P – BR LG–B – BR L–Y – BR	Ignition coil with igniter (ignition signal)	Idling	Pulse generation (See page 05–143)
IGF (E13–24) – E1 (E13–5)	W–R – BR	Ignition coil with igniter (ignition confirmation signal)	Ignition switch ON	4.5 to 5.5 V
IGF (E13–24) – E1 (E13–5)	W–R – BR	Ignition coil with igniter (ignition confirmation signal)	Idling	Pulse generation (See page 05–143)
G2+ (E13–26) – NE– (E13–34)	W – R	Camshaft position sensor	Idling	Pulse generation (See page 05–140)
NE+ (E13–27) – NE– (E13–34)	G – R	Crankshaft position sensor	Idling	Pulse generation (See page 05–136)
FC (E10–16) – E01 (E13–7)	G–Y – W–B	Fuel pump control	Ignition switch ON	9 to 14 V
M+ (E12–5) – E01 (E13–7) M– (E12–4) – E01 (E13–7)	B – W–B W – W–B	Throttle actuator	Idling	Pulse generation
OX1A (E12–22) – E2 (E13–28)	B – BR	Heated oxygen sensor	Maintain engine speed at 2,500 rpm for 2 minutes after warming up the sensor	Pulse generation (See page 05–74)
OX1B (E10–23) – E2– (E13–28)	B – BR	Heated oxygen sensor	Maintain engine speed at 2,500 rpm for 2 minutes after warming up the sensor	Pulse generation (See page 05–100)
HT1A (E12–6) – E03 (E12–7) HT1B (E9–7) – E03 (E12–7)	Y – W–B P – W–B	Heated oxygen sensor heater	Idling	Below 3.0 V
HT1A (E12–6) – E03 (E12–7) HT1B (E9–7) – E03 (E12–7)	Y – W–B P – W–B	Heated oxygen sensor heater	Ignition switch ON	9 to 14 V
KNK1 (E12–1) – EKNK (E12–2)	B – W	Knock sensor	Maintain engine speed at 4,000 rpm after warming up the engine	Pulse generation (See page 05–132)
OCV+ (E13–14) – OCV– (E13–13)	W–G – Y–B	Camshaft timing oil control valve (OCV)	Ignition switch ON	Pulse generation (See page 05–34)
EVP1 (E12–19) – E01 (E13–7)	W–G – W–B	EVAP VSV	Ignition switch ON	9 to 14 V
EVP1 (E12–19) – E01 (E13–7)	W–G – W–B	EVAP VSV	Idling	Pulse generation
STA (E13–12) – E1 (E13–5)	B–Y – BR	Starter signal	Shift position N, Ignition switch START	6.0 V or more

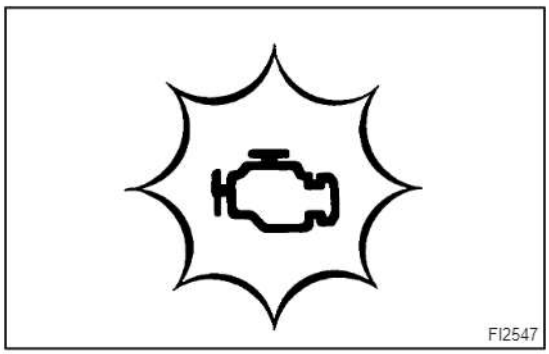
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Symbols (Terminals No.)	Wiring Color	Terminal Description	Condition	STD Voltage
STP (E10–19) – E1 (E13–5)	G–W – BR	Stop lamp switch	Brake pedal depressed	9 to 14 V
STP (E10–19) – E1 (E13–5)	G–W – BR	Stop lamp switch	Brake pedal released	Below 1.5 V
ST1– (E10–12) – E1 (E13–5)	G–W – BR	Stop lamp switch	Ignition switch ON, Brake pedal depressed	Below 1.5 V
ST1– (E10–12) – E1 (E13–5)	G–W – BR	Stop lamp switch	Ignition switch ON, Brake pedal released	7.5 to 14 V
W (E9–11) – E01 (E13–7)	W – W–B	MIL	Idling	9 to 14 V
W (E9–11) – E01 (E13–7)	W – W–B	MIL	Ignition switch ON	Below 3.0 V
TACH (E10–3) – E1 (E13–5)	GR–R – BR	Engine speed	Idling	Pulse generation
SPD (E10–17) – E01 (E13–7)	V–W – W–B	Speed signal from combination meter	Ignition switch ON, Rotate driving wheel slowly	Pulse generation (See page 05–158)
TC (E9–20) – E1 (E13–5)	W–L – BR	Terminal TC of DLC3	Ignition switch ON	9 to 14 V
SIL (E10–15) – E1 (E13–5)	W–G – BR	Terminal SIL of DLC3	Connect the intelligent tester II to the DLC3	Pulse generation
ELS (E9–12) – E1 (E13–5)	G – BR	Electric load	Taillamp switch OFF	0 to 1.5 V
ELS (E9–12) – E1 (E13–5)	G – BR	Electric load	Taillamp switch ON	9 to 14 V
F/PS (E9–14) – E1 (E13–5)	LG–B – BR	Airbag sensor assembly	Ignition switch ON	Below 1.5 V

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05JO8–03

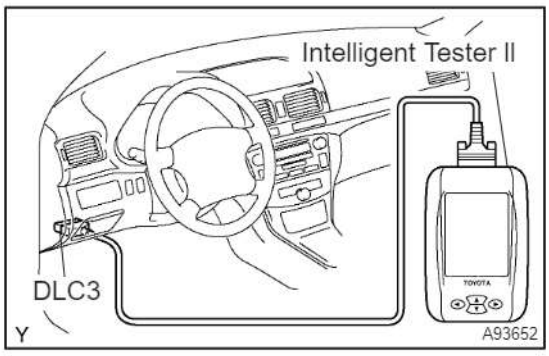
DIAGNOSIS SYSTEM


FI2547

1. DESCRIPTION

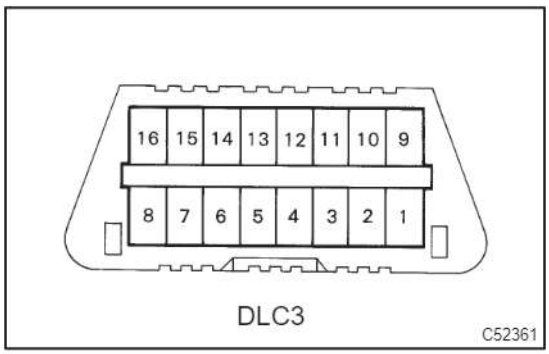
- When troubleshooting Euro–OBD vehicles, the only difference from the usual troubleshooting procedure is that you connect an OBD scan tool (complying with ISO 15031–4) or the intelligent tester II to the vehicle, and read the various data output from the vehicle's ECM.
- Euro–OBD regulations require that the vehicle's on–board computer illuminates the MIL (Malfunction Indicator Lamp) on the instrument panel when the computer detects a malfunction in: 1) the emission control systems and components, or 2) the powertrain control components (which affect vehicle emissions), or 3) the computer. In addition, the applicable DTCs (Diagnostic Trouble Codes) prescribed by ISO 15031–4 are recorded in the ECM memory (see page 05–27).

If the malfunction does not recur in 3 consecutive trips, the MIL goes off automatically but the DTCs remain recorded in the ECM memory.



- To check the DTCs, connect the OBD scan tool or intelligent tester II to the DLC3 (Data Link Connector 3) on the vehicle. The OBD scan tool or intelligent tester II also enables you to erase the DTCs and check the freeze frame data and various forms of engine data. (See the instruction manual for the OBD scan tool or intelligent tester II.)
- The diagnosis system operates in normal mode during normal vehicle use. In normal mode, 2 trip detection logic* is used to ensure accurate detection of malfunctions. Check mode is also available to technicians as an option. In check mode, 1 trip detection logic is used for simulating malfunction symptoms and increasing the system's ability to detect malfunctions, including intermittent problems (intelligent tester II only) (see page 05–20).
- *2 trip detection logic:
  When a malfunction is first detected, the malfunction is temporarily stored in the ECM memory (1st trip). If the ignition switch is turned to OFF and then to ON again, and the same malfunction is detected again, the MIL will illuminate (2nd trip).
- Freeze frame data:
  The freeze frame data record the engine condition (fuel system, calculated engine load, engine coolant temperature, fuel trim, engine speed, vehicle speed, etc.) when a malfunction is detected. When troubleshooting, the freeze frame data can help determine if the vehicle was moving or stationary, 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.

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DLC3

2. CHECK DLC3

(a) The vehicle's ECM uses the ISO 9141–2 (Euro–OBD) communication protocol. The terminal arrangement of the DLC3 complies with ISO 15031–03 and matches the ISO 9141–2 format.

Symbol	Terminal No.	Name	Reference Terminal	Result	Condition
SIL	7	Bus "+" line	5 – Signal ground	Pulse generation	During transmission
CG	4	Chassis ground	Body ground	1 Ω or less	Always
SG	5	Signal ground	Body ground	1 Ω or less	Always
BAT	16	Battery positive	Body ground	9 to 14 V	Always

HINT:

When you use the intelligent tester II, first connect the cable of the tester to the DLC3. Next, turn the ignition switch to ON. Finally turn the tester ON. If the screen displays NO INFORMATION AVAILABLE and bus check is also failed, a problem exists in the vehicle, the tester or the tester cable.

- If communication is normal when the tester is connected to another vehicle, inspect the DLC3 on the original vehicle.
- If communication is still not possible when the tester is connected to another vehicle, the problem is probably in the tester or the cable, so consult the Service Department listed in its instruction manual.

3. INSPECT BATTERY VOLTAGE

Standard: 11 to 14 V

If the voltage is below 11 V, recharge the battery before proceeding.

4. CHECK MIL

(a) The MIL illuminates when the ignition switch is turned to ON and the engine is not running.

HINT:

If the MIL is not illuminated, check the MIL Circuit (see page 05–204).

(b) When the engine is started, the MIL should turn off. If the MIL remains on, the diagnosis system has detected a malfunction or abnormality in the system.

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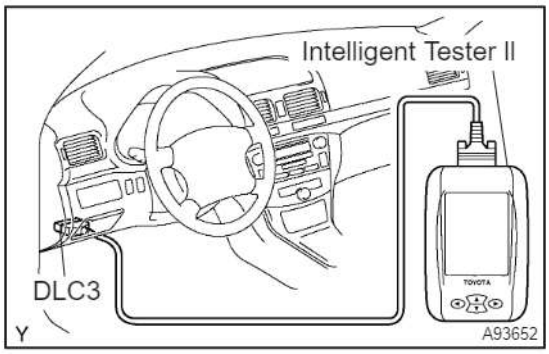
05KNS–02

DTC CHECK/CLEAR

NOTICE:

Intelligent tester II only:

When the diagnosis system is changed from normal mode to check mode or vice–versa, all DTCs and freeze frame data recorded in normal mode will be erased. Before changing modes, always check and make a note of DTCs and freeze frame data.



1. CHECK DTC (using the intelligent tester II)

(a) Connect the intelligent tester II to the DLC3.

(b) Turn the ignition switch to ON and turn the intelligent tester II ON.

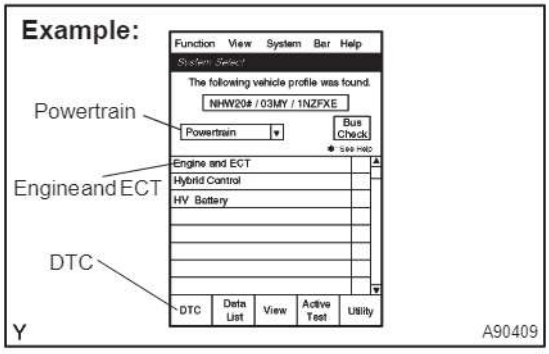
(c) Select the following menu items: Powertrain / Engine and ECT / DTC.

(d) Check DTCs and freeze frame data, and then write them down.

HINT:

If you need help using the intelligent tester II, refer to the instruction manual.

(e) See page 05–27 to confirm the details of the DTCs.



2. FREEZE FRAME DATA

(a) Connect the intelligent tester II to the DLC3.

(b) Turn the ignition switch to ON and turn the intelligent tester II ON.

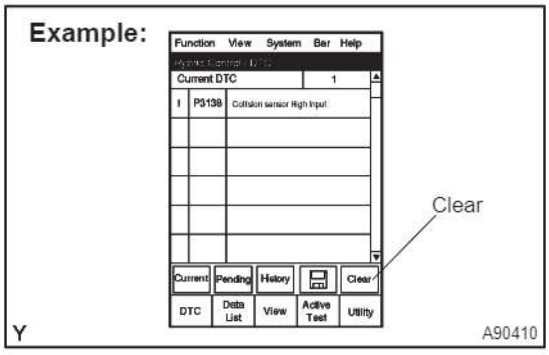
(c) Read DTCs by selecting the following menu items: Powertrain / Engine and ECT / DTC.

(d) Select a parameter(s) to check the freeze frame data.

(e) Note down the DTC(s) and freeze frame data.

HINT:

If you need help using the intelligent tester II, refer to the instruction manual.



3. CLEAR DTCs AND FREEZE FRAME DATA (using the intelligent tester II)

(a) Connect the intelligent tester II to the DLC3.

(b) Turn the ignition switch to ON (do not start the engine) and turn the intelligent tester II ON.

(c) Select the following menu items: Powertrain / Engine and ECT / DTC / Clear.

(d) Erase DTCs and freeze frame data by pressing the YES button on the tester.

HINT:

If you need help using the intelligent tester II, refer to the instruction manual.

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4. CLEAR DTCs AND FREEZE FRAME DATA (not using the intelligent tester II)

(a) Remove the EFI and ETCS fuse from the engine room R/B for more than 60 seconds, or disconnect the negative battery cable for more than 60 seconds. When disconnecting the negative battery cable, perform the "INITIALIZE" procedure (see page 05–1).

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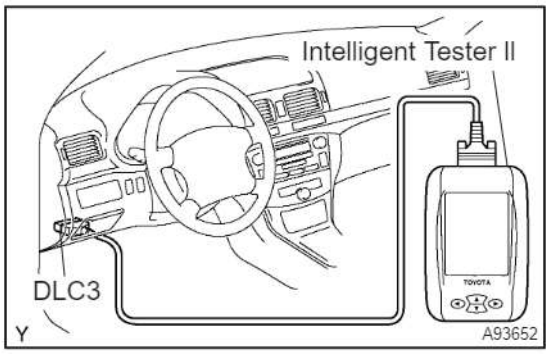
05JOA-03

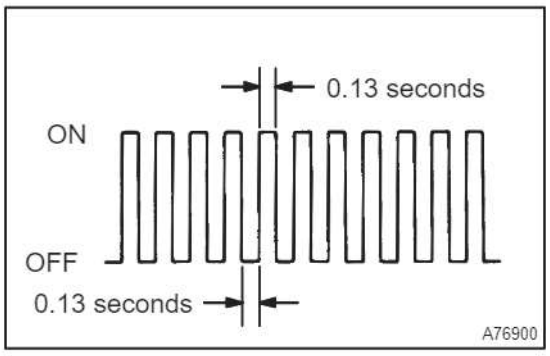
CHECK MODE PROCEDURE

HINT:

Intelligent tester II only:

Compared to normal mode, check mode has more sensing ability to detect malfunctions. Furthermore, the same diagnostic items which are detected in normal mode can also be detected in check mode.





1. CHECK MODE PROCEDURE

(a) Make sure that the items below are true.
  (1) Battery voltage 11 V or more.
  (2) Throttle valve fully closed.
  (3) Transmission in the P or N position.
  (4) A/C switched OFF.

(b) Turn the ignition switch to OFF.

(c) Connect the intelligent tester II to the DLC3.

(d) Turn the ignition switch to ON and turn the intelligent tester II ON.

(e) Select the following menu items: Powertrain / Engine and ECT / Utility / Check Mode.

(f) Make sure that the MIL flashes as shown in the illustration.

NOTICE:

All the recorded DTCs and freeze frame data will be erased if: 1) the intelligent tester II is used to change the ECM from normal mode to check mode or vice–versa; or 2) during check mode, the ignition switch is turned from ON to ACC or OFF.

(g) Start the engine (the MIL should turn off).

(h) Simulate the condition of the malfunction described by the customer.

(i) After simulating the malfunction condition, check the DTCs, freeze frame data and other data.

(j) After checking the DTCs, inspect the applicable circuits (see page 05–12).

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05JOB-03

FAIL–SAFE CHART

If any of the following DTCs are recorded, the ECM enters fail–safe mode.

DTC No.	Fail–Safe Operation	Fail–Safe Deactivation Condition
P0031 P0032	Heated oxygen sensor (Sensor 1) heater is turned off	Ignition switch turned to OFF
P0037 P0038	Heated oxygen sensor (Sensor 2) heater is turned off	Ignition switch turned to OFF
P0100 P0102 P0103	Ignition timing is calculated from engine RPM and Throttle Position (TP)	"Pass" condition detected
P0110 P0112 P0113	Intake Air Temperature (IAT) is fixed at 20°C (68°F)	"Pass" condition detected
P0115 P0117 P0118	Engine Coolant Temperature (ECT) is fixed at 80°C (176°F)	"Pass" condition detected
P0120 P0122 P0123 P0220 P0222 P0223 P2102 P2103 P2111 P2112 P2118 P2119 P2135	When Electronic Throttle Control System (ETCS) is malfunctioning, electric current to throttle actuator is cut off and throttle valve returns to throttle position (TP) 16° by its spring. Then, required engine power is calculated using ignition timing and Accelerator Pedal Position (APP). Engine is controlled by intermittent fuel–cut. As a result, fully slowly depressing accelerator pedal enables driving at minimum speed. However, quickly depressing pedal would vary vehicle speed remarkably.	"Pass" condition detected followed by the ignition switch turned to OFF
P0121	Fuel is cut intermittently	"Pass" condition detected followed by the ignition switch turned to OFF
P0325 P0327 P0328	Maximum ignition timing retardation	Ignition switch turned to OFF
P0351 P0352 P0353 P0354	Fuel is cut	"Pass" condition detected
P2120 P2121 P2122 P2123 P2125 P2127 P2128 P2138	Accelerator Pedal Position (APP) sensor has main circuit and associate circuit. When one of circuits is malfunctioning, APP is calculated by output of other circuit. When both of circuits are malfunctioning, it is interpreted that accelerator pedal is releasing. As a result, throttle valve is closed and engine idles.	"Pass" condition detected followed by the ignition switch turned to OFF

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05JOC-03

DATA LIST/ACTIVE TEST

1. DATA LIST

HINT:

Using the Data List displayed on the intelligent tester II, you can read values including those of the switches, sensors, and actuators, without removing any parts. Reading the Data List as the first step of troubleshooting is one method to shorten diagnostic time.

NOTICE:

In the table below, the values listed under "Normal Condition" are reference values. Do not depend solely on these reference values when deciding whether a part is faulty or not.

(a) Warm up the engine.
(b) Turn the ignition switch to OFF.
(c) Connect the intelligent tester II to the DLC3.
(d) Turn the ignition switch to ON.
(e) Turn the intelligent tester II ON.
(f) Select the following menu items: Powertrain / Engine and ECT / Data List.
(g) Check the results by referring to the following table.

Intelligent Tester II Display (Abbreviation)	MeasurementItem/Range (Display)	Normal Condition *1	Diagnostic Note
Injector (INJECTOR)	Injection period of the No. 1 cylinder/ Min.: 0 ms, Max.: 32.6 ms	Idling: 1.92 to 3.37 ms	—
IGN Advance (IGN ADVANCE)	Ignition timing advance for No. 1 cylinder/ Min.: –64 deg., Max.: 63.5 deg.	Idling: BTDC 10 to 18 deg. (N position)	—
CALC Load (CALC LOAD)	Calculated load by ECM/ Min.: 0 %, Max.: 100 %	• Idling: 27.5 to 46.4 % • Running without load (2,500 rpm): 19.7 to 40.5 %	—
AFM (AFM)	Air flow rate from MAF meter/ Min.: 0 g/s, Max.: 665.35 g/s	Idling: 3 to 7 g/s (1,500 rpm)	If the value is approximately 0.0 g/s: • Mass air flow meter power source circuit is open • VG circuit is open or shorted If the value is 160.0 g/s or more: • E2G circuit is open
Engine SPD (ENGINE SPD)	Engine speed/ Min.: 0 rpm, Max.: 16,383 rpm	Idling: 650 to 750 rpm (N position)	—
Coolant Temp (COOLANT TEMP)	Engine coolant temperature/ Min.: –40°C (–40°F) Max.: 215°C (419°F)	After warming up the engine: 80° to 95°C (176° to 203°F)	• If the value is –40°C (–40°F): sensor circuit is open • If the value is 140°C (284°F): sensor circuit is shorted
Intake Air (INTAKE AIR)	Intake air temperature/ Min.: –40°C (–40°F) Max.: 215°C (419°F)	Equivalent to ambient air temperature	• If the value is –40°C (–40°F): sensor circuit is open • If the value is 140°C (284°F): sensor circuit is shorted
Throttle POS (THROTTLE POS)	Absolute throttle position sensor/ Min.: 0 %, Max.: 100 %	• Throttle fully closed: 8 to 20 % • Throttle fully open: 64 to 96 %	Read the value with the ignition switch ON (Do not start engine)
Vehicle SPD (VEHICLE SPD)	Vehicle speed/ Min.: 0 km/h, Max.: 255 km/h	Actual vehicle speed	Speed indicated on the speedometer
Accelerator POS No.1 (ACCEL POS #1)	Accelerator pedal position sensor No.1 output voltage/ Min.: 0 V, Max.: 5 V	• Accelerator pedal released: 0.5 to 1.1 V • Accelerator pedal depressed: 2.6 to 4.5 V	Read the value with the ignition switch ON (Do not start engine)

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Intelligent Tester II Display (Abbreviation)	MeasurementItem/Range (Display)	Normal Condition *1	Diagnostic Note
Accelerator POS No.2 (ACCEL POS #2)	Accelerator pedal position sensor No.2 output voltage/ Min.: 0 V, Max.: 5 V	• Accelerator pedal released: 1.2 to 2.0 V • Accelerator pedal depressed: 3.4 to 5.0 V	Read the value with the ignition switch ON (Do not start engine)
Throttle POS No.2 (THROTTLE POS #2)	Throttle position sensor No. 2 output voltage/ Min.: 0 V, Max.: 5 V	• Throttle fully closed: 2.1 to 3.1 V • Throttle fully open: 4.5 to 5.0 V	Read the value with the ignition switch ON (Do not start engine)
Throttle Request POS (THROTTLE TARGT)	Throttle requirement position Min.: 0 V, Max.: 5 V	Idling: 0.4 to 1.1 V	—
Throttle Motor Open Duty (THROTL OPN DUTY)	Throttle motor opening duty ratio/ Min.: 0 %, Max.: 100 %	Throttle fully closed: 0 %	• When the accelerator pedal is depressed, duty ratio is increased • Read the value with the ignition switch ON (Do not start engine)
Throttle Motor Close Duty (THROTL CLS DUTY)	Throttle motor closed duty ratio/ Min.: 0 %, Max.: 100 %	Throttle fully open: 0 %	• When the accelerator pedal is released quickly, duty ratio is increased • Read the value with the ignition switch ON (Do not start engine)
Throttle Motor (THROTTLE MOT)	Whether or not throttle motor control is permitted/ ON or OFF	Idling: ON	Read the value with the ignition switch ON (Do not start engine)
ETCS Actuator Power (+BM)	Whether or not Electronic Throttle Control System (ETCS) power is applied/ ON or OFF	Idling: ON	—
Accelerator IDL POS (ACCEL IDL POS)	Whether or not accelerator pedal position sensor is detecting engine idling/ ON or OFF	Idling: ON	—
Throttle IDL POS (THROTTL IDL POS)	Whether or not throttle position sensor is detecting engine idling/ ON or OFF	Idling: ON	—
Fail Safe Drive (FAIL #1)	Whether or not fail–safe function is executed/ ON or OFF	ETCS has failed: ON	—
Fail Safe Drive (Main CPU) (FAIL #2)	Whether or not fail–safe function is executed/ ON or OFF	ETCS has failed: ON	—
Throttle Closed Initial Value (THROTTL INITIAL)	Throttle fully closed (learned value) Min.: 0 V, Max.: 5 V	0.5 to 0.9 V	—
Accelerator Learned Value (ACCEL LEARN VAL)	Accelerator fully closed (learned value) Min.: 0 V, Max.: 5 V	0.4 to 0.8 V	—
Throttle Motor Current (THROTTLE MOT)	Throttle motor current Min.: 0 A, Max.: 20 A	Idling: 0 to 3.0 A	—
O2S B1 S1 (O2S B1 S1)	Heated oxygen sensor output voltage for bank 1 sensor 1/ Min.: 0 V, Max.: 1.275 V	Driving (50 km/h, 31 mph): 0.1 to 0.9 V	Performing the A/F Control function of the Active Test enables the technician to check voltage output of the sensor
O2S B1 S2 (O2S B1 S2)	Heated oxygen sensor output voltage for bank 1 sensor 2/ Min.: 0 V, Max.: 1.275 V	Driving (50 km/h, 31 mph): 0.1 to 0.9 V	Performing the A/F Control function of the Active Test enables the technician to check voltage output of the sensor

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Intelligent Tester II Display (Abbreviation)	MeasurementItem/Range (Display)	Normal Condition *1	Diagnostic Note
Short FT #1 (SHORT FT #1)	Short–term fuel trim of bank 1/ Min.: –100 %, Max.: 100 %	0 ± 20 %	This item is the short–term fuel compensation used to maintain the air–fuel ratio at stoichiometric air–fuel ratio
Long FT #1 (LONG FT #1)	Long–term fuel trim of bank 1/ Min.: –100 %, Max.: 99.2 %	0 ± 20 %	This item is overall long–term fuel compensation that helps to maintain air–fuel ratio at stoichiometric air–fuel ratio (steadies long term deviations of short–term fuel trim from central value)
TOTAL FT#1 (TOTAL FT#1)	Total fuel trim of bank 1: Average value for fuel trim system of bank 1/ Min.: –0.5, Max.: 1.496	Idling: 0.5 to 1.4	—
O2 FT B1 S1 (O2 FT B1 S1)	Short–term fuel trim associated with the bank 1 sensor 1/ Min.: –100 %, Max.: 100 %	0 ± 20 %	Same as Short FT #1
O2FT B1 S2 (O2FT B1 S2)	Short–term fuel trim associated with the bank 1 sensor 2/ Min.: –100 %, Max.: 100 %	0 ± 20 %	Same as Short FT #1
FUEL SYS #1 (FUEL SYS #1)	Fuel system status (Bank1) / OL or CL or OL DRIVE or OL FAULT or CL FAULT	Idling after warming up: CL	• OL (Open Loop): Has not yet satisfied conditions for closed loop • CL (Closed Loop): Using the heated oxygen sensor as feed back for fuel control • OL DRIVE: Open loop due to driving conditions (fuel enrichment) • OL FAULT: Open loop due to detected system fault • CL FAULT: Closed loop but the heated oxygen sensor used for fuel control is malfunctioning
FC IDL (FC IDL)	Fuel cut idle/ ON or OFF	Fuel cut operation: ON	Fuel cut idle = "ON" when the throttle valve is fully closed and engine speed is over 1,500 rpm
MIL Status (MIL/WARN LIGHT)	MIL status/ ON or OFF	MIL ON: ON	—
Starter SIG (STARTER SIG)	Starter signal/ ON or OFF	Cranking: ON	—
A/C SIG (A/C SIG)	A/C signal/ ON or OFF	A/C ON: ON	—
PNP SW (PNP SW [NSW])	Park/Neutral position switch signal/ ON or OFF	P or N position: ON	—
Elect Load SIG (ELECT LOAD SIG)	Electrical load signal/ ON or OFF	• Taillamp switch ON: ON • Defogger switch ON: ON	—
Stop Light SW (STOP LIGHT SW)	Stop lamp switch/ ON or OFF	• Brake pedal depressed: ON • Brake pedal released: OFF	—
PS Oil Press SW (PS OIL PRESS SW)	Power steering oil pressure switch signal/ ON or OFF	• While turning the steering wheel: ON • While not turning the steering wheel: OFF	Idle–up control is performed when PS is ON
PS Signal (PS SIGNAL)	Power steering signal/ ON or OFF	When the steering wheel is turned	This signal is usually ON until the ignition switch is turned to OFF

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Intelligent Tester II Display (Abbreviation)	MeasurementItem/Range (Display)	Normal Condition *1	Diagnostic Note
Fuel Pump (FUEL PUMP / SPD)	Fuel pump/speed status/ ON/H or OFF/M,L	Idling: ON	—
EVAP VSV (EVAP VSV)	EVAP VSV/ ON or OFF	VSV operating: ON	EVAP VSV is controlled by the ECM (ground side duty control)
VVT CTRL B1 (VVT CTRL B1)	VVT control status (bank 1)/ ON or OFF	VVT system in operation: ON	—
IGNITION (IGNITION)	Ignition counter/ Min.: 0, Max.: 400	0 to 400	—
Cylinder #1,#2,#3,#4 Misfire Rate (Cyl #1, #2, #3, #4)	Misfire ratio of the cylinder 1 to 4/ Min.: 0, Max.: 255	0 %	This item is displayed only when idling
MISFIRE RPM (MISFIRE RPM)	Engine RPM for first misfire range/ Min.: 0 rpm, Max.: 6,375 rpm	Misfire 0: 0 rpm	—
MISFIRE LOAD (MISFIRE LOAD)	Engine load for first misfire range/ Min.: 0 g/rev, Max.: 3.98 g/rev	Misfire 0: 0 g/rev	—
FC TAU (FC TAU)	Fuel cut TAU: Fuel cut during very light load/ ON or OFF	Fuel cut operating: ON	Fuel cut is being performed under very light load to prevent engine combustion from becoming incomplete
Check Mode (CHECK MODE)	Check mode/ ON or OFF	Check mode ON: ON	See page 05–20

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

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2. ACTIVE TEST

HINT:

Performing an Active Test using the intelligent tester II enables components including the relay, VSV, and actuator to be operated without removing any parts. Performing the Active Test as the first step of trouble-shooting is one method to shorten diagnostic time.

Data List is displayed during an Active Test.

(a) Warm up the engine.
(b) Turn the ignition switch to OFF.
(c) Connect the intelligent tester II to the DLC3.
(d) Turn the ignition switch to ON.
(e) Turn the intelligent tester II ON.
(f) Select the following menu items: Powertrain / Engine and ECT / Active Test.
(g) Perform the Active Test by referring to the following table.

Intelligent Tester II Display (Abbreviation)	Test Details	Diagnostic Note
Injector Volume (INJ VOL)	[Test Details] Control the injection volume Min.: –12 %, Max.: 25 % [Vehicle Condition] Engine speed: 3,000 rpm or less	• All injectors are tested at once • Injection volume is gradually changed between –12 % and 25 %
A/F Control (A/F CONTROL)	[Test Details] Control the injection volume –12.5 or 25 % (Change the injection volume by 12.5 % or 25 %) [Vehicle Condition] Engine speed: 3,000 rpm or less	The following A/F Control procedure enables the technician to check and graph the voltage outputs of both the heated oxygen sensors To display the graph, select the following menu items: View / Line graph 1 or Line graph 2
Fuel Pump Relay (FUEL PMP SP CTL)	[Test Details] Control the fuel pump speed ON or OFF	—
Purge VSV (EVAP (PURGE) VSV)	[Test Details] Activate the EVAP VSV control ON or OFF	—
VVT Control (Bank 1) (VVT CTRL B1)	[Test Details] Activate the VVT system (Bank 1) ON or OFF	• ON: Rough idle or engine stall • OFF: Normal engine speed
FC IDL Prohibit (FC IDL PROHBT)	[Test Details] Control the idle fuel cut prohibition ON or OFF	During idling
TE1 (TC) (TC/TE1)	[Test Details] Connect the TC and TE1 ON or OFF	—

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054JD–22

DIAGNOSTIC TROUBLE CODE CHART

HINT:

Parameters listed in the chart may not be exactly the same as your readings due to factors such as the type of instrument.

If a DTC is displayed during the DTC check in check mode, check the circuit for the DTC listed in the table below. For details of each DTC, refer to the "See page" under the respective "DTC No." in this chart.

DTC No. (See Page)	Detection Item	Trouble Area	*1 MIL	Memory
P0010 (05–34)	Camshaft Position "A" Actuator Circuit (Bank 1)	• Open or short in oil control valve circuit • Oil control valve • ECM	○	○
P0011 (05–38)	Camshaft Position "A" –Timing Over–Advanced or System Performance (Bank 1)	• Valve timing • Oil control valve • Camshaft timing gear assy • ECM	—	○
P0012 (05–38)	Camshaft Position "A" –Timing Over– Retarded (Bank 1)	• Valve timing • Oil control valve • Camshaft timing gear assy • ECM	—	○
P0016 (05–42)	Crankshaft Position – Camshaft Position Correlation (Bank 1 Sensor A)	• Mechanical system (Jumped tooth of timing chain or chain stretched) • ECM	—	○
P0031 (05–43)	Oxygen Sensor Heater Control Circuit Low (Bank 1 Sensor 1)	• Open or short in heater circuit of heated oxygen sensor • Heated oxygen sensor heater (Sensor 1) • EFI relay • ECM	○	○
P0032 (05–43)	Oxygen Sensor Heater Control Circuit High (Bank 1 Sensor 1)	• Open or short in heater circuit of heated oxygen sensor • Heated oxygen sensor heater (Sensor 1) • EFI relay • ECM	○	○
P0037 (05–46)	Oxygen Sensor Heater Control Circuit Low (Bank 1 Sensor 2)	• Open in heater circuit of heated oxygen sensor • Heated oxygen sensor heater (Sensor 2) • EFI relay • ECM	○	○
P0038 (05–46)	Oxygen Sensor Heater Control Circuit High (Bank 1 Sensor 2)	• Short in heater circuit of heated oxygen sensor • Heated oxygen sensor heater (Sensor 2) • EFI relay • ECM	○	○
P0100 (05–49)	Mass Air Flow Circuit Malfunction	• Open or short in mass air flow meter circuit • Mass air flow meter • ECM	○	○
P0102 (05–49)	Mass or Volume Air Flow Circuit Low Input	• Open in mass air flow meter circuit • Mass air flow meter • ECM	○	○
P0103 (05–49)	Mass or Volume Air Flow Circuit High Input	• Short in mass air flow meter circuit • Mass air flow meter • ECM	○	○
P0110 (05–55)	Intake Air Temperature Circuit	• Open or short in intake air temperature sensor circuit • Intake air temperature sensor (built into mass air flow meter) • ECM	○	○
P0112 (05–55)	Intake Air Temperature Circuit Low Input	• Short in intake air temperature sensor circuit • Intake air temperature sensor (built into mass air flow meter) • ECM	○	○
P0113 (05–55)	Intake Air Temperature Circuit High Input	• Open in intake air temperature sensor circuit • Intake air temperature sensor (built into mass air flow meter) • ECM	○	○

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DTC No. (See Page)	Detection Item	Trouble Area	*1 MIL	Memory
P0115 (05–60)	Engine Coolant Temperature Circuit	• Open or short in engine coolant temperature sensor circuit • Engine coolant temperature sensor • ECM	○	○
P0116 (05–65)	Engine Coolant Temperature Circuit Range/Performance Problem	• Engine coolant temperature sensor	○	○
P0117 (05–60)	Engine Coolant Temperature Circuit Low Input	• Short in engine coolant temperature sensor circuit • Engine coolant temperature sensor • ECM	○	○
P0118 (05–60)	Engine Coolant Temperature Circuit High Input	• Open in engine coolant temperature sensor circuit • Engine coolant temperature sensor • ECM	○	○
P0120 (05–66)	Throttle/Pedal Position Sensor/ Switch "A" Circuit	• Throttle position sensor (built into throttle body) • ECM	○	○
P0121 (05–73)	Throttle/Pedal Position Sensor/ Switch "A" Circuit Range/Performance Problem	• Throttle position sensor (built into throttle body)	○	○
P0122 (05–66)	Throttle/Pedal Position Sensor/ Switch "A" Circuit Low Input	• Throttle position sensor (built into throttle body) • Short in VTA1 circuit • Open in VC circuit • ECM	○	○
P0123 (05–66)	Throttle/Pedal Position Sensor/ Switch "A" Circuit High Input	• Throttle position sensor (built into throttle body) • Open in VTA1 circuit • Open in E2 circuit • VC and VTA1 circuits are short–circuited • ECM	○	○
P0130 *4 (05–74)	Oxygen Sensor Circuit Malfunction (Bank 1 Sensor 1)	• Open or short in heated oxygen sensor circuit • Heated oxygen sensor (Sensor 1) • Heated oxygen sensor heater (Sensor 1) • EFI relay • Air induction system • Fuel pressure • Injector • ECM	○	○
P0133 *4 (05–84)	Oxygen Sensor Circuit Slow Response (Bank 1 Sensor 1)	• Open or short in heated oxygen sensor circuit • Heated oxygen sensor (Sensor 1) • Heated oxygen sensor heater (Sensor 1) • EFI relay • Air induction system • Fuel pressure • Injector • ECM	○	○
P0134 (05–91)	Oxygen Sensor Circuit No Activity Detected (Bank 1 Sensor 1)	• Open or short in heated oxygen sensor circuit • Heated oxygen sensor (Sensor 1) • PCV valve and hose • EFI relay • Air induction system • Fuel pressure • Injector • Gas leakage in exhaust system • ECM	○	○
P0136 (05–100)	Oxygen Sensor Circuit Malfunction (Bank 1 Sensor 2)	• Open or short in heated oxygen sensor circuit • Heated oxygen sensor (sensor 2) • Heated oxygen sensor heater (sensor 2) • EFI relay	○	○

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DTC No. (See Page)	Detection Item	Trouble Area	*1 MIL	Memory
P0171 *4 (05–106)	System Too Lean (Bank 1)	• Air induction system • Injector blockage • Mass air flow meter • Engine coolant temperature sensor • Fuel pressure • Gas leakage in exhaust system • Open or short in heated oxygen sensor (sensor 1) circuit • Heated oxygen sensor (sensor 1) • PCV valve and hose • PCV hose connection • ECM	○	○
P0172 *4 (05–106)	System Too Rich (Bank 1)	• Injector leakage or blockage • Mass air flow meter • Engine coolant temperature sensor • Ignition system • Fuel pressure • Gas leakage in exhaust system • Open or short in heated oxygen sensor (sensor 1) circuit • Heated oxygen sensor (sensor 1) • ECM	○	○
P0220 (05–66)	Throttle/Pedal Position Sensor/ Switch "B" Circuit	• Throttle position sensor (built into throttle body) • ECM	○	○
P0222 (05–66)	Throttle/Pedal Position Sensor/ Switch "B" Circuit Low Input	• Throttle position sensor (built into throttle body) • Short in VTA2 circuit • Open in VC circuit • ECM	○	○
P0223 (05–66)	Throttle/Pedal Position Sensor/ Switch "B" Circuit High Input	• Throttle position sensor (built into throttle body) • Open in VTA2 circuit • Open in E2 circuit • VC and VTA2 circuits are short–circuited • ECM	○	○
P0300 *4 (05–118)	Random/Multiple Cylinder Misfire Detected	• Open or short in engine wire harness • 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	○ *2	○
P0301 *4 (05–118)	Cylinder 1 Misfire Detected	• Same as DTC P0300	○ *2	○
P0302 *4 (05–118)	Cylinder 2 Misfire Detected	• Same as DTC P0300	○ *2	○
P0303 *4 (05–118)	Cylinder 3 Misfire Detected	• Same as DTC P0300	○ *2	○
P0304 *4 (05–118)	Cylinder 4 Misfire Detected	• Same as DTC P0300	○ *2	○
P0325 (05–132)	Knock Sensor 1 Circuit (Bank 1 or Single Sensor)	• Open or short in knock sensor circuit • Knock sensor (under–torqued or looseness) • ECM	○	○

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DTC No. (See Page)	Detection Item	Trouble Area	*1 MIL	Memory
P0327 (05–132)	Knock Sensor 1 Circuit Low Input (Bank 1 or Single Sensor)	• Short in knock sensor circuit • Knock sensor • ECM	○	○
P0328 (05–132)	Knock Sensor 1 Circuit High Input (Bank 1 or Single Sensor)	• Open in knock sensor circuit • Knock sensor • ECM	○	○
P0335 (05–136)	Crankshaft Position Sensor "A" Circuit	• Open or short in crankshaft position sensor circuit • Crankshaft position sensor • Sensor plate (crankshaft) • ECM	○	○
P0339 (05–136)	Crankshaft Position Sensor "A" Circuit Intermittent	• Same as DTC P0335	—	○
P0340 (05–140)	Camshaft Position Sensor "A" Circuit (Bank 1 or Single Sensor)	• Open or short in camshaft position sensor circuit • Camshaft position sensor • Camshaft timing pulley • Jumped tooth of timing chain • ECM	○	○
P0341 (05–140)	Camshaft Position Sensor "A" Circuit Range/Performance (Bank 1 or Single Sensor)	• Same as DTC P0340	○	○
P0351 (05–143)	Ignition Coil "A" Primary/Secondary Circuit	• Ignition system • Open or short in IGF or IGT1 to 4 circuit from ignition coil with igniter to ECM • No. 1 to No. 4 ignition coil with igniter • ECM	○	○
P0352 (05–143)	Ignition Coil "B" Primary/Secondary Circuit	• Same as DTC P0351	○	○
P0353 (05–143)	Ignition Coil "C" Primary/Secondary Circuit	• Same as DTC P0351	○	○
P0354 (05–143)	Ignition Coil "D" Primary/Secondary Circuit	• Same as DTC P0351	○	○
P0420 *4 (05–150)	Catalyst System Efficiency Below Threshold (Bank 1)	• Gas leakage in exhaust system • Heated oxygen sensor (sensor 1) • Heated oxygen sensor (sensor 2) • Three–way catalytic converter	○	○
P0443 (05–155)	Evaporative Emission Control System Purge Control Valve Circuit	• Open or short in EVAP VSV circuit • EVAP VSV • ECM	○	○
P0500 (05–158)	Vehicle Speed Sensor "A"	• Open or short in speed sensor circuit • Speed sensor • Combination meter • ECM • Skid control ECU	○	○
P0504 (05–161)	Brake Switch "A"/"B" Correlation	• Short in stop lamp switch signal circuit • Stop lamp fuse • Stop lamp switch • ECM	—	○
P0505 (05–165)	Idle Air Control System	• Electronic throttle control system • Air induction system • PCV hose connection	○	○
P0560 (05–167)	System Voltage	• Open in backup power source circuit • ECM	○	○
P0604 (05–170)	Internal Control Module Random Access Memory (RAM) Error	• ECM	○	○
P0606 (05–170)	ECM/PCM Processor	• ECM	○	○

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DTC No. (See Page)	Detection Item	Trouble Area	*1 MIL	Memory
P0607 (05–170)	Control Module Performance	• ECM	○	○
P0617 (05–171)	Starter Relay Circuit High	• Short in park/neutral position switch circuit (MMT) • Short in STA circuit • Park/neutral position switch (MMT) • ECM	○	○
P0657 (05–170)	Actuator Supply Voltage Circuit / Open	• ECM	○	○
P0705 (05–247)	Transmission Range Sensor Circuit Malfunction (PRNDL Input)	• Electronic control automatic transaxle	○	○
P0710 (05–252)	Transmission Fluid Temperature Sensor "A" Circuit	• Electronic control automatic transaxle	○	○
P0711 (05–255)	Transmission Fluid Temperature Sensor "A" Performance	• Electronic control automatic transaxle	○	○
P0712 (05–252)	Transmission Fluid Temperature Sensor "A" Circuit Low Input	• Electronic control automatic transaxle	○	○
P0713 (05–252)	Transmission Fluid Temperature Sensor "A" Circuit High Input	• Electronic control automatic transaxle	○	○
P0717 (05–258)	Turbine Speed Sensor Circuit No Signal	• Electronic control automatic transaxle	○	○
P0724 (05–261)	Brake Switch "B" Circuit High	• Electronic control automatic transaxle	○	○
P0741 (05–264)	Torque Converter Clutch Solenoid Performance (Shift Solenoid Valve SL)	• Electronic control automatic transaxle	○	○
P0751 (05–268)	Shift Solenoid "A" Performance (Shift Solenoid Valve S1)	• Electronic control automatic transaxle	○	○
P0756 (05–271)	Shift Solenoid "B" Performance (Shift Solenoid Valve S2)	• Electronic control automatic transaxle	○	○
P0787 (05–274)	Shift/Timing Solenoid Low (Shift Solenoid Valve ST)	• Electronic control automatic transaxle	○	○
P0788 (05–274)	Shift/Timing Solenoid High (Shift Solenoid Valve ST)	• Electronic control automatic transaxle	○	○
P0973 (05–277)	Shift Solenoid "A" Control Circuit Low (Shift Solenoid Valve S1)	• Electronic control automatic transaxle	○	○
P0974 (05–277)	Shift Solenoid "A" Control Circuit High (Shift Solenoid Valve S1)	• Electronic control automatic transaxle	○	○
P0976 (05–280)	Shift Solenoid "B" Control Circuit Low (Shift Solenoid Valve S2)	• Electronic control automatic transaxle	○	○
P0977 (05–280)	Shift Solenoid "B" Control Circuit High (Shift Solenoid Valve S2)	• Electronic control automatic transaxle	○	○
P0998 (05–283)	Shift Solenoid "F" Control Circuit Low (Shift Solenoid Valve SB)	• Electronic control automatic transaxle	○	○
P0999 (05–283)	Shift Solenoid "F" Control Circuit High (Shift Solenoid Valve SB)	• Electronic control automatic transaxle	○	○
P2102 (05–174)	Throttle Actuator Control Motor Circuit Low	• Open in throttle control actuator circuit • Throttle actuator • ECM	○	○
P2103 (05–174)	Throttle Actuator Control Motor Circuit High	• Short in throttle control actuator circuit • Throttle actuator • Throttle valve • Throttle body assembly • ECM	○	○

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DTC No. (See Page)	Detection Item	Trouble Area	*1 MIL	Memory
P2111 (05–177)	Throttle Actuator Control System – Stuck Open	• Throttle actuator • Throttle body assembly • Throttle valve	○	○
P2112 (05–177)	Throttle Actuator Control System – Stuck Closed	• Same as DTC P2111	○	○
P2118 (05–179)	Throttle Actuator Control Motor CurrentRange/Performance	• Open in ETCS power source circuit • ETCS fuse • ECM	○	○
P2119 (05–182)	Throttle Actuator Control Throttle BodyRange/Performance	• Electronic throttle control system • ECM	○	○
P2120 (05–184)	Throttle/Pedal Position Sensor/ Switch "D" Circuit	• Accelerator pedal position sensor • ECM	○	○
P2121 (05–192)	Throttle/Pedal Position Sensor/ Switch "D" Circuit Range/Perfor- mance	• Accelerator pedal position sensor circuit • Accelerator pedal position sensor • ECM	○	○
P2122 (05–184)	Throttle/Pedal Position Sensor/ Switch "D" Circuit Low Input	• Accelerator pedal position sensor • Open in VCP1 circuit • Open or ground short in VPA1 circuit • ECM	○	○
P2123 (05–184)	Throttle/Pedal Position Sensor/ Switch "D" Circuit High Input	• Accelerator pedal position sensor • Open in EPA circuit • ECM	○	○
P2125 (05–184)	Throttle/Pedal Position Sensor/ Switch "E" Circuit	• Accelerator pedal position sensor • ECM	○	○
P2127 (05–184)	Throttle/Pedal Position Sensor/ Switch "E" Circuit Low Input	• Accelerator pedal position sensor • Open in VCP2 circuit • Open or ground short in VPA2 circuit • ECM	○	○
P2128 (05–184)	Throttle/Pedal Position Sensor/ Switch "E" Circuit High Input	• Accelerator pedal position sensor • Open in EPA2 circuit • ECM	○	○
P2135 (05–66)	Throttle/Pedal Position Sensor/ Switch "A"/"B" Voltage Correla- tion	• VTA1 and VTA2 circuits are short–circuited • Throttle position sensor (built into throttle body) • ECM	○	○
P2138 (05–184)	Throttle/Pedal Position Sensor/ Switch "D"/"E" Voltage Correla- tion	• VPA1 and VPA2 circuits are short circuited • Accelerator pedal position sensor • ECM	○	○
P2195 *4 (05–74)	Oxygen Sensor Signal Stuck Lean (Bank 1 Sensor 1)	• Open or short in heated oxygen sensor circuit • Heated oxygen sensor (Sensor 1) • Heated oxygen sensor heater (Sensor 1) • EFI relay • Air induction system • Fuel pressure • Injector • ECM	○	○
P2196 *4 (05–74)	Oxygen Sensor Signal Stuck Rich (Bank 1 Sensor 1)	• Same as DTC P2195	○	○
P2716 (05–286)	Pressure Control Solenoid "D" Electrical (Shift Solenoid SLT)	• Electronic control automatic transaxle	○	○
P2769 (05–289)	Torque Converter Clutch Sole- noid Circuit Low (Shift Solenoid Valve SL)	• Electronic control automatic transaxle	○	○

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DTC No. (See Page)	Detection Item	Trouble Area	*1 MIL	Memory
P2770 (05–289)	Torque Converter Clutch Solenoid Circuit High (Shift Solenoid Valve SL)	• Electronic control automatic transaxle	○	○
B2799 (*3)	Engine Immobilizer System Malfunction	• Immobilizer system	—	○

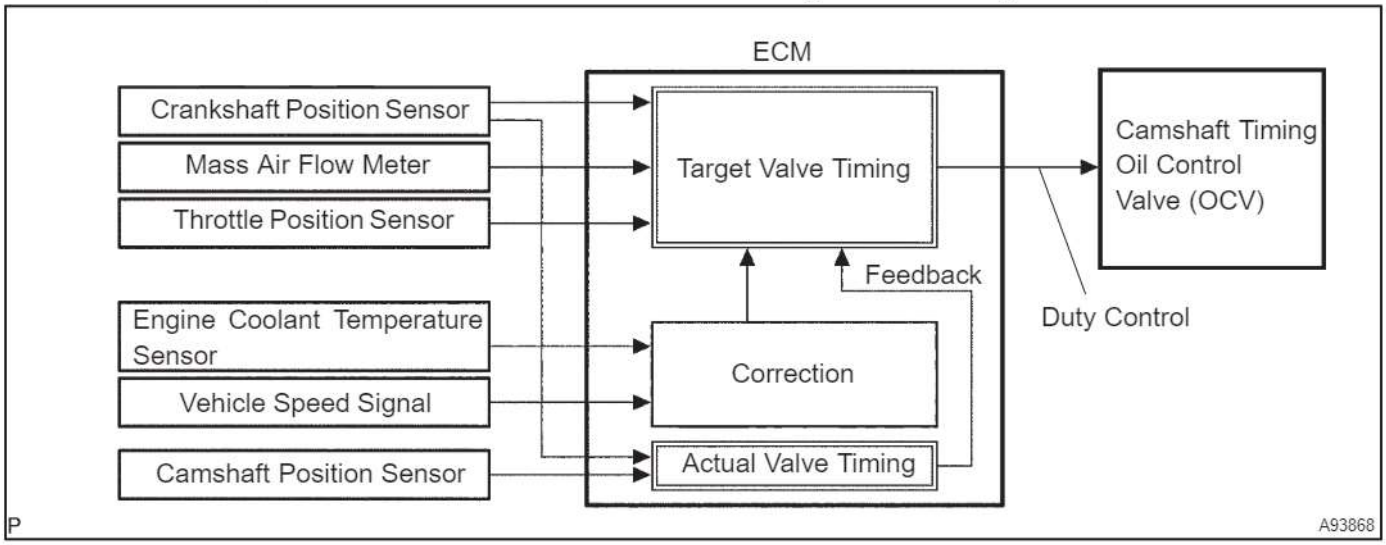
*1: MIL (Malfunction Indicator Lamp) illuminates.
*2: MIL illuminates or flashes continuously.
*3: See page 05–1625 of Pub. No. RM1018E AVENSIS.
*4: Euro–OBD vehicles

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DTC	P0010	CAMSHAFT POSITION "A" ACTUATOR CIRCUIT (BANK 1)

CIRCUIT DESCRIPTION

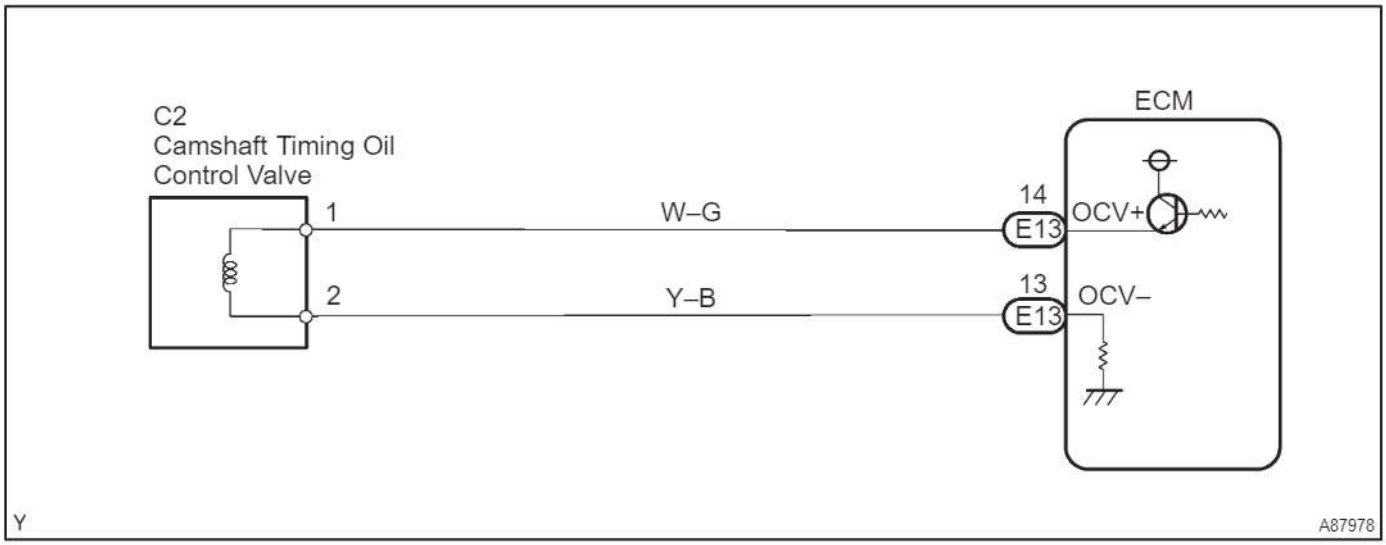
The Variable Valve Timing (VVT) system includes the ECM, Oil Control Valve (OCV) and VVT controller. The ECM sends a target "duty–cycle" control signal to the OCV. This control signal, applied to the OCV, regulates the oil pressure supplied to the VVT controller. Camshaft timing control is performed based on engine operating conditions such as intake air volume, throttle position and engine coolant temperature.
The ECM controls the OCV based on the signals from several sensors. The VVT controller regulates the intake camshaft angle using oil pressure through the OCV. As a result, the relative position between the camshaft and crankshaft is optimized, the engine torque and the fuel economy improve, and the exhaust emission drops. The ECM detects the actual valve timing using signals from the camshaft and crankshaft position sensors. The ECM performs feedback control and verifies target valve timing.



DTC No.	DTC Detection Condition	Trouble Area
P0010	Open or short in oil control valve circuit (1 trip detection logic)	• Open or short in oil control valve circuit • Oil control valve • ECM

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WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

Read freeze frame data using the intelligent tester II. Freeze frame data record the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, 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	PERFORM ACTIVE TEST USING INTELLIGENT TESTER II(OPERATE OCV)

(a) Start the engine and warm it up.
(b) Turn the ignition switch to OFF.
(c) Connect the intelligent tester II to the DLC3.
(d) Turn the ignition switch to ON and turn the intelligent tester II ON.
(e) Select the following menu items: Powertrain / Engine and ECT / Active Test / VVT Control (Bank 1).
(f) Check the engine speed when operating the OCV using the intelligent tester II.

Standard:

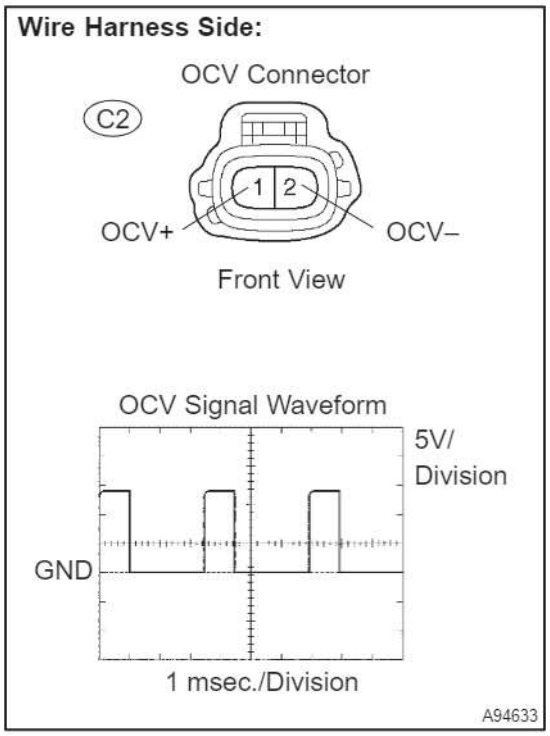
Tester Operation	Specified Condition
OCV is OFF	Normal engine speed
OCV is ON	Rough idling or engine stalling

OK → **CHECK FOR INTERMITTENT PROBLEMS** (See page 05–9)

NG

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2 INSPECT CAMSHAFT TIMING OIL CONTROL VALVE ASSY(OCV)



(a) Disconnect the C2 OCV connector.
(b) During idling, check the waveform between the specified terminals of the C2 OCV connector using the oscilloscope.

Standard:

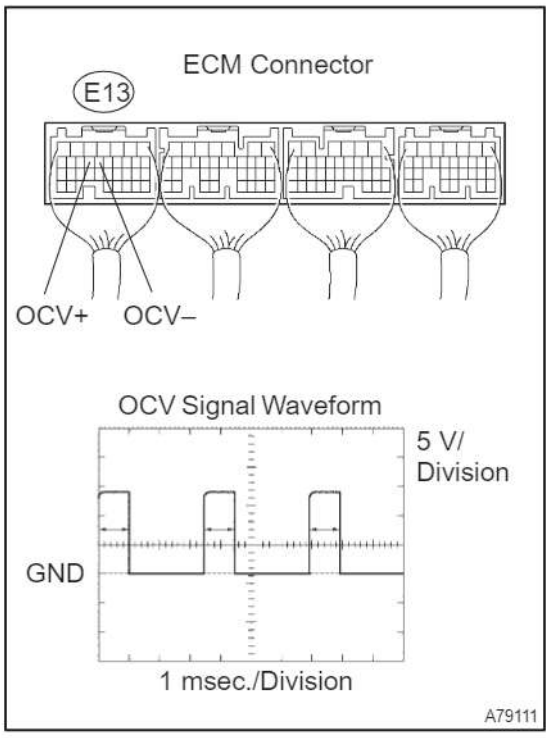
Tester Connection	Specified Condition
OCV+ (C2–1) – OCV– (C2–2)	Correct waveform is as shown

(c) Reconnect the OCV connector.

NG → **REPLACE CAMSHAFT TIMING OIL CONTROL VALVE ASSY**

OK

3 INSPECT ECM(OCV SIGNAL)



(a) Inspect using the oscilloscope.
(b) During idling, check the waveform between the specified terminals of the E13 ECM connector.

Standard:

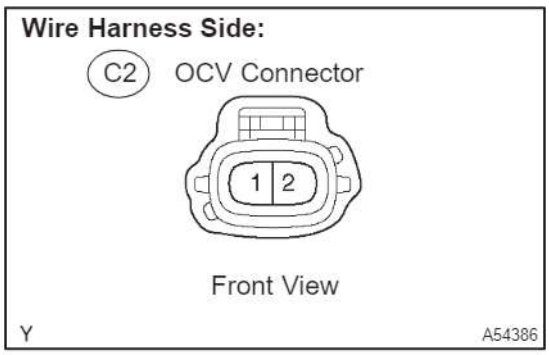
Tester Connection	Specified Condition
OCV+ (E13–14) – OCV– (E13–13)	Correct waveform is as shown

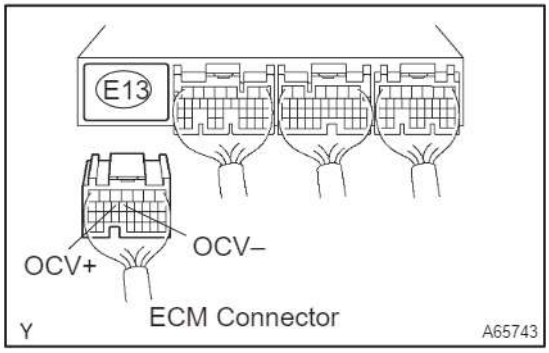
NG → **REPLACE ECM (See page 10–65 of Pub. No. RM1018E AVENSIS)**

OK

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4	CHECK HARNESS AND CONNECTOR(CAMSHAFT TIMING OIL CONTROL VALVE (OCV) – ECM)





(a) Disconnect the C2 OCV connector.
(b) Disconnect the E13 ECM connector.
(c) Check the resistance.

Standard (Check for open):

Tester Connection	Specified Condition
OCV (C2–1) – OCV+ (E13–14)	Below 1 Ω
OCV (C2–2) – OCV– (E13–13)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
OCV (C2–1) or OCV+ (E13–14) – Body ground	10 kΩ or higher
OCV (C2–1) or OCV– (E13–13) – Body ground	10 kΩ or higher

(d) Reconnect the OCV connector.
(e) Reconnect the ECM connector.

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

OK

CHECK FOR INTERMITTENT PROBLEMS (See page 05–9)

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DTC	P0011	CAMSHAFT POSITION "A" –TIMING OVER–ADVANCED OR SYSTEM PERFORMANCE (BANK 1)

DTC	P0012	CAMSHAFT POSITION "A" –TIMING OVER–RETARDED (BANK 1)

CIRCUIT DESCRIPTION

Refer to DTC P0010 on page 05–34.

DTC No.	DTC Detection Condition	Trouble Area
P0011	Advanced cam timing: After engine is warmed up, valve timing does not change from current valve timing while driving at engine speed of 500 to 4,000 rpm (1 trip detection logic)	• Valve timing • Oil control valve • Camshaft timing gear assy • ECM
P0012	Retarded cam timing: After engine is warmed up, valve timing does not change from current valve timing while driving at engine speed of 500 to 4,000 rpm (2 trip detection logic)	• Valve timing • Oil control valve • Camshaft timing gear assy • ECM

WIRING DIAGRAM

Refer to DTC P0010 on page 05–34.

INSPECTION PROCEDURE

HINT:

Advanced timing over (Valve timing is out of specified range)	P0011
Retarded timing over (Valve timing is out of specified range)	P0012

- If DTC P0011 or P0012 is displayed, check the VVT system circuit.
- Read freeze frame data using the intelligent tester II. Freeze frame data record the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, 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	CHECK VALVE TIMING (See page 14–49 of Pub. No. RM1018E AVENSIS)

(a) Check for looseness or a jumped tooth of the timing chain.
OK: The matchmarks of the crankshaft pulley and camshaft pulley are aligned.

NG → ADJUST VALVE TIMING (See page 14–49 of Pub. No. RM1018E AVENSIS)

OK

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2 PERFORM ACTIVE TEST USING INTELLIGENT TESTER II(OPERATE OCV)

(a) Start the engine and warm it up.
(b) Turn the ignition switch to OFF.
(c) Connect the intelligent tester II to the DLC3.
(d) Turn the ignition switch to ON and turn the intelligent tester II ON.
(e) Select the following menu items: Powertrain / Engine and ECT / Active Test / VVT Control (Bank 1).
(f) Check the engine speed when operating the OCV using the intelligent tester II.

Standard:

Tester Operation	Specified Condition
OCV is OFF	Normal engine speed
OCV is ON	Rough idling or engine stalling

NG → **Go to step 4**

OK

3 CHECK IF DTC OUTPUT RECURS(DTC P0011 OR P0012)

(a) Clear the DTC(s) using the intelligent tester II (see page 05–18).
(b) Start the engine and warm it up.
(c) Drive the vehicle for 10 minutes or more.
(d) Read output DTCs using the intelligent tester II.

OK: No DTC output.

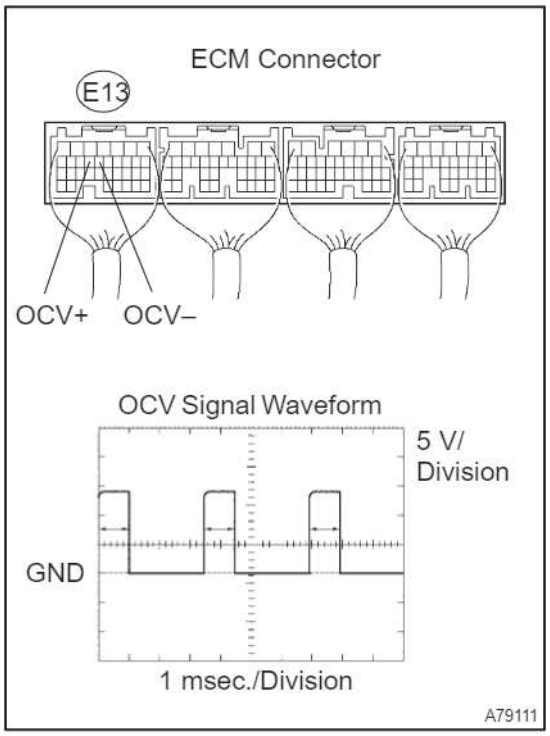
OK → **VVT SYSTEM OK**

HINT:
DTC P0011 or P0012 is output when foreign objects in engine oil are caught in some part of the system. These DTCs will remain set even when the system returns to normal after a short time. Foreign objects are filtered out by the oil filter.

NG

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4	INSPECT ECM(OCV SIGNAL)



(a) Inspect using the oscilloscope.
(b) During idling, check the waveform between the specified terminals of the E13 ECM connector.

Standard:

Tester Connection	Specified Condition
OCV+ (E13–14) – OCV– (E13–13)	Correct waveform is as shown

NG → **REPLACE ECM(See page 10–65 of Pub. No. RM1018E AVENSIS)**

OK

5	INSPECT OIL CONTROL VALVE FILTER

OK: The filter is not clogged.

NG → **REPLACE OIL CONTROL VALVE FILTER**

OK

6	INSPECT CAMSHAFT TIMING OIL CONTROL VALVE ASSY(OCV) (See page 10–3)

OK: The OCV has no contamination and moves smoothly.

OK → **Go to step 8**

NG

7	REPLACE CAMSHAFT TIMING OIL CONTROL VALVE ASSY(OCV)

GO

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8	**INSPECT CAMSHAFT TIMING GEAR ASSY (See page 14–64 of Pub. No. RM1018E AVENSIS)**

OK: The camshaft timing gear rotates smoothly when applying pressure.

OK → **Go to step 10**

NG

9	**REPLACE CAMSHAFT TIMING GEAR ASSY**

GO

10	**CHECK FOR BLOCKAGE(OCV, OIL CHECK VALVE AND OIL HOLE)**

OK: No blockage.

NG → **REPAIR OR REPLACE**

OK

11	**CHECK IF DTC OUTPUT RECURS(DTC P0011 OR P0012)**

(a) Clear the DTC(s) using the intelligent tester II (see page 05–18).
(b) Start the engine and warm it up.
(c) Drive the vehicle for 10 minutes or more.
(d) Read output DTCs using the intelligent tester II.

Standard: No DTC output.

OK → **VVT SYSTEM OK**

HINT:
DTC P0011 or P0012 is output when foreign objects in engine oil are caught in some part of the system. These DTCs will remain set even when the system returns to normal after a short time. Foreign objects are filtered out by the oil filter.

NG

REPLACE ECM (See page 10–65 of Pub. No. RM1018E AVENSIS)

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DTC	P0016	CRANKSHAFT POSITION – CAMSHAFT POSITION CORRELATION (BANK 1 SENSOR A)

CIRCUIT DESCRIPTION

Refer to DTC P0335 and P0339 on page 05–136.

DTC No.	DTC Detection Condition	Trouble Area
P0016	Deviation in crankshaft position sensor signal and camshaft position signal (2 trip detection logic)	• Mechanical system (Jumped tooth of timing chain or chain stretched) • ECM

WIRING DIAGRAM

Refer to DTC P0335 and P0339 on page 05–136.

INSPECTION PROCEDURE

Read freeze frame data using the intelligent tester II. Freeze frame data record the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, 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	CHECK VALVE TIMING(CHECK FOR LOOSENESS AND JUMPED TEETH ON TIMING CHAIN) (See page 14–49 of Pub. No. RM1018E AVENSIS)

(a) Check for looseness or a jumped tooth of the timing chain.
OK: The matchmarks of the crankshaft pulley and camshaft pulley are aligned.

NG → **ADJUST VALVE TIMING (See page 14–49 of Pub. No. RM1018E AVENSIS) (REPAIR OR REPLACE TIMING CHAIN)**

OK

REPLACE ECM (See page 10–65 of Pub. No. RM1018E AVENSIS)

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DTC	P0031	OXYGEN SENSOR HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 1)

DTC	P0032	OXYGEN SENSOR HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 1)

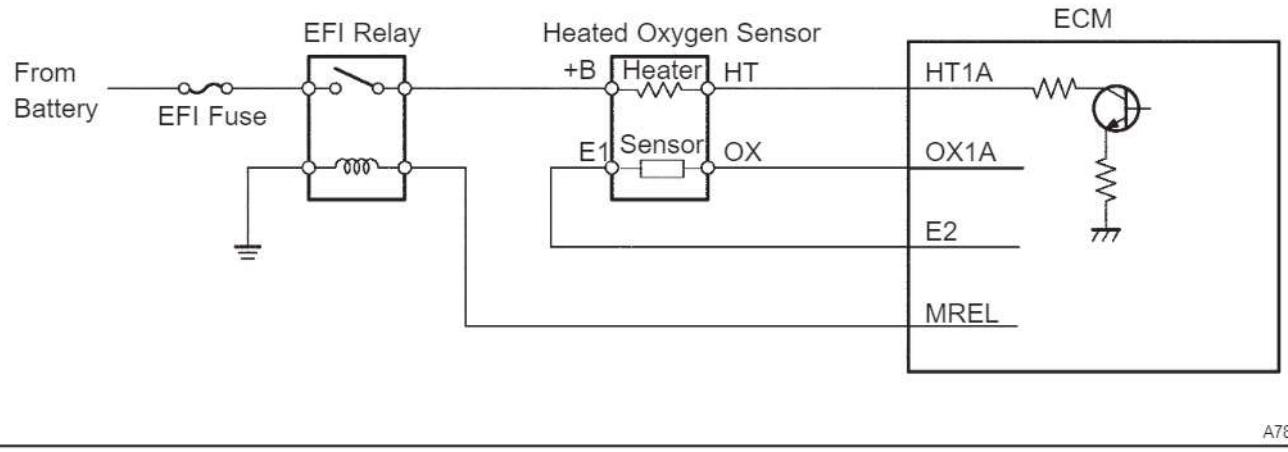
CIRCUIT DESCRIPTION

Refer to DTC P0130 on page 05–74.

HINT:

The ECM provides a pulse width modulated control circuit to adjust current through the heater. The heated oxygen sensor heater circuit uses a relay on the +B side of the circuit.

Reference (Sensor 1 System Diagram):



DTC No.	DTC Detection Condition	Trouble Area
P0031	Heated current is 0.8 A or less when heater operates (1 trip detection logic)	• Open or short in heater circuit of heated oxygen sensor • Heated oxygen sensor heater (sensor 1) • EFI relay • ECM
P0032	Heated current exceeds 10 A when the heater operates (1 trip detection logic)	• Open or short in heater circuit of heated oxygen sensor • Heated oxygen sensor heater (sensor 1) • EFI relay • ECM

HINT:

- Sensor 1 refers to the sensor mounted in front of the Three–Way Catalytic Converter (TWC) and located near the engine assembly.
- Sensor 2 refers to the sensor mounted behind the TWC and located far from the engine assembly.

WIRING DIAGRAM

Refer to DTC P0130 on page 05–74.

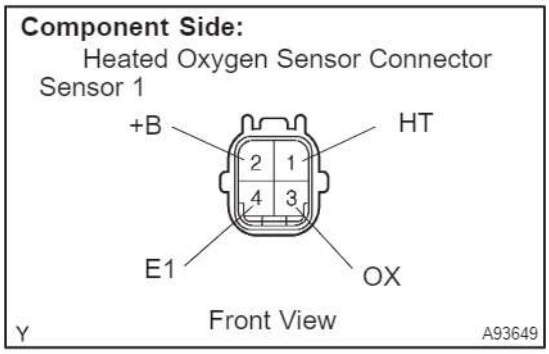
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INSPECTION PROCEDURE

HINT:

Read freeze frame data using the intelligent tester II. Freeze frame data record the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, 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 HEATED OXYGEN SENSOR(HEATER RESISTANCE)



(a) Disconnect the H7 heated oxygen sensor connector.

(b) Measure the resistance between the terminals of the heated oxygen sensor connector.

Standard (Sensor 1):

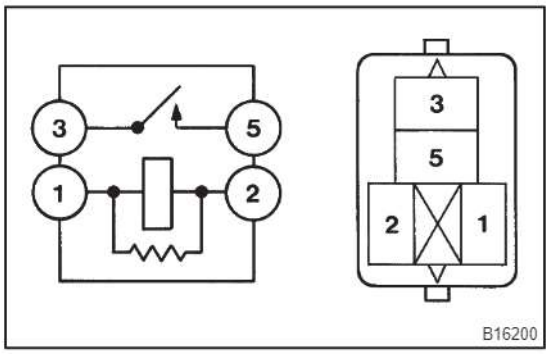
Tester Connection	Specified Condition
1 (HT) – 2 (+B)	5 to 10 Ω at 20°C (68°F)
1 (HT) – 4 (E1)	10 kΩ or higher

(c) Reconnect the heated oxygen sensor connector.

NG → **REPLACE HEATED OXYGEN SENSOR**

OK

2 INSPECT EFI RELAY



(a) Remove the EFI relay from the engine room R/B.

(b) Check the EFI relay resistance.

Standard:

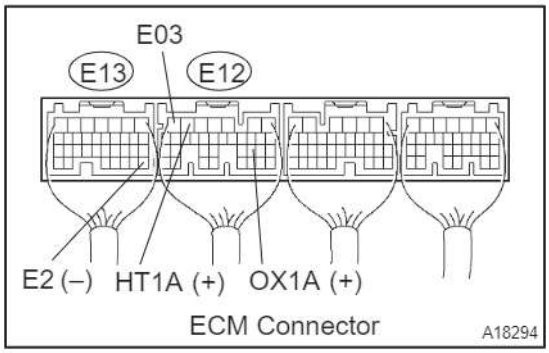
Tester Connection	Specified Condition
3 – 5	10 kΩ or higher
3 – 5	Below 1 Ω (Apply battery voltage to terminals 1 and 2)

(c) Reinstall the EFI relay.

NG → **REPLACE EFI RELAY**

OK

3 INSPECT ECM(HT1A VOLTAGE)



(a) Turn the ignition switch to ON.

(b) Measure the voltage between the applicable terminals of the E12 and E13 ECM connectors.

Standard:

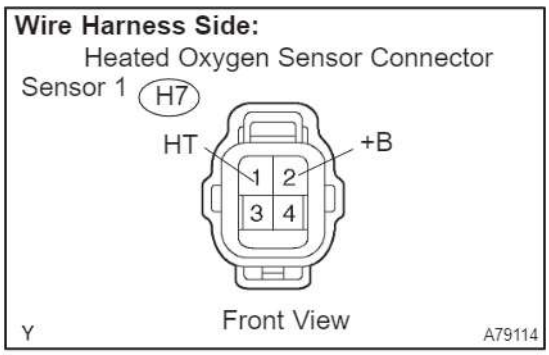
Tester Connection	Specified Condition
HT1A (E12–6) – E03 (E12–7)	9 to 14 V
OX1A (E12–22) – E2 (E13–28)	9 to 14 V

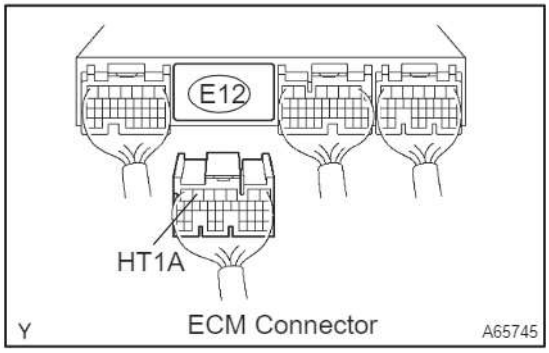
OK → **REPLACE ECM (See page 10–65 of Pub. No. RM1018E AVENSIS)**

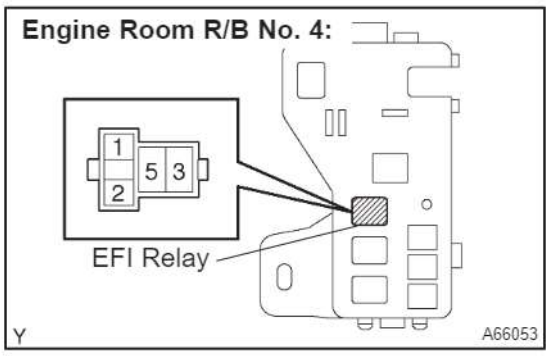
NG

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4	CHECK HARNESS AND CONNECTOR(HEATED OXYGEN SENSOR – ECM, HEATED OXYGEN SENSOR – EFI RELAY)







(a) Check the harness and the connectors between the ECM and the heated oxygen sensor.
(1) Disconnect the H7 heated oxygen sensor connector.
(2) Disconnect the E12 ECM connector.
(3) Check the resistance.

Standard (Check for open):

Tester Connection	Specified Condition
HT (H7–1) – HT1A (E12–6)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
HT (H7–1) or HT1A (E12–6) – Body ground	10 kΩ or higher

(4) Reconnect the heated oxygen sensor connector.
(5) Reconnect the ECM connector.

(b) Check the harness and the connectors between the heated oxygen sensor and EFI relay.
(1) Disconnect the H7 heated oxygen sensor connector.
(2) Remove the EFI relay from the engine room R/B No.4.
(3) Check the resistance.

Standard (Check for open):

Tester Connection	Specified Condition
+B (H7–2) – EFI relay (3)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
+B (H7–2) or EFI relay (3) – Body ground	10 kΩ or higher

(4) Reconnect the heated oxygen sensor connector.
(5) Reinstall the EFI relay.

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

OK

REPLACE ECM (See page 10–65 of Pub. No. RM1018E AVENSIS)

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DTC	P0037	OXYGEN SENSOR HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 2)

DTC	P0038	OXYGEN SENSOR HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 2)

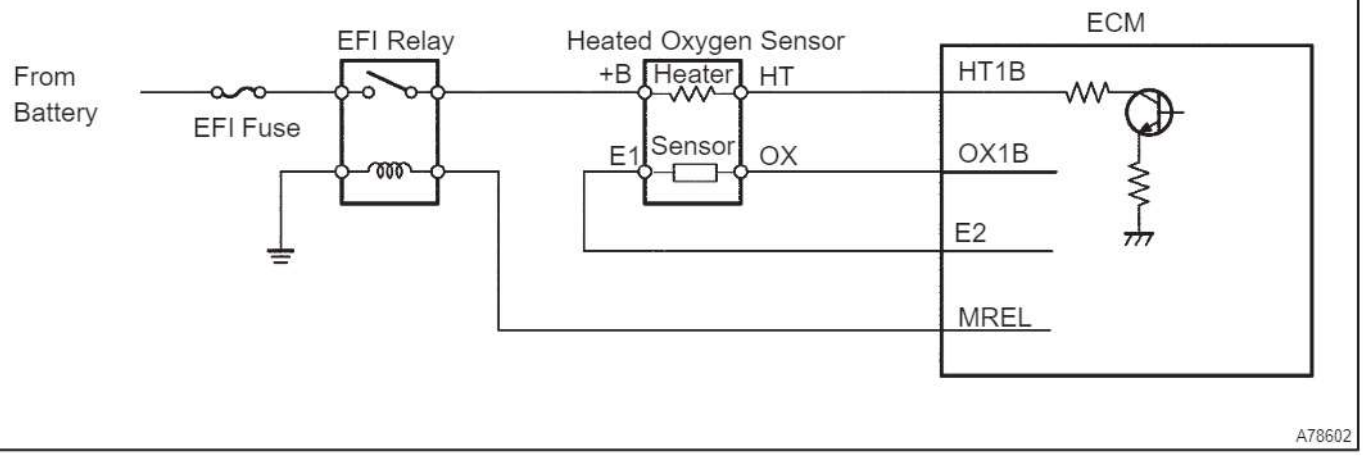
CIRCUIT DESCRIPTION

Refer to DTC P0130 on page 05–74.

HINT:

The ECM provides a pulse width modulated control circuit to adjust current through the heater. The heated oxygen sensor heater circuit uses a relay on the +B side of the circuit.

Reference (Sensor 2 System Diagram):



DTC No.	DTC Detection Condition	Trouble Area
P0037	Heated current is 0.25 A or less when heater operates (1 trip detection logic)	• Open in heater circuit of heated oxygen sensor • Heated oxygen sensor heater (sensor 2) • EFI relay • ECM
P0038	Heater current exceeds 2 A when heater operates (1 trip detection logic)	• Short in heater circuit of heated oxygen sensor • Heated oxygen sensor heater (sensor 2) • EFI relay • ECM

HINT:

- Sensor 1 refers to the sensor mounted in front of the Three–Way Catalytic Converter (TWC) and located near the engine assembly.
- Sensor 2 refers to the sensor mounted behind the TWC and located far from the engine assembly.

WIRING DIAGRAM

Refer to DTC P0130 on page 05–74.

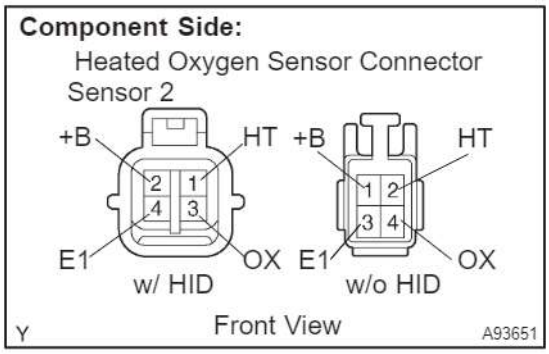
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INSPECTION PROCEDURE

HINT:

Read freeze frame data using the intelligent tester II. Freeze frame data record the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, 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 HEATED OXYGEN SENSOR(HEATER RESISTANCE)



(a) Disconnect the H17 heated oxygen sensor connector.

(b) Measure the resistance between the terminals of the heated oxygen sensor connector.

Standard:

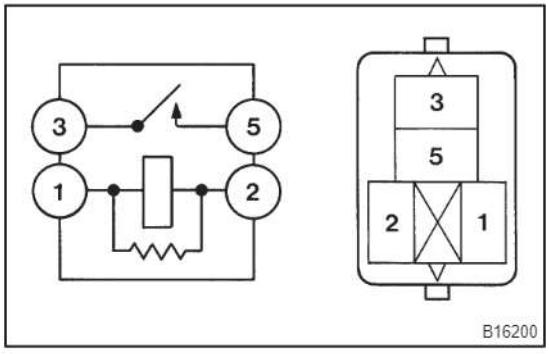
Tester Connection	Specified Condition
With HID: 1 (HT) – 2 (+B)	11 to 16 Ω at 20°C (68°F)
With HID: 1 (HT) – 4 (E1)	No Continuity
Without HID: 2 (HT) – 1 (+B)	11 to 16 Ω at 20°C (68°F)
Without HID: 2 (HT) – 3 (E1)	No Continuity

(c) Reconnect the heated oxygen sensor connector.

NG → **REPLACE HEATED OXYGEN SENSOR**

OK

2 INSPECT EFI RELAY



(a) Remove the EFI relay from the engine room R/B No. 4.

(b) Check the EFI relay resistance.

Standard:

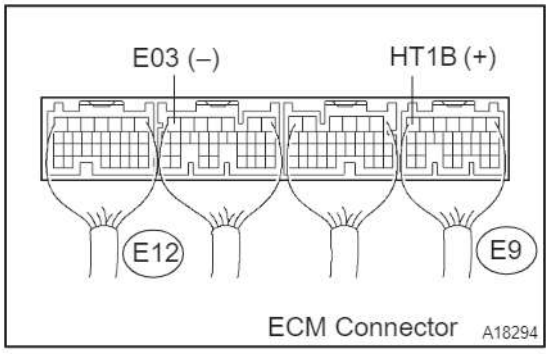
Tester Connection	Specified Condition
3 – 5	10 kΩ or higher
3 – 5	Below 1 Ω (Apply battery voltage to terminals 1 and 2)

(c) Reinstall the EFI relay.

NG → **REPLACE EFI RELAY**

OK

3 INSPECT ECM(HT1B VOLTAGE)



(a) Turn the ignition switch to ON.

(b) Measure the voltage between the applicable terminals of the E9 and E12 ECM connectors.

Standard:

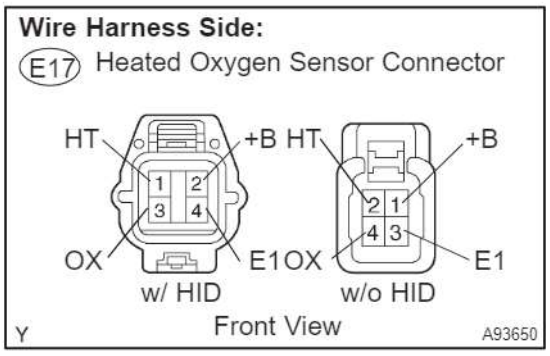
Tester Connection	Specified Condition
HT1B (E9–7) – E03 (E12–7)	9 to 14 V

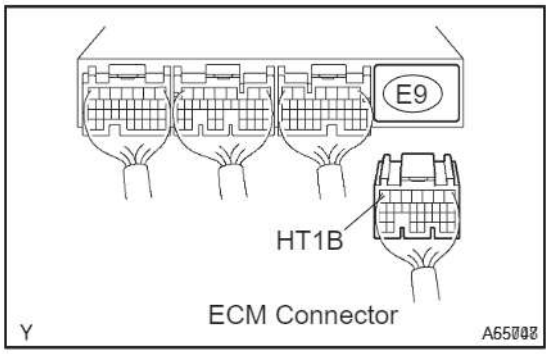
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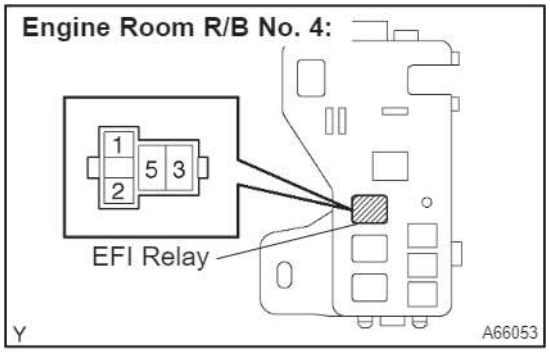
OK	REPLACE ECM (See page 10–65 of Pub. No. RM1018E AVENSIS)

NG

4	CHECK HARNESS AND CONNECTOR(HEATED OXYGEN SENSOR – ECM, HEATED OXYGEN SENSOR – EFI RELAY)







(a) Check the harness and the connectors between the ECM and heated oxygen sensor.
  (1) Disconnect the H17 heated oxygen sensor connector.
  (2) Disconnect the E9 ECM connector.
  (3) Check the resistance.

Standard (Check for open):

Tester Connection	Specified Condition
With HID: HT (H17–1) – HT1B (E9–7)	Below 1 Ω
Without HID: HT (H17–2) – HT1B (E9–7)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
With HID: HT (H17–1) or HT1B (E9–7) – Body ground	10 kΩ or higher
Without HID: HT (H17–2) or HT1B (E9–7) – Body ground	10 kΩ or higher

  (4) Reconnect the heated oxygen sensor connector.
  (5) Reconnect the ECM connector.

(b) Check the harness and the connectors between the heated oxygen sensor and EFI relay.
  (1) Disconnect the H17 heated oxygen sensor connector.
  (2) Remove the EFI relay from the engine room R/B No. 4.
  (3) Check the resistance.

Standard (Check for open):

Tester Connection	Specified Condition
+B (H17–1) – EFI relay (3)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
+B (H17–1) or EFI relay (3) – Body ground	10 kΩ or higher

  (4) Reconnect the heated oxygen sensor connector.
  (5) Reinstall the EFI relay.

NG	REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPLACE ECM (See page 10–65 of Pub. No. RM1018E AVENSIS)

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DTC	P0100	MASS AIR FLOW CIRCUIT MALFUNCTION

DTC	P0102	MASS OR VOLUME AIR FLOW CIRCUIT LOW INPUT

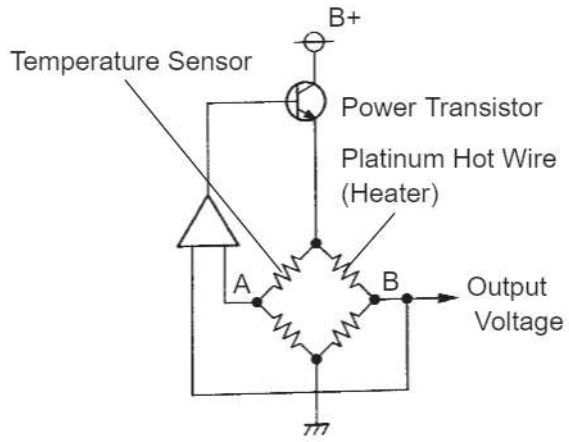
DTC	P0103	MASS OR VOLUME AIR FLOW CIRCUIT HIGH INPUT

CIRCUIT DESCRIPTION

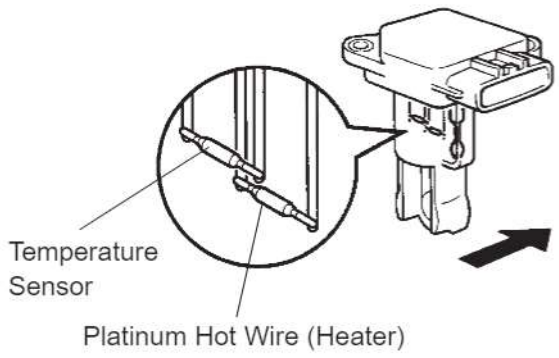
The Mass Air Flow (MAF) meter is a sensor that measures the amount of air flowing through the throttle valve. The ECM uses this information to determine the fuel injection time and provides a proper air–fuel ratio. Inside the MAF meter, there is a heated platinum wire exposed to the flow of intake air.

By applying a specific current to the wire, the ECM heats this wire to a given temperature. The flow of incoming air cools the wire and an internal thermistor, affecting their resistance. To maintain a constant current value, the ECM varies the voltage applied to these components in the MAF meter. The voltage level is proportional to the flow of the air passing through the sensor. The ECM interprets this voltage as the intake air amount.

The circuit is constructed so that the platinum hot wire and temperature sensor provide a bridge circuit, and the power transistor is controlled so that the potential of A and B remains equal to maintain the predetermined temperature.



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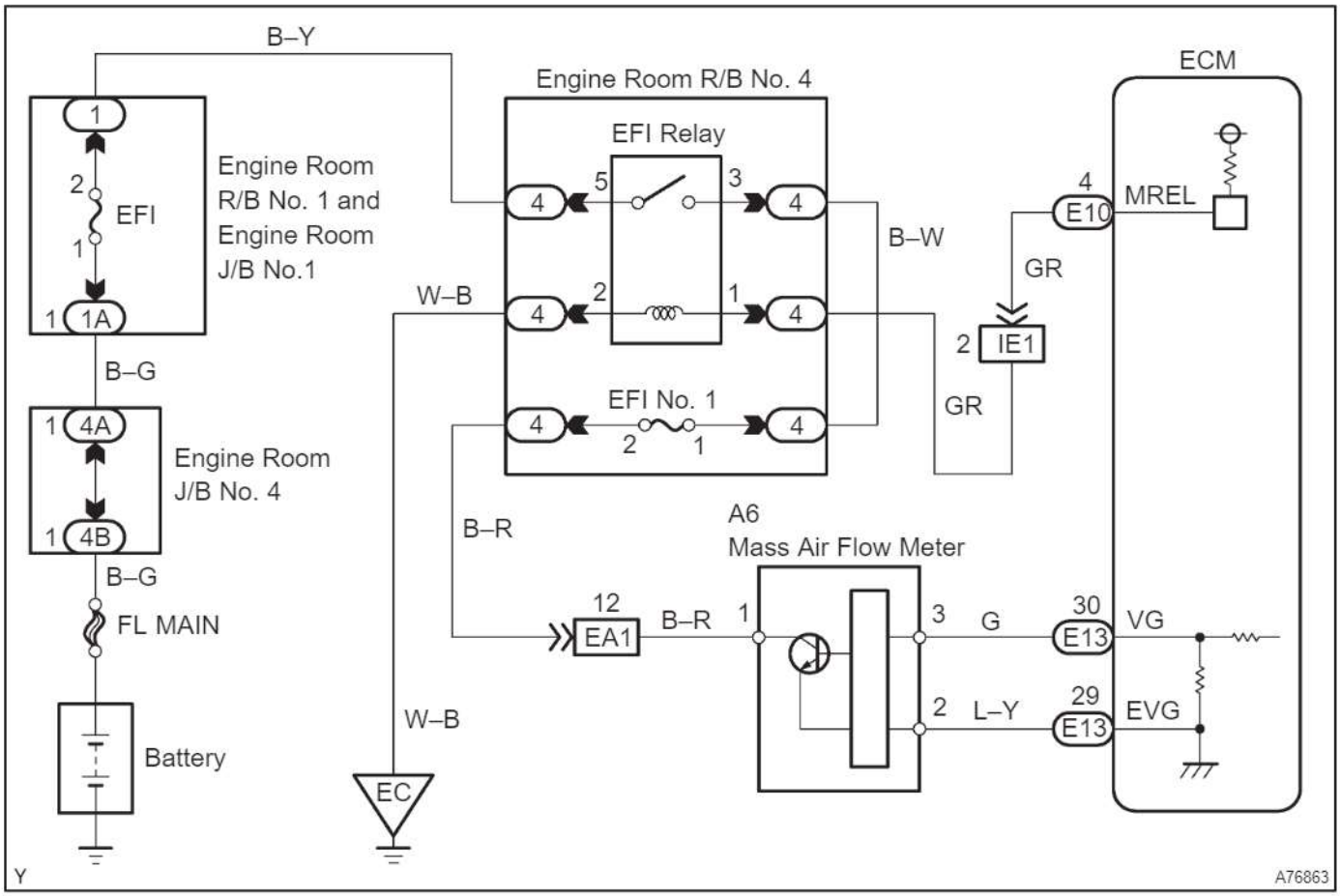
DTC No.	DTC Detection Condition	Trouble Area
P0100	When the mass air flow meter circuit has an open or a short for more than 3 seconds	• Open or short in mass air flow meter circuit • Mass air flow meter • ECM
P0102	When the mass air flow meter circuit has an open for more than 3 seconds	• Open in mass air flow meter circuit • Mass air flow meter • ECM
P0103	When the mass air flow meter circuit has a short for more than 3 seconds	• Short in mass air flow meter circuit • Mass air flow meter • ECM

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HINT:
When DTC P0100, P0102 or P0103 is detected, check the air–flow ratio by selecting Powertrain / Engine and ECT / Data List / AFM on the intelligent tester II.

Air Flow Value (gm/second)	Malfunction
Approximately 0.0	• Open in mass air flow meter power source circuit • Open or short in VG circuit
271.0 or more	• Open in EVG circuit

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:
Read freeze frame data using the intelligent tester II. Freeze frame data record the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, 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.

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1 READ VALUE OF INTELLIGENT TESTER II(MASS AIR FLOW RATE)

(a) Connect the intelligent tester II to the DLC3.
(b) Start the engine.
(c) Turn the intelligent tester II ON.
(d) Select the following menu items: Powertrain / Engine and ECT / Data List / AFM.
(e) Read the value.

Result:

Mass Air Flow Rate (g/second)	Proceed To
0.0	A
271.0 or more	B
Between 1.0 and 270.0 (*1)	C

*1: The value must be changed when the throttle valve is opened or closed.

B → **Go to step 6**

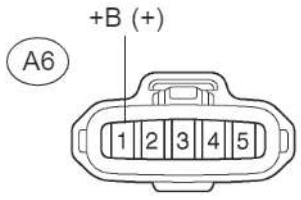
C → **CHECK FOR INTERMITTENT PROBLEMS**

A

2 INSPECT MASS AIR FLOW METER(POWER SOURCE)

Wire Harness Side:

Mass Air Flow Meter Connector



Front View

A84809

(a) Disconnect the A6 mass air flow meter connector.
(b) Turn the ignition switch to ON.
(c) Measure the voltage between the terminal of the wire harness side connector and body ground.

Standard:

Tester Connection	Specified Condition
+B (A6–1) – Body ground	9 to 14 V

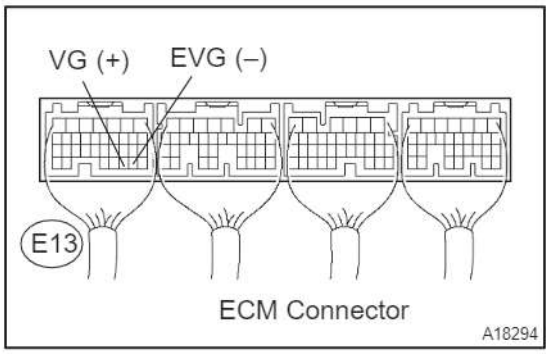
(d) Reconnect the mass air flow meter connector.

NG → **Go to step 5**

OK

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3 INSPECT ECM(VG VOLTAGE)



(a) Start the engine.
(b) Measure the voltage between the specified terminals of the E13 ECM connector.

HINT:
The shift position should be P or N and the A/C switch should be turned OFF.

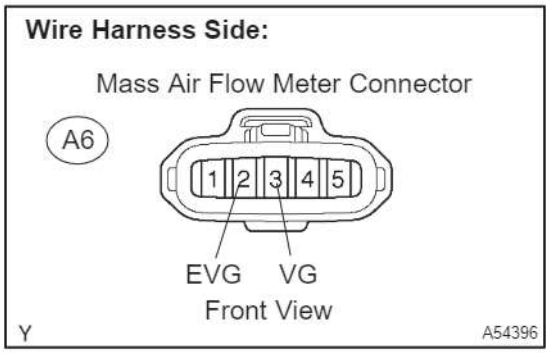
Standard:

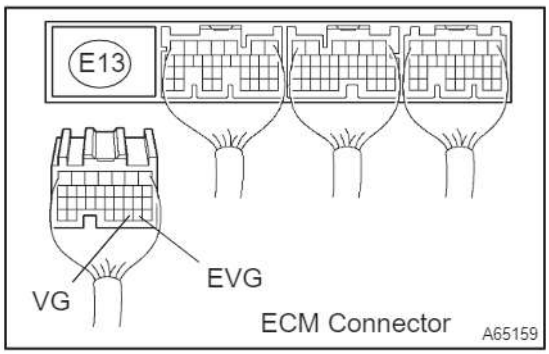
Tester Connection	Condition	Specified Condition
VG (E13–30) – EVG (E13–29)	Engine is idling	0.5 to 3.0 V

OK → **REPLACE ECM (See page 10–65 of Pub. No. RM1018E AVENSIS)**

NG

4 CHECK HARNESS AND CONNECTOR(MASS AIR FLOW METER – ECM)





(a) Disconnect the A6 mass air flow meter connector.
(b) Disconnect the E13 ECM connector.
(c) Check the resistance.

Standard (Check for open):

Tester Connection	Specified Condition
VG (A6–3) – VG (E13–30)	Below 1 Ω
EVG (A6–2) – EVG (E13–29)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
VG (A6–3) or VG (E13–30) – Body ground	10 kΩ or higher

(d) Reconnect the mass air flow meter connector.
(e) Reconnect the ECM connector.

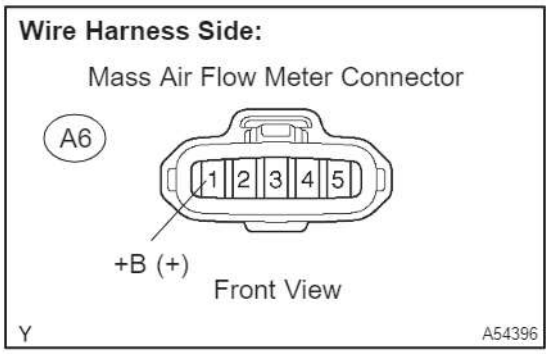
NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

REPLACE MASS AIR FLOW METER

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5 CHECK HARNESS AND CONNECTOR(MASS AIR FLOW METER – EFI RELAY)



(a) Disconnect the A6 mass air flow meter connector.
(b) Remove the EFI relay from the engine room R/B No. 4.
(c) Check the resistance.

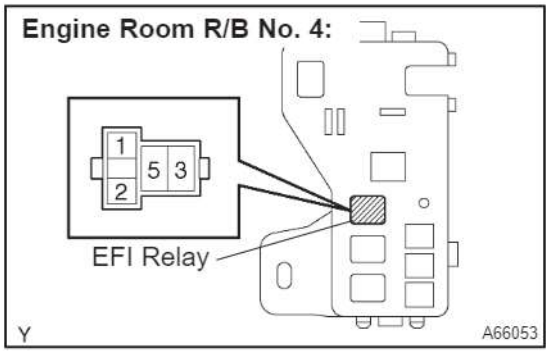
Standard (Check for open):

Tester Connection	Specified Condition
+B (A6–1) – EFI relay (3)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
+B (A6–1) or EFI relay (3) – Body ground	10 kΩ or higher

(d) Reconnect the mass air flow meter connector.
(e) Reinstall the EFI relay.

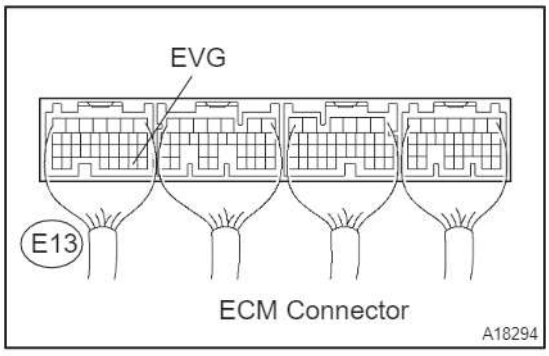


NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

INSPECT ECM POWER SOURCE CIRCUIT (See page 05–195)

6 INSPECT ECM(SENSOR GROUND)



(a) Check the resistance between the specified terminal of the E13 ECM connector and body ground.

Standard:

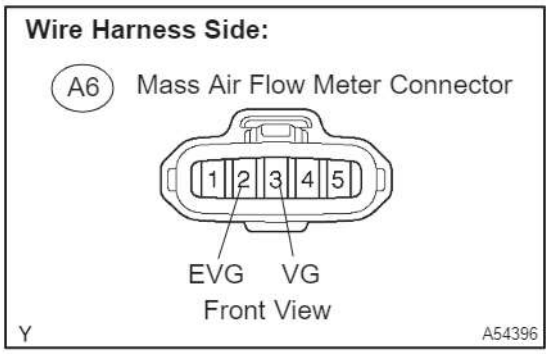
Tester Connection	Specified Condition
EVG (E13–29) – Body ground	Below 1 Ω

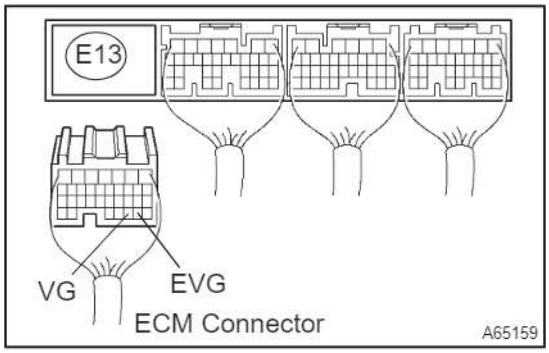
NG → **REPLACE ECM (See page 10–65 of Pub. No. RM1018E AVENSIS)**

OK

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7 CHECK HARNESS AND CONNECTOR(MASS AIR FLOW METER – ECM)





(a) Disconnect the A6 mass air flow meter connector.
(b) Disconnect the E13 ECM connector.
(c) Check the resistance.

Standard (Check for open):

Tester Connection	Specified Condition
VG (A6–3) – VG (E13–30)	Below 1 Ω
EVG (A6–2) – EVG (E13–29)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
VG (A6–3) or VG (E13–30) – Body ground	10 kΩ or higher

(d) Reconnect the mass air flow meter connector.
(e) Reconnect the ECM connector.

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

OK

REPLACE MASS AIR FLOW METER

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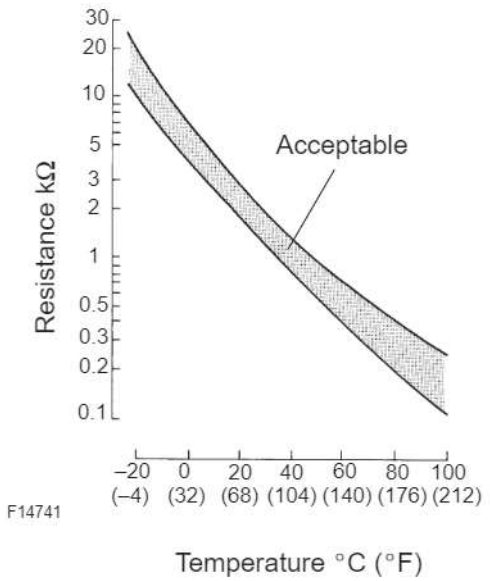
DTC	P0110	INTAKE AIR TEMPERATURE CIRCUIT

DTC	P0112	INTAKE AIR TEMPERATURE CIRCUIT LOW INPUT

DTC	P0113	INTAKE AIR TEMPERATURE CIRCUIT HIGH INPUT

CIRCUIT DESCRIPTION

(Figure 1)



The Intake Air Temperature (IAT) sensor is built into the Mass Air Flow (MAF) meter, and monitors the intake air temperature. The IAT sensor has a built–in thermistor that varies its resistance depending on the temperature of the intake air. When the air temperature is low, the resistance in the thermistor increases. When the temperature is high, the resistance drops. The variations in resistance are reflected as voltage changes to the ECM terminal (see figure 1).

The IAT sensor is connected to the ECM. The 5 V power source voltage in the ECM is applied to the IAT sensor from terminal THA via resistor R.

That is, the resistor R and the IAT sensor are connected in series. When the resistance value of the IAT sensor changes in accordance with changes in the intake air temperature, the voltage at terminal THA also changes. Based on this signal, the ECM increases the fuel injection volume to improve the driveability during cold engine operation.

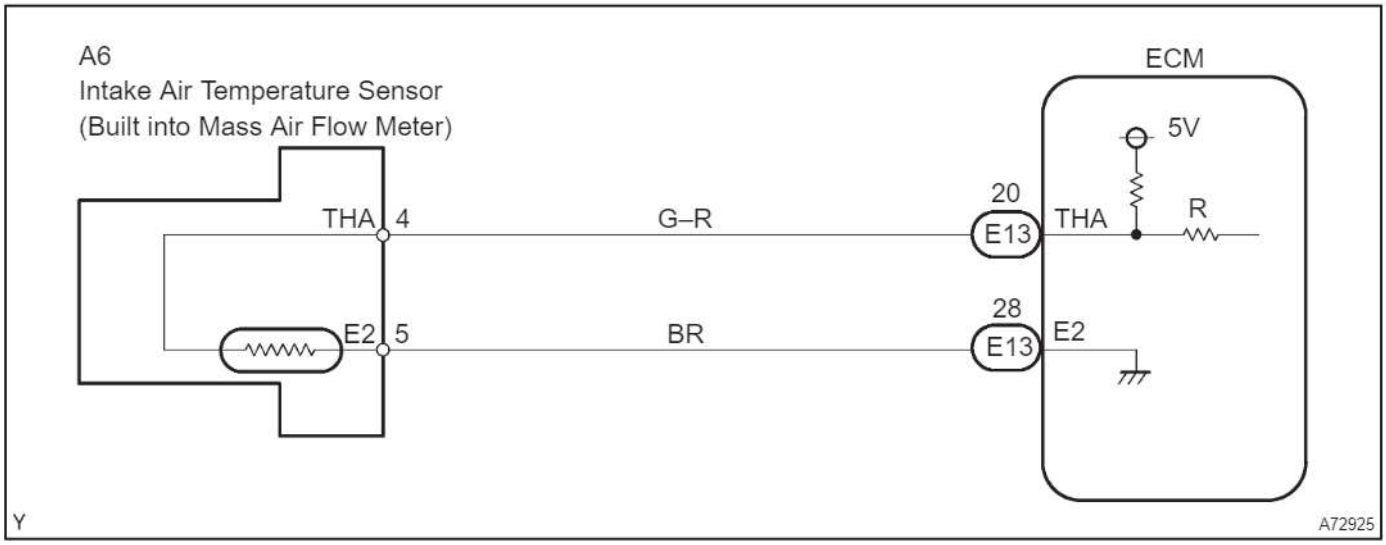
DTC No.	Proceed To	DTC Detection Condition	Trouble Area
P0110	Step 1	Open or short in intake air temperature sensor circuit for 0.5 seconds (1 trip detection logic)	• Open or short in intake air temperature sensor circuit • Intake air temperature sensor (built into mass air flow meter) • ECM
P0112	Step 4	Short in intake air temperature sensor circuit for 0.5 seconds (1 trip detection logic)	• Short in intake air temperature sensor circuit • Intake air temperature sensor (built into mass air flow meter) • ECM
P0113	Step 2	Open in intake air temperature sensor circuit for 0.5 seconds (1 trip detection logic)	• Open in intake air temperature sensor circuit • Intake air temperature sensor (built into mass air flow meter) • ECM

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HINT:
When DTC P0110, P0112 or P0113 is detected, check the intake air temperature by selecting Powertrain / Engine and ECT / Data List / Intake Air on the intelligent tester II.

Temperature Displayed	Malfunction
–40°C (–40°F)	Open circuit
140°C (284°F) or more	Short circuit

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

- If different 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 intelligent tester II. Freeze frame data record the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, 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.

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1	READ VALUE OF INTELLIGENT TESTER II(INTAKE AIR TEMPERATURE)

(a) Connect the intelligent tester II to the DLC3.
(b) Turn the ignition switch to ON and turn the intelligent tester II ON.
(c) Select the following menu items: Powertrain / Engine and ECT / Data List / Intake Air.
(d) Read the value.
OK:
Temperature value: Same as the actual intake air temperature.
Result:

Temperature Displayed	Proceed To
–40°C (–40°F)	A
140°C (284°F) or more	B
OK (Same as air actual intake temperature)	C

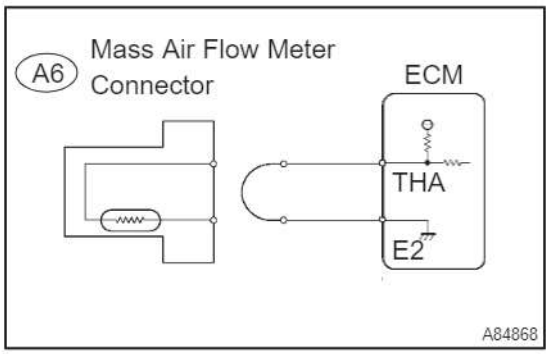
HINT:
- If there is an open circuit, the intelligent tester II indicates –40°C (–40°F).
- If there is a short circuit, the intelligent tester II indicates 140°C (284°F) or more.

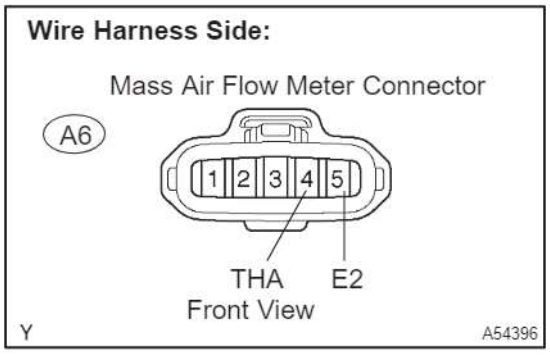
B → **Go to step 4**

C → **CHECK FOR INTERMITTENT PROBLEMS** (See page 05–9)

A

2	READ VALUE OF INTELLIGENT TESTER II(CHECK FOR OPEN IN WIRE HARNESS)





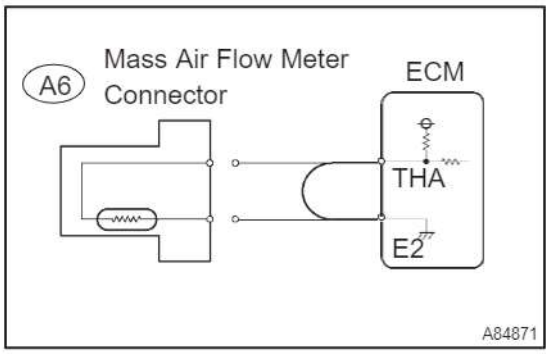
(a) Disconnect the A6 mass air flow meter connector.
(b) Connect terminals THA and E2 of the mass air flow meter wire harness side connector.
(c) Connect the intelligent tester II to the DLC3.
(d) Turn the ignition switch to ON and turn the intelligent tester II ON.
(e) Select the following menu items: Powertrain / Engine and ECT / Data List / Intake Air.
(f) Read the value.
OK:
Temperature value: 140°C (284°F) or more
(g) Reconnect the mass air flow meter connector.

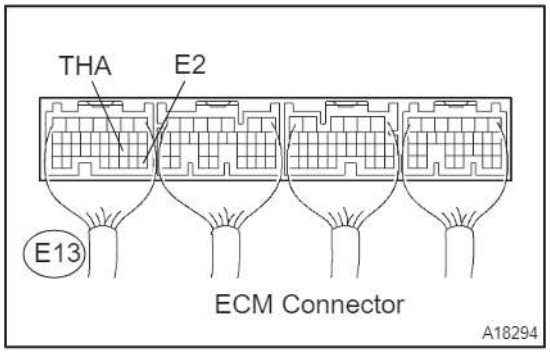
OK → **CONFIRM GOOD CONNECTION AT SENSOR. IF OK, REPLACE MASS AIR FLOW METER**

NG

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3	READ VALUE OF INTELLIGENT TESTER II(CHECK FOR OPEN IN ECM)





(a) Disconnect the A6 mass air flow meter connector.
(b) Connect terminals THA and E2 of the E13 ECM connector.

HINT:
Before checking, do visual and contact pressure checks on the ECM connector.

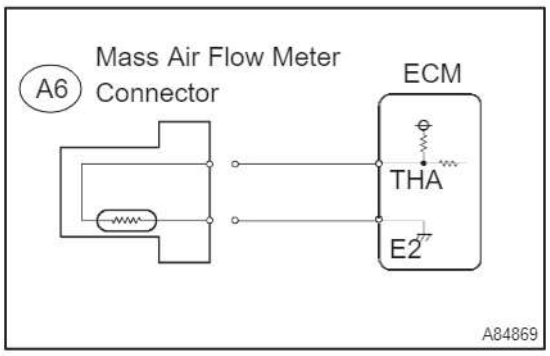
(c) Connect the intelligent tester II to the DLC3.
(d) Turn the ignition switch to ON and turn the intelligent tester II ON.
(e) Select the following menu items: Powertrain / Engine and ECT / Data List / Intake Air.
(f) Read the value.
OK:
Temperature value: 140°C (284°F) or more
(g) Reconnect the mass air flow meter connector.

OK	REPAIR OR REPLACE HARNESS OR CONNECTOR

NG

CONFIRM GOOD CONNECTION AT ECM. IF OK, REPLACE ECM
(See page 10–65 of Pub. No. RM1018E AVENSIS)

4	READ VALUE OF INTELLIGENT TESTER II(CHECK FOR SHORT IN WIRE HARNESS)



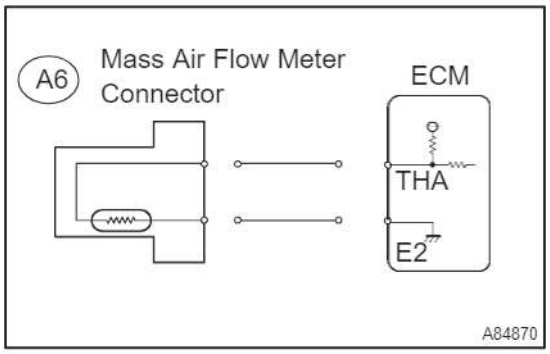
(a) Disconnect the A6 mass air flow meter connector.
(b) Connect the intelligent tester II to the DLC3.
(c) Turn the ignition switch to ON and turn the intelligent tester II ON.
(d) Select the following menu items: Powertrain / Engine and ECT / Data List / Intake Air.
(e) Read the value.
OK:
Temperature value: –40°C (–40°F)
(f) Reconnect the mass air flow meter connector.

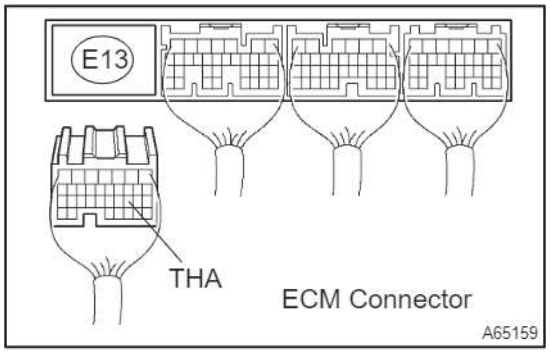
OK	REPLACE MASS AIR FLOW METER

NG

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5	READ VALUE OF INTELLIGENT TESTER II(CHECK FOR SHORT IN ECM)





(a) Disconnect the E13 ECM connector.
(b) Disconnect the A6 mass air flow meter connector.
(c) Turn the ignition switch to ON and turn the intelligent tester II ON.
(d) Select the following menu items: Powertrain / Engine and ECT / Data List / Intake Air.
(e) Read the value.
OK:
Temperature value: –40°C (–40°F)
(f) Reconnect the ECM sensor connector.
(g) Reconnect the mass air flow meter connector.

OK	REPAIR OR REPLACE HARNESS OR CONNECTOR

NG

REPLACE ECM (See page 10–65 of Pub. No. RM1018E AVENSIS)

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DTC	P0115	ENGINE COOLANT TEMPERATURE CIRCUIT

DTC	P0117	ENGINE COOLANT TEMPERATURE CIRCUIT LOW INPUT

DTC	P0118	ENGINE COOLANT TEMPERATURE CIRCUIT HIGH INPUT

CIRCUIT DESCRIPTION

A thermistor is built in the engine coolant temperature sensor and changes its resistance value according to the engine coolant temperature.

The structure of the sensor and connection to the ECM is the same as those of the intake air temperature sensor.

HINT:

If the ECM detects DTC P0115, P0117 or P0118, the ECM enters fail–safe mode in which the engine coolant temperature is assumed to be 80°C (176°F).

DTC No.	Proceed To	DTC Detection Condition	Trouble Area
P0115	Step 1	Open or short in engine coolant temperature sensor circuit for 0.5 seconds (1 trip detection logic)	• Open or short in engine coolant temperature sensor circuit • Engine coolant temperature sensor • ECM
P0117	Step 4	• Short in engine coolant temperature sensor circuit for 0.5 seconds (Sensor resistance value is less than 79 Ω) (1 trip detection logic)	• Short in engine coolant temperature sensor circuit • Engine coolant temperature sensor • ECM
P0118	Step 2	• Open in engine coolant temperature sensor circuit for 0.5 seconds (Sensor resistance value is more than 156 kΩ) (1 trip detection logic)	• Open in engine coolant temperature sensor circuit • Engine coolant temperature sensor • ECM

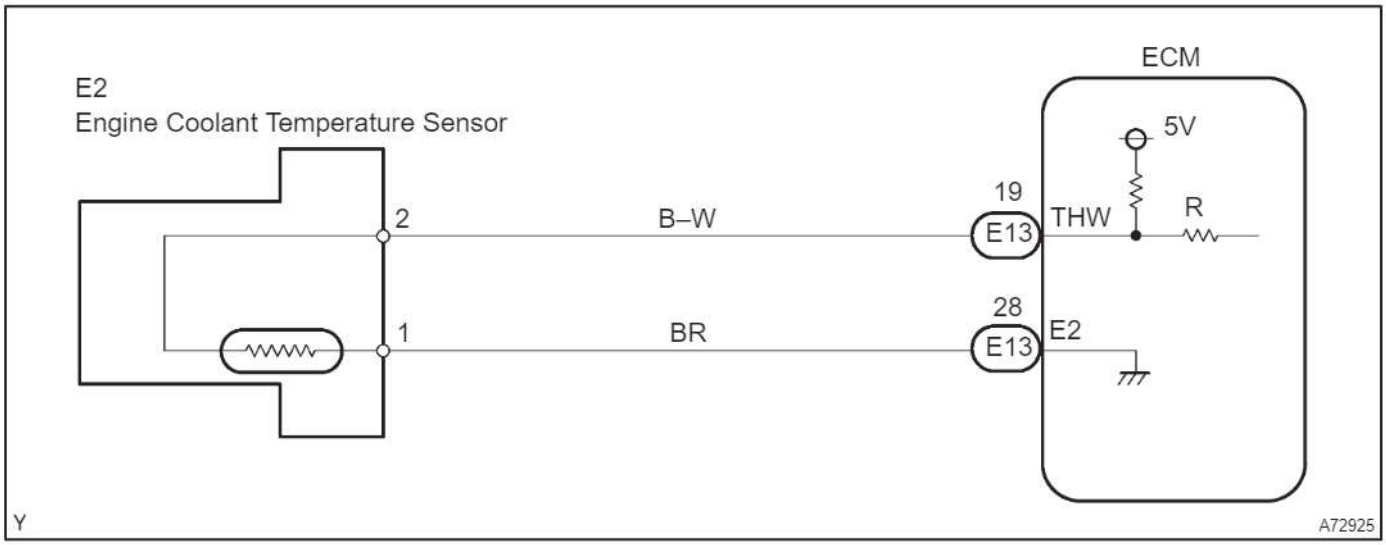
HINT:

When DTC P0115, P0117 or P0118 is detected, check the engine coolant temperature by selecting Powertrain / Engine and ECT / Data List / Coolant Temp on the intelligent tester II.

Temperature Displayed	Malfunction
–40°C (–40°F)	Open circuit
140°C (284°F) or more	Short circuit

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WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

- If different 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 intelligent tester II. Freeze frame data record the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, 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	READ VALUE OF INTELLIGENT TESTER II(ENGINE COOLANT TEMPERATURE)

(a) Connect the intelligent tester II to the DLC3.
(b) Turn the ignition switch to ON and turn the intelligent tester II ON.
(c) Select the following menu items: Powertrain / Engine and ECT / Data List / Coolant Temp.
(d) Read the value.

OK:

Temperature value: 80° to 97°C (176° to 207°F) after warming up the engine.

Result:

Temperature Displayed	Proceed To
–40°C (–40°F)	A
140°C (284°F) or more	B
OK (Same as the actual engine coolant temperature)	C

HINT:

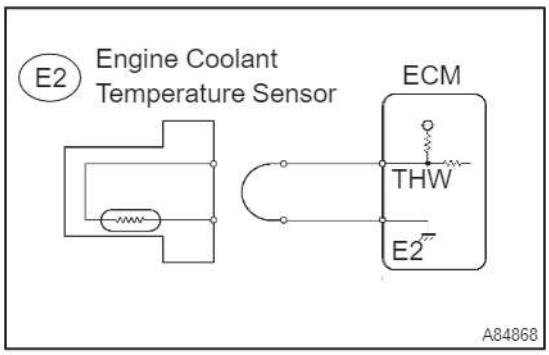
- If there is an open circuit, the intelligent tester II indicates –40°C (–40°F).
- If there is a short circuit, the intelligent tester II indicates 140°C (284°F) or more.

B	Go to step 4
C	CHECK FOR INTERMITTENT PROBLEMS (See page 05–9)

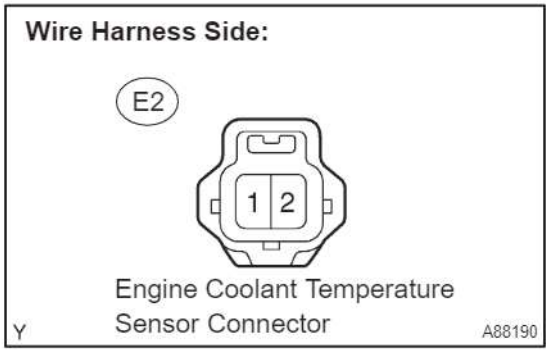
A

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2	READ VALUE OF INTELLIGENT TESTER II(CHECK FOR OPEN IN WIRE HARNESS)



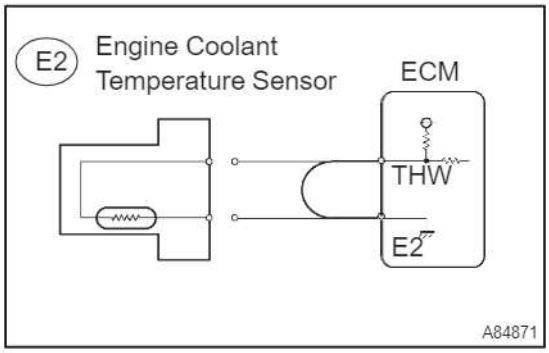
(a) Disconnect the E2 engine coolant temperature sensor connector.
(b) Connect terminals 1 and 2 of the engine coolant temperature sensor wire harness side connector.
(c) Connect the intelligent tester II to the DLC3.
(d) Turn the ignition switch to ON and turn the intelligent tester II ON.
(e) Select the following menu items: Powertrain / Engine and ECT / Data List / Coolant Temp.
(f) Read the value.
OK:
Temperature value: 140°C (284°F) or more
(g) Reconnect the engine coolant temperature sensor connector.



OK	CONFIRM GOOD CONNECTION AT SENSOR. IF OK, REPLACE ENGINE COOLANT TEMPERATURE SENSOR

NG

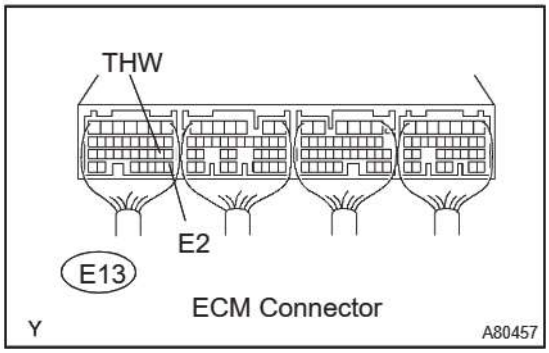
3	READ VALUE OF INTELLIGENT TESTER II(CHECK FOR OPEN IN ECM)



(a) Disconnect the E2 engine coolant temperature sensor connector.
(b) Connect terminals THW and E2 of the E13 ECM connector.

HINT:
Before checking, do visual and contact pressure checks on the ECM connector.

(c) Connect the intelligent tester II to the DLC3.
(d) Turn the ignition switch to ON and turn the intelligent tester II ON.
(e) Select the following menu items: Powertrain / Engine and ECT / Data List / Coolant Temp.
(f) Read the value.
OK:
Temperature value: 140°C (284°F) or more
(g) Reconnect the engine coolant temperature sensor connector.



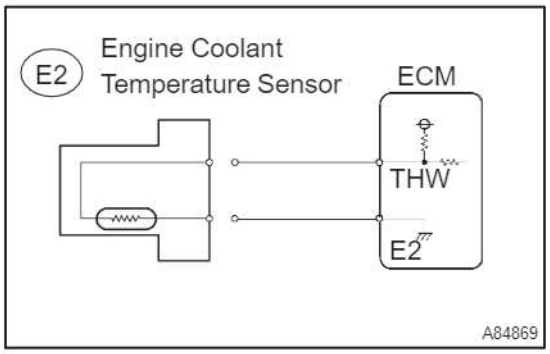
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OK	REPAIR OR REPLACE HARNESS OR CONNECTOR

NG

CONFIRM GOOD CONNECTION AT ECM. IF OK, REPLACE ECM
(See page 10–65 of Pub. No. RM1018E AVENSIS)

4 READ VALUE OF INTELLIGENT TESTER II(CHECK FOR SHORT IN WIRE HARNESS)

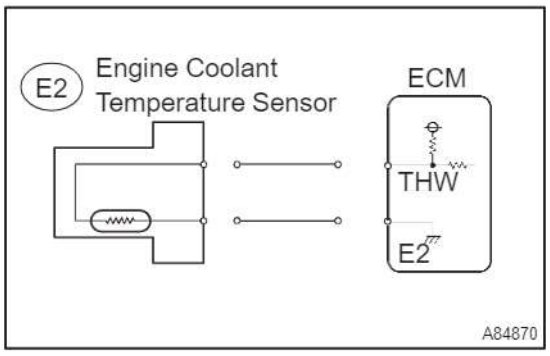


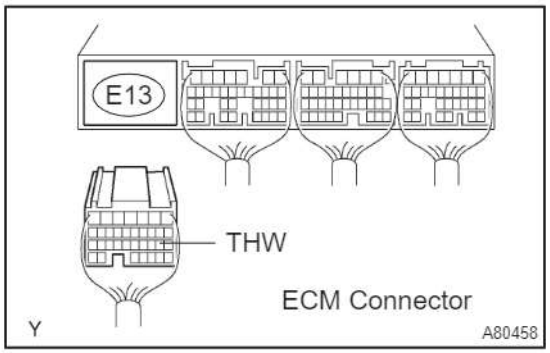
(a) Disconnect the E2 engine coolant temperature sensor connector.
(b) Connect the intelligent tester II to the DLC3.
(c) Turn the ignition switch to ON and turn the intelligent tester II ON.
(d) Select the following menu items: Powertrain / Engine and ECT / Data List / Coolant Temp.
(e) Read the value.
OK:
Temperature value: –40°C (–40°F)
(f) Reconnect the engine coolant temperature sensor connector.

OK	REPLACE ENGINE COOLANT TEMPERATURE SENSOR

NG

5 READ VALUE OF INTELLIGENT TESTER II(CHECK FOR SHORT IN ECM)





(a) Disconnect the E2 engine coolant temperature sensor connector.
(b) Disconnect the E13 ECM connector.
(c) Connect the intelligent tester II to the DLC3.
(d) Turn the ignition switch to ON and turn the intelligent tester II ON.
(e) Select the following menu items: Powertrain / Engine and ECT / Data List / Coolant Temp.
(f) Read the value.
OK:
Temperature value: –40°C (–40°F)
(g) Reconnect the engine coolant temperature sensor connector.
(h) Reconnect the ECM connector.

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OK → REPAIR OR REPLACE HARNESS OR CONNECTOR

NG

REPLACE ECM (See page 10–65 of Pub. No. RM1018E AVENSIS)

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DTC	P0116	ENGINE COOLANT TEMPERATURE CIRCUIT RANGE/PERFORMANCE PROBLEM

CIRCUIT DESCRIPTION

Refer to DTC P0115 on page 05–60.

DTC No.	DTC Detection Condition	Trouble Area
P0116	If the engine coolant temperature was between 35°C (95°F) and 60°C (140°F) at engine start, and conditions (a) and (b) are met (2 trip detection logic): (a) Vehicle is driven at varying speeds (under acceleration and deceleration) (b) Engine coolant temperature remains within 3°C (5.4°F) of the engine starting temperature	• Engine coolant temperature sensor
P0116	If the engine coolant temperature was more than 60°C (140°F) at engine start, and conditions (a) and (b) are met (6 trip detection logic): (a) Vehicle is driven at varying speeds (under acceleration and deceleration) (b) Engine coolant temperature remains within 1°C (1.8°F) of the engine starting temperature, and this is successively recorded 6 times	• Engine coolant temperature sensor

WIRING DIAGRAM

Refer to DTC P0115 on page 05–60.

INSPECTION PROCEDURE

HINT:

- If DTCs P0115, P0116, P0117 and P0118 are output simultaneously, the engine coolant temperature sensor may have an open or short circuit. Troubleshoot those DTCs first.
- Read freeze frame data using the intelligent tester II. Freeze frame data record the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, 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.

REPLACE ENGINE COOLANT TEMPERATURE SENSOR

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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

HINT:
These DTCs are related to the throttle position sensor.

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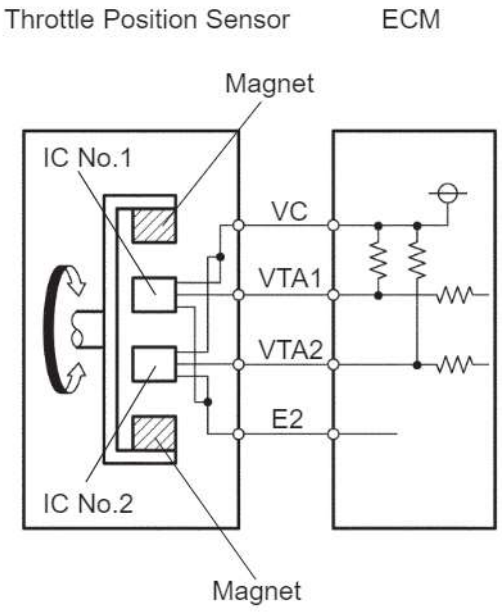
CIRCUIT DESCRIPTION

HINT:

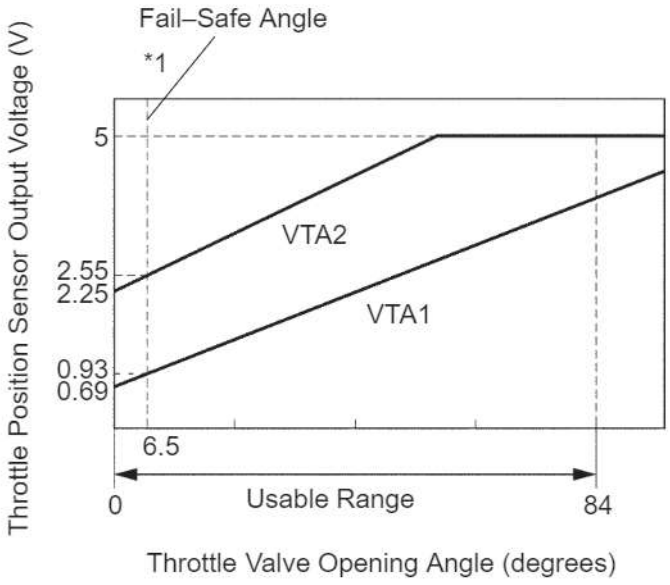
- This ETCS (Electronic Throttle Control System) does not use a throttle cable.
- This throttle position sensor is a non–contact type.

The throttle position sensor is mounted on the throttle body and 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 and signal output: VTA1 and VTA2. VTA1 is used to detect the throttle opening angle and VTA2 is used to detect a malfunction in VTA1. Voltage applied to VTA1 and VTA2 changes between 0V and 5V 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 actual 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 input.



A19755



A19802

Throttle Valve Fully Closed, VTA1 is 10 to 20 %

Throttle Valve Fully Opened, VTA1 is 64 to 96 %

*1: Fail–Safe Angle (6.5°), VTA1 is approximately 16 %

NOTE: Throttle valve opening angle detected by the sensor terminal VTA1 is expressed as percentages.

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DTC No.	DTC Detection Condition	Trouble Area
—	Conditions of DTC P0120, P0122, P0123, P0220, P0222 or P0223 continue for 2 seconds (Open or short in the throttle position sensor circuit)	—
P0120	Output voltage of VTA1 quickly fluctuates up and down beyond lower and upper malfunction thresholds	• Throttle position sensor (built into throttle body) • ECM
P0122	VTA1 is 0.2 V or less	• Throttle position sensor (built into throttle body) • Short in VTA1 circuit • Open in VC circuit • ECM
P0123	VTA1 is 4.8 V or more	• Throttle position sensor (built into throttle body) • Open in VTA1 circuit • Open in E2 circuit • VC and VTA1 circuits are short–circuited • ECM
P0220	Output voltages of VTA1 and VTA2 quickly fluctuate up and down beyond their respective lower and upper malfunction thresholds	• Throttle position sensor (built into throttle body) • ECM
P0222	VTA2 is 0.5 V or less	• Throttle position sensor (built into throttle body) • Short in VTA2 circuit • Open in VC circuit • ECM
P0223	VTA2 is 4.8 V or more, VTA1 is between 0.2 V and 1.8 V	• Throttle position sensor (built into throttle body) • Open in VTA2 circuit • Open in E2 circuit • VC and VTA2 circuits are short–circuited • ECM
P2135	Condition (a) continues for 0.5 seconds or more, or condition (b) continues for 0.4 seconds 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 0.5 V or less	• VTA1 and VTA2 circuits are short–circuited • Throttle position sensor (built into throttle body) • ECM

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 ignition switch is turned to OFF.

HINT:

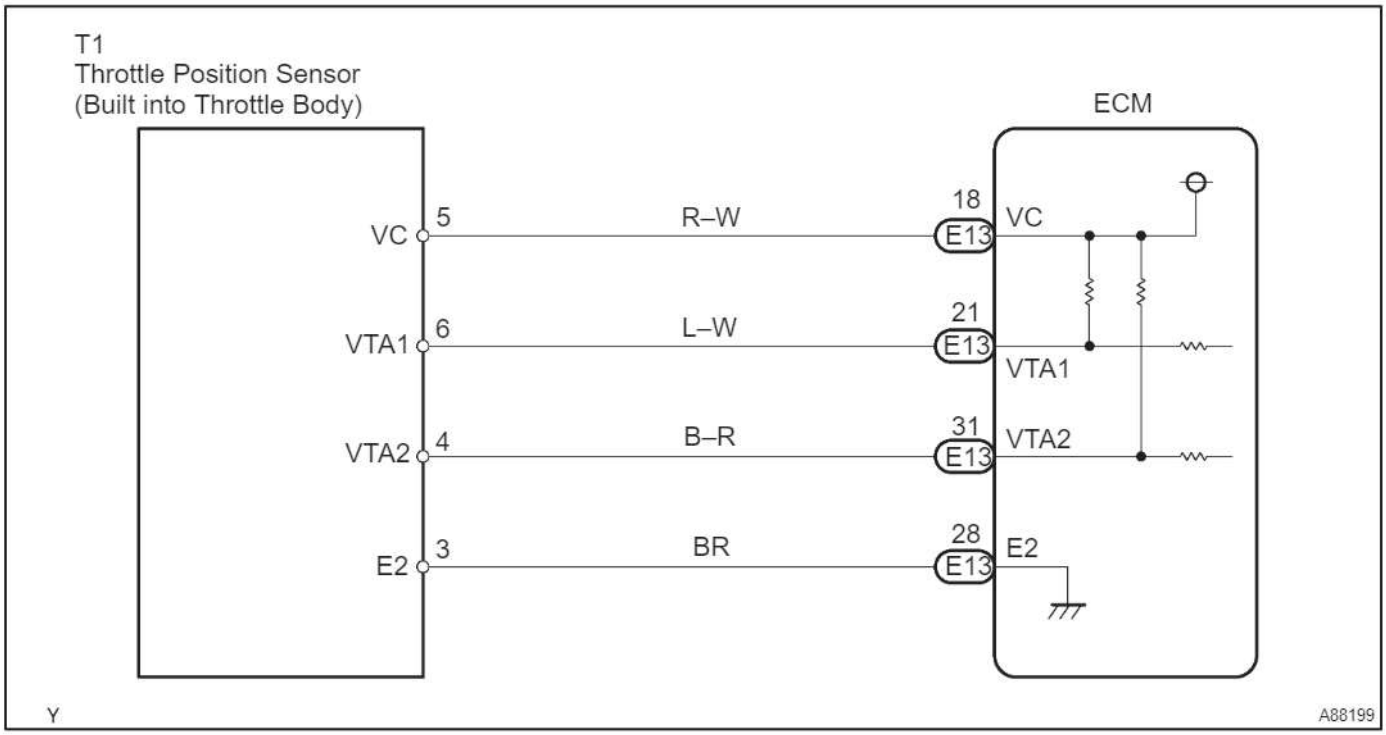
- When any of these DTCs is detected, check the throttle valve opening angle (Throttle POS and Throttle POS No. 2) using the intelligent tester II.
- The Throttle POS means VTA1 signal (expressed as percentages), and Throttle POS No. 2 means the VTA2 signal (expressed as voltages).

Reference (Normal condition):

Tester Display	Accelerator Pedal Fully Released	Accelerator Pedal Fully Depressed
Throttle POS	10 to 24 %	64 to 96 %
Throttle POS No. 2	2.1 to 3.1 V	4.5 to 5.0 V

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WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

- If different 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 intelligent tester II. Freeze frame data record the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, 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.

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1	READ VALUE OF INTELLIGENT TESTER II(THROTTLE POS AND THROTTLE POS NO.2)

(a) Connect the intelligent tester II to the DLC3.
(b) Turn the ignition switch to ON and turn the intelligent tester II ON.
(c) Select the following menu items: Powertrain / Engine and ECT / Data List / Throttle POS and Throttle POS No. 2.
(d) Check the values displayed on the intelligent tester II.

Result:

TP (VTA1) When AP Released	TP No. 2 (VTA2) When AP Released	TP (VTA1) When AP Depressed	TP No. 2 (VTA2) When AP Depressed	Trouble Area	Proceed To
0 %	0 to 0.2 V	0 %	0 to 0.2 V	VC circuit open	A
100 %	4.5 to 5.0 V	100 %	4.5 to 5.0 V	E2 circuit open	A
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	A
10 to 24 % (Fail–safe)	0 to 0.2 V or 4.5 to 5.0 V	10 to 24 % (Fail–safe)	0 to 0.2 V or 4.5 to 5.0 V	VTA2 circuit open or ground short	A
10 to 24 %	2.1 to 3.1 V	64 to 96 % (Not fail–safe)	4.5 to 5.0 V (Not fail–safe)	Throttle position sensor circuit is normal	B

HINT:

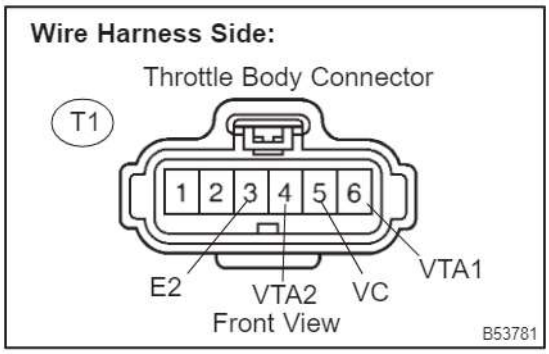
- TP stands for Throttle Position, and AP stands for Accelerator Pedal.
- VTA1 is expressed as percentages, and VTA2 is expressed as voltages.

B → **Go to step 5**

A

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



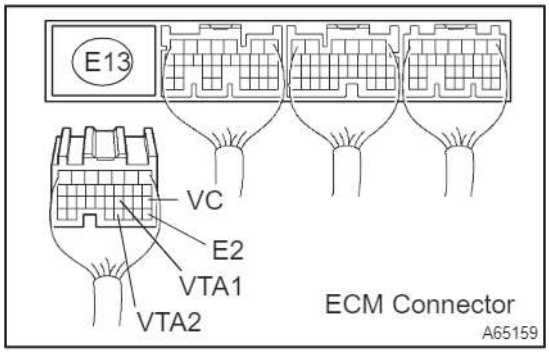
(a) Disconnect the T1 throttle body connector.
(b) Disconnect the E13 ECM connector.
(c) Check the resistance.

Standard (Check for open):

Tester Connection	Specified Condition
VC (T1–5) – VC (E13–18)	Below 1 Ω
VTA1 (T1–6) – VTA1 (E13–21)	Below 1 Ω
VTA2 (T1–4) – VTA2 (E13–31)	Below 1 Ω
E2 (T1–3) – E2 (E13–28)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
VC (T1–5) or VC (E13–18) – Body ground	10 kΩ or higher
VTA1 (T1–6) or VTA1 (E13–21) – Body ground	10 kΩ or higher
VTA2 (T1–4) or VTA2 (E13–31) – Body ground	10 kΩ or higher

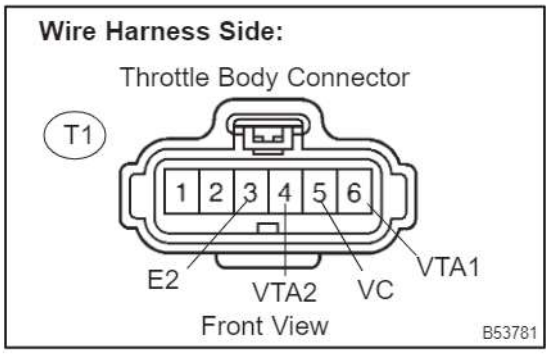


(d) Reconnect the throttle body connector.
(e) Reconnect the ECM connector.

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

OK

3 INSPECT ECM(VC VOLTAGE)

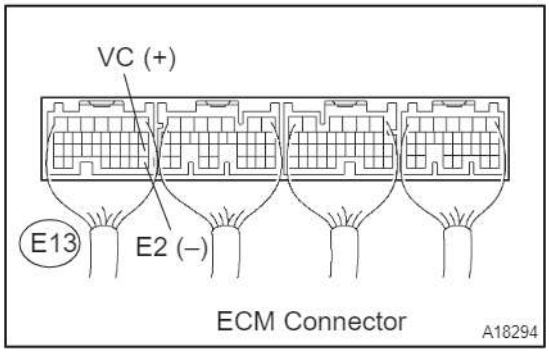


(a) Disconnect the T1 throttle body connector.
(b) Turn the ignition switch to ON and turn the intelligent tester II ON.
(c) Measure the voltage between the specified terminals of the E13 ECM connector.

Standard:

Tester Connection	Specified Condition
VC (E13–18) – E2 (E13–28)	4.5 to 5.5 V

(d) Reconnect the throttle body connector.



NG → **REPLACE ECM (See page 10–65 of Pub. No. RM1018E AVENSIS)**

OK

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4	REPLACE THROTTLE BODY ASSY (See page 10–6)

GO

5	CHECK IF DTC OUTPUT RECURS(THROTTLE POSITION SENSOR DTCS)

(a) Clear the DTC(s) (see page 05–18).
(b) Start the engine.
(c) Run the engine in idling for 15 seconds or more.
(d) Connect the intelligent tester II to the DLC3.
(e) Turn the ignition switch to ON and turn the intelligent tester II ON.
(f) Select the following menu items: Powertrain / Engine and ECT / DTC.
(g) Read DTCs.

Result:

Display (DTC Output)	Proceed To
P0120, P0122, P0123, P0220, P0222, P0223 and/or P2135	A
No output	B

B → **SYSTEM OK**

A

REPLACE ECM (See page 10–65 of Pub. No. RM1018E AVENSIS)

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DTC	P0121	THROTTLE/PEDAL POSITION SENSOR/SWITCH "A" CIRCUIT RANGE/PERFORMANCE PROBLEM

HINT:
These DTCs are related to the throttle position sensor.

CIRCUIT DESCRIPTION

Refer to DTC P0120 on page 05–66.

DTC No.	DTC Detection Condition	Trouble Area
P0121	Difference between VTA and VTA2 voltage deviates from the malfunction criteria (1 trip detection logic)	• Throttle position sensor (built into throttle body)

INSPECTION PROCEDURE

HINT:
Read freeze frame data using the intelligent tester II. Freeze frame data record the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, 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.

REPLACE THROTTLE BODY ASSY (See page 10–6)

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DTC	P0130	OXYGEN SENSOR CIRCUIT MALFUNCTION (BANK 1 SENSOR 1)

DTC	P2195	OXYGEN SENSOR SIGNAL STUCK LEAN (BANK 1 SENSOR 1)

DTC	P2196	OXYGEN SENSOR SIGNAL STUCK RICH (BANK 1 SENSOR 1)

CIRCUIT DESCRIPTION

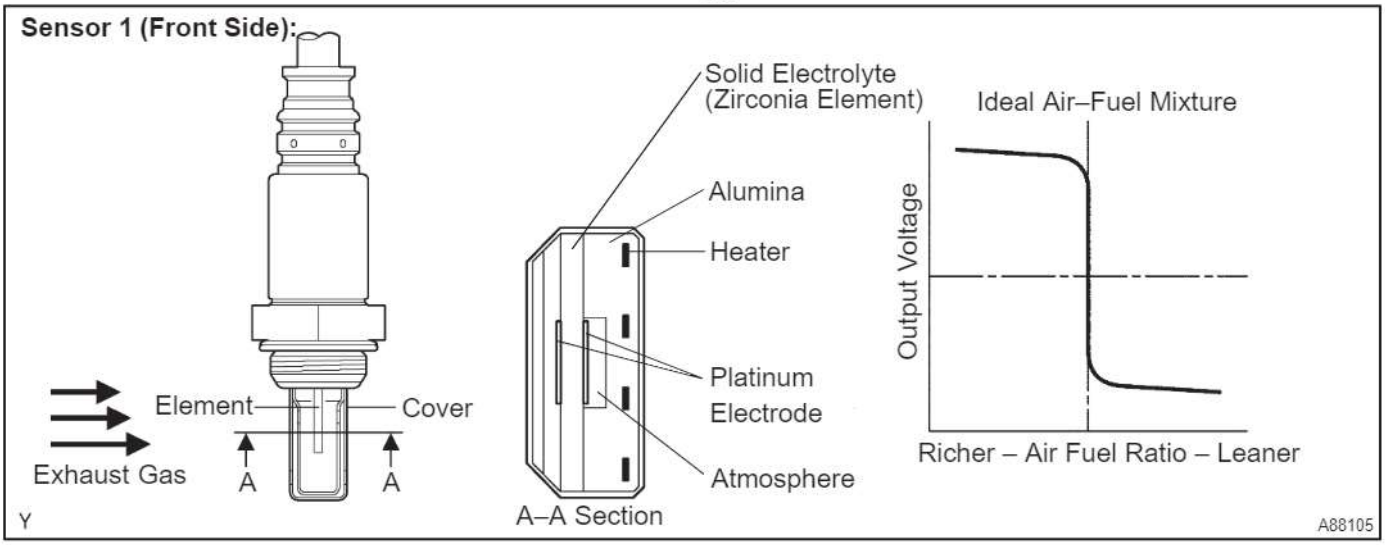
In order to obtain a high purification rate for the carbon monoxide (CO), hydrocarbon (HC) and nitrogen oxide (NOx) components of the exhaust gas, a Three–Way Catalytic Converter (TWC) is used. For the most efficient use of the TWC, the air–fuel ratio must be precisely controlled so that it is always close to the stoichiometric air–fuel ratio.

The heated oxygen sensor has the characteristic whereby its output voltage changes suddenly in the vicinity of the stoichiometric air–fuel ratio. This is used to detect the oxygen concentration in the exhaust gas and provide the ECM with feedback to control the air–fuel ratio.

When the air–fuel ratio becomes lean, the oxygen concentration in the exhaust gas increases. The heated oxygen sensor informs the ECM of the lean condition (low voltage, i.e. less than 0.45 V).

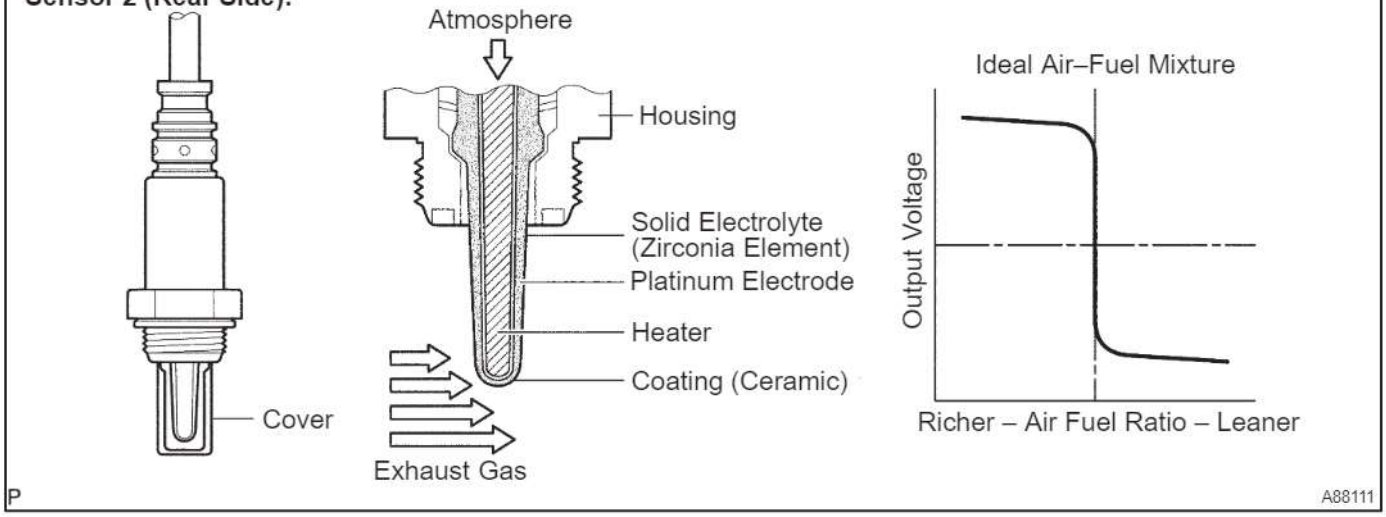
When the air–fuel ratio is richer than the stoichiometric air–fuel ratio, the oxygen concentration in the exhaust gas is reduced. And the heated oxygen sensor informs the ECM of the rich condition (high voltage, i.e. more than 0.45 V). The ECM judges by the voltage output of the heated oxygen sensor whether the air–fuel ratio is rich or lean and controls the injection time accordingly. If a malfunction of the heated oxygen sensor causes an output of abnormal voltage, the ECM will be unable to perform accurate air–fuel ratio control.

The heated oxygen sensor includes a heater which heats the zirconia element. The heater is controlled by the ECM. When the intake air volume is low (the temperature of the exhaust gas is low), a current flows to the heater in order to heat the sensor for accurate oxygen concentration detection.



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Sensor 2 (Rear Side):



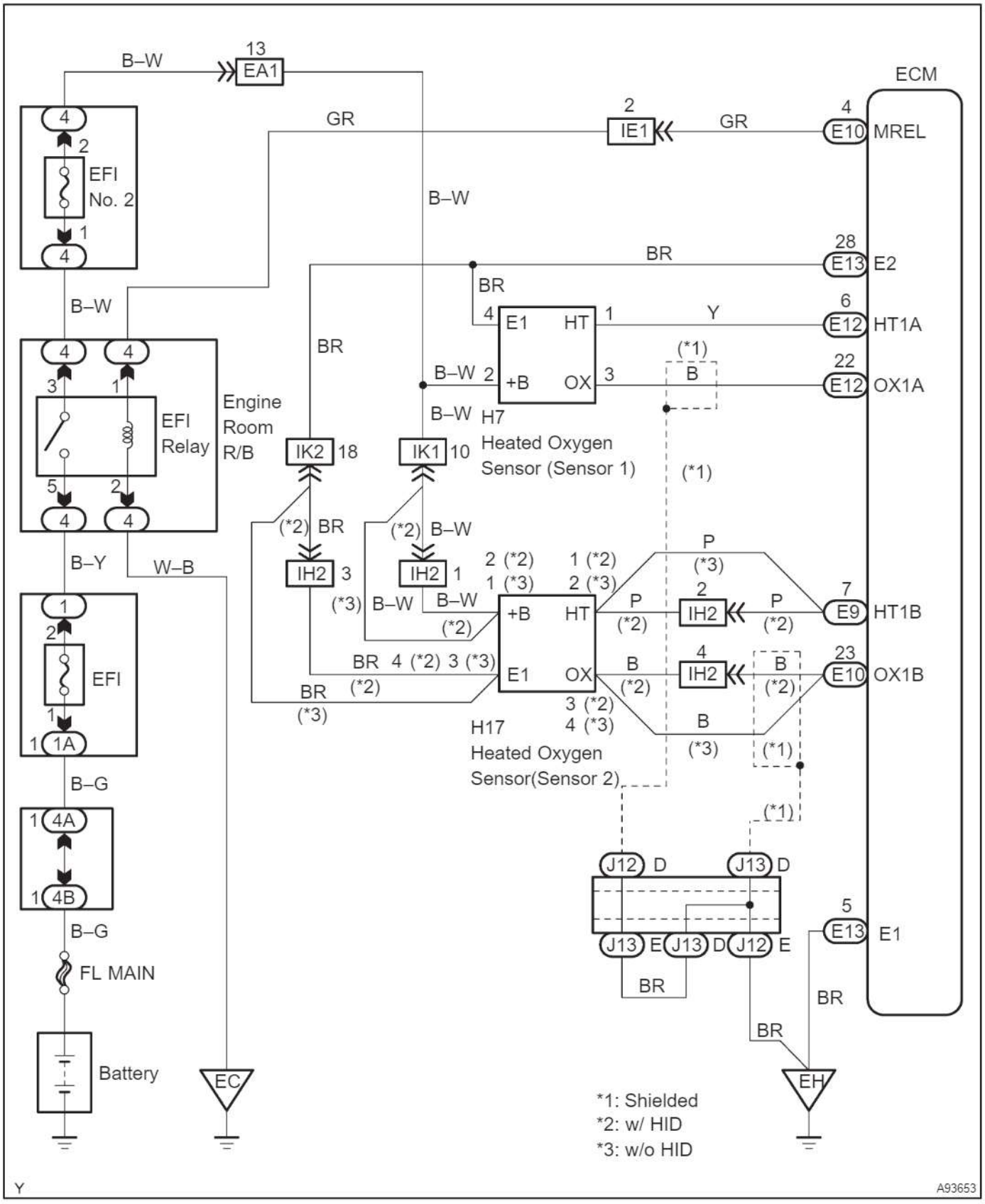
DTC No.	DTC Detection Condition	Trouble Area
P0130	After engine is warmed up, output voltage of heated oxygen sensor remains at 0.4 V or more, or 0.5 V or less, during engine idling (2 trip detection logic)	• Open or short in heated oxygen sensor circuit • Heated oxygen sensor (sensor 1) • Heated oxygen sensor heater (sensor 1) • EFI relay • Air induction system • Fuel pressure • Injector • ECM
P2195	The following conditions are met (2 trip detection logic): • Heated oxygen sensor (sensor 1) voltage remains at below 0.5 V (stuck in lean condition) • Engine is idling after engine warm–up	• Open or short in heated oxygen sensor circuit • Heated oxygen sensor (sensor 1) • Heated oxygen sensor heater (sensor 1) • EFI relay • Air induction system • Fuel pressure • Injector • ECM
P2196	The following conditions are met (2 trip detection logic): • Heated oxygen sensor (sensor 1) voltage remains at 0.4 V or more (stuck in rich condition) • Engine is idling after engine warm–up	• Open or short in heated oxygen sensor circuit • Heated oxygen sensor (sensor 1) • Heated oxygen sensor heater (sensor 1) • EFI relay • Air induction system • Fuel pressure • Injector • ECM

HINT:

- Sensor 1 refers to the sensor near the engine assembly.
- The output voltage of the heated oxygen sensor and the short–term fuel trim value can be read using the intelligent tester II.

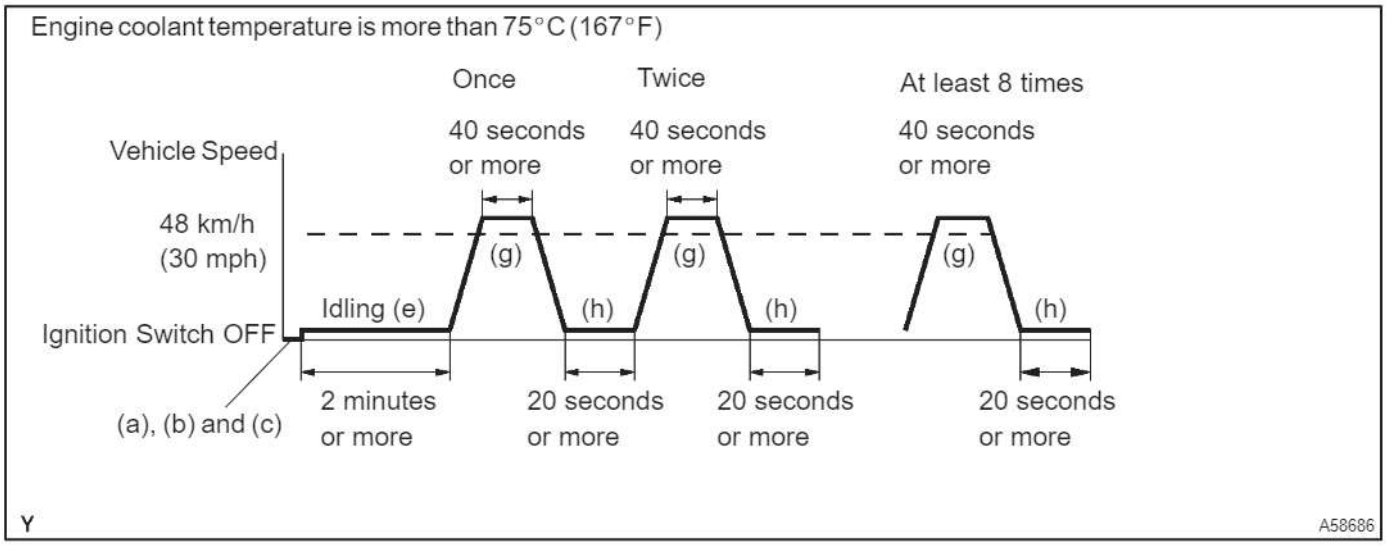
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WIRING DIAGRAM



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CONFIRMATION DRIVING PATTERN



(a) Connect the intelligent tester II to the DLC3.
(b) Turn the ignition switch to ON and turn the intelligent tester II ON.
(c) Switch the ECM from normal mode to check mode using the intelligent tester II (see page 05–20).
(d) Start the engine.
(e) Allow the engine to idle for 2 minutes.
(f) Warm up the engine until the engine coolant temperature reaches more than 75°C (167°F).
(g) Drive the vehicle at 48 km/h (30 mph) or more for 40 seconds or more.
(h) Stop the vehicle and allow the engine to idle for 20 seconds or more.
(i) Repeat the steps (g) and (h) at least 8 times in one driving cycle.

HINT:

If a malfunction exists, the MIL will be illuminated during step (i).

NOTICE:

If the conditions in this test are not strictly followed, no malfunction will be detected. If you do not have the intelligent tester II, turn the ignition switch to OFF after performing steps from (d) to (i), then perform steps (d) to (i) again.

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INSPECTION PROCEDURE

HINT:

Intelligent tester II only:

Malfunctioning areas can be found using the Active Test / A/F Control operation. The A/F Control operation can determine if the heated oxygen sensor or other potential trouble areas are malfunctioning or not.

(a) Perform the Active Test using the intelligent tester II.

HINT:

The A/F Control operation lowers the injection volume by 12.5 % or increases the injection volume by 25 %.

(1) Connect the intelligent tester II to the DLC3.
(2) Start the engine and turn the intelligent tester II ON.
(3) Warm up the engine by running the engine at 2,500 rpm for approximately 3 minutes.
(4) On the intelligent tester II, select the following menu items: Powertrain / Engine and ECT / Active Test / A/F Control.
(5) Select the following monitor items: O2S B1 S1 and O2S B1 S2.
(6) Perform the A/F Control operation with the engine in an idling condition (press the right or left button).

Result:

The heated oxygen sensor reacts in accordance with increases and decreases of the injection volume:

+25 % → Rich output: More than 0.5 V

–12.5 % → Lean output: Less than 0.4 V

NOTICE:

Sensor 1 (front sensor) has an output delay of a few seconds. Sensor 2 (rear sensor) has a maximum output delay of approximately 20 seconds.

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	Output Voltage of Heated Oxygen Sensor (sensor 1: front sensor)	Output Voltage of Heated Oxygen Sensor (sensor 2: rear sensor)	Main Suspect Trouble Area
Case 1	Injection volume +25 % –12.5 % Output voltage More than 0.5 V Less than 0.4V OK	Injection volume +25 % –12.5 % Output voltage More than 0.5 V Less than 0.4V OK	—
Case 2	Injection volume +25 % –12.5 % Output voltage Almost no reaction NG	Injection volume +25 % –12.5 % Output voltage More than 0.5 V Less than 0.4V OK	Sensor 1: front sensor (Sensor 1, heater, sensor 1 circuit)
Case 3	Injection volume +25 % –12.5 % Output voltage More than 0.5 V Less than 0.4V OK	Injection volume +25 % –12.5 % Output voltage Almost no reaction NG	Sensor 2: rear sensor (Sensor 2, heater, sensor 2 circuit)
Case 4	Injection volume +25 % –12.5 % Output voltage Almost no reaction NG	Injection volume +25 % –12.5 % Output voltage Almost no reaction NG	Extremely rich or lean actual air–fuel ratio (Injector, fuel pressure, gas leakage in exhaust system, etc.)

The following A/F Control procedure enables the technician to check and graph the voltage output of both the heated oxygen sensors.

To display the graph, select the following menu items on the tester: View / Line Graph.

NOTICE:

If the vehicle is short of fuel, the air–fuel ratio becomes lean and the heated oxygen sensor DTCs will be recorded, and the MIL then illuminates.

HINT:

- If different 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 intelligent tester II. Freeze frame data record the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, 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.
- A high heated oxygen sensor (sensor 1) voltage (0.5 V or more) could be caused by a rich air–fuel mixture. Check for conditions that would cause the engine to run rich.
- A low heated oxygen sensor (sensor 1) voltage (0.4 V or less) could be caused by a lean air–fuel mixture. Check for conditions that would cause the engine to run lean.

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1	CHECK OTHER DTC OUTPUT(IN ADDITION TO DTC P0130, P2195 AND P2196)

(a) Connect the intelligent tester II to the DLC3.
(b) Turn the ignition switch to ON and turn the intelligent tester II ON.
(c) Select the following menu items: Powertrain / Engine and ECT / DTC.
(d) Read DTCs.

Result:

Display (DTC Output)	Proceed To
P0130 and/or P2195 or P2196	A
P0130 or P2195 and/or P2196 and other DTCs	B

HINT:
If any DTCs other than P0130, P2195 and P2196 are output, troubleshoot those DTCs first.

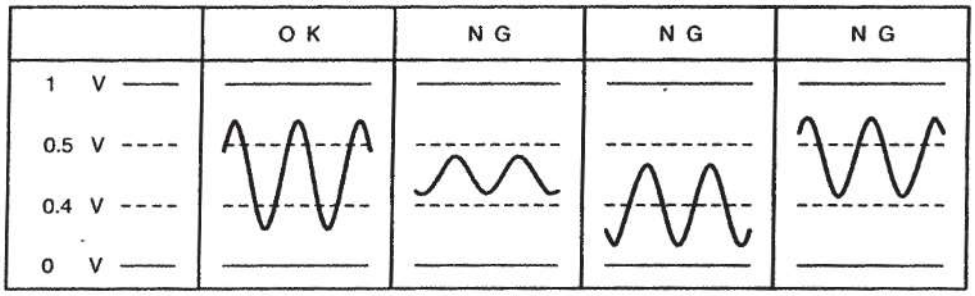
B → **GO TO RELEVANT DTC CHART** (See page 05–27)

A

2	READ VALUE OF INTELLIGENT TESTER II(OUTPUT VOLTAGE OF HEATED OXYGEN SENSOR)

(a) Connect the intelligent tester II to the DLC3.
(b) Start the engine and turn the intelligent tester II ON.
(c) Select the following menu items: Powertrain / Engine and ECT / Data List / O2S B1 S1.
(d) Warm up the heated oxygen sensor at the engine speed of 2,500 rpm for approximately 90 seconds.
(e) Read the output voltage of the heated oxygen sensor during engine idling.

Standard:
Fluctuates between less than 0.4 V and more than 0.5 V (see the following figure).



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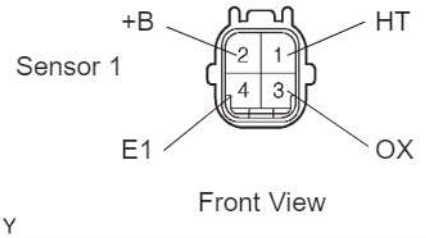
OK → **Go to step 9**

NG

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3 INSPECT HEATED OXYGEN SENSOR(HEATER RESISTANCE)

Component Side:
Heated Oxygen Sensor Connector



(a) Disconnect the H7 heated oxygen sensor connector.
(b) Measure the resistance between the terminals of the heated oxygen sensor connector.
Standard:

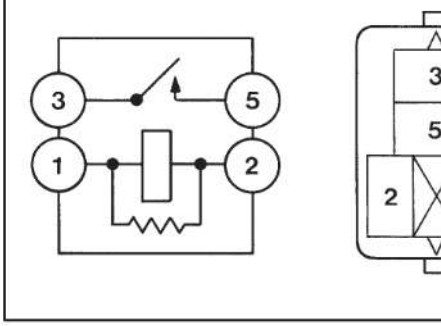
Tester Connection	Specified Condition
1 (HT) – 2 (+B)	5 to 10 Ω at 20°C (68°F)
1 (HT) – 4 (E1)	10 kΩ or higher

(c) Reconnect the heated oxygen sensor connector.

NG → REPLACE HEATED OXYGEN SENSOR

OK

4 INSPECT EFI RELAY



(a) Remove the EFI relay from the engine room R/B No. 4.
(b) Check the EFI relay resistance.
Standard:

Tester Connection	Specified Condition
3 – 5	10 kΩ or higher
3 – 5	Below 1 Ω (Apply battery voltage to terminals 1 and 2)

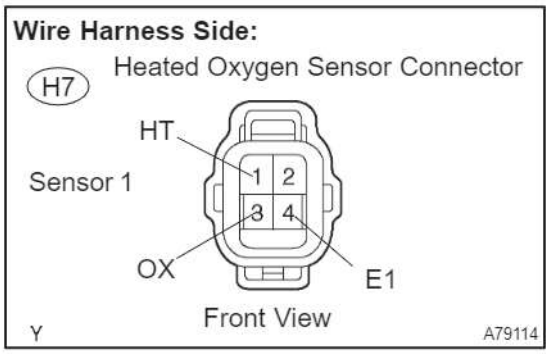
(c) Reinstall the EFI relay.

NG → REPLACE EFI RELAY

OK

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5 CHECK HARNESS AND CONNECTOR(HEATED OXYGEN SENSOR – ECM)



(a) Disconnect the H7 heated oxygen sensor connector.
(b) Disconnect the E12 and E13 ECM connectors.
(c) Check the resistance.

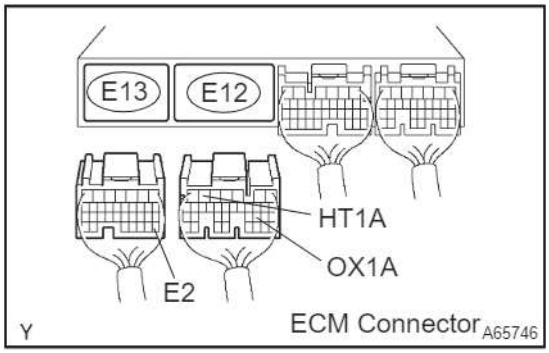
Standard (Check for open):

Tester Connection	Specified Condition
OX (H7–3) – OX1A (E12–22)	Below 1 Ω
HT (H7–1) – HT1A (E12–6)	Below 1 Ω
E1 (H7–4) – E2 (E13–28)	Below 1 Ω

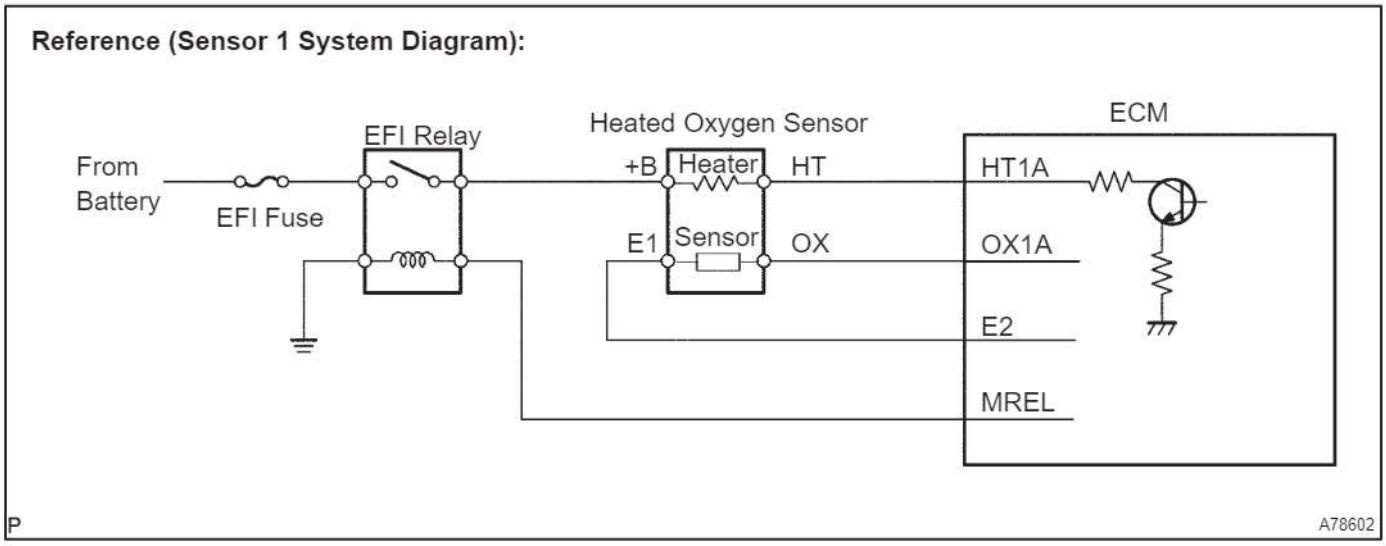
Standard (Check for short):

Tester Connection	Specified Condition
OX (H7–3) or OX1A (E12–22) – Body ground	10 kΩ or higher
HT (H7–1) or HT1A (E12–6) – Body ground	10 kΩ or higher

(d) Reconnect the heated oxygen sensor connector.
(e) Reconnect the ECM connector.



Reference (Sensor 1 System Diagram):



NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

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6	CHECK AIR INDUCTION SYSTEM

(a) Check for vacuum leaks in the air induction system.

NG → REPAIR OR REPLACE AIR INDUCTION SYSTEM

OK

7	CHECK FUEL PRESSURE (See page 11–5 of Pub. No. RM1018E AVENSIS)

(a) Check the fuel pressure (high or low pressure).

NG → REPAIR OR REPLACE FUEL SYSTEM

OK

8	INSPECT FUEL INJECTOR ASSY(INJECTION AND VOLUME) (See page 11–8 of Pub. No. RM1018E AVENSIS)

NG → REPLACE FUEL INJECTOR ASSY (See page 11–10 of Pub. No. RM1018E AVENSIS)

OK

REPLACE HEATED OXYGEN SENSOR

9	PERFORM CONFIRMATION DRIVING PATTERN

HINT:
Clear all DTCs prior to performing the confirmation driving pattern.

GO

10	CHECK IF DTC OUTPUT RECURS(DTC P0130, P2195 AND P2196)

(a) Connect the intelligent tester II to the DLC3.
(b) Turn the ignition switch to ON and turn the intelligent tester II ON.
(c) Select the following menu items: Powertrain / Engine and ECT / DTC.
(d) Read DTCs.

Result:

Display (DTC Output)	Proceed To
P0130 and/or P2195 or P2196	A
No output	B

B → CHECK FOR INTERMITTENT PROBLEMS (See page 05–9)

A

REPLACE HEATED OXYGEN SENSOR

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DTC	P0133	OXYGEN SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 1)

CIRCUIT DESCRIPTION

Refer to DTC P0130 on page 05–74.

DTC No.	DTC Detection Condition	Trouble Area
P0133	Voltage of heated oxygen sensor (sensor 1) does not fluctuate between lean and rich for 0.9 seconds (2 trip detection logic) Lean: 0.35 V or less Rich: 0.45 V or more	• Open or short in heated oxygen sensor circuit • Heated oxygen sensor (sensor 1) • Heated oxygen sensor heater (sensor 1) • EFI relay • Air induction system • Fuel pressure • Injector • ECM

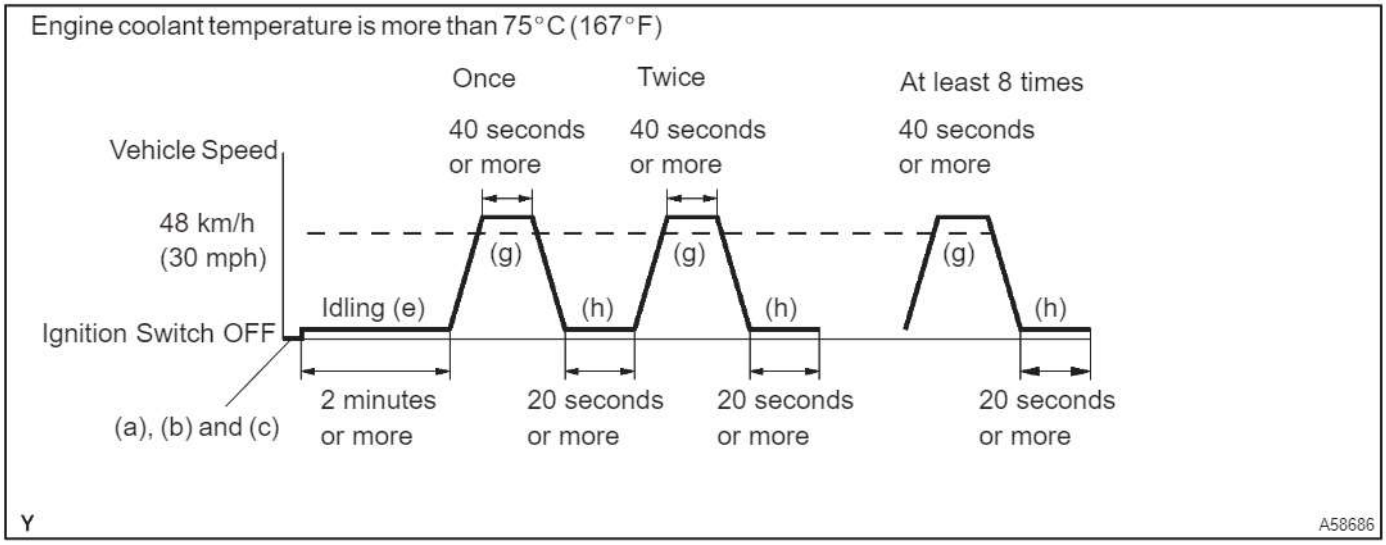
HINT:

- Sensor 1 refers to the sensor near the engine assembly.

WIRING DIAGRAM

Refer to DTC P0130 on page 05–74.

CONFIRMATION DRIVING PATTERN



(a) Connect the intelligent tester II to the DLC3.
(b) Turn the ignition switch to ON and turn the intelligent tester II ON.
(c) Switch the ECM from normal mode to check mode using the intelligent tester II (see page 05–20).
(d) Start the engine.
(e) Allow the engine to idle for 2 minutes.
(f) Warm up the engine until the engine coolant temperature reaches more than 75°C (167°F).
(g) Drive the vehicle at 48 km/h (30 mph) or more for 40 seconds or more.
(h) Stop the vehicle and allow the engine to idle for 20 seconds or more.
(i) Repeat the steps (g) and (h) at least 8 times in one driving cycle.

HINT:

If a malfunction exists, the MIL will be illuminated during step (i).

NOTICE:

If the conditions in this test are not strictly followed, no malfunction will be detected. If you do not have the intelligent tester II, turn the ignition switch to OFF after performing steps from (d) to (i), then perform steps (d) to (i) again.

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INSPECTION PROCEDURE

HINT:

Intelligent tester II only:

Malfunctioning areas can be found using the Active Test / A/F Control operation. The A/F Control operation can determine if the heated oxygen sensor or other potential trouble areas are malfunctioning or not.

(a) Perform the Active Test using the intelligent tester II.

HINT:

The A/F Control operation lowers the injection volume by 12.5 % or increases the injection volume by 25 %.

(1) Connect the intelligent tester II to the DLC3.
(2) Start the engine and turn the intelligent tester II ON.
(3) Warm up the engine by running the engine at 2,500 rpm for approximately 3 minutes.
(4) On the intelligent tester II, select the following menu items: Powertrain / Engine and ECT / Active Test / A/F Control.
(5) Select the following monitor items: O2S B1 S1 and O2S B1 S2.
(6) Perform the A/F Control operation with the engine in an idling condition (press the right or left button).

Result:

The heated oxygen sensor reacts in accordance with increases and decreases of the injection volume:

+25 % → Rich output: More than 0.5 V

–12.5 % → Lean output: Less than 0.4 V

NOTICE:

Sensor 1 (front sensor) has an output delay of a few seconds. Sensor 2 (rear sensor) has a maximum output delay of approximately 20 seconds.

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	Output Voltage of Heated Oxygen Sensor (sensor 1: front sensor)	Output Voltage of Heated Oxygen Sensor (sensor 2: rear sensor)	Main Suspect Trouble Area
Case 1	Injection volume +25 % –12.5 % Output voltage More than 0.5 V Less than 0.4V OK	Injection volume +25 % –12.5 % Output voltage More than 0.5 V Less than 0.4V OK	—
Case 2	Injection volume +25 % –12.5 % Output voltage Almost no reaction NG	Injection volume +25 % –12.5 % Output voltage More than 0.5 V Less than 0.4V OK	Sensor 1: front sensor (Sensor 1, heater, sensor 1 circuit)
Case 3	Injection volume +25 % –12.5 % Output voltage More than 0.5 V Less than 0.4V OK	Injection volume +25 % –12.5 % Output voltage Almost no reaction NG	Sensor 2: rear sensor (Sensor 2, heater, sensor 2 circuit)
Case 4	Injection volume +25 % –12.5 % Output voltage Almost no reaction NG	Injection volume +25 % –12.5 % Output voltage Almost no reaction NG	Extremely rich or lean actual air–fuel ratio (Injector, fuel pressure, gas leakage in exhaust system, etc.)

The following A/F Control procedure enables the technician to check and graph the voltage output of both the heated oxygen sensors.

To display the graph, select the following menu items on the tester: View / Line Graph.

NOTICE:

If the vehicle is short of fuel, the air–fuel ratio becomes lean and the heated oxygen sensor DTCs will be recorded, and the MIL then illuminates.

HINT:

- If different 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 intelligent tester II. Freeze frame data record the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, 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.
- A high heated oxygen sensor (sensor 1) voltage (0.5 V or more) could be caused by a rich air–fuel mixture. Check for conditions that would cause the engine to run rich.
- A low heated oxygen sensor (sensor 1) voltage (0.4 V or less) could be caused by a lean air–fuel mixture. Check for conditions that would cause the engine to run lean.

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1	CHECK OTHER DTC OUTPUT(IN ADDITION TO DTC P0133)

(a) Connect the intelligent tester II to the DLC3.
(b) Turn the ignition switch to ON and turn the intelligent tester II ON.
(c) Select the following menu items: Powertrain / Engine and ECT / DTC.
(d) Read DTCs.

Result:

Display (DTC Output)	Proceed To
P0133	A
P0133 and other DTCs	B

HINT:
If any DTCs other than P0133 are output, troubleshoot those DTCs first.

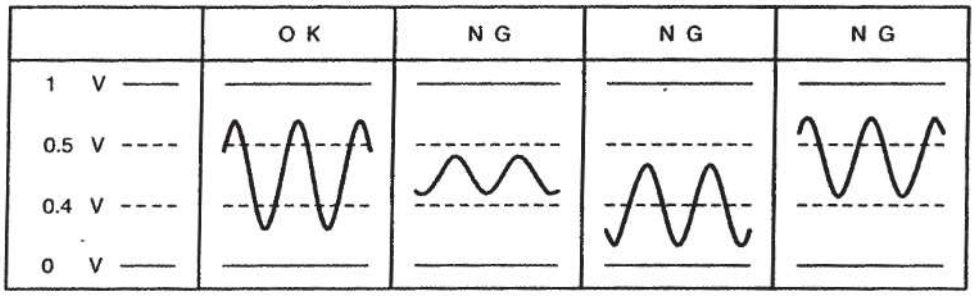
B → **GO TO RELEVANT DTC CHART** (See page 05–27)

A

2	READ VALUE OF INTELLIGENT TESTER II(HEATED OXYGEN SENSOR DURING IDLING)

(a) Connect the intelligent tester II to the DLC3.
(b) Start the engine and turn the intelligent tester II ON.
(c) Select the following menu items: Powertrain / Engine and ECT / Data List / O2S B1 S1.
(d) Warm up the heated oxygen sensor at the engine speed of 2,500 rpm for approximately 90 seconds.
(e) Read the output voltage of the heated oxygen sensor during engine idling.

Standard:
Fluctuates between less than 0.4 V and more than 0.5 V (see the following figure).



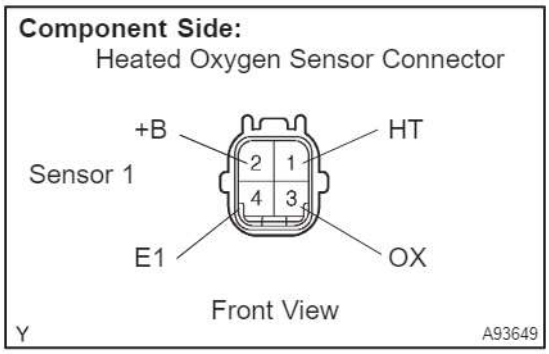
A97090

OK → **Go to step 9**

NG

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3 INSPECT HEATED OXYGEN SENSOR(HEATER RESISTANCE)



(a) Disconnect the H7 heated oxygen sensor connector.
(b) Measure the resistance between the terminals of the heated oxygen sensor connector.

Standard:

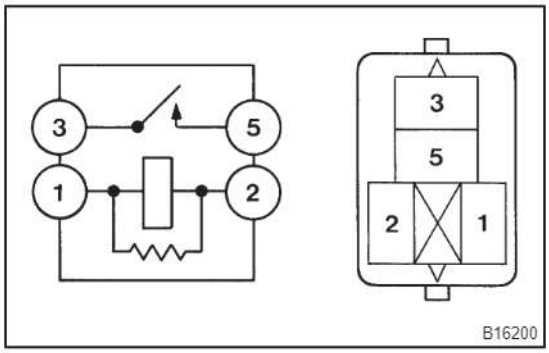
Tester Connection	Specified Condition
1 (HT) – 2 (+B)	5 to 10 Ω at 20°C (68°F)
1 (HT) – 4 (E1)	10 kΩ or higher

(c) Reconnect the heated oxygen sensor connector.

NG → REPLACE HEATED OXYGEN SENSOR

OK

4 INSPECT EFI RELAY



(a) Remove the EFI relay from the engine room R/B No. 4.
(b) Check the EFI relay resistance.

Standard:

Tester Connection	Specified Condition
3 – 5	10 kΩ or higher
3 – 5	Below 1 Ω (Apply battery voltage to terminals 1 and 2)

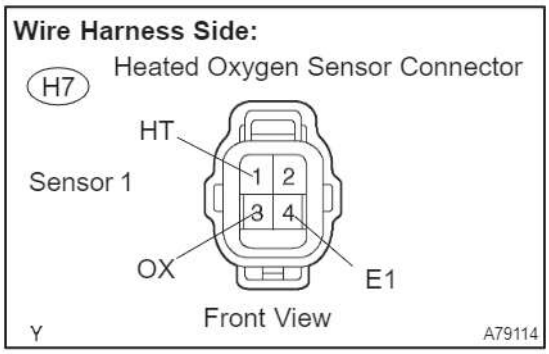
(c) Reinstall the EFI relay.

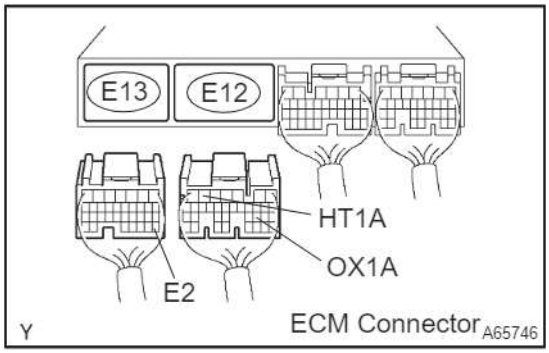
NG → REPLACE EFI RELAY

OK

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5 CHECK HARNESS AND CONNECTOR(HEATED OXYGEN SENSOR – ECM)





(a) Disconnect the H7 heated oxygen sensor connector.
(b) Disconnect the E12 and E13 ECM connectors.
(c) Check the resistance.

Standard (Check for open):

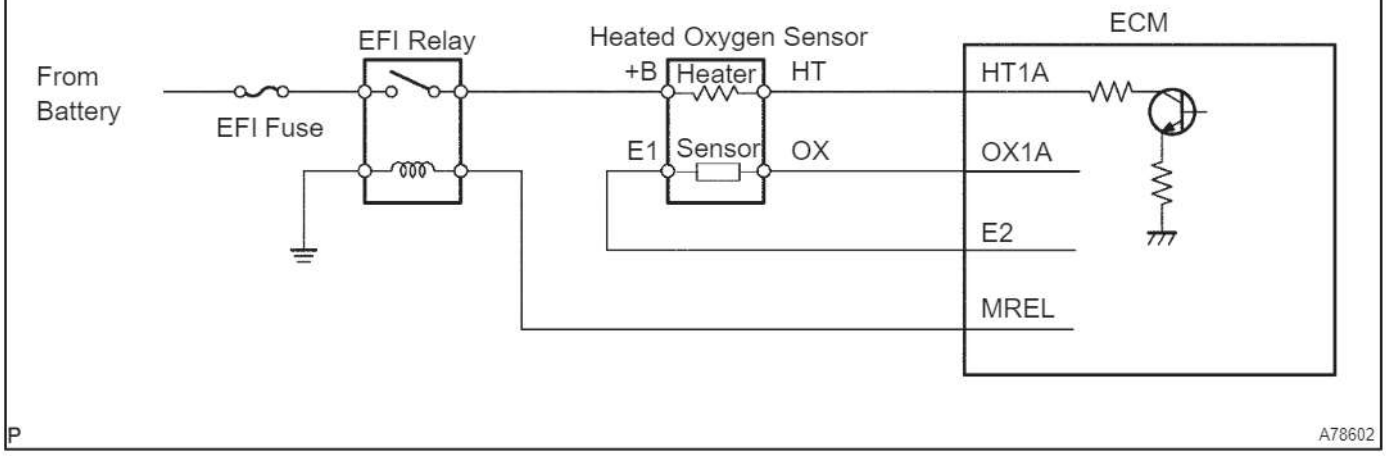
Tester Connection	Specified Condition
OX (H7–3) – OX1A (E12–22)	Below 1 Ω
HT (H7–1) – HT1A (E12–6)	Below 1 Ω
E1 (H7–4) – E2 (E13–28)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
OX (H7–3) or OX1A (E12–22) – Body ground	10 kΩ or higher
HT (H7–1) or HT1A (E12–6) – Body ground	10 kΩ or higher

(d) Reconnect the heated oxygen sensor connector.
(e) Reconnect the ECM connector.

Reference (Sensor 1 System Diagram):



NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

6 CHECK AIR INDUCTION SYSTEM

(a) Check for vacuum leaks in the air induction system.

NG → REPAIR OR REPLACE AIR INDUCTION SYSTEM

OK

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7	CHECK FUEL PRESSURE (See page 11–5 of Pub. No. RM1018E AVENSIS)

(a) Check the fuel pressure (high or low pressure).

NG → REPAIR OR REPLACE FUEL SYSTEM

OK

8	INSPECT FUEL INJECTOR ASSY(INJECTION AND VOLUME) (See page 11–8 of Pub. No. RM1018E AVENSIS)

NG → REPLACE FUEL INJECTOR ASSY (See page 11–10 of Pub. No. RM1018E AVENSIS)

OK

REPLACE HEATED OXYGEN SENSOR

9	PERFORM CONFIRMATION DRIVING PATTERN

HINT:
Clear all DTCs prior to performing the confirmation driving pattern.

GO

10	CHECK IF DTC OUTPUT RECURS(DTC P0133)

(a) Connect the intelligent tester II to the DLC3.
(b) Turn the ignition switch to ON and turn the intelligent tester II ON.
(c) Select the following menu items: Powertrain / Engine and ECT / DTC.
(d) Read DTCs.

Result:

Display (DTC Output)	Proceed To
P0133	A
No output	B

B → CHECK FOR INTERMITTENT PROBLEMS (See page 05–9)

A

REPLACE HEATED OXYGEN SENSOR

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DTC	P0134	OXYGEN SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 1 SENSOR 1)

CIRCUIT DESCRIPTION

Refer to DTC P0130 on page 05–74.

DTC No.	DTC Detecting Condition	Trouble Area
P0134	After engine is warmed up, voltage of heated oxygen sensor (sensor 1) does not become rich (greater than 0.45 V) even once when conditions (a), (b), (c), (d) and (e) continue for more than 50 seconds (1 trip detection logic): (a) Engine speed: 1,400 rpm or more (b) Vehicle speed: 40 km/h (25 mph) or more (c) Throttle valve is not fully closed (d) 180 seconds or more after starting engine (e) Engine coolant temperature is more than 40°C (104°F)	• Open or short in heated oxygen sensor circuit • Heated oxygen sensor (sensor 1) • PCV valve and hose • EFI relay • Air induction system • Fuel pressure • Injector • Gas leakage in exhaust system • ECM

HINT:

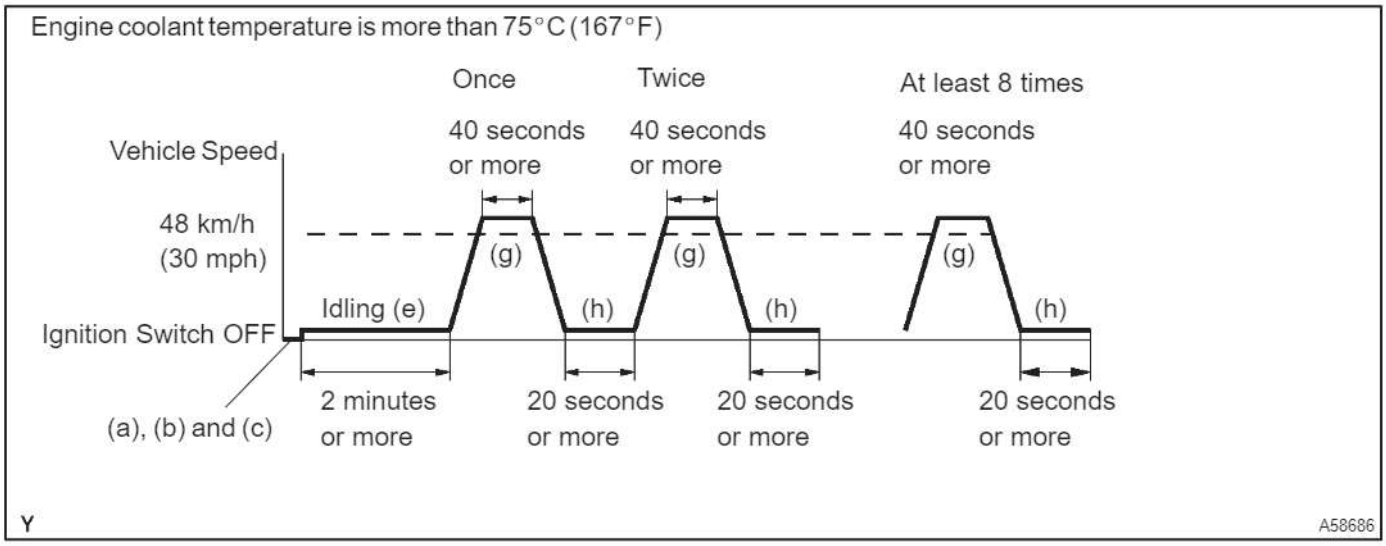
- Sensor 1 refers to the sensor near the engine assembly.
- When DTC P0134 is detected, confirm the output voltage of the heated oxygen sensor (sensor 1) in the Data List using the intelligent tester II.
  If the voltage output of the heated oxygen sensor is less than 0.1 V, the heated oxygen sensor circuit may be open or short.

WIRING DIAGRAM

Refer to DTC P0130 on page 05–74.

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CONFIRMATION DRIVING PATTERN



(a) Connect the intelligent tester II to the DLC3.
(b) Turn the ignition switch to ON and turn the intelligent tester II ON.
(c) Switch the ECM from normal mode to check mode using the intelligent tester II (see page 05–20).
(d) Start the engine.
(e) Allow the engine to idle for 2 minutes.
(f) Warm up the engine until the engine coolant temperature reaches more than 75°C (167°F).
(g) Drive the vehicle at 48 km/h (30 mph) or more for 40 seconds or more.
(h) Stop the vehicle and allow the engine to idle for 20 seconds or more.
(i) Repeat the steps (g) and (h) at least 8 times in one driving cycle.

HINT:

If a malfunction exists, the MIL will be illuminated during step (i).

NOTICE:

If the conditions in this test are not strictly followed, no malfunction will be detected. If you do not have the intelligent tester II, turn the ignition switch to OFF after performing steps from (d) to (i), then perform steps (d) to (i) again.

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INSPECTION PROCEDURE

HINT:

Intelligent tester II only:

Malfunctioning areas can be found using the Active Test / A/F Control operation. The A/F Control operation can determine if the heated oxygen sensor or other potential trouble areas are malfunctioning or not.

(a) Perform the Active Test using the intelligent tester II.

HINT:

The A/F Control operation lowers the injection volume by 12.5 % or increases the injection volume by 25 %.

(1) Connect the intelligent tester II to the DLC3.
(2) Start the engine and turn the intelligent tester II ON.
(3) Warm up the engine by running the engine at 2,500 rpm for approximately 3 minutes.
(4) On the intelligent tester II, select the following menu items: Powertrain / Engine and ECT / Active Test / A/F Control.
(5) Select the following monitor items: O2S B1 S1 and O2S B1 S2.
(6) Perform the A/F Control operation with the engine in an idling condition (press the right or left button).

Result:

The heated oxygen sensor reacts in accordance with increases and decreases of the injection volume:

+25 % → Rich output: More than 0.5 V

–12.5 % → Lean output: Less than 0.4 V

NOTICE:

Sensor 1 (front sensor) has an output delay of a few seconds. Sensor 2 (rear sensor) has a maximum output delay of approximately 20 seconds.

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	Output Voltage of Heated Oxygen Sensor (sensor 1: front sensor)	Output Voltage of Heated Oxygen Sensor (sensor 2: rear sensor)	Main Suspect Trouble Area
Case 1	Injection volume +25 % –12.5 % Output voltage More than 0.5 V Less than 0.4V **OK**	Injection volume +25 % –12.5 % Output voltage More than 0.5 V Less than 0.4V **OK**	—
Case 2	Injection volume +25 % –12.5 % Output voltage Almost no reaction **NG**	Injection volume +25 % –12.5 % Output voltage More than 0.5 V Less than 0.4V **OK**	Sensor 1: front sensor (Sensor 1, heater, sensor 1 circuit)
Case 3	Injection volume +25 % –12.5 % Output voltage More than 0.5 V Less than 0.4V **OK**	Injection volume +25 % –12.5 % Output voltage Almost no reaction **NG**	Sensor 2: rear sensor (Sensor 2, heater, sensor 2 circuit)
Case 4	Injection volume +25 % –12.5 % Output voltage Almost no reaction **NG**	Injection volume +25 % –12.5 % Output voltage Almost no reaction **NG**	Extremely rich or lean actual air–fuel ratio (Injector, fuel pressure, gas leakage in exhaust system, etc.)

The following A/F Control procedure enables the technician to check and graph the voltage output of both the heated oxygen sensors.

To display the graph, select the following menu items on the tester: View / Line Graph.

NOTICE:

If the vehicle is short of fuel, the air–fuel ratio becomes lean and the heated oxygen sensor DTCs will be recorded, and the MIL then illuminates.

HINT:

- If different 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 intelligent tester II. Freeze frame data record the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, 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.
- A high heated oxygen sensor (sensor 1) voltage (0.5 V or more) could be caused by a rich air–fuel mixture. Check for conditions that would cause the engine to run rich.
- A low heated oxygen sensor (sensor 1) voltage (0.4 V or less) could be caused by a lean air–fuel mixture. Check for conditions that would cause the engine to run lean.

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1	CHECK OTHER DTC OUTPUT(IN ADDITION TO DTC P0134)

(a) Connect the intelligent tester II to the DLC3.
(b) Turn the ignition switch to ON and turn the intelligent tester II ON.
(c) Select the following menu items: Powertrain / Engine and ECT / DTC.
(d) Read DTCs.

Result:

Display (DTC Output)	Proceed To
P0134	A
P0134 and other DTCs	B

HINT:
If any DTCs other than P0134 are output, troubleshoot those DTCs first.

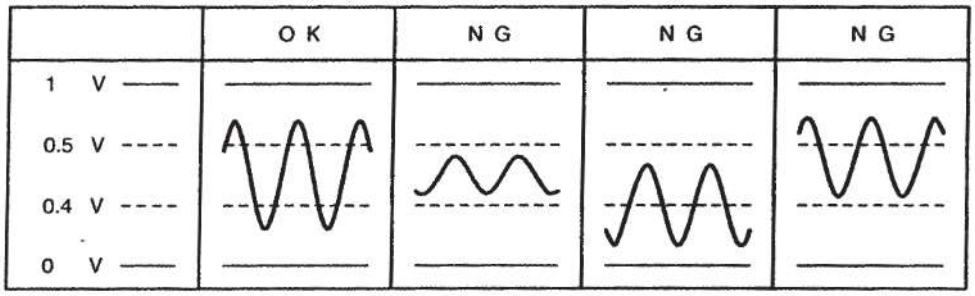
B → **GO TO RELEVANT DTC CHART** (See page 05–27)

A

2	READ VALUE OF INTELLIGENT TESTER II(OUTPUT VOLTAGE OF HEATED OXYGEN SENSOR)

(a) Connect the intelligent tester II to the DLC3.
(b) Start the engine and turn the intelligent tester II ON.
(c) Select the following menu items: Powertrain / Engine and ECT / Data List / O2S B1 S1.
(d) Warm up the heated oxygen sensor at the engine speed of 2,500 rpm for approximately 90 seconds.
(e) Read the output voltage of the heated oxygen sensor during engine idling.

Standard:
Fluctuates between less than 0.4 V and more than 0.5 V (see the following figure).



A97090

OK → **Go to step 12**

NG

3	CHECK CONNECTION OF PCV HOSE

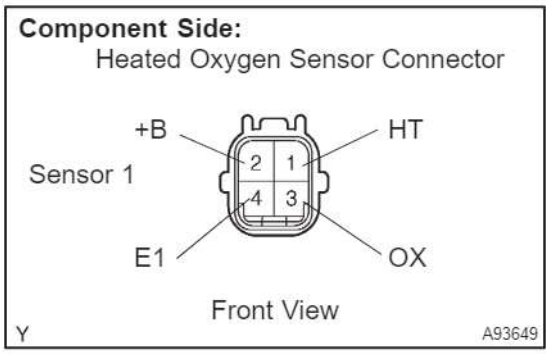
OK: The PCV hose is connected correctly and not damaged.

NG → **REPAIR OR REPLACE PCV HOSE**

OK

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4 INSPECT HEATED OXYGEN SENSOR(HEATER RESISTANCE)



(a) Disconnect the H7 heated oxygen sensor connector.
(b) Measure the resistance between the terminals of the heated oxygen sensor connector.

Standard:

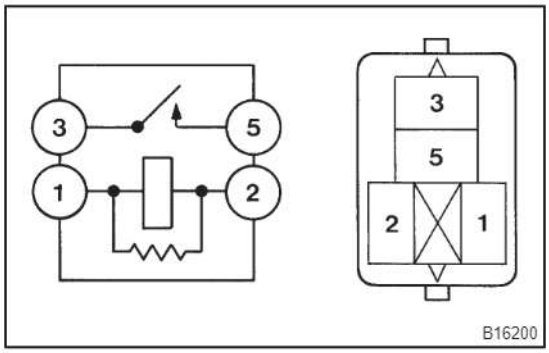
Tester Connection	Specified Condition
1 (HT) – 2 (+B)	5 to 10 Ω at 20°C (68°F)
1 (HT) – 4 (E1)	10 kΩ or higher

(c) Reconnect the heated oxygen sensor connector.

NG → REPLACE HEATED OXYGEN SENSOR

OK

5 INSPECT EFI RELAY



(a) Remove the EFI relay from the engine room R/B No. 4.
(b) Check the EFI relay resistance.

Standard:

Tester Connection	Specified Condition
3 – 5	10 kΩ or higher
3 – 5	Below 1 Ω (Apply battery voltage to terminals 1 and 2)

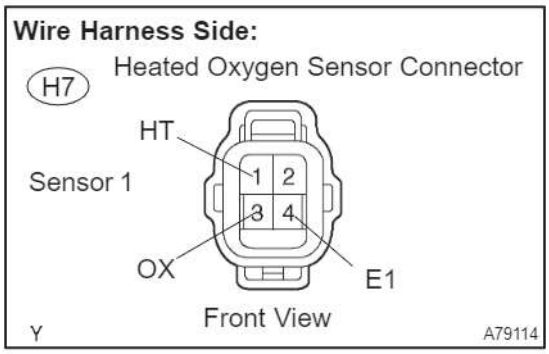
(c) Reinstall the EFI relay.

NG → REPLACE EFI RELAY

OK

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6 CHECK HARNESS AND CONNECTOR(HEATED OXYGEN SENSOR – ECM)



(a) Disconnect the H7 heated oxygen sensor connector.
(b) Disconnect the E12 and E13 ECM connectors.
(c) Check the resistance.

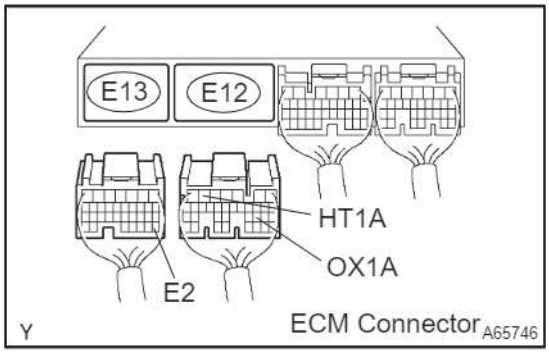
Standard (Check for open):

Tester Connection	Specified Condition
OX (H7–3) – OX1A (E12–22)	Below 1 Ω
HT (H7–1) – HT1A (E12–6)	Below 1 Ω
E1 (H7–4) – E2 (E13–28)	Below 1 Ω

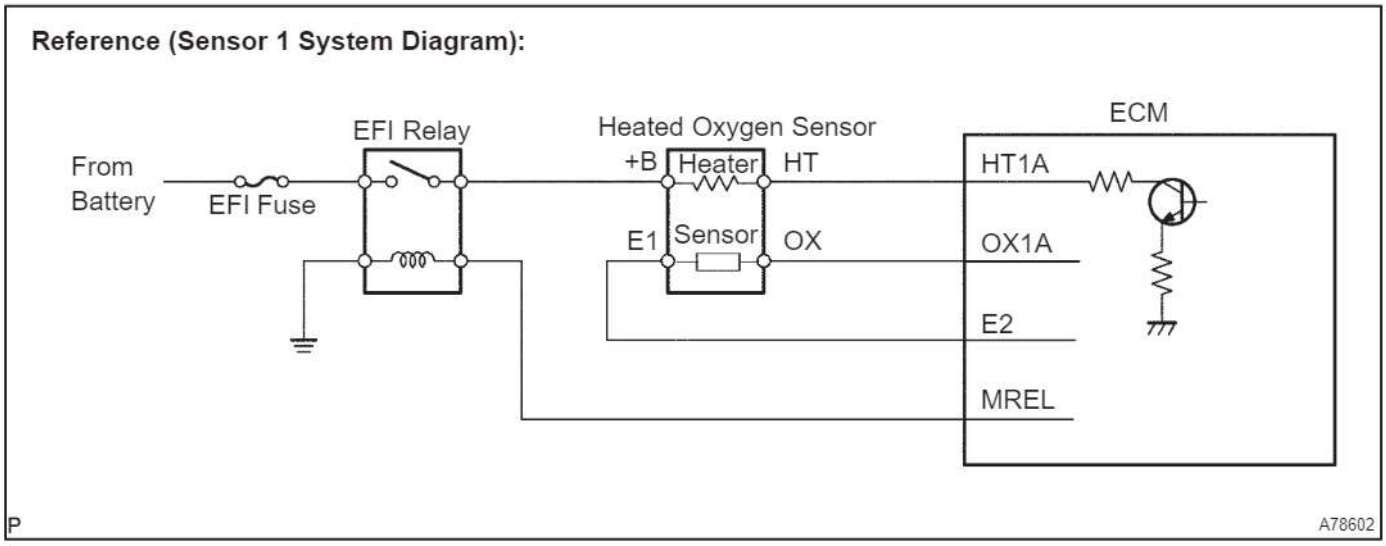
Standard (Check for short):

Tester Connection	Specified Condition
OX (H7–3) or OX1A (E12–22) – Body ground	10 kΩ or higher
HT (H7–1) or HT1A (E12–6) – Body ground	10 kΩ or higher

(d) Reconnect the heated oxygen sensor connector.
(e) Reconnect the ECM connector.



Reference (Sensor 1 System Diagram):



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

OK

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7	CHECK WHETHER MISFIRE OCCURS OR NOT BY MONITORING DTC AND DATA LIST

NG → TROUBLESHOOT MISFIRES

OK

8	CHECK AIR INDUCTION SYSTEM

(a) Check for vacuum leaks in the air induction system.

NG → REPAIR OR REPLACE AIR INDUCTION SYSTEM

OK

9	CHECK FUEL PRESSURE (See page 11–5 of Pub. No. RM1018E AVENSIS)

(a) Check the fuel pressure (high or low pressure).

NG → REPAIR OR REPLACE FUEL SYSTEM

OK

10	INSPECT FUEL INJECTOR ASSY(INJECTION AND VOLUME) (See page 11–8 of Pub. No. RM1018E AVENSIS)

NG → REPLACE FUEL INJECTOR ASSY (See page 11–10 of Pub. No. RM1018E AVENSIS)

OK

11	CHECK FOR EXHAUST GAS LEAKS

NG → REPAIR OR REPLACE EXHAUST GAS LEAKAGE POINT

OK

REPAIR OR REPLACE EXHAUST GAS LEAKAGE POINT

12	PERFORM CONFIRMATION DRIVING PATTERN

HINT:
Clear all DTCs prior to performing the confirmation driving pattern.

GO

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13	CHECK IF DTC OUTPUT RECURS(DTC P0134)

(a) Connect the intelligent tester II to the DLC3.
(b) Turn the ignition switch to ON and turn the intelligent tester II ON.
(c) Select the following menu items: Powertrain / Engine and ECT / DTC.
(d) Read DTCs.

Result:

Display (DTC Output)	Proceed To
P0134	A
No output	B

B → **REPLACE ECM (See page 10–65 of Pub. No. RM1018E AVENSIS)**

A

14	CONFIRM IF VEHICLE HAS RUN OUT OF FUEL IN PAST

NO → **CHECK FOR INTERMITTENT PROBLEMS (see page 05–9)**

YES

DTC IS CAUSED BY RUNNING OUT OF FUEL

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DTC	P0136	OXYGEN SENSOR CIRCUIT MALFUNCTION (BANK 1 SENSOR 2)

CIRCUIT DESCRIPTION

Refer to DTC P0130 on page 05–74.

DTC No	DTC Detection Condition	Trouble Area
P0136	Heated oxygen sensor voltage does not change during driving (1 trip detection logic)	• Open or short in heated oxygen sensor circuit • Heated oxygen sensor (sensor 2) • Heated oxygen sensor heater (sensor 2) • EFI relay

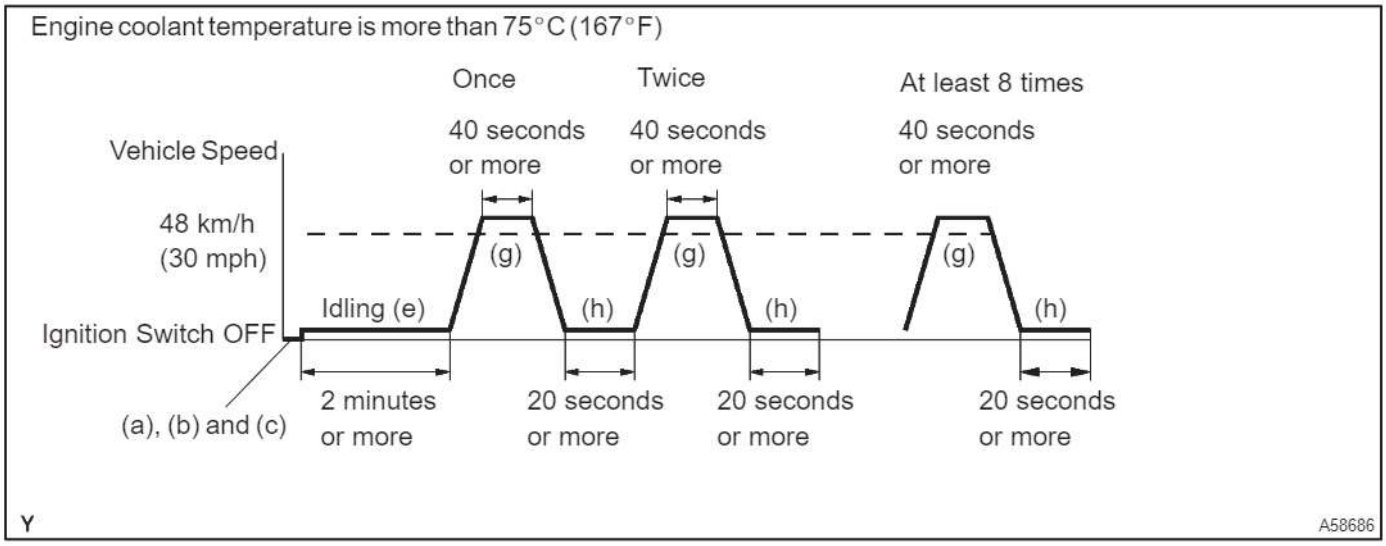
HINT:

Sensor 2 refers to the sensor farthest away from the engine assembly.

WIRING DIAGRAM

Refer to DTC P0130 on page 05–74.

CONFIRMATION DRIVING PATTERN



(a) Connect the intelligent tester II to the DLC3.
(b) Turn the ignition switch to ON and turn the intelligent tester II ON.
(c) Switch the ECM from normal mode to check mode using the intelligent tester II (see page 05–20).
(d) Start the engine.
(e) Allow the engine to idle for 2 minutes.
(f) Warm up the engine until the engine coolant temperature reaches more than 75°C (167°F).
(g) Drive the vehicle at 48 km/h (30 mph) or more for 40 seconds or more.
(h) Stop the vehicle and allow the engine to idle for 20 seconds or more.
(i) Repeat the steps (g) and (h) at least 8 times in one driving cycle.

HINT:

If a malfunction exists, the MIL will be illuminated during step (i).

NOTICE:

If the conditions in this test are not strictly followed, no malfunction will be detected. If you do not have the intelligent tester II, turn the ignition switch to OFF after performing steps from (d) to (i), then perform steps (d) to (i) again.

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INSPECTION PROCEDURE

HINT:

Intelligent tester II only:

Malfunctioning areas can be found using the Active Test / A/F Control operation. The A/F Control operation can determine if the heated oxygen sensor or other potential trouble areas are malfunctioning or not.

(a) Perform the Active Test using the intelligent tester II.

HINT:

The A/F Control operation lowers the injection volume by 12.5 % or increases the injection volume by 25 %.

(1) Connect the intelligent tester II to the DLC3.
(2) Start the engine and turn the intelligent tester II ON.
(3) Warm up the engine by running the engine at 2,500 rpm for approximately 3 minutes.
(4) On the intelligent tester II, select the following menu items: Powertrain / Engine and ECT / Active Test / A/F Control.
(5) Select the following monitor items: O2S B1 S1 and O2S B1 S2.
(6) Perform the A/F Control operation with the engine in an idling condition (press the right or left button).

Result:

The heated oxygen sensor reacts in accordance with increases and decreases of the injection volume:

+25 % → Rich output: More than 0.5 V

–12.5 % → Lean output: Less than 0.4 V

NOTICE:

Sensor 1 (front sensor) has an output delay of a few seconds. Sensor 2 (rear sensor) has a maximum output delay of approximately 20 seconds.

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	Output Voltage of Heated Oxygen Sensor (sensor 1: front sensor)	Output Voltage of Heated Oxygen Sensor (sensor 2: rear sensor)	Main Suspect Trouble Area
Case 1	Injection volume +25 % –12.5 % Output voltage More than 0.5 V Less than 0.4V OK	Injection volume +25 % –12.5 % Output voltage More than 0.5 V Less than 0.4V OK	—
Case 2	Injection volume +25 % –12.5 % Output voltage Almost no reaction NG	Injection volume +25 % –12.5 % Output voltage More than 0.5 V Less than 0.4V OK	Sensor 1: front sensor (Sensor 1, heater, sensor 1 circuit)
Case 3	Injection volume +25 % –12.5 % Output voltage More than 0.5 V Less than 0.4V OK	Injection volume +25 % –12.5 % Output voltage Almost no reaction NG	Sensor 2: rear sensor (Sensor 2, heater, sensor 2 circuit)
Case 4	Injection volume +25 % –12.5 % Output voltage Almost no reaction NG	Injection volume +25 % –12.5 % Output voltage Almost no reaction NG	Extremely rich or lean actual air–fuel ratio (Injector, fuel pressure, gas leakage in exhaust system, etc.)

The following A/F Control procedure enables the technician to check and graph the voltage output of both the heated oxygen sensors.

To display the graph, select the following menu items on the tester: View / Line Graph.

NOTICE:

If the vehicle is short of fuel, the air–fuel ratio becomes lean and the heated oxygen sensor DTCs will be recorded, and the MIL then illuminates.

HINT:

- If different 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 intelligent tester II. Freeze frame data record the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, 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.
- A high heated oxygen sensor (sensor 1) voltage (0.5 V or more) could be caused by a rich air–fuel mixture. Check for conditions that would cause the engine to run rich.
- A low heated oxygen sensor (sensor 1) voltage (0.4 V or less) could be caused by a lean air–fuel mixture. Check for conditions that would cause the engine to run lean.

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1 CHECK OTHER DTC OUTPUT(IN ADDITION TO DTC P0136)

(a) Connect the intelligent tester II to the DLC3.
(b) Turn the ignition switch to ON and turn the intelligent tester II ON.
(c) Select the following menu items: Powertrain / Engine and ECT / DTC.
(d) Read DTCs.

Result:

Display (DTC Output)	Proceed To
P0136	A
P0136 and other DTCs	B

HINT:
If any DTCs other than P0136 are output, troubleshoot those DTCs first.

B → **GO TO RELEVANT DTC CHART (See page 05–27)**

A

2 READ VALUE OF INTELLIGENT TESTER II(OUTPUT VOLTAGE OF HEATED OXYGEN SENSOR)

(a) Connect the intelligent tester II to the DLC3.
(b) Start the engine and turn the intelligent tester II ON.
(c) Select the following menu items: Powertrain / Engine and ECT / DTC.
(d) After warming up the engine, run the engine at 2,500 rpm for 3 minutes.
(e) Read the output voltage of the heated oxygen sensor when the engine speed is suddenly increased.

HINT:
Quickly accelerate the engine to 4,000 rpm 3 times by using the accelerator pedal.

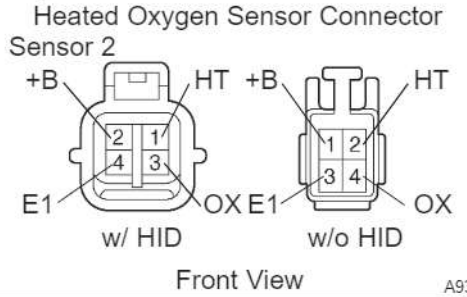
Standard: Fluctuates between 0.4 V or less and 0.5 V or more.

OK → **Go to step 6**

NG

3 INSPECT HEATED OXYGEN SENSOR(HEATER RESISTANCE)

Component Side:



(a) Disconnect the H17 heated oxygen sensor connector.
(b) Measure the resistance between the terminals of the heated oxygen sensor connector.

Standard:

Tester Connection	Specified Condition
With HID: 1 (HT) – 2 (+B)	11 to 16 Ω at 20°C (68°F)
With HID: 1 (HT) – 4 (E1)	10 kΩ or higher
Without HID: 2 (HT) – 1 (+B)	11 to 16 Ω at 20°C (68°F)
Without HID: 2 (HT) – 3 (E1)	10 kΩ or higher

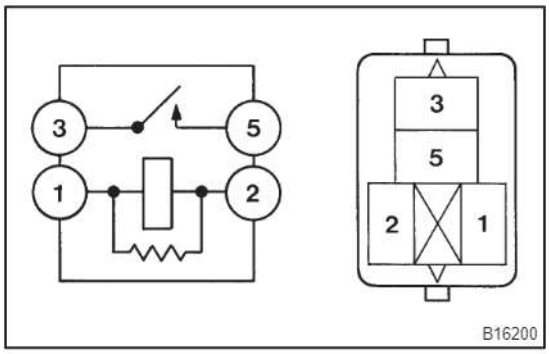
(c) Reconnect the heated oxygen sensor connector.

NG → **REPLACE HEATED OXYGEN SENSOR**

OK

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4 INSPECT EFI RELAY



(a) Remove the EFI relay from the engine room R/B No. 4.
(b) Check the EFI relay resistance.

Standard:

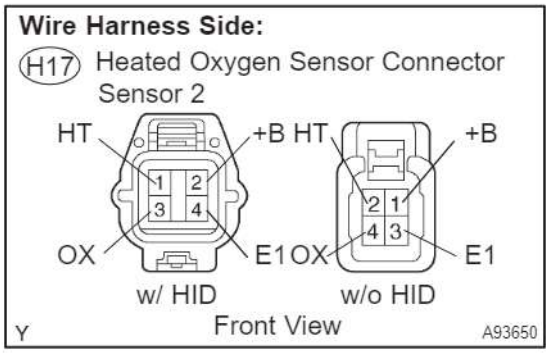
Tester Connection	Specified Condition
3 – 5	10 kΩ or higher
3 – 5	Below 1 Ω (Apply battery voltage to terminals 1 and 2)

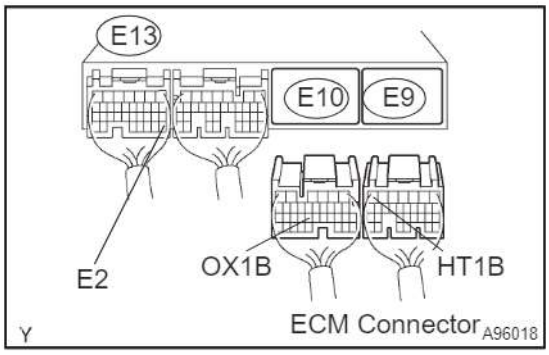
(c) Reinstall the EFI relay.

NG → REPLACE EFI RELAY

OK

5 CHECK HARNESS AND CONNECTOR(HEATED OXYGEN SENSOR – ECM)





(a) Disconnect the H17 heated oxygen sensor connector.
(b) Disconnect the E9 and E10 ECM connectors.
(c) Check the resistance.

Standard (Check for open):

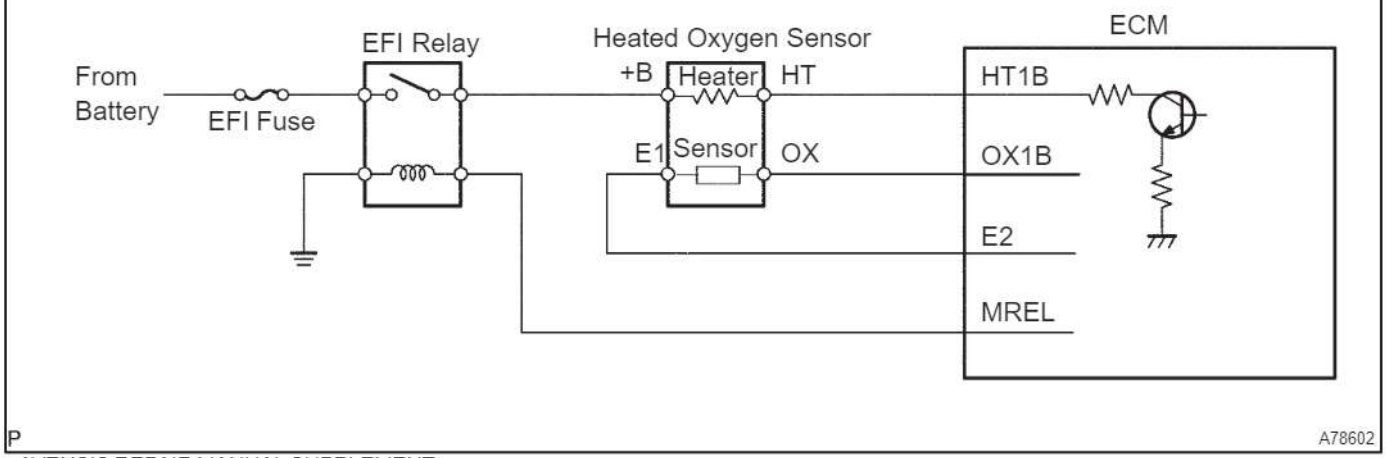
Tester Connection	Specified Condition
With HID: OX (H17–3) – OX1B (E10–23)	Below 1 Ω
With HID: HT (H17–1) – HT1B (E9–7)	Below 1 Ω
With HID: E1 (H17–4) – E2 (E13–28)	Below 1 Ω
Without HID: OX (H17–4) – OX1B (E10–23)	Below 1 Ω
Without HID: HT (H17–2) – HT1B (E9–7)	Below 1 Ω
Without HID: E1 (H17–3) – E2 (E13–28)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
With HID: OX (H17–3) or OX1B (E10–23) – Body ground	10 kΩ or higher
With HID: HT (H17–1) or HT1B (E9–7) – Body ground	10 kΩ or higher
Without HID: OX (H17–4) or OX1B (E10–23) – Body ground	10 kΩ or higher
Without HID: HT (H17–2) or HT1B (E9–7) – Body ground	10 kΩ or higher

(d) Reconnect the heated oxygen sensor connector.
(e) Reconnect the ECM connector.

Reference (Sensor 2 System Diagram):



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NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPLACE HEATED OXYGEN SENSOR

6	PERFORM CONFIRMATION DRIVING PATTERN

HINT:
Clear all DTCs prior to performing the confirmation driving pattern.

GO

7	CHECK IF DTC OUTPUT RECURS(DTC P0136)

(a) Connect the intelligent tester II to the DLC3.
(b) Turn the ignition switch to ON and turn the intelligent tester II ON.
(c) Select the following menu items: Powertrain / Engine and ECT / DTC.
(d) Read DTCs.

Result:

Display (DTC Output)	Proceed To
No output	A
P0136	B

B → REPLACE HEATED OXYGEN SENSOR

A

CHECK FOR INTERMITTENT PROBLEMS (See page 05–9)

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DTC	P0171	SYSTEM TOO LEAN (BANK 1)

DTC	P0172	SYSTEM TOO RICH (BANK 1)

CIRCUIT DESCRIPTION

The fuel trim is related to the feedback compensation value, not to the basic injection time. The fuel trim includes the short–term fuel trim and the long–term fuel trim.
The short–term fuel trim is the short–term fuel compensation used to maintain the air–fuel ratio at its ideal theoretical value. The signal from the heated oxygen sensor indicates whether the air–fuel ratio is rich or lean compared to the ideal theoretical value, triggering a reduction in the fuel volume if the air–fuel ratio is rich, and an increase in the fuel volume if it is lean.
The long–term fuel trim is the overall fuel compensation in order to balance the short–term fuel trim for a continual deviation from the central value by individual engine differences, operating environment and age deterioration.
If both the short–term fuel trim and the long–term fuel trim are lean or rich beyond a standard level, it is detected as a malfunction in the SFI system. The ECM illuminates the MIL and the DTC is set.

DTC No.	DTC Detection Condition	Trouble Area
P0171	When air–fuel ratio feedback is stable after warming up engine, fuel trim is considerably in error on lean side (2 trip detection logic)	• Air induction system • Injector blockage • Mass air flow meter • Engine coolant temperature sensor • Fuel pressure • Gas leakage in exhaust system • Open or short in heated oxygen sensor (sensor 1) circuit • Heated oxygen sensor (sensor 1) • PCV valve and hose • PCV hose connection • ECM
P0172	When air–fuel ratio feedback is stable after warming up engine, fuel trim is considerably in error on rich side (2 trip detection logic)	• Injector leakage or blockage • Mass air flow meter • Engine coolant temperature sensor • Ignition system • Fuel pressure • Gas leakage in exhaust system • Open or short in heated oxygen sensor (sensor 1) circuit • Heated oxygen sensor (sensor 1) • ECM

HINT:

- When DTC P0171 is set, the actual air–fuel ratio is lean. When DTC P0172 is set, the actual air–fuel ratio is rich.
- If the vehicle runs out of fuel, the air–fuel ratio is lean and DTC P0171 may be set. The MIL then illuminates.
- If the total of the short–term fuel trim value and long–term fuel trim value is within ± 20 %, the system is functioning normally.

WIRING DIAGRAM

Refer to DTC P0130 on page 05–74.

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INSPECTION PROCEDURE

HINT:

Intelligent tester II only:

Malfunctioning areas can be found using the Active Test / A/F Control operation. The A/F Control operation can determine if the heated oxygen sensor or other potential trouble areas are malfunctioning or not.

(a) Perform the Active Test using the intelligent tester II.

HINT:

The A/F Control operation lowers the injection volume by 12.5 % or increases the injection volume by 25 %.

(1) Connect the intelligent tester II to the DLC3.
(2) Start the engine and turn the intelligent tester II ON.
(3) Warm up the engine by running the engine at 2,500 rpm for approximately 3 minutes.
(4) On the intelligent tester II, select the following menu items: Powertrain / Engine and ECT / Active Test / A/F Control.
(5) Select the following monitor items: O2S B1 S1 and O2S B1 S2.
(6) Perform the A/F Control operation with the engine in an idling condition (press the right or left button).

Result:

The heated oxygen sensor reacts in accordance with increases and decreases of the injection volume:

+25 % → Rich output: More than 0.5 V

–12.5 % → Lean output: Less than 0.4 V

NOTICE:

Sensor 1 (front sensor) has an output delay of a few seconds. Sensor 2 (rear sensor) has a maximum output delay of approximately 20 seconds.

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	Output Voltage of Heated Oxygen Sensor (sensor 1: front sensor)	Output Voltage of Heated Oxygen Sensor (sensor 2: rear sensor)	Main Suspect Trouble Area
Case 1	Injection volume +25 % –12.5 % Output voltage More than 0.5 V Less than 0.4V **OK**	Injection volume +25 % –12.5 % Output voltage More than 0.5 V Less than 0.4V **OK**	—
Case 2	Injection volume +25 % –12.5 % Output voltage Almost no reaction **NG**	Injection volume +25 % –12.5 % Output voltage More than 0.5 V Less than 0.4V **OK**	Sensor 1: front sensor (Sensor 1, heater, sensor 1 circuit)
Case 3	Injection volume +25 % –12.5 % Output voltage More than 0.5 V Less than 0.4V **OK**	Injection volume +25 % –12.5 % Output voltage Almost no reaction **NG**	Sensor 2: rear sensor (Sensor 2, heater, sensor 2 circuit)
Case 4	Injection volume +25 % –12.5 % Output voltage Almost no reaction **NG**	Injection volume +25 % –12.5 % Output voltage Almost no reaction **NG**	Extremely rich or lean actual air–fuel ratio (Injector, fuel pressure, gas leakage in exhaust system, etc.)

The following A/F Control procedure enables the technician to check and graph the voltage output of both the heated oxygen sensors.

To display the graph, select the following menu items on the tester: View / Line Graph.

NOTICE:

If the vehicle is short of fuel, the air–fuel ratio becomes lean and the heated oxygen sensor DTCs will be recorded, and the MIL then illuminates.

HINT:

- Read freeze frame data using the intelligent tester II. Freeze frame data record the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, 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.
- A high heated oxygen sensor (sensor 1) voltage (0.5 V or more) could be caused by a rich air–fuel mixture. Check for conditions that would cause the engine to run rich.
- A low heated oxygen sensor (sensor 1) voltage (0.4 V or less) could be caused by a lean air–fuel mixture. Check for conditions that would cause the engine to run lean.

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1	CHECK AIR INDUCTION SYSTEM

(a) Check for vacuum leaks in the air induction system.
OK: No vacuum leak.

NG → REPAIR OR REPLACE AIR INDUCTION SYSTEM

OK

2	CHECK CONNECTION OF PCV HOSE

OK: The PCV hose is connected correctly and not damaged.

NG → REPAIR OR REPLACE PCV HOSE

OK

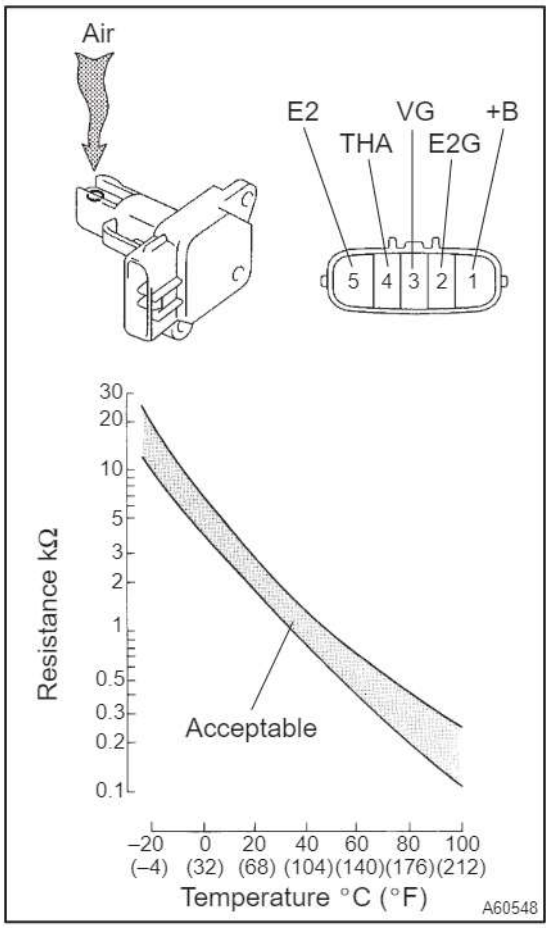
3	INSPECT FUEL INJECTOR ASSY(INJECTION AND VOLUME) (See page 11–8 of Pub. No. RM1018E AVENSIS)

NG → REPLACE FUEL INJECTOR ASSY (See page 11–10 of Pub. No. RM1018E AVENSIS)

OK

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4 INSPECT MASS AIR FLOW METER



(a) Remove the mass air flow meter.

(b) Inspect output voltage.

(1) Apply the battery voltage across terminals +B and E2G.

(2) Connect the positive (+) tester probe to terminal VG, and negative (–) tester probe to terminal E2G.

(3) Blow air into the mass air flow meter, and check that the voltage fluctuates.

(c) Inspect the resistance.

(1) Measure the resistance between the terminals of the intake air temperature sensor.

Standard:

Tester Connection	Specified Condition
THA (4) – E2 (5)	13.6 to 18.4 kΩ at –20°C (–4°F)
THA (4) – E2 (5)	2.21 to 2.69 kΩ at 20°C (68°F)
THA (4) – E2 (5)	0.49 to 0.67 kΩ at 60°C (140°F)

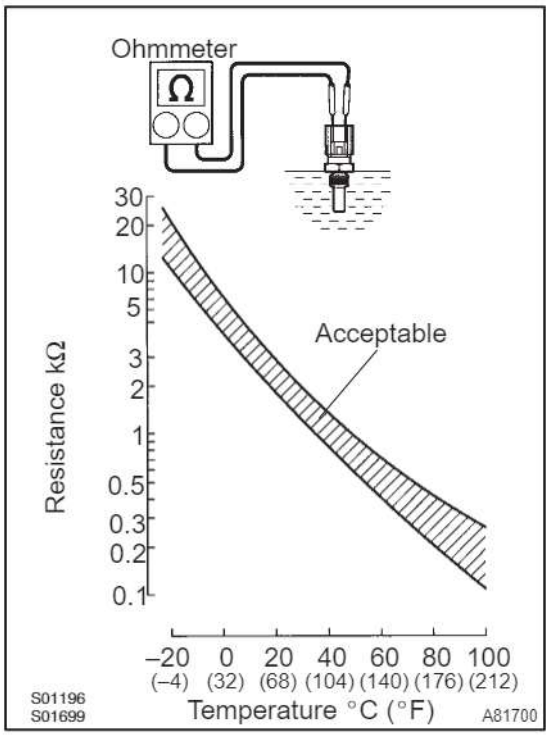
(d) Reinstall the mass air flow meter.

NG → **REPLACE MASS AIR FLOW METER**

OK

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5	INSPECT ENGINE COOLANT TEMPERATURE SENSOR(RESISTANCE)



(a) Remove the engine coolant temperature sensor.
(b) Measure the resistance between the terminals of the engine coolant temperature sensor.

Standard:

Tester Connection	Specified Condition
1 – 2	2.32 to 2.59 kΩ at 20°C (68°F)
1 – 2	0.310 to 0.326 kΩ at 80°C (176°F)

NOTICE:

When checking the engine coolant temperature sensor in water, be careful not to allow water to get in contact with the terminals. After checking, dry the sensor.

HINT:

Alternative procedure: Connect an ohmmeter to the installed engine coolant temperature sensor and read the resistance. Use an infrared thermometer to measure the engine temperature in the immediate vicinity of the sensor. Compare these values against the resistance/temperature graph. Change the engine temperature (warm up or allow to cool down) and repeat the test.

NG → **REPLACE ENGINE COOLANT TEMPERATURE SENSOR**

OK

6	CHECK FOR SPARK AND IGNITION (See page 18–3 of Pub. No. RM1018E AVENSIS)

OK: The spark occurs.

NG → **REPAIR OR REPLACE**

OK

7	CHECK FUEL PRESSURE (See page 11–5 of Pub. No. RM1018E AVENSIS)

(a) Check the fuel pressure (high or low pressure).

NG → **CHECK AND REPLACE FUEL SYSTEM**

OK

8	CHECK FOR EXHAUST GAS LEAKAGE

OK: No gas leak.

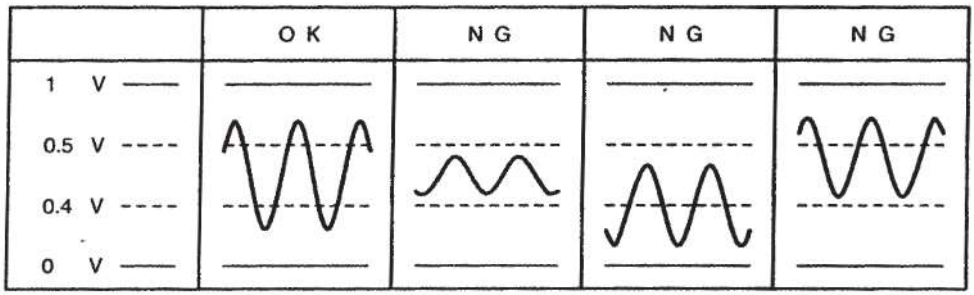
NG → **REPAIR OR REPLACE EXHAUST GAS LEAKAGE POINT**

OK

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9	READ VALUE OF INTELLIGENT TESTER II(OUTPUT VOLTAGE OF HEATED OXYGEN SENSOR)

(a) Connect the intelligent tester II to the DLC3.
(b) Start the engine and turn the intelligent tester II ON.
(c) Select the following menu items: Powertrain / Engine and ECT / Data List / O2S B1 S1.
(d) Warm up the heated oxygen sensor at the engine speed of 2,500 rpm for approximately 90 seconds.
(e) Read the output voltage of the heated oxygen sensor during engine idling.
Standard:
Fluctuates between less than 0.4 V and more than 0.5 V (see the following figure).



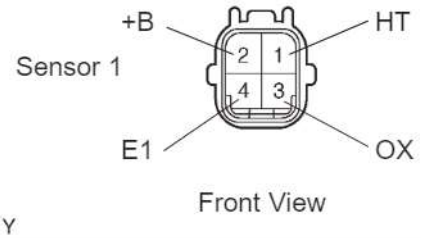
A97090

OK → **Go to step 17**

NG

10	INSPECT HEATED OXYGEN SENSOR(HEATER RESISTANCE)

Component Side:
Heated Oxygen Sensor Connector



Y A93649

(a) Disconnect the H7 heated oxygen sensor connector.
(b) Measure the resistance between the terminals of the heated oxygen sensor connector.
Standard:

Tester Connection	Specified Condition
1 (HT) – 2 (+B)	5 to 10 Ω at 20°C (68°F)
1 (HT) – 4 (E1)	10 kΩ or higher

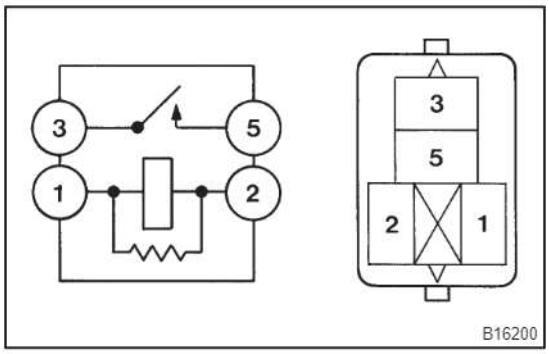
(c) Reconnect the heated oxygen sensor connector.

NG → **REPLACE HEATED OXYGEN SENSOR**

OK

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11	INSPECT EFI RELAY



(a) Remove the EFI relay from the engine room R/B No. 4.
(b) Check the EFI relay resistance.

Standard:

Tester Connection	Specified Condition
3 – 5	10 kΩ or higher
3 – 5	Below 1 Ω (Apply battery voltage to terminals 1 and 2)

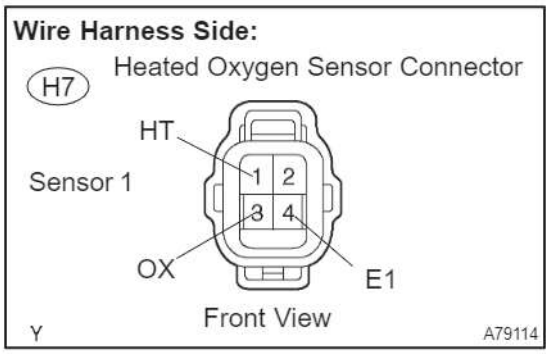
(c) Reinstall the EFI relay.

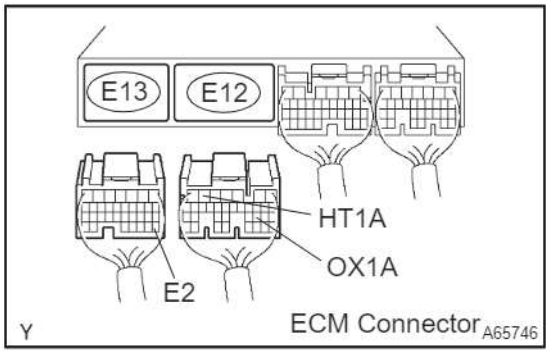
NG → **REPLACE EFI RELAY**

OK

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12 CHECK HARNESS AND CONNECTOR(HEATED OXYGEN SENSOR – ECM)





(a) Disconnect the H7 heated oxygen sensor connector.
(b) Disconnect the E12 and E13 ECM connectors.
(c) Check the resistance.

Standard (Check for open):

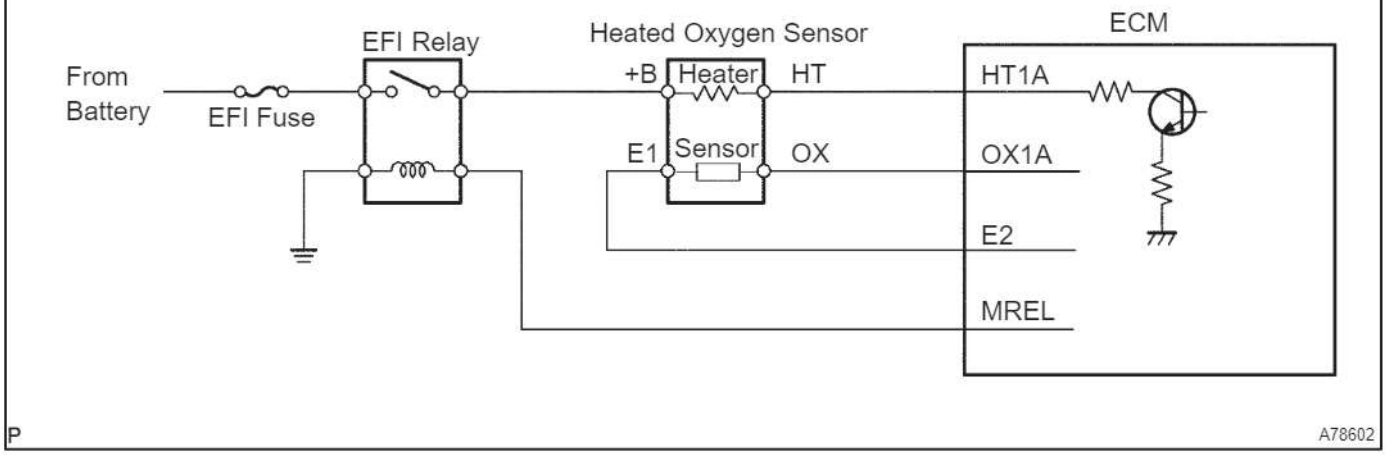
Tester Connection	Specified Condition
OX (H7–3) – OX1A (E12–22)	Below 1 Ω
HT (H7–1) – HT1A (E12–6)	Below 1 Ω
E1 (H7–4) – E2 (E13–28)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
OX (H7–3) or OX1A (E12–22) – Body ground	10 kΩ or higher
HT (H7–1) or HT1A (E12–6) – Body ground	10 kΩ or higher

(d) Reconnect the heated oxygen sensor connector.
(e) Reconnect the ECM connector.

Reference (Sensor 1 System Diagram):



NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

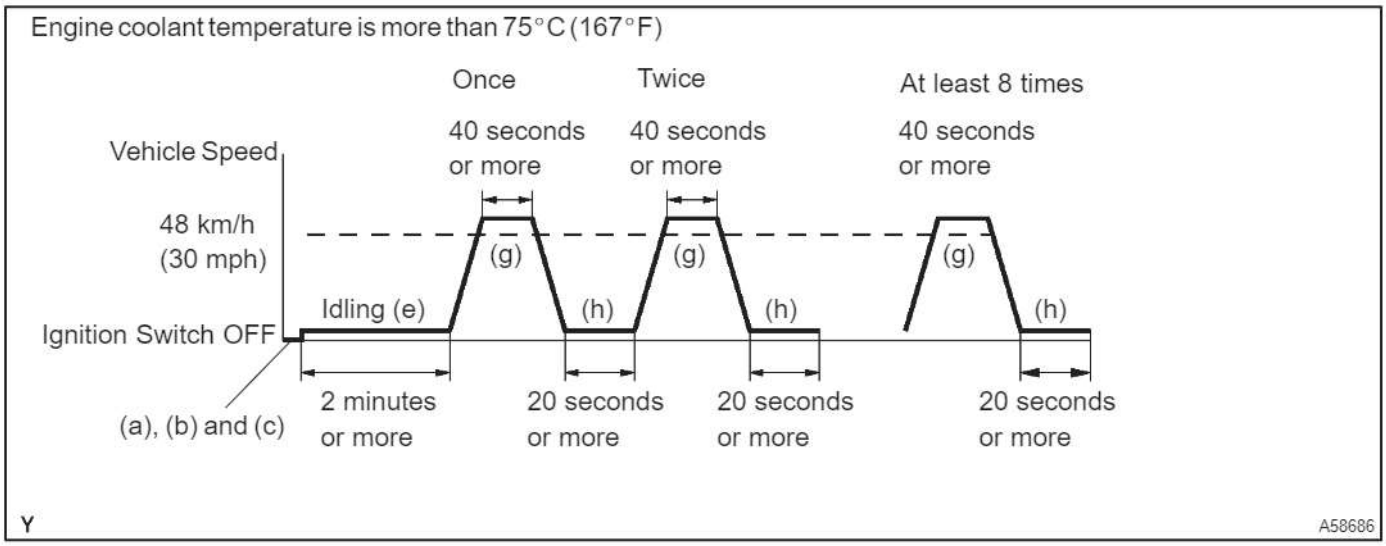
OK

13 REPLACE HEATED OXYGEN SENSOR

GO

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14	PERFORM CONFIRMATION DRIVING PATTERN



(a) Connect the intelligent tester II to the DLC3.
(b) Turn the ignition switch to ON and turn the intelligent tester II ON.
(c) Switch the ECM from normal mode to check mode using the intelligent tester II (see page 05–20).
(d) Start the engine.
(e) Allow the engine to idle for 2 minutes.
(f) Warm up the engine until the engine coolant temperature reaches more than 75°C (167°F).
(g) Drive the vehicle at 48 km/h (30 mph) or more for 40 seconds or more.
(h) Stop the vehicle and allow the engine to idle for 20 seconds or more.
(i) Repeat the steps (g) and (h) at least 8 times in one driving cycle.

HINT:

If a malfunction exists, the MIL will be illuminated during step (i).

NOTICE:

If the conditions in this test are not strictly followed, no malfunction will be detected. If you do not have the intelligent tester II, turn the ignition switch to OFF after performing steps from (d) to (i), then perform steps (d) to (i) again.

GO

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15	CHECK IF DTC OUTPUT RECURS(DTC P0171 AND/OR P0172)

(a) Connect the intelligent tester II to the DLC3.
(b) Turn the ignition switch to ON and turn the intelligent tester II ON.
(c) Select the following menu items: Powertrain / Engine and ECT / DTC.
(d) Read DTCs.

Result:

Display (DTC Output)	Proceed To
No output	A
P0171 and/or P0172	B

B → **REPLACE ECM AND PERFORM CONFIRMATION DRIVING PATTERN (Refer to step 14)**

A

16	CONFIRM IF VEHICLE HAS RUN OUT OF FUEL IN PAST

NO → **CHECK FOR INTERMITTENT PROBLEMS (See page 05–9)**

YES

DTCS ARE CAUSED BY RUNNING OUT OF FUEL (DTCS P0171 AND/OR P0172)

17	PERFORM CONFIRMATION DRIVING PATTERN

HINT:
Clear all DTCs prior to performing the confirmation driving pattern (refer to step 14).

GO

18	CHECK IF DTC OUTPUT RECURS(DTC P0171 AND/OR P0172)

(a) Connect the intelligent tester II to the DLC3.
(b) Turn the ignition switch to ON and turn the intelligent tester II ON.
(c) Select the following menu items: Powertrain / Engine and ECT / DTC.
(d) Read DTCs.

Result:

Display (DTC Output)	Proceed To
P0171 and/or P0172	A
No output	B

B → **Go to step 22**

A

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19	REPLACE HEATED OXYGEN SENSOR

GO

20	PERFORM CONFIRMATION DRIVING PATTERN

HINT:
Clear all DTCs prior to performing the confirmation driving pattern (refer to step 14).

GO

21	CHECK IF DTC OUTPUT RECURS(DTC P0171 AND/OR P0172)

(a) Connect the intelligent tester II to the DLC3.
(b) Turn the ignition switch to ON and turn the intelligent tester II ON.
(c) Select the following menu items: Powertrain / Engine and ECT / DTC.
(d) Read DTCs.

Result:

Display (DTC Output)	Proceed To
No output	A
P0171 and/or P0172	B

B → **REPLACE ECM AND PERFORM CONFIRMATION DRIVING PATTERN (Refer to step 14)**

A

22	CONFIRM IF VEHICLE HAS RUN OUT OF FUEL IN PAST

NO → **CHECK FOR INTERMITTENT PROBLEMS (See page 05–9)**

YES

DTCS ARE CAUSED BY RUNNING OUT OF FUEL (DTCS P0171 AND/OR P0172)

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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

CIRCUIT DESCRIPTION

When a misfire occurs in the engine, hydrocarbons (HC) enter the exhaust gas in high concentrations. If this HC concentration is high enough, there could be an increase in exhaust emission levels. High concentrations of HC can also cause temperature of the catalyst to increase, possibly damaging the catalyst. To prevent this increase in emissions and limit the possibility of thermal damage, the ECM monitors the misfire rate. When the temperature of the catalyst reaches a point of thermal degradation, the ECM will blink the MIL. For monitoring misfire, the ECM uses both the camshaft position sensor and the crankshaft position sensor. The camshaft position sensor is used to identify misfiring cylinders and the crankshaft position sensor is used to measure variations in the crankshaft rotation speed. The misfire counter increments when crankshaft rotation speed variations exceed threshold values.

If the misfiring rate exceeds the threshold and could cause emission deterioration, the ECM illuminates the MIL.

HINT:

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

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DTC No.	DTC Detection Condition	Trouble Area
P0300	Misfiring of random cylinders is detected	• Open or short in engine wire harness • 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	Misfiring of each cylinder is detected	• Open or short in engine wire harness • 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

HINT:

When the DTCs for misfiring cylinders are recorded repeatedly but no random misfire DTC is recorded, it indicates that the misfires have been set and recorded at different times.

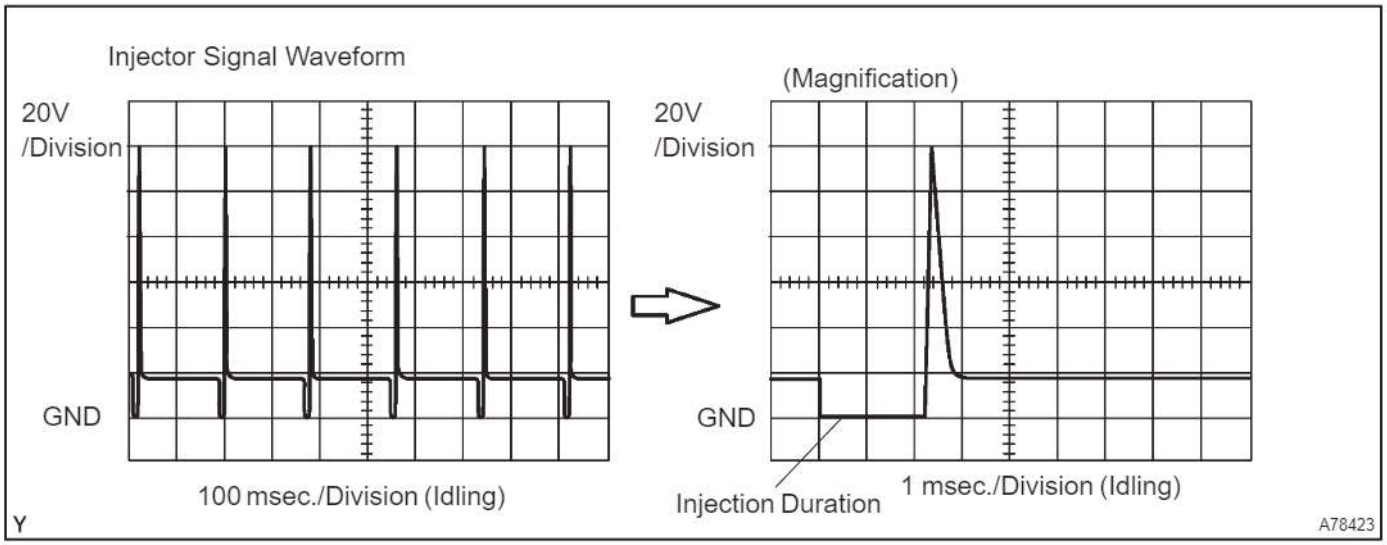
Reference: Inspection using the oscilloscope

With the engine idling, check the waveform between terminals #10 to #40 and E01 of the ECM connectors.

Item	Contents
Terminal	#10 to #40 – E01
Equipment Setting	20V/Division, 100 or 1 ms/Division
Condition	Idling

HINT:

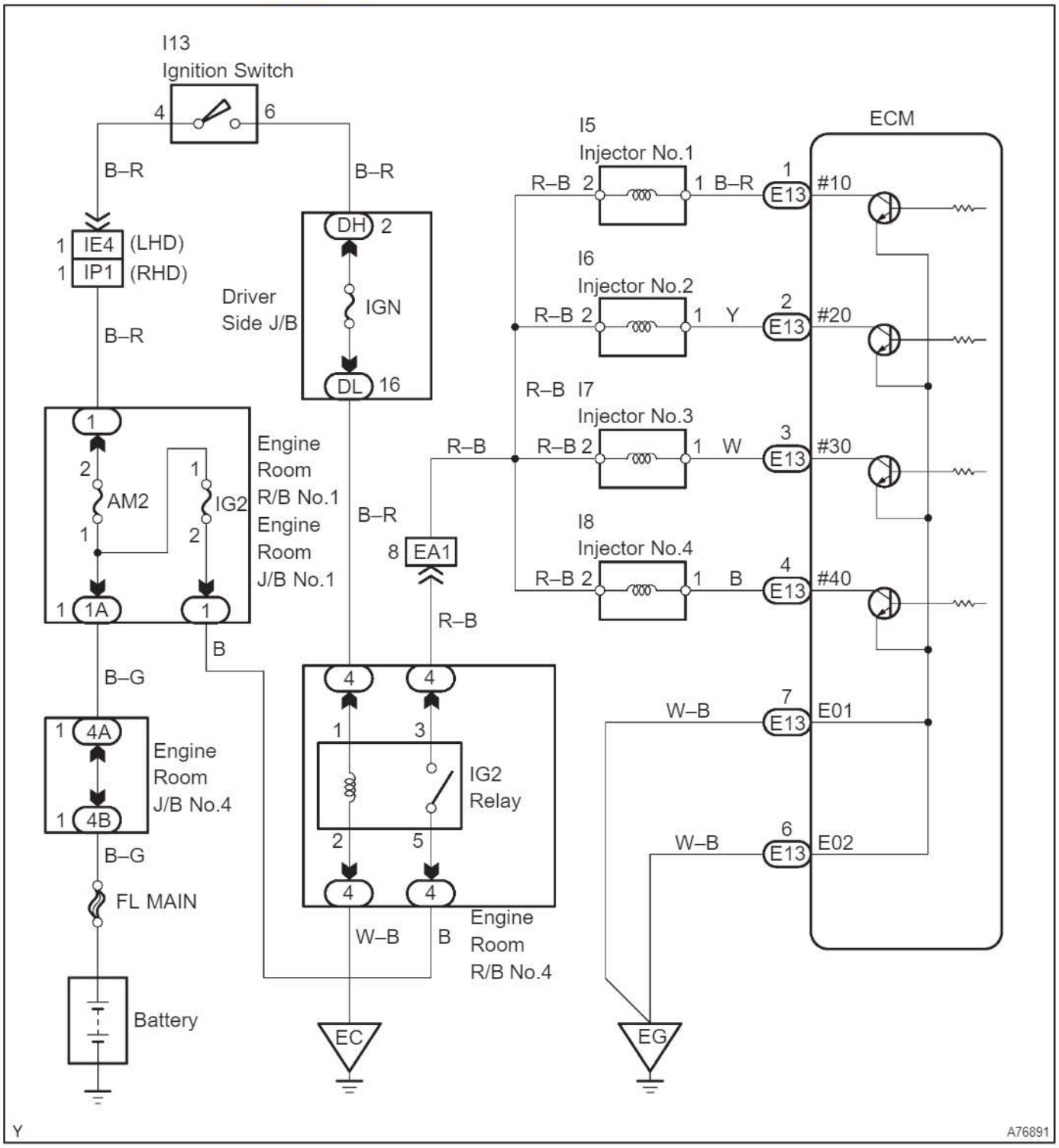
The correct waveform is as shown.



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WIRING DIAGRAM

Refer to DTC P0351 on page 05–143 for the wiring diagram of the ignition system.



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CONFIRMATION DRIVING PATTERN

(a) Connect the intelligent tester II to the DLC3.
(b) Turn the ignition switch to ON and turn the intelligent tester II ON.
(c) Note down the DTC(s) and freeze frame data.
(d) Switch the ECM from normal mode to check mode using the intelligent tester II (see page 05–20).
(e) Check the misfire counter values for each cylinder when idling. If the misfire counter value indicates 0, perform the following procedure of the confirmation driving pattern.
(f) Drive the vehicle several times using an engine speed (Engine Speed), engine load (Calculate Load) and other data stored in the freeze frame data.

If you have no intelligent tester II, turn the ignition switch to OFF after the symptom is simulated once. Then repeat the simulation process again.

HINT:

In order to record the misfire DTCs, it is necessary to drive around Misfire RPM and Misfire Load in Data List for the following period of time. Do not turn the ignition switch to OFF. Turning the ignition switch to OFF switches the diagnosis system from check mode to normal mode. So all DTCs and other data will be 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

(g) Check if there is the DTC(s) to verify whether misfires have occurred. If the DTC(s) is present, record the DTC and freeze frame data.
(h) Turn the ignition switch to OFF and wait for at least 5 seconds.

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INSPECTION PROCEDURE

HINT:

- If any DTCs other than the misfire DTCs are set simultaneously, first troubleshoot them.
- If a misfire does not occur when the vehicle is brought to the workshop, a misfire can be confirmed by reproducing the condition of the freeze frame data. Also, after finishing repairs, confirm that misfires do not recur (see the confirmation driving pattern).
- Read freeze frame data using the intelligent tester II. Freeze frame data record the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, 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.
- On 6 and 8 cylinder engines, misfiring cylinders cannot be identified at high engine speed and only a general misfire DTC P0300 is stored instead of the individual misfiring cylinder DTCs (P0301 to P0308).
  If a misfire starts in a high engine speed area or a misfire occurs only in a high engine speed area, only DTC P0300 may be stored.

  When only a general misfire DTC P0300 is stored:
- Erase the general misfire DTC from the ECM using the intelligent tester II.
- Start the engine and perform the confirmation driving pattern.
- Check the value of the misfire ratio for each cylinder. Or check the DTC(s).
- Perform repairs on the cylinder that has a high misfire ratio. Or repair the cylinder indicated by the DTC.
- After finishing repairs, perform the confirmation driving pattern again and confirm that no misfire occurs.
- When either of Short FT #1 and Long FT #1 in the freeze frame data is over the range of ±20 %, there is a possibility that the air–fuel ratio is becoming 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 that misfires occur only during engine warm–up.
- If a misfire cannot be reproduced, the following reasons may apply: 1) the vehicle has low fuel, 2) improper fuel is being used, and 3) the ignition plug has been contaminated.
- Be sure to check the misfire counter value after repairs.

1	CHECK OTHER DTC OUTPUT(IN ADDITION TO MISFIRE DTCS)

(a) Connect the intelligent tester II to the DLC3.
(b) Turn the ignition switch to ON and turn the intelligent tester II ON.
(c) Select the following menu items: Powertrain / Engine and ECT / DTC.
(d) Read DTCs.

Result:

Display (DTC Output)	Proceed To
P0300, P0301, P0302, P0303 and/or P0304	A
P0300, P0301, P0302, P0303 or P0304 and other DTCs	B

HINT:

If any DTCs other than P0300, P0301, P0302, P0303 or P0304 are output, troubleshoot those DTCs.

B → GO TO RELEVANT DTC CHART (See page 05–27)

A

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

(a) Check the connection condition of the wire harnesses and connector.
(b) Check the piping of the vacuum hose.
(c) Check the vacuum hose for disconnection or breakage.

OK: Connected correctly and no damage on the wire harnesses.

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

OK

3	CHECK CONNECTION OF PCV HOSE

OK: The PCV hose is connected correctly and not damaged.

NG → **REPAIR OR REPLACE PCV HOSE**

OK

4	READ VALUE OF INTELLIGENT TESTER II(NUMBER OF MISFIRING CYLINDERS)

(a) Connect the intelligent tester II to the DLC3.
(b) Turn the ignition switch to ON and turn the intelligent tester II ON.
(c) Start the engine.
(d) On the intelligent tester II, select the following menu items: Powertrain / Engine and ECT / Data List / Cylinder #1 Misfire Rate – Cylinder #4 Misfire Rate.
(e) Check the number of misfiring cylinders on the intelligent tester II.

HINT:
When a misfire is not reproduced, be sure to proceed according to the table below based on the stored DTC.

Result:

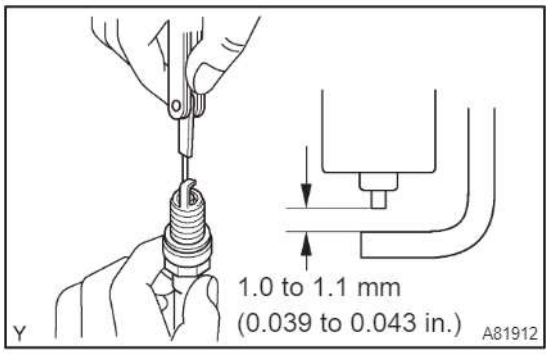
High Misfire Rate Cylinder	Proceed To
1 or 2 cylinders	A
3 cylinders or more	B

B → **Go to step 15**

A

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5	CHECK SPARK PLUG AND SPARK OF MISFIRING CYLINDER



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

Supplier	Type
DENSO	K16R–U11

(d) Check the spark plug electrode gap.
Standard: 1.0 to 1.1 mm (0.039 to 0.043 in.)
Maximum: 1.3 mm (0.047 in.)

NOTICE:
If adjusting the gap of a new spark plug, bend only the ground electrode. Do not touch the tip. Never attempt to adjust the gap of a used plug.

(e) Check the electrode for carbon deposits.
(f) Perform a spark test.

CAUTION:
Completely disconnect each injector connector.

NOTICE:
Do not crank the engine for more than 5 to 10 seconds.

(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 a spark occurs while the engine is being cranked.

OK: A spark jumps across electrode gap.

(g) Reinstall the spark plug.
(h) Reinstall the ignition coil assembly.

OK	Go to step 8

NG

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6	CHANGE NORMAL SPARK PLUG AND CHECK SPARK OF MISFIRING CYLINDER

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

CAUTION:
Completely disconnect each injector connector.
NOTICE:
Do not crank the engine for more than 5 to 10 seconds.

(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 a spark occurs while the engine is being cranked.

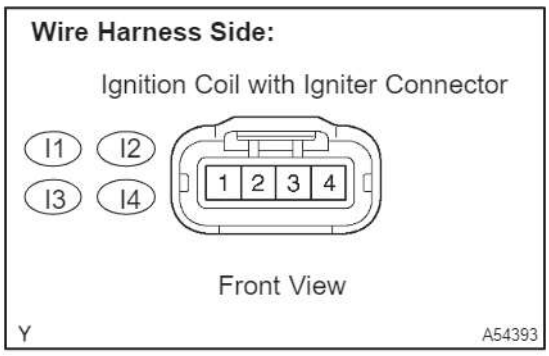
OK: A spark jumps across electrode gap.

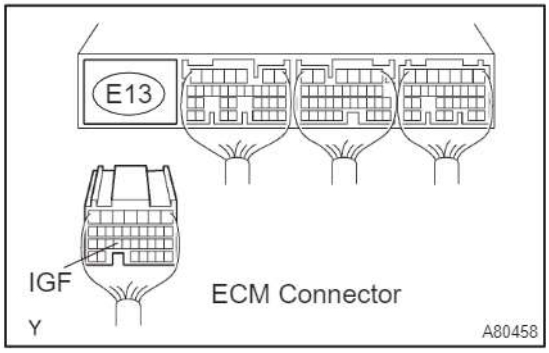
OK → **REPLACE IGNITION COIL ASSY**

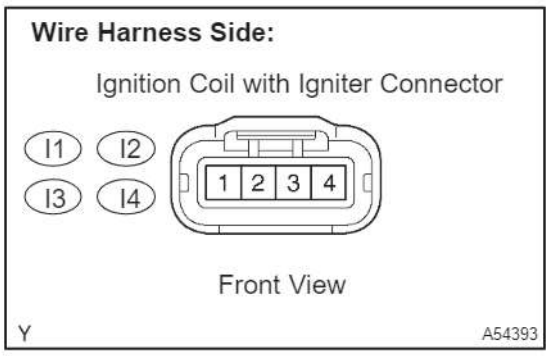
NG

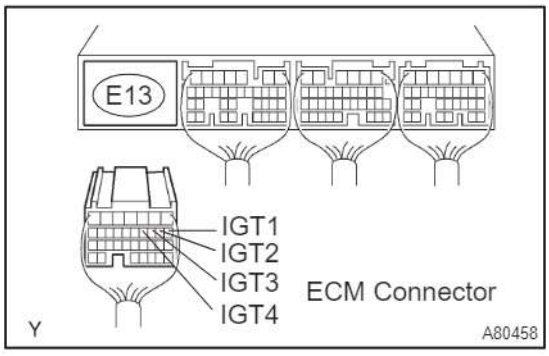
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7 CHECK HARNESS AND CONNECTOR OF MISFIRING CYLINDER(IGNITION COIL ASSY – ECM)









(a) Check the harness and the connectors between the ignition coil with igniter and ECM (IGF terminal).

(1) Disconnect the I1, I2, I3 and/or I4 ignition coil with igniter connector.

(2) Disconnect the E13 ECM connector.

(3) Check the resistance.

Standard (Check for open):

Tester Connection	Specified Condition
Ignition coil (I1–2) – IGF (E13–24)	Below 1 Ω
Ignition coil (I2–2) – IGF (E13–24)	Below 1 Ω
Ignition coil (I3–2) – IGF (E13–24)	Below 1 Ω
Ignition coil (I4–2) – IGF (E13–24)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
Ignition coil (I1–2) or IGF (E13–24) – Body ground	10 kΩ or higher
Ignition coil (I2–2) or IGF (E13–24) – Body ground	10 kΩ or higher
Ignition coil (I3–2) or IGF (E13–24) – Body ground	10 kΩ or higher
Ignition coil (I4–2) or IGF (E13–24) – Body ground	10 kΩ or higher

(4) Reconnect the ignition coil with igniter connector.

(5) Reconnect the ECM connector.

(b) Check the harness and the connectors between the ignition coil with igniter and ECM (IGT terminal).

(1) Disconnect the I1, I2, I3 and/or I4 ignition coil with igniter connector.

(2) Disconnect the E13 ECM connector.

(3) Check the resistance.

Standard (Check for open):

Tester Connection	Specified Condition
Ignition coil (I1–3) – IGT1 (E13–8)	Below 1 Ω
Ignition coil (I2–3) – IGT2 (E13–9)	Below 1 Ω
Ignition coil (I3–3) – IGT3 (E13–10)	Below 1 Ω
Ignition coil (I4–3) – IGT4 (E13–11)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
Ignition coil (I1–3) or IGT1 (E13–8) – Body ground	10 kΩ or higher
Ignition coil (I2–3) or IGT2 (E13–9) – Body ground	10 kΩ or higher
Ignition coil (I3–3) or IGT3 (E13–10) – Body ground	10 kΩ or higher
Ignition coil (I4–3) or IGT4 (E13–11) – Body ground	10 kΩ or higher

(4) Reconnect the ignition coil with igniter connector.

(5) Reconnect the ECM connector.

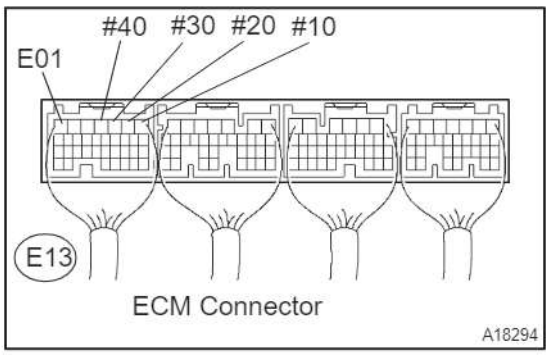
OK → **REPLACE IGNITION COIL ASSY**

NG

REPAIR OR REPLACE HARNESS OR CONNECTOR

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



(a) Turn the ignition switch to ON.
(b) Measure the voltage between the specified terminals of the E13 ECM connector.

Standard:

Tester Connection	Specified Condition
#10 (E13–1) – E01 (E13–7)	9 to 14 V
#20 (E13–2) – E01 (E13–7)	9 to 14 V
#30 (E13–3) – E01 (E13–7)	9 to 14 V
#40 (E13–4) – E01 (E13–7)	9 to 14 V

OK → **Go to step 11**

NG

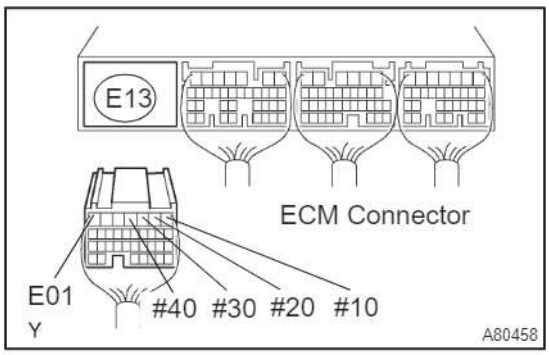
9	INSPECT FUEL INJECTOR RESISTANCE OF MISFIRING CYLINDER (See page 11–8 of Pub. No. RM1018E AVENSIS)

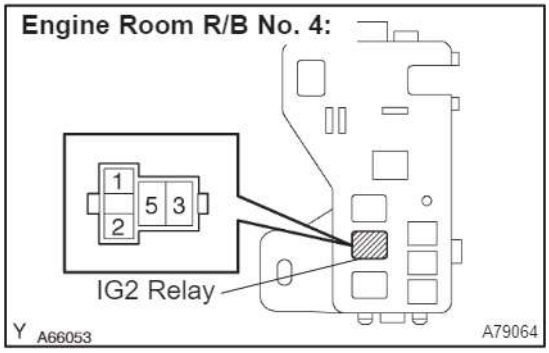
NG → **REPLACE FUEL INJECTOR ASSY (See page 11–10 of Pub. No. RM1018E AVENSIS)**

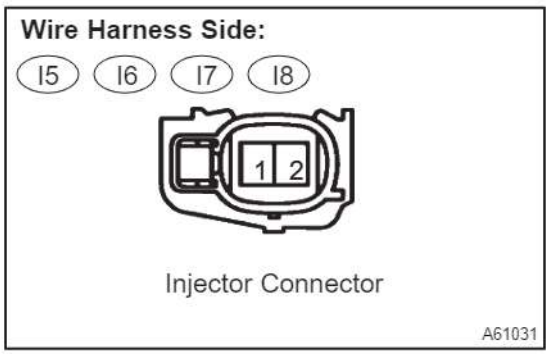
OK

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10 CHECK HARNESS AND CONNECTOR OF MISFIRING CYLINDER(INJECTOR – ECM, INJECTOR – IG2 RELAY)







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

(1) Disconnect the I5, I6, I7 and/or I8 injector connector.

(2) Disconnect the E13 ECM connector.

(3) Check the resistance.

Standard (Check for open):

Tester Connection	Specified Condition
Injector (I5–1) – #10 (E13–1)	Below 1 Ω
Injector (I6–1) – #20 (E13–2)	Below 1 Ω
Injector (I7–1) – #30 (E13–3)	Below 1 Ω
Injector (I8–1) – #40 (E13–4)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
Injector (I5–1) or #10 (E13–1) – Body ground	10 kΩ or higher
Injector (I6–1) or #20 (E13–2) – Body ground	10 kΩ or higher
Injector (I7–1) or #30 (E13–3) – Body ground	10 kΩ or higher
Injector (I8–1) or #40 (E13–4) – Body ground	10 kΩ or higher

(4) Reconnect the injector connector.

(5) Reconnect the ECM connector.

(b) Check the harness and connectors between the injector and IG2 relay.

(1) Disconnect the I5, I6, I7 and/or I8 injector connector.

(2) Remove the IG2 relay from the engine room R/B No. 4.

(3) Check the resistance.

Standard (Check for open):

Tester Connection	Specified Condition
Injector (I5–2) – Engine room R/B No. 4 (IG2 relay terminal 3)	Below 1 Ω
Injector (I6–2) – Engine room R/B No. 4 (IG2 relay terminal 3)	Below 1 Ω
Injector (I7–2) – Engine room R/B No. 4 (IG2 relay terminal 3)	Below 1 Ω
Injector (I8–2) – Engine room R/B No. 4 (IG2 relay terminal 3)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
Injector (I5–2) or Engine room R/B No. 4 (IG2 relay terminal 3) – Body ground	10 kΩ or higher
Injector (I6–2) or Engine room R/B No. 4 (IG2 relay terminal 3) – Body ground	10 kΩ or higher
Injector (I7–2) or Engine room R/B No. 4 (IG2 relay terminal 3) – Body ground	10 kΩ or higher
Injector (I8–2) or Engine room R/B No. 4 (IG2 relay terminal 3) – Body ground	10 kΩ or higher

(4) Reconnect the injector connector.

(5) Reinstall the IG2 relay.

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NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

11	INSPECT FUEL INJECTOR INJECTION AND INJECTION VOLUME OF MISFIRING CYLINDER (See page 11–8 of Pub. No. RM1018E AVENSIS)

NG → REPLACE FUEL INJECTOR ASSY (See page 11–10 of Pub. No. RM1018E AVENSIS)

OK

12	CHECK CYLINDER COMPRESSION PRESSURE OF MISFIRING CYLINDER (See page 14–1 of Pub. No. RM1018E AVENSIS)

NG → REPAIR OR REPLACE

OK

13	CHECK VALVE CLEARANCE OF MISFIRING CYLINDER (See page 14–6 of Pub. No. RM1018E AVENSIS)

NG → ADJUST VALVE CLEARANCE (See page 14–6 of Pub. No. RM1018E AVENSIS)

OK

14	PROCEED TO STEP APPROPRIATE FOR NUMBER OF MISFIRING CYLINDERS(REFER TO RESULT OF STEP 4)

HINT:

- If the result of step 4 is ”1 or 2 cylinders”, proceed to A.
- If the result of step 4 is ” 3 cylinders or more”, proceed to B.

B → CHECK FOR INTERMITTENT PROBLEMS (See page 05–9)

A

15	CHECK VALVE TIMING(CHECK FOR LOOSENESS AND JUMPED TEETH ON TIMING CHAIN) (See page 14–49 of Pub. No. RM1018E AVENSIS)

OK: The matchmarks of the crankshaft pulley and camshaft pulley are aligned.

NG → ADJUST VALVE TIMING (See page 14–49 of Pub. No. RM1018E AVENSIS)

OK

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16	CHECK FUEL PRESSURE (See page 11–5 of Pub. No. RM1018E AVENSIS)

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

OK

17	READ VALUE OF INTELLIGENT TESTER II(INTAKE AIR TEMPERATURE AND MASS AIR FLOW RATE)

(a) Connect the intelligent tester II to the DLC3.
(b) Turn the ignition switch to ON.
(c) Check the intake air temperature.
  (1) On the intelligent tester II, select the following menu items: Powertrain / Engine and ECT / Data List / Intake Air.
  (2) Read the value.
  Standard: Equivalent to ambient air temperature.
(d) Check the mass air flow rate.
  (1) On the intelligent tester II, select the following menu items: Powertrain / Engine and ECT / Data List / AFM.
  (2) Read the values.
  Standard:

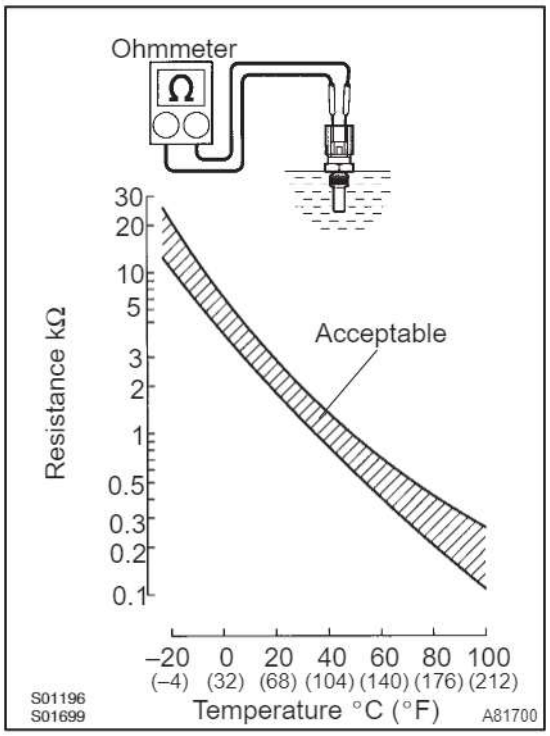
Condition	Mass Air Flow Rate (gm/s)
Ignition switch ON (do not start engine)	0
Idling	3.2 to 4.7
Revving up without load (2,500 rpm)	13.1 to 18.9
Idling – Revving up	Mass air flow rate fluctuates

NG → REPLACE MASS AIR FLOW METER

OK

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18	INSPECT ENGINE COOLANT TEMPERATURE SENSOR(RESISTANCE)



(a) Remove the engine coolant temperature sensor.
(b) Measure the resistance between the terminals.
Standard:

Tester Connection	Specified Condition
1 – 2	2.32 to 2.59 kΩ at 20°C (68°F)
1 – 2	0.310 to 0.326 kΩ at 80°C (176°F)

NOTICE:
When checking the engine coolant temperature sensor in water, be careful not to allow water to get in contact with the terminals. After the check, dry the sensor.
HINT:
Alternative procedure: Connect an ohmmeter to the installed engine coolant temperature sensor and read the resistance. Use an infrared thermometer to measure the engine temperature in the immediate vicinity of the sensor. Compare these values against the resistance/temperature graph. Change the engine temperature (warm up or allow to cool down) and repeat the test.

NG → **REPLACE ENGINE COOLANT TEMPERATURE SENSOR**

OK

19	PROCEED TO STEP APPROPRIATE FOR NUMBER OF MISFIRING CYLINDERS(REFER TO RESULT OF STEP 4)

HINT:
- If the result of step 4 is ”1 or 2 cylinders”, proceed to A.
- If the result of step 4 is ”3 cylinders or more”, proceed to B.

B → **GO BACK TO STEP 4**

A

CHECK FOR INTERMITTENT PROBLEMS (See page 05–9)

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DTC	P0325	KNOCK SENSOR 1 CIRCUIT (BANK 1 OR SINGLE SENSOR)

DTC	P0327	KNOCK SENSOR 1 CIRCUIT LOW INPUT (BANK 1 OR SINGLE SENSOR)

DTC	P0328	KNOCK SENSOR 1 CIRCUIT HIGH INPUT (BANK 1 OR SINGLE SENSOR)

CIRCUIT DESCRIPTION

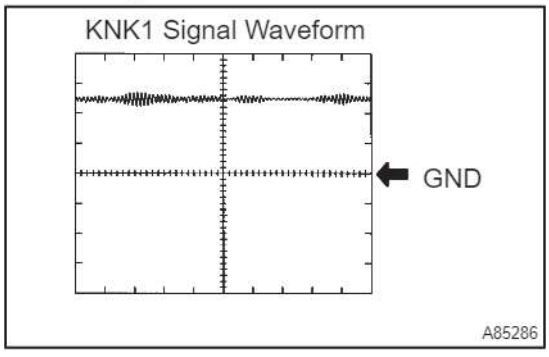
The flat type knock sensor (non–resonant type) has a structure that can detect vibration in a wider band of frequency, from about 6 kHz to 15 kHz and has the following features:

- The knock sensor is fitted on the cylinder block to detect engine knocking.
- The sensor contains a piezoelectric element which generates voltage when it becomes deformed. This occurs when the cylinder block vibrates due to knocking. If engine knocking occurs, the ignition timing is retarded to suppress it.

DTC No.	DTC Detecting Condition	Trouble Area
P0325	Knock sensor signal level remains at low for more than 10 seconds	• Open or short in knock sensor circuit • Knock sensor (under–torqued or looseness) • ECM
P0327	Output voltage of the knock sensor is 0.5 V or less	• Short in knock sensor circuit • Knock sensor • ECM
P0328	Output voltage of the knock sensor is 4.5 V or more	• Open in knock sensor circuit • Knock sensor • ECM

HINT:

If the ECM detects DTC P0325, P0327 and/or P0328, it enters fail–safe mode in which the corrective retarded angle value is set to the maximum value.



Reference: Inspection by using the oscilloscope.

The correct waveform is as shown.

Item	Contents
Terminal	KNK1 – EKNK
Equipment Setting	0.01 to 10 V/Division, 0.01 to 10 msec./Division
Condition	After warming up the engine, keep the engine speed at 4,000 rpm

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DTC	P0325	KNOCK SENSOR 1 CIRCUIT (BANK 1 OR SINGLE SENSOR)

DTC	P0327	KNOCK SENSOR 1 CIRCUIT LOW INPUT (BANK 1 OR SINGLE SENSOR)

DTC	P0328	KNOCK SENSOR 1 CIRCUIT HIGH INPUT (BANK 1 OR SINGLE SENSOR)

CIRCUIT DESCRIPTION

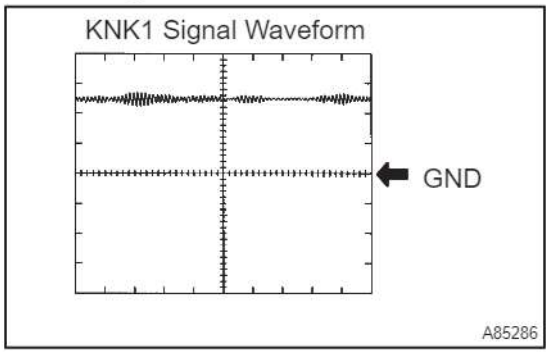
The flat type knock sensor (non–resonant type) has a structure that can detect vibration in a wider band of frequency, from about 6 kHz to 15 kHz and has the following features:

- The knock sensor is fitted on the cylinder block to detect engine knocking.
- The sensor contains a piezoelectric element which generates voltage when it becomes deformed. This occurs when the cylinder block vibrates due to knocking. If engine knocking occurs, the ignition timing is retarded to suppress it.

DTC No.	DTC Detecting Condition	Trouble Area
P0325	Knock sensor signal level remains at low for more than 10 seconds	• Open or short in knock sensor circuit • Knock sensor (under–torqued or looseness) • ECM
P0327	Output voltage of the knock sensor is 0.5 V or less	• Short in knock sensor circuit • Knock sensor • ECM
P0328	Output voltage of the knock sensor is 4.5 V or more	• Open in knock sensor circuit • Knock sensor • ECM

HINT:

If the ECM detects DTC P0325, P0327 and/or P0328, it enters fail–safe mode in which the corrective retarded angle value is set to the maximum value.



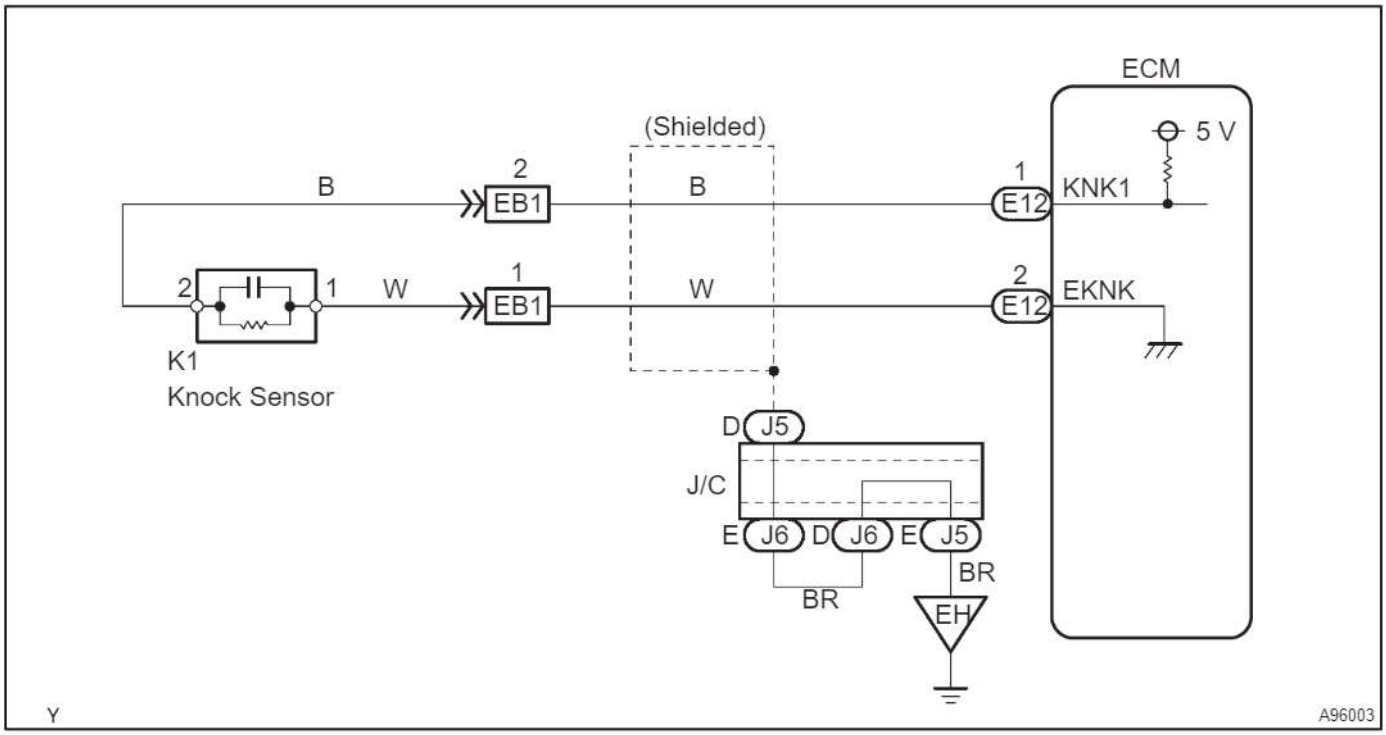
Reference: Inspection by using the oscilloscope.

The correct waveform is as shown.

Item	Contents
Terminal	KNK1 – EKNK
Equipment Setting	0.01 to 10 V/Division, 0.01 to 10 msec./Division
Condition	After warming up the engine, keep the engine speed at 4,000 rpm

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WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

Read freeze frame data using the intelligent tester II. Freeze frame data record the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, 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	READ OUTPUT DTC

(a) Clear the DTC(s) (see page 05–18).
(b) Warm up the engine.
(c) Run the engine at 3,000 rpm for 10 seconds or more.
(d) Connect the intelligent tester II to the DLC3.
(e) Turn the ignition switch to ON and turn the intelligent tester II ON.
(f) Select the following menu items: Powertrain / Engine and ECT / DTC.
(g) Read DTCs.

Result :

Display (DTC Output)	Proceed To
P0325	A
P0325, and P0327 and/or P0328	B
No output	C

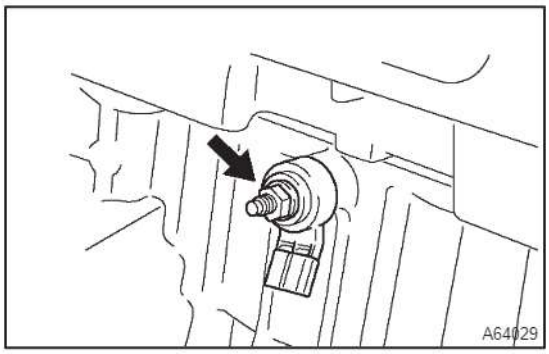
B → **Go to step 3**

C → **CHECK FOR INTERMITTENT PROBLEMS (See page 05–9)**

A

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2 INSPECT KNOCK SENSOR



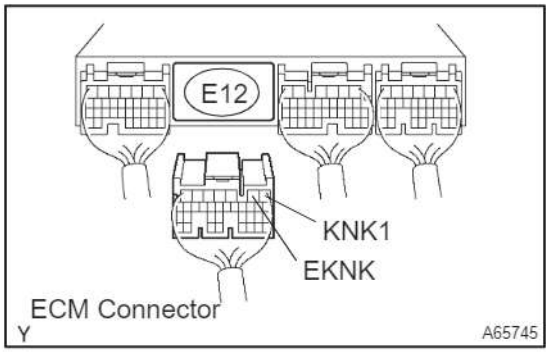
(a) Check the knock sensor installation.
OK:
Torque: 20 N·m (204 kgf·cm, 15 ft·lbf)

NG → **SECURELY REINSTALL SENSOR**

OK

REPLACE KNOCK SENSOR

3 CHECK HARNESS AND CONNECTOR(ECM – KNOCK SENSOR)



(a) Disconnect the E12 ECM connector.
(b) Measure the resistance between the terminals of the E12 ECM connector.
Standard:

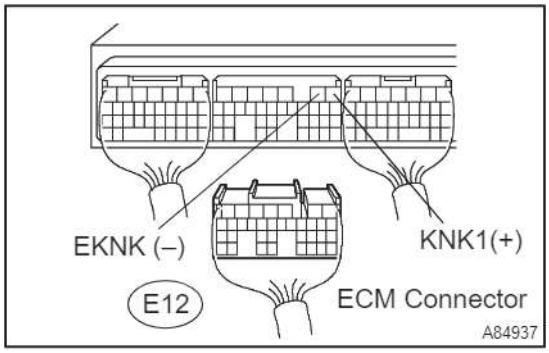
Tester Connection	Specified Condition
KNK1 (E12–1) – EKNK (E12–2)	120 to 280 kΩ at 20°C (68°F)

(c) Reconnect the ECM connector.

NG → **Go to step 5**

OK

4 INSPECT ECM(KNK1 VOLTAGE)



(a) Disconnect the E12 ECM connector.
(b) Turn the ignition switch to ON.
(c) Measure the voltage between the terminals of the E12 ECM terminal.
Standard:

Tester Connection	Specified Condition
KNK1 (E12–1) – EKNK (E12–2)	4.5 to 5.5 V

(d) Reconnect the ECM connector.

NG → **REPLACE ECM (See page 10–65 of Pub. No. RM1018E AVENSIS)**

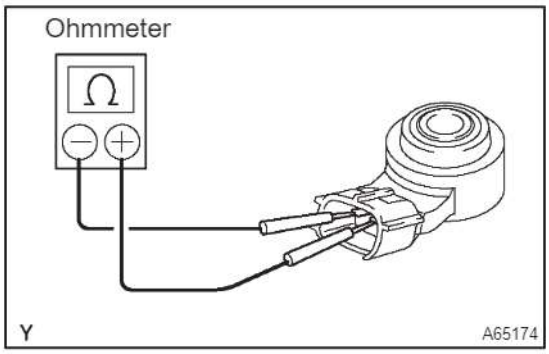
OK

CHECK FOR INTERMITTENT PROBLEMS (See page 05–9)

NOTICE:
Fault may be intermittent. Check the wire harness and connectors carefully.

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5	INSPECT KNOCK SENSOR



(a) Remove the knock sensor.
(b) Measure the resistance between the terminals.
Standard:

Tester Connection	Specified Condition
KNK1 (K1–1) – EKNK (K1–2)	120 to 280 kΩ at 20°C (68°F)

(c) Reinstall the knock sensor.

NG → **REPLACE KNOCK SENSOR**

OK

REPAIR OR REPLACE HARNESS OR CONNECTOR

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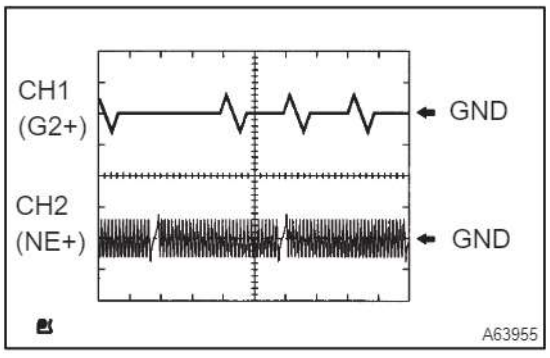
DTC	P0335	CRANKSHAFT POSITION SENSOR "A" CIRCUIT

DTC	P0339	CRANKSHAFT POSITION SENSOR "A" CIRCUIT INTERMITTENT

CIRCUIT DESCRIPTION

The crankshaft position sensor system consists of a crankshaft position sensor plate and a pickup coil. The sensor plate has 34 teeth and is installed on the crankshaft. The pickup coil is made of an iron core and magnet. The sensor plate rotates and as each tooth passes through the pickup coil, a pulse signal is created. The pickup coil generates 34 signals per engine revolution. Based on these signals, the ECM calculates the crankshaft position and engine RPM. Using these calculations, the fuel injection time and ignition timing are controlled.

DTC No.	DTC Detection Condition	Trouble Area
P0335	No crankshaft position sensor signal to ECM during cranking (2 trip detection logic)	• Open or short in crankshaft position sensor circuit • Crankshaft position sensor • Sensor plate (crankshaft) • ECM
P0335	No crankshaft position sensor signal to ECM at engine speed of 600 rpm or more (2 trip detection logic)	• Open or short in crankshaft position sensor circuit • Crankshaft position sensor • Sensor plate (crankshaft) • ECM
P0339	In conditions (a), (b) and (c), when no crankshaft position sensor (NE) signal is input for 0.05 seconds or more. (a) Engine revolution 1,000 rpm or more (b) Starter signal is OFF (c) 3 seconds or more has lapsed after starter signal was switched from ON to OFF	• Open or short in crankshaft position sensor circuit • Crankshaft position sensor • Sensor plate (crankshaft) • ECM



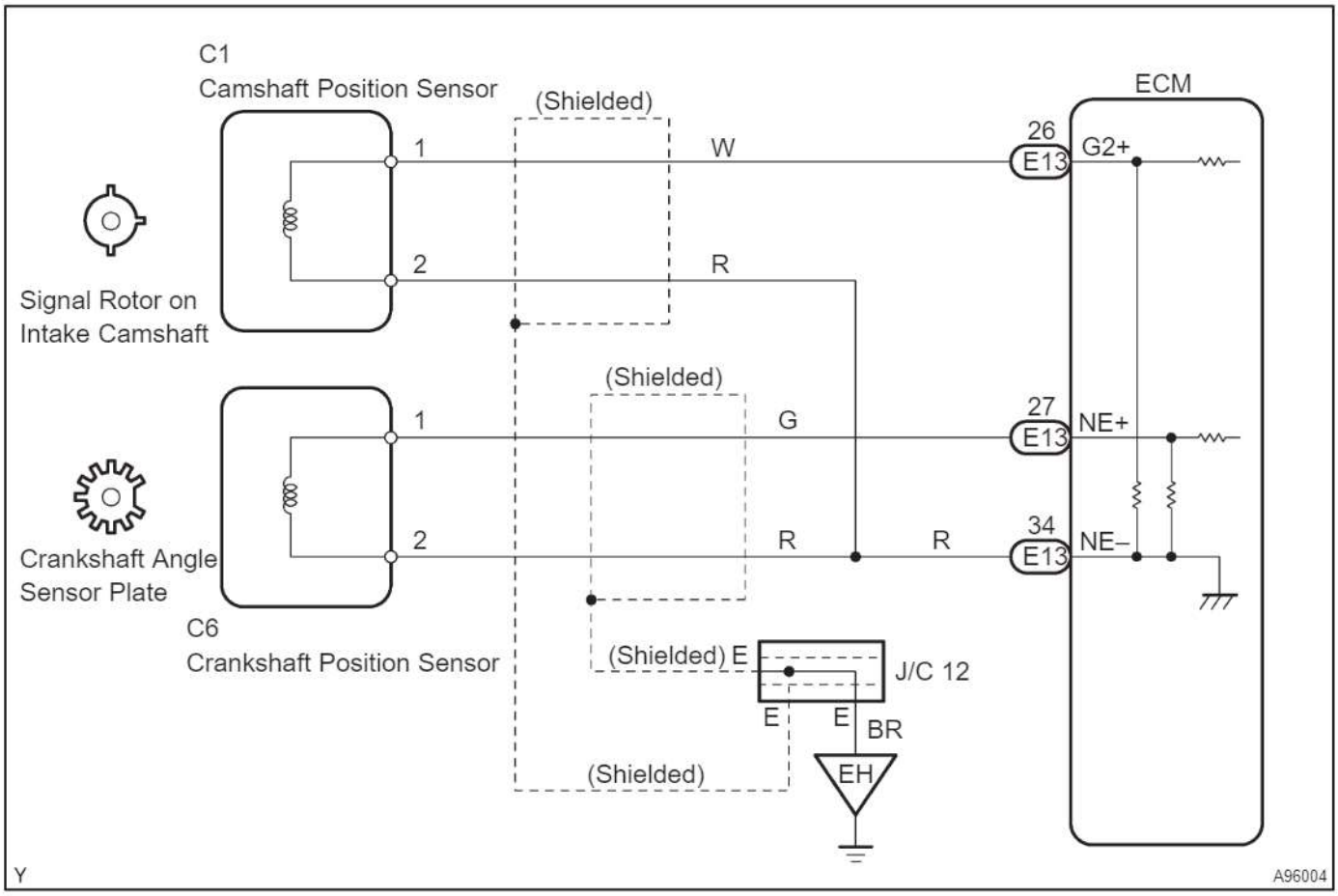
Reference: Inspection using the oscilloscope.
HINT:

- The correct waveform is as shown on the left.
- G2+ stands for the camshaft position sensor signal, and NE+ stands for the crankshaft position sensor signal.

Item	Contents
Terminal	CH1: G2+ – NE– CH2: NE+ – NE–
Equipment Setting	5V/Division, 20ms/Division
Condition	During cranking or idling

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WIRING DIAGRAM



INSPECTION PROCEDURE

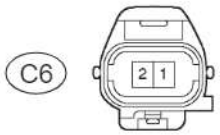
HINT:

- If no problem is found in the diagnostic troubleshooting procedure of DTC P0335, troubleshoot the engine mechanical systems.
- Check the value on the intelligent tester II.
  (a) Connect the intelligent tester II to the DLC3.
  (b) Start the engine and turn the intelligent tester II ON.
  (c) Select the following menu items: Powertrain / Engine and ECT / Data List / Engine SPD.
- The engine speed can be confirmed in the Data List using the intelligent tester II. If there are no NE signals from the crankshaft position sensor despite the engine revolving, the engine speed will be indicated as zero. If the voltage output of the crankshaft position sensor is insufficient, the engine speed will be indicated as lower than the actual engine rpm.
- Read freeze frame data using the intelligent tester II. Freeze frame data record the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, 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.

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1 INSPECT CRANKSHAFT POSITION SENSOR(RESISTANCE)

Component Side:



Crankshaft Position Sensor

Y A73303

(a) Disconnect the C6 crankshaft position sensor connector.
(b) Measure the resistance between terminals 1 and 2.

Standard:

Tester Connection	Specified Condition
1 – 2	1,630 to 2,740 Ω at cold
1 – 2	2,065 to 3,225 Ω at hot

NOTICE:

Terms "cold" and "hot" refer to the temperature of the coils. "Cold" means approximately –10° to 50°C (14° to 122°F). "Hot" means approximately 50° to 100°C (122° to 212°F).

(c) Reconnect the crankshaft position sensor connector.

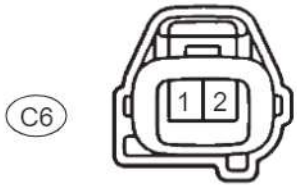
NG → **REPLACE CRANKSHAFT POSITION SENSOR (See page 18–6 of Pub. No. RM1018E AVENSIS)**

OK

2 CHECK HARNESS AND CONNECTOR(CRANKSHAFT POSITION SENSOR – ECM)

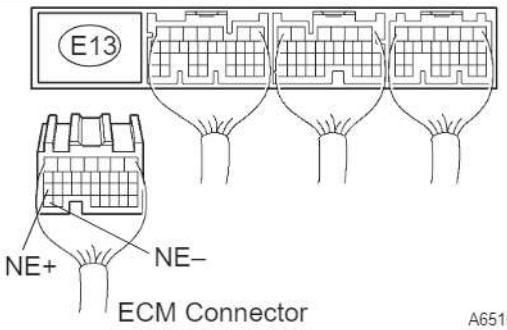
Wire Harness Side:

Crankshaft Position Sensor Connector



Front View

A66132



ECM Connector

A65159

(a) Disconnect the C6 crankshaft position sensor connector.
(b) Disconnect the E13 ECM connector.
(c) Check the resistance.

Standard (Check for open):

Tester Connection	Specified Condition
Crankshaft position sensor (C6–1) – NE+ (E13–27)	Below 1 Ω
Crankshaft position sensor (C6–2) – NE– (E13–34)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
Crankshaft position sensor (C6–1) or NE+ (E13–27) – Body ground	10 kΩ or higher
Crankshaft position sensor (C6–2) or NE– (E13–34) – Body ground	10 kΩ or higher

(d) Reconnect the crankshaft position sensor connector.
(e) Reconnect the ECM connector.

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

OK

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3	CHECK SENSOR INSTALLATION(CRANKSHAFT POSITION SENSOR)

(a) Check the crankshaft position sensor installation.
OK: The sensor is installed correctly.

NG → SECURELY REINSTALL SENSOR

OK

4	CHECK CRANKSHAFT POSITION SENSOR PLATE(TEETH OF SENSOR PLATE(CRANKSHAFT))

(a) Check the teeth of the sensor plate.
OK: The plate does not have any cracks or deformation.

NG → REPLACE CRANKSHAFT POSITION SENSOR PLATE (CRANKSHAFT)

OK

REPLACE ECM (See page 10–65 of Pub. No. RM1018E AVENSIS)

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DTC	P0340	CAMSHAFT POSITION SENSOR "A" CIRCUIT (BANK 1 OR SINGLE SENSOR)

DTC	P0341	CAMSHAFT POSITION SENSOR "A" CIRCUIT RANGE/PERFORMANCE (BANK 1 OR SINGLE SENSOR)

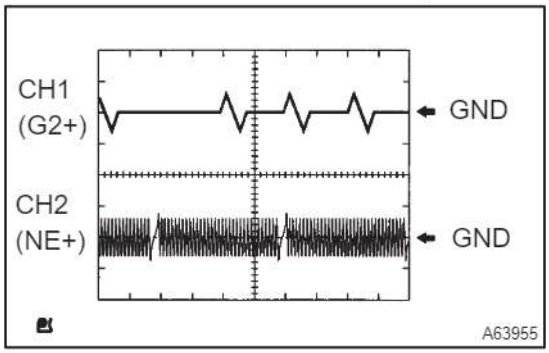
CIRCUIT DESCRIPTION

The Camshaft Position (CMP) sensor consists of a magnet and an iron core which is wrapped with copper wire, and is installed on the cylinder head. When the camshaft rotates, each of 3 teeth on the camshaft passes through the CMP sensor. This activates the internal magnet in the sensor, generating a voltage in the copper wire. The camshaft rotation is synchronized with the crankshaft rotation. When the crankshaft turns twice the voltage is generated 3 times in the CMP sensor. The generated voltage in the sensor acts as a signal, allowing the ECM to locate the camshaft position. This signal is then used to control ignition timing, fuel injection timing, and the VVT system.

DTC No.	DTC Detection Condition	Trouble Area
P0340	• No camshaft position sensor signal to ECM during cranking (2 trip detection logic) • No camshaft position sensor signal to ECM at engine speed of 600 rpm or more (1 trip detection logic)	• Open or short in camshaft position sensor circuit • Camshaft position sensor • Camshaft timing pulley • Jumped tooth of timing chain • ECM
P0341	While crankshaft rotates twice, camshaft position sensor signal is input to ECM 12 times or more (1 trip detection logic)	• Open or short in camshaft position sensor circuit • Camshaft position sensor • Camshaft timing pulley • Jumped tooth of timing chain • ECM

HINT:

- DTC P0340 indicates a malfunction related to the CMP sensor (+) circuit (the wire harness between the ECM and CMP sensor, and the CMP sensor itself).
- DTC P0341 indicates a malfunction related to the CMP sensor (–) circuit (the wire harness between the ECM and CMP sensor, and the CMP sensor itself).



Reference: Inspection using the oscilloscope.

HINT:

- The correct waveform is as shown on the left.
- G2+ stands for the camshaft position sensor signal, and NE+ stands for the crankshaft position sensor signal.

Item	Contents
Terminal	CH1: G2+ – NE– CH2: NE+ – NE–
Equipment Setting	5V/Division, 20ms/Division
Condition	During cranking or idling

WIRING DIAGRAM

Refer to DTC P0335 on page 05–136.

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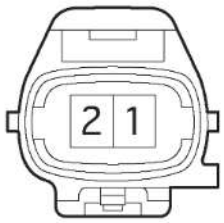
INSPECTION PROCEDURE

HINT:

Read freeze frame data using the intelligent tester II. Freeze frame data record the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, 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 CAMSHAFT POSITION SENSOR(RESISTANCE)

Component Side:



Camshaft Position Sensor

A64984

(a) Disconnect the C1 camshaft position sensor connector.

(b) Measure the resistance between the terminals of the camshaft position sensor.

Standard:

Tester Connection	Specified Condition
1 – 2	835 to 1,400 Ω at cold
1 – 2	1,060 to 1,645 Ω at hot

NOTICE:

Terms "cold" and "hot" refer to the temperature of the coils. "Cold" means approximately –10° to 50°C (14° to 122°F). "Hot" means approximately 50° to 100°C (122° to 212°F).

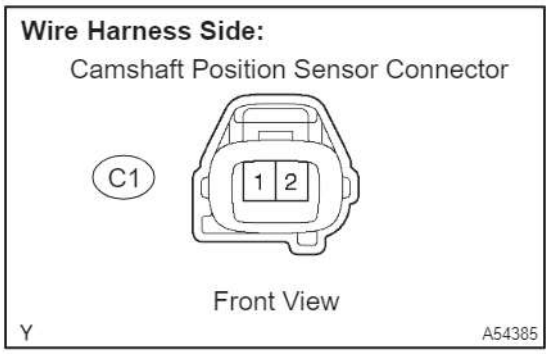
(c) Reconnect the camshaft position sensor connector.

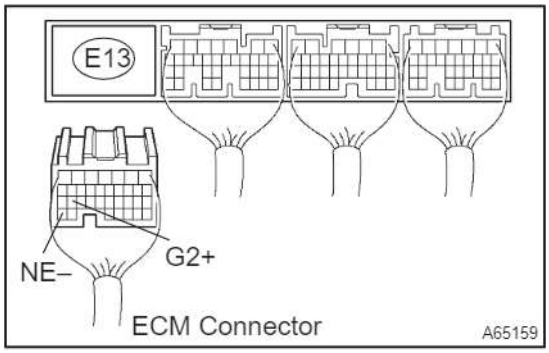
NG → **REPLACE CAMSHAFT POSITION SENSOR (See page 18–5 of Pub. No. RM1018E AVENSIS)**

OK

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2 CHECK HARNESS AND CONNECTOR(CAMSHAFT POSITION SENSOR – ECM)





(a) Disconnect the C1 camshaft position sensor connector.
(b) Disconnect the E13 ECM connector.
(c) Check the resistance.

Standard (Check for open):

Tester Connection	Specified Condition
Camshaft position sensor (C1–1) – G2+ (E13–26)	Below 1 Ω
Camshaft position sensor (C1–2) – NE– (E13–34)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
Camshaft position sensor (C1–1) or G2+ (E13–26) – Body ground	10 kΩ or higher
Camshaft position sensor (C1–2) or NE– (E13–34) – Body ground	10 kΩ or higher

(d) Reconnect the camshaft position sensor connector.
(e) Reconnect the ECM connector.

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

OK

3 CHECK SENSOR INSTALLATION(CAMSHAFT POSITION SENSOR)

(a) Check the sensor installation.
OK: The sensor is installed correctly.

NG → **SECURELY REINSTALL SENSOR**

OK

4 CHECK CAMSHAFT

(a) Check the teeth of the camshaft.
OK: The teeth do not have any cracks or deformation.

NG → **REPLACE CAMSHAFT**

OK

REPLACE ECM (See page 10–65 of Pub. No. RM1018E AVENSIS)

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DTC	P0351	IGNITION COIL ”A” PRIMARY/SECONDARY CIRCUIT

DTC	P0352	IGNITION COIL ”B” PRIMARY/SECONDARY CIRCUIT

DTC	P0353	IGNITION COIL ”C” PRIMARY/SECONDARY CIRCUIT

DTC	P0354	IGNITION COIL ”D” PRIMARY/SECONDARY CIRCUIT

CIRCUIT DESCRIPTION

HINT:

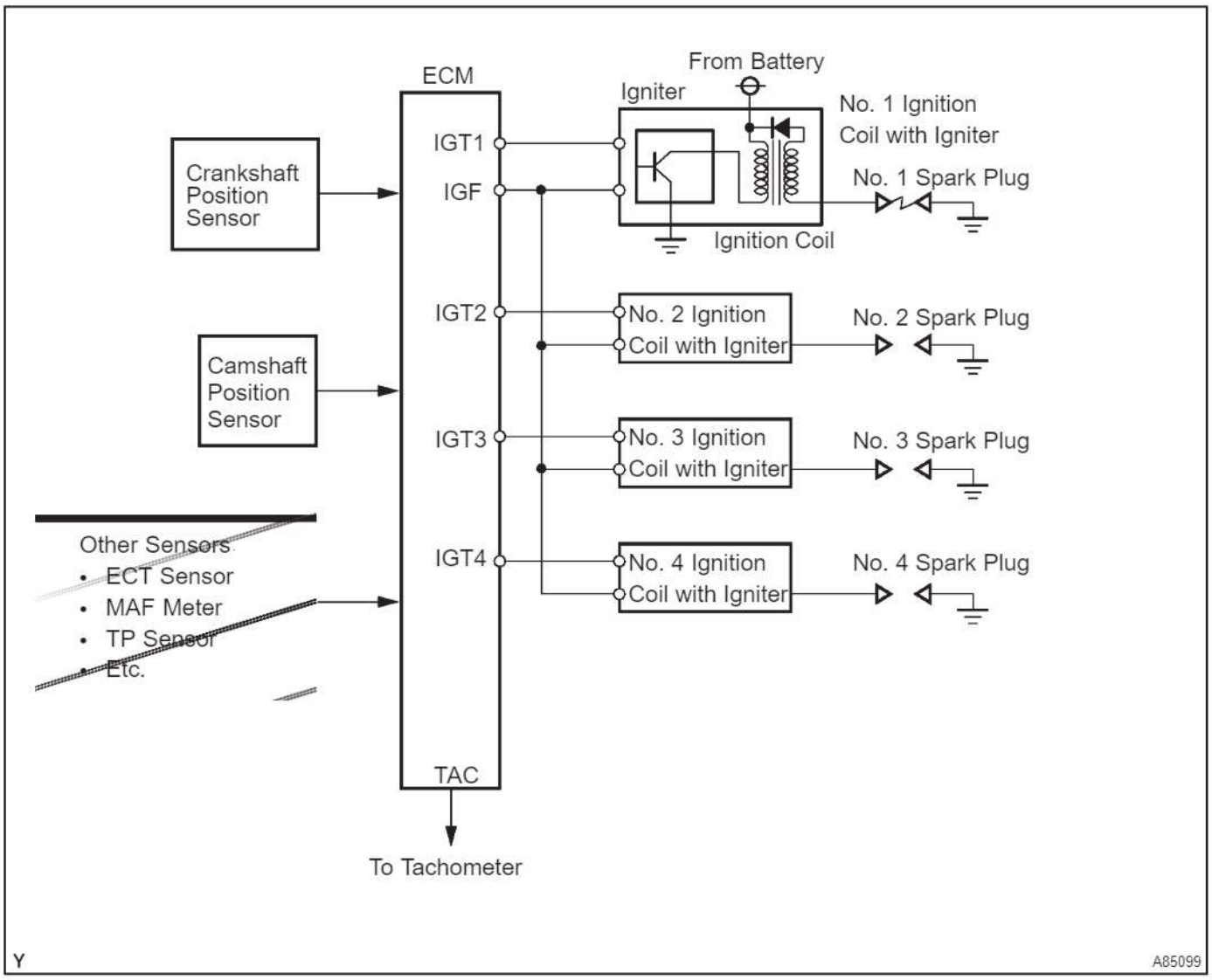
- These DTCs indicate a malfunction related to the primary circuit.
- If DTC P0351 is displayed, check No. 1 ignition coil with igniter circuit.
- If DTC P0352 is displayed, check No. 2 ignition coil with igniter circuit.
- If DTC P0353 is displayed, check No. 3 ignition coil with igniter circuit.
- If DTC P0354 is displayed, check No. 4 ignition coil with igniter circuit.

A Direct Ignition System (DIS) is used on this vehicle.

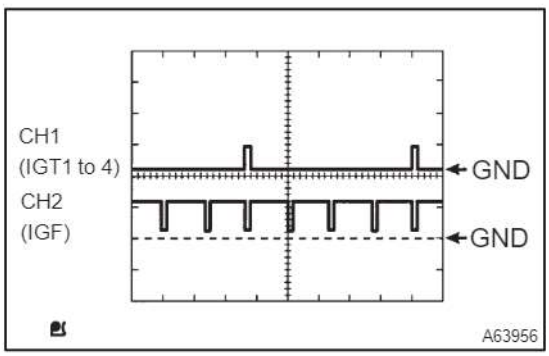
The DIS is a 1–cylinder ignition system which ignites one cylinder with one ignition coil. In the 1–cylinder ignition system, one spark plug is connected to the end of the secondary winding. High–voltage is generated in the secondary winding and is applied directly to the spark plug. The spark of the spark plug passes from the center electrode to the ground electrode.

The ECM determines the ignition timing and transmits the ignition (IGT) signals for each cylinder. Using the IGT signals, the ECM turns ON and OFF the power transistor inside the igniter, which switches ON and OFF a current to the primary coil. When the current to the primary coil is cut off, high–voltage is generated in the secondary coil and this voltage is applied to the spark plugs to create sparks inside the cylinders. As the ECM cuts the current to the primary coil, the igniter sends back the ignition confirmation (IGF) signal to the ECM.

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DTC No.	DTC Detection Condition	Trouble Area
P0351 P0352 P0353 P0354	No IGF signal to ECM while engine is running	• Ignition system • Open or short in IGF or IGT1 to 4 circuit from ignition coil with igniter to ECM • No. 1 to No. 4 ignition coil with igniter • ECM

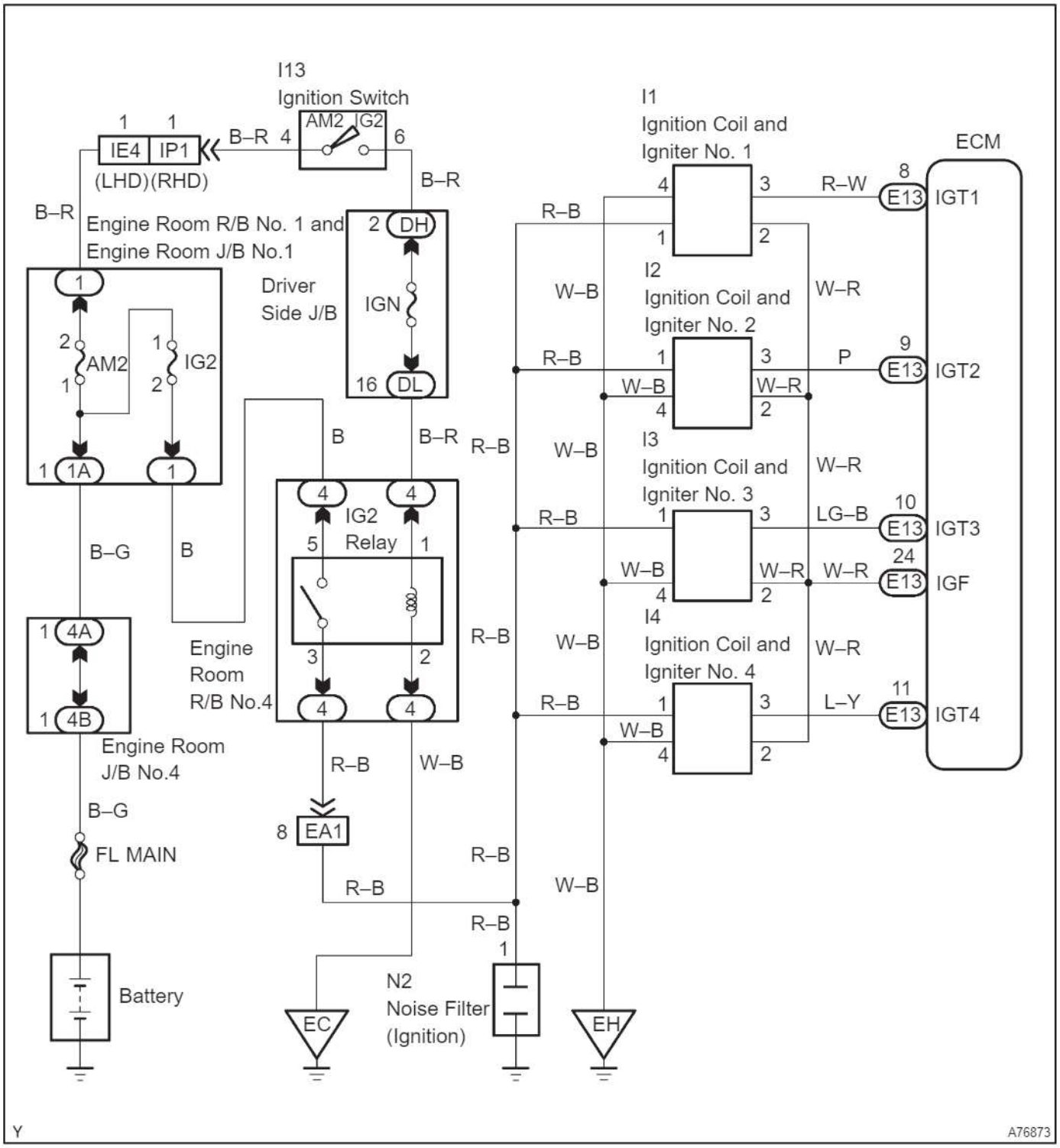


Reference: Inspection using the oscilloscope.
During cranking or idling, check the waveform between terminals IGT1 to IGT4 and E1, and IGF and E1 of the E11 ECM connector.

Item	Contents
Terminal	CH1: IGT1, IGT2, IGT3, IGT4 – E1 CH2: IGF1 – E1
Equipment Setting	2 V/Division, 20 ms/Division
Condition	While the engine is cranking or idling

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WIRING DIAGRAM



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INSPECTION PROCEDURE

HINT:

Read freeze frame data using the intelligent tester II. Freeze frame data record the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, 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	PERFORM SIMULATION TEST

(a) Clear the DTC(s) (see page 05–18).

(b) Shuffle arrangement of the ignition coil with igniters.

NOTICE:

Do not shuffle the connectors.

(c) Perform the simulation test.

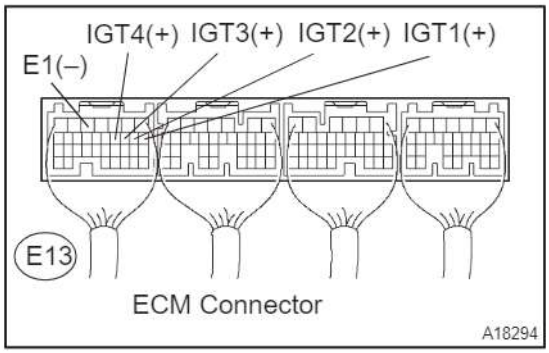
Result:

Display (DTC Output)	Proceed To
Same DTCs (that have been erased)	A
Other DTCs	B

B → **REPLACE IGNITION COIL ASSY**

A

2	INSPECT ECM(IGT1, IGT2, IGT3, IGT4 AND IGF1 SIGNAL)

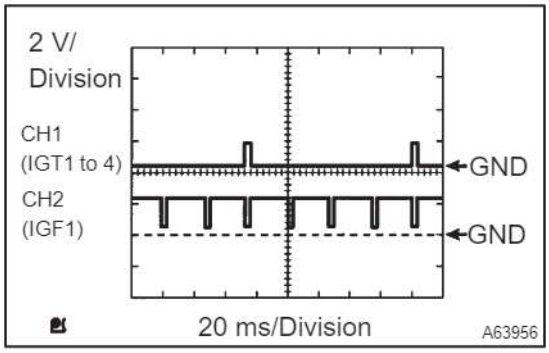


(a) Inspect using the oscilloscope.

(b) During cranking or idling, check the waveform between the specified terminals of the E13 ECM connector.

Standard:

Tester Connection	Specified Condition
IGT1 (E13–8) – E1 (E13–5)	Correct waveform is as shown
IGT2 (E13–9) – E1 (E13–5)	Correct waveform is as shown
IGT3 (E13–10) – E1 (E13–5)	Correct waveform is as shown
IGT4 (E13–11) – E1 (E13–5)	Correct waveform is as shown

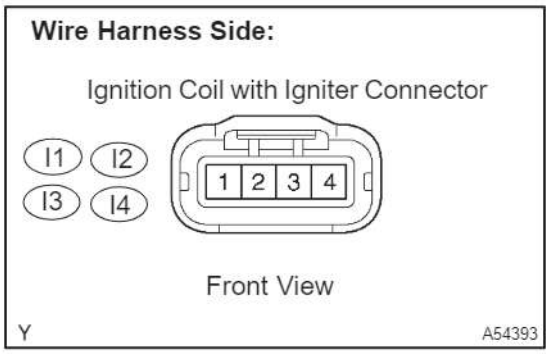


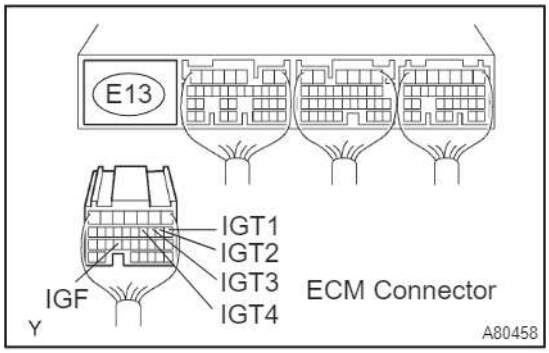
NG → **REPLACE ECM (See page 10–65 of Pub. No. RM1018E AVENSIS)**

OK

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3 CHECK HARNESS AND CONNECTOR(IGNITION COIL ASSY – ECM)





(a) Disconnect the I1, I2, I3 or I4 ignition coil with igniter connector.
(b) Disconnect the E13 ECM connector.
(c) Check the resistance.

Standard (Check for open):

Tester Connection	Specified Condition
Ignition coil (I1–2) – IGF (E13–24)	Below 1 Ω
Ignition coil (I2–2) – IGF (E13–24)	Below 1 Ω
Ignition coil (I3–2) – IGF (E13–24)	Below 1 Ω
Ignition coil (I4–2) – IGF (E13–24)	Below 1 Ω

Standard (Check for open):

Tester Connection	Specified Condition
Ignition coil (I1–3) – IGT1 (E13–8)	Below 1 Ω
Ignition coil (I2–3) – IGT2 (E13–9)	Below 1 Ω
Ignition coil (I3–3) – IGT3 (E13–10)	Below 1 Ω
Ignition coil (I4–3) – IGT4 (E13–11)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
Ignition coil (I1–2) or IGF (E13–24) – Body ground	10 kΩ or higher
Ignition coil (I2–2) or IGF (E13–24) – Body ground	10 kΩ or higher
Ignition coil (I3–2) or IGF (E13–24) – Body ground	10 kΩ or higher
Ignition coil (I4–2) or IGF (E13–24) – Body ground	10 kΩ or higher

Standard (Check for short):

Tester Connection	Specified Condition
Ignition coil (I1–3) or IGT1 (E13–8) – Body ground	10 kΩ or higher
Ignition coil (I2–3) or IGT2 (E13–9) – Body ground	10 kΩ or higher
Ignition coil (I3–3) or IGT3 (E13–10) – Body ground	10 kΩ or higher
Ignition coil (I4–3) or IGT4 (E13–11) – Body ground	10 kΩ or higher

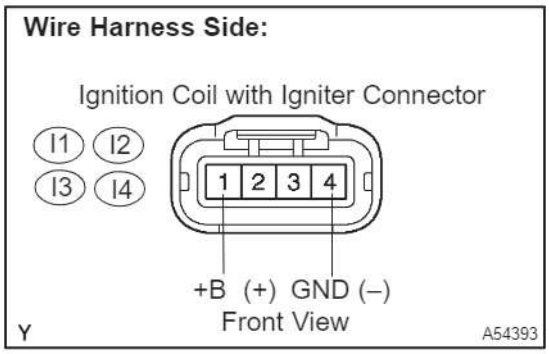
(d) Reconnect the ECM connector.
(e) Reconnect the ignition coil with igniter connector.

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

OK

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4 INSPECT SPARK PLUG(POWER SOURCE)



(a) Disconnect the I1, I2, I3 or I4 ignition coil with igniter connector.

(b) Check the resistance.

Standard (Check for open):

Tester Connection	Specified Condition
GND (I1–4) – Body ground	Below 1 Ω
GND (I2–4) – Body ground	Below 1 Ω
GND (I3–4) – Body ground	Below 1 Ω
GND (I4–4) – Body ground	Below 1 Ω

(c) Turn the ignition switch to ON.

(d) Measure the voltage between the terminals of the wire harness side connectors.

Standard:

Tester Connection	Specified Condition
+B (I1–1) – GND (I1–4)	9 to 14 V
+B (I2–1) – GND (I2–4)	9 to 14 V
+B (I3–1) – GND (I3–4)	9 to 14 V
+B (I4–1) – GND (I4–4)	9 to 14 V

(e) Reconnect the ignition coil with igniter connector.

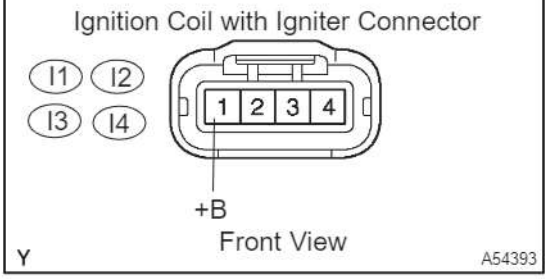
OK → **REPLACE IGNITION COIL ASSY**

NG

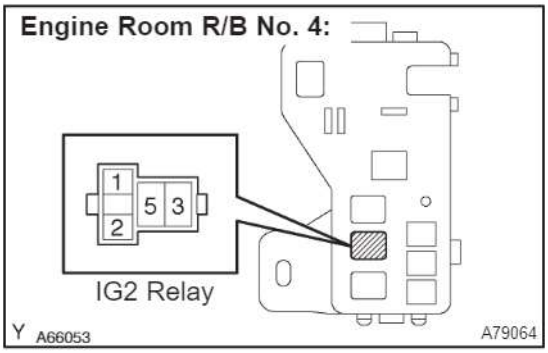
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5 CHECK HARNESS AND CONNECTOR(IGNITION COIL ASSY – IG2 RELAY)

Wire Harness Side:



Engine Room R/B No. 4:



(a) Disconnect the I1, I2, I3 or I4 ignition coil with igniter connector.
(b) Remove the IG2 relay from the engine room R/B No. 4.
(c) Check the resistance.

Standard (Check for open):

Tester Connection	Specified Condition
Ignition coil (I1–1) – Engine room R/B No. 4 (IG2 relay terminal 3)	Below 1 Ω
Ignition coil (I2–1) – Engine room R/B No. 4 (IG2 relay terminal 3)	Below 1 Ω
Ignition coil (I3–1) – Engine room R/B No. 4 (IG2 relay terminal 3)	Below 1 Ω
Ignition coil (I4–1) – Engine room R/B No. 4 (IG2 relay terminal 3)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
Ignition coil (I1–1) or Engine room R/B No. 4 (IG2 relay terminal 3) – Body ground	10 kΩ or higher
Ignition coil (I2–1) or Engine room R/B No. 4 (IG2 relay terminal 3) – Body ground	10 kΩ or higher
Ignition coil (I3–1) or Engine room R/B No. 4 (IG2 relay terminal 3) – Body ground	10 kΩ or higher
Ignition coil (I4–1) or Engine room R/B No. 4 (IG2 relay terminal 3) – Body ground	10 kΩ or higher

(d) Reconnect the ignition coil with igniter connector.
(e) Reinstall the IG2 relay.

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

OK

REPLACE IGNITION COIL ASSY

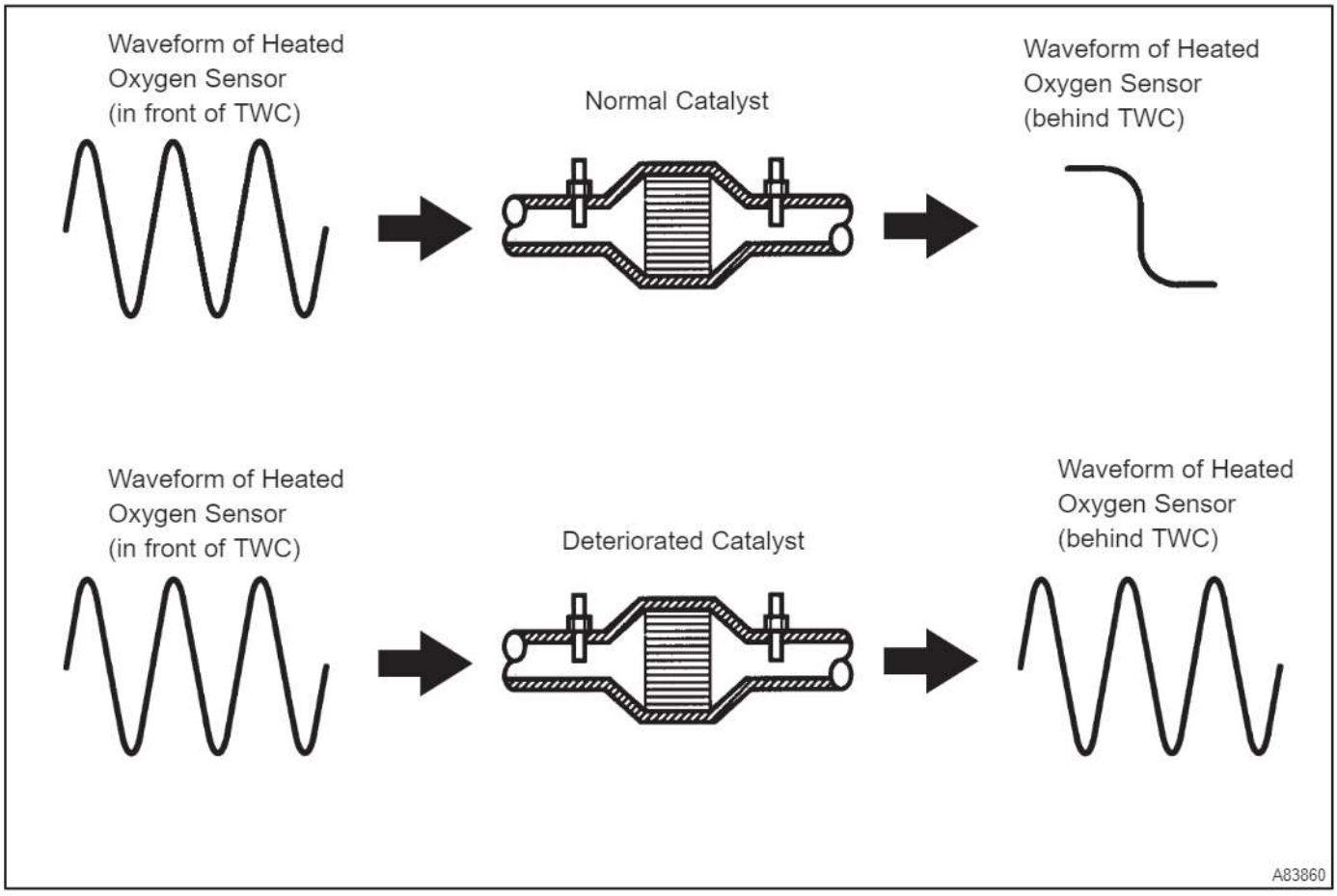
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DTC	P0420	CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD (BANK 1)

CIRCUIT DESCRIPTION

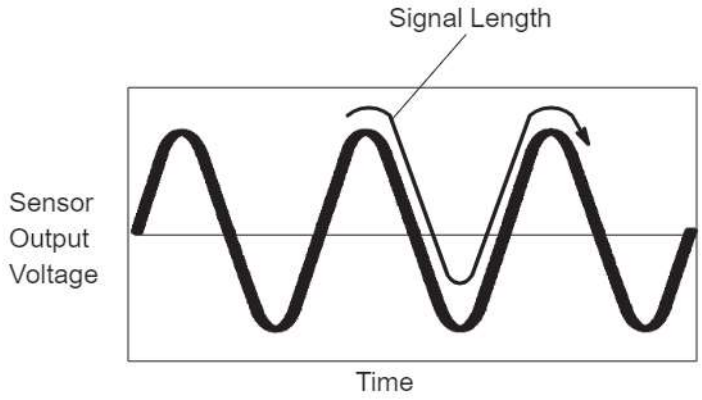
This vehicle has two Heated Oxygen (O2) sensors. One is located in front of the Three–Way Catalyst Converter (TWC), and the other is mounted behind the TWC. Each signal output of the sensors is converted into a waveform inside the ECM. The front O2 sensor is used to monitor the air–fuel ratio by the ECM, and whose signal prompts the ECM to perform air–fuel ratio feedback control. As a result, the air–fuel ratio is balanced, and the waveform of the front O2 sensor oscillates between rich and lean regularly.

To determine whether or not the catalyst performance has deteriorated, the ECM compares the waveforms of the front and rear O2 sensors. While the catalyst is functioning normally, the waveform of the rear O2 sensor fluctuates between rich and lean more slowly than the front O2 sensor's waveform. When the rear O2 sensor's waveform frequently fluctuates, it indicates that the catalyst performance deteriorates.



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Heated Oxygen Sensor Signal Length:

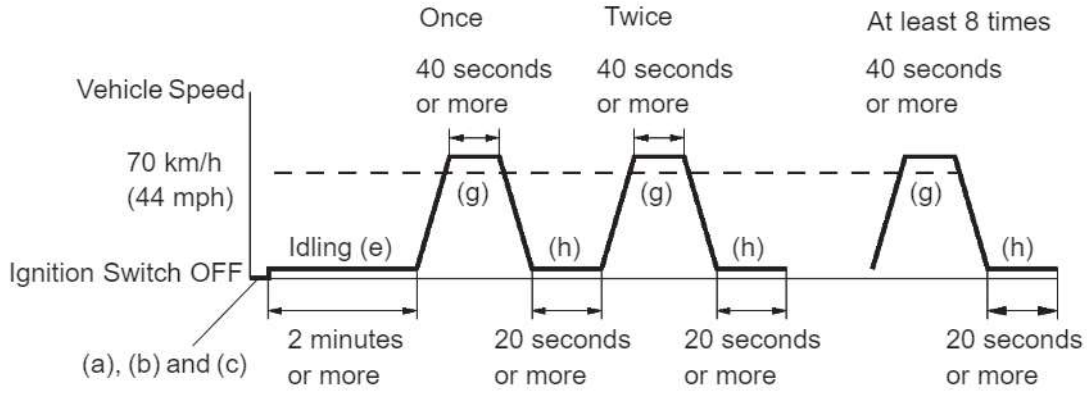


A82718

DTC No.	DTC Detecting Condition	Trouble Area
P0420	After engine and TWC are warmed up, and while vehicle is driven within predetermined vehicle speed and engine speed range: Waveforms of heated oxygen sensor (sensor 2) frequently fluctuates between rich and lean (2 trip detection logic)	• Gas leakage in exhaust system • Heated oxygen sensor (sensor 1) • Heated oxygen sensor (sensor 2) • Three–way catalytic converter (TWC)

CONFIRMATION DRIVING PATTERN

Engine coolant temperature is more than 75°C (167°F)



Y

A58686

(a) Connect the intelligent tester II to the DLC3.
(b) Turn the ignition switch to ON and turn the intelligent tester II ON.
(c) Switch the ECM from normal mode to check mode using the intelligent tester II (see page 05–20).
(d) Start the engine.
(e) Allow the engine to idle for 2 minutes.
(f) Warm up the engine until the engine coolant temperature reaches more than 75°C (167°F).
(g) Drive the vehicle at 70 km/h (44 mph) or more for 40 seconds or more.
(h) Stop the vehicle and allow the engine to idle for 20 seconds or more.
(i) Repeat the steps (g) and (h) at least 8 times in one driving cycle.

HINT:

If a malfunction exists, the MIL will be illuminated during step (i).

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NOTICE:
If the conditions in this test are not strictly followed, no malfunction will be detected. If you do not have the intelligent tester II, turn the ignition switch to OFF after performing steps from (d) to (i), then perform steps (d) to (i) again.

WIRING DIAGRAM

Refer to DTC P0130 on page 05–74.

INSPECTION PROCEDURE

HINT:
Read freeze frame data using the intelligent tester II. Freeze frame data record the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, 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	CHECK OTHER DTC OUTPUT(IN ADDITION TO DTC P0420)

(a) Connect the intelligent tester II to the DLC3.
(b) Turn the ignition switch to ON and turn the intelligent tester II ON.
(c) Select the following menu items: Powertrain / Engine and ECT / DTC.
(d) Read DTCs.
Result:

Display (DTC Output)	Proceed To
P0420	A
P0420 and other DTCs	B

HINT:
If any DTCs other than P0420 are output, troubleshoot those DTCs first.

B → GO TO RELEVANT DTC CHART (See page 05–27)

A

2	CHECK FOR EXHAUST GAS LEAKAGE

OK: No gas leakage.

NG → REPAIR OR REPLACE EXHAUST GAS LEAKAGE POINT

OK

3	INSPECT HEATED OXYGEN SENSOR(SENSOR 1) (See page 05–74)

NG → REPLACE HEATED OXYGEN SENSOR

OK

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4	INSPECT HEATED OXYGEN SENSOR(SENSOR 2) (See page 05–100)

OK: During air–fuel ratio feedback, the oxygen sensor output fluctuates between rich and lean.

NG → REPLACE HEATED OXYGEN SENSOR

OK

REPLACE THREE–WAY CATALYTIC CONVERTER (BOTH FRONT AND REAR TWC)

NOTICE:

On the damaged bank, replace both the front and rear catalysts.

HINT:

Intelligent tester II only:

Malfunctioning areas can be found by performing the Active Test / A/F Control operation. The A/F Control operation can determine if the heated oxygen sensor or other potential trouble areas are malfunctioning or not.

(a) Perform the Active Test using the intelligent tester II.

HINT:

The A/F Control operation lowers the injection volume by 12.5 % or increases the injection volume by 25 %.

(1) Connect the intelligent tester II to the DLC3.
(2) Start the engine and turn the intelligent tester II ON.
(3) Warm up the engine by running the engine at 2,500 rpm for approximately 3 minutes.
(4) On the intelligent tester II, select the following menu items: Powertrain / Engine and ECT / Active Test / A/F Control.
(5) Select the following monitor items: O2S B1 S1 and O2S B1 S2.
(6) Perform the A/F Control operation with the engine in an idling condition (press the right or left button).

Result:

The heated oxygen sensor reacts in accordance with increases and decreases of the injection volume:

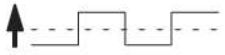
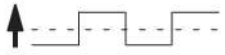
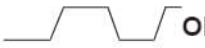
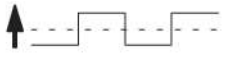
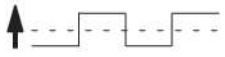
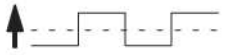
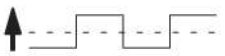
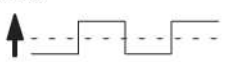
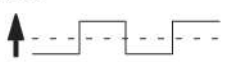
+25 % → Rich output: More than 0.5 V

–12.5 % → Lean output: Less than 0.4 V

NOTICE:

Sensor 1 (front sensor) has an output delay of a few seconds. Sensor 2 (rear sensor) has a maximum output delay of approximately 20 seconds.

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	Output Voltage of Heated Oxygen Sensor (sensor 1: front sensor)	Output Voltage of Heated Oxygen Sensor (sensor 2: rear sensor)	Main Suspect Trouble Area
Case 1	Injection volume +25 % –12.5 %  Output voltage More than 0.5 V Less than 0.4V  OK	Injection volume +25 % –12.5 %  Output voltage More than 0.5 V Less than 0.4V  OK	—
Case 2	Injection volume +25 % –12.5 %  Output voltage Almost no reaction NG	Injection volume +25 % –12.5 %  Output voltage More than 0.5 V Less than 0.4V  OK	Sensor 1: front sensor (Sensor 1, heater, sensor 1 circuit)
Case 3	Injection volume +25 % –12.5 %  Output voltage More than 0.5 V Less than 0.4V  OK	Injection volume +25 % –12.5 %  Output voltage Almost no reaction NG	Sensor 2: rear sensor (Sensor 2, heater, sensor 2 circuit)
Case 4	Injection volume +25 % –12.5 %  Output voltage Almost no reaction NG	Injection volume +25 % –12.5 %  Output voltage Almost no reaction NG	Extremely rich or lean actual air–fuel ratio (Injector, fuel pressure, gas leakage in exhaust system, etc.)

The following A/F Control procedure enables the technician to check and graph the voltage output of both the heated oxygen sensors.
To display the graph, select the following menu items on the tester: View / Line Graph.

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DTC	P0443	EVAPORATIVE EMISSION CONTROL SYSTEM PURGE CONTROL VALVE CIRCUIT

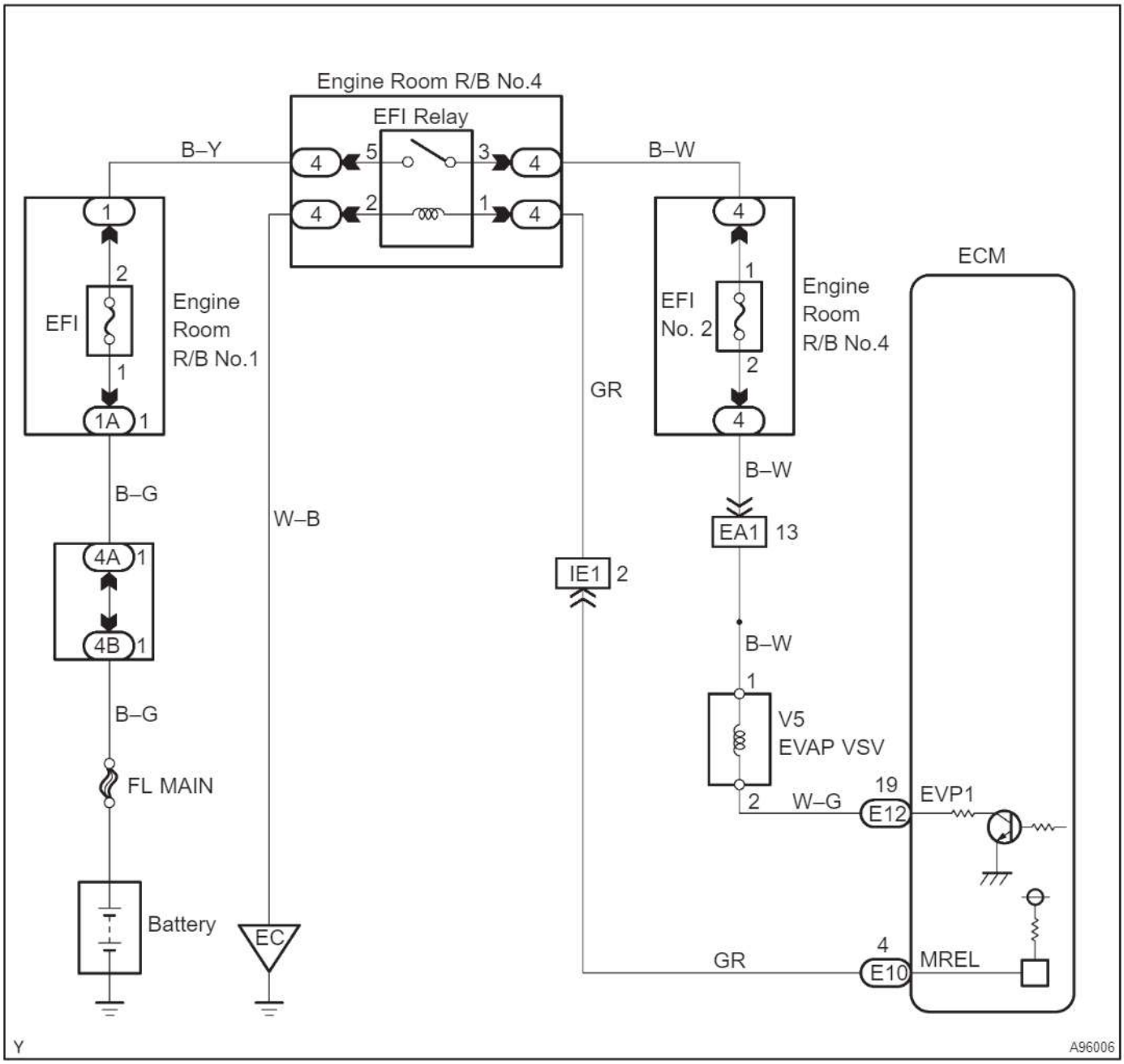
CIRCUIT DESCRIPTION

In order to reduce hydrocarbon (HC) emissions, evaporated fuel from the fuel tank is routed through the charcoal canister to the intake manifold for combustion in the cylinders.

The ECM changes the duty signal to the EVAP VSV so that the intake of HC emissions is appropriate for the driving conditions (engine load, engine speed, vehicle speed, etc.) after the engine is warmed up.

DTC No.	DTC Detection Condition	Trouble Area
P0443	Proper response to ECM command does not occur (1 trip detection logic)	• Open or short in EVAP VSV circuit • EVAP VSV • ECM

WIRING DIAGRAM



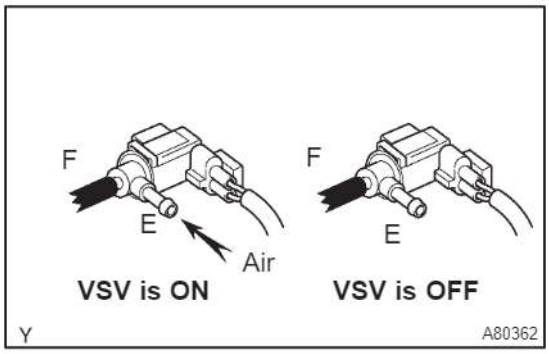
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INSPECTION PROCEDURE

HINT:

Read freeze frame data using the intelligent tester II. Freeze frame data record the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, 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	PERFORM ACTIVE TEST USING INTELLIGENT TESTER II(EVAP VSV)



(a) Disconnect the vacuum hose of the EVAP VSV.
(b) Connect the intelligent tester II to the DLC3.
(c) Start the engine and turn the intelligent tester II ON.
(d) Select the following menu items: Powertrain / Engine and ECT / Active Test / Purge VSV. Press the right or left button.
(e) Check if the disconnected port applies suction to your finger when operating the EVAP VSV using the intelligent tester II.

Standard:

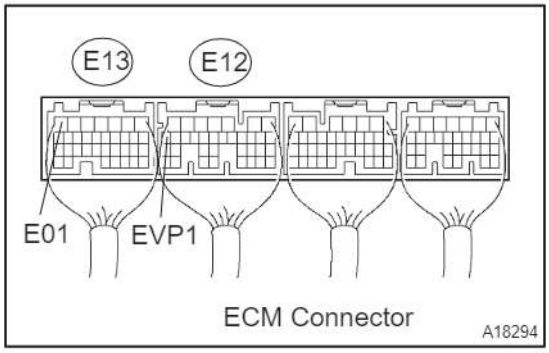
Tester Operation	Specified Condition
VSV is ON	Applies suction to your finger
VSV is OFF	Applies no suction to your finger

(f) Reconnect the vacuum hose.

OK → **CHECK FOR INTERMITTENT PROBLEMS (See page 05–9)**

NG

2	INSPECT ECM(CHECK VOLTAGE)



(a) Turn the ignition switch to ON.
(b) Measure the voltage between the terminals of the E12 and E13 ECM connectors.

Standard:

Tester Connection	Specified Condition
EVP1 (E12–19) – E01 (E13–7)	9 to 14 V

OK → **REPLACE ECM (See page 10–65 of Pub. No. RM1018E AVENSIS)**

NG

3	INSPECT VACUUM SWITCHING VALVE(OPERATION OF EVAP VSV)

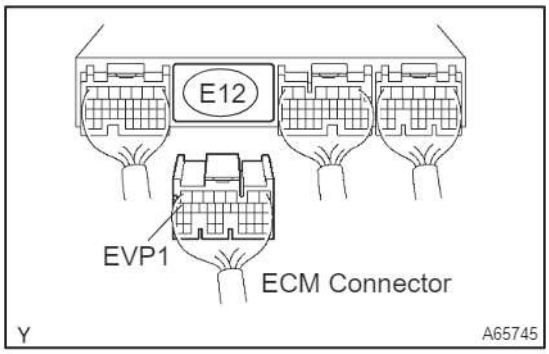
OK: Air flows when the battery voltage is applied to the EVAP VSV.

NG → **REPLACE VACUUM SWITCHING VALVE**

OK

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4 CHECK HARNESS AND CONNECTOR(ECM – EVAP VSV)



(a) Disconnect the E12 ECM connector.
(b) Disconnect the V5 EVAP VSV connector.
(c) Check the resistance.

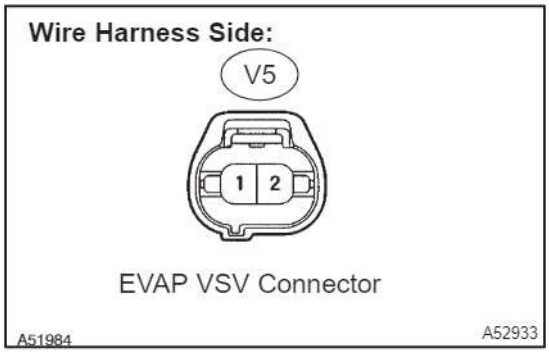
Standard (Check for open):

Tester Connection	Specified Condition
EVAP VSV (V5–2) – EVP1 (E12–19)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
EVAP VSV (V5–2) or PRG (E12–19) – Body ground	10 kΩ or higher

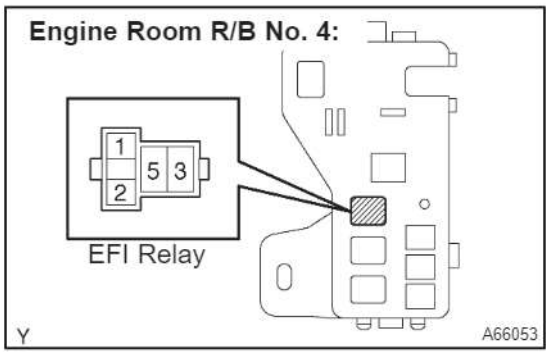
(d) Reconnect the ECM connector.
(e) Reconnect the EVAP VSV connector.



NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

5 CHECK HARNESS AND CONNECTOR(EFI RELAY – EVAP VSV)



(a) Remove the EFI relay from the engine room R/B No. 4.
(b) Disconnect the V5 EVAP VSV connector.
(c) Check the resistance.

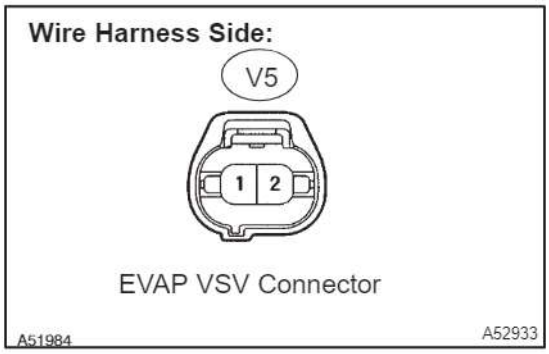
Standard (Check for open):

Tester Connection	Specified Condition
EVAP VSV (V5–1) – EFI relay (3)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
EVAP VSV (V5–1) or EFI relay (3) – Body ground	10 kΩ or higher

(d) Reinstall the EFI relay
(e) Reconnect the EVAP VSV connector.



NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

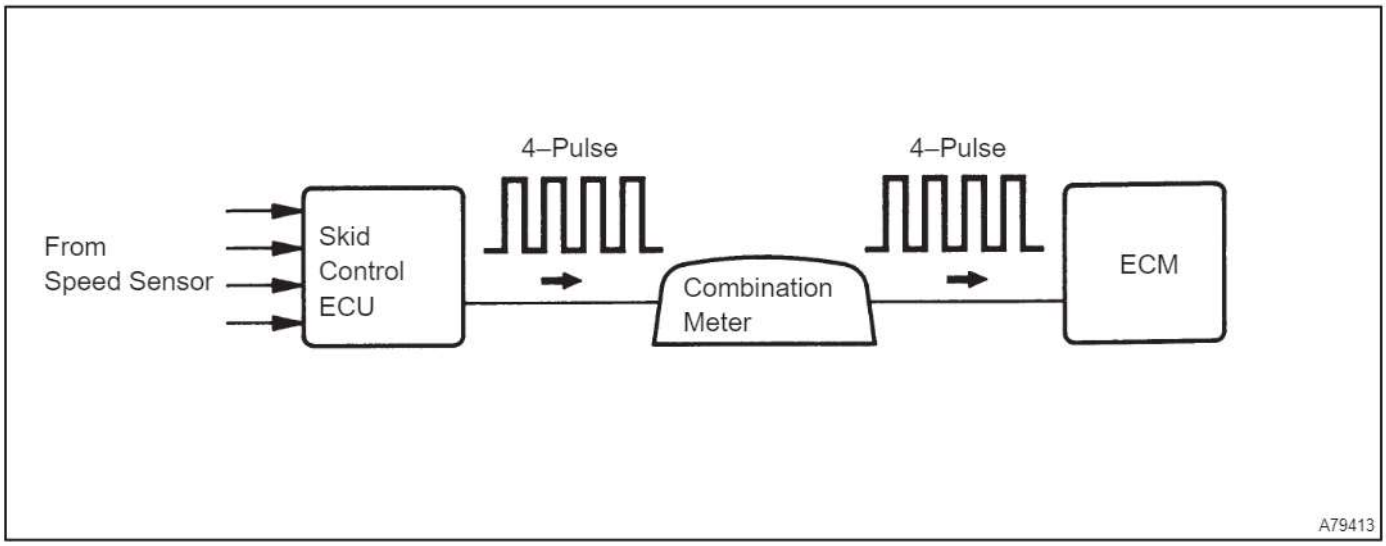
INSPECT ECM POWER SOURCE CIRCUIT (See page 05–195)

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DTC	P0500	VEHICLE SPEED SENSOR "A"

CIRCUIT DESCRIPTION

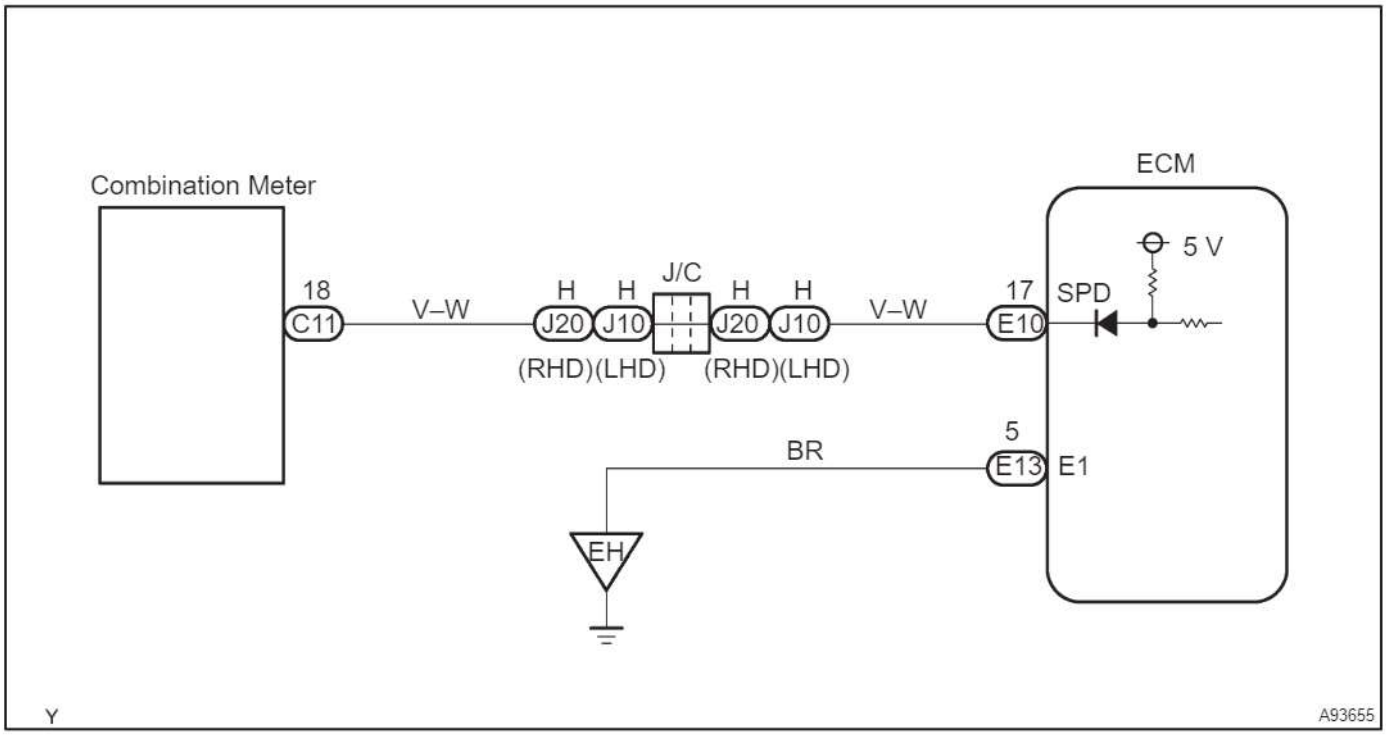
The speed sensor detects the wheel speed and sends appropriate signals to the skid control ECU. The skid control ECU converts these wheel speed signals into a 4–pulse signal and outputs it to the ECM via the combination meter. The ECM determines the vehicle speed based on the frequency of these pulse signals.



DTC No.	DTC Detection Condition	Trouble Area
P0500	Conditions (a), (b) and (c) continue for 8 seconds or more (2 trip detection logic): (a) Engine coolant temperature is more than 60°C (140°F) (b) Engine speed is between 2,000 rpm and 3,000 rpm (c) No speed signal is input to ECM	• Open or short in speed sensor circuit • Speed sensor • Combinationmeter • ECM • Skid control ECU

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WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

Read freeze frame data using the intelligent tester II. Freeze frame data record the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, 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	CHECK OPERATION OF SPEEDOMETER

(a) Drive the vehicle and check if the operation of the speedometer in the combination meter is normal.

HINT:

The vehicle speed sensor is operating normally if the speedometer reading is normal.

NG → **CHECK SPEEDOMETER CIRCUIT (See page 05–1510 of Pub. No. RM1018E AVENSIS)**

OK

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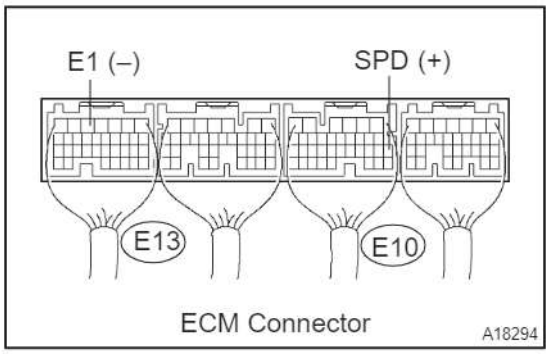
2	READ VALUE OF INTELLIGENT TESTER II(VEHICLE SPEED)

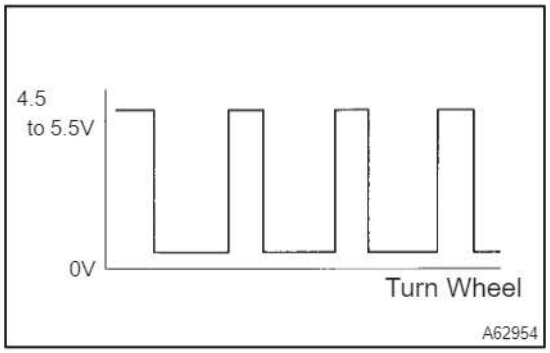
(a) Connect the intelligent tester II to the DLC3.
(b) Start the engine and turn the intelligent tester II ON.
(c) On the intelligent tester II, select the following menu items: Powertrain / Engine and ECT / Data List / Vehicle SPD.
(d) Check the vehicle speed at the engine speed of 2,000 rpm or more when the vehicle is running.
Standard: Same value as the actual vehicle speed.

YES → **CHECK FOR INTERMITTENT PROBLEMS (See page 05–9)**

NO

3	INSPECT ECM(SPD VOLTAGE)





(a) Shift the transmission gear selector lever to the neutral position.
(b) Jack up the vehicle.
(c) Turn the ignition switch to ON.
(d) Measure the voltage between the terminals of the E10 and E13 ECM connectors as the wheel is turned slowly.
Standard:

Tester Connection	Specified Condition
SPD (E10–17) – E1 (E13–5)	Generatedintermittently

HINT:
The output voltage should fluctuate up and down similarly to the diagram on the left when the wheel is turned slowly.

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

OK

REPLACE ECM (See page 10–65 of Pub. No. RM1018E AVENSIS)

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DTC P0504 BRAKE SWITCH "A"/"B" CORRELATION

CIRCUIT DESCRIPTION

In this system, the signal of the stop lamp switch is used to judge whether the brake system is abnormal or not.

The stop lamp switch has a duplex system (signals STP and ST1–) to detect abnormalities. When the signals of depressing and releasing the brake pedal are detected simultaneously, the ECM interprets this as a malfunction of the stop lamp switch.

HINT:

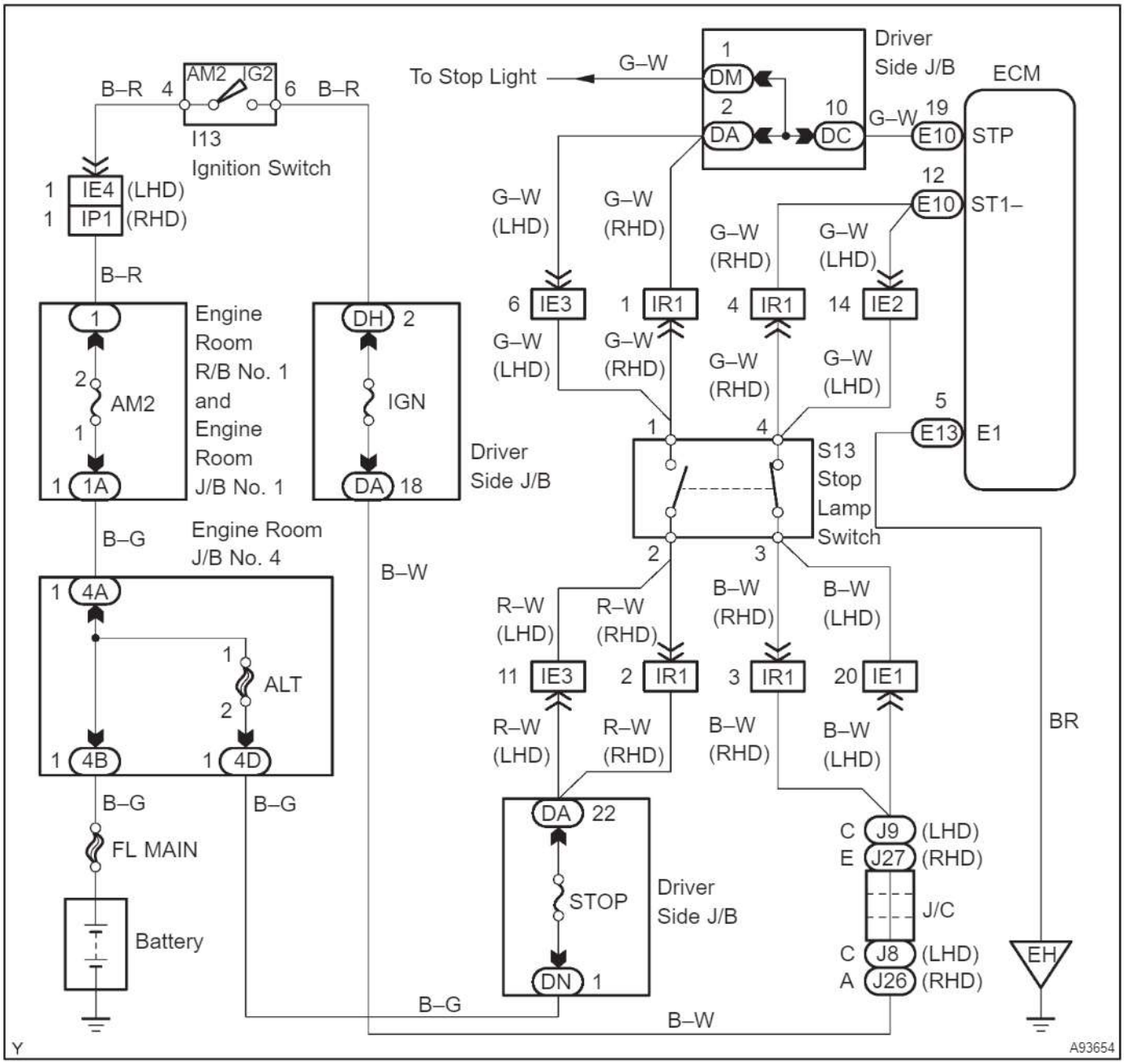
Normal condition is as shown in the table.

Signal	Brake Pedal Released	In Transition	Brake Pedal Depressed
STP	OFF	ON	ON
ST1–	ON	ON	OFF

DTC No.	DTC Detection Condition	Trouble Area
P0504	Conditions (a), (b) and (c) continue for 0.5 seconds or more: (a) Ignition switch ON (b) Brake pedal released (c) STP signal is OFF when the ST1– signal is OFF	• Short in stop lamp switch signal circuit • Stop lamp fuse • Stop lamp switch • ECM

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WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

Read freeze frame data using the intelligent tester II. Freeze frame data record the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, 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.

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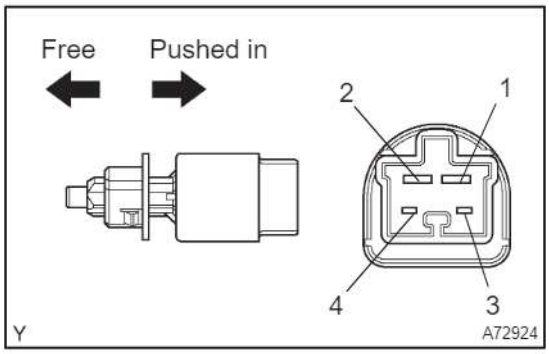
1 CHECK OPERATION OF STOP LAMP

(a) Check if the stop lamps go on and off normally when the brake pedal is depressed and released.
OK: The stop lamps turn ON when you depress the brake pedal.

NG → **REPAIR OR REPLACE STOP LAMP SWITCH CIRCUIT**

OK

2 INSPECT STOP LAMP SWITCH ASSY



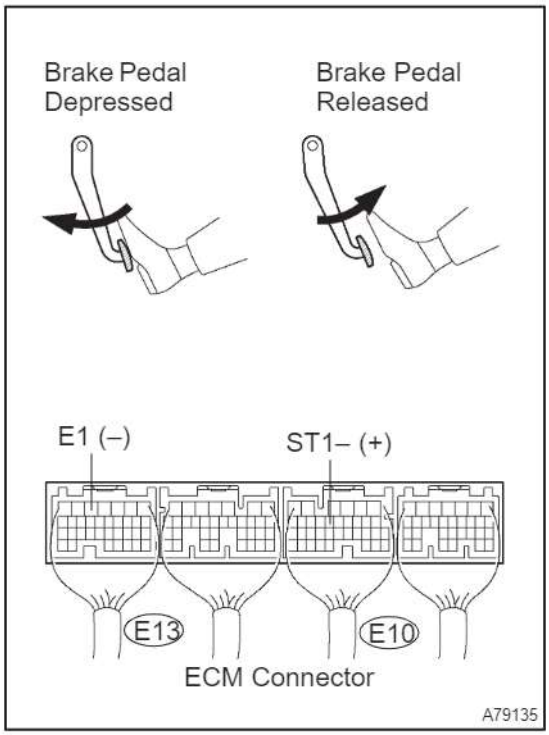
(a) Check the resistance between each pair of terminals.
Standard:

Switch Position	Tester Connection	Specified Condition
Switch pin free	1 – 2	Below 1 Ω
Switch pin free	3 – 4	10 kΩ or higher
Switch pin pushed in	1 – 2	10 kΩ or higher
Switch pin pushed in	3 – 4	Below 1 Ω

NG → **REPLACE STOP LAMP SWITCH ASSY**

OK

3 READ VALUE OF INTELLIGENT TESTER II(STP SIGNAL AND ST1– VOLTAGE)



(a) Connect the intelligent tester II to the DLC3.
(b) Turn the ignition switch to ON and turn the intelligent tester II ON.
(c) Select the following menu items: Powertrain / Engine and ECT / Data List / Stop Light SW.
(d) Check the result.
Standard:

Brake Pedal	Specified Condition
Depressed	STP Signal ON
Released	STP Signal OFF

(e) Measure the voltage between the specified terminals of the E10 and E13 ECM connectors.
Standard:

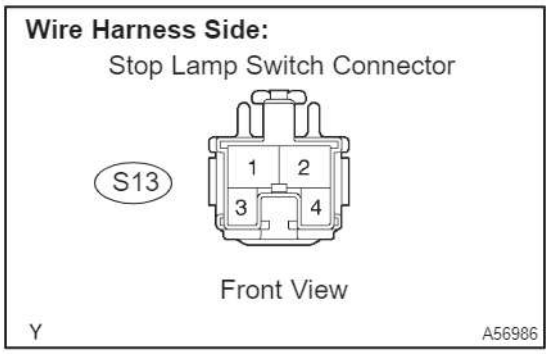
Tester Connection	Brake Pedal	Specified Condition
ST1– (E10–12) – E1 (E13–5)	Depressed	Below 1.5 V
ST1– (E10–12) – E1 (E13–5)	Released	7.5 to 14 V

OK → **CHECK FOR INTERMITTENT PROBLEMS (See page 05–9)**

NG

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4 CHECK HARNESS AND CONNECTOR(STOP LAMP SWITCH – ECM)

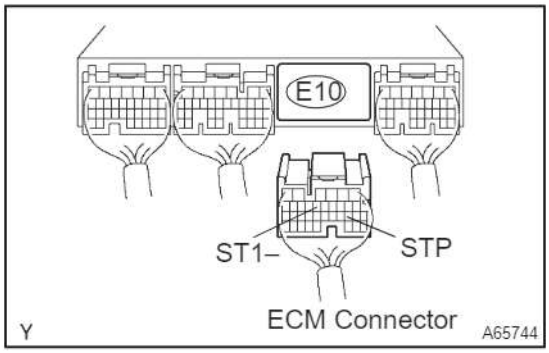


(a) Disconnect the S13 stop lamp switch connector.
(b) Disconnect the E10 ECM connector.
(c) Check the resistance.

Standard (Check for open):

Tester Connection	Specified Condition
Stop lamp switch (S13–1) – STP (E10–19)	Below 1 Ω
Stop lamp switch (S13–4) – ST1– (E10–12)	Below 1 Ω

(d) Reconnect the stop lamp switch connector.
(e) Reconnect the ECM connector.



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

OK

REPLACE ECM (See page 10–65 of Pub. No. RM1018E AVENSIS)

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DTC P0505 IDLE AIR CONTROL SYSTEM

CIRCUIT DESCRIPTION

The idle speed is controlled by the ETCS (Electronic Throttle Control System).
The ETCS is composed of the throttle actuator which operates the throttle valve, and the throttle position sensor which detects an opening angle of the throttle valve.
The ECM controls the throttle motor to provide the proper throttle valve opening angle to obtain the target idling speed.

DTC No.	DTC Detection Condition	Trouble Area
P0505	Idling speed continues to vary greatly from target speed (2 trip detection logic)	• Electronic throttle control system • Air induction system • PCV hose connection

INSPECTION PROCEDURE

HINT:
Read freeze frame data using the intelligent tester II. Freeze frame data record the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, 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 CHECK OTHER DTC OUTPUT(IN ADDITION TO DTC P0505)

(a) Connect the intelligent tester II to the DLC3.
(b) Turn the ignition switch to ON and turn the intelligent tester II ON.
(c) Select the following menu items: Powertrain / Engine and ECT / DTC.
(d) Read DTCs.

Result:

Display (DTC Output)	Proceed To
P0505	A
P0505 and other DTCs	B

HINT:
If any DTCs other than P0505 are output, troubleshoot those DTCs first.

B → **GO TO RELEVANT DTC CHART** (See page 05–27)

A

2 CHECK CONNECTION OF PCV HOSE

OK: The PCV hose is connected correctly and not damaged.

NG → **REPAIR OR REPLACE PCV HOSE**

OK

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3	CHECK AIR INDUCTION SYSTEM

(a) Check for vacuum leaks in the air induction system.
OK: No leak in the air induction system.

NG → REPAIR OR REPLACE AIR INDUCTION SYSTEM

OK

CHECK ELECTRONIC THROTTLE CONTROL SYSTEM (See page 10–1)

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DTC	P0560	SYSTEM VOLTAGE

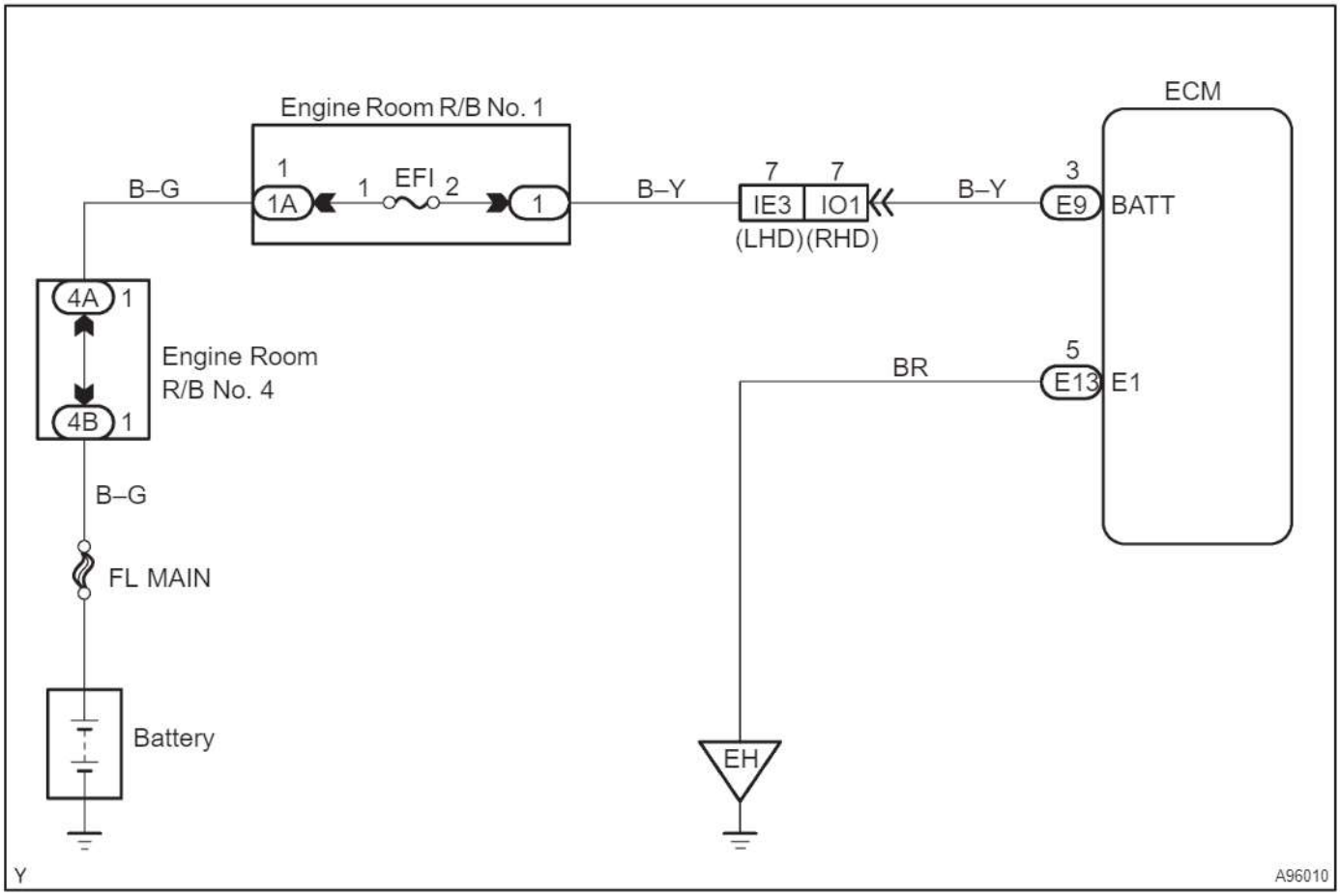
CIRCUIT DESCRIPTION

The battery supplies electricity to terminal BATT of the ECM even when the ignition switch is OFF. This electricity allows the ECM to store DTC histories, freeze frame data, fuel trim values, and other data.

DTC No.	DTC Detection Condition	Trouble Area
P0560	Open in backup power source circuit	• Open in backup power source circuit • ECM

HINT:
If DTC P0560 is set, the ECM does not store other DTCs.

WIRING DIAGRAM

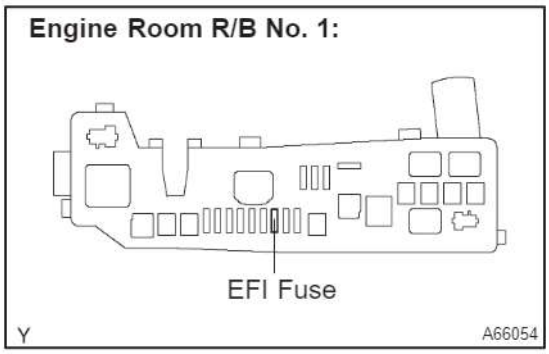


INSPECTION PROCEDURE

HINT:
Read freeze frame data using the intelligent tester II. Freeze frame data record the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, 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.

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1 CHECK FUSE(EFI FUSE)

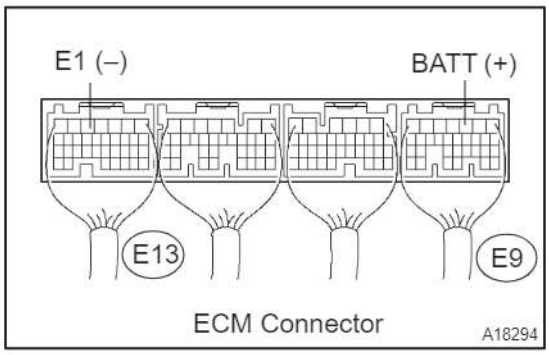


(a) Remove the EFI fuse from the engine room R/B No. 1.
(b) Check the EFI fuse resistance.
Standard: Below 1 Ω
(c) Reinstall the EFI fuse.

NG → **CHECK FOR SHORT IN ALL HARNESSES AND COMPONENTS CONNECTED TO FUSE**

OK

2 INSPECT ECM(BATT VOLTAGE)



(a) Measure the voltage between the terminals of the E9 and E13 ECM connectors.
Standard:

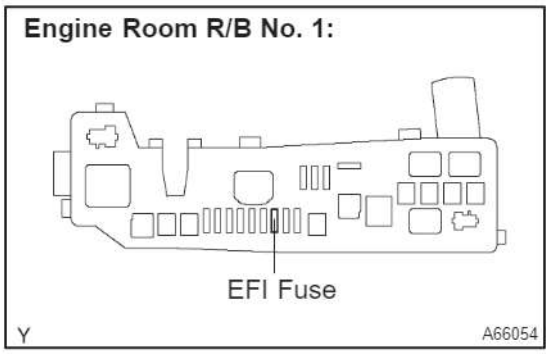
Tester Connection	Specified Condition
BATT (E9–3) – E1 (E13–5)	9 to 14 V

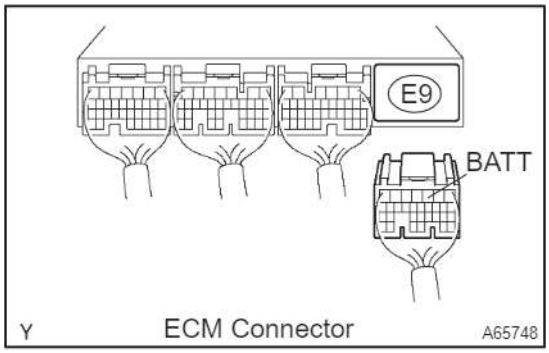
OK → **REPLACE ECM (See page 10–65 of Pub. No. RM1018E AVENSIS)**

NG

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3 CHECK HARNESS AND CONNECTOR(ECM – EFI FUSE, EFI FUSE – BATTERY)





(a) Check the harness and the connectors between the EFI fuse and ECM.
(1) Remove the EFI fuse from the engine room R/B No. 1.
(2) Disconnect the E9 ECM connector.
(3) Check the resistance.

Standard (Check for open):

Tester Connection	Specified Condition
EFI fuse (2) – BATT (E9–3)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
EFI fuse (2) or BATT (E9–3) – Body ground	10 kΩ or higher

(4) Reinstall the EFI fuse.
(5) Reconnect the ECM connector.

(b) Check the harness and the connector between the EFI fuse and battery.
(1) Remove the EFI fuse from the engine room R/B No. 1.
(2) Disconnect the positive battery cable.
(3) Check the resistance.

Standard (Check for open):

Tester Connection	Specified Condition
Positive battery cable terminal – EFI fuse (1)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
Positive battery cable terminal or EFI fuse (1) – Body ground	10 kΩ or higher

(4) Reinstall the EFI fuse.
(5) Reconnect the positive battery cable.

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

OK

CHECK AND REPLACE ENGINE ROOM RELAY BLOCK

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DTC	P0604	INTERNAL CONTROL MODULE RANDOM ACCESS MEMORY (RAM) ERROR

DTC	P0606	ECM/PCM PROCESSOR

DTC	P0607	CONTROL MODULE PERFORMANCE

DTC	P0657	ACTUATOR SUPPLY VOLTAGE CIRCUIT/OPEN

CIRCUIT DESCRIPTION

The ECM continuously monitors its internal memory status, internal circuits, and output signals to the throttle actuator. This self–check ensures that the ECM is functioning properly. If any malfunction is detected, the ECM will set appropriate DTCs and illuminate the MIL.
The ECM memory status is diagnosed by internal ”mirroring” of the main CPU and the sub CPU to detect Random Access Memory (RAM) errors. The two CPUs also perform continuous mutual monitoring.

DTC No.	DTC Detection Condition	Trouble Area
P0604 P0606 P0607 P0657	ECM internal error	• ECM

INSPECTION PROCEDURE

HINT:
Read freeze frame data using the intelligent tester II. Freeze frame data record the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, 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.

REPLACE ECM (See page 10–65 of Pub. No. RM1018E AVENSIS)

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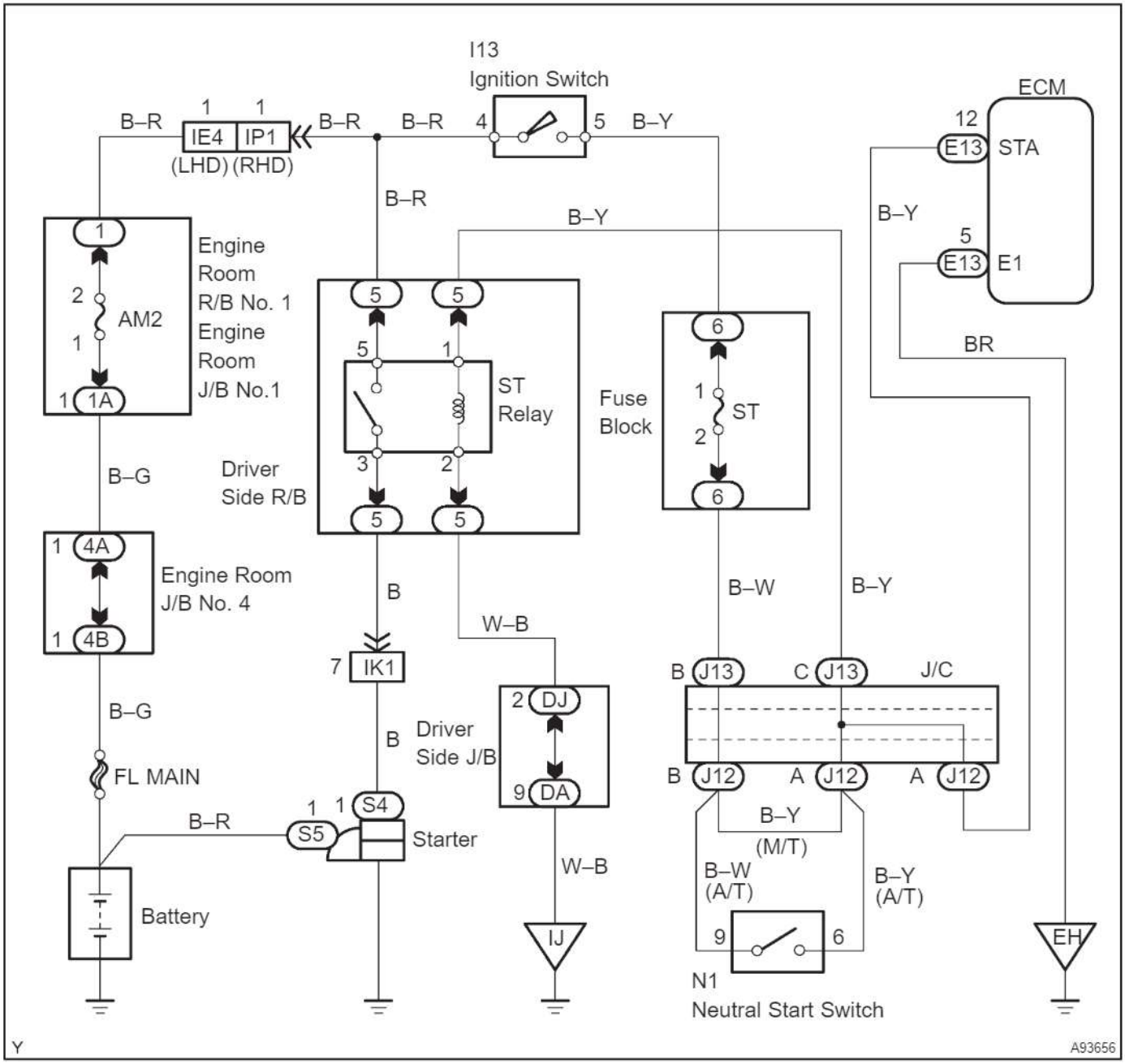
DTC	P0617	STARTER RELAY CIRCUIT HIGH

CIRCUIT DESCRIPTION

While the engine is being cranked, the positive battery voltage is applied to terminal STA of the ECM.

DTC No.	DTC Detection Condition	Trouble Area
P0617	When conditions (a), (b) and (c) are met when the battery voltage of 10.5 V or more is applied for 20 seconds (a) Vehicle speed greater than 20 km/h (12 mph) (b) Engine RPM greater than 1,000 rpm (c) STA signal ON	• Short in park/neutral position switch circuit (MMT) • Short in STA circuit • Park/neutral position switch (MMT) • ECM

WIRING DIAGRAM



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INSPECTION PROCEDURE

HINT:

Read freeze frame data using the intelligent tester II. Freeze frame data record the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, 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	READ VALUE OF INTELLIGENT TESTER II(STA SIGNAL)

(a) Connect the intelligent tester ll to the DLC3.
(b) Turn the ignition switch to ON and turn the intelligent tester ll ON.
(c) Select the following menu items: Powertrain / Engine and ECT / Data List / Starter SIG.
(d) Check the result when the ignition switch is turned to the ON and START positions.

Standard:

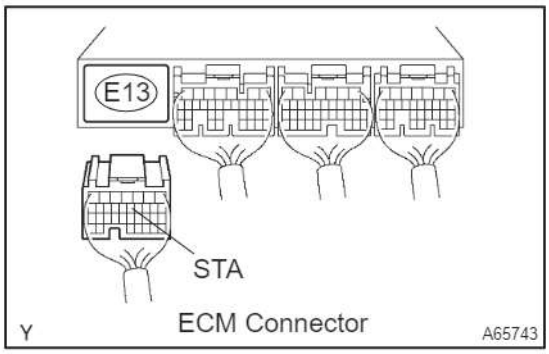
Ignition Switch Position	ON	START
STARTER SIG	OFF	ON

OK → **PROCEED TO NEXT CIRCUIT INSPECTION SHOWN ON PROBLEM SYMPTOMS TABLE** (See page 05–12)

NG

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2 CHECK HARNESS AND CONNECTOR(ECM – ST RELAY)



(a) Disconnect the E13 ECM connector.
(b) Remove the ST relay from the driver side R/B.
(c) Check the resistance.

Standard (Check for open):

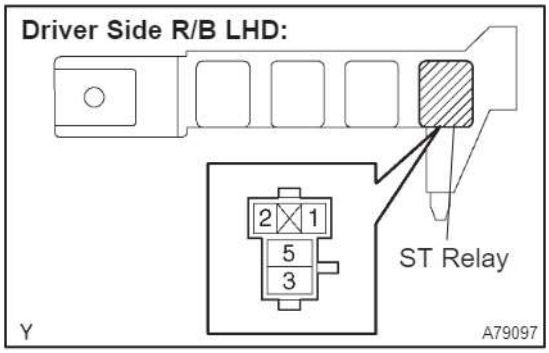
Tester Connection	Specified Condition
ST relay (1) – STA (E13–12)	Below 1 Ω

Standard (Check for short):

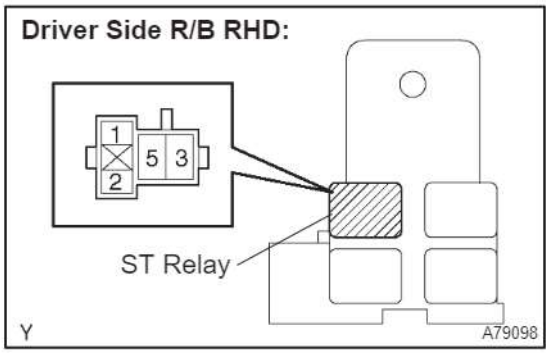
Tester Connection	Specified Condition
ST relay (1) or STA (E13–12) – Body ground	10 kΩ or higher

(d) Reconnect the ECM connector.
(e) Reinstall the ST relay.

Driver Side R/B LHD:



Driver Side R/B RHD:



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

OK

REPLACE ECM (See page 10–65 of Pub. No. RM1018E AVENSIS)

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DTC	P2102	THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT LOW

DTC	P2103	THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT HIGH

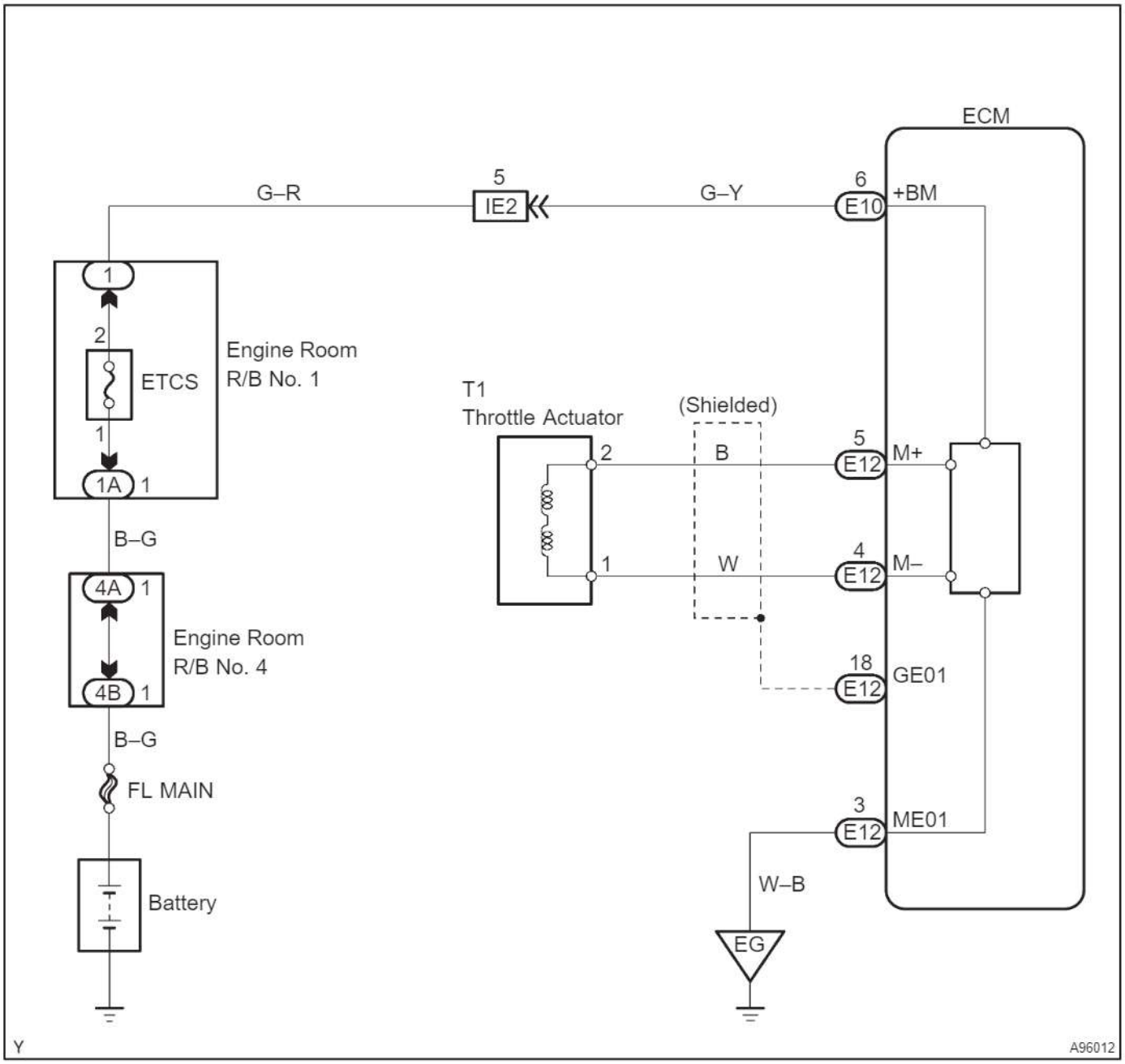
CIRCUIT DESCRIPTION

The throttle actuator is operated by the ECM and it opens and closes the throttle valve.
The opening angle of the throttle valve is detected by the throttle position sensor which is mounted on the throttle body. It provides feedback to the ECM to control the throttle actuator in order to control the throttle valve opening angle properly in response to the driving condition.
If this malfunction is detected, the ECM shuts down the power for the throttle actuator, and the throttle valve is locked at a certain angle by the return spring. Also, the whole electronically controlled throttle operation is cancelled until the system returns to normal and the ignition switch is turned to OFF.
HINT:
This ETCS (Electronic Throttle Control System) does not use a throttle cable.

DTC No.	DTC Detection Condition	Trouble Area
P2102	Conditions (a) and (b) continue for 2.0 seconds (1 trip detection logic): (a) Throttle actuator output duty ratio is 80 % or more (b) Throttle actuator current is 0.5 A or less	• Open in throttle actuator circuit • Throttle actuator • ECM
P2103	Either of following conditions is met (1 trip detection logic): • Throttle actuator current is 10 A or more for 0.1 seconds • Throttle actuator current is 7A or more for 0.6 seconds	• Short in throttle actuator circuit • Throttle actuator • Throttle valve • Throttle body assembly • ECM

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WIRING DIAGRAM



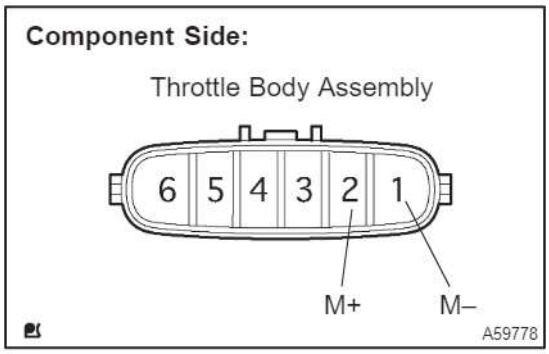
INSPECTION PROCEDURE

HINT:

Read freeze frame data using the intelligent tester II. Freeze frame data record the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, 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.

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1 INSPECT THROTTLE BODY ASSY(RESISTANCE OF THROTTLE ACTUATOR)



(a) Disconnect the T1 throttle body connector.
(b) Measure the resistance between the terminals of the throttle actuator.
Standard:

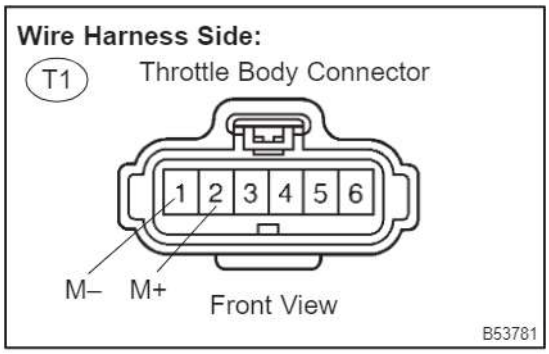
Tester Connection	Specified Condition
M+ (T1–2) – M– (T1–1)	0.3 to 100 Ω at 20°C (68°F)

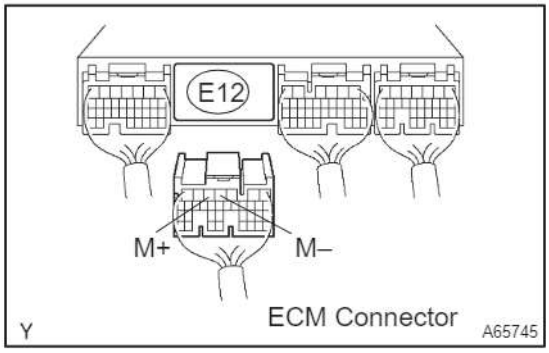
(c) Reconnect the throttle body connector.

NG → **REPLACE THROTTLE BODY ASSY (See page 10–6)**

OK

2 CHECK HARNESS AND CONNECTOR(THROTTLE ACTUATOR – ECM)





(a) Disconnect the T1 throttle body connector.
(b) Disconnect the E12 ECM connector.
(c) Check the resistance.
Standard (Check for open):

Tester Connection	Specified Condition
M+ (T1–2) – M+ (E12–5)	Below 1 Ω
M– (T1–1) – M– (E12–4)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
M+ (T1–2) or M+ (E12–5) – Body ground	10 kΩ or higher
M– (T1–1) or M– (E12–4) – Body ground	10 kΩ or higher

(d) Reconnect the throttle body connector.
(e) Reconnect the ECM connector.

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

OK

3 INSPECT THROTTLE BODY ASSY

(a) Visually check for foreign objects between the throttle valve and the housing.
Also, check if the valve can open and close smoothly.
OK: The throttle valve is not contaminated with foreign objects and can move smoothly.

NG → **REMOVE FOREIGN OBJECT AND CLEAN THROTTLE BODY**

OK

REPLACE ECM (See page 10–65 of Pub. No. RM1018E AVENSIS)

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DTC	P2111	THROTTLE ACTUATOR CONTROL SYSTEM – STUCK OPEN

DTC	P2112	THROTTLE ACTUATOR CONTROL SYSTEM – STUCK CLOSED

CIRCUIT DESCRIPTION

The throttle actuator is operated by the ECM and it opens and closes the throttle valve using gears. The opening angle of the throttle valve is detected by the throttle position sensor which is mounted on the throttle body. And, it provides feedback to the ECM to control the throttle actuator in order to control the throttle valve opening angle properly in response to the driving condition. If this malfunction is detected, the ECM shuts down the power for the throttle actuator, and the throttle valve is locked at a certain angle by the return spring. Also, the whole electronically controlled throttle operation is cancelled until the system returns to normal and the ignition switch is turned to OFF.

HINT:

This ETCS (Electronic Throttle Control System) does not use a throttle cable.

DTC No.	DTC Detection Condition	Trouble Area
P2111	Throttle actuator locked during ECM ordering it to close (1 trip detection logic)	• Throttle actuator • Throttle body assembly • Throttle valve
P2112	Throttle actuator locked during ECM ordering it to open (1 trip detection logic)	• Throttle actuator • Throttle body assembly • Throttle valve

WIRING DIAGRAM

Refer to DTC P2102 on page 05–174.

INSPECTION PROCEDURE

HINT:

Read freeze frame data using the intelligent tester II. Freeze frame data record the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, 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	CHECK OTHER DTC OUTPUT(IN ADDITION TO DTC P2111 AND/OR P2112)

(a) Connect the intelligent tester II to the DLC3.
(b) Turn the ignition switch to ON and turn the intelligent tester II ON.
(c) Select the following menu items: Powertrain / Engine and ECT / DTC.
(d) Read DTCs.

Result:

Display (DTC Output)	Proceed To
P2111 or P2112	A
P2111 or P2112 and other DTCs	B

HINT:

If any DTCs other than P2111 or P2112 are output, troubleshoot those DTCs first.

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B → GO TO RELEVANT DTC CHART (See page 05–27)

A

2 INSPECT THROTTLE BODY ASSY(VISUALLY CHECK THROTTLE VALVE)

(a) Check for contamination between the throttle valve and the housing. If necessary, clean the throttle body. And check that the throttle valve moves smoothly.
OK: The throttle valve is not contaminated with foreign objects and can move smoothly.

NG → REPLACE THROTTLE BODY ASSY (See page 10–6)

OK

3 CHECK IF DTC OUTPUT RECURS(DTC P2111 AND/OR P2112)

(a) Clear the DTC(s) (see page 05–18).
(b) Start the engine, and depress and release the accelerator pedal quickly (to fully open and fully close the throttle valve).
(c) Connect the intelligent tester II to the DLC3.
(d) Turn the ignition switch to ON and turn the intelligent tester II ON.
(e) Select the following menu items: Powertrain / Engine and ECT / DTC.
(f) Read DTCs.
Result:

Display (DTC Output)	Proceed To
No DTC	A
P2111 and/or P2112	B

B → REPLACE ECM (See page 10–65 of Pub. No. RM1018E AVENSIS)

A

CHECK FOR INTERMITTENT PROBLEMS (See page 05–9)

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DTC	P2118	THROTTLE ACTUATOR CONTROL MOTOR CURRENT RANGE/PERFORMANCE

CIRCUIT DESCRIPTION

The ETCS (Electronic Throttle Control System) has a dedicated power supply circuit. The voltage (+BM) is monitored and when the voltage is low (less than 4 V), the ECM concludes that the ETCS has a fault and a current to the throttle actuator is cut.
When the voltage becomes unstable, the ETCS becomes unstable. For this reason, when the voltage is low, the current to the actuator is cut. If repairs are made and the system has returned to normal, turn the ignition switch to OFF. The ECM then allows the current to flow to the actuator and the actuator can be restarted.
HINT:
This ETCS does not use a throttle cable.

DTC No.	DTC Detection Condition	Trouble Area
P2118	Open in ETCS power source circuit	• Open in ETCS power source circuit • ETCS fuse • ECM

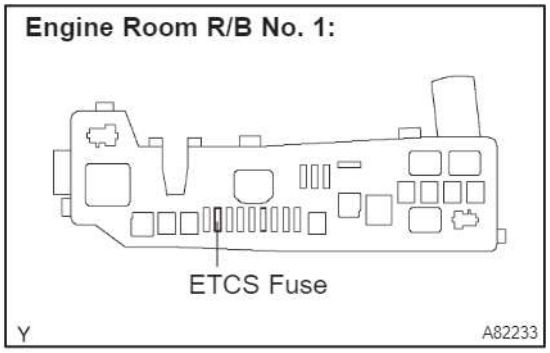
WIRING DIAGRAM

Refer to DTC P2102 on page 05–174.

INSPECTION PROCEDURE

HINT:
Read freeze frame data using the intelligent tester II. Freeze frame data record the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, 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	CHECK FUSE(ETCS FUSE)



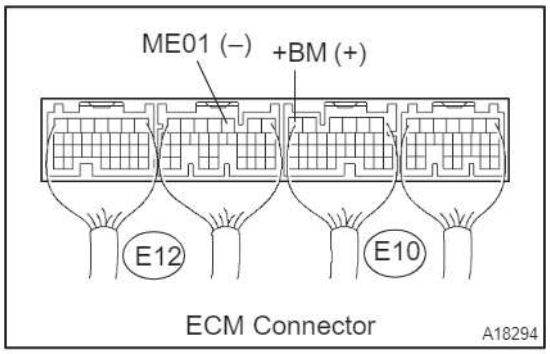
(a) Remove the ETCS fuse from the engine room R/B No. 1.
(b) Check the ETCS fuse resistance.
Standard: Below 1 Ω
(c) Reinstall the ETCS fuse.

NG → **CHECK FOR SHORT IN ALL HARNESSES AND COMPONENTS CONNECTED TO FUSE**

OK

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2	INSPECT ECM(+BM VOLTAGE)



(a) Measure the voltage between the specified terminals of the E10 and E12 ECM connectors.

Standard:

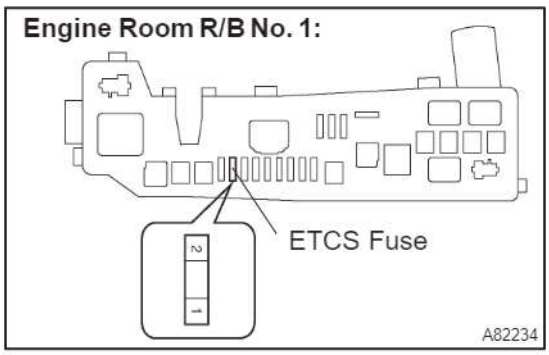
Tester Connection	Specified Condition
+BM (E10–6) – ME01 (E12–3)	9 to 14 V

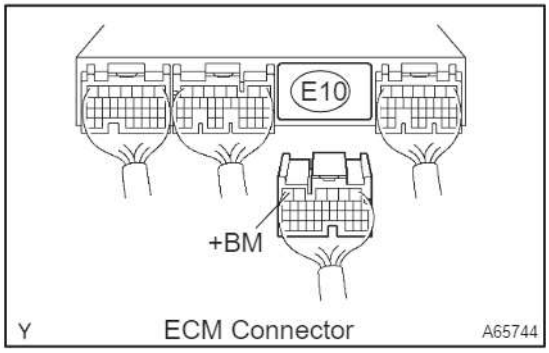
OK → **REPLACE ECM (See page 10–65 of Pub. No. RM1018E AVENSIS)**

NG

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3	CHECK HARNESS AND CONNECTOR(ECM – ETCS FUSE, ETCS FUSE – BATTERY)





(a) Check the harness and connectors between the ETCS fuse and ECM.
(1) Remove the ETCS fuse from the engine room R/B No. 1.
(2) Disconnect the E10 ECM connector.
(3) Check the resistance.

Standard (Check for open):

Tester Connection	Specified Condition
ETCS fuse (2) – +BM (E10–6)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
ETCS fuse (2) or +BM (E10–6) – Body ground	10 kΩ or higher

(4) Reinstall the ETCS fuse.
(5) Reconnect the ECM connector.

(b) Check the harness and connector between the ETCS fuse and positive battery cable.
(1) Remove the ETCS fuse from the engine room R/B No. 1.
(2) Disconnect the positive battery cable.
(3) Check the resistance.

Standard (Check for open):

Tester Connection	Specified Condition
Positive battery cable terminal – ETCS fuse (1)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
Positive battery cable terminal or ETCS fuse (1) – Body ground	10 kΩ or higher

(4) Reinstall the ETCS fuse.
(5) Reconnect the positive battery cable.

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

OK

CHECK AND REPLACE ENGINE ROOM RELAY BLOCK

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DTC	P2119	THROTTLE ACTUATOR CONTROL THROTTLE BODY RANGE/PERFORMANCE

CIRCUIT DESCRIPTION

The ETCS (Electronic Throttle Control System) is composed of the throttle actuator, the Throttle Position (TP) sensor, the Accelerator Pedal Position (APP) sensor, and the ECM. This system is the one valve type throttle body. In order to deliver the proper opening angle of the throttle valve in response to the driving condition, the TP sensor mounted on the throttle body detects the actual throttle valve opening angle, and provides feedback for the ECM in order that the ECM controls the actuator.

If the ETCS has a malfunction, the ECM shuts down the power for the actuator, and the throttle valve is locked at a certain angle by the return spring. Also, the whole electronically controlled throttle operation is cancelled until the system returns to normal and the ignition switch is turned to OFF.

DTC No.	DTC Detection Condition	Trouble Area
P2119	Throttle valve opening angle continues to vary greatly from target opening angle	• Electronic throttle control system • ECM

WIRING DIAGRAM

Refer to DTC P2102 on page 05–174.

INSPECTION PROCEDURE

HINT:

Read freeze frame data using the intelligent tester II. Freeze frame data record the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, 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	CHECK OTHER DTC OUTPUT(IN ADDITION TO DTC P2119)

(a) Connect the intelligent tester II to the DLC3.
(b) Turn the ignition switch to ON and turn the intelligent tester II ON.
(c) Select the following menu items: Powertrain / Engine and ECT / DTC.
(d) Read DTCs.

Result:

Display (DTC Output)	Proceed To
P2119	A
P2119 and other DTCs	B

HINT:

If any DTCs other than P2119 are output, troubleshoot those DTCs first.

B → GO TO RELEVANT DTC CHART (See page 05–27)

A

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2	CHECK IF DTC OUTPUT RECURS(DTC P2119)

(a) Clear the DTC(s) (see page 05–18).
(b) Allow the engine to idle for 15 seconds.
(c) Securely apply the parking brake, and place the shift position in D.
(d) Depress the brake pedal securely and the accelerator pedal fully for 5 seconds.
(e) Connect the intelligent tester II to the DLC3.
(f) Turn the ignition switch to ON and turn the intelligent tester II ON.
(g) Select the following menu items: Powertrain / Engine and ECT / DTC.
(h) Read DTCs.

HINT:
Actual throttle valve angle can be confirmed in Throttle POS under the Data List menus on the intelligent tester II.

OK: No DTC output.

NG → **REPLACE THROTTLE BODY ASSY (See page 10–6)**

OK →

NORMAL

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DTC	P2120	THROTTLE/PEDAL POSITION SENSOR/SWITCH ”D” CIRCUIT

DTC	P2122	THROTTLE/PEDAL POSITION SENSOR/SWITCH ”D” CIRCUIT LOW INPUT

DTC	P2123	THROTTLE/PEDAL POSITION SENSOR/SWITCH ”D” CIRCUIT HIGH INPUT

DTC	P2125	THROTTLE/PEDAL POSITION SENSOR/SWITCH ”E” CIRCUIT

DTC	P2127	THROTTLE/PEDAL POSITION SENSOR/SWITCH ”E” CIRCUIT LOW INPUT

DTC	P2128	THROTTLE/PEDAL POSITION SENSOR/SWITCH ”E” CIRCUIT HIGH INPUT

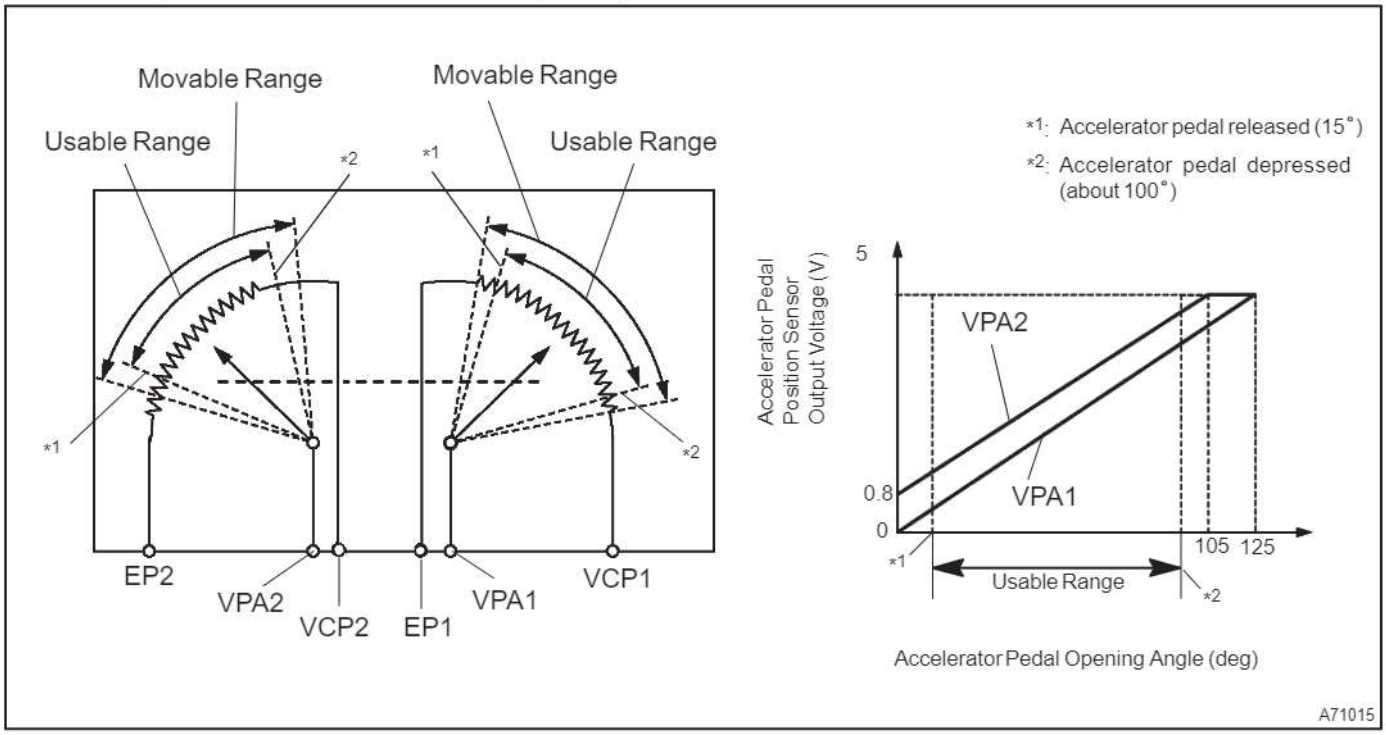
DTC	P2138	THROTTLE/PEDAL POSITION SENSOR/SWITCH ”D”/”E” VOLTAGE CORRELATION

HINT:
These DTCs are related to the accelerator pedal position sensor.

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CIRCUIT DESCRIPTION

The accelerator pedal position sensor is mounted on the accelerator pedal bracket and it has the 2 sensors to detect the accelerator position and malfunctions of the accelerator position sensor itself.
In the accelerator pedal position sensor, the voltage applied to pedal terminals VPA1 and VPA2 of the ECM changes between 0 V and 5 V in proportion to the opening angle of the accelerator pedal. The VPA1 is a signal to indicate the actual accelerator pedal opening angle which is used for engine control, and the VPA2 is a signal to indicate the information about the opening angle which is used for detecting a malfunction in the sensor itself.
The ECM judges the current accelerator pedal opening angle with the signals from pedal terminals VPA1 and VPA2, and the ECM controls the throttle motor based on these signals.
HINT:
This ETCS (Electronic Throttle Control System) does not use a throttle cable.



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DTC No.	DTC Detection Condition	Trouble Area
P2120	VPA1 quickly fluctuates up and down beyond upper and lower malfunction thresholds for 0.5 seconds or more	• Accelerator pedal position sensor • ECM
P2122	Condition (a) continues for 0.5 seconds or more when accelerator pedal is fully released: (a) VPA1 is 0.2 V or less	• Accelerator pedal position sensor • Open in VCP1 circuit • Open or ground short in VPA1 circuit • ECM
P2123	Condition (a) continues for 2.0 seconds or more: (a) VPA1 is 4.8 V or more	• Accelerator pedal position sensor • Open in EPA circuit • ECM
P2125	VPA2 quickly fluctuates up and down beyond upper and lower malfunction thresholds for 0.5 seconds or more	• Accelerator pedal position sensor • ECM
P2127	Condition (a) continues for 0.5 seconds or more when accelerator pedal is fully released: (a) VPA2 is 0.5 V or less	• Accelerator pedal position sensor • Open in VCP2 circuit • Open or ground short in VPA2 circuit • ECM
P2128	Conditions (a) and (b) continue for 2.0 seconds or more: (a) VPA2 is 4.8 V or more (b) VPA1 is 0.2 V or more and VPA1 is 3.45 V or less	• Accelerator pedal position sensor • Open in EPA2 circuit • ECM
P2138	Condition (a) or (b) continues for 2.0 seconds or more: (a) Difference between VPA1 and VPA2 is 0.02 V or less (b) VPA1 is 0.2 V or less and VPA2 is 0.5 V or less	• VPA1 and VPA2 circuits are short–circuited • Accelerator pedal position sensor • ECM

HINT:

When DTC P2120, P2122, P2123, P2125, P2127, P2128 and/or P2138 is detected, check the output voltage of the accelerator pedal position sensor by selecting Powertrain / Engine and ECT / Data List / Accelerator POS No. 1 and Accelerator POS No. 2 on the intelligent tester II.

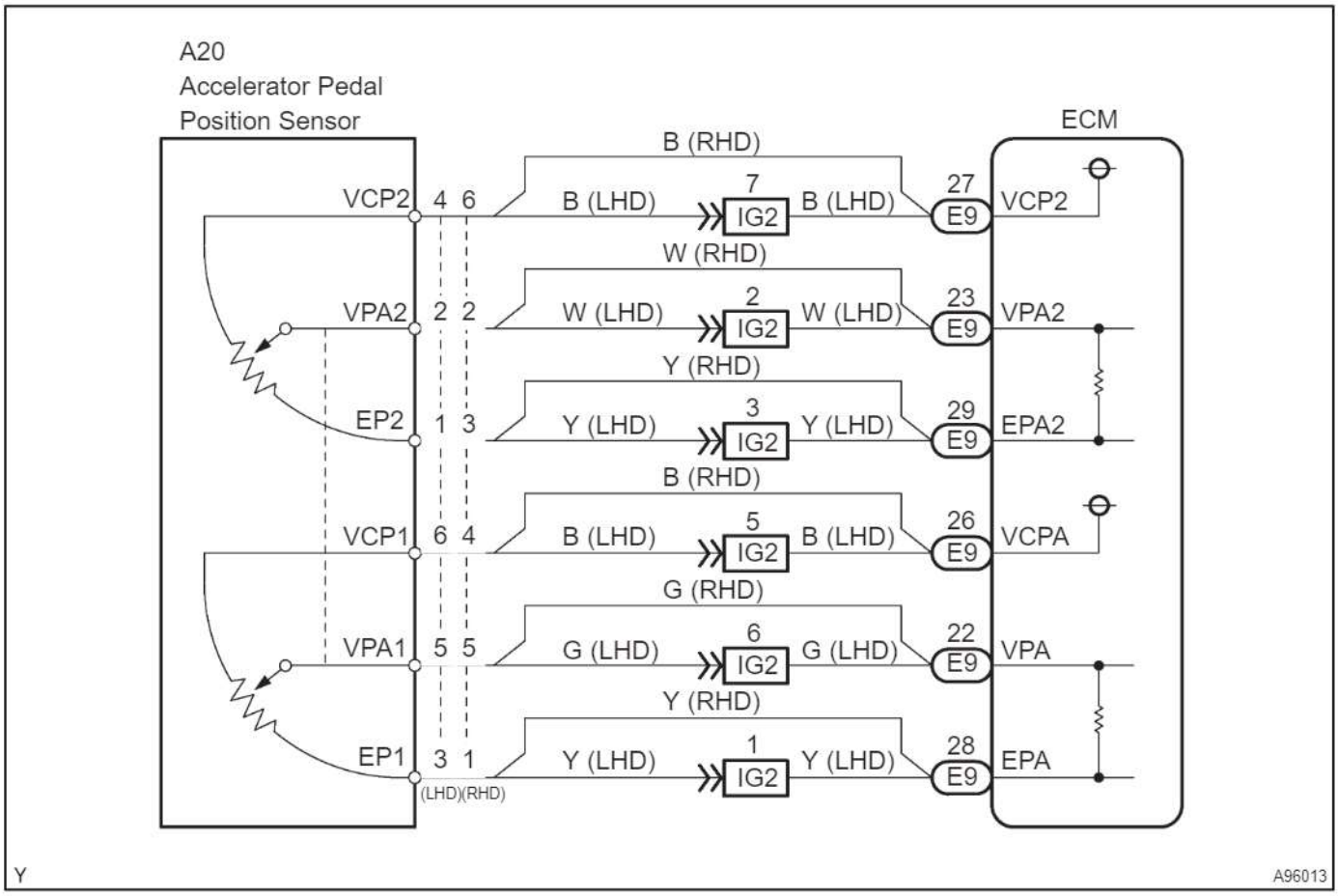
Reference:

Trouble Area	Accelerator Pedal Position (Voltage Output)			
	Accelerator Pedal Released		Accelerator Pedal Depressed	
	Accelerator POS No. 1	Accelerator POS No. 2	Accelerator POS No. 1	Accelerator POS No. 2
Normal condition	0.5 to 1.1 V	1.2 to 2.0 V	2.6 to 4.5 V	3.4 to 5.0 V
VCP circuit open	0 to 0.2 V	0 to 0.2 V	0 to 0.2 V	0 to 0.2 V
Open or ground short in VPA1 circuit	0 to 0.2 V	1.2 to 2.0 V	0 to 0.2 V	3.4 to 5.0 V
Open or ground short in VPA2 circuit	0.5 to 1.1 V	0 to 0.2 V	2.6 to 4.5 V	0 to 0.2 V
EPA circuit open	4.5 to 5.0 V	4.5 to 5.0 V	4.5 to 5.0 V	4.5 to 5.0 V

Accelerator pedal position is expressed as voltages.

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WIRING DIAGRAM

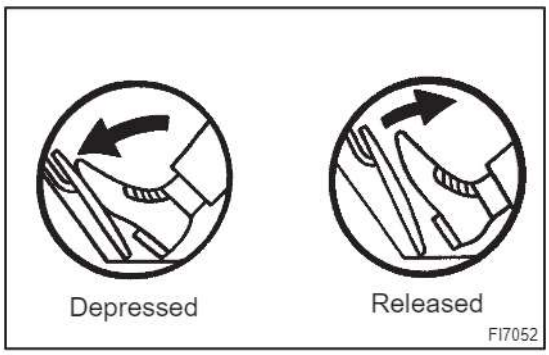


INSPECTION PROCEDURE

HINT:

Read freeze frame data using the intelligent tester II. Freeze frame data record the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, 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	**READ VALUE OF INTELLIGENT TESTER II(ACCELERATOR POS NO.1 AND ACCELERATOR POS NO.2)**



(a) Connect the intelligent tester II to the DLC3.
(b) Turn the ignition switch to ON and turn the intelligent tester II ON.
(c) Select the following menu items: Powertrain / Engine and ECT / Data List / Accelerator POS No. 1 and Accelerator POS No. 2.
(d) Read the value.

Standard:

Accelerator Pedal	Accelerator POS No. 1	Accelerator POS No. 2
Released	0.5 to 1.1 V	1.2 to 2.0 V
Depressed	2.6 to 4.5 V	3.4 to 5.0 V

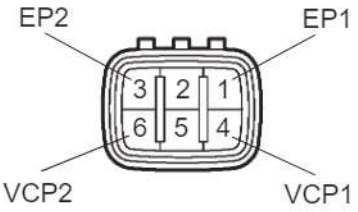
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OK	Go to step 6

NG

2 INSPECT ACCELERATOR PEDAL ASSY(ACCELERATOR PEDAL POSITION SENSOR)

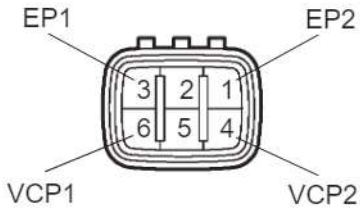
Component Side (RHD):



Accelerator Pedal Position Sensor

A84814

Component Side (LHD):



Accelerator Pedal Position Sensor

A84814

(a) Disconnect the A20 accelerator pedal position sensor connector.

(b) Measure the resistance between each pair of terminals.

Standard (RHD):

Tester Connection	Specified Condition
EP1 (1) – VCP1 (4)	2.25 to 4.75 kΩ at 20°C (68°F)
EP2 (3) – VCP2 (6)	2.25 to 4.75 kΩ at 20°C (68°F)

Standard (LHD):

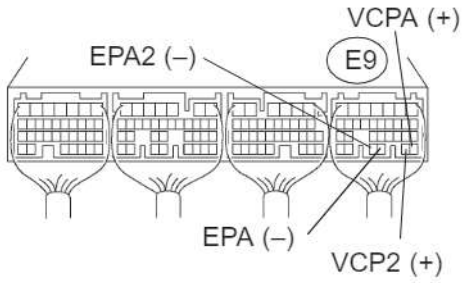
Tester Connection	Specified Condition
EP1 (3) – VCP1 (6)	2.25 to 4.75 kΩ at 20°C (68°F)
EP2 (1) – VCP2 (4)	2.25 to 4.75 kΩ at 20°C (68°F)

(c) Reconnect the accelerator pedal position sensor connector.

NG	REPLACE ACCELERATOR PEDAL ASSY (See page 10–12)

OK

3 INSPECT ECM(VCPA AND VCP2 VOLTAGE)



Y ECM Connector

A66060

(a) Turn the ignition switch to ON.

(b) Measure the voltage between the specified terminals of the E9 ECM connector.

Standard:

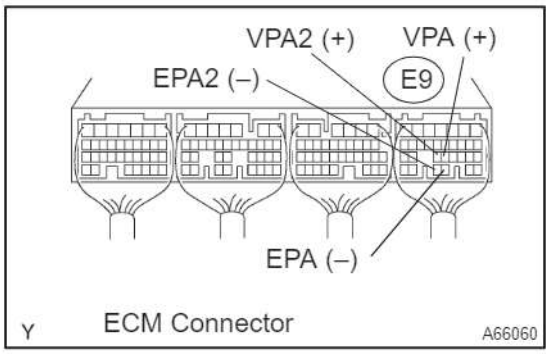
Tester Connection	Specified Condition
VCPA (E9–26) – EPA (E9–28)	4.5 to 5.0 V
VCP2 (E9–27) – EPA2 (E9–29)	4.5 to 5.0 V

NG	REPLACE ECM (See page 10–65 of Pub. No. RM1018E AVENSIS)

OK

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4 INSPECT ECM(VPA AND VPA2 VOLTAGE)



(a) Turn the ignition switch to ON.
(b) Measure the voltage between the specified terminals of the E9 ECM connector.

Standard:

Accelerator Pedal Position	Tester Connection	Specified Condition
Released	VPA (E9–22) – EPA (E9–28)	0.5 to 1.1 V
Depressed	VPA (E9–22) – EPA (E9–28)	2.6 to 4.5 V
Released	VPA2 (E9–23) – EPA2 (E9–29)	1.2 to 2.0 V
Depressed	VPA2 (E9–23) – EPA2 (E9–29)	3.4 to 5.0 V

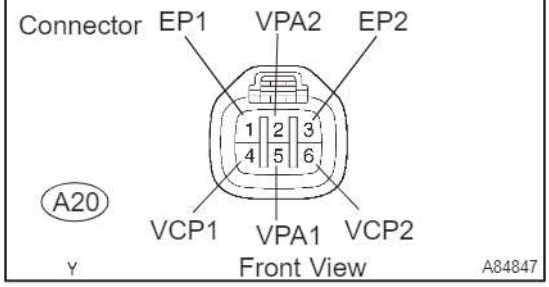
OK → **REPLACE ECM (See page 10–65 of Pub. No. RM1018E AVENSIS)**

NG

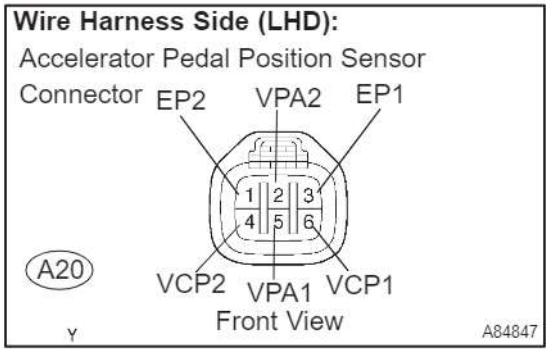
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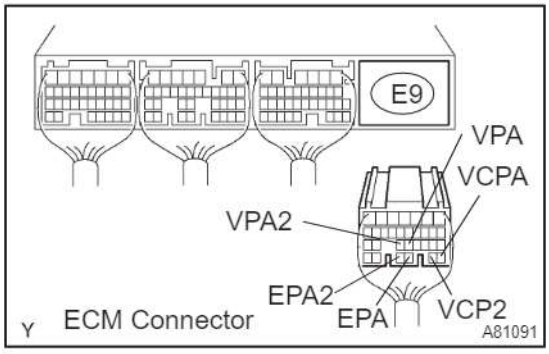
5	CHECK HARNESS AND CONNECTOR(ACCELERATOR PEDAL POSITION SENSOR – ECM)

Wire Harness Side (RHD):



Wire Harness Side (LHD):





(a) Disconnect the A20 accelerator pedal position sensor connector.

(b) Disconnect the E9 ECM connector.

(c) Check the resistance.

Standard (RHD) (Check for open):

Tester Connection	Specified Condition
VPA1 (A20–5) – VPA (E9–22)	Below 1 Ω
EP1 (A20–1) – EPA (E9–28)	Below 1 Ω
VCP1 (A20–4) – VCPA (E9–26)	Below 1 Ω
VPA2 (A20–2) – VPA2 (E9–23)	Below 1 Ω
EP2 (A20–3) – EPA2 (E9–29)	Below 1 Ω
VCP2 (A20–6) – VCP2 (E9–27)	Below 1 Ω

Standard (LHD) (Check for open):

Tester Connection	Specified Condition
VPA1 (A20–5) – VPA (E9–22)	Below 1 Ω
EP1 (A20–3) – EPA (E9–28)	Below 1 Ω
VCP1 (A20–6) – VCPA (E9–26)	Below 1 Ω
VPA2 (A20–2) – VPA2 (E9–23)	Below 1 Ω
EP2 (A20–1) – EPA2 (E9–29)	Below 1 Ω
VCP2 (A20–4) – VCP2 (E9–27)	Below 1 Ω

Standard (RHD) (Check for short):

Tester Connection	Specified Condition
VPA1 (A20–5) or VPA (E9–22) – Body ground	10 kΩ or higher
EP1 (A20–1) or EPA (E9–28) – Body ground	10 kΩ or higher
VCP1 (A20–4) or VCPA (E9–26) – Body ground	10 kΩ or higher
VPA2 (A20–2) or VPA2 (E9–23) – Body ground	10 kΩ or higher
EP2 (A20–3) or EPA2 (E9–29) – Body ground	10 kΩ or higher
VCP2 (A20–6) or VCP2 (E9–27) – Body ground	10 kΩ or higher

Standard (LHD) (Check for short):

Tester Connection	Specified Condition
VPA1 (A20–5) or VPA (E9–22) – Body ground	10 kΩ or higher
EP1 (A20–3) or EPA (E9–28) – Body ground	10 kΩ or higher
VCP1 (A20–6) or VCPA (E9–26) – Body ground	10 kΩ or higher
VPA2 (A20–2) or VPA2 (E9–23) – Body ground	10 kΩ or higher
EP2 (A20–1) or EPA2 (E9–29) – Body ground	10 kΩ or higher
VCP2 (A20–4) or VCP2 (E9–27) – Body ground	10 kΩ or higher

(d) Reconnect the accelerator pedal position sensor connector.

(e) Reconnect the ECM connector.

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

OK

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6	CHECK IF DTC OUTPUT RECURS(ACCELERATOR PEDAL POSITION SENSOR DTCS)

(a) Connect the intelligent tester II to the DLC3.
(b) Turn the ignition switch to ON and turn the intelligent tester II ON.
(c) Clear the DTC(s) (see page 05–18).
(d) Start the engine.
(e) Run the engine at idling speed for 15 seconds or more.
(f) Select the following menu items: Powertrain / Engine and ECT / DTC.
(g) Read DTCs (see page 05–18).

Result:

Display (DTC Output)	Proceed To
P2120, P2122, P2123, P2125, P2127, P2128 and/or P2138	A
No output	B

B → **NORMAL**

A

REPLACE ECM (See page 10–65 of Pub. No. RM1018E AVENSIS)

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DTC	P2121	THROTTLE/PEDAL POSITION SENSOR/SWITCH "D" CIRCUIT RANGE/PERFORMANCE

HINT:
This DTC is related to the accelerator pedal position sensor.

CIRCUIT DESCRIPTION

Refer to DTC P2120 on page 05–184.

DTC No.	DTC Detection Condition	Trouble Area
P2121	Conditions (a) and (b) continue for 0.5 seconds: (a) Difference between VPA1 and VPA2 exceeds the threshold (b) IDL is OFF	• Accelerator pedal position sensor circuit • Accelerator pedal position sensor • ECM

HINT:
When DTC P2121 is detected, check the output voltage of the accelerator pedal position sensor by selecting Powertrain / Engine and ECT / Data List / Accelerator POS No. 1 and Accelerator POS No. 2 on the intelligent tester II.

Reference:

Trouble Area	Accelerator Pedal Position (Voltage Output)			
	Accelerator Pedal Released		Accelerator Pedal Depressed	
	Accelerator POS No. 1	Accelerator POS No. 2	Accelerator POS No. 1	Accelerator POS No. 2
Normal condition	0.5 to 1.1 V	1.2 to 2.0 V	2.6 to 4.5 V	3.4 to 5.0 V
VCP circuit open	0 to 0.2 V	0 to 0.2 V	0 to 0.2 V	0 to 0.2 V
VPA circuit open or ground short	0 to 0.2 V	1.2 to 2.0 V	0 to 0.2 V	3.4 to 5.0 V
VPA2 circuit open or ground short	0.5 to 1.1 V	0 to 0.2 V	2.6 to 4.5 V	0 to 0.2 V
EPA circuit open	4.5 to 5.0 V	4.5 to 5.0 V	4.5 to 5.0 V	4.5 to 5.0 V

WIRING DIAGRAM

Refer to DTC P2120 on page 05–184.

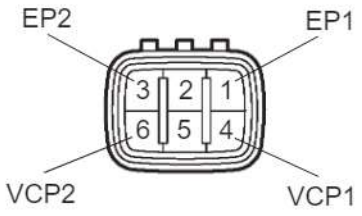
INSPECTION PROCEDURE

HINT:
Read freeze frame data using the intelligent tester II. Freeze frame data record the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, 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.

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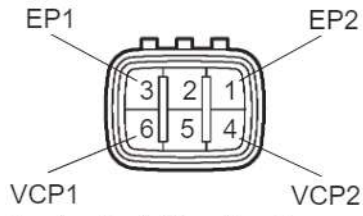
1 INSPECT ACCELERATOR PEDAL ASSY(ACCELERATOR PEDAL POSITION SENSOR)

Component Side (RHD):



Accelerator Pedal Position Sensor A84814

Component Side (LHD):



Accelerator Pedal Position Sensor A84814

(a) Disconnect the A20 accelerator pedal position sensor connector.

(b) Measure the resistance between each pair of terminals.

Standard (RHD):

Tester Connection	Specified Condition
EP1 (1) – VCP1 (4)	2.25 to 4.75 kΩ at 20°C (68°F)
EP2 (3) – VCP2 (6)	2.25 to 4.75 kΩ at 20°C (68°F)

Standard (LHD):

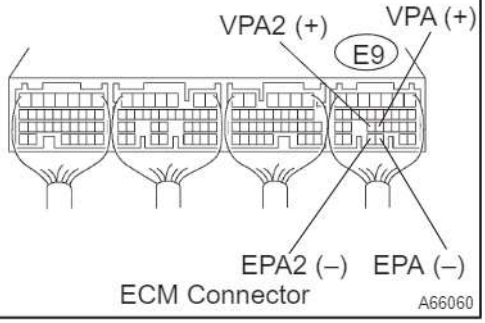
Tester Connection	Specified Condition
EP1 (3) – VCP1 (6)	2.25 to 4.75 kΩ at 20°C (68°F)
EP2 (1) – VCP2 (4)	2.25 to 4.75 kΩ at 20°C (68°F)

(c) Reconnect the accelerator pedal position sensor connector.

NG → **REPLACE ACCELERATOR PEDAL ASSY (See page 10–12)**

OK

2 INSPECT ECM(VPA AND VPA2 VOLTAGE)



ECM Connector A66060

(a) Turn the ignition switch to ON.

(b) Measure the voltage between the specified terminals of the E9 ECM connector.

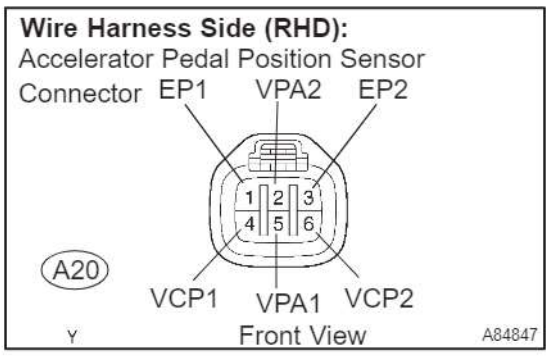
Accelerator Pedal Position	Tester Connection	Specified Condition
Released	VPA (E9–22) – EPA (E9–28)	0.5 to 1.1 V
Depressed	VPA (E9–22) – EPA (E9–28)	2.6 to 4.5 V
Released	VPA2 (E9–23) – EPA2 (E9–29)	1.2 to 2.0 V
Depressed	VPA2 (E9–23) – EPA2 (E9–29)	3.4 to 5.0 V

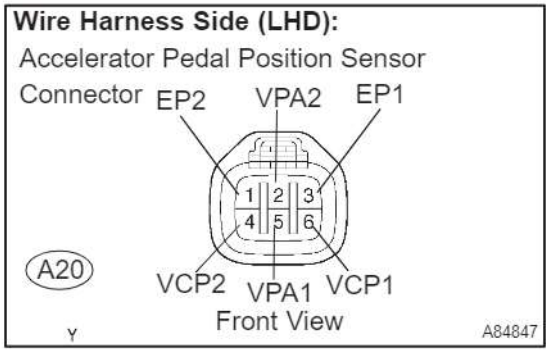
OK → **REPLACE ECM (See page 10–65 of Pub. No. RM1018E AVENSIS)**

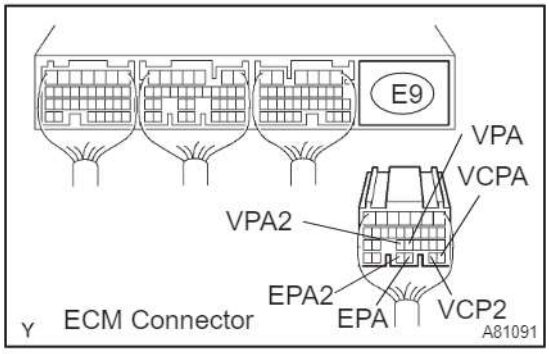
NG

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3	CHECK HARNESS AND CONNECTOR(ACCELERATOR PEDAL POSITION SENSOR – ECM)







(a) Disconnect the A20 accelerator pedal position sensor connector.

(b) Disconnect the E9 ECM connector.

(c) Check the resistance.

Standard (RHD) (Check for open):

Tester Connection	Specified Condition
VPA1 (A20–5) – VPA (E9–22)	Below 1 Ω
EP1 (A20–1) – EPA (E9–28)	Below 1 Ω
VCP1 (A20–4) – VCPA (E9–26)	Below 1 Ω
VPA2 (A20–2) – VPA2 (E9–23)	Below 1 Ω
EP2 (A20–3) – EPA2 (E9–29)	Below 1 Ω
VCP2 (A20–6) – VCP2 (E9–27)	Below 1 Ω

Standard (LHD) (Check for open):

Tester Connection	Specified Condition
VPA1 (A20–5) – VPA (E9–22)	Below 1 Ω
EP1 (A20–3) – EPA (E9–28)	Below 1 Ω
VCP1 (A20–6) – VCPA (E9–26)	Below 1 Ω
VPA2 (A20–2) – VPA2 (E9–23)	Below 1 Ω
EP2 (A20–1) – EPA2 (E9–29)	Below 1 Ω
VCP2 (A20–4) – VCP2 (E9–27)	Below 1 Ω

Standard (RHD) (Check for short):

Tester Connection	Specified Condition
VPA1 (A20–5) or VPA (E9–22) – Body ground	10 kΩ or higher
EP1 (A20–1) or EPA (E9–28) – Body ground	10 kΩ or higher
VCP1 (A20–4) or VCPA (E9–26) – Body ground	10 kΩ or higher
VPA2 (A20–2) or VPA2 (E9–23) – Body ground	10 kΩ or higher
EP2 (A20–3) or EPA2 (E9–29) – Body ground	10 kΩ or higher
VCP2 (A20–6) or VCP2 (E9–27) – Body ground	10 kΩ or higher

Standard (LHD) (Check for short):

Tester Connection	Specified Condition
VPA1 (A20–5) or VPA (E9–22) – Body ground	10 kΩ or higher
EP1 (A20–3) or EPA (E9–28) – Body ground	10 kΩ or higher
VCP1 (A20–6) or VCPA (E9–26) – Body ground	10 kΩ or higher
VPA2 (A20–2) or VPA2 (E9–23) – Body ground	10 kΩ or higher
EP2 (A20–1) or EPA2 (E9–29) – Body ground	10 kΩ or higher
VCP2 (A20–4) or VCP2 (E9–27) – Body ground	10 kΩ or higher

(d) Reconnect the accelerator pedal position sensor connector.

(e) Reconnect the ECM connector.

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

OK

REPLACE ACCELERATOR PEDAL ASSY (See page 10–12)

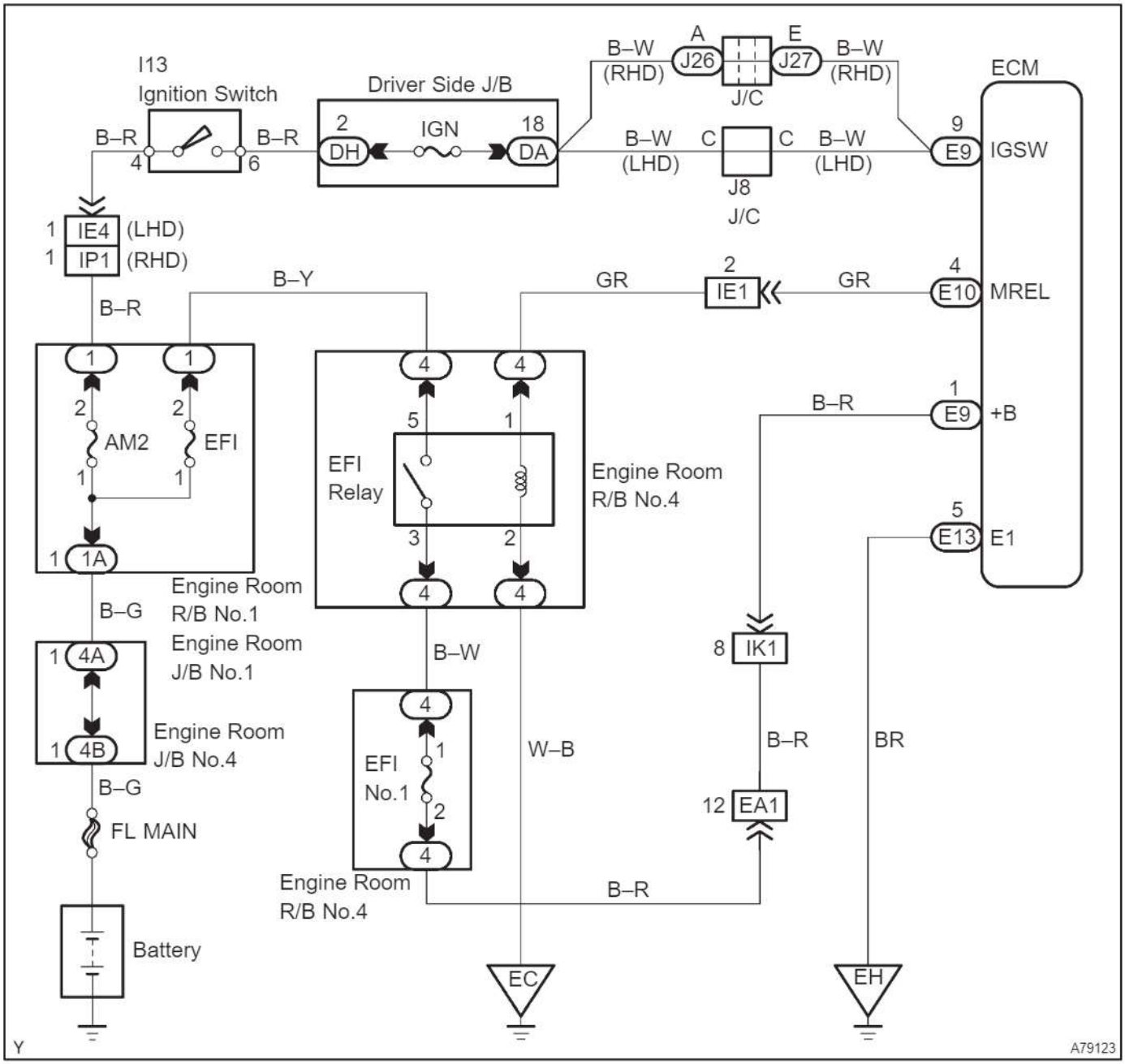
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ECM POWER SOURCE CIRCUIT

CIRCUIT DESCRIPTION

When the ignition switch is turned to ON, the battery voltage is applied to terminal IGSW of the ECM. The ECM "MREL" output signal causes a current to flow to the coil, closing the contacts of the EFI relay and supplying power to terminal +B of the ECM.

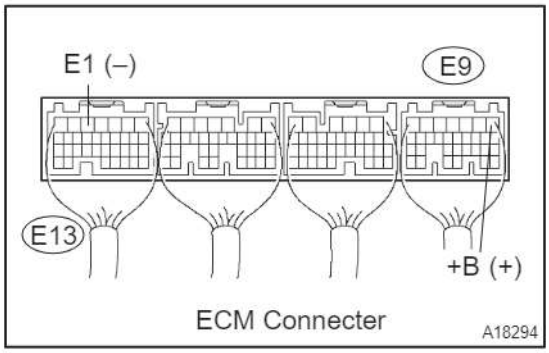
WIRING DIAGRAM



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INSPECTION PROCEDURE

1 INSPECT ECM(+B VOLTAGE)



(a) Turn the ignition switch to ON.
(b) Measure the voltage between the terminals of the E9 and E13 ECM connectors.

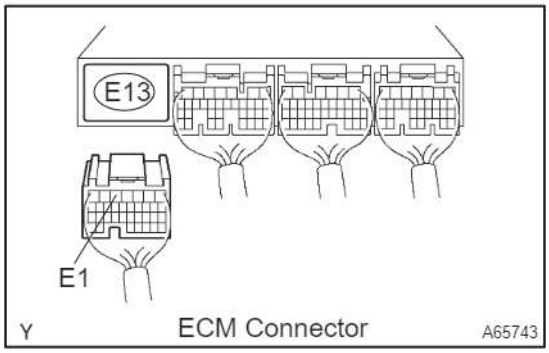
Standard:

Tester Connection	Specified Condition
+B (E9–1) – E1 (E13–5)	9 to 14 V

OK → **PROCEED TO NEXT CIRCUIT INSPECTION SHOWN ON PROBLEM SYMPTOMS TABLE (See page 05–12)**

NG

2 CHECK HARNESS AND CONNECTOR(ECM – BODY GROUND)



(a) Disconnect the negative (–) battery cable.
(b) Disconnect the E13 ECM connector.
(c) Check the resistance.

Standard (Check for open):

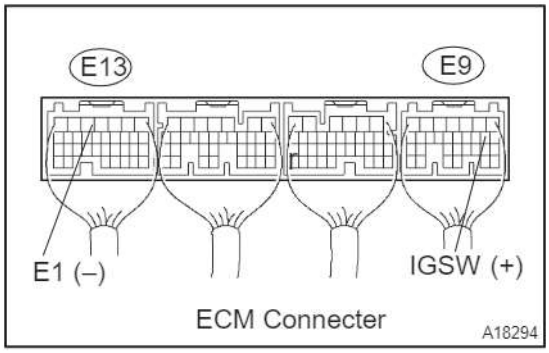
Tester Connection	Specified Condition
E1 (E13–5) – Body ground	Below 1 Ω

(d) Reconnect the ECM connector.
(e) Reconnect the negative battery cable.

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

OK

3 INSPECT ECM(IGSW VOLTAGE)



(a) Turn the ignition switch to ON.
(b) Measure the voltage between the terminals of the E9 and E13 ECM connectors.

Standard:

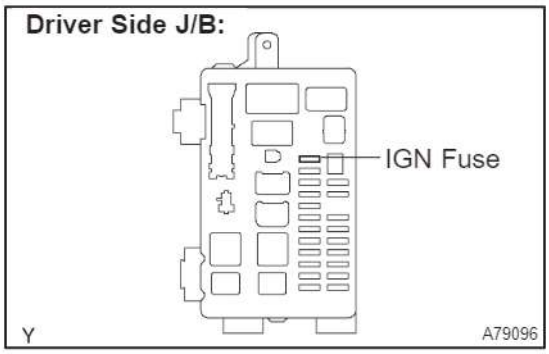
Tester Connection	Specified Condition
IGSW (E9–9) – E1 (E13–5)	9 to 14 V

OK → **Go to step 5**

NG

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4 CHECK FUSE(IGN FUSE)



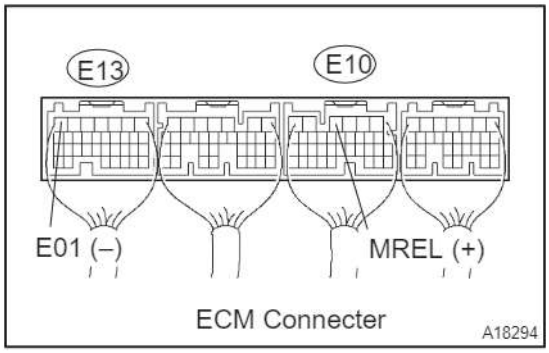
(a) Remove the IGN fuse from the driver side J/B.
(b) Check the IGN fuse resistance.
Standard: Below 1 Ω
(c) Reinstall the IGN fuse.

NG → **CHECK FOR SHORT IN ALL HARNESSES AND COMPONENTS CONNECTED TO FUSE**

OK

CHECK AND REPAIR HARNESS AND CONNECTOR (BATTERY – ECM)

5 INSPECT ECM(MREL VOLTAGE)



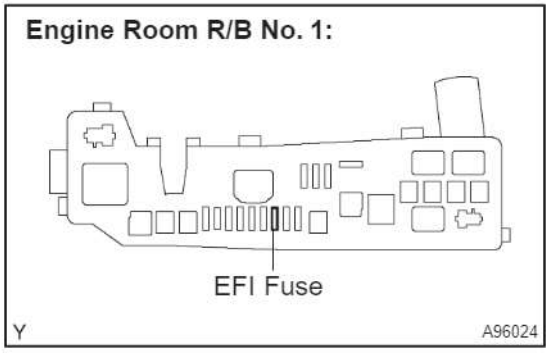
(a) Turn the ignition switch to ON.
(b) Measure the voltage between the terminals of the E10 and E13 ECM connectors.
Standard:

Tester Connection	Specified Condition
MREL (E10–4) – E01 (E13–7)	9 to 14 V

NG → **REPLACE ECM (See page 10–65 of Pub. No. RM1018E AVENSIS)**

OK

6 CHECK FUSE(EFI FUSE)



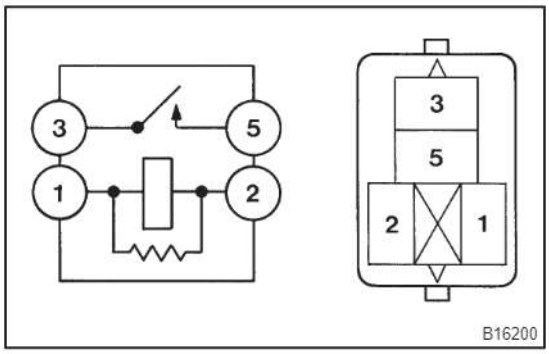
(a) Remove the EFI fuse from the engine room R/B No. 1.
(b) Check the EFI fuse resistance.
Standard: Below 1 Ω
(c) Reinstall the EFI fuse.

NG → **CHECK FOR SHORT IN ALL HARNESSES AND COMPONENTS CONNECTED TO FUSE**

OK

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7 INSPECT EFI RELAY



(a) Remove the EFI relay from the engine room R/B No. 4.
(b) Check the EFI relay resistance.

Standard:

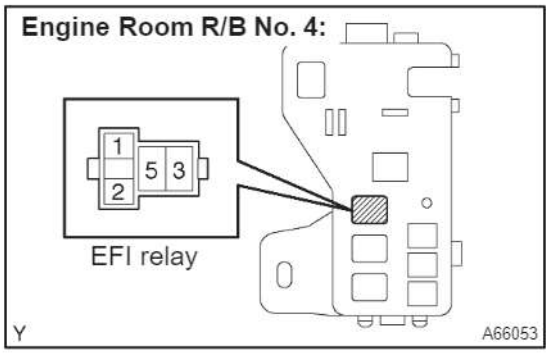
Tester Connection	Specified Condition
3 – 5	10 kΩ or higher
3 – 5	Below 1 Ω (Apply battery voltage to terminals 1 and 2)

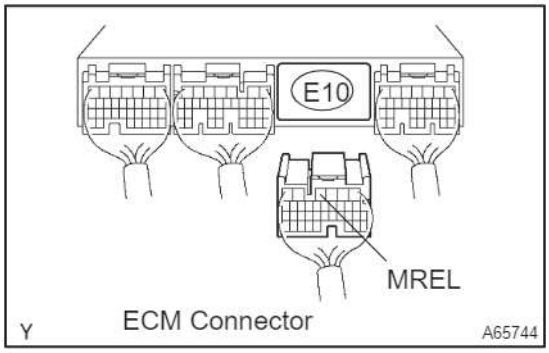
(c) Reinstall the EFI relay.

NG → REPLACE EFI RELAY

OK

8 CHECK HARNESS AND CONNECTOR(EFI RELAY – ECM, EFI RELAY – BODY GROUND)





(a) Check the harness and connectors between the EFI relay and the ECM connector.
(1) Remove the EFI relay from the engine room R/B No. 4.
(2) Disconnect the E10 ECM connector.
(3) Check the resistance.

Standard (Check for open):

Tester Connection	Specified Condition
EFI relay (1) – MREL (E10–4)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
EFI relay (1) or MREL (E10–4) – Body ground	10 kΩ or higher

(4) Reinstall the EFI relay.
(5) Reconnect the ECM connector.

(b) Check the harness and connector between the EFI relay and the body ground.
(1) Remove the EFI relay from the engine room R/B No. 4.
(2) Check the resistance.

Standard (Check for open):

Tester Connection	Specified Condition
EFI relay (2) – Body ground	Below 1 Ω

(3) Reinstall the EFI relay.

OK → REPAIR OR REPLACE HARNESS OR CONNECTOR

NG

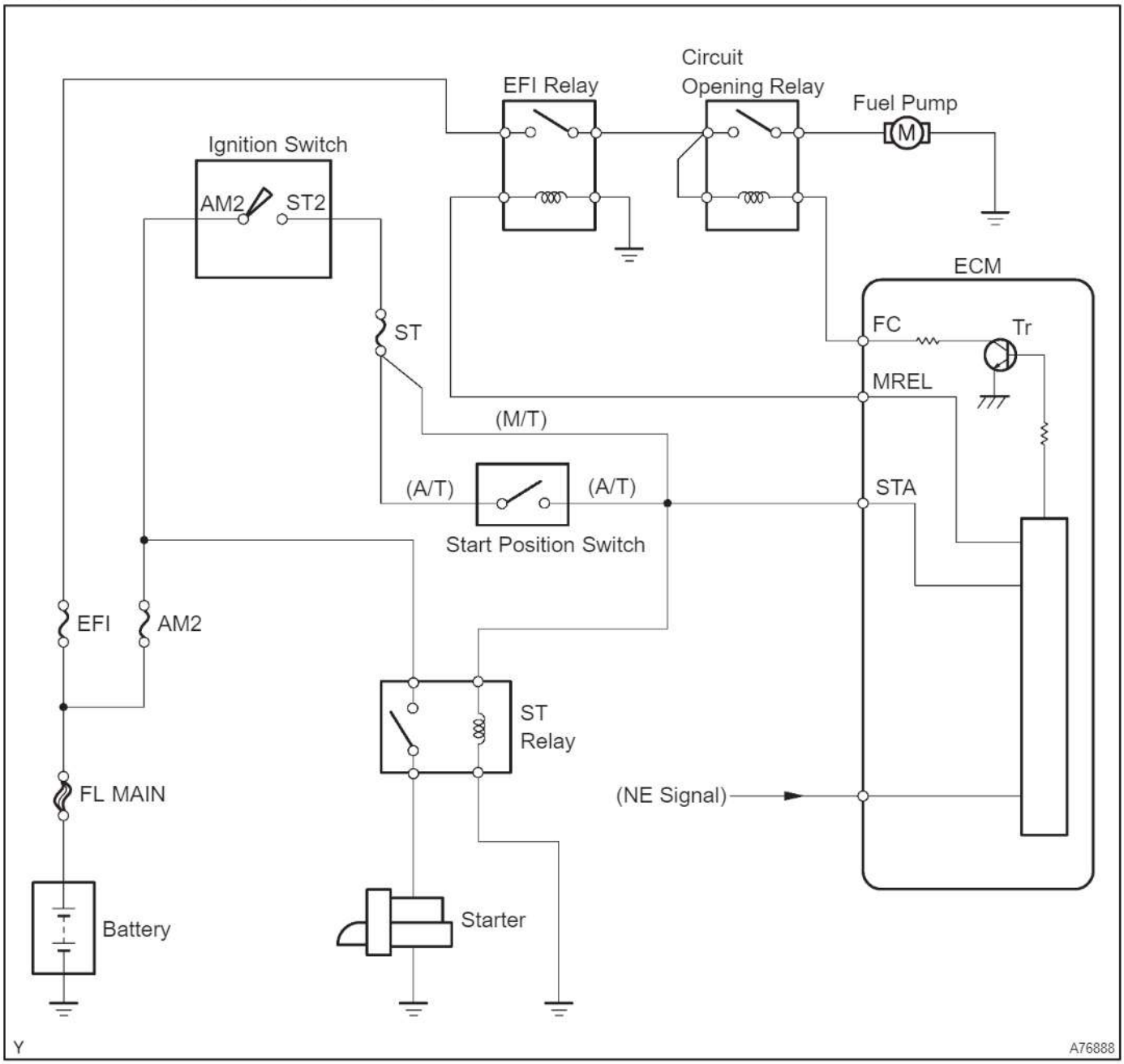
CHECK AND REPAIR HARNESS AND CONNECTOR (TERMINAL +B OF ECM – BATTERY POSITIVE TERMINAL)

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FUEL PUMP CONTROL CIRCUIT

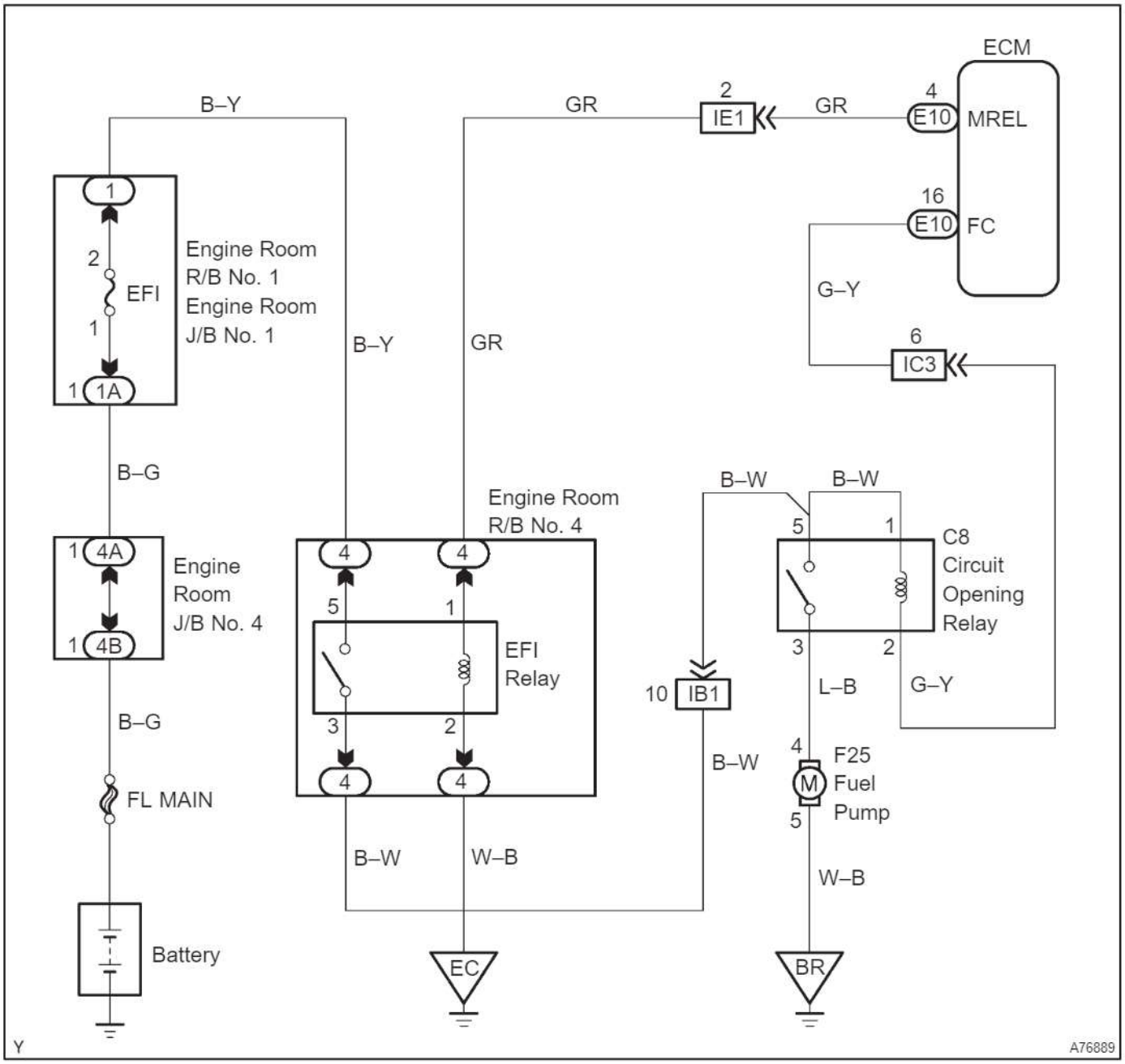
CIRCUIT DESCRIPTION

In the diagram below, when the engine is cranked, a current flows from terminal ST2 of the ignition switch to the starter relay coil and also a current flows to terminal STA of the ECM (STA signal).
When the STA signal and NE signal are transmitted to the ECM, the power transistor (Tr) is turned ON, a current flows to the coil of the circuit opening relay, the relay switches on, the power is supplied to the fuel pump and the fuel pump operates.
While the NE signal is generated (when engine running), the ECM keeps Tr ON (circuit opening relay ON) and the fuel pump also keeps operating.



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WIRING DIAGRAM



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INSPECTION PROCEDURE

1	PERFORM ACTIVE TEST USING INTELLIGENT TESTER II(OPERATE CIRCUIT OPENING RELAY)

(a) Connect the intelligent tester II to the DLC3.
(b) Turn the ignition switch to ON and turn the intelligent tester II ON.
(c) Select the following menu items: Powertrain / Engine and ECT / Active Test / Fuel Pump Relay.
(d) Check the operation of the relay while operating it using the intelligent tester II.
Standard: Operating sounds can be heard from the relay.

OK → PROCEED TO NEXT CIRCUIT INSPECTION SHOWN ON PROBLEM SYMPTOMS TABLE (See page 05–12)

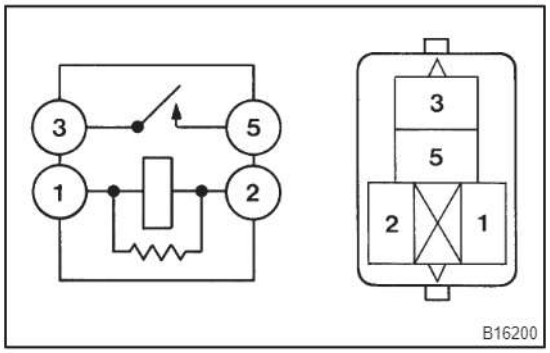
NG

2	CHECK ECM POWER SOURCE CIRCUIT (See page 05–195)

NG → REPAIR OR REPLACE POWER SOURCE CIRCUIT

OK

3	INSPECT CIRCUIT OPENING RELAY



(a) Remove the C8 circuit opening relay.
(b) Check the circuit opening relay resistance.
Standard:

Tester Connection	Specified Condition
3 – 5	10 kΩ or higher
3 – 5	Below 1 Ω (Apply battery voltage to terminals 1 and 2)

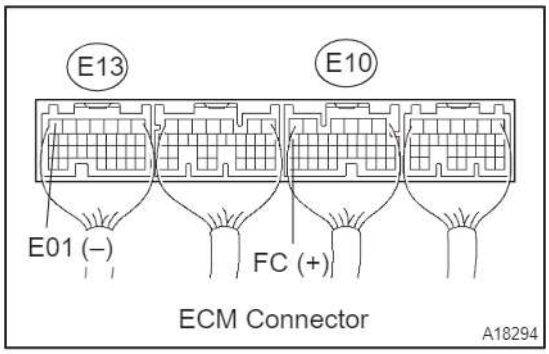
(c) Reinstall the circuit opening relay.

NG → REPLACE CIRCUIT OPENING RELAY

OK

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4 INSPECT ECM(FC VOLTAGE)



(a) Turn the ignition switch to ON.
(b) Measure the voltage between the terminals of the E10 and E13 ECM connectors.

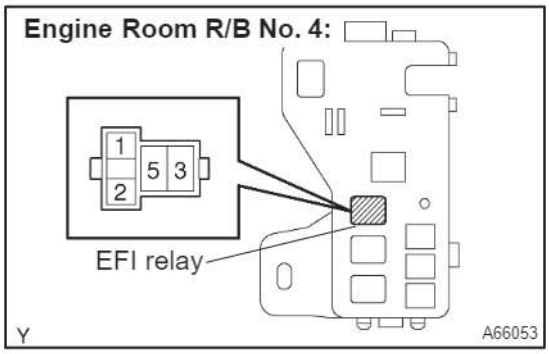
Standard:

Tester Connection	Specified Condition
FC (E10–16) – E01 (E13–7)	9 to 14 V

OK → **Go to step 6**

NG

5 CHECK HARNESS AND CONNECTOR(EFI RELAY – ECM, CIRCUIT OPENING RELAY – ECM, EFI RELAY – CIRCUIT OPENING RELAY)



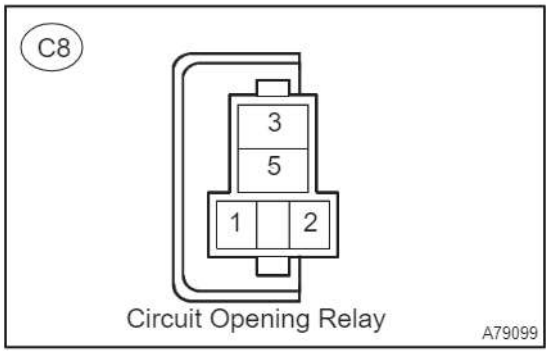
(a) Remove the EFI relay from the engine room R/B No. 4.
(b) Remove the C8 circuit opening relay.
(c) Disconnect the E10 ECM connector.
(d) Check the resistance.

Standard (Check for open):

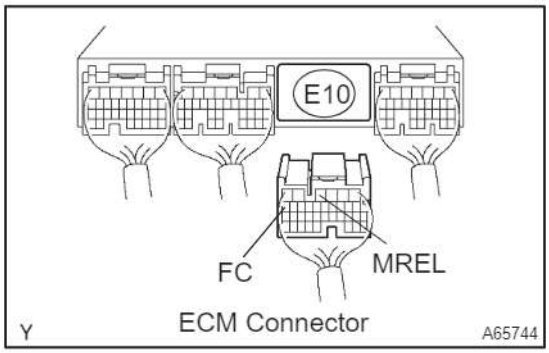
Tester Connection	Specified Condition
Engine room R/B No. 4 (EFI relay terminal 1) – MREL (E10–4)	Below 1 Ω
Circuit opening relay (C8–2) – FC (E10–16)	Below 1 Ω
Engine room R/B No. 4 (EFI relay terminal 3) – Circuit opening relay (C8–5)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
Engine room R/B No. 4 (EFI relay terminal 1) or MREL (E10–4) – Body ground	10 kΩ or higher
Circuit opening relay (C8–2) or FC (E10–16) – Body ground	10 kΩ or higher
Engine room R/B No. 4 (EFI relay terminal 3) or Circuit opening relay (C8–5) – Body ground	10 kΩ or higher



(e) Reinstall the EFI relay.
(f) Reinstall the circuit opening relay.
(g) Reconnect the ECM connector.



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

OK

REPLACE ECM (See page 10–65 of Pub. No. RM1018E AVENSIS)

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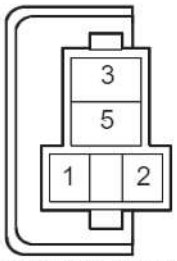
6	INSPECT FUEL PUMP (See page 11–9 of Pub. No. RM1018E AVENSIS)

NG → REPAIR OR REPLACE FUEL PUMP

OK

7	CHECK HARNESS AND CONNECTOR(CIRCUIT OPENING RELAY – FUEL PUMP, FUEL PUMP – BODY GROUND)

C8



Circuit Opening Relay

A79099

(a) Remove the C8 circuit opening relay.
(b) Disconnect the F25 fuel pump connector.
(c) Check the resistance.

Standard (Check for open):

Tester Connection	Specified Condition
Circuit opening relay (C8–3) – Fuel pump (F25–4)	Below 1 Ω
Fuel pump (F25–5) – Body ground	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
Circuit opening relay (C8–3) or Fuel pump (F25–4) – Body ground	10 kΩ or higher

(d) Reinstall the circuit opening relay.
(e) Reconnect the fuel pump connector.

Wire Harness Side:

F25 Fuel Pump Connector



Front View

A66276

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPLACE ECM (See page 10–65 of Pub. No. RM1018E AVENSIS)

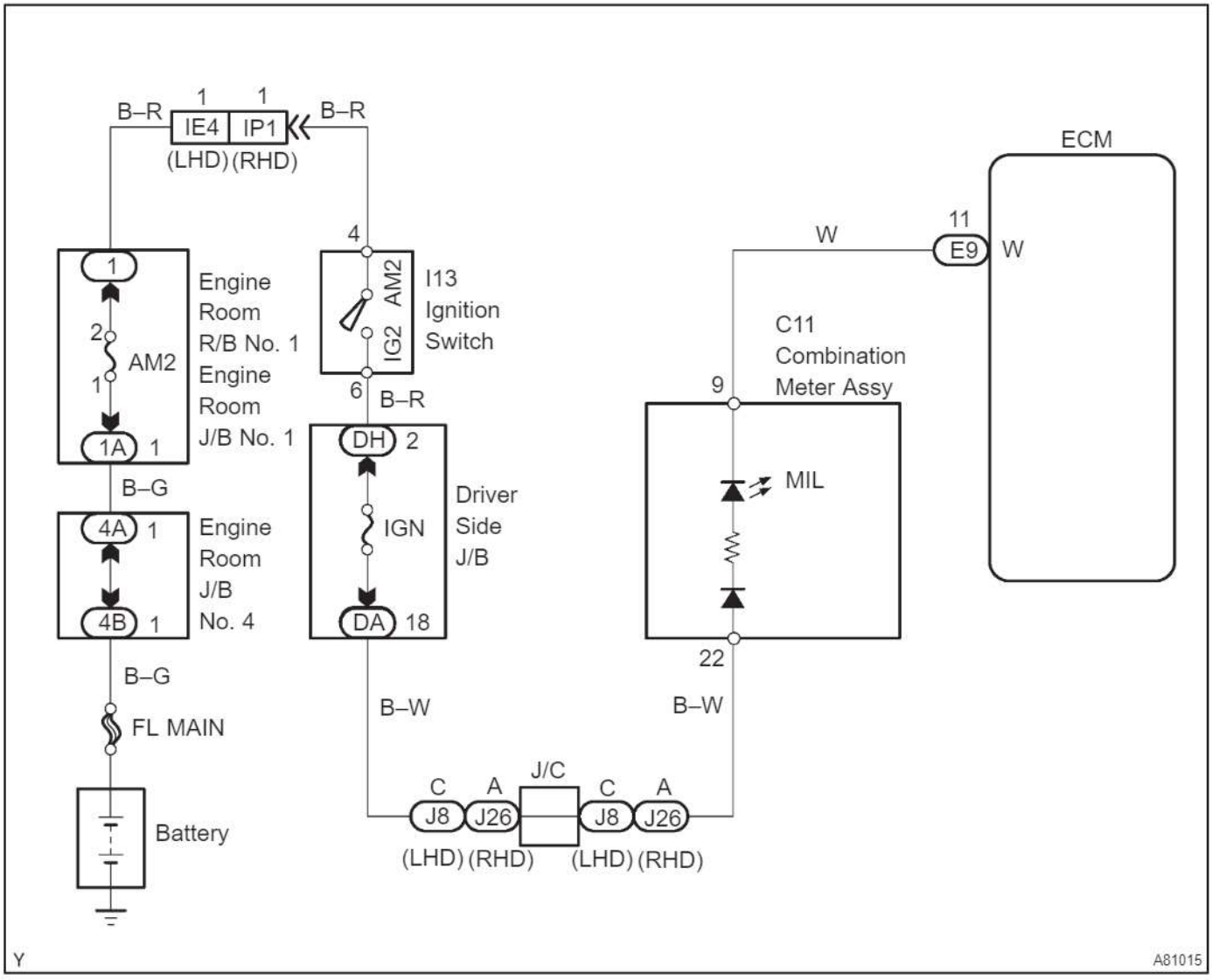
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MIL CIRCUIT

CIRCUIT DESCRIPTION

The MIL (Malfunction Indicator Lamp) is used to indicate the ECM detection of vehicle malfunctions.
By turning the ignition switch to ON, the power is supplied to the MIL circuit, and the ECM provides the circuit ground that illuminates the MIL.
Operation of the MIL should be checked visually:
When the ignition switch is first turned to ON, the MIL should be illuminated. If it is always OFF or ON, use the intelligent tester II and follow the procedure below to determine cause of the problem.

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:
Troubleshoot each trouble symptom in accordance with the chart below.

Reference:

Result	Proceed To
MIL remains on	Start inspection from step 1
MIL is not illuminated	Start inspection from step 3

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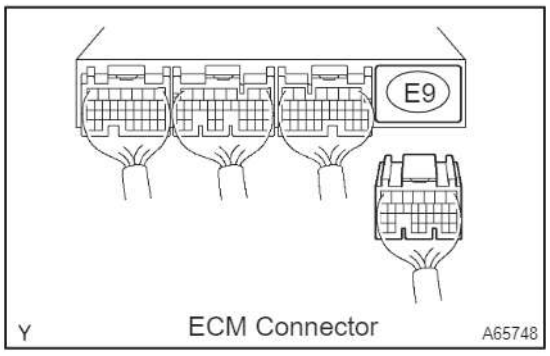
1	CHECK IF MIL TURNS OFF

(a) Connect the intelligent tester II to the DLC3.
(b) Turn the ignition switch to ON and turn the intelligent tester II ON.
(c) Select the following menu items: Powertrain / Engine and ECT / DTC.
(d) Check if DTCs have been stored. Note down if there are DTCs.
(e) Select the following menu items: Powertrain / Engine and ECT / DTC / Clear.
(f) Clear the DTC(s).
(g) Check if the MIL turns off.
Standard: The MIL should turn off.

OK	REPAIR CIRCUIT INDICATED BY OUTPUT DTC (See page 05–27)

NG

2	CHECK HARNESS AND CONNECTOR(CHECK FOR SHORT IN WIRE HARNESS)



(a) Disconnect the E9 ECM connector.
(b) Turn the ignition switch to ON.
(c) Check that the MIL is not illuminated.
Standard: MIL is not illuminated.
(d) Reconnect the ECM connector.

OK	REPLACE ECM (See page 10–65 of Pub. No. RM1018E AVENSIS)

NG

CHECK AND REPAIR HARNESS AND CONNECTOR

3	CHECK IF MIL ILLUMINATES

(a) Check if the MIL illuminates when turning the ignition switch to ON.
Standard: The MIL should illuminate.

OK	NORMAL

NG

4	INSPECT COMBINATION METER ASSY(MIL CIRCUIT)

(a) See the combination meter troubleshooting procedure on page 05–1510 of Pub. No. RM1018E AVENSIS.

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NG → REPAIR OR REPLACE BULB OR COMBINATION METER ASSEMBLY

OK

CHECK AND REPAIR HARNESS AND CONNECTOR (COMBINATION METER – ECM)

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ELECTRONIC CONTROLLED AUTOMATIC TRANSAXLE [ECT] (U341E) (From February, 2004)

05CVL-07

PRECAUTION

NOTICE:

Perform the RESET MEMORY (AT initialization) when replacing the automatic transaxle assy, engine assy or ECM (see page 05–225).

HINT:

Initialization can not be completed by only disconnecting the battery terminal.

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05KAJ-01

DEFINITION OF TERMS

Term	Definition
Monitor description	Description of what the ECM monitors and how it detects malfunctions (monitoring purpose and its details).

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05KAK-01

PART AND SYSTEM NAME LIST

This reference list indicates the part names used in this manual along with their definitions.

Part and system name	Definition
Toyota HCAC system, Hydrocarbon adsorptive Catalyst (HCAC) system, HC adsorptive three–way catalyst	HC adsorptive three–way catalytic converter
Variable Valve Timing sensor, VVT sensor	Camshaft position sensor
Variable valve timing system, VVT system	Camshaft timing control system
Camshaft timing oil control valve, Oil control valve OCV, VVT, VSV	Camshaft timing oil control valve
Variable timing and lift, VVTL	Camshaft timing and lift control
Crankshaft position sensor "A"	Crankshaft position sensor
Engine speed sensor	Crankshaft position sensor
THA	Intake air temperature
Knock control module	Engine knock control module
Knock sensor	Engine knock sensor
Mass or volume air flow circuit	Mass air flow sensor circuit
Vacuum sensor	Manifold air pressure sensor
Internal control module, Control module, Engine control ECU, PCM	Power train control module
FC idle	Deceleration fuel cut
Idle air control valve	Idle speed control
VSV for CCV, Canister close valve VSV for canister control	Evaporative emissions canister vent valve
VSV for EVAP, Vacuum switching valve assembly No. 1, EVAP VAV, Purge VSV	Evaporative emissions canister purge valve
VSV for pressure switching valve, Bypass VSV	Evaporative emission pressure switching valve
Vapor pressure sensor, EVAP pressure sensor, Evaporative emission control system pressure sensor	Fuel tank pressure sensor
Charcoal canister	Evaporative emissions canister
ORVR system	On–boad refueling vapor recovery system
Intake manifold runner control	Intake manifold tuning system
Intake manifold runner valve, IMRV, IACV (runner valve)	Intake manifold tuning valve
Intake control VSV	Intake manifold tuning solenoid valve
AFS	Air fuel ratio sensor
O2 sensor	Heater oxygen sensor
Oxygen sensor pumping current circuit	Oxygen sensor output signal
Oxygen sensor reference ground circuit	Oxygen sensor signal ground
Accel position sensor	Accelerator pedal position sensor
Throttle actuator control motor, Actuator control motor, Electronic throttle motor, Throttle control motor	Electronic throttle actuator
Electronic throttle control system, Throttle actuator control system	Electronic throttle control system
Throttle/pedal position sensor, Throttle/pedal position switch, Throttle position sensor/switch	Throttle position sensor
Turbo press sensor	Turbocharger pressure sensor
Turbo VSV	Turbocharger pressure control solenoid valve
P/S pressure switch	Power–steering pressure switch
VSV for ACM	Active control engine mount
Speed sensor, Vehicle speed sensor "A", Speed sensor for skid control ECU	Vehicle speed sensor
ATF temperature sensor, Trans. fluid temp. sensor, ATF temperature sensor "A"	Transmission fluid temperature sensor
Electronic controlled automatic transmission, ECT	Electronically controlled automatic
Intermediate shaft speed sensor "A"	Couter gear speed sensor

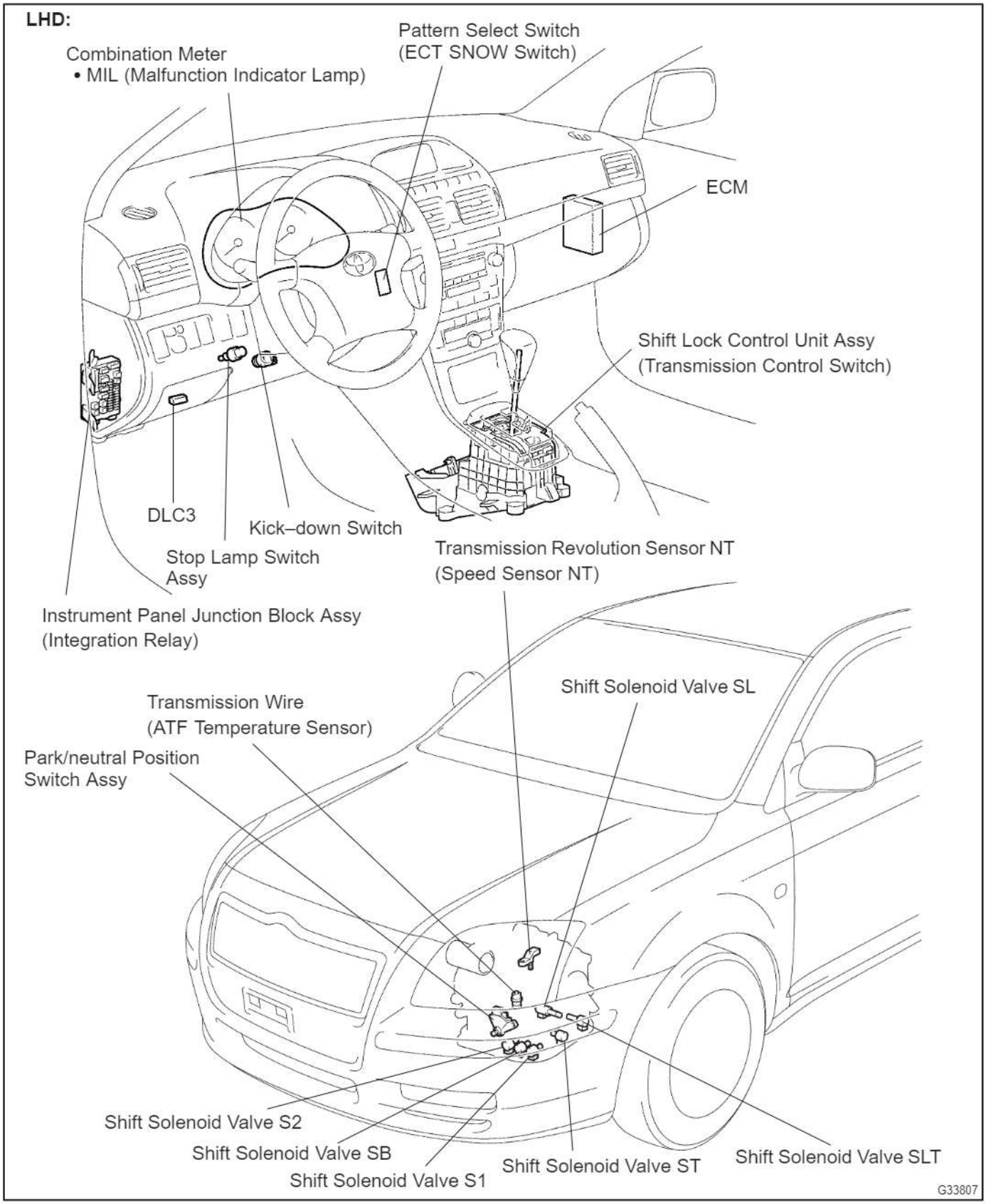
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Part and system name	Definition
Output speed sensor	Output shaft speed sensor
Input speed sensor, Input turbine speed sensor "A", Speed sensor (NT), Turbine speed sensor	Input turbine speed sensor
PNP switch, NSW	Park/neutral position switch
Pressure control solenoid	Transmission pressure control solenoid
Shift solenoid	Transmission shift solenoid valve
Transmission control switch, Shift lock control unit	Shift lock control module
Engine immobilizer system, Immobilizer system	Vehicle anti–theft system

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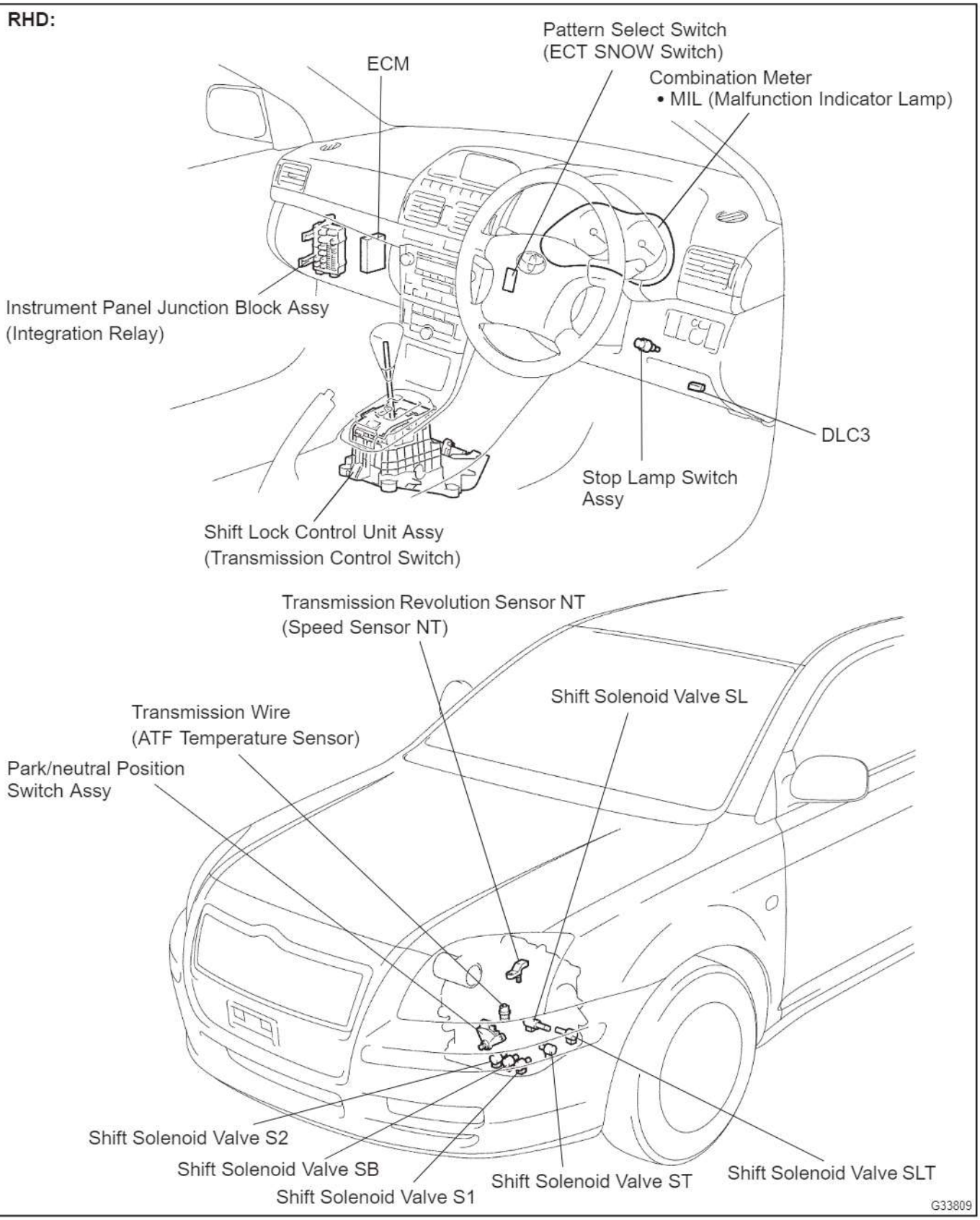
05L2I-01

LOCATION



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RHD:

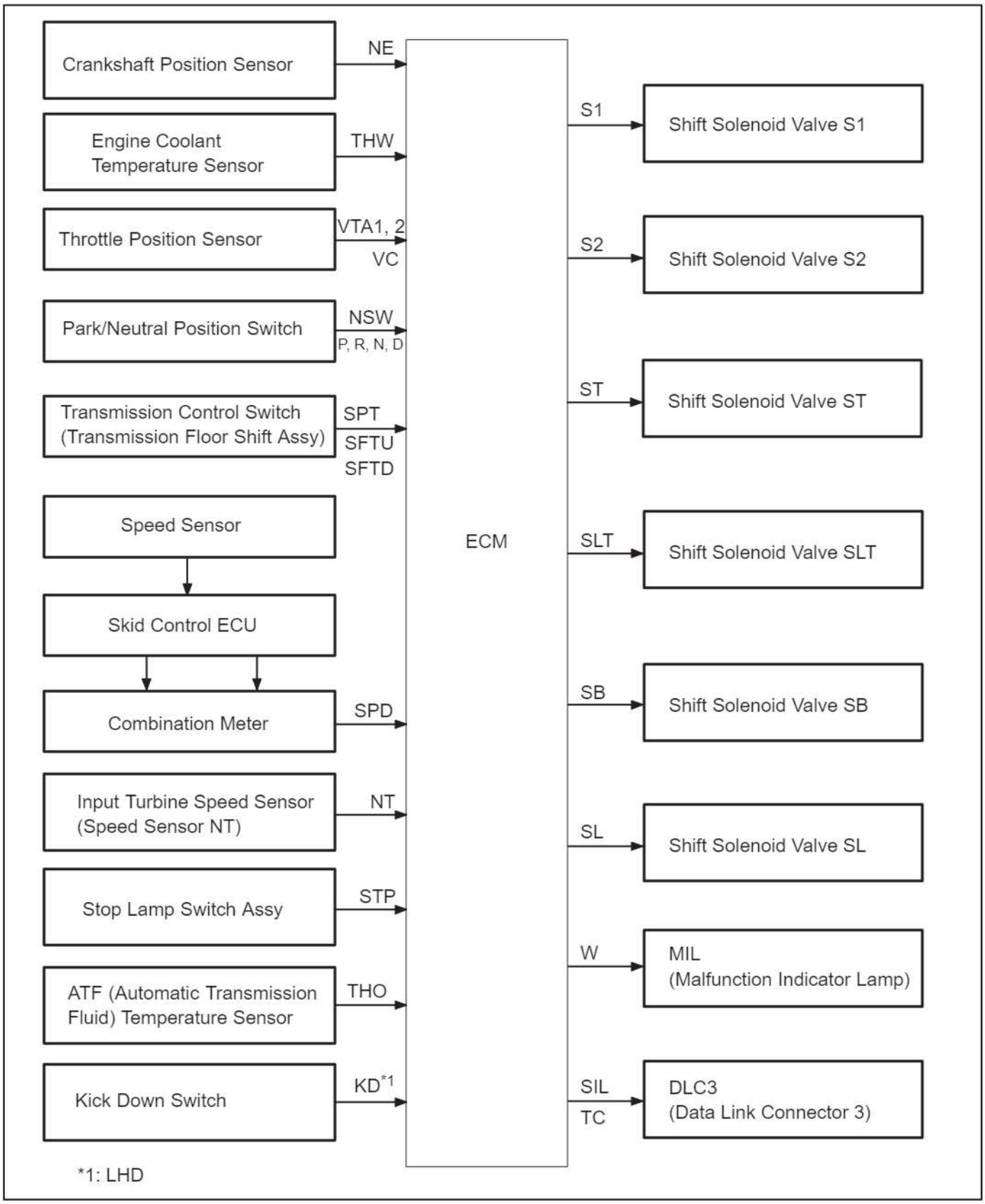


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05KAM-02

SYSTEM DIAGRAM

The configuration of the electronic control system in the U341E automatic transaxles is as shown in the following chart.



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05KAN-01

SYSTEM DESCRIPTION

1. SYSTEM DESCRIPTION

(a) The ECT (Electronic controlled automatic transmission/transaxle) is an automatic transmission/transaxle that electronically controls shift timing using the ECM. The ECM detects electrical signals that indicate engine and driving conditions, controls the shift point, and selects the appropriate shift pattern based on driver habits and road conditions. As a result, fuel efficiency and power transmission/transaxle performance are improved.

Shift shock has been reduced by controlling the engine and transmission/transaxle simultaneously.

In addition, the ECT has the following features:

- Diagnostic function.
- Fail–safe function when a malfunction occurs.

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0568H-10

HOW TO PROCEED WITH TROUBLESHOOTING

HINT:

- The intelligent tester II can be used at steps 3, 4, 6, and 9.

1	Vehicle Brought to Workshop

2	Customer Problem Analysis (SEE PAGE 05–218)

3	Connect the intelligent tester II to DLC3

4	Check and Clear DTC and Freeze Frame Data (SEE PAGE 05–239)

5	Visual Inspection

6	Setting the Check Mode Diagnosis (SEE PAGE 05–240)

7	Problem Symptom Confirmation (SEE PAGE 05–219)

- Symptom does not occur: Go to step 8
- Symptom occur: Go to step 9

8	Symptom Simulation (SEE PAGE 01–22)

9	DTC Check (SEE PAGE 05–239)

- DTC is not output: Go to step 10
- DTC is output: Go to step 17

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10	Basic Inspection (See Pub. No. RM1018E, page 40–2, 40–8 and 40–69)

NG → Go to step 19

OK

11	Mechanical System Test (SEE PAGE 05–221)

NG → Go to step 16

OK

12	Hydraulic Test (SEE PAGE 05–223)

NG → Go to step 16

OK

13	Manual Shifting Test (SEE PAGE 05–224)

NG → Go to step 15

OK

14	Problem Symptoms Table Chapter 1 (SEE PAGE 05–229)

NG → Go to step 18

OK

15	Problem Symptoms Table Chapter 2 (SEE PAGE 05–229)

16	Part Inspection

→ Go to step 19

17	DTC Chart (SEE PAGE 05–245)

18	Circuit Inspection

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19	Repair or Replace

20	Confirmation Test

End

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056II–07

CUSTOMER PROBLEM ANALYSIS CHECK

Automatic Transaxle System Check Sheet

Inspector's Name :

Customer's Name		VIN	
		Production Date	/ /
		Licence Plate No.	
Date Vehicle Brought In	/ /	Odometer Reading	km mile

Date Problem Occurred	/ /
How Often Does Problem Occur?	☐ Continuous ☐ Intermittent (times a day)

Symptoms	☐ Vehicle does not move (☐ Any position ☐ Particular position)
	☐ No up–shift (☐ 1st → 2nd ☐ 2nd → 3rd ☐ 3rd → O/D)
	☐ No down–shift (☐ O/D → 3rd ☐ 3rd → 2nd ☐ 2nd → 1st)
	☐ Lock–up malfunction
	☐ Shift point too high or too low
	☐ Harsh engagement (☐ N → D ☐ Lock–up ☐ Any drive position)
	☐ Slip or shudder
	☐ No kick–down
	☐ Others ( )

Check Item	MIL	☐ Normal ☐ Remains ON

DTC Check	1st Time	☐ Normal code ☐ Malfunction code (DTC)
	2nd Time	☐ Normal code ☐ Malfunction code (DTC)

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05KAO–02

ROAD TEST

1. PROBLEM SYMPTOM CONFIRMATION

(a) Based on the result of the customer problem analysis, try to reproduce the symptoms. If the problem is that the transaxle does not shift up, shift down, or the shift point is too high or too low, conduct the following road test referring to the automatic shift schedule and simulate the problem symptoms.

2. ROAD TEST

NOTICE:

Perform the test at the ATF (Automatic Transmission Fluid) temperature 50 to 80˚C (122 to 176˚F) in the normal operation.

(a) D position test:

Shift into the D position and fully depress the accelerator pedal and check the following points.

(1) Check up–shift operation.

Check that 1 → 2, 2 → 3 and 3 → 4 up–shifts take place, and that the shift points conform to the automatic shift schedule (See Pub. No. RM1018E, page 03–45).

HINT:

4th Gear Up–shift Prohibition Control

- Engine coolant temperature is 60 ˚C (140 ˚F) or less and vehicle speed is at 70 km/h (43 mph) or less.
- ATF temperature is 10 ˚C (50 ˚F) or less.

4th and 3rd Gear Lock–up Prohibition Control

- Brake pedal is depressed.
- Accelerator pedal is released.
- ATF temp. is 10˚C (50˚F) or less.
- Engine coolant temperature is 60 ˚C (140 ˚F) or less.

(2) Check for shift shock and slip.

Check for shock and slip at the 1 → 2, 2 → 3 and 3 → 4 up–shifts.

(3) Check for abnormal noise and vibration.

Check for abnormal noise and vibration when up–shifting from 1 → 2, 2 → 3 and 3 → 4 while driving with the shift lever in the D position, and check while driving in the lock–up condition.

HINT:

The check for the cause of abnormal noise and vibration must be done thoroughly as it could also be due to loss of balance in the differential, torque converter clutch, etc.

(4) Check kick–down operation.

Check vehicle speeds when the 2nd to 1st, 3rd to 2nd and 4th to 3rd kick–downs take place while driving with the shift lever in the D position. Confirm that each speed is within the applicable vehicle speed range indicated in the automatic shift schedule (See Pub. No. RM1018E, page 03–45).

(5) Check for abnormal shock and slip at kick–down.

(6) Check the lock–up mechanism.

- Drive in D position (4th gear), at a steady speed (lock–up ON).
- Lightly depress the accelerator pedal and check that the engine speed does not change abruptly.

HINT:

- There is no lock–up function in the 1st and 2nd gear.
- If there is a big jump in engine speed, there is no lock–up.

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(b) S position test

Shift to the S position, depress the accelerator pedal and check the following points:

(1) Check shift operation.

- While driving in the D position and 4th gear, shift into the S position and back to the D position. Check that the gear change 4 → 3 down–shift and 3 → 4 up–shift can be performed.
- With the shift lever in the S position (while the vehicle is stopped), shift into the "+" position to check that the shift position on the combination meter changes as follows: 1 → 2, 2 → 3 and 3 → 4.
- While driving in the 3(S) position and 3rd gear (at a vehicle speed of approximately 30 to 40 km/h (19 to 25 mph)), shift into the "–" position and check if the 2nd gear down–shift occurs and the engine brake performs properly.
- While driving in the 2(S) position and 2nd gear (at a vehicle speed of approximately 20 to 30 km/h (12 to 19 mph)), shift into the "–" position and check if the 1st gear down–shift occurs and the engine brake performs properly.

HINT:

Manual shift (S position) is prohibited under either of the following conditions:

- Down–shifting may cause engine overrun.
- The driver continuously down–shifts. (Down–shifting to 1st gear may not be performed.)

(c) R position test:

Shift into the R position, lightly depress the accelerator pedal, and check that the vehicle moves backward without any abnormal noise or vibration.

CAUTION:

Before conducting this test ensure that the test area is free from people and obstruction.

(d) P position test:

Stop the vehicle on the grade (more than 5°) and after shifting into the P position, release the parking brake. Then, check that the parking lock pawl holds the vehicle in place.

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05KAP-02

MECHANICAL SYSTEM TESTS

1. PERFORM MECHANICAL SYSTEM TESTS

(a) Measure the stall speed.

The object of this test is to check the overall performance of the transaxle and engine by measuring the stall speeds in the D and R positions.

NOTICE:

- **Perform the test at the normal operating ATF (Automatic Transmission Fluid) temperature 50 to 80°C (122 to 176°F).**
- **Do not continuously run this test for longer than 10 seconds.**
- **To ensure safety, do this test in a wide, clear level area which provides good traction.**
- **The stall test should always be carried out in pairs. One technician should observe the conditions of wheels or wheel stoppers outside the vehicle while the other is doing the test.**

(1) Chock the 4 wheels.

(2) Connect an Intelligent Tester II to the DLC3.

(3) Fully apply the parking brake.

(4) Keep your left foot pressed firmly on the brake pedal.

(5) Start the engine.

(6) Shift into the D position. Press all the way down on the accelerator pedal with your right foot.

(7) Quickly read the stall speed at this time.

Stall speed: 2,400 ± 150 rpm

(8) Do the same test in the R position.

Stall speed: 2,400 ± 150 rpm

Evaluation:

Problem	Possible cause
(a) Stall engine speed is low in D and R positions	• Engine power output may be insufficient • Stator one–way clutch not operating properly HINT: If the value is less than the specified value by 600 rpm or more, the torque converter could be faulty.
(b) Stall engine speed is high in D position	• Line pressure is too low • Forward clutch slipping • One–way clutch No.2 not operating properly
(c) Stall engine speed is high in R position	• Line pressure is too low • Reverse clutch slipping • 1st and reverse brake slipping
(d) Stall engine speed is high in D and R positions	• Line pressure is too low • Improper fluid level

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(b) Measure the time lag.

(1) When the shift lever is shifted while the engine is idling, there will be a certain time lapse or lag before the shock can be felt. This is used for checking the condition of the direct clutch, forward clutch, and 1st and reverse brake.

NOTICE:

- **Perform the test at the normal operating ATF temperature 50 to 80 °C (122 to 176 °F).**
- **Be sure to allow 1 minute interval between tests.**
- **Perform the test three times, and measure the time lags. Calculate the average value of the three time lags.**

(2) Connect an Intelligent Tester II to the DLC3.

(3) Fully apply the parking brake.

(4) Start and warm up the engine and check idle speed.

Idle speed: approx. 700 rpm (In N position and A/C OFF)

(5) Shift the lever from N to D position. Using a stop watch, measure the time from when the lever is shifted until the shock is felt.

Time lag: N → D less than 1.2 seconds

(6) In the same way, measure the time lag for N → R.

Time lag: N → R less than 1.5 seconds

Evaluation (If N → D or N → R time lag is longer than the specified):

Problem	Possible cause
N → D time lag is longer	• Line pressure is too low • Forward clutch worn • One–way clutch No.2 not operating properly
N → R time lag is longer	• Line pressure is too low • Reverse clutch worn • 1st and reverse brake worn

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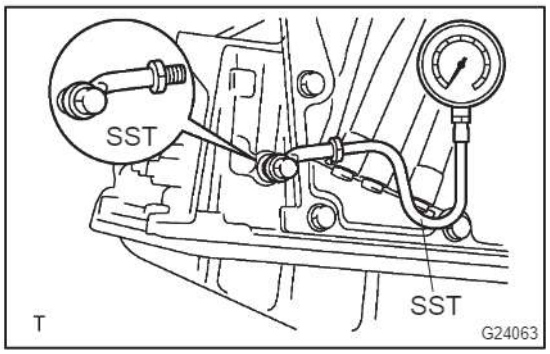
HYDRAULIC TEST

1. PERFORM HYDRAULIC TEST

(a) Measure the line pressure.

NOTICE:

- **Perform the test at the normal operating ATF (Automatic Transmission Fluid) temperature 50 to 80˚C (122 to 176˚F).**
- **The line pressure test should always be carried out in pairs. One technician should observe the conditions of wheels or wheel stopper outside the vehicle while the other is doing the test.**
- **Be careful to prevent SST's hose from interfering with the exhaust pipe.**
- **This check must be conducted after checking and adjusting engine.**
- **Perform under condition that A/C is OFF.**
- **When conducting stall test, do not continue more than 10 seconds.**



(1) Warm up the ATF.
(2) Remove the test plug on the left side of the transaxle case and connect SST.

SST 09992–00095 (09992– 00231, 09992–00271)

(3) Fully apply the parking brake and chock the 4 wheels.
(4) Connect an Intelligent Tester II to the DLC3.
(5) Start the engine and check idling speed.
(6) Keep your left foot pressing firmly on the brake pedal and shift into D position.
(7) Measure the line pressure when the engine is idling.
(8) Depress the accelerator pedal all the way down. Quickly read the highest line pressure when engine speed reaches stall speed.
(9) In the same way, do the test in R position.

Specified line pressure:

Condition	D position kPa (kgf / cm^2, psi)	R position kPa (kgf / cm^2, psi)
Idling	372 to 412 kPa (3.8 to 4.2 kgf/cm^2, 54 to 60 psi)	553 to 623 kPa (5.6 to 6.4 kgf/cm^2, 80 to 90 psi)
Stall test	1,126 to 1,226 kPa (11.5 to 12.5 kgf/cm^2, 163 to 178 psi)	1,664 to 1,864 kPa (17.0 to 19.0 kgf/cm^2, 241 to 270 psi)

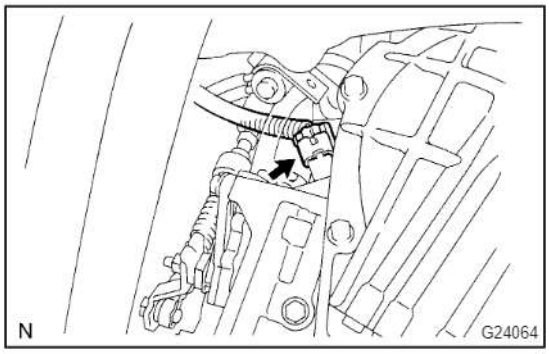
Evaluation:

Problem	Possible cause
If the measured values at all positions are higher	• Shift solenoid valve SLT defective • Regulator valve detective
If the measured values at all positions are lower	• Shift solenoid valve SLT defective • Regulator valve detective • Oil pump defective
If pressure is low in the D position only	• D position circuit fluid leak • Forward clutch defective
If pressure is low in the R position only	• R position circuit fluid leak • Reverse clutch defective • 1st and reverse brake defective

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MANUAL SHIFTING TEST



1. PERFORM MANUAL SHIFTING TEST

HINT:

- With this test, it can be determined whether the trouble occurs in the electrical circuit or is a mechanical problem in the transaxle.
- If any abnormalities are found in the following test, the problem is in the transaxle itself.

(a) Disconnect the transmission wire connector.

(b) Drive with the transmission wire disconnected.
Shifting the shift lever to the D position to check whether the shifting condition changes the table below.

Shift Position	Shifting Condition
D	No Shift (Not Change)

HINT:

When driving with the transmission wire disconnected, the gear position will be as follows:

- When the shift lever is in the D position, the gear is held in the 3rd position.
- When the shift lever is in the R or the P position, the gear is also in the R or the P position respectively.

(c) Connect the transmission wire connector.

(d) Clear the DTC (see page 05–239).

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05KAS-02

INITIALIZATION

1. RESET MEMORY

CAUTION:

Perform the RESET MEMORY (AT initialization) when replacing the automatic transaxle assy, engine assy or ECM.

NOTICE:

Intelligent tester II only

HINT:

The ECM memorizes the condition that the ECT controls the automatic transaxle assy and engine assy according to those characteristics. Therefore, when the automatic transaxle assy, engine assy, or ECM has been replaced, it is necessary to reset the memory so that the ECM can memorize the new information. Reset procedure is as follows.

(a) Turn the ignition switch off.
(b) Connect the intelligent tester II to the DLC3.
(c) Turn the ignition switch to the ON position.
(d) Turn the intelligent tester II main switch on.
(e) Perform the reset memory procedure from the main menu.

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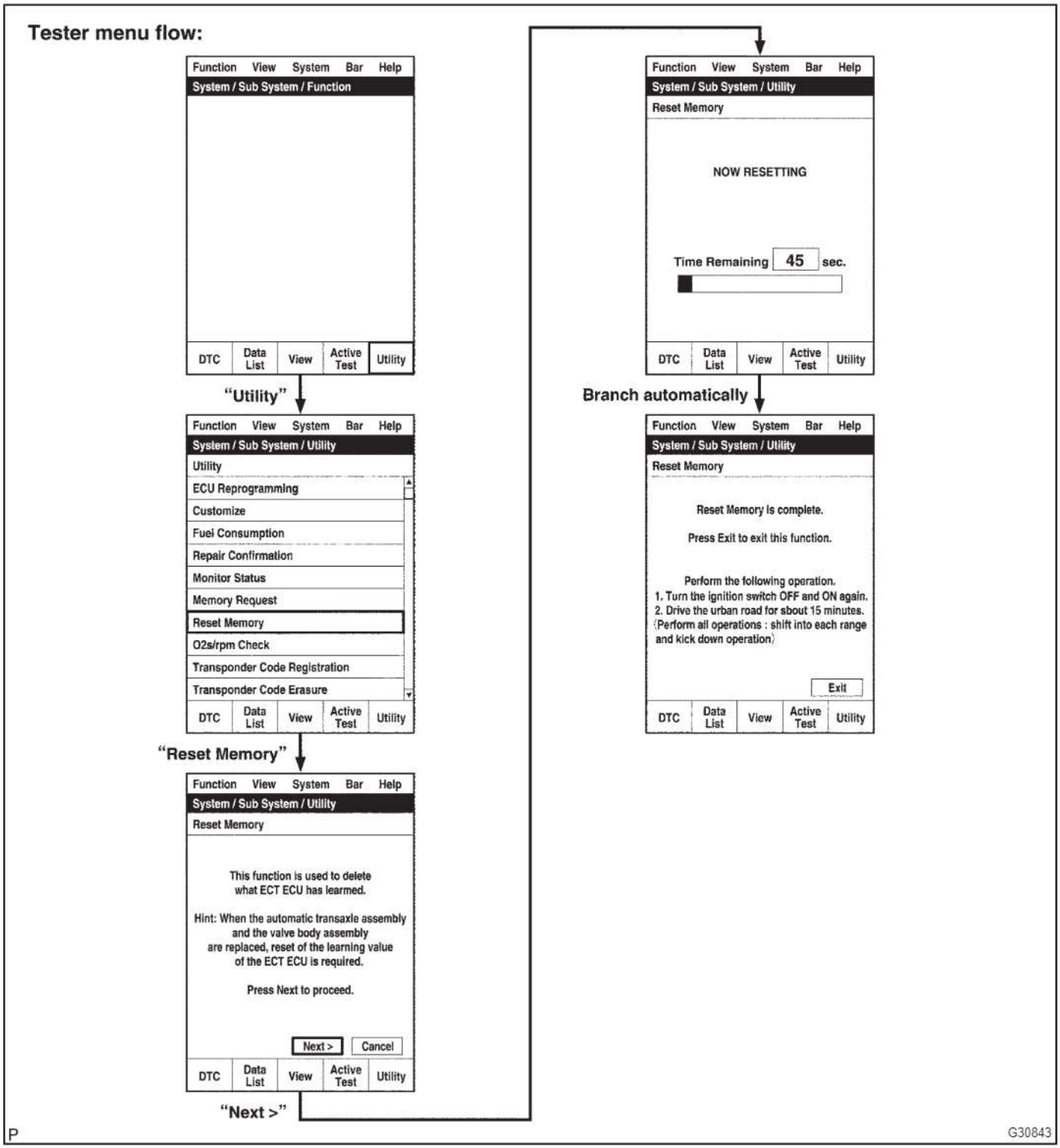
CAUTION:

After performing the RESET MEMORY, be sure to perform the ROAD TEST (see page 05–219) described earlier.

HINT:

The ECM is learned by performing the ROAD TEST.

Tester menu flow:



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05KAT-02

MONITOR DRIVE PATTERN

1. MONITOR DRIVE PATTERN FOR ECT TEST

(a) Perform this drive pattern as one method to simulate the detection conditions of the ECT malfunctions. (The DTCs may not be detected due the actual driving conditions. And some codes may not be detected through this drive pattern).

HINT:

Preparation for driving

- Warm up the engine sufficiently. (Engine coolant temperature is 60 °C (140 °F) or higher)
- Drive the vehicle when the atmospheric temperature is –10 °C (14 °F) or higher. (Malfunction is not detected when the atmospheric temperature is –10 °C (14 °F) or less)

Driving note

- Drive the vehicle through all gears.
  Stop → 1st → 2nd → 3rd → 4th → 4th (lock–up ON).
- Perform engine brake test in the S position.
  While driving in the 4(S) position and 4th gear lock–up, shift into the "–" position and down–shift from 4th to 3rd, 3rd to 2nd, 2nd to 1st.
  Check that the engine brake performs properly whenever down–shift takes place.
- Repeat the above driving pattern three times or more.

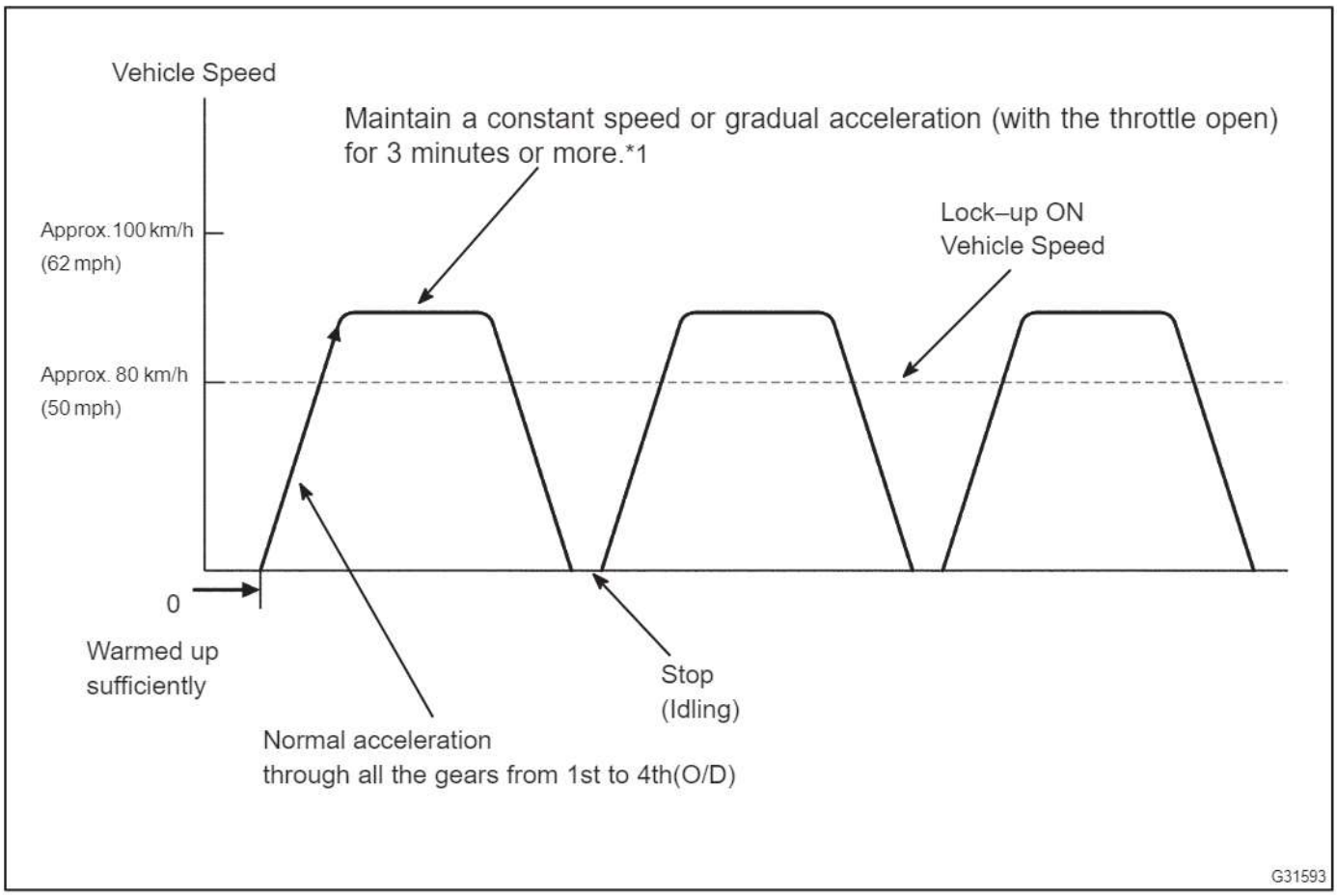
NOTICE:

- **When using the intelligent tester II, monitor status can be found in the "Power train / Engine and ECT / Data List".**
- **In the event that the drive pattern must be interrupted (possibly due to traffic conditions or other factors) the drive pattern can be resumed and, in most cases, the monitor can be completed.**

CAUTION:

Perform this drive pattern on a level road as much as possible and strictly observe the posted speed limits and traffic laws while driving.

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HINT:

*1: Drive at such a speed in the uppermost gear, to engage lock–up. The vehicle can be driven at a speed lower than that in the above diagram under the lock–up condition.

NOTICE:

It is necessary to drive the vehicle for approximately 30 minutes to detect DTC P0711 (ATF temperature sensor malfunction).

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056IN–10

PROBLEM SYMPTOMS TABLE

HINT:

If a normal code is displayed during the diagnostic trouble code check although the trouble still occurs, check the electrical circuits for each symptom in the order given in the charts on the following pages and proceed to the page given for troubleshooting.

The Matrix Chart is divided into 2 chapters.

1. **Chapter 1: Electronic Circuit Matrix Chart**
   - Refer to the table below when the trouble cause is considered to be electrical.
   - If the instruction "Proceed to next circuit inspection shown on matrix chart" is given in the flow chart of each circuit, proceed to the circuit with the next highest number in the table to continue the check.
   - If the trouble still occurs even though there are no abnormalities in any of the other circuits, check and replace the ECM.

HINT:

*1: When the circuit on which mark *1 is attached is a malfunction, DTC could be output (see page 05–245).

*2: LHD

Symptom	Suspect Area	See page
No up–shift (1st → 2nd)	ECM	01–32
No up–shift (2nd → 3rd)	ECM	01–32
No up–shift (3rd → 4th)	1. Park/neutral position switch circuit *1 2. ECM	05–247 01–32
No down–shift (4th → 3rd)	1. Park/neutral position switch circuit *1 2. ECM	05–247 01–32
No down–shift (3rd → 2nd)	ECM	01–32
No down–shift (2nd → 1st)	ECM	01–32
No lock–up or No lock–up off	1. Shift solenoid valve (SL) circuit *1 2. Stop light switch circuit *1 3. Engine coolant temp. sensor circuit *1 4. ECM	05–289 05–261 05–27 01–32
Shift point too high or too low	1. Throttle position sensor circuit *1 2. Shift solenoid valve (SLT) circuit *1 3. Engine coolant temp. sensor circuit *1 4. ECM	05–27 05–286 05–27 01–32
Up–shift to 4th from 3rd while engine is cold	1. Engine coolant temp. sensor circuit *1 2. ATF temperature sensor circuit *1 3. ECM	05–27 05–252 01–32
No gear change by shifting into "+" or "–" while the shift lever is in the S position	1. Transmission control switch circuit 2. ECM	05–292 01–32
Harsh engagement (N → D)	ECM	01–32
Harsh engagement (Lock–up)	ECM	01–32
Harsh engagement (Any driving position)	1. Shift solenoid valve (SLT) circuit *1 2. ECM	05–286 01–32
Poor acceleration	1. Shift solenoid valve (SLT) circuit *1 2. Pattern select (ECT SNOW) switch circuit 3. ECM	05–286 05–297 01–32
Engine stalls when starting off or stopping	1. Shift solenoid valve (SL) circuit *1 2. ECM	05–289 01–32

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No kick–down	1. Kick–down switch circuit *2 2. ECM	05–301 01–32
Malfunction in shifting	1. Park/neutral position switch circuit *1 2. Transmission control switch circuit 3. ECM	05–247 05–292 01–32

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2. Chapter 2: On–Vehicle Repair and Off–Vehicle Repair (★: U340E AUTOMATIC TRANSAXLE Repair Manual Pub. No. RM824E) (●:AVENSIS Repair Manual Pub. No. RM1018E, page 05–1001)

Symptom	Suspected Area	See page
Vehicle does not move in any forward position and reverse position	1. Manual valve	★
	2. Valve body assy (Primary regulator valve)	●
	3. Valve body assy (Secondary regulator valve)	●
	4. Planetary gear unit	★
	5. Forward clutch	★
	6. One–way clutch No. 2	★
	7. Reverse Clutch	★
	8. 1st and reverse brake	★
Vehicle does not move in R position	1. Manual valve	★
	2. Planetary gear unit	★
	3. Reverse Clutch	★
	4. 1st and reverse brake	★
No up–shift (1st → 2nd)	1. Valve body assy (1–2 shift valve)	●
	2. 2nd brake	★
	3. One–way clutch No. 1	★
No up–shift (2nd → 3rd)	1. Valve body assy (2–3 shift valve)	●
	2. Direct clutch	★
No up–shift (3rd → 4th)	1. Valve body assy (3–4 shift valve)	●
	2. O/D and 2nd brake	★
No down–shift (4th → 3rd)	Valve body assy (3–4 shift valve)	●
No down–shift (3rd → 2nd)	Valve body assy (2–3 shift valve)	●
No down–shift (2nd → 1st)	Valve body assy (1–2 shift valve)	●
No lock–up or No lock–up off	1. Valve body assy (Lock–up relay valve)	●
	2. Valve body assy (Lock–up control valve)	●
	3. Valve body assy (Solenoid relay valve)	●
	4. Valve body assy (Solenoid modulator valve)	●
	5. Torque converter clutch	●
Harsh engagement (N → D)	1. Valve body assy (C_1 accumulator)	●
	2. Valve body assy (Accumulator control valve)	●
	3. Forward clutch	★
	4. One–way clutch No. 2	★
Harsh engagement (N → R)	1. C_3 accumulator	★
	2. Valve body assy (Accumulator control valve)	●
	3. Valve body assy (Reverse control valve)	●
	4. Reverse clutch	★
	5. 1st and reverse brake	★
Harsh engagement (Lock–up)	1. Valve body assy (Lock–up relay valve)	●
	2. Valve body assy (Accumulator control valve)	●
	3. Valve body assy (Lock–up control valve)	●
	4. Torque converter clutch	●
Harsh engagement (1st → 2nd)	1. B_2 accumulator	★
	2. Valve body assy (Accumulator control valve)	●
	3. 2nd brake	★
	4. One–way clutch No. 1	★
Harsh engagement (2nd → 3rd)	1. C_2 accumulator	★
	2. Valve body assy (Accumulator control valve)	●
	3. Direct clutch	★

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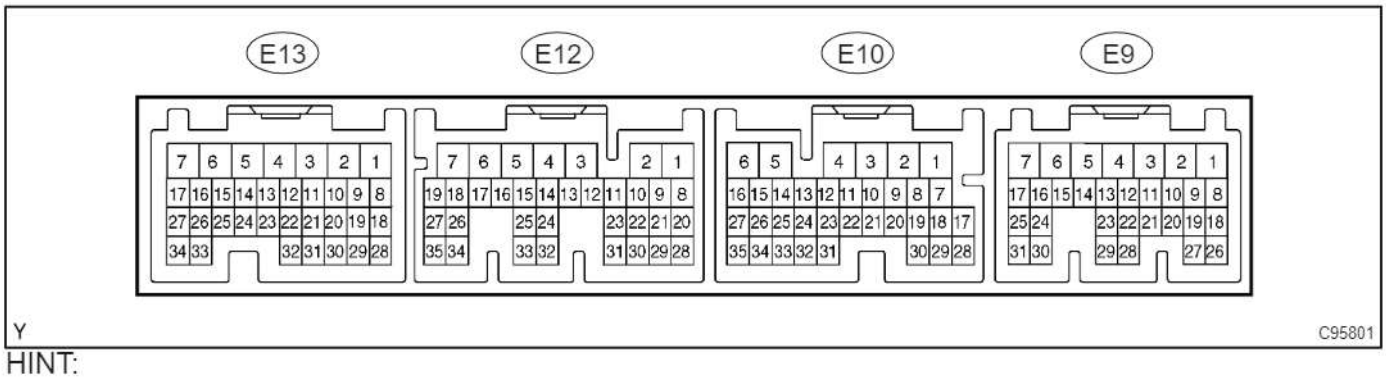
Harsh engagement (3rd → 4th)	1. Valve body assy (B_1 accumulator) 2. Valve body assy (Accumulator control valve) 3. Valve body assy (3–4 shift timing valve) 4. O/D and 2nd brake	● ● ● ★
Harsh engagement (4th → 3)	1. Valve body assy (3–4 shift timing valve) 2. Valve body assy (4–3 shift timing valve)	● ●
Harsh engagement (D, 2, 1 position)	Valve body assy (Coast relay valve)	●
Slip or shudder (Forward position)	1. Valve body assy (Oil strainer) 2. Torque converter clutch 3. Forward clutch 4. Direct clutch 5. O/D and 2nd brake 6. 2nd brake 7. One–way clutch No. 1 8. One–way clutch No. 2	● ● ★ ★ ★ ★ ★ ★
Slip or shudder (Reverse position)	1. Valve body assy (Oil strainer) 2. Reverse clutch 3. 1st and reverse brake	● ★ ★
Slip or shudder (1st)	One–way clutch No. 2	★
Slip or shudder (2nd)	1. 2nd brake 2. One–way clutch No. 1	★ ★
Slip or shudder (3rd)	Direct clutch	★
Slip or shudder (4th)	O/D and 2nd brake	★
No engine braking (1st: 1 position)	1. Valve body assy (Reverse control valve) 2. 1st and reverse brake	● ★
No engine braking (2nd: 2 position)	1. Valve body assy (3–4 shift valve) 2. O/D and 2nd brake	● ★
No kick–down	1. Valve body assy (1–2 shift valve) 2. Valve body assy (2–3 shift valve) 3. Valve body assy (3–4 shift valve)	● ● ●
Poor acceleration	1. Valve body assy (SLT damper) 2. Torque converter clutch	● ●
Large shift shock or engine stalls when starting off or stopping	Torque converter clutch	●

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05L2J--01

TERMINALS OF ECM

1. ECM



HINT:

Each ECM terminal's standard voltage is shown in the table below.

In the table, first follow the information under "Condition". Look under "Symbols (Terminal No.)" for the terminals to inspected. The standard voltage between the terminals is shown under "Specific Condition".

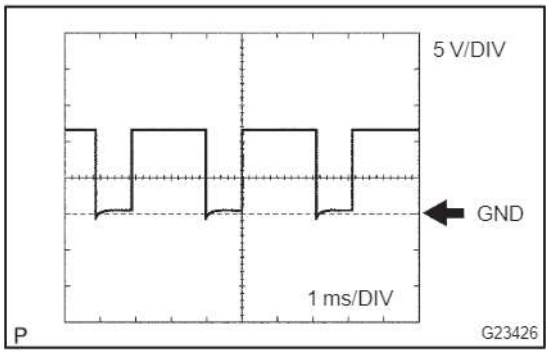
Use the illustration above as a reference for the ECM terminals.

Symbols (Terminals No.)	Wiring Color	Terminal Description	Condition	Specified Condition
SLT+ (E12–13) – SLT– (E12–12)	P–L – P	SLT solenoid signal	Engine idle speed	Pulse generation (See waveform 1)
THO (E12–32) – E2 (E13–28)	V – BR	ATF temperature sensor signal	ATF temperature: 115 °C (239 °F) or more	Below 1.5 V
ST (E12–20) – E1 (E13–5)	R–B – BR	ST solenoid signal	IG switch ON	Below 1 V
↑	↑	↑	IG switch ON and R gear	10 to 14 V
SL (E12–15) – E1 (E13–5)	R – BR	SL solenoid signal	IG switch ON	Below 1 V
↑	↑	↑	Vehicle driving under lock–up range	10 to 14 V
S2 (E12–10) – E1 (E13–5)	P – BR	S2 solenoid signal	IG switch ON	Below 1 V
↑	↑	↑	1st or O/D gear	10 to 14 V
↑	↑	↑	2nd or 3rd gear	Below 1 V
S1 (E12–11) – E1 (E13–5)	P–L – BR	S1 solenoid signal	IG switch ON	10 to 14 V
↑	↑	↑	1st or 2nd gear	10 to 14 V
↑	↑	↑	3rd or O/D gear	Below 1 V
SB (E12–8) – E1 (E13–5)	L – BR	SB solenoid signal	IG switch ON	Below 1 V
NT+ (E12–26) – NT– (E12–34)	B–O – B	Speed sensor (NT) signal	Vehicle speed 20 km/h (12 mph)	Pulse generation (See waveform 2)
SPT (E10–8) – E1 (E13–5)	L – BR	S shift position switch signal	IG switch ON and shift lever S position	10 to 14 V
↑	↑	↑	IG switch ON and shift lever except S position	Below 1 V
D (E10–10) – E1 (E13–5)	LG–B – BR	D shift position switch signal	IG switch ON and shift lever D and S position	10 to 14 V
↑	↑	↑	IG switch ON and shift lever except D and S position	Below 1 V
R (E10–11) – E1 (E13–5)	R–Y – BR	R shift position switch signal	IG switch ON and shift lever R position	10 to 14 V
↑	↑	↑	IG switch ON and shift lever except R position	Below 1 V

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KD *1 (E10–31) – E1 (E13–5)	W – BR	Kick–down switch signal	IG switch ON and Accelerator pedal is depressed	Below 1 V
↑	↑	↑	IG switch ON and Accelerator pedal is released	10 to 14 V
SPD (E10–17) – E1 (E13–5)	V–W – BR	Speed signal	Vehicle speed 20 km/h (12 mph)	Pulse generation (See waveform 3)
STP (E10–19) – E1 (E13–5)	G–W – BR	Stop lamp switch signal	Brake pedal is depressed	7.5 to 14 V
↑	↑	↑	Brake pedal is released	Below 1.5 V
SFTU (E10–2) – E1 (E13–5)	R – BR	Up shift switch signal	IG switch ON and shift lever S position	10 to 14 V
↑	↑	↑	IG switch ON and shift lever "+" position (Up shift)	Below 1 V
SFTD (E10–1) – E1 (E13–5)	B – BR	Down shift switch signal	IG switch ON and shift lever S position	10 to 14 V
↑	↑	↑	IG switch ON and shift lever "–" position (Down shift)	Below 1 V
P (E9–13) – E1 (E13–5)	W–L – BR	Park position switch signal	IG switch ON and shift lever P position	10 to 14 V
↑	↑	↑	IG switch ON and shift lever except P position	Below 1 V
N (E10–20) – E1 (E13–5)	R – BR	Neutral position switch signal	IG switch ON and shift lever N position	10 to 14 V
↑	↑	↑	IG switch ON and shift lever except N position	Below 1 V
NSW (E13–23) – E1 (E13–5)	B–W – BR	Park neutral switch signal	IG switch ON and shift lever P and N position	Below 1 V
↑	↑	↑	IG switch ON and shift lever except P and N position	10 to 14 V

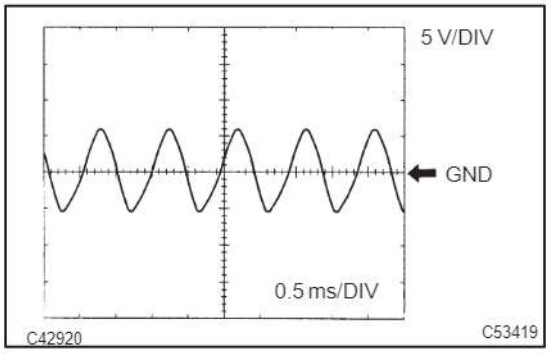
HINT:
*1: LHD



Waveform 1

Reference:

Terminal	SLT+ – SLT–
Tool setting	5V/DIV, 1ms/DIV
Vehicle condition	Engine idle speed

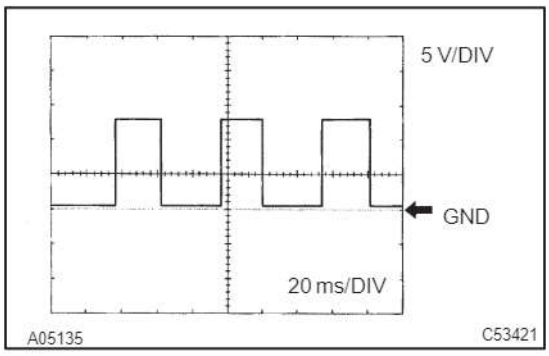


Waveform 2

Reference:

Terminal	NT+ – NT–
Tool setting	5V/DIV, 0.5ms/DIV
Vehicle condition	Vehicle speed 20 km/h (12 mph)

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Waveform 3

Reference:

Terminal	SPD – E1
Tool setting	5V/DIV, 20ms/DIV
Vehicle condition	Vehicle speed 20 km/h (12 mph)

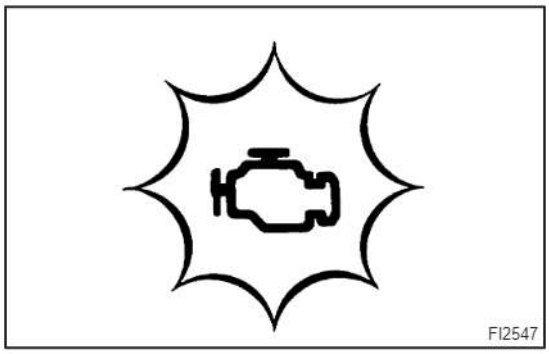
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05KAV–02

DIAGNOSIS SYSTEM

EURO–OBD (EUROPE)

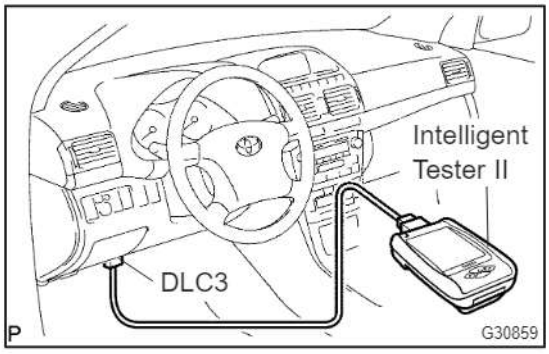
When troubleshooting Europe On–Board Diagnostic (Euro–OBD) vehicles, the vehicle must be connected to an OBD scan tool (complying with ISO 15031–4). Various data output from the vehicle's ECM can then be read.



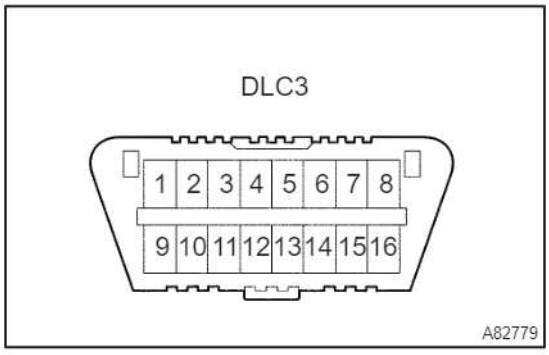
Euro–OBD regulations require that the vehicle's on–board computer illuminates the Malfunction Indicator Lamp (MIL) on the instrument panel when the computer detects a malfunction in:

1) The emission control system/components.
2) The powertrain control components (which affect vehicle emissions).
3) The computer.

In addition, the applicable Diagnostic Trouble Codes (DTCs) prescribed by ISO 15031–6 are recorded in the ECM memory. If the malfunction does not reoccur in 3 consecutive trips, the MIL turns off automatically but the DTCs remain recorded in the ECM memory.



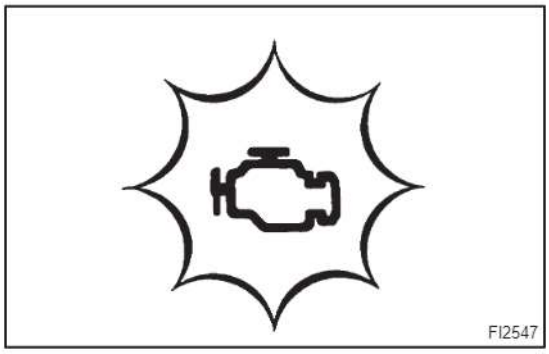
To check DTCs, connect the Intelligent Tester II or OBD scan tool to the Data Link Connector 3 (DLC3) of the vehicle.
The scan tool displays DTCs, the freeze frame data and a variety of the engine data.
The DTCs and freeze frame data can be erased with the scan tool (see page 05–239).



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M–OBD (EXCEPT EUROPEAN SPEC.)

When troubleshooting Multiplex On–Board Diagnostic (M–OBD) vehicles, the vehicle must be connected to the Intelligent Tester II. Various data output from the ECM can then be read.



OBD II regulations require that the vehicle's on–board computer illuminates the MIL on the instrument panel when the computer detects a malfunction in:

1) The emission control system / components
2) The power train control components (which affect vehicle emissions)
3) The computer

In addition to, the applicable DTCs are recorded in the ECM memory. If the malfunction does not recur in 3 consecutive trips, the MIL turns off automatically but the DTCs remain recorded in the ECM memory.

NORMAL MODE AND CHECK MODE

The diagnosis system operates in "normal mode" during normal vehicle use. In normal mode, "2 trip detection logic" is used to ensure accurate detection of malfunctions. "Check mode" is also available to technicians as an option. In check mode, "1–trip detection logic" is used for simulating malfunction symptoms and increasing the system's ability to detect malfunctions, including intermittent malfunctions (Intelligent Tester II only).

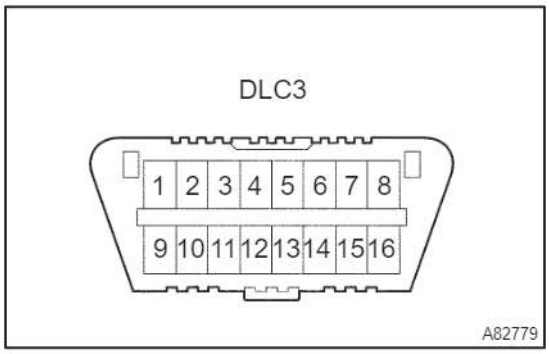
2–TRIP DETECTION LOGIC

When a malfunction is first detected, the malfunction is temporarily stored in the ECM memory (1st trip). If the ignition switch is turned OFF and then ON again, and the same malfunction is detected again, the MIL will illuminate.

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FREEZE FRAME DATA

Freeze frame data records the engine conditions (fuel system, calculated load, engine coolant temperature, fuel trim, engine speed, vehicle speed, etc.) 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, and other data from the time the malfunction occurred.



DLC3 (Data Link Connector 3)

The vehicle's ECM uses the ISO 9141–2 (Euro–OBD)/ ISO 14230(M–OBD) communication protocol. The terminal arrangement of the DLC3 complies with ISO 15031–03 and matches the ISO 9141–2/ ISO 14230 format.

HINT:

Connect the cable of the Intelligent Tester II to the DLC3, turn the ignition switch ON and attempt to use the Intelligent Tester II. If the screen displays UNABLE TO CONNECT TO VEHICLE, a problem exists in the vehicle side or the tester side.

If the communication is normal when the tool is connected to another vehicle, inspect the DLC3 on 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. Consult the Service Department listed in the tool's instruction manual.

Symbol	Terminal No.	Name	Reference terminal	Result	Condition
SIL	7	Bus "+" line	5 – Signal ground	Pulse generation	During transmission
CG	4	Chassis ground	Body ground	1 Ω or less	Always
SG	5	Signal ground	Body ground	1 Ω or less	Always
BAT	16	Battery positive	Body ground	9 to 14 V	Always

INSPECT BATTERY VOLTAGE

Battery Voltage: 11 to 14 V

If voltage is below 11 V, replace the battery before proceeding.

CHECK MIL

(a) Check that the MIL illuminates when turning the ignition switch ON.

If the MIL does not illuminate, there is a problem in the MIL circuit (refer to MIL CIRCUIT on page 05–204).

(b) When the engine is started, the MIL should turn off.

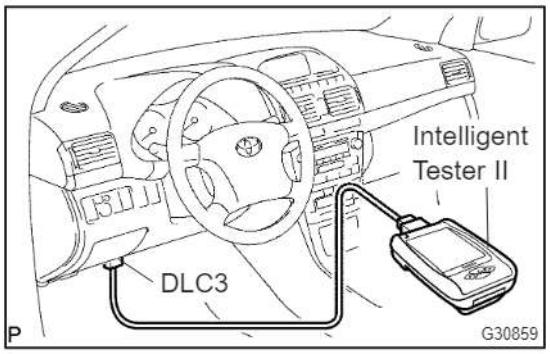
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05KAW-02

DTC CHECK/CLEAR

1. CHECK DTC WITH INTELLIGENT TESTER II

DTCs which are stored in the ECM can be displayed with the Intelligent Tester II and generic OBD scantool.
These scan tools can display pending DTCs and current DTCs. Some DTC aren't stored if the ECM doesn't detect a malfunction during consecutive driving. However, the detected malfunction during once driving is stored as pending DTC.



(a) Connect the Intelligent Tester II to the Data Link Connector 3 (DLC3).
(b) Turn the ignition switch ON.
(c) Enter the following menus: Enter/ Power train/ Engine and ECT/ DTC/ Current (or Pending).
(d) Confirm the DTCs and freeze frame data and then write them down.
(e) See page 05–245 to confirm the details of the DTCs.

NOTICE:
When simulating a symptom with the scan tool to check the DTCs, use normal mode. For codes on DIAGNOSTIC TROUBLE CODE CHART subject to "2–trip detection logic", perform the following actions.
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 MIL illuminates and the DTCs are recorded in the ECM.

2. CLEAR DTC WITH INTELLIGENT TESTER II

(a) Connect the Intelligent Tester II to the DLC3.
(b) Turn the ignition switch ON.
(c) Enter the following menus: Enter/ Power train/ Engine and ECT/ DTC/ Clear.

3. CLEAR DTC WITHOUT INTELLIGENT TESTER II

Disconnecting the battery terminal or remove the EFI and ETCS fuses from the engine room R/B for 60 seconds or more. But if you disconnect the battery terminal, you should do the "INITIALIZE" procedure.

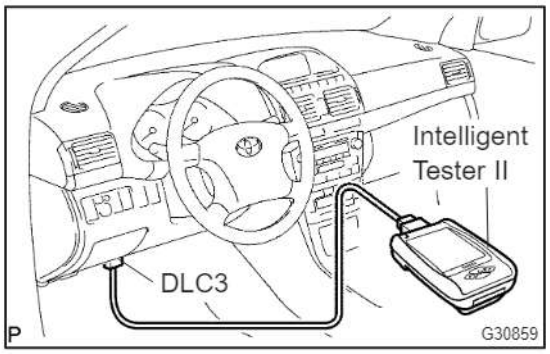
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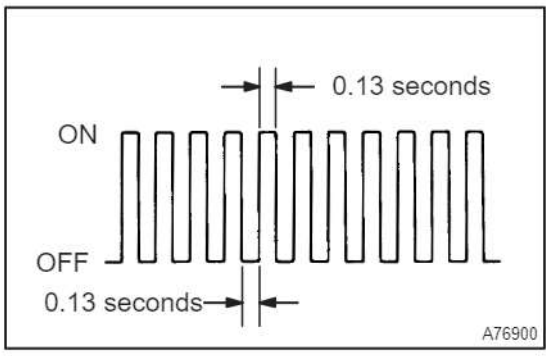
05KAX-02

CHECK MODE PROCEDURE

DESCRIPTION

Check mode has a higher sensitivity to malfunctions and can detect malfunctions that normal mode cannot detect. Check mode can also detect all the malfunctions that normal mode can detect. In check mode, DTCs are detected with 1–tirp detection logic.





CHECK MODE PROCEDURE

(a) Make sure that the items below are true:
  (1) Battery positive voltage 11 V or more
  (2) Throttle valve fully closed
  (3) Transmission in the P or N position
  (4) A/C switched OFF
(b) Turn the ignition switch OFF.
(c) Connect the Intelligent Tester II to the DLC3.
(d) Turn the ignition switch ON.
(e) Enter the following menues: Utility/ Check Mode.
(f) Change the ECM to check mode. Make sure the MIL flashes as shown in the illustration.

NOTICE:

All DTCs and freeze frame data recorded will be erased if: 1) the intelligent tester II is used to change the ECM from normal mode to check mode or vice versa; or 2) during check mode, the ignition switch is turned from ON to ACC or LOCK.

Before check mode, make notes of the DTCs and freeze frame data.

(g) Start the engine. The MIL should turn off after the engine starts.
(h) Perform "MONITOR DRIVE PATTERN" for the ECT test (see page 05–227).
  (Or, simulate the conditions of the malfunction described by the customer).
(i) After simulating the malfunction conditions, use the Intelligent Tester II diagnosis selector to check the DTC and freeze frame data.

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05KAY–02

FAIL–SAFE CHART

1. FAIL–SAFE

This function minimizes the loss of the ECT functions when any malfunction occurs in each sensor or solenoid.

(a) ATF (Automatic Transmission Fluid) temperature sensor:
When the ATF temperature sensor has a malfunction, 4th upshift is prohibited.

(b) Input turbine speed sensor NT (Speed sensor NT):
When the Input turbine speed sensor has a malfunction, 4th upshift is prohibited.

(c) Shift solenoid valve ST:
When the solenoid valve ST has a malfunction, 4th upshift is prohibited.

(d) Shift solenoid valve SLT:
When the solenoid valve SLT has a malfunction, 4th upshift is prohibited.

(e) Shift solenoid valve SB:
When the solenoid valve SB has a malfunction, S shift control is prohibited, and the driving mode turns to the normal D position.

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(f) Shift solenoid valve S1 and S2:

Fail safe function:

If either of the shift solenoid valve circuits develops an open or short, the ECM turns the other shift solenoid "ON" and "OFF" in order to shift into the gear positions shown in the table below.

Manual shifting as shown in the following table must be done (In case of a short circuit, the ECM stops sending the current to the short circuit solenoid).

Even if starting the engine in the fail–safe mode, the gear position remain in the same position.

Position	NORMAL			SHIFT SOLENOID VALVE S1 MALFUNCTIONING			SHIFT SOLENOID VALVE S2 MALFUNCTIONING			BOTH SHIFT SOLENOID VALVES MALFUNCTIONING
	Solenoid valve		Gear	Solenoid valve		Gear	Solenoid valve		Gear	Gear when shift selector is manually operated
	S1	S2		S1	S2		S1	S2		
D	ON	ON	1st	X	OFF	3rd	ON	X	2nd	3rd
	ON	OFF	2nd	X	OFF	3rd	ON	X	2nd	3rd
	OFF	OFF	3rd	X	OFF	3rd	OFF	X	3rd	3rd
	OFF	ON	4th	X	ON	4th	OFF	X	3rd	3rd
2 (S position)	ON	ON	1st	X	OFF	3rd	ON	X	2nd	3rd
	ON	OFF	2nd	X	OFF	3rd	ON	X	2nd	3rd
	OFF	OFF	3rd	X	OFF	3rd	OFF	X	3rd	3rd
1 (S position)	ON	ON	1st	X	OFF	3rd	ON	X	2nd	3rd
	ON	OFF	2nd	X	OFF	3rd	ON	X	2nd	3rd

X: OFF (the ECM stops sending current to a malfunctioning solenoid valve)

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05KAZ-02

DATA LIST/ACTIVE TEST

1. DATA LIST

HINT:

Using the Intelligent Tester II Data List allows switch, sensor, actuator and other item values to be read without removing any parts. Reading the Data List early in troubleshooting is one way to shorten labor time.

NOTICE:

In the table below, the values listed under "Normal Condition" are reference values. Do not depend solely on these reference values when deciding whether a part is faulty or not.

(a) Warm up the engine.
(b) Turn the ignition switch off.
(c) Connect the Intelligent Tester II to the DLC3.
(d) Turn the ignition switch to the ON position.
(e) Turn on the tester.
(f) Select the item "Enter / Power train / Engine and ECT / Data List".
(g) Follow the instructions on the tester and read the Data List.

Item	Measurement Item/ Range (display)	Normal Condition	Diagnostic Note
Stop Light Switch	Stop light SW Status/ ON or OFF	• Brake Pedal is depressed: ON • Brake Pedal is released: OFF	–
Neutral Position SW Signal	PNP SW Status/ ON or OFF	Shift lever position is; P and N: ON Except P and N: OFF	When the shift lever position displayed on the hand–held tester differs from the actual position, adjustment of the PNP switch or the shift cable may be incorrect. HINT: When the failure still occurs even after adjusting these parts, see page 05–247.
Shift SW Status (R Range)	PNP SW Status/ ON or OFF	Shift lever position is; R: ON Except R: OFF	↑
Shift SW Status (D Range)	PNP SW Status/ ON or OFF	Shift lever position is; D and S: ON Except D and S: OFF	↑
Shift Status	Actual Gear position/ 1st, 2nd, 3rd, 4th (O/D)	Shift lever position is; • D: 1st, 2nd, 3rd or 4th • S: 1st, 2nd, 3rd or 4th	–
Lock Up Solenoid Status	Lock Up Solenoid Status/ ON or OFF	• Lock Up: ON • Except Lock Up: OFF	–
SLT Solenoid Status	Shift Solenoid SLT Status/ ON or OFF	• Accelerator pedal is depressed: OFF • Accelerator pedal is released: ON	–
A/T Oil Temperature 1	ATF Temp. Sensor Value/ min.: –40°C (–40°F) max.: 215°C (419°F)	• After Stall Test; Approx. 80°C (176°F) • Equal to ambient temperature when the engine is cold	If the value is "–40°C (–40°F)" or "215°C (419°F)", ATF temp. sensor circuit is opened or shorted.

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Kick Down Switch Status *1	Kick down SW Status/ ON or OFF	• Accelerator Pedal is depressed all the way down: ON • Accelerator Pedal is released: OFF	–
Snow Switch Status	Pattern SW (ECT SNOW) Status/ ON or OFF	• IG SW ON: OFF ↓ • Pattern SW (ECT SNOW) Push: ON ↓ • Pattern SW (ECT SNOW) Push: OFF	–

HINT:
*1: LHD

2. ACTIVE TEST

HINT:
Performing the Intelligent Tester II Active Test allows relay, Vacuum Switching Valve (VSV), actuator and other items to be operated without removing any parts. Performing the Active Test early in troubleshooting is one way to shorten labor time. The Data List can be displayed during the Active Test.

(a) Warm up the engine.
(b) Turn the ignition switch off.
(c) Connect the Intelligent Tester II to the DLC3.
(d) Turn the ignition switch to the ON position.
(e) Turn on the tester.
(f) Select the item "Enter / Power train / Engine and ECT / Active Test".
(g) Follow the instructions on the tester and read the Active Test.

Item	Test Details	Diagnostic Note
Control the Shift Position	[Test Details] Operate the shift solenoid valve and set the each shift position by yourself. [Vehicle Condition] Less than 50 km/h (31 mph) [Others] • Press "→" button: Shift up • Press "←" button: Shift down	Possible to check the operation of the shift solenoid valves.
Control the Lock Up	[Test Details] Control the shift solenoid SL to set the automatic transaxle to the lock–up condition. [Vehicle Condition] Vehicle Speed: 58 km/h (36 mph) or more	Possible to check the SL operation.
Control the Line Pressure Up *	[Test Details] Operate the shift solenoid SLT and raise the line pressure. [Vehicle Condition] • Vehicle Stopped. • IDL: ON [HINT] OFF: Line pressure up (When the active test of "LINE PRESS UP" is performed, the ECM commands the SLT solenoid to turn off). ON: No action (normal operation)	–

*: "Control the Line Pressure Up" in the ACTIVE TEST is performed to check the line pressure changes by connecting the SST to the automatic transmission, which is used in the HYDRAULIC TEST (see page 05–223) as well.

HINT:
The pressure values in ACTIVE TEST and HYDRAULIC TEST are different from each other.

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0569K-10

DIAGNOSTIC TROUBLE CODE CHART

If a DTC is displayed during the DTC check, check the parts listed in the table below and proceed to the page given.

HINT:

- *1 : ● ... MIL (Malfunction Indicator Lamp) light up
- *2 : "○" mark means ECM memorizes the malfunction code if the ECM detects the DTC detection condition.
- This DTC may be output when the clutch, brake and gear components etc. inside the automatic transaxle are damaged.

DTC No. (See Page)	Detection Item	Trouble Area	MIL *1	Memory *2
P0500 (05–158)	Vehicle Speed Sensor "A"	• Combination meter • Open or short in vehicle speed sensor circuit • Vehicle speed sensor • ECM	●	○
P0705 (05–247)	Transmission Range Sensor Circuit Malfunction (PRNDL Input)	• Open or short in park/neutral position switch circuit • Park/neutral position switch • ECM	●	○
P0710 (05–252)	Transmission Fluid Temperature Sensor "A" Circuit	• Open or short in ATF temperature sensor circuit • Transmission wire (ATF temperature sensor) • ECM	●	○
P0711 (05–255)	Transmission Fluid Temperature Sensor "A" Performance	• Open or short in ATF temperature sensor circuit • Transmission wire (ATF temperature sensor) • ECM	●	○
P0712 (05–252)	Transmission Fluid Temperature Sensor "A" Circuit Low Input	• Short in ATF temperature sensor circuit • Transmission wire (ATF temperature sensor) • ECM	●	○
P0713 (05–252)	Transmission Fluid Temperature Sensor "A" Circuit High Input	• Open in ATF temperature sensor circuit • Transmission wire (ATF temperature sensor) • ECM	●	○
P0717 (05–258)	Turbine Speed Sensor Circuit No Signal	• Open or short in transmission revolution sensor NT (speed sensor NT) circuit • Transmission revolution sensor NT (speed sensor NT) • ECM • Automatic transaxle assembly	●	○
P0724 (05–261)	Brake Switch "B" Circuit High	• Short in stop light switch circuit • Stop light switch • ECM	●	○
P0741 (05–264)	Torque Converter Clutch Solenoid Performance (Shift Solenoid Valve SL)	• Shift solenoid valve SL remains open or closed • Valve body is blocked • Shift solenoid valve SL • Torque converter clutch • Automatic transaxle (clutch, brake or gear etc.) • Line pressure is too low • ECM	●	○
P0751 (05–268)	Shift Solenoid "A" Performance (Shift Solenoid Valve S1)	• Shift solenoid valve S1 remains open or closed • Valve body is blocked • Shift solenoid valve S1 • Automatic transaxle (clutch, brake or gear etc.) • ECM	●	○
P0756 (05–271)	Shift Solenoid "B" Performance (Shift Solenoid Valve S2)	• Shift solenoid valve S2 remains open or closed • Valve body is blocked • Shift solenoid valve S2 • Automatic transaxle (clutch, brake or gear etc.) • ECM	●	○

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P0787 (05–274)	Shift/Timing Solenoid Low (Shift Solenoid Valve ST)	• Short in shift solenoid valve ST circuit • Shift solenoid valve ST • ECM	●	○
P0788 (05–274)	Shift/Timing Solenoid High (Shift Solenoid Valve ST)	• Open in shift solenoid valve ST circuit • Shift solenoid valve ST • ECM	●	○
P0973 (05–277)	Shift Solenoid "A" Control Circuit Low (Shift Solenoid Valve S1)	• Short in shift solenoid valve S1 circuit • Shift solenoid valve S1 • ECM	●	○
P0974 (05–277)	Shift Solenoid "A" Control Circuit High (Shift Solenoid Valve S1)	• Open in shift solenoid valve S1 circuit • Shift solenoid valve S1 • ECM	●	○
P0976 (05–280)	Shift Solenoid "B" Control Circuit Low (Shift Solenoid Valve S2)	• Short in shift solenoid valve S2 circuit • Shift solenoid valve S2 • ECM	●	○
P0977 (05–280)	Shift Solenoid "B" Control Circuit High (Shift Solenoid Valve S2)	• Open in shift solenoid valve S2 circuit • Shift solenoid valve S2 • ECM	●	○
P0998 (05–283)	Shift Solenoid "F" Control Circuit Low (Shift Solenoid Valve SB)	• Short in shift solenoid valve SB circuit • Shift solenoid valve SB • ECM	●	○
P0999 (05–283)	Shift Solenoid "F" Control Circuit High (Shift Solenoid Valve SB)	• Open in shift solenoid valve SB circuit • Shift solenoid valve SB • ECM	●	○
P2716 (05–286)	Pressure Control Solenoid "D" Electrical (Shift Solenoid Valve SLT)	• Open or short in shift solenoid valve SLT circuit • Shift solenoid valve SLT • ECM	●	○
P2769 (05–289)	Torque Converter Clutch Solenoid Circuit Low (Shift Solenoid Valve SL)	• Short in shift solenoid valve SL circuit • Shift solenoid valve SL • ECM	●	○
P2770 (05–289)	Torque Converter Clutch Solenoid Circuit High (Shift Solenoid Valve SL)	• Open in shift solenoid valve SL circuit • Shift solenoid valve SL • ECM	●	○

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DTC	P0705	TRANSMISSION RANGE SENSOR CIRCUIT MALFUNCTION (PRNDL INPUT)

CIRCUIT DESCRIPTION

The park/neutral position switch detects the shift lever position and sends signals to the ECM.

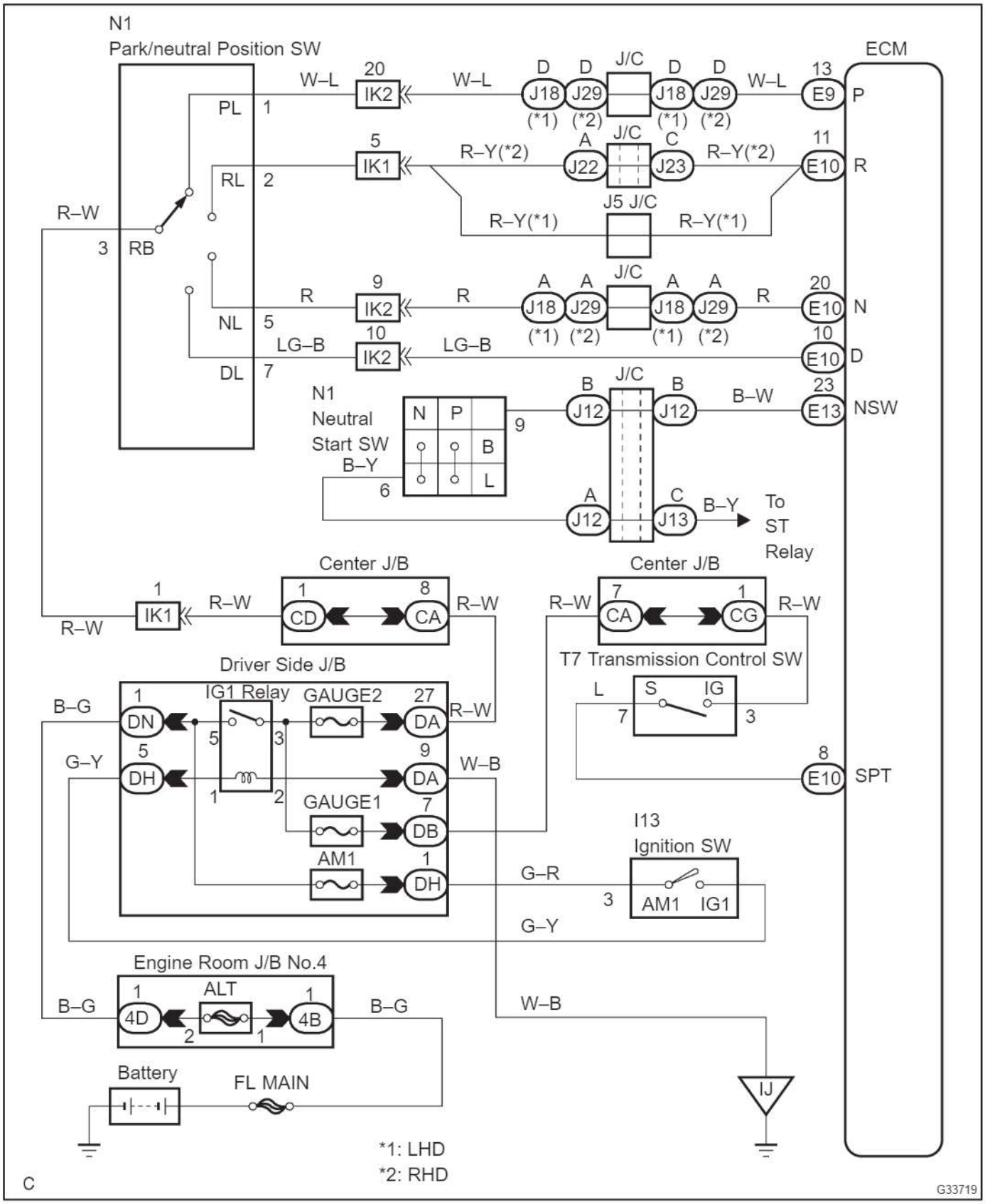
DTC No.	DTC Detection Condition	Trouble Area
P0705	(A) Any 2 or more signals of the following are ON simultaneously (2–trip detection logic) • P input signal is ON. • N input signal is ON. • R input signal is ON. • D input signal is ON. (B) When any of following conditions is met for 2.0 sec. or more in the S position (2–trip detection logic) • P input signal is ON. • N input signal is ON. • R input signal is ON.	• Open or short in park/neutral position switch circuit • Park/neutral position switch • ECM

MONITOR DESCRIPTION

The park/neutral position switch detects the shift lever position and sends a signal to the ECM.
For security, the park/neutral position switch detects the shift lever position so that engine can be started only when the vehicle is in P or N shift position.
When the park/neutral position switch sends more than one signal at a time from switch positions P, R, N or D, the ECM interprets this as a fault in the switch. The ECM will turn on the MIL and store the DTC.

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WIRING DIAGRAM



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INSPECTION PROCEDURE

HINT:

Using the Intelligent Tester II Data List allows switch, sensor, actuator and other item values to be read without removing any parts. Reading the Data List early in troubleshooting is one way to shorten labor time.

NOTICE:

In the table below, the values listed under "Normal Condition" are reference values. Do not depend solely on these reference values when deciding whether a part is faulty or not.

(a) Turn the ignition switch off.
(b) Connect the Intelligent Tester II to the DLC3.
(c) Turn the ignition switch to the ON position.
(d) Turn on the tester.
(e) Select the item "Enter / Power train / Engine and ECT / Data List".
(f) Follow the instructions on the tester and read the Data List.

Item	Measurement Item/ Range (display)	Normal Condition	Diagnostic Note
Neutral Position SW Signal	PNP SW Status/ ON or OFF	Shift lever position is; P and N: ON Except P and N: OFF	When the shift lever position displayed on the hand–held tester differs from the actual position, adjustment of the PNP switch or the shift cable may be incorrect.
Shift SW Status (R Range)	PNP SW Status/ ON or OFF	Shift lever position is; R: ON Except R: OFF	↑
Shift SW Status (D Range)	PNP SW Status/ ON or OFF	Shift lever position is; D and S: ON Except D and S: OFF	↑

1 INSPECT PARK/NEUTRAL POSITION SWITCH ASSY

Switch Side:
(Connector Front View):



(a) Disconnect the park/neutral position switch connector.
(b) Measure resistance according to the value(s) in the table below when the shift lever is moved to each position.

Standard:

Shift Position	Tester Connection	Specified Condition
P	1 – 3 and 6 – 9	Below 1 Ω
Except P	↑	10 kΩ or higher
R	2 – 3	Below 1 Ω
Except R	↑	10 kΩ or higher
N	3 – 5 and 6 – 9	Below 1 Ω
Except N	↑	10 kΩ or higher
D, S, "+" and "–"	3 – 7	Below 1 Ω
Except D, S, "+" and "–"	↑	10 kΩ or higher

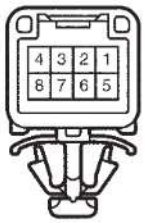
NG → **REPLACE PARK/NEUTRAL POSITION SWITCH ASSY (See Pub. No. RM1018E, page 40–3)**

OK

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2 INSPECT SHIFT LOCK CONTROL UNIT ASSY

Switch Side:
(Connector Front View):



T7

G28380

(a) Connect the park/neutral position switch connector.
(b) Disconnect the transmission control switch connector of shift lock control unit assy.
(c) Measure resistance according to the value(s) in the table below when the shift lever is moved to each position.

Standard:

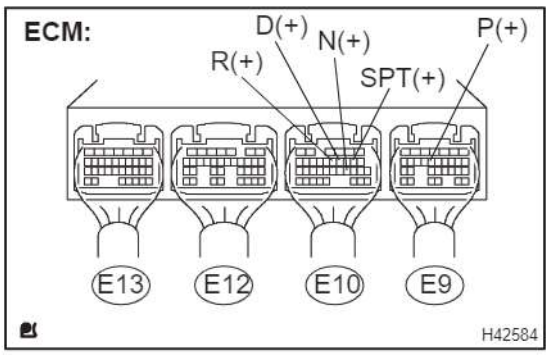
Shift Position	Tester Connection	Specified Condition
S, "+" and "–"	3 – 7	Below 1 Ω
Except S, "+" and "–"	↑	10 kΩ or higher

NG → **REPLACE SHIFT LOCK CONTROL UNIT ASSY (See Pub. No. RM1018E, page 40–60)**

OK

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3	CHECK HARNESS AND CONNECTOR(PARK/NEUTRAL POSITION SWITCH – ECM)



(a) Connect the transmission control switch connector of shift lock control unit assy.

(b) Turn the ignition switch to the ON position, and measure the voltage according to the value(s) in the table below when the shift lever is moved to each position.

Standard:

Shift Position	Tester connection	Specified condition
P	E9 – 13 (P) – Body ground	10 to 14 V
Except P	↑	Below 1 V
N	E10 – 20 (N) – Body ground	10 to 14 V
Except N	↑	Below 1 V
R	E10 – 11 (R) – Body ground	10 to 14 V*
Except R	↑	Below 1 V
D and S	E10 – 10 (D) – Body ground	10 to 14 V
Except D and S	↑	Below 1 V
S, "+" and "–"	E10 – 8 (SPT) – Body ground	10 to 14 V
Except S, "+" and "–"	↑	Below 1 V

HINT:

*: The voltage will drop slightly due to lighting up of the back up light.

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR (SEE PAGE 01–32)**

OK

REPLACE ECM

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DTC	P0710	TRANSMISSION FLUID TEMPERATURE SENSOR "A" CIRCUIT

DTC	P0712	TRANSMISSION FLUID TEMPERATURE SENSOR "A" CIRCUIT LOW INPUT

DTC	P0713	TRANSMISSION FLUID TEMPERATURE SENSOR "A" CIRCUIT HIGH INPUT

CIRCUIT DESCRIPTION

The ATF (Automatic Transmission Fluid) temperature sensor converts the fluid temperature into a resistance value which is input into the ECM.
The ECM applies a voltage to the temperature sensor through ECM terminal THO.
The sensor resistance changes with the transmission fluid temperature. As the temperature becomes higher, the sensor resistance decreases.
One terminal of the sensor is grounded so that the sensor resistance decreases and the voltage goes down as the temperature becomes higher.
The ECM calculates the fluid temperature based on the voltage signal.

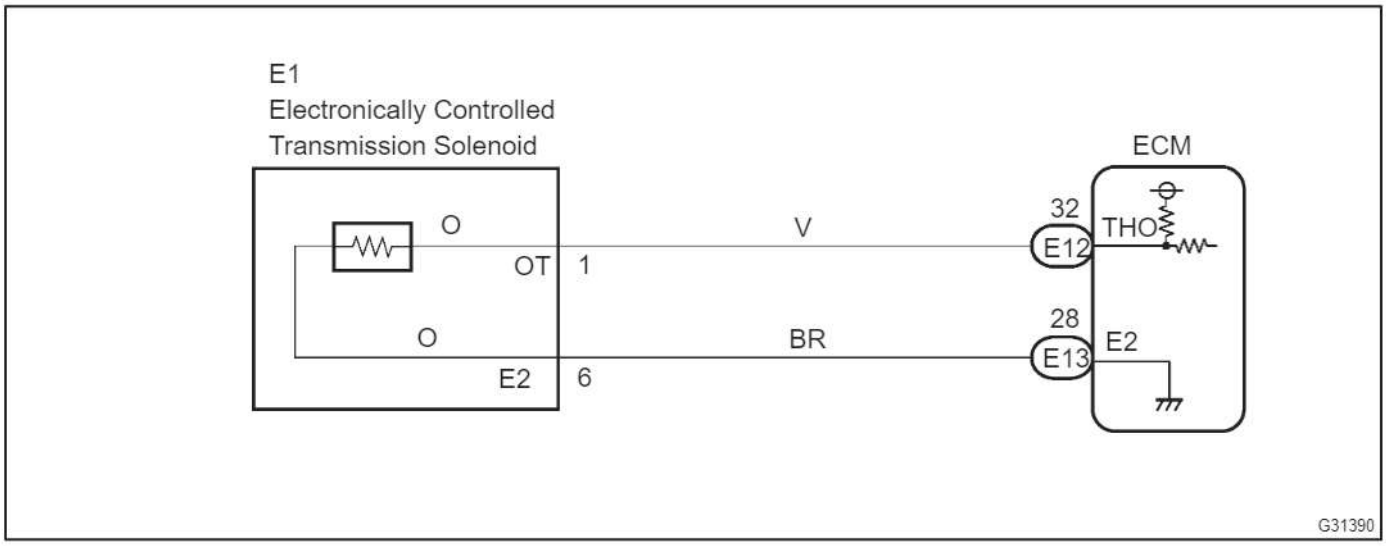
DTC No.	DTC Detection Condition	Trouble Area
P0710	(a) and (b) is detected momentary within 0.5 sec. when neither P0712 or P0713 is not detected (1–trip detection logic) (a) ATF temperature sensor resistance is less than 79 Ω. (b) ATF temperature sensor resistance is more than 156 kΩ. HINT: Within 0.5 sec., the malfunction switches from (a) to (b) or from (b) to (a)	• Open or short in ATF temperature sensor circuit • Transmission wire (ATF temperature sensor) • ECM
P0712	ATF temperature sensor resistance is less than 79 Ω for 0.5 sec. or more (1–trip detection logic)	• Short in ATF temperature sensor circuit • Transmission wire (ATF temperature sensor) • ECM
P0713	ATF temperature sensor resistance is more than 156 kΩ when 15 minutes or more after the engine start DTC is detected for 0.5 sec. or more (1–trip detection logic)	• Open in ATF temperature sensor circuit • Transmission wire (ATF temperature sensor) • ECM

MONITOR DESCRIPTION

The automatic transmission fluid (ATF) temperature sensor converts ATF temperature to an electrical resistance value. Based on the resistance, the ECM determines the ATF temperature, and the ECM detects an opens or shorts in the ATF temperature circuit. If the resistance value of the ATF temperature is less than 79 Ω*1 or more than 156 kΩ*2, the ECM interprets this as a fault in the ATF sensor or wiring. The ECM will turn on the MIL and store the DTC.
*1: 150°C (302°F) or more is indicated regardless of the actual ATF temperature.
*2: –40°C (–40°F) is indicated regardless of the actual ATF temperature.
HINT:
The ATF temperature can be checked on the Intelligent Tester II display.

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WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:
Using the Intelligent Tester II Data List allows switch, sensor, actuator and other item values to be read without removing any parts. Reading the Data List early in troubleshooting is one way to shorten labor time.
NOTICE:
In the table below, the values listed under "Normal Condition" are reference values. Do not depend solely on these reference values when deciding whether a part is faulty or not.
(a) Warm up the engine.
(b) Turn the ignition switch off.
(c) Connect the Intelligent Tester II to the DLC3.
(d) Turn the ignition switch to the ON position.
(e) Turn on the tester.
(f) Select the item "Enter / Power train / Engine and ECT / Data List".
(g) Follow the instructions on the tester and read the Data List.

Item	Measurement Item/ Range (display)	Normal Condition
A/T Oil Temperature 1	ATF Temp. Sensor Value/ min.: –40°C (–40°F) max.: 215°C (419°F)	• After Stall Test; Approx. 80°C (176°F) • Equal to ambient temperature when cold soak

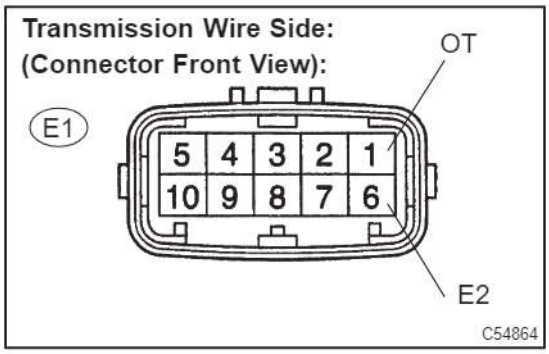
HINT:
When DTC P0712 is output and Intelligent Tester II output is 150°C (302°F) or more, there is a short circuit.
When DTC P0713 is output and Intelligent Tester II output is –40°C (–40°F), there is an open circuit.
Measure the resistance between terminal THO (OT) and body ground.

Temperature Displayed	Malfunction
–40°C (–40°F)	Open circuit
150°C (302°F) or more	Short circuit

HINT:
If a circuit related to the ATF temperature sensor becomes open, P0713 is immediately set (in 0.5 second).
When P0713 is set, P0711 cannot be detected.
It is not necessary to inspect the circuit when P0711 is set.

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1 INSPECT TRANSMISSION WIRE(ATF TEMPERATURE SENSOR)



(a) Disconnect the transmission wire connector from the transaxle.

(b) Measure the resistance according to the value(s) in the table below.

Standard:

Tester Connection	Specified Condition
1 (OT) – 6 (E2)	79 Ω to 156 kΩ

(c) Measure the resistance according to the value(s) in the table below.

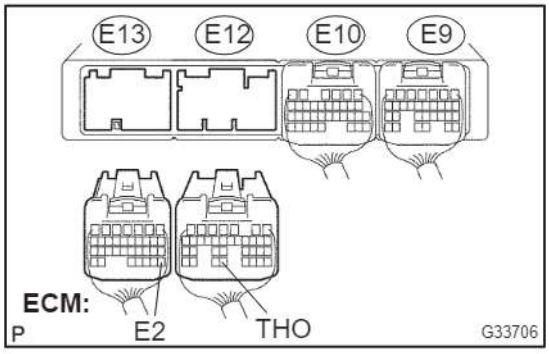
Standard (Check for short):

Tester Connection	Specified Condition
1 (OT) – Body ground	10 kΩ or higher
6 (E2) – Body ground	↑

NG → **REPAIR OR REPLACE TRANSMISSION WIRE (See Pub. No. RM1018E, page 40–51)**

OK

2 CHECK HARNESS AND CONNECTOR(TRANSMISSION WIRE – ECM)



(a) Connect the transmission wire connector to the transaxle.

(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard:

Tester Connection	Specified Condition
E12 – 32 (THO) – E13 – 28 (E2)	79 Ω to 156 kΩ

(d) Measure the resistance according to the value(s) in the table below.

Standard (Check for short):

Tester Connection	Specified Condition
E12 – 32 (THO) – Body ground	10 kΩ or higher
E13 – 28 (E2) – Body ground	↑

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR (SEE PAGE 01–32)**

OK

REPLACE ECM

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DTC	P0711	TRANSMISSION FLUID TEMPERATURE SENSOR "A" PERFORMANCE

CIRCUIT DESCRIPTION

The ATF (Automatic Transmission Fluid) temperature sensor converts the fluid temperature into a resistance value which is input into the ECM.

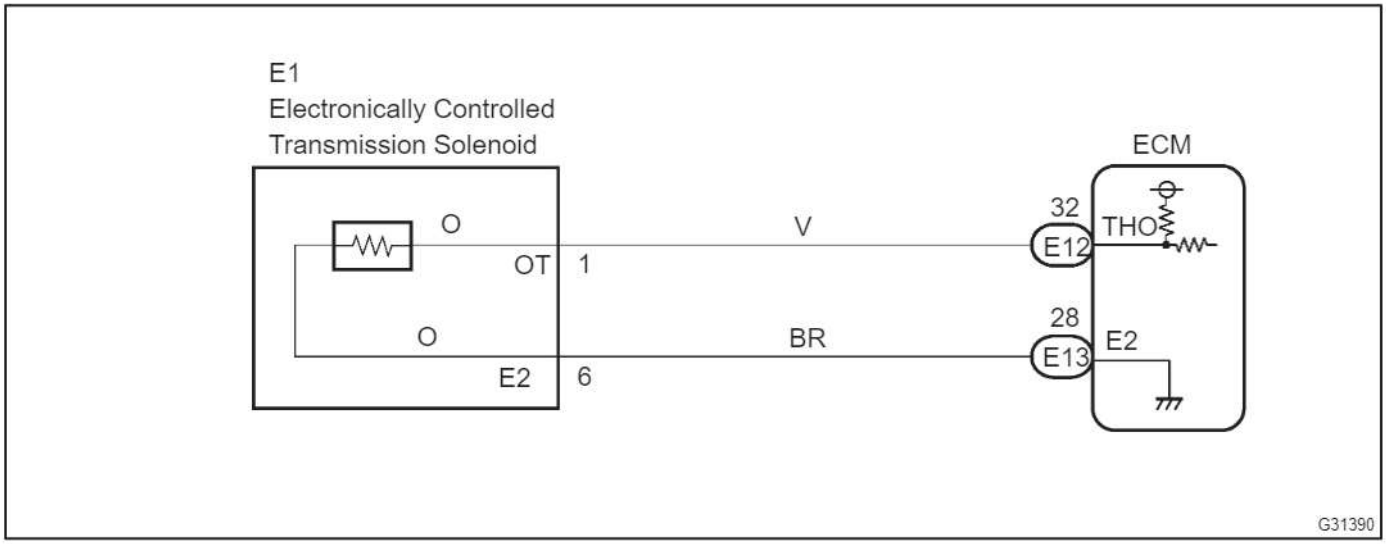
DTC No.	DTC Detection Condition	Trouble Area
P0711	(A) Both (a) and (b) are detected: (2–trip detection logic) (a) Intake air and engine coolant temperatures are more than –10°C (14°F) at engine start (b) After normal driving for over 19 min. and 8 km (5 mile) or more, ATF temp. is less than 10°C (50°F)	• Open or short in ATF temperature sensor circuit • Transmission wire (ATF temperature sensor) • ECM

MONITOR DESCRIPTION

The ATF temperature sensor converts the ATF temperature to an electrical resistance value. Based on the resistance, the ECM determines the ATF temperature and detects an opens or shorts in the ATF temperature circuit or a fault of the ATF temperature sensor.

After running the vehicle for a certain period, the ATF temperature should increase. If the ATF temperature is below 10°C (50°F) after running the vehicle for a certain period, the ECM interprets this as a fault, and turns on the MIL.

WIRING DIAGRAM



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INSPECTION PROCEDURE

HINT:
Using the Intelligent Tester II Data List allows switch, sensor, actuator and other item values to be read without removing any parts. Reading the Data List early in troubleshooting is one way to shorten labor time.
NOTICE:
In the table below, the values listed under "Normal Condition" are reference values. Do not depend solely on these reference values when deciding whether a part is faulty or not.
(a) Warm up the engine.
(b) Turn the ignition switch off.
(c) Connect the Intelligent Tester II to the DLC3.
(d) Turn the ignition switch to the ON position.
(e) Turn on the tester.
(f) Select the item "Enter / Power train / Engine and ECT / Data List".
(g) Follow the instructions on the tester and read the Data List.

Item	Measurement Item/ Range (display)	Normal Condition
A/T Oil Temperature 1	ATF Temp. Sensor Value/ min.: –40°C (–40°F) max.: 215°C (419°F)	• After Stall Test; Approx. 80°C (176°F) • Equal to ambient temperature when cold soak

HINT:
When DTC P0712 is output and Intelligent Tester II output is 150°C (302°F) or more, there is a short circuit.
When DTC P0713 is output and Intelligent Tester II output is –40°C (–40°F), there is an open circuit.
Measure the resistance between terminal THO (OT) and body ground.

Temperature Displayed	Malfunction
–40°C (–40°F)	Open circuit
150°C (302°F) or more	Short circuit

HINT:
If a circuit related to the ATF temperature sensor becomes open, P0713 is immediately set (in 0.5 second).
When P0713 is set, P0711 cannot be detected.
It is not necessary to inspect the circuit when P0711 is set.

1	CHECK OTHER DTCS OUTPUT(IN ADDITION TO DTC P0711)

(a) Connect the Intelligent Tester II to the DLC3.
(b) Turn the ignition switch to the ON position.
(c) Turn on the tester.
(d) Select the item "Power train / Engine and ECT / DTC / Current or Pending".
(e) Read the DTCs using the Intelligent Tester II.
Result:

Display (DTC output)	Proceed to
Only "P0711" is output	A
"P0711" and other DTCs	B

HINT:
If any other codes besides "P0711" are output, perform troubleshooting for those DTCs first.

B → GO TO RELEVANT DTC CHART (SEE PAGE 05–245)

A

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2	CHECK TRANSAXLE FLUID LEVEL (See Pub. No. RM1018E, page 40–2)

OK:
Automatic transaxle fluid level is correct.

NG → ADD FLUID

OK ↓

REPLACE TRANSMISSION WIRE (See Pub. No. RM1018E, page 40–51)

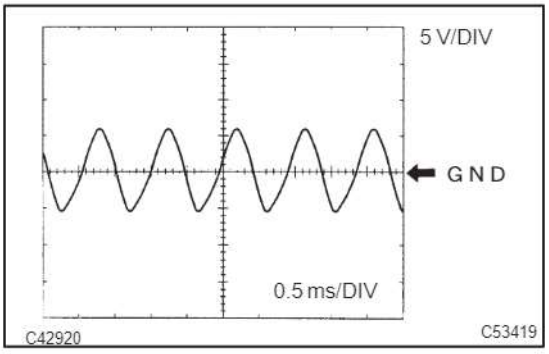
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DTC	P0717	TURBINE SPEED SENSOR CIRCUIT NO SIGNAL

CIRCUIT DESCRIPTION

This sensor detects the rotation speed of the input turbine. By comparing the input turbine speed signal (NT) with the vehicle speed sensor signal, the ECM detects the shift timing of the gears and appropriately controls the engine torque and hydraulic pressure according to various conditions. Thus, providing smooth gear shift.

DTC No.	DTC Detection Condition	Trouble Area
P0717	ECM detects conditions (a), (b) and (c) continuity for 5 sec. or more: (1–trip detection logic) (a) Vehicle speed: 50 km/h (31 mph) or more (b) Park/neutral position switch (NSW, R and L) is OFF (c) Speed sensor (NT): less than 300 rpm	• Open or short in transmission revolution sensor NT (speed sensor NT) circuit • Transmission revolution sensor NT (speed sensor NT) • ECM



Reference (Using an oscilloscope):

Check the waveform between the terminals NT+ and NT– of the ECM connector.

Standard: Refer to the illustration.

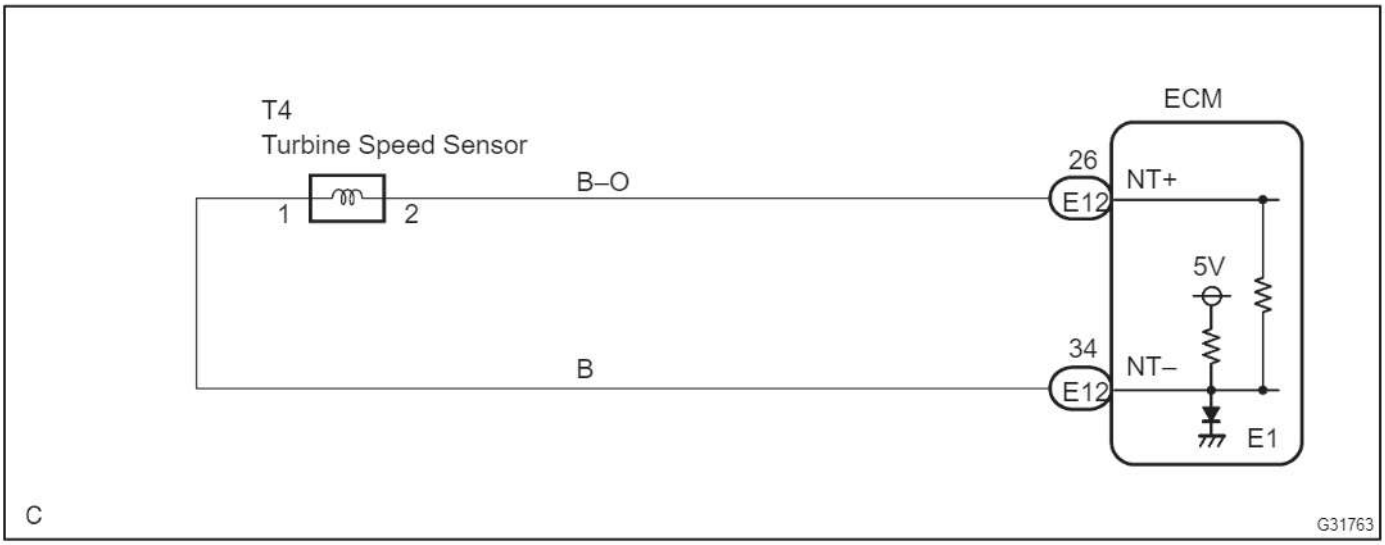
Terminal	NT+ – NT–
Tool setting	5V/DIV, 0.5ms/DIV
Vehicle condition	Vehicle speed 20 km/h (12 mph)

MONITOR DESCRIPTION

The input speed sensor detects the transmission input shaft speed. The ECM determines the gear shift timing based on a comparison of the input speed sensor (input shaft speed) with the output speed sensor (output shaft speed).

When the output shaft speed is higher then the expected value and the input shaft speed is 300 rpm or less while running with the shift in the D position, the ECM will conclude that there is malfunction of the input turbine speed sensor (NT). The ECM will illuminate the MIL.

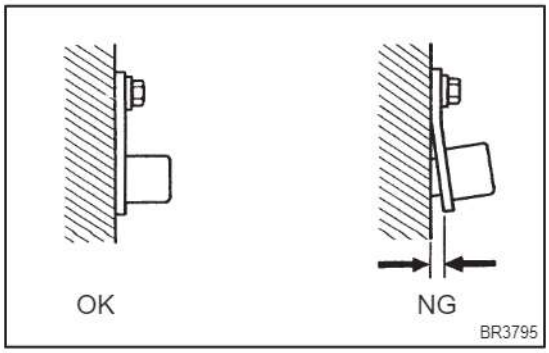
WIRING DIAGRAM



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INSPECTION PROCEDURE

1 INSPECT SPEED SENSOR INSTALLATION

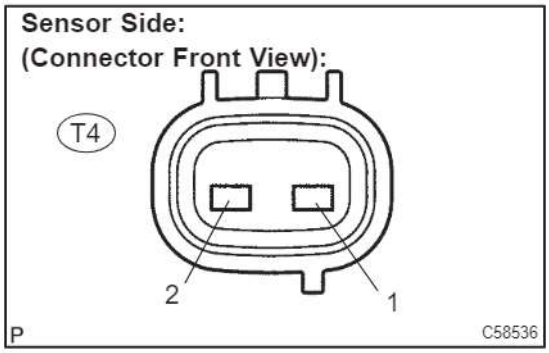


(a) Check the speed sensor installation.
OK:
The installation bolt is tightened properly and there is no clearance between the sensor and transaxle case.

NG → **REPLACE SPEED SENSOR(NT)**

OK

2 INSPECT SPEED SENSOR(NT)



(a) Disconnect the speed sensor connector from the transaxle.
(b) Measure the resistance according to the value(s) in the table below.
Standard:

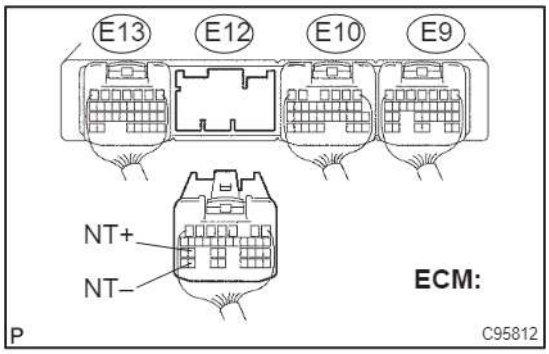
Tester Connection	Specified Condition 20 °C (68 °F)
1 – 2	560 to 680 Ω

NG → **REPLACE SPEED SENSOR(NT)**

OK

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3	CHECK HARNESS AND CONNECTOR(SPEED SENSOR – ECM)



(a) Connect the speed sensor connector.
(b) Disconnect the ECM connector.
(c) Measure the resistance according to the value(s) in the table below.

Standard:

Tester Connection	Specified Condition 20 °C (68 °F)
E12 – 26 (NT+) – E12 – 34 (NT–)	560 to 680 Ω

(d) Measure the resistance according to the value(s) in the table below.

Standard (Check for short):

Tester Connection	Specified Condition
E12 – 26 (NT+) – Body ground	10 kΩ or higher
E12 – 34 (NT–) – Body ground	↑

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR (SEE PAGE 01–32)**

OK

REPLACE ECM

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DTC	P0724	BRAKE SWITCH "B" CIRCUIT HIGH

CIRCUIT DESCRIPTION

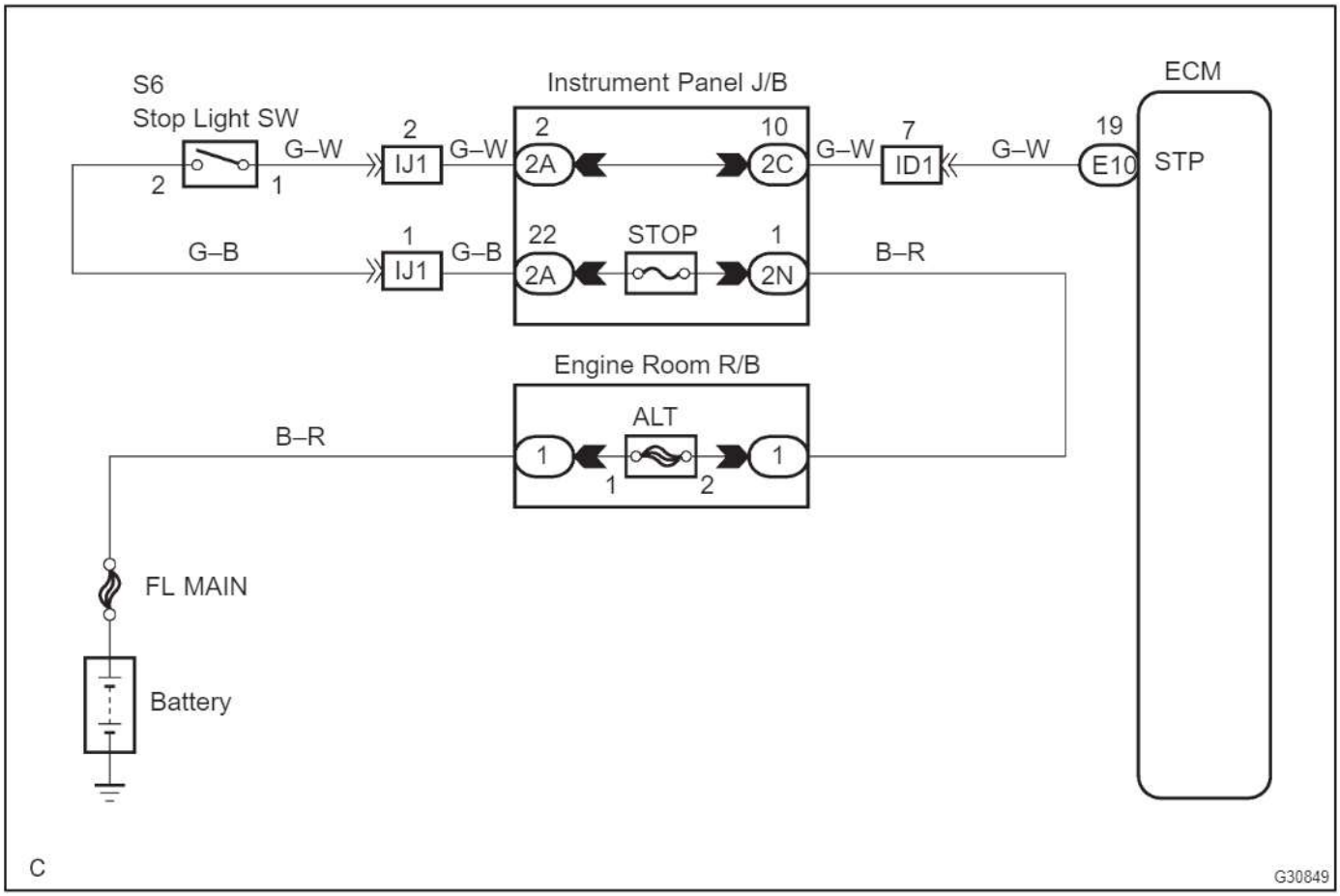
The purpose of this circuit is to prevent the engine from stalling while driving in lock–up condition, when brakes are suddenly applied.
When the brake pedal is depressed, this switch sends a signals to the ECM. Then the ECM cancels the operation of the lock–up clutch while braking is in progress.

DTC No.	DTC Detecting Condition	Trouble Area
P0724	The stop light switch remains ON even when the vehicle is driven in a GO (30 km/h) and STOP (3 km/h) fashion 10 times. (2–trip detection logic).	• Short in stop light switch signal circuit • Stop light switch • ECM

MONITOR DESCRIPTION

This DTC indicates that the stop light switch remains on. When the stop light switch remains ON during "stop and go" driving, the ECM interprets this as a fault in the stop light switch and the MIL comes on and the ECM stores the DTC. The vehicle must stop (less than 3 km/h (2 mph)) and go (30 km/h (19 mph) or more) ten times for two driving cycles in order to detect malfunction.

WIRING DIAGRAM



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INSPECTION PROCEDURE

HINT:

Using the Intelligent Tester II Data List allows switch, sensor, actuator and other item values to be read without removing any parts. Reading the Data List early in troubleshooting is one way to shorten labor time.

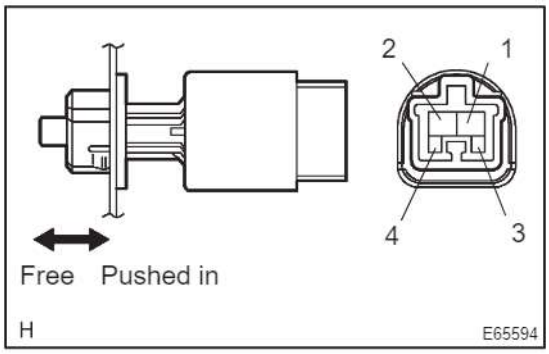
NOTICE:

In the table below, the values listed under "Normal Condition" are reference values. Do not depend solely on these reference values when deciding whether a part is faulty or not.

(a) Warm up the engine.
(b) Turn the ignition switch off.
(c) Connect the Intelligent Tester II to the DLC3.
(d) Turn the ignition switch to the ON position.
(e) Turn on the tester.
(f) Select the item "Enter / Power train / Engine and ECT / Data List".
(g) Follow the instructions on the tester and read the Data List.

Item	Measurement Item/ Range (display)	Normal Condition
Stop Light Switch	Stop light SW Status/ ON or OFF	• Brake Pedal is depressed: ON • Brake Pedal is released: OFF

1 INSPECT STOP LAMP SWITCH ASSY



(a) Remove the stop lamp switch assy.
(b) Measure the resistance according to the value(s) in the table below.

Standard:

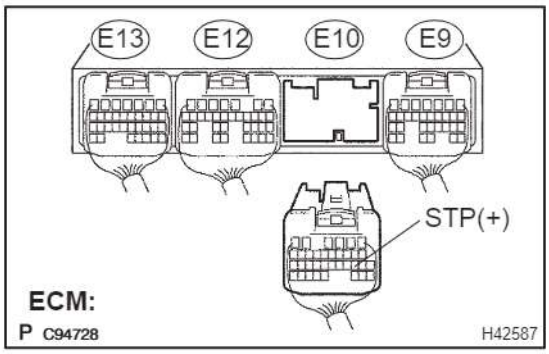
Switch position	Tester Connection	Specified Condition
Switch pin free	1 – 2	Below 1 Ω
Switch pin pushed in	↑	10 kΩ or higher
Switch pin free	3 – 4	10 kΩ or higher
Switch pin pushed in	↑	Below 1 Ω

NG → **REPLACE STOP LAMP SWITCH ASSY**

OK

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2	CHECK HARNESS AND CONNECTOR(STOP LAMP SWITCH ASSY – ECM)



(a) Install the stop lamp switch assy.
(b) Measure the voltage according to the value(s) in the table below when the brake pedal is depressed and released.

Standard:

Condition	Tester Connection	Specified Condition
Brake pedal is depressed	E10 – 19 (STP) – Body ground	10 to 14 V
Brake pedal is released	↑	Below 1 V

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR (SEE PAGE 01–32)**

OK

REPLACE ECM

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DTC	P0741	TORQUE CONVERTER CLUTCH SOLENOID PERFORMANCE (SHIFT SOLENOID VALVE SL)

SYSTEM DESCRIPTION

The ECM uses the signals from the throttle position sensor, Air–flow meter, turbine (input) speed sensor and crankshaft position sensor to monitor the engagement condition of the lock–up clutch.
Then the ECM compares the engagement condition of the lock–up clutch with the lock–up schedule in the ECM memory to detect a mechanical problems of the shift solenoid valve SL, valve body and torque converter clutch.

DTC No.	DTC Detection Condition	Trouble Area
P0741	Lock–up does not occur when driving in lock–up range (normal driving at 85 km/h [53 mph]), or lock–up remains ON in lock–up OFF range (2–trip detection logic)	• Shift solenoid valve SL remains open or closed • Valve body is blocked • Shift solenoid valve SL • Torque converter clutch • Automatic transaxle (clutch, brake or gear etc.) • Line pressure is too low • ECM

MONITOR DESCRIPTION

Based on the signals from the throttle position sensor, the airflow meter and the crankshaft position sensor, the ECM sends a signal to the shift solenoid valve SL to regulate the hydraulic pressure and provide smoother gearshifts. The shift–solenoid valve SL responds to commands from the ECM. The valve controls the lock–up relay valve to perform torque converter lock–up functions.
The ECM compares the engine rpm (NE) signal and the input turbine speed signal to detect torque converter lock–up. The ECM then compares the lock–up status against the lock–up schedule in the ECM memory. If the ECM does not detect lock–up at the appropriate time, it will conclude that there is a malfunction of shift solenoid SL. The ECM will illuminate the MIL.

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INSPECTION PROCEDURE

HINT:

Performing the Intelligent Tester II Active Test allows relay, Vacuum Switching Valve (VSV), actuator and other items to be operated without removing any parts. Performing the Active Test early in troubleshooting is one way to shorten labor time. The Data List can be displayed during the Active Test.

(a) Warm up the engine.
(b) Turn the ignition switch off.
(c) Connect the Intelligent Tester II to the DLC3.
(d) Turn the ignition switch to the ON position.
(e) Turn on the tester.
(f) Clear the DTC.
(g) Select the item "Enter / Power train / Engine and ECT / Active Test / Control the Lock Up".
(h) Follow the instructions on the tester and read the Active Test.

Item	Test Details	Diagnostic Note
Control the Lock Up	[Test Details] Control the shift solenoid SL to set the automatic transaxle to the lock–up condition. [Vehicle Condition] Vehicle Speed: 58 km/h (36 mph) or more	Possible to check the SL operation.

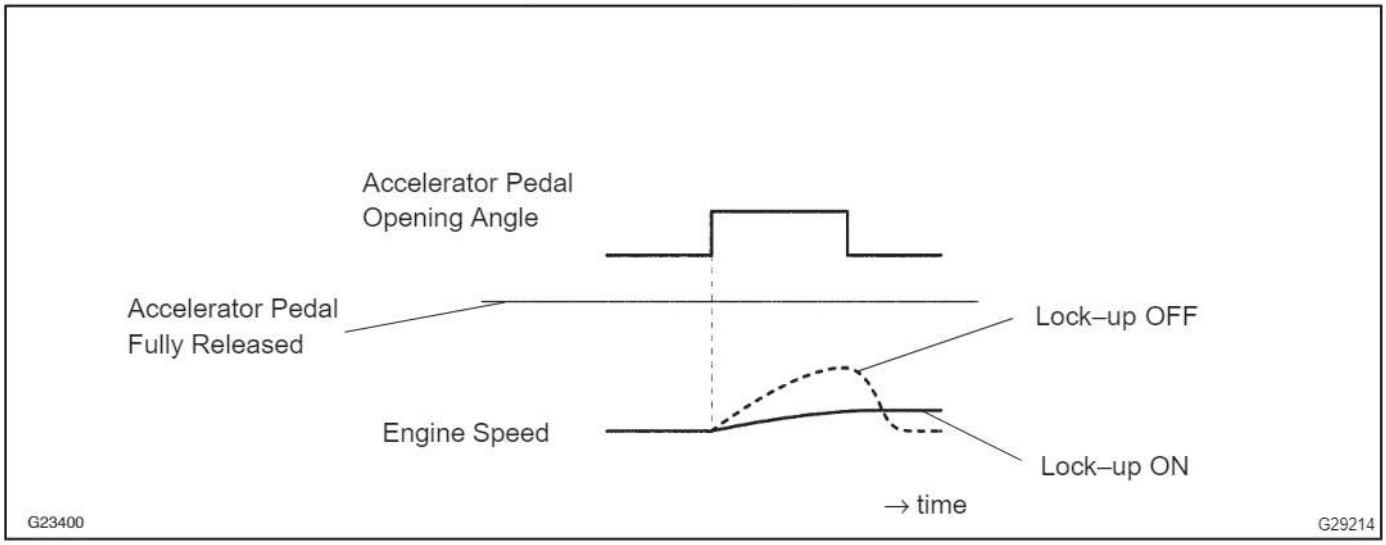
HINT:

- This test can be conducted when the vehicle speed is 58 km/h (36 mph) or more.
- This test can be conducted with the 3rd or 4th gear.

(i) Lightly depress the accelerator pedal and check that the engine speed does not change abruptly.

HINT:

- When changing the accelerator pedal opening angle while driving, if the engine speed does not change, lock–up is on.
- Slowly release, but not fully, the accelerator pedal in order to decelerate. (Fully releasing the pedal will close the throttle valve and lock–up may be turned off.)



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1 CHECK OTHER DTCS OUTPUT(IN ADDITION TO DTC P0741)

(a) Connect the Intelligent Tester II to the DLC3.
(b) Turn the ignition switch to the ON position.
(c) Turn on the tester.
(d) Select the item "Power train / Engine and ECT / DTC / Current or Pending".
(e) Read the DTCs using the Intelligent Tester II.

Result:

Display (DTC output)	Proceed to
Only "P0741" is output	A
"P0741" and other DTCs	B

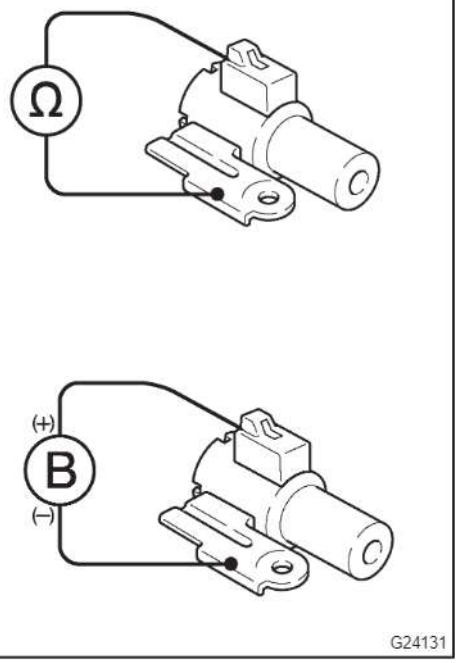
HINT:
If any other codes besides "P0741" is output, perform the troubleshooting for those DTCs first.

B → **GO TO RELEVANT DTC CHART (SEE PAGE 05–245)**

A

2 INSPECT SHIFT SOLENOID VALVE(SL)

Shift Solenoid Valve SL:



(a) Remove the shift solenoid valve SL.
(b) Measure the resistance according to the value(s) in the table below.

Standard:

Tester Connection	Specified Condition 20 °C (68 °F)
Solenoid Connector (SL) – Solenoid Body (SL)	11 to 15 Ω

(c) Connect positive (+) lead to the terminal of solenoid connector, negative (–) lead to the solenoid body.

OK:

The solenoid makes an operating noise.

NG → **REPLACE SHIFT SOLENOID VALVE(SL)**

OK

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3	INSPECT TRANSMISSION VALVE BODY ASSY(See chapter 2 in the problem symptoms table) (SEE PAGE 05–229)

OK:

There are no foreign objects on each valve and they operate smoothly.

NG → REPAIR OR REPLACE TRANSMISSION VALVE BODY ASSY (See Pub. No. RM1018E, page 40–42)

OK

4	INSPECT TORQUE CONVERTER CLUTCH ASSY (See Pub. No. RM1018E, page 40–37)

OK:

The torque converter clutch operates normally.

NG → REPLACE TORQUE CONVERTER CLUTCH ASSY

OK

REPAIR OR REPLACE AUTOMATIC TRANSAXLE ASSY (See Pub. No. RM1018E, page 40–11)

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DTC	P0751	SHIFT SOLENOID "A" PERFORMANCE (SHIFT SOLENOID VALVE S1)

SYSTEM DESCRIPTION

The ECM uses signals from the vehicle speed sensor and speed sensor NT to detect the actual gear position (1st, 2nd, 3rd or 4th gear).

Then the ECM compares the actual gear with the shift schedule in the ECM memory to detect mechanical problems of the shift solenoid valves and valve body.

DTC No.	DTC Detecting Condition	Trouble Area
P0751	The gear required by the ECM does not match the actual gear when driving (2–trip detection logic)	• Shift solenoid valve S1 remains open or closed • Valve body is blocked • Shift solenoid valve S1 • Automatic transaxle (clutch, brake or gear etc.) • ECM

MONITOR DESCRIPTION

The ECM commands gear shifts by turning the shift solenoid valves "ON/OFF". According to the input shaft revolution, intermediate (counter) shaft revolution and output shaft revolution, the ECM detects the actual gear position (1st, 2nd, 3rd or 4th gear position). When the gear position commanded by the ECM and the actual gear position are not same, the ECM illuminates the MIL.

Example:

When either condition (a) or (b) is met, the ECM detects a malfunction.

(a) The ECM commands the 1st gear, but the actual gear is 2nd.

(b) The ECM commands the 2nd gear, but the actual gear is 1st.

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INSPECTION PROCEDURE

HINT:

Performing the Intelligent Tester II Active Test allows relay, Vacuum Switching Valve (VSV), actuator and other items to be operated without removing any parts. Performing the Active Test early in troubleshooting is one way to shorten labor time. The Data List can be displayed during the Active Test.

(a) Warm up the engine.
(b) Turn the ignition switch off.
(c) Connect the Intelligent Tester II to the DLC3.
(d) Turn the ignition switch to the ON position.
(e) Turn on the tester.
(f) Clear the DTC.
(g) Select the item "Enter / Power train / Engine and ECT / Active Test / Control the Shift Position".
(h) Follow the instructions on the tester and read the Active Test.

HINT:

While driving, the shift position can be forcibly changed with the Intelligent Tester II.
Comparing the shift position commanded by the ACTIVE TEST with the actual shift position enables you to confirm the problem (see page 05–241).

Item	Test Details	Diagnostic Note
Control the Shift Position	[Test Details] Operate the shift solenoid valve and set the each shift position by yourself. [Vehicle Condition] • IDL: ON • Less than 50 km/h (31 mph) [Others] • Press "→" button: Shift up • Press "←" button: Shift down	Possible to check the operation of the shift solenoid valves.

HINT:

- This test can be conducted when the vehicle speed is 50 km/h (31 mph) or less.
- The shift position commanded by the ECM is shown in the DATA LIST (Shift Status) display on the Intelligent Tester II.

1	CHECK OTHER DTCS OUTPUT(IN ADDITION TO DTC P0751)

(a) Connect the Intelligent Tester II to the DLC3.
(b) Turn the ignition switch to the ON position.
(c) Turn on the tester.
(d) Select the item "Power train / Engine and ECT / DTC / Current or Pending".
(e) Read the DTCs using the Intelligent Tester II.

Result:

Display (DTC output)	Proceed to
Only "P0751" is output	A
"P0751" and other DTCs	B

HINT:

If any other codes besides "P0751" is output, perform the troubleshooting for those DTCs first.

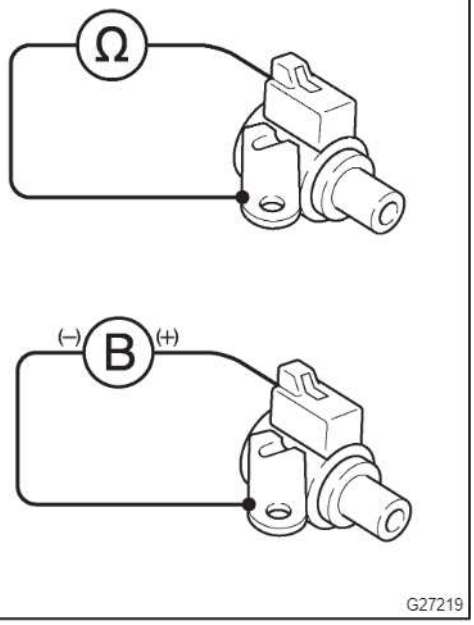
B → GO TO RELEVANT DTC CHART (SEE PAGE 05–245)

A

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2	INSPECT SHIFT SOLENOID VALVE(S1)

Shift Solenoid Valve S1:



(a) Remove the shift solenoid valve S1.

(b) Measure the resistance according to the value(s) in the table below.

Standard:

Tester Connection	Specified Condition 20 °C (68 °F)
Solenoid Connector (S1) – Solenoid Body (S1)	11 to 15 Ω

(c) Connect positive (+) lead to the terminal of solenoid connector, negative (–) lead to the solenoid body.

OK:

The solenoid makes an operating noise.

NG → **REPLACE SHIFT SOLENOID VALVE(S1)**

OK

3	INSPECT TRANSMISSION VALVE BODY ASSY(See chapter 2 in the problem symptoms table) (SEE PAGE 05–229)

OK:

There are no foreign objects on each valve and they operate smoothly.

NG → **REPAIR OR REPLACE TRANSMISSION VALVE BODY ASSY (See Pub. No. RM1018E, page 40–42)**

OK

4	INSPECT TORQUE CONVERTER CLUTCH ASSY (See Pub. No. RM1018E, page 40–37)

OK:

The torque converter clutch operates normally.

NG → **REPLACE TORQUE CONVERTER CLUTCH ASSY**

OK

REPAIR OR REPLACE AUTOMATIC TRANSAXLE ASSY (See Pub. No. RM1018E, page 40–11)

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DTC	P0756	SHIFT SOLENOID "B" PERFORMANCE (SHIFT SOLENOID VALVE S2)

SYSTEM DESCRIPTION

The ECM uses signals from the vehicle speed sensor to detect the actual gear position (1st, 2nd, 3rd or 4th gear).

Then the ECM compares the actual gear with the shift schedule in the ECM memory to detect mechanical problems of the shift solenoid valves and valve body.

DTC No.	DTC Detecting Condition	Trouble Area
P0756	The gear required by the ECM does not match the actual gear when driving (2–trip detection logic)	• Shift solenoid valve S2 remains open or closed • Valve body is blocked • Shift solenoid valve S2 • Automatic transaxle (clutch, brake or gear etc.) • ECM

MONITOR DESCRIPTION

The ECM commands gear shifts by turning the shift solenoid valves "ON/OFF". According to the input shaft revolution, intermediate (counter) shaft revolution and output shaft revolution, the ECM detects the actual gear position (1st, 2nd, 3rd or 4th gear position). When the gear position commanded by the ECM and the actual gear position are not same, the ECM illuminates the MIL and stores the DTC.

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INSPECTION PROCEDURE

HINT:

Performing the Intelligent Tester II Active Test allows relay, Vacuum Switching Valve (VSV), actuator and other items to be operated without removing any parts. Performing the Active Test early in troubleshooting is one way to shorten labor time. The Data List can be displayed during the Active Test.

(a) Warm up the engine.
(b) Turn the ignition switch off.
(c) Connect the Intelligent Tester II to the DLC3.
(d) Turn the ignition switch to the ON position.
(e) Turn on the tester.
(f) Clear the DTC.
(g) Select the item "Enter / Power train / Engine and ECT / Active Test / Control the Shift Position".
(h) Follow the instructions on the tester and read the Active Test.

HINT:

While driving, the shift position can be forcibly changed with the Intelligent Tester II.
Comparing the shift position commanded by the ACTIVE TEST with the actual shift position enables you to confirm the problem (see page 05–241).

Item	Test Details	Diagnostic Note
Control the Shift Position	[Test Details] Operate the shift solenoid valve and set the each shift position by yourself. [Vehicle Condition] • IDL: ON • Less than 50 km/h (31 mph) [Others] • Press "→" button: Shift up • Press "←" button: Shift down	Possible to check the operation of the shift solenoid valves.

HINT:

- This test can be conducted when the vehicle speed is 50 km/h (31 mph) or less.
- The shift position commanded by the ECM is shown in the DATA LIST (Shift Status) display on the Intelligent Tester II.

1	CHECK OTHER DTCS OUTPUT(IN ADDITION TO DTC P0756)

(a) Connect the Intelligent Tester II to the DLC3.
(b) Turn the ignition switch to the ON position.
(c) Turn on the tester.
(d) Select the item "Power train / Engine and ECT / DTC / Current or Pending".
(e) Read the DTCs using the Intelligent Tester II.

Result:

Display (DTC output)	Proceed to
Only "P0756" is output	A
"P0756" and other DTCs	B

HINT:

If any other codes besides "P0756" is output, perform the troubleshooting for those DTCs first.

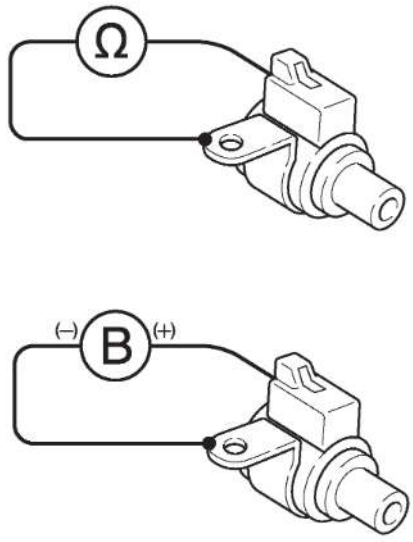
B → GO TO RELEVANT DTC CHART (SEE PAGE 05–245)

A

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2	INSPECT SHIFT SOLENOID VALVE(S2)

Shift Solenoid Valve S2:



G27220

(a) Remove the shift solenoid valve S2.

(b) Measure the resistance according to the value(s) in the table below.

Standard:

Tester Connection	Specified Condition 20 °C (68 °F)
Solenoid Connector (S2) – Solenoid Body (S2)	11 to 15 Ω

(c) Connect positive (+) lead to the terminal of solenoid connector, negative (–) lead to the solenoid body.

OK:

The solenoid makes an operating noise.

NG → **REPLACE SHIFT SOLENOID VALVE(S2)**

OK

3	INSPECT TRANSMISSION VALVE BODY ASSY(See chapter 2 in the problem symptoms table) (SEE PAGE 05–229)

OK:

There are no foreign objects on each valve and they operate smoothly.

NG → **REPAIR OR REPLACE TRANSMISSION VALVE BODY ASSY (See Pub. No. RM1018E, page 40–42)**

OK

4	INSPECT TORQUE CONVERTER CLUTCH ASSY (See Pub. No. RM1018E, page 40–37)

OK:

The torque converter clutch operates normally.

NG → **REPLACE TORQUE CONVERTER CLUTCH ASSY**

OK

REPAIR OR REPLACE AUTOMATIC TRANSAXLE ASSY (See Pub. No. RM1018E, page 40–11)

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DTC	P0787	SHIFT/TIMING SOLENOID LOW (SHIFT SOLENOID VALVE ST)

DTC	P0788	SHIFT/TIMING SOLENOID HIGH (SHIFT SOLENOID VALVE ST)

CIRCUIT DESCRIPTION

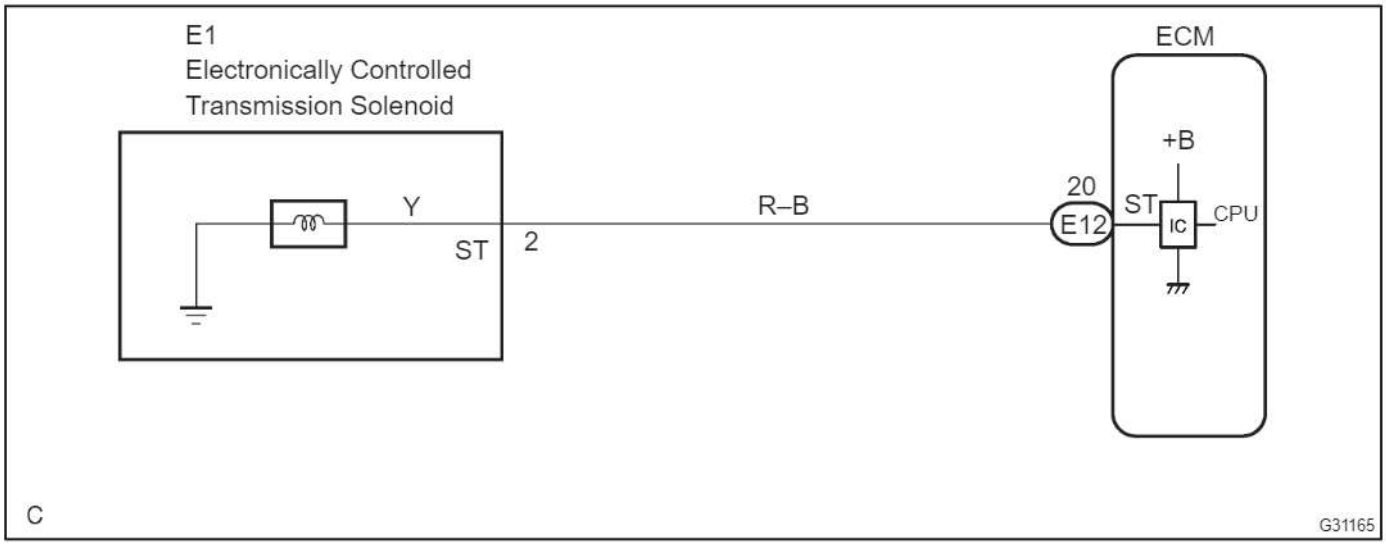
The shift solenoid valve ST is used for shifting from the 3rd to 4th gear, and from the 4th to 3rd gear. Actuates solenoid valves ST and SLT in accordance with the signals from the ECM, and guides this output pressure directly to 4–3 shift timing valve and 3–4 shift timing valve in order to regulate the line pressure that acts on the B_1 brake and C_1 clutch.

DTC No.	DTC Detection Condition	Trouble Area
P0787	ECM detects short in solenoid valve ST circuit 4 times when solenoid valve ST is operated (1–trip detection logic)	• Short in shift solenoid valve ST circuit • Shift solenoid valve ST • ECM
P0788	ECM detects open in solenoid valve ST circuit 4 times when solenoid valve ST is not operated (1–trip detection logic)	• Open in shift solenoid valve ST circuit • Shift solenoid valve ST • ECM

MONITOR DESCRIPTION

The ECM commands gear shifts by turning the shift solenoid valves "ON/OFF". When there is an open or short circuit in any shift solenoid valve circuit, the ECM detects the problem and illuminates the MIL and stores the DTC. And the ECM performs the fail–safe function and turns the other shift solenoid valves in good condition "ON/OFF" (In case of an open or short circuit, the ECM stops sending current to the circuit.) (see page 05–241).

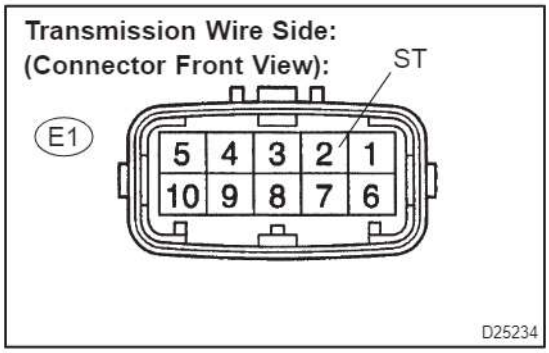
WIRING DIAGRAM



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INSPECTION PROCEDURE

1 INSPECT TRANSMISSION WIRE(ST)



(a) Disconnect the transmission wire connector from the transaxle.
(b) Measure the resistance according to the value(s) in the table below.

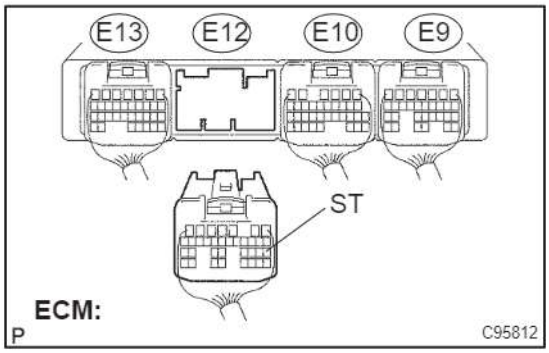
Standard:

Tester Connection	Specified Condition 20 °C (68 °F)
2 – Body ground	11 to 15 Ω

NG → **Go to step 3**

OK

2 CHECK HARNESS AND CONNECTOR(TRANSMISSION WIRE – ECM)



(a) Connect the transmission connector to the transaxle.
(b) Disconnect the connector from the ECM.
(c) Measure the resistance according to the value(s) in the table below.

Standard:

Tester Connection	Specified Condition 20 °C (68 °F)
E12 – 20 (ST) – Body ground	11 to 15 Ω

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR (SEE PAGE 01–32)**

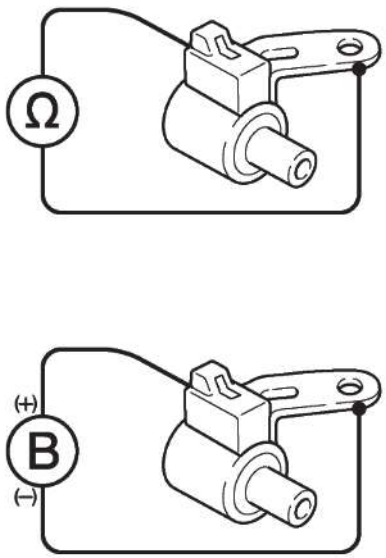
OK

REPLACE ECM

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3 INSPECT SHIFT SOLENOID VALVE(ST)

Shift Solenoid Valve ST:



(a) Remove the shift solenoid valve ST.

(b) Measure the resistance according to the value(s) in the table below.

Standard:

Tester Connection	Specified Condition 20 °C (68 °F)
Solenoid Connector (ST) – Solenoid Body (ST)	11 to 15 Ω

(c) Connect positive (+) lead to the terminal of solenoid connector, negative (–) lead to the solenoid body.

OK:

The solenoid makes an operating noise.

NG → **REPLACE SHIFT SOLENOID VALVE(ST)**

OK →

REPAIR OR REPLACE TRANSMISSION WIRE (See Pub. No. RM1018E, page 40–51)

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DTC	P0973	SHIFT SOLENOID "A" CONTROL CIRCUIT LOW (SHIFT SOLENOID VALVE S1)

DTC	P0974	SHIFT SOLENOID "A" CONTROL CIRCUIT HIGH (SHIFT SOLENOID VALVE S1)

CIRCUIT DESCRIPTION

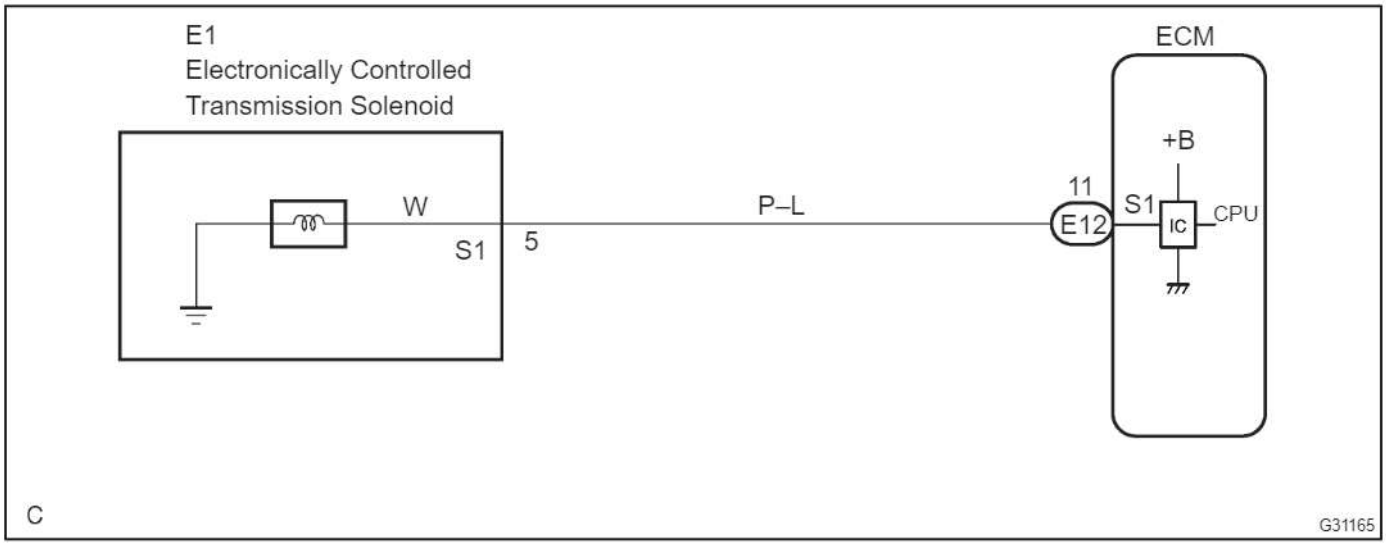
Shifting from 1st to 4th is performed in combination with "ON" and "OFF" operation of the shift solenoid valves S1 and S2 which is controlled by the ECM. If an open or short circuit occurs in either of the shift solenoid valves, the ECM controls the remaining normal shift solenoid valve to allow the vehicle to be operated smoothly (Fail safe function).

DTC No.	DTC Detection Condition	Trouble Area
P0973	ECM detects short in solenoid valve S1 circuit 2 times when solenoid valve S1 is operated (1–trip detection logic)	• Short in shift solenoid valve S1 circuit • Shift solenoid valve S1 • ECM
P0974	ECM detects open in solenoid valve S1 circuit 2 times when solenoid valve S1 is not operated (1–trip detection logic)	• Open in shift solenoid valve S1 circuit • Shift solenoid valve S1 • ECM

MONITOR DESCRIPTION

The ECM commands gear shifts by turning the shift solenoid valves "ON/OFF". When there is an open or short circuit in any shift solenoid valve circuit, the ECM detects the problem and illuminates the MIL and stores the DTC. And the ECM performs the fail–safe function and turns the other shift solenoid valves in good condition "ON/OFF" (In case of an open or short circuit, the ECM stops sending current to the circuit.) (see page 05–241).

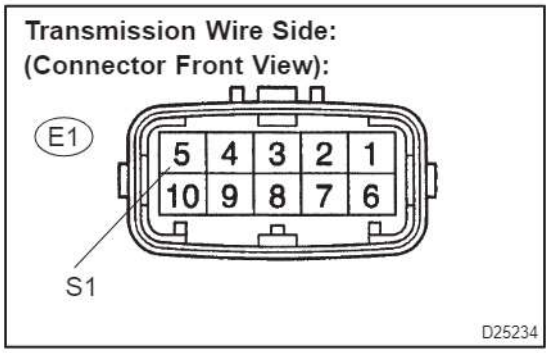
WIRING DIAGRAM



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INSPECTION PROCEDURE

1 INSPECT TRANSMISSION WIRE(S1)



(a) Disconnect the transmission wire connector from the transaxle.
(b) Measure the resistance according to the value(s) in the table below.

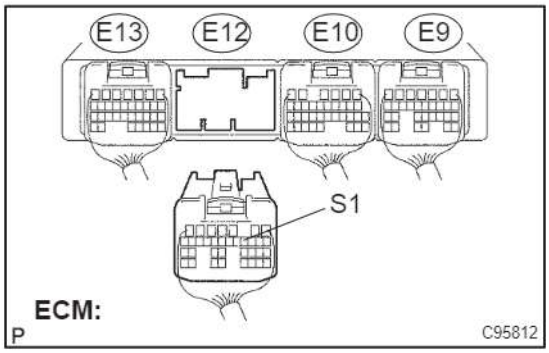
Standard:

Tester Connection	Specified Condition 20 °C (68 °F)
5 – Body ground	11 to 15 Ω

NG → **Go to step 3**

OK

2 CHECK HARNESS AND CONNECTOR(TRANSMISSION WIRE – ECM)



(a) Connect the transmission connector to the transaxle.
(b) Disconnect the connector from the ECM.
(c) Measure the resistance according to the value(s) in the table below.

Standard:

Tester Connection	Specified Condition 20 °C (68 °F)
E12 – 11 (S1) – Body ground	11 to 15 Ω

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR (SEE PAGE 01–32)**

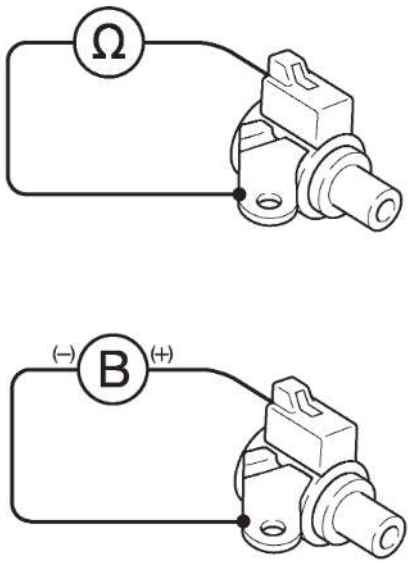
OK

REPLACE ECM

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3	INSPECT SHIFT SOLENOID VALVE(S1)

Shift Solenoid Valve S1:



(a) Remove the shift solenoid valve S1.

(b) Measure the resistance according to the value(s) in the table below.

Standard:

Tester Connection	Specified Condition 20 °C (68 °F)
Solenoid Connector (S1) – Solenoid Body (S1)	11 to 15 Ω

(c) Connect positive (+) lead to the terminal of solenoid connector, negative (–) lead to the solenoid body.

OK:

The solenoid makes an operating noise.

NG → **REPLACE SHIFT SOLENOID VALVE(S1)**

OK

REPAIR OR REPLACE TRANSMISSION WIRE (See Pub. No. RM1018E, page 40–51)

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DTC	P0976	SHIFT SOLENOID "B" CONTROL CIRCUIT LOW (SHIFT SOLENOID VALVE S2)

DTC	P0977	SHIFT SOLENOID "B" CONTROL CIRCUIT HIGH (SHIFT SOLENOID VALVE S2)

CIRCUIT DESCRIPTION

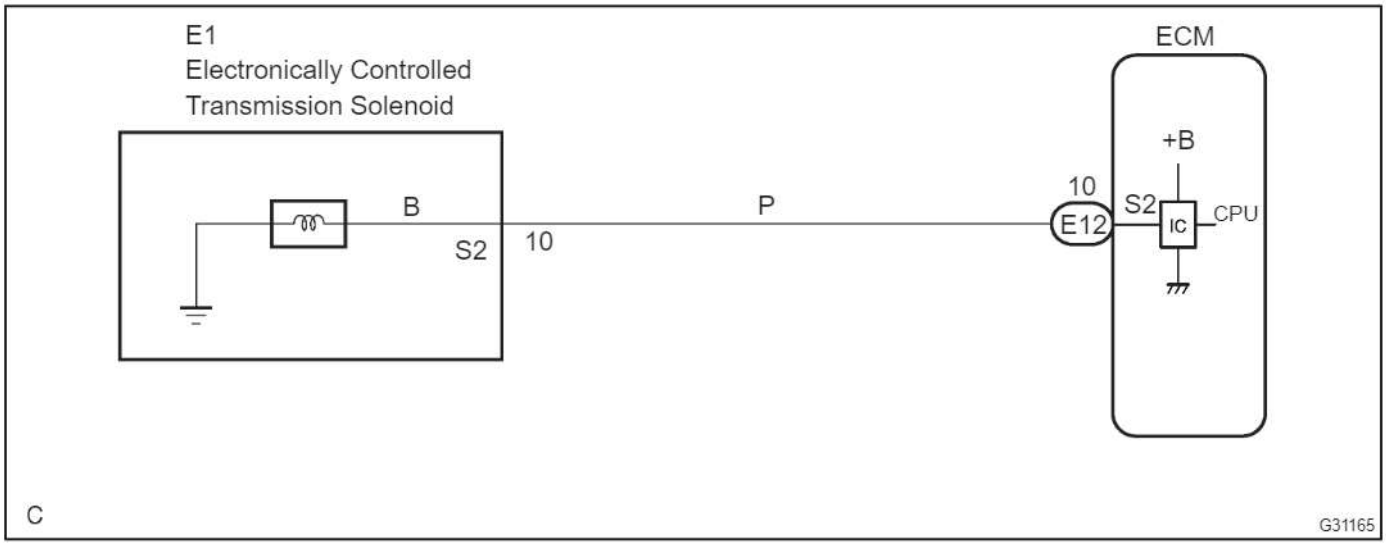
Shifting from 1st to 4th is performed in combination with "ON" and "OFF" operation of the shift solenoid valves S1 and S2 which is controlled by the ECM. If an open or short circuit occurs in either of the shift solenoid valves, the ECM controls the remaining normal shift solenoid valve to allow the vehicle to be operated smoothly (Fail safe function).

DTC No.	DTC Detection Condition	Trouble Area
P0976	ECM detects short in solenoid valve S2 circuit 2 times when solenoid valve S2 is operated (1–trip detection logic)	• Short in shift solenoid valve S2 circuit • Shift solenoid valve S2 • ECM
P0977	ECM detects open in solenoid valve S2 circuit 2 times when solenoid valve S2 is not operated (1–trip detection logic)	• Open in shift solenoid valve S2 circuit • Shift solenoid valve S2 • ECM

MONITOR DESCRIPTION

The ECM commands gear shifts by turning the shift solenoid valves "ON/OFF". When there is an open or short circuit in any shift solenoid valve circuit, the ECM detects the problem and illuminates the MIL and stores the DTC. And the ECM performs the fail–safe function and turns the other shift solenoid valves in good condition "ON/OFF" (In case of an open or short circuit, the ECM stops sending current to the circuit.) (see page 05–241).

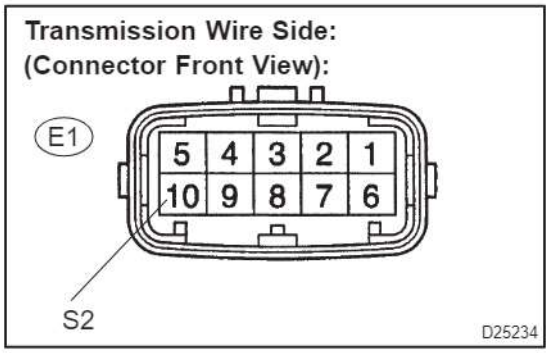
WIRING DIAGRAM



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INSPECTION PROCEDURE

1	INSPECT TRANSMISSION WIRE(S2)



(a) Disconnect the transmission wire connector from the transaxle.
(b) Measure the resistance according to the value(s) in the table below.

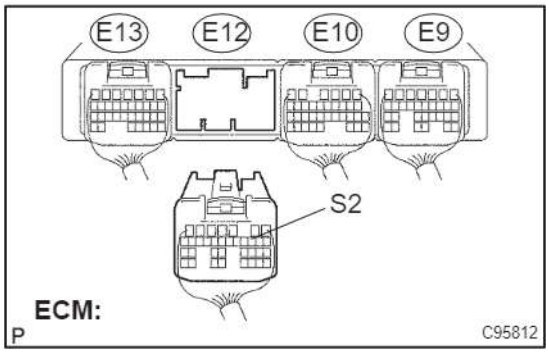
Standard:

Tester Connection	Specified Condition 20 °C (68 °F)
10 – Body ground	11 to 15 Ω

NG → **Go to step 3**

OK

2	CHECK HARNESS AND CONNECTOR(TRANSMISSION WIRE – ECM)



(a) Connect the transmission connector to the transaxle.
(b) Disconnect the connector from the ECM.
(c) Measure the resistance according to the value(s) in the table below.

Standard:

Tester Connection	Specified Condition 20 °C (68 °F)
E12 – 10 (S2) – Body ground	11 to 15 Ω

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR (SEE PAGE 01–32)**

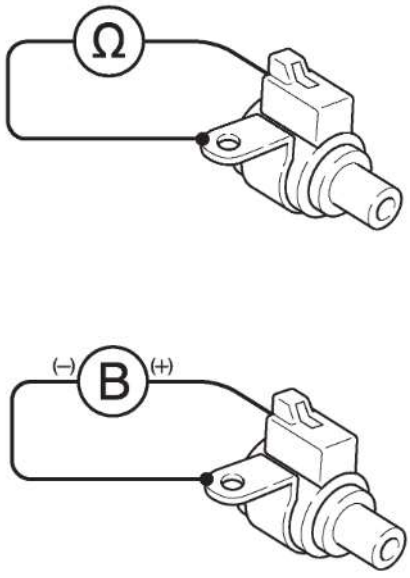
OK

REPLACE ECM

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3 INSPECT SHIFT SOLENOID VALVE(S2)

Shift Solenoid Valve S2:



(a) Remove the shift solenoid valve S2.

(b) Measure the resistance according to the value(s) in the table below.

Standard:

Tester Connection	Specified Condition 20 °C (68 °F)
Solenoid Connector (S2) – Solenoid Body (S2)	11 to 15 Ω

(c) Connect positive (+) lead to the terminal of solenoid connector, negative (–) lead to the solenoid body.

OK:

The solenoid makes an operating noise.

NG → **REPLACE SHIFT SOLENOID VALVE(S2)**

OK →

REPAIR OR REPLACE TRANSMISSION WIRE (See Pub. No. RM1018E, page 40–51)

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DTC	P0998	SHIFT SOLENOID "F" CONTROL CIRCUIT LOW (SHIFT SOLENOID VALVE SB)

DTC	P0999	SHIFT SOLENOID "F" CONTROL CIRCUIT HIGH (SHIFT SOLENOID VALVE SB)

CIRCUIT DESCRIPTION

Shift solenoid valve SB controls the 2nd brake (B_1) and 1st and reverse brake pressures and performs the 1st and 2nd engine brake control.

Fail safe function:

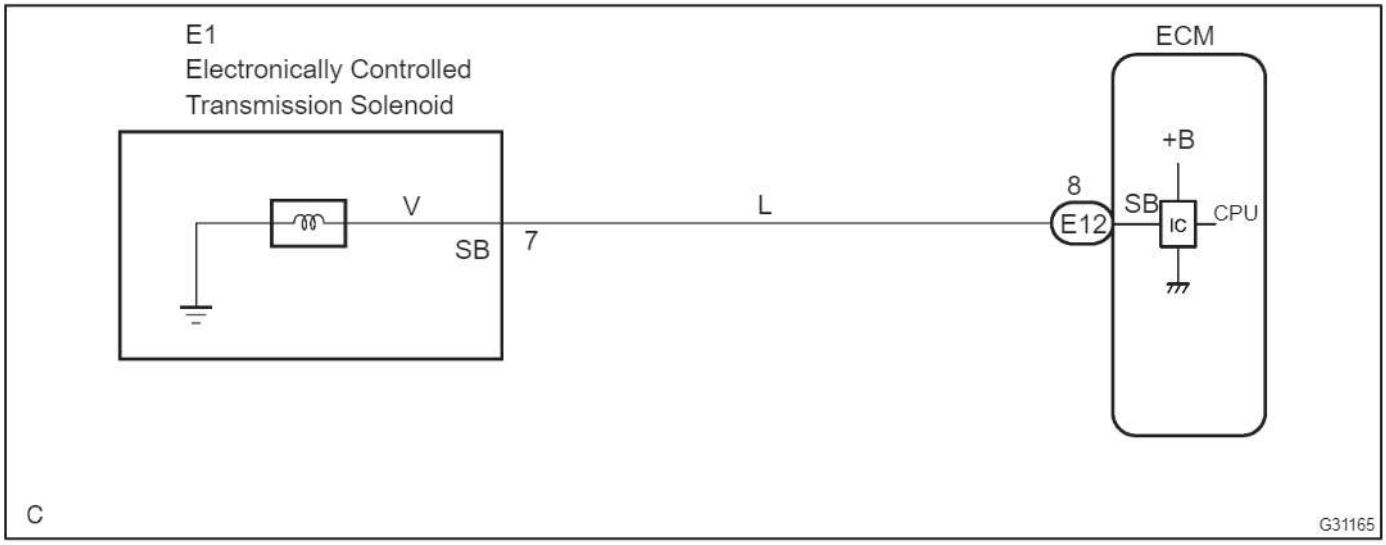
- S shift control prohibition.
- On activating the fail–safe function during S shift, the driving mode turns to the normal D position.

DTC No.	DTC Detection Condition	Trouble Area
P0998	ECM detects short in solenoid valve SB circuit 2 times when solenoid valve SB is operated (1–trip detection logic)	• Short in shift solenoid valve SB circuit • Shift solenoid valve SB • ECM
P0999	ECM detects open in solenoid valve SB circuit 2 times when solenoid valve SB is not operated (1–trip detection logic)	• Open in shift solenoid valve SB circuit • Shift solenoid valve SB • ECM

MONITOR DESCRIPTION

The ECM commands gear shifts by turning the shift solenoid valves "ON/OFF". When there is an open or short circuit in any shift solenoid valve circuit, the ECM detects the problem and illuminates the MIL and stores the DTC. And the ECM performs the fail–safe function and turns the other shift solenoid valves in good condition "ON/OFF" (In case of an open or short circuit, the ECM stops sending current to the circuit.) (see page 05–241).

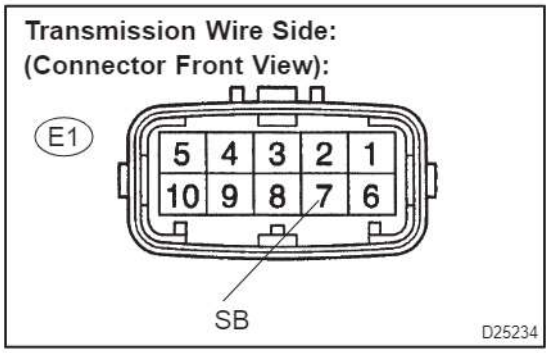
WIRING DIAGRAM



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INSPECTION PROCEDURE

1 INSPECT TRANSMISSION WIRE(SB)



(a) Disconnect the transmission wire connector from the transaxle.
(b) Measure the resistance according to the value(s) in the table below.

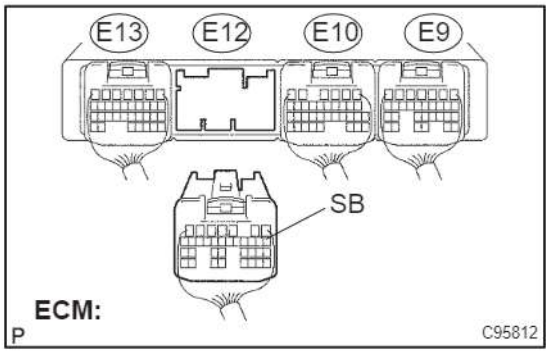
Standard:

Tester Connection	Specified Condition 20 °C (68 °F)
7 – Body ground	11 to 15 Ω

NG → **Go to step 3**

OK

2 CHECK HARNESS AND CONNECTOR(TRANSMISSION WIRE – ECM)



(a) Connect the transmission connector to the transaxle.
(b) Disconnect the connector from the ECM.
(c) Measure the resistance according to the value(s) in the table below.

Standard:

Tester Connection	Specified Condition 20 °C (68 °F)
E12 – 8 (SB) – Body ground	11 to 15 Ω

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR (SEE PAGE 01–32)**

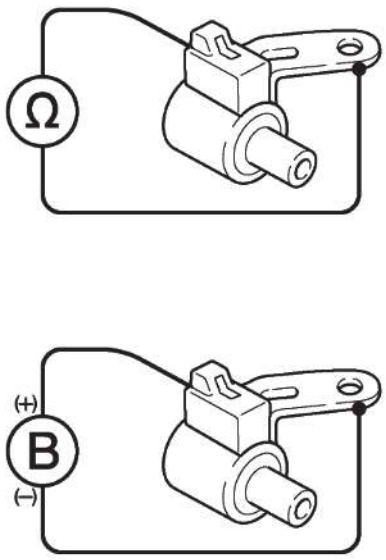
OK

REPLACE ECM

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3 INSPECT SHIFT SOLENOID VALVE(SB)

Shift Solenoid Valve SB:



(a) Remove the shift solenoid valve SB.

(b) Measure the resistance according to the value(s) in the table below.

Standard:

Tester Connection	Specified Condition 20 °C (68 °F)
Solenoid Connector (SB) – Solenoid Body (SB)	11 to 15 Ω

(c) Connect positive (+) lead to the terminal of solenoid connector, negative (–) lead to the solenoid body.

OK:

The solenoid makes an operating noise.

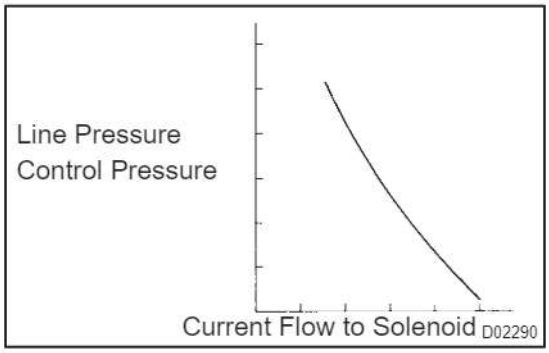
NG → **REPLACE SHIFT SOLENOID VALVE(SB)**

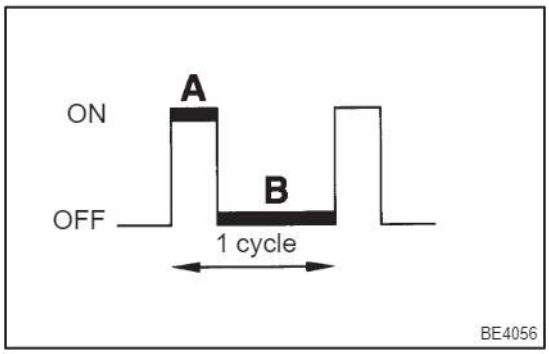
OK →

REPAIR OR REPLACE TRANSMISSION WIRE (See Pub. No. RM1018E, page 40–51)

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DTC	P2716	PRESSURE CONTROL SOLENOID "D" ELECTRICAL (SHIFT SOLENOID SLT)





CIRCUIT DESCRIPTION

The linear solenoid valve (SLT) controls the transaxle line pressure for smooth transaxle operation based on signals from the throttle position sensor and the vehicle speed sensor. The ECM adjusts the duty cycle of the SLT solenoid valve to control hydraulic line pressure coming from the primary regulator valve. Appropriate line pressure assures smooth shifting with varying engine outputs.

(*): Duty Ratio

The duty ratio is the ratio of the period of continuity in one cycle. For example, if A is the period of continuity in one cycle, and B is the period of non–continuity, then

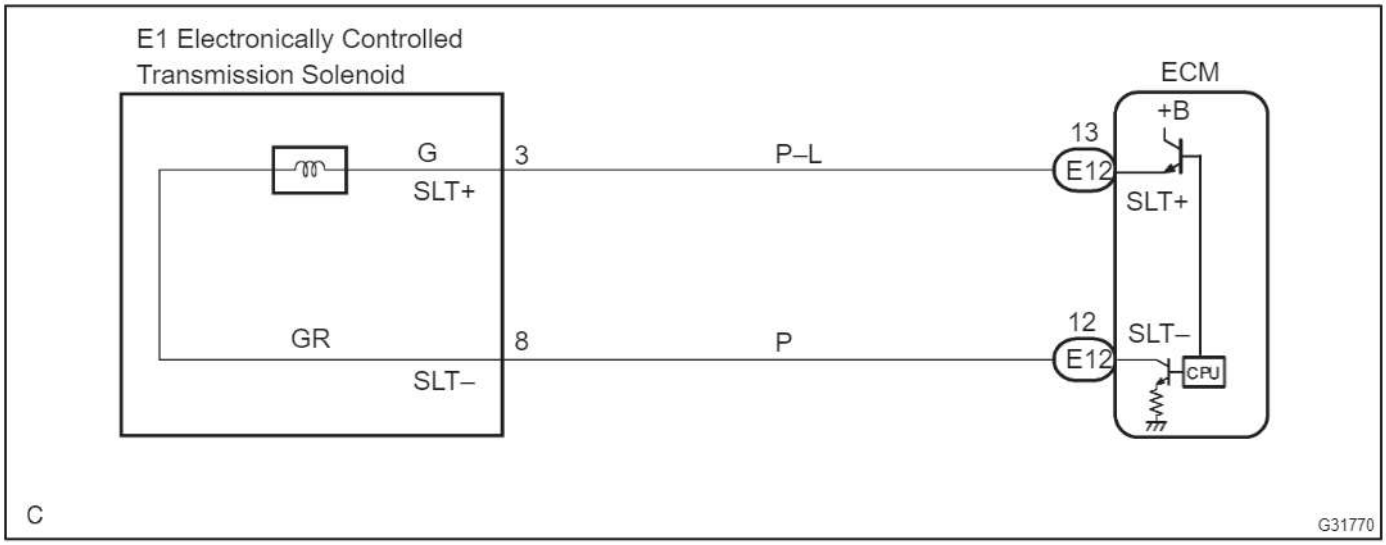
Duty Ratio=A/(A+B) x 100 (%)

DTC No.	DTC Detection Condition	Trouble Area
P2716	Condition (a) or (b) below is detected 1 sec. or more: (1–trip detection logic) (a) SLT– terminal: 0V (b) SLT– terminal: 12V	• Open or short in shift solenoid valve SLT circuit • Shift solenoid valve SLT • ECM

MONITOR DESCRIPTION

When an open or short in the linear solenoid valve (SLT) circuit is detected, the ECM interprets this as a fault. The ECM will turn ON the MIL and store the DTC.

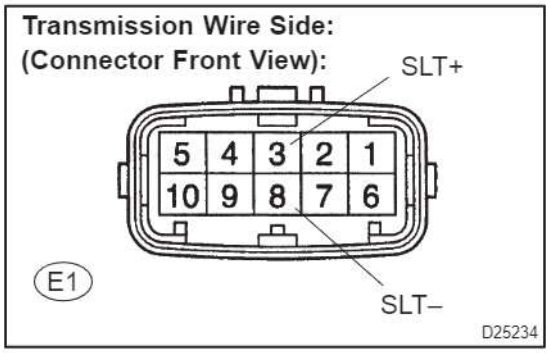
WIRING DIAGRAM



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INSPECTION PROCEDURE

1 INSPECT TRANSMISSION WIRE(SLT)



(a) Disconnect the transmission wire connector from the transaxle.

(b) Measure the resistance according to the value(s) in the table below.

Standard:

Tester Connection	Specified Condition 20 °C (68 °F)
3 (SLT+) – 8 (SLT–)	5.0 to 5.6 Ω

(c) Measure the resistance according to the value(s) in the table below.

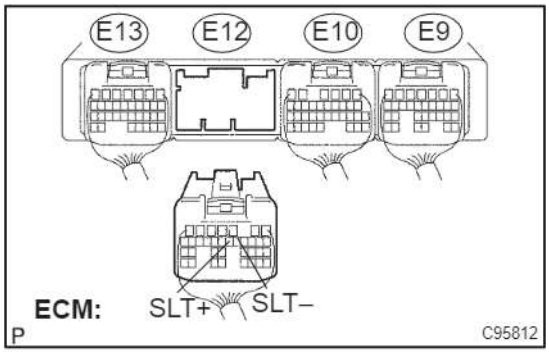
Standard (Check for short):

Tester Connection	Specified Condition
3 (SLT+) – Body ground	10 kΩ or higher
8 (SLT–) – Body ground	↑

NG → **Go to step 3**

OK

2 CHECK HARNESS AND CONNECTOR(TRANSMISSION WIRE – ECM)



(a) Connect the transmission wire connector to the transaxle.

(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard:

Tester Connection	Specified Condition 20 °C (68 °F)
E12 – 13 (SLT+) – E12 – 12 (SLT–)	5.0 to 5.6 Ω

(d) Measure the resistance according to the value(s) in the table below.

Standard (Check for short):

Tester Connection	Specified Condition
E12 – 13 (SLT+) – Body ground	10 kΩ or higher
E12 – 12 (SLT–) – Body ground	↑

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR (SEE PAGE 01–32)**

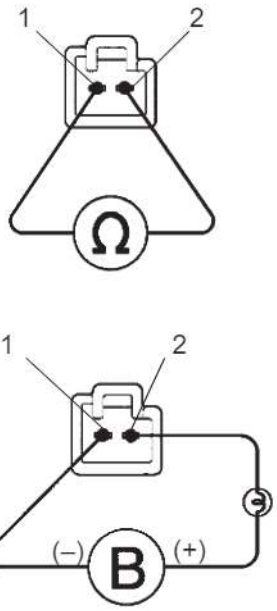
OK

REPLACE ECM

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3 INSPECT SHIFT SOLENOID VALVE(SLT)

Shift Solenoid Valve SLT:



D25466

(a) Remove the shift solenoid valve SLT.

(b) Measure the resistance according to the value(s) in the table below.

Standard:

Tester Connection	Specified Condition 20 °C (68 °F)
1 – 2	5.0 to 5.6 Ω

(c) Connect the positive (+) lead with a 21 W bulb to terminal 2 and the negative (–) lead to terminal 1 of the solenoid valve connector, then check the movement of the valve.

OK:

The solenoid makes an operating noise.

NG → **REPLACE SHIFT SOLENOID VALVE(SLT)**

OK →

REPAIR OR REPLACE TRANSMISSION WIRE (See Pub. No. RM1018E, page 40–51)

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DTC	P2769	TORQUE CONVERTER CLUTCH SOLENOID CIRCUIT LOW (SHIFT SOLENOID VALVE SL)

DTC	P2770	TORQUE CONVERTER CLUTCH SOLENOID CIRCUIT HIGH (SHIFT SOLENOID VALVE SL)

CIRCUIT DESCRIPTION

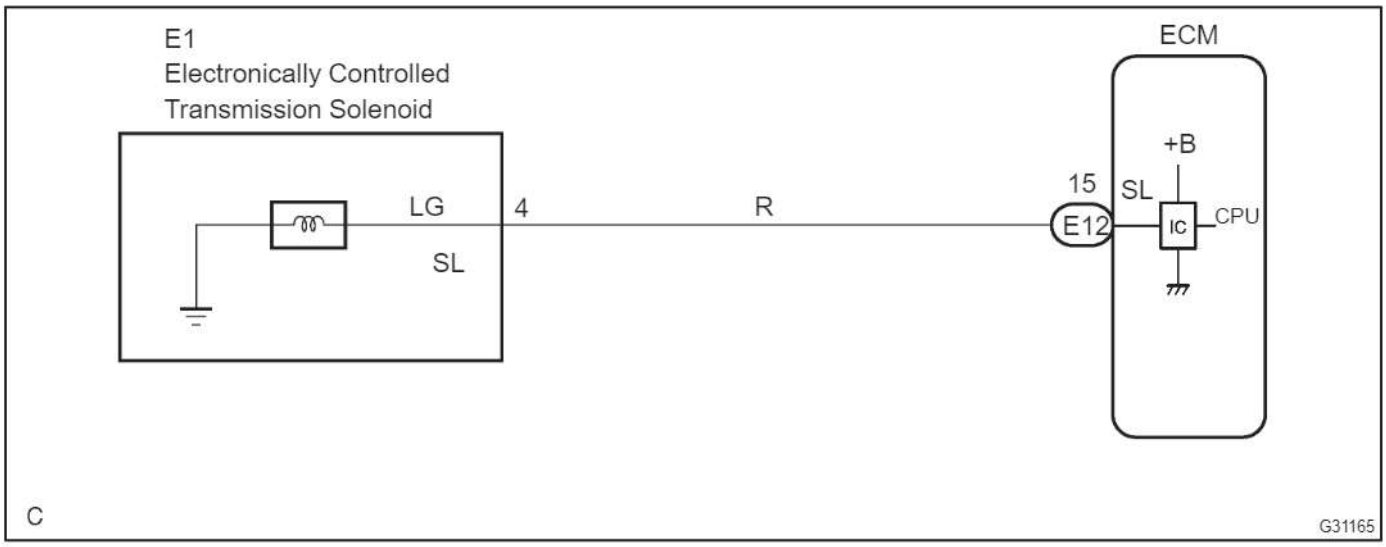
The shift solenoid valve SL is turned "ON" and "OFF" by signals from the ECM in order to control the hydraulic pressure operation, the lock–up relay valve, which then the controls operation of the lock–up clutch.

DTC No.	DTC Detection Condition	Trouble Area
P2769	ECM detects short in solenoid valve SL circuit (0.1 sec.) when solenoid valve SL is operated (2–trip detection logic)	• Short in shift solenoid valve SL circuit • Shift solenoid valve SL • ECM
P2770	ECM detects open in solenoid valve SL circuit (0.1 sec.) when solenoid valve SL is not operated (2–trip detection logic)	• Open in shift solenoid valve SL circuit • Shift solenoid valve SL • ECM

MONITOR DESCRIPTION

Based on the signals from the Throttle Position Sensor, the Airflow Meter and the Crankshaft Position Sensor, the ECM sends a signal to the shift solenoid valve SL to regulate the hydraulic pressure and provide smoother gearshifts. The shift solenoid valve SL responds to commands from the ECM. The valve controls the lock–up relay valve to perform the torque–converter lock–up function. If the ECM detects an open or short circuit for shift solenoid valve SL, it will illuminate the MIL.

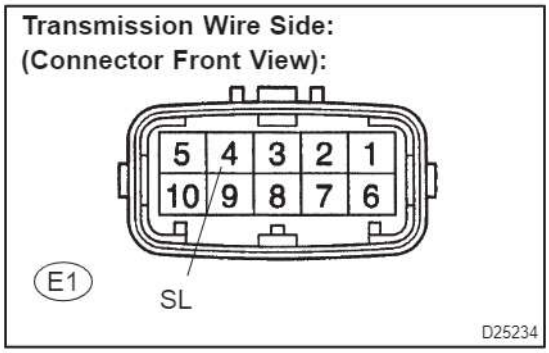
WIRING DIAGRAM



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INSPECTION PROCEDURE

1 INSPECT TRANSMISSION WIRE(SL)



(a) Disconnect the transmission wire connector from the transaxle.
(b) Measure the resistance according to the value(s) in the table below.

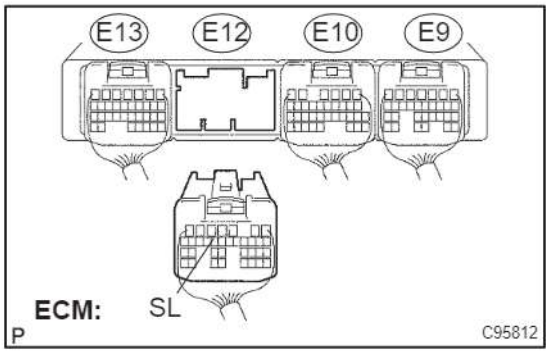
Standard:

Tester Connection	Specified Condition 20 °C (68 °F)
4 – Body ground	11 to 15 Ω

NG → **Go to step 3**

OK

2 CHECK HARNESS AND CONNECTOR(TRANSMISSION WIRE – ECM)



(a) Connect the transmission wire connector.
(b) Disconnect the ECM connector.
(c) Measure the resistance according to the value(s) in the table below.

Standard:

Tester Connection	Specified Condition 20 °C (68 °F)
E12 – 15 (SL) – Body ground	11 to 15 Ω

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR (SEE PAGE 01–32)**

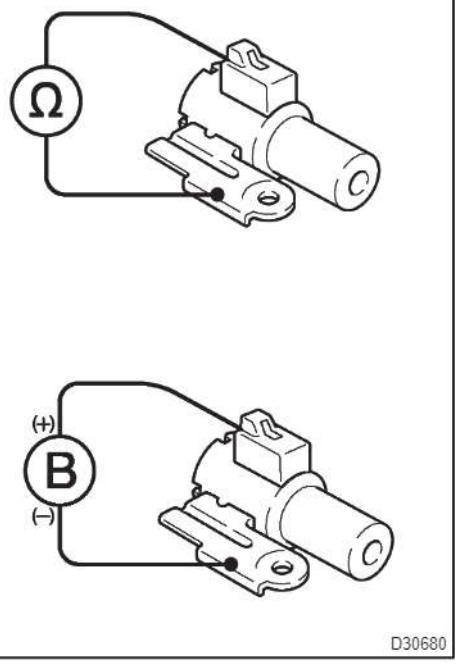
OK

REPLACE ECM

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3	INSPECT SHIFT SOLENOID VALVE(SL)

Shift Solenoid Valve SL:



(a) Remove the shift solenoid valve SL.

(b) Measure the resistance according to the value(s) in the table below.

Standard:

Tester Connection	Specified Condition 20 °C (68 °F)
Solenoid Connector (SL) – Solenoid Body (SL)	11 to 15 Ω

(c) Connect positive (+) lead to the terminal of solenoid connector, negative (–) lead to the solenoid body.

OK:

The solenoid valve makes an operating noise.

NG → **REPLACE SHIFT SOLENOID VALVE(SL)**

OK →

REPAIR OR REPLACE TRANSMISSION WIRE (See Pub. No. RM1018E, page 40–51)

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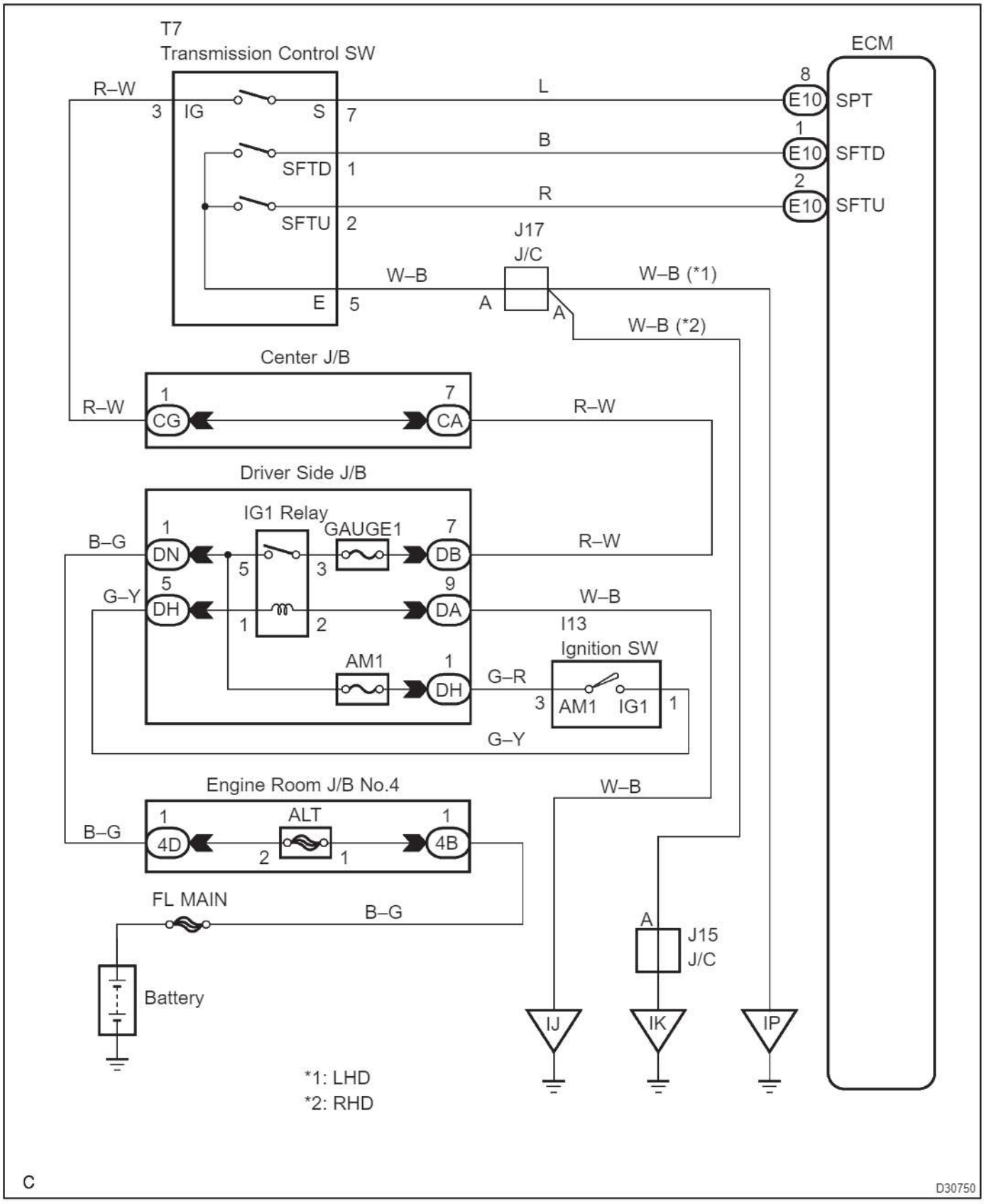
TRANSMISSION CONTROL SWITCH CIRCUIT

CIRCUIT DESCRIPTION

When moving the shift lever into the S position using the transmission control switch, it is possible to switch the shift range position between ”1” (first range) and ”4” (forth range).
Shifting up ”+” once raises one shift range position, and shifting down ”–” lowers one shift range position.

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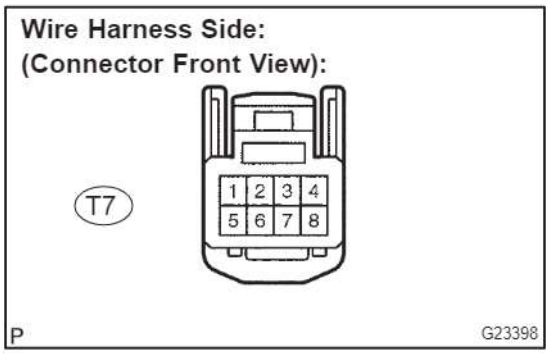
WIRING DIAGRAM



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INSPECTION PROCEDURE

1	CHECK HARNESS AND CONNECTOR(BATTERY – TRANSMISSION CONTROL SWITCH)



(a) Disconnect the transmission control switch connector of shift lock control unit assy.

(b) Measure the voltage according to the value(s) in the table below.

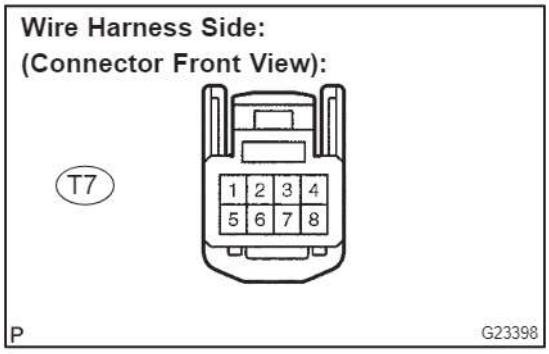
Standard:

Switch Condition	Tester Connection	Specified Condition
IG switch ON	3 – Body ground	10 to 14 V
IG switch OFF	↑	Below 1 V

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR (SEE PAGE 01–32)

OK

2	CHECK HARNESS AND CONNECTOR(TRANSMISSION CONTROL SWITCH – BODY GROUND)



(a) Measure the resistance according to the value(s) in the table below.

Standard:

Tester Connection	Specified Condition
5 – Body ground	Below 1 Ω

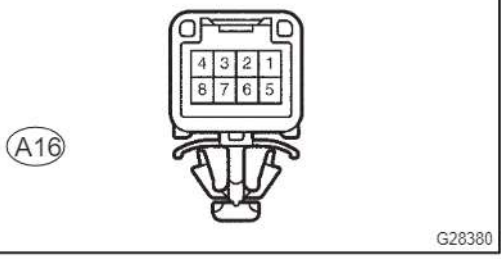
NG → REPAIR OR REPLACE HARNESS OR CONNECTOR (SEE PAGE 01–32)

OK

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3 INSPECT SHIFT LOCK CONTROL UNIT ASSY

Switch Side:
(Connector Front View):



(a) Measure resistance between each terminal of shift lock control unit assy when the shift lever is moved to each position.

Standard:

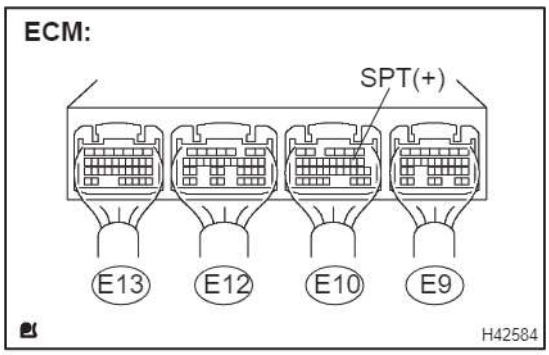
Shift Position	Tester Connection	Specified Condition
S, "+" and "–"	3 – 7	Below 1 Ω
Except S, "+" and "–"	↑	10 kΩ or higher
Press continuously "+" (Up shift)	2 – 5	Below 1 Ω
S	↑	10 kΩ or higher
Press continuously "–" (Down shift)	1 – 5	Below 1 Ω
S	↑	10 kΩ or higher

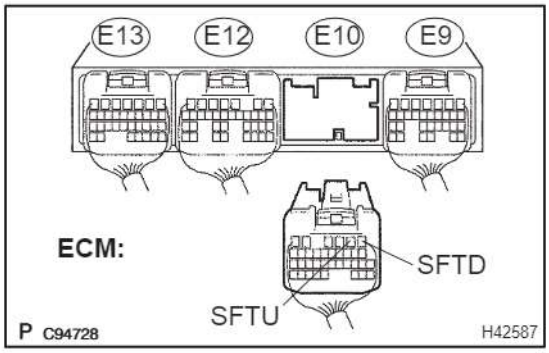
NG → **REPLACE SHIFT LOCK CONTROL UNIT ASSY (See Pub. No. RM1018E, page 40–60)**

OK

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4	CHECK HARNESS AND CONNECTOR(TRANSMISSION CONTROL SWITCH – ECM)





(a) Connect the transmission control switch connector of shift lock control unit assy.

(b) Turn the ignition switch to the ON position, and measure the voltage according to the value(s) in the table below when the shift lever is moved to each position.

Standard:

Shift Position	Tester Connection	Specified Condition
S, "+" and "–"	E10 – 8 (SPT) – Body ground	10 to 14 V
Except S, "+" and "–"	↑	Below 1 V

(c) Turn the ignition switch to the LOCK position.

(d) Disconnect the ECM connector.

(e) Measure the resistance according to the value(s) in the table below when the shift lever is moved to each position.

Standard:

Shift Position	Tester Connection	Specified Condition
Press continuously "+" (Up shift)	E10 – 2 (SFTU) – Body ground	Below 1 Ω
S	↑	10 kΩ or higher
Press continuously "–" (Down shift)	E10 – 1 (SFTD) – Body ground	Below 1 Ω
S	↑	10 kΩ or higher

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR (SEE PAGE 01–32)**

OK

PROCEED TO NEXT CIRCUIT INSPECTION SHOWN IN PROBLEM SYMPTOMS TABLE (SEE PAGE 05–229)

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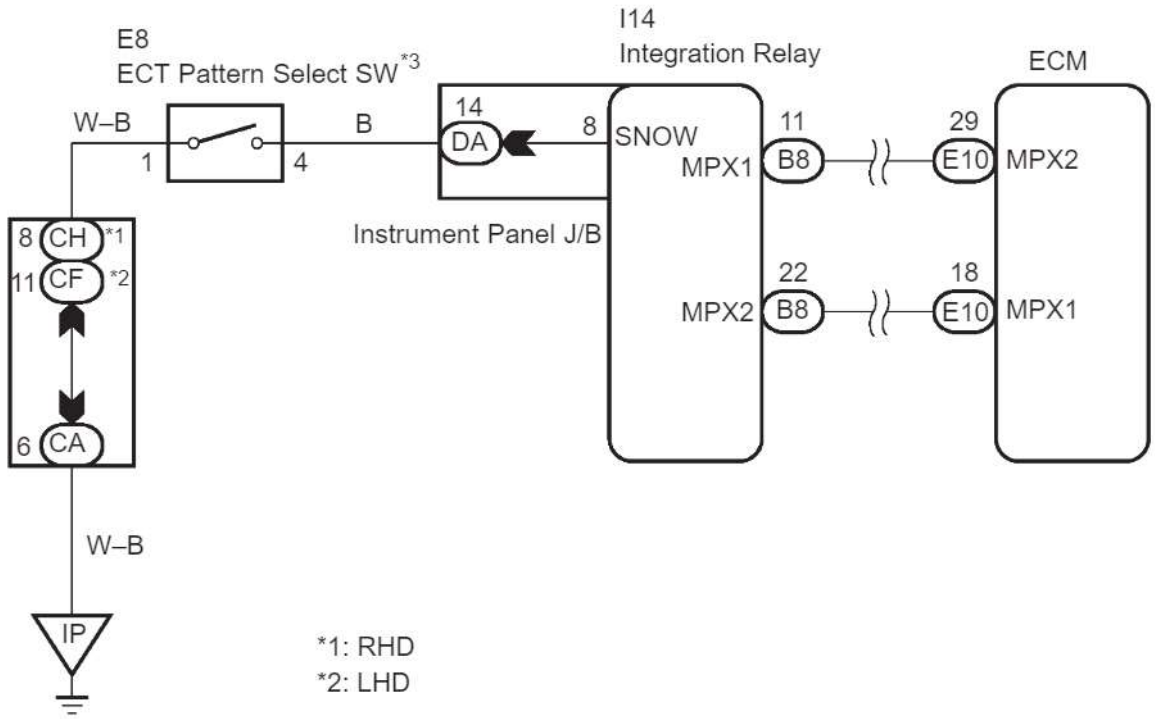
PATTERN SELECT SWITCH CIRCUIT

CIRCUIT DESCRIPTION

Integration relay receives pattern select switch information, and sends it through the multiplex communication system to the ECM.

ECT SNOW is the system that operates the throttle motor to control engine output to reduce skidding of the driving wheels, guarantee takeoff acceleration, driving straightness and turning stability.

WIRING DIAGRAM



(*3) Pattern Select Switch (ECT SNOW Switch)

When the ECT SNOW switch is pushed, the switch contact is made and the ECT SNOW mode is selected. To cancel the ECT SNOW mode, push the ECT SNOW switch once again. The ECT SNOW mode is automatically cancelledout when the ignition switch is turned "OFF".

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INSPECTION PROCEDURE

1	DRIVING TEST

(a) Start the engine.
(b) Turn the ECT SNOW switch "OFF" (Normal drive mode).
(c) Confirm vehicle response by driving from a parked position to fully depressing the accelerator pedal.
(d) Turn the ECT SNOW switch "ON" and perform the same check as (c).
Confirm that there is a difference between ECT SNOW switch "ON" and "OFF".

HINT:
- Driving test should be done on a paved road (a nonskid road).
- Make sure not to use the TRAC system when testing a vehicle equipped with one.

OK:

There is a difference in acceleration between "ON" and "OFF".

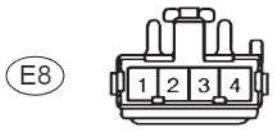
NG → **Go to step 2**

OK

PROCEED TO NEXT CIRCUIT INSPECTION SHOWN IN PROBLEM SYMPTOMS TABLE (SEE PAGE 05–229)

2	CHECK HARNESS AND CONNECTOR(PATTERN SELECT SWITCH ASSY NO.1 – BODY GROUND)

Wire Harness Side:
(Connector Front View):



B59192

(a) Disconnect the connector of pattern select switch.
(b) Measure the resistance according to the value(s) in the table below.

Standard:

Tester Connection	Specified Condition
1 – Body ground	Below 1 Ω

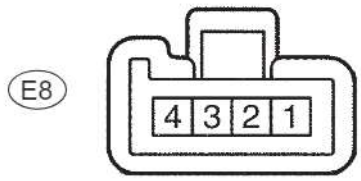
NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR (SEE PAGE 01–32)**

OK

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3	INSPECT PATTERN SELECT SWITCH ASSY

Switch Side:
(Connector Front View):



(a) Measure the resistance according to the value(s) in the table below.

Standard:

Switch Condition	Tester Connection	Specified Condition
Press continuously Pattern select switch (SNOW)	1 – 4	Below 1 Ω
Release Pattern select switch (SNOW)	↑	10 kΩ or higher

NG → **REPLACE PATTERN SELECT SWITCH ASSY**

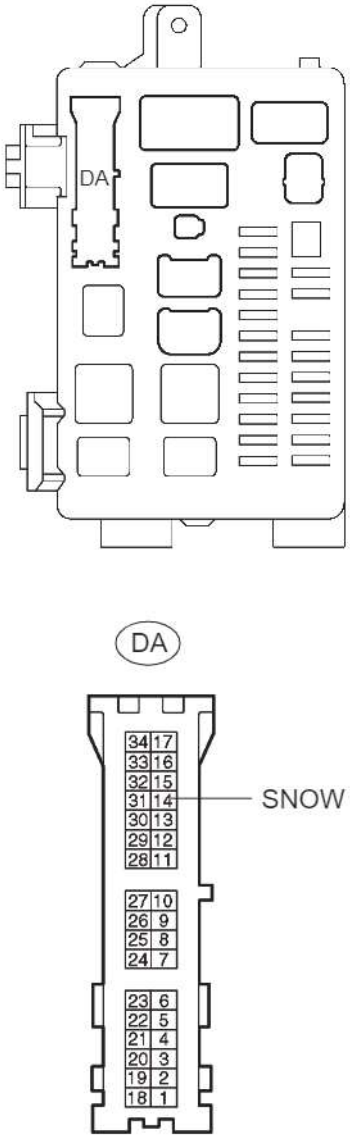
OK

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4	CHECK HARNESS AND CONNECTOR(PATTERN SELECT SWITCH ASSY NO.1 – MULTIPLEX NETWORK BODY ECU)

Instrument Panel J/B Assy

Vehicle Front Side:



(a) Connect the connector of pattern select switch.

(b) Disconnect the instrument panel J/B assy (integration relay) connector.

(c) Measure the resistance between terminal SNOW of instrument panel J/B assy (integration relay) connector and body ground.

Standard:

Switch Condition	Tester Connection	Specified Condition
Press continuously Pattern select switch (SNOW)	DA – 14 (SNOW) – Body ground	Below 1 Ω
Release Pattern select switch (SNOW)	↑	10 kΩ or higher

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR (SEE PAGE 01–32)

OK

PROCEED TO NEXT CIRCUIT INSPECTION SHOWN IN PROBLEM SYMPTOMS TABLE (SEE PAGE 05–229)

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KICK–DOWN SWITCH CIRCUIT

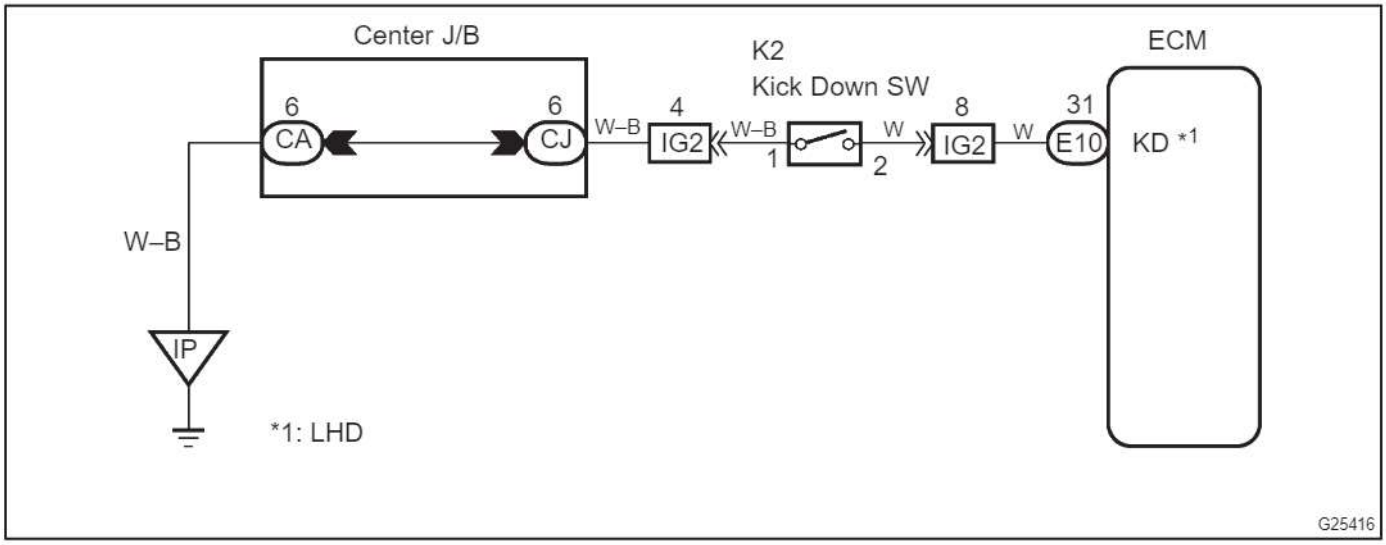
CIRCUIT DESCRIPTION

The kick–down switch is turned ON when the accelerator pedal is fully depressed and a signal is sent to the ECM.

When the kick–down switch is turned ON, the ECM controls gear shifting according to the programmed shift diagrams.

If a short circuit develops in the kick–down switch, the ECM disregards the kick–down signals and controls shifting at the normal shift points.

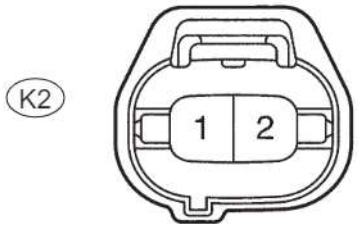
WIRING DIAGRAM



INSPECTION PROCEDURE

1	CHECK HARNESS AND CONNECTOR(KICK DOWN SWITCH – BODY GROUND)

Wire Harness Side:
(Connector Front View):



(a) Disconnect the kick–down switch connector.

(b) Measure the voltage according to the value(s) in the table below.

Standard:

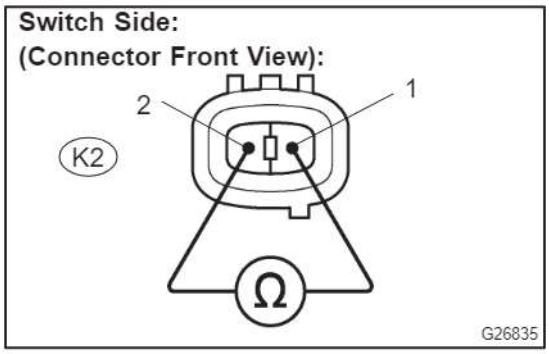
Tester Connection	Specified Condition
1 – Body ground	Below 1 Ω

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR (SEE PAGE 01–32)**

OK →

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2 INSPECT KICK DOWN SWITCH



(a) Measure resistance according to the value(s) in the table below when kick–down switch is ON and OFF.

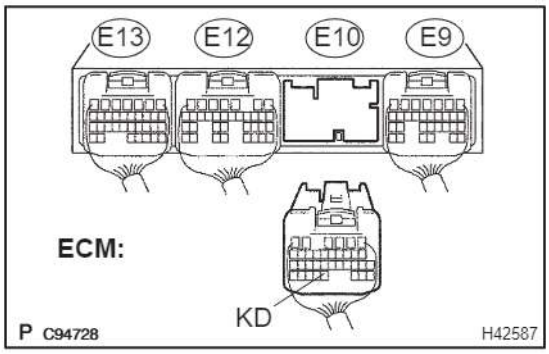
Standard:

Switch Condition	Tester Connection	Specified Condition
Press continuously (Kick–down switch is ON)	1 – 2	Below 1 Ω
Release (Kick–down switch is OFF)	↑	10 kΩ or higher

NG → **REPLACE KICK DOWN SWITCH**

OK

3 CHECK HARNESS AND CONNECTOR(KICK DOWN SWITCH – ECM)



(a) Connect the kick–down switch connector.
(b) Disconnect the ECM connector.
(c) Measure resistance according to the value(s) in the table below when accelerator pedal is fully depressed or not.

Standard:

Switch Condition	Tester Connection	Specified Condition
Fully depressed (Kick–down switch is ON)	E10 –31 (KD) – Body ground	Below 1 Ω
Release (Kick–down switch is OFF)	↑	10 kΩ or higher

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR (SEE PAGE 01–32)**

OK

PROCEED TO NEXT CIRCUIT INSPECTION SHOWN IN PROBLEM SYMPTOMS TABLE (SEE PAGE 05–229)

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CRUISE CONTROL SYSTEM (2AZ–FSE)(From February, 2004)

05ADI-06

HOW TO PROCEED WITH TROUBLESHOOTING

1	VEHICLE BROUGHT TO WORKSHOP

2	CUSTOMER PROBLEM ANALYSIS (SEE PAGE 05–305)

3	CHECK AND CLEAR DTCS (SEE PAGE 05–306)

4	PROBLEM SYMPTOM CONFIRMATION

- SYMPTOM DOES NOT OCCUR (GO TO STEP 5)
- SYMPTOM OCCURS (GO TO STEP 6)

5	SYMPTOM SIMULATION (SEE PAGE 01–22)

6	DTC CHECK (SEE PAGE 05–306)

(a) Check for cruise control system DTC output.

- TROUBLE CODE (GO TO STEP 7)
- NORMAL SYSTEM CODE (GO TO STEP 8)

7	DTC CHART (SEE PAGE 05–313)

8	PROBLEM SYMPTOMS TABLE (SEE PAGE 05–316)

9	CIRCUIT INSPECTION (SEE PAGE 05–317 TO 05–328)

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10	TERMINAL OF ECM (SEE PAGE 05–315)

11	IDENTIFICATION OF PROBLEM

12	REPAIR OR REPLACE

13	CONFIRMATION TEST

END

HINT:
The intelligent tester II can be used at the following diagnostic steps; 3, 6, 9 and 13.

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05ADJ-08

CUSTOMER PROBLEM ANALYSIS CHECK

CRUISE CONTROL SYSTEM Check Sheet

Inspector's name: _____

Customer's Name		**VIN**	
		Production Date	
		Licence Plate No.	
Date Vehicle Brought in	/ /	**Odometer Reading**	**km mile**

Condition of Problem Occurrence	**Date Problem Occurred**	/ /
	Frequency Problem Occurs?	☐ Continuous ☐ Intermittent (times a day)
	Vehicle Speed when Problem Occurred	**km mile**

Symptoms	☐ Auto cancel occurs	● Driving condition ☐ City driving ☐ Freeway ☐ Uphill ☐ Downhill ● After cancel occurred, did the driver activate cruise control again? ☐ Yes ☐ No
	☐ Cancel does not occur	☐ Depressing the brake pedal ☐ Shifting into any position except D while driving ☐ Pulling the cruise control main switch to CANCEL
	☐ Cruise control malfunction	☐ Acceleration function failure ☐ Deceleration function failure ☐ Hunting occurs ☐ O/D cut off does not occur ☐ O/D does not return
	☐ Switch malfunction	☐ SET ☐ ACCEL ☐ COAST ☐ RESUME ☐ CANCEL
	☐ CRUISE main indicator light	☐ Remains ON ☐ Does not come on ☐ Blinks

DTC Check	**1st Time**	☐ Normal System Code ☐ Trouble Code (Code)
	2nd Time	☐ Normal System Code ☐ Trouble Code (Code)

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05KYC-01

PRE–CHECK

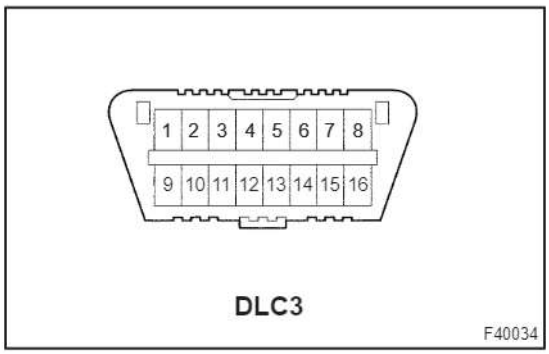
1. DIAGNOSIS SYSTEM

(a) Description

The ECM stores trouble codes when trouble occurs on the vehicle.

The diagnosis system allows for reading of the trouble codes from the DLC3. If the CRUISE main indicator light does not come on after DTC check, it means a malfunction has occurred in the cruise control system.

Use the intelligent tester II to check and solve the problem.



(b) Check the DLC3.

The vehicle's ECM uses ISO 9141–2 (Euro–OBD)/ISO 14230 (M–OBD) for communication protocol. The terminal arrangement of the DLC3 complies with ISO 15031–3 and matches the ISO 9141–2/ISO 14230 format.

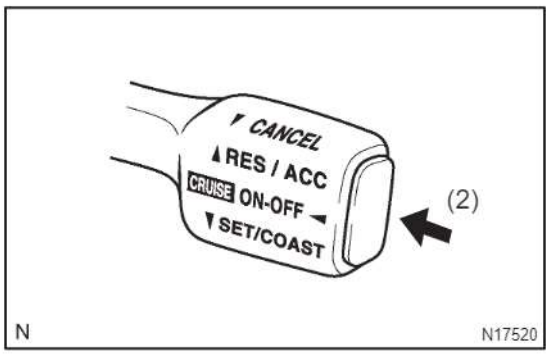
Symbols (Terminals No.)	Terminal Description	Condition	Specified Condition
SIL(7) – SG(5)	Bus "+" line	During transmission	Pulse generation
CG(4) – Body ground	Chassis ground	Always	Below 1 Ω
SG(5) – Body ground	Signal ground	Always	Below 1 Ω
BAT(16) – Body ground	Battery positive	Always	11 to 14 V

HINT:

If the display shows "UNABLE TO CONNECT TO VEHICLE" after connecting the intelligent tester II to the DLC3 and turning the ignition to the ON position, there is a problem with either the vehicle or the tool. (Intelligent tester II only)

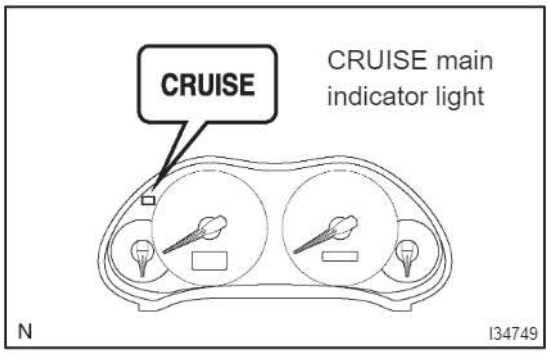
- If communication is normal when connecting the tool to another vehicle, inspect the DLC3 on the original vehicle.
- If communication is still not possible when connecting the tool to another vehicle, it suggests the problem is the tool's own. In this case, consult Service Department listed in the tool's instruction manual.

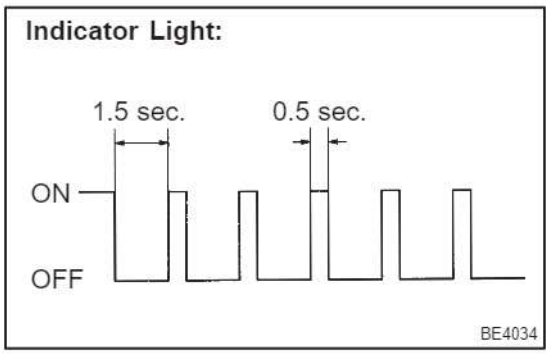
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(c) Check the indicator.
(1) Turn the ignition switch to the ON position.
(2) Check that the CRUISE main indicator light comes on when the cruise control main switch ON–OFF button is pushed on, and that the indicator light goes off when the ON–OFF button is pushed off.

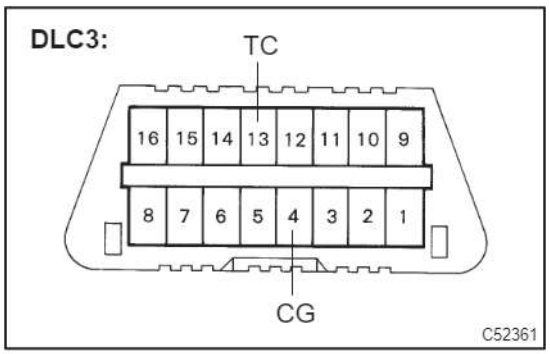
HINT:
If there is a problem with the indicator light, inspect the CRUISE main indicator light circuit (see page 05–327).





HINT:
If a malfunction occurs in the vehicle speed sensors, stop lamp switch assy or other related parts during cruise control driving, the ECM actuates AUTO CANCEL of the cruise control. Then the CRUISE main indicator light starts to blink, informing the driver of the malfunction. At the same time, data of the malfunction is stored as a diagnostic trouble code (DTC).

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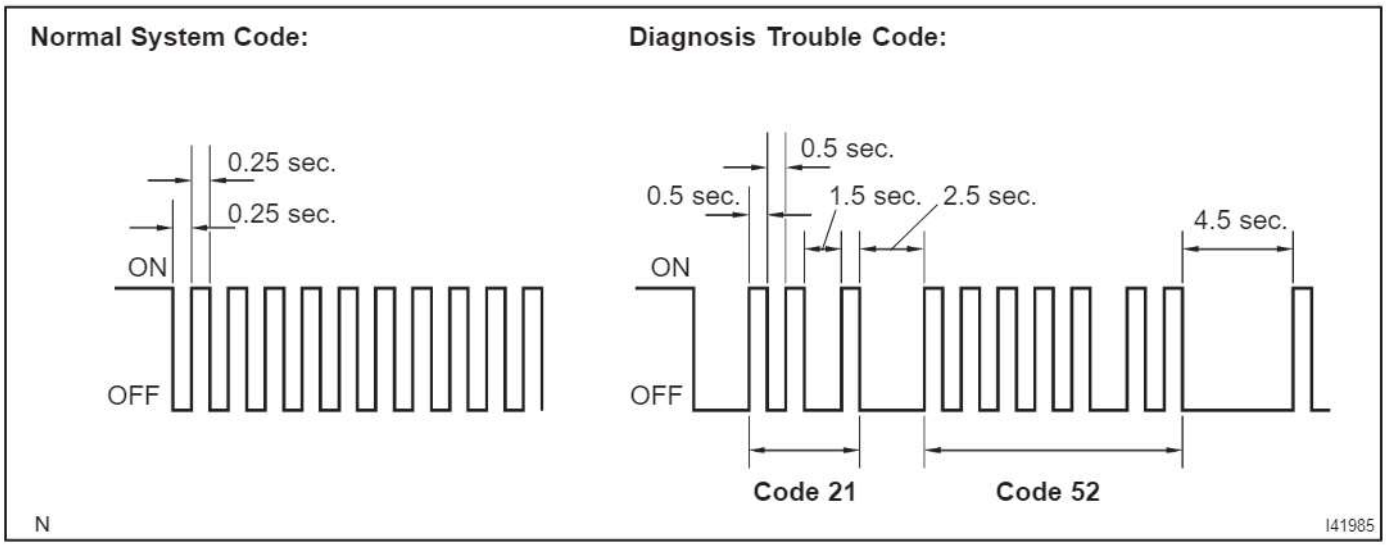


(d) Output DTCs using diagnosis check wire.

(1) Using SST, create a short–circuit between terminals TC and CG of the DLC3.

(2) Turn the ignition switch to the ON position.

(3) Read and record DTCs from the CRUISE main indicator light on the combination meter. As examples, refer to the chart below for the blinking patterns of the normal system code and diagnosis trouble code 21 and 52.

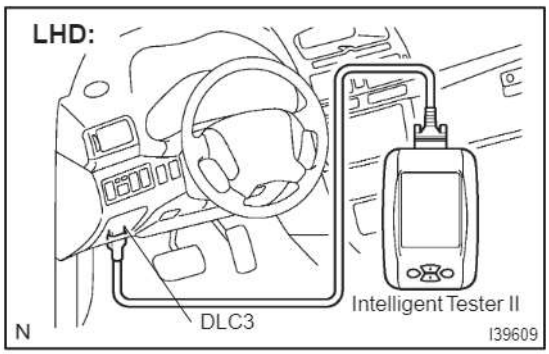


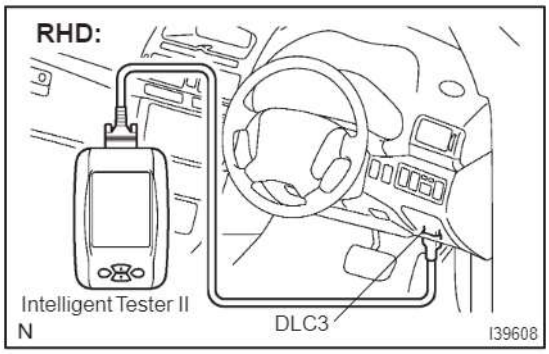
HINT:

If the CRUISE main indicator light does not blink because of any DTC or in the normal code blinking pattern, inspect the following circuits.

Relevant Circuit	See Page
Diagnosis circuit	05–328
CRUISE main indicator circuit	05–327

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2. USING INTELLIGENT TESTER II

(a) Connect the intelligent tester II to the DLC3.

(b) Turn the ignition switch to the ON position.

(c) Read the DTCs on the tester screen.

HINT:

Intelligent tester II has a "Snapshot" function which records the monitored data.

Refer to the intelligent tester II operator's manual for further details.

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3. DATA LIST

(a) While the intelligent tester II is connected to the DLC3 with the ignition switch in the ON position, the CRUISE CONTROL data list can be displayed. Follow the prompts on the tester screen to access the data list.

CC (ECM):

Item	Measurement Item / Display (Range)	Normal Condition	Diagnostic Note
CCS Vehicle Spd	Vehicle speed / min.: 0 km/h (0 mph), max.: 255 km/h (158 mph)	Actual vehicle speed	–
CCS Mem Vehicle Spd	Cruise control memorized speed / min.: 36 km/h (22.5 mph), max.: 200 km/h (125 mph)	Actual stored vehicle speed	–
Throttle Opening Angle	Required throttle opening angle / min.: 0°, max.: 125°	Actual required throttle opening	–
Cruise Control	Cruise control system active condition / ON or OFF	ON: Cruise control activated OFF: Cruise control inactivated	–
Main SW M–CPU	Main SW signal (Main CPU) / ON or OFF	ON: Main SW ON (Pushed on) OFF: Main SW OFF (Pushed off)	"3"
Main SW S–CPU	Main SW signal (Sub CPU) / ON or OFF	ON: Main SW ON (Pushed on) OFF: Main SW OFF (Pushed off)	"3"
CCS Ready M–CPU	Cruise control system standby condition (Main CPU) / ON or OFF	ON ⇔ OFF: Change ON/OFF each time Main SW is pushed in.	"1"
CCS Ready S–CPU	Cruise control system standby condition (Sub CPU) / ON or OFF	ON ⇔ OFF: Change ON/OFF each time Main SW is pushed in.	"1"
CCS indicator M–CPU	Cruise indicator signal (Main CPU) / ON or OFF	ON: "CRUISE" ON OFF: "CRUISE" OFF	"2"
CCS indicator S–CPU	Cruise indicator signal (Sub CPU) / ON or OFF	ON: "CRUISE" ON OFF: "CRUISE" OFF	"2"
Cancel Switch	CANCEL SW signal / ON or OFF	ON: CANCEL SW ON OFF: CANCEL SW OFF	–
SET/COAST Switch	SET/COAST SW signal / ON or OFF	ON: SET/COAST SW ON OFF: SET/COAST SW OFF	–
RES/ACC Switch	RES/ACC SW signal / ON or OFF	ON: RES/ACC SW ON OFF: RES/ACC SW OFF	–
Stp Light SW M–CPU	Stop lamp SW signal (Main CPU) / ON or OFF	ON: Brake pedal depressed OFF: Brake pedal released	–
Stp Light SW S1–CPU	Stop lamp SW signal (Sub CPU) / ON or OFF	ON: Brake pedal depressed OFF: Brake pedal released	–
Stp Light SW S2–CPU	Stop light SW signal (Sub CPU) / ON or OFF	ON: Brake pedal depressed OFF: Brake pedal released	–
Shift D Position	PNP SW signal (D position) / ON or OFF	ON: Shift D position OFF: Any shift position except D	–

HINT:

"3" is OK but "1" is NG → ECM failure

"1" is OK but "2" is NG → DTC output or ECM failure

"3" is OK but the cruise indicator does not come on → CRUISE main indicator, wire harness or ECM failure

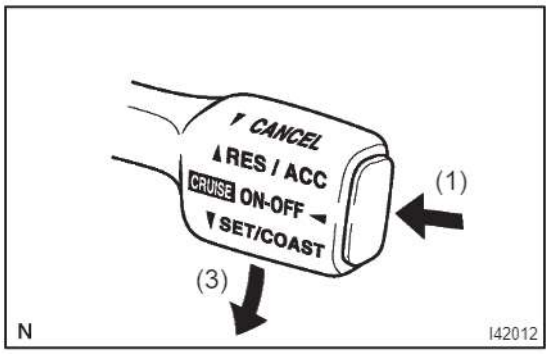
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4. DTC CLEAR

(a) The following methods will erase the DTCs and freeze frame data.
  (1) The intelligent tester II can be used to erase the codes.
  (2) Disconnecting the battery terminal or EFI No.1 fuse can also erase the codes.

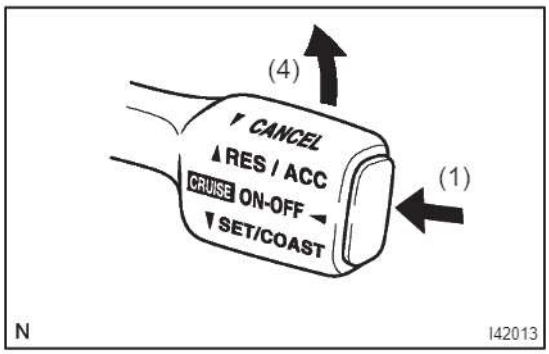
(b) After completing repair, the DTC retained in the memory can be cleared by removing the EFI No.1 fuse for 1 minute or more with the ignition switch off.

(c) Check that the normal system code is displayed after connecting the fuse.

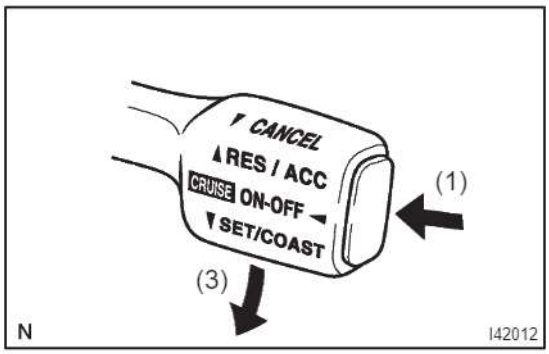


5. PROBLEM SYMPTOM CONFIRMATION (ROAD TEST)

(a) Inspect the SET function.
  (1) Push the ON–OFF button on.
  (2) Drive at the required speed (40 km/h (25 mph) or higher).
  (3) Push down the cruise control main switch to SET/COAST.
  (4) After releasing the switch, check that the vehicle cruises at the set speed.

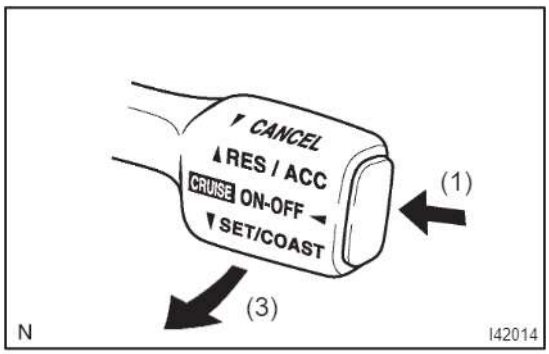


(b) Inspect the ACC (ACCEL) switch.
  (1) Push the ON–OFF button on.
  (2) Drive at the required speed (40 km/h (25 mph) or higher).
  (3) Push down the cruise control main switch to SET/COAST.
  (4) Check that vehicle speed increases while the cruise control main switch is pushed up to RES/ACC, and that the vehicle cruises at the newly set speed when the switch is released.
  (5) Momentarily push up the cruise control main switch to RES/ACC and then immediately release it. Check that vehicle speed increases by approximately 1.6 km/h (1.0 mph) (Tap–up function).

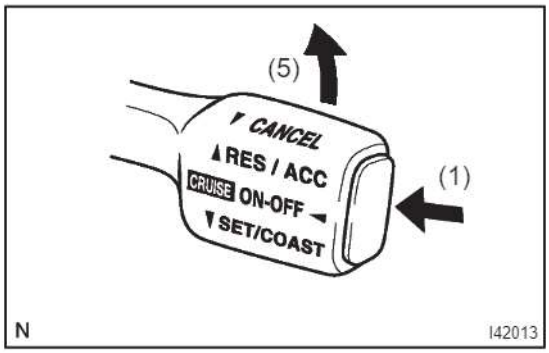


(c) Inspect the COAST function.
  (1) Push the ON–OFF button on.
  (2) Drive at the required speed (40 km/h (25 mph) or higher).
  (3) Push down the cruise control main switch to SET/COAST.
  (4) Check that vehicle speed decreases while the cruise control main switch is pushed down to SET/COAST, and that the vehicle cruises at the newly set speed when the switch is released.
  (5) Momentarily push down the cruise control main switch to SET/COAST, and then immediately release it.
  Check that vehicle speed decreases by approximately 1.6 km/h (1.0 mph) (Tap–down function).

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(d) Inspect the CANCEL function.
(1) Push the ON–OFF button on.
(2) Drive at the required speed (40 km/h (25 mph) or higher).
(3) Push down the cruise control main switch to SET/COAST.
(4) When doing one of the following, check that the cruise control system is cancelled and that the normal driving mode is reset.
- Depressing the brake pedal
- Shifting into any position except D while driving
- Pushing the ON–OFF button off
- Pulling the cruise control main switch to CANCEL



(e) Inspect the RES (RESUME) function.
(1) Push the ON–OFF button on.
(2) Drive at the required speed (40 km/h (25 mph) or higher).
(3) Push down the cruise control main switch to SET/COAST.
(4) When doing one of the following, check that the cruise control system is cancelled and that the normal driving mode is reset.
- Depressing the brake pedal
- Shifting into any position except D while driving
- Pulling the cruise control main switch to CANCEL

(5) After pushing up the cruise control main switch to RES/ACC at a driving speed of more than 40 km/h (25 mph), check that the vehicle restores the speed prior to the cancellation.

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056HH-07

DIAGNOSTIC TROUBLE CODE CHART

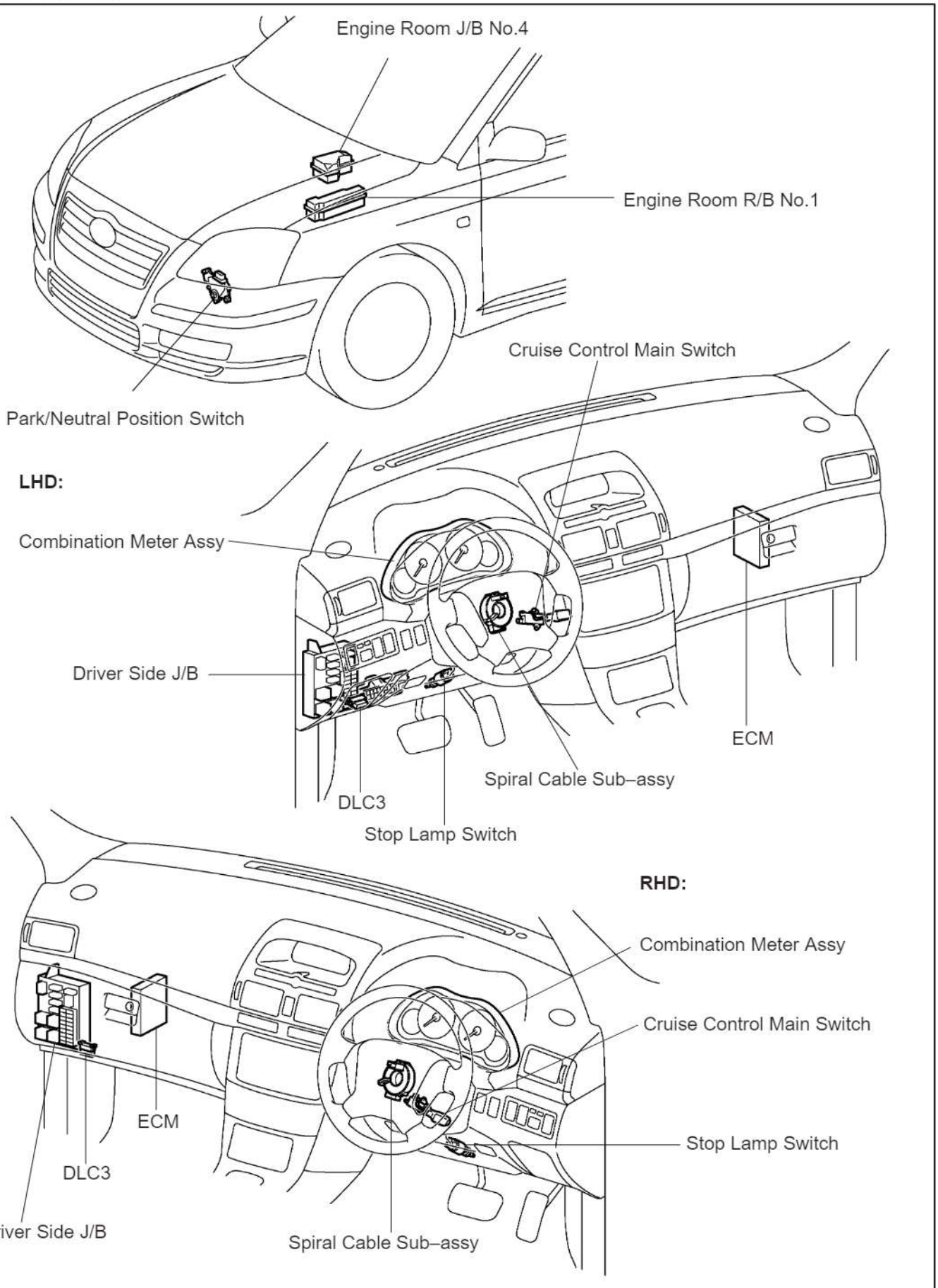
If a trouble code is indicated while checking DTCs, inspect the circuit listed for that code in the table below, and proceed to the applicable page.

DTC No. (See Page)	Circuit Inspection	Trouble Area
P0500/21 (05–317)	Vehicle speed sensor circuit	• Vehicle speed sensor • Vehicle speed sensor signal circuit • ECM
P0503/23 (05–317)	Vehicle speed sensor circuit	• Vehicle speed sensor • Vehicle speed sensor signal circuit • ECM
P0571/52 (05–318)	Stop light switch circuit	• Stop lamp switch assy • Stop lamp switch assy circuit • ECM
P0607/54 (05–321)	Input signal circuit	• ECM

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05ADK-06

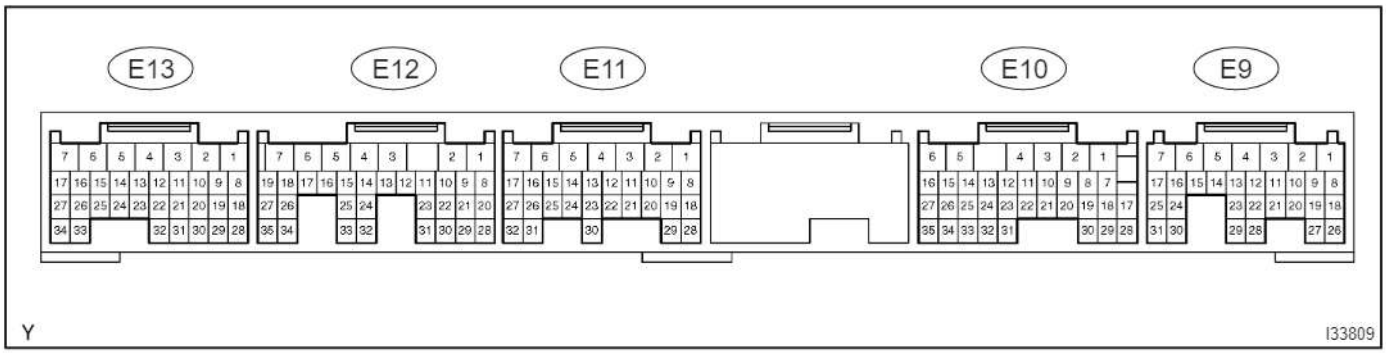
LOCATION



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05KYD–01

TERMINALS OF ECM



Symbols (Terminals No.)	Wiring Color	Terminal Description	Condition	Specified Condition
TC (E9–20) – E1 (E11–1)	W–L – BR	DTC input signal	Ignition switch ON → Connect terminals TC and CG of DLC3	10 to 14 V → Below 2 V
ST1– (E10–12) – E1 (E11–1)	G–W – BR	Cruise cancel input signal	Ignition switch ON, depress brake pedal → release brake pedal	Below 1 V → 10 to 14 V
STP (E10–19) – E1 (E11–1)	G–W – BR	Stop lamp switch input signal	Ignition switch ON, depress brake pedal → release brake pedal	10 to 14 V → Below 1 V
CCS (E10–24) – E1 (E11–1)	W – BR	Cruise control main switch input signal	Ignition switch ON Cancel switch held ON SET/COAST switch held ON RES/ACC switch held ON MAIN switch held ON	10 to 14 V 6.6 to 10.1 V 4.5 to 7.1 V 2.3 to 4 V Below 1 V

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056HK-07

PROBLEM SYMPTOMS TABLE

If a normal system code is displayed during the DTC check but the problem still occurs, check the circuits for each problem symptom in the order given in the table below and proceed to the relevant troubleshooting page.

HINT:

Inspect the "Fuse" and "Relay" before confirming the suspected areas as shown in the chart below.

Inspect each malfunction circuit in numerical order for the corresponding symptom.

Symptom	Suspected Area	See Page
Main switch cannot be turned ON. (Cruise indicator light in combination meter does not come on.)	1. Cruise control switch circuit 2. CRUISE main indicator light circuit 3. ECM 4. Combination meter assy	05–322 05–327 *2 *1
Vehicle speed setting cannot be done. (Although indicator light in combination meter comes on when the main switch is turned ON, it goes off when vehicle speed is set.)	1. Cruise control switch circuit 2. ECM	05–322 *2
Setting cannot be done. (Indicator light in combination meter comes on when the main switch is turned ON and it remains ON while setting.)	1. Cruise control switch circuit 2. Stop lamp switch circuit 3. Park/Neutral position switch circuit 4. Combination meter system 5. ECM	05–322 05–318 *2 *1 *2
While the vehicle is driven with cruise control, the set control is cancelled. (Indicator light and CRUISE remain ON.)	1. Cruise control switch circuit 2. Vehicle speed sensor circuit 3. Stop lamp switch circuit 4. CRUISE main indicator light circuit 5. Park/Neutral position switch circuit 6. ECM 7. Combination meter assy	05–322 05–317 05–318 05–327 *2 *2 *1
Hunting (Speed is not constant.)	1. Vehicle speed sensor circuit 2. ECM	05–317 *2
Setting cannot be cancelled. (When Coast, Acceleration, Resume, Set speed change and Control switch are operated.)	1. Cruise control switch circuit 2. ECM	05–322 *2
DTC is not output, or is output when should not be.	1. Diagnosis circuit	05–328
CRUISE main indicator light does not come on.	1. Cruise control switch circuit 2. CRUISE main indicator light circuit 3. ECM 4. Combination meter assy	05–322 05–327 *2 *1

*1: See Pub. No. RM1018E

*2: See Pub. No. RM1045E

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DTC	P0500/21	VEHICLE SPEED SENSOR CIRCUIT

DTC	P0503/23	VEICLE SPEED SENSOR CIRCUIT

CIRCUIT DESCRIPTION

See Pub. No. RM1045E, page 05–183.

DTC No.	DTC Detection Condition	Trouble Area
P0500/21	This trouble code is output when the vehicle speed signal from the vehicle speed sensor is cut for 0.14 sec. or more while the cruise control is in operation.	• Vehicle speed sensor • Vehicle speed sensor signal circuit • ECM
P0503/23	Momentary interruption and noise are detected when a rapid change of vehicle speed occurs while the cruise control is in operation.	• Vehicle speed sensor • Vehicle speed sensor signal circuit • ECM

WIRING DIAGRAM

See Pub. No. RM1045E, page 05–183.

INSPECTION PROCEDURE

See Pub. No. RM1045E, page 05–183.

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DTC P0571/52 STOP LIGHT SWITCH CIRCUIT

CIRCUIT DESCRIPTION

When the brake pedal is depressed, the stop lamp switch assy sends a signal to the ECM. When the ECM receives this signal, it cancels the cruise control.

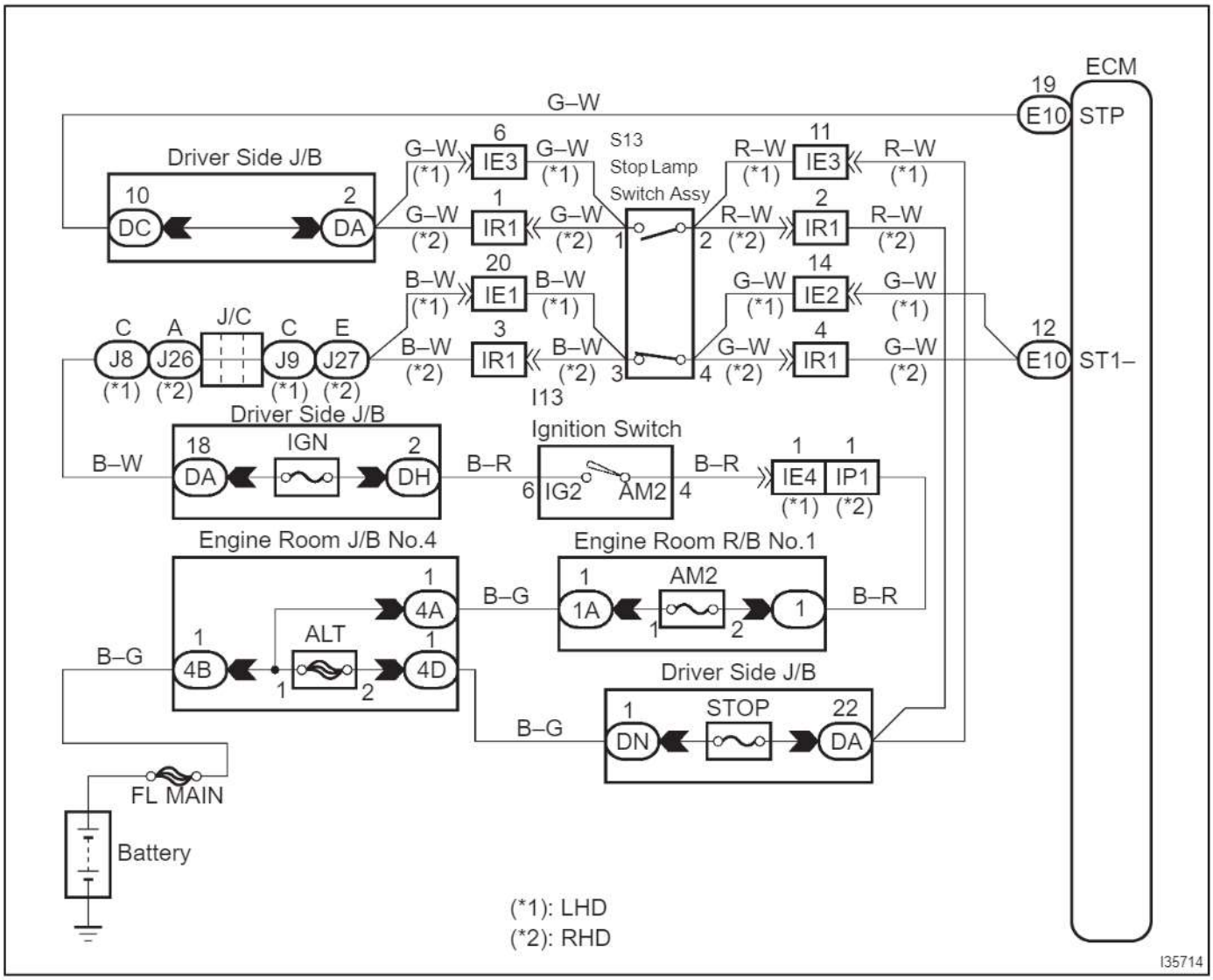
Fail–safe function operates to enable normal driving even if there is a malfunction in the stop lamp signal circuit.

The cancel condition occurs when positive battery voltage is applied to terminal STP.

When the brake is applied, battery positive voltage is normally applied to terminal STP of the ECM through the STOP fuse and the stop lamp switch assy, and the ECM turns the cruise control off.

DTC No.	DTC Detection Condition	Trouble Area
P0571/52	This trouble code is output when the voltage of the STP terminal and that of the ST1– terminal on the ECM are below 1 V for 0.5 sec. or more.	• Stop lamp switch assy • Stop lamp switch assy circuit • ECM

WIRING DIAGRAM



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INSPECTION PROCEDURE

HINT:

Start the inspection from step 1 when using the intelligent tester II and start from step 2 when not using the intelligent tester II.

1	READ VALUE ON INTELLIGENT TESTER II

(a) Connect the intelligent tester II to the DLC3.
(b) Turn the ignition switch to the ON position, and turn the intelligent tester II main switch on.
(c) Select the item "Stp Light SW M–CPU", "Stp Light SW S1–CPU" or "Stp Light SW S2–CPU" in the DATA LIST, and read its value displayed on the intelligent tester II.
(d) Check that the stop lamp comes on when the brake pedal is depressed, and goes off when the brake pedal is released.

ECM:

Item	Measurement Item / Display (Range)	Normal Condition	Diagnostic Note
Stp Light SW M–CPU	Stop lamp SW signal (Main CPU) / ON or OFF	ON : Brake pedal depressed OFF : Brake pedal released	–
Stp Light SW S1–CPU	Stop lamp SW signal (Sub CPU) / ON or OFF	ON : Brake pedal depressed OFF : Brake pedal released	–
Stp Light SW S2–CPU	Stop lamp SW signal (Sub CPU) / ON or OFF	ON : Brake pedal depressed OFF : Brake pedal released	–

OK:

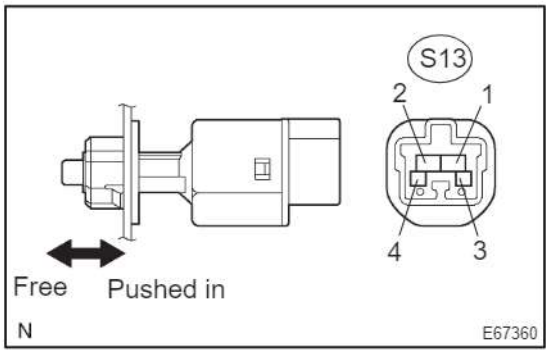
When the brake pedal is operated, the display changes as shown above.

NG → **Go to step 2**

OK

REPLACE ECM (SEE PUB. NO. RM1045E, PAGE 10–29)

2	INSPECT STOP LAMP SWITCH ASSY



(a) Disconnect the stop lamp switch connector.
(b) Measure the resistance according to the value(s) in the table below.

Standard:

Tester Connection	Condition	Specified Condition
1 – 2	Switch pin free	Below 1 Ω
3 – 4	Switch pin free	10 kΩ or higher
1 – 2	Switch pin pushed in	10 kΩ or higher
3 – 4	Switch pin pushed in	Below 1 Ω

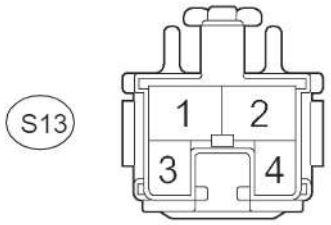
NG → **REPLACE STOP LAMP SWITCH ASSY**

OK

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3 CHECK HARNESS AND CONNECTOR (STOP LAMP SWITCH – BATTERY)

Stop Lamp Switch
Connector Front View:



(a) Measure the voltage according to the value(s) in the table below.

Standard:

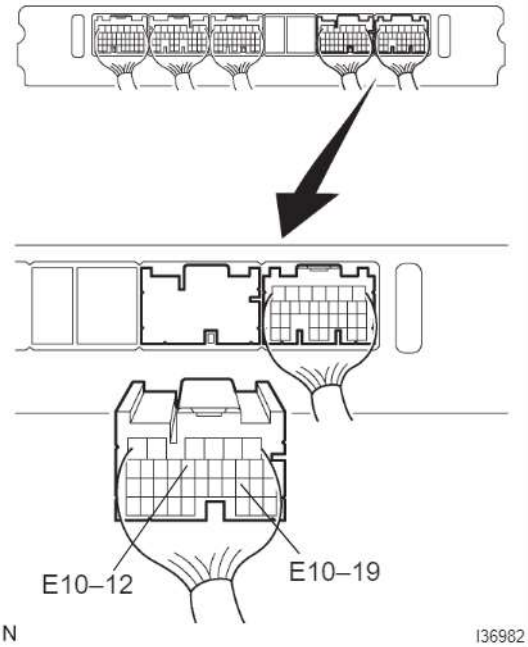
Tester Connection	Condition	Specified Condition
2 – Body ground	Always	10 to 14 V
3 – Body ground	Ignition switch ON	10 to 14 V

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

OK

4 INSPECT ECM

ECM
Wire Harness View:



(a) Reconnect the stop lamp switch connector.
(b) Disconnect the E10 connector from the ECM.
(c) Measure the voltage according to the value(s) in the table below.

Standard:

Tester Connection	Condition	Specified Condition
E10–12 – Body ground	Ignition switch ON, depress brake pedal → release brake pedal	Below 1 V → 10 to 14 V
E10–19 – Body ground	Ignition switch ON, depress brake pedal → release brake pedal	10 to 14 V → Below 1 V

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR (STOP LAMP SWITCH – ECM)**

OK

REPLACE ECM (SEE PUB. NO. RM1045E, PAGE 10–29)

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DTC P0607/54 INPUT SIGNAL CIRCUIT

CIRCUIT DESCRIPTION

This DTC indicates the internal abnormalities of the ECM.

DTC No.	Detection Item	Trouble Area
P0607/54	The ECM has a supervisory CPU and a control ECU inside. When each input STP signal is different for 0.15 sec. or more, this trouble code is output. This trouble code is output after 0.4 sec. has passed from the time the cruise cancel input signal (STP input) is input into the ECM.	• ECM

HINT:

The ECM receives signals from each sensor to control all the functions of the cruise control with the micro-computer.

When a trouble code is detected, fail–safe remains on until the ignition switch is turned off.

INSPECTION PROCEDURE

1	REPLACE ECM (SEE PUB. NO. RM1045E, PAGE 10–29)

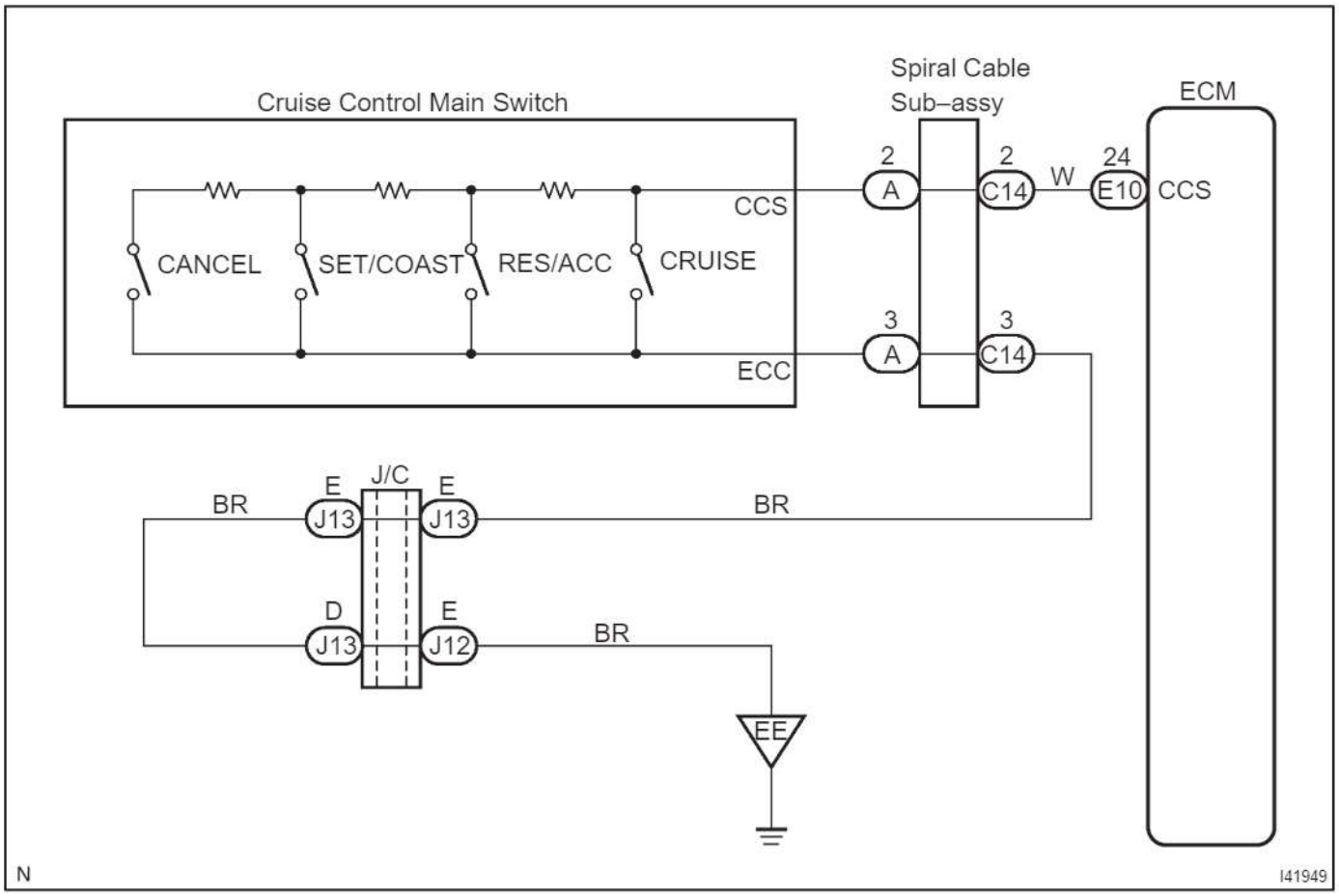
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CRUISE CONTROL SWITCH CIRCUIT

CIRCUIT DESCRIPTION

The cruise control main switch operates seven functions: SET, COAST, TAP–DOWN, RESUME, ACCEL, TAP–UP, and CANCEL. The SET, TAP–DOWN and COAST functions, and the RESUME, TAP–UP and ACCEL functions are operated with the same switch. The cruise control main switch is an automatic return type switch which turns on only while operating it in each arrow direction and turns off after releasing it. The internal contact point of the cruise control main switch is turned on with the switch operation. Then the ECM reads the voltage value that has been changed by the switch operation to control SET, COAST, RESUME, ACCEL and CANCEL.

WIRING DIAGRAM

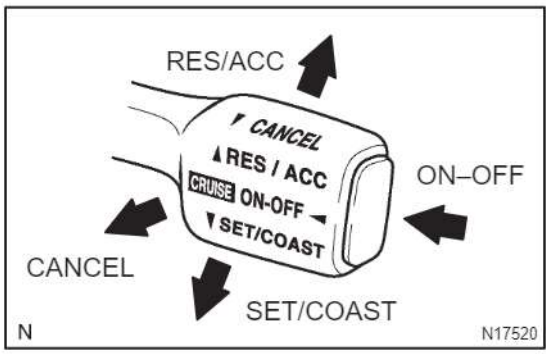


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INSPECTION PROCEDURE

HINT:
Start the inspection from step 1 when using the intelligent tester II and start from step 2 when not using the intelligent tester II.

1	READ VALUE ON INTELLIGENT TESTER II



(a) Connect the intelligent tester II to the DLC3.
(b) Turn the ignition switch to the ON position.
(c) According to the display on the intelligent tester II, read the "DATA LIST".

ECM:

Item	Measurement Item / Display (Range)	Normal Condition	Diagnostic Note
Main SW M–CPU	Main SW signal (Main CPU) / ON or OFF	ON : Main SW ON (Pushed on) OFF Main SW OFF (Pushed off)	–
Main SW S–CPU	Main SW signal (Sub CPU) / ON or OFF	ON : Main SW ON (Pushed on) OFF Main SW OFF (Pushed off)	–
Cancel Switch	CANCEL SW signal / ON or OFF	ON : CANCEL SW ON OFF : CANCEL SW OFF	–
SET/COAST Switch	SET/COAST SW signal / ON or OFF	ON : SET/COAST SW ON OFF : SET/COAST SW OFF	–
RES/ACC Switch	RES/ACC SW signal / ON or OFF	ON : RES/ACC SW ON OFF : RES/ACC SW OFF	–

OK:
When the cruise control main switch is operated, the display changes as shown above.
Result:

OK	A
NG (All items are defective.)	B
NG (One to four items are defective.)	C

B → **Go to step 2**

C → **REPLACE CRUISE CONTROL MAIN SWITCH ASSY**

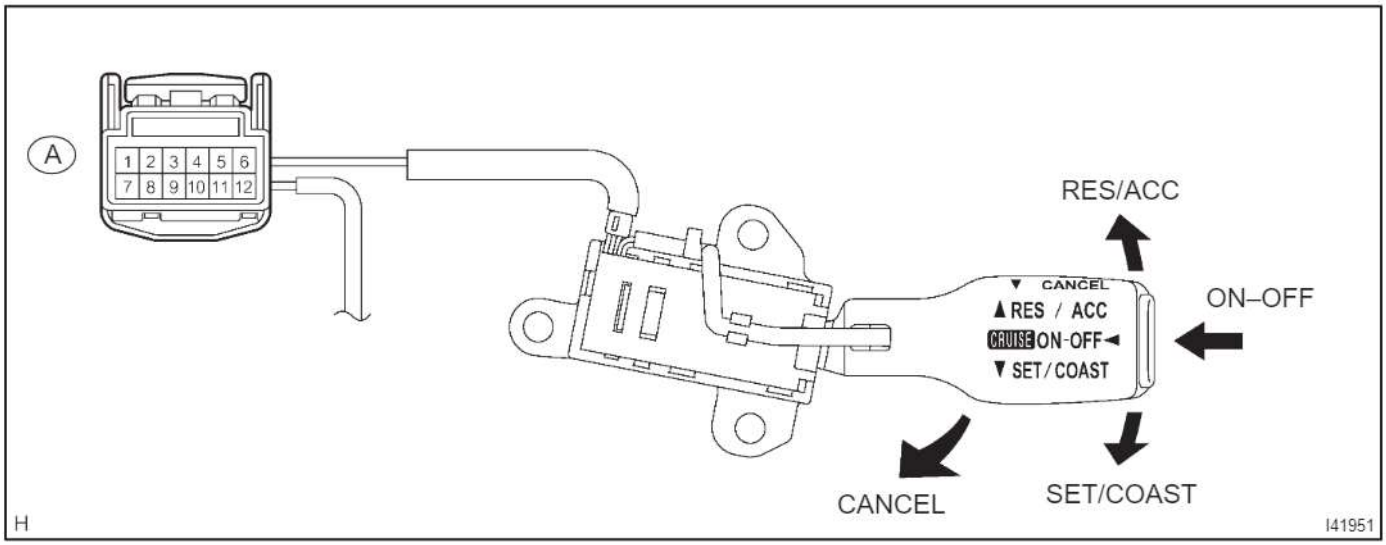
A

PROCEED TO NEXT CIRCUIT INSPECTION SHOWN IN PROBLEM SYMPTOMS TABLE (SEE PAGE 05–316)

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2 INSPECT CRUISE CONTROL MAIN SWITCH ASSY

(a) Disconnect the cruise control main switch connector.



(b) Measure the resistance according to the value(s) in the table below.
Standard:

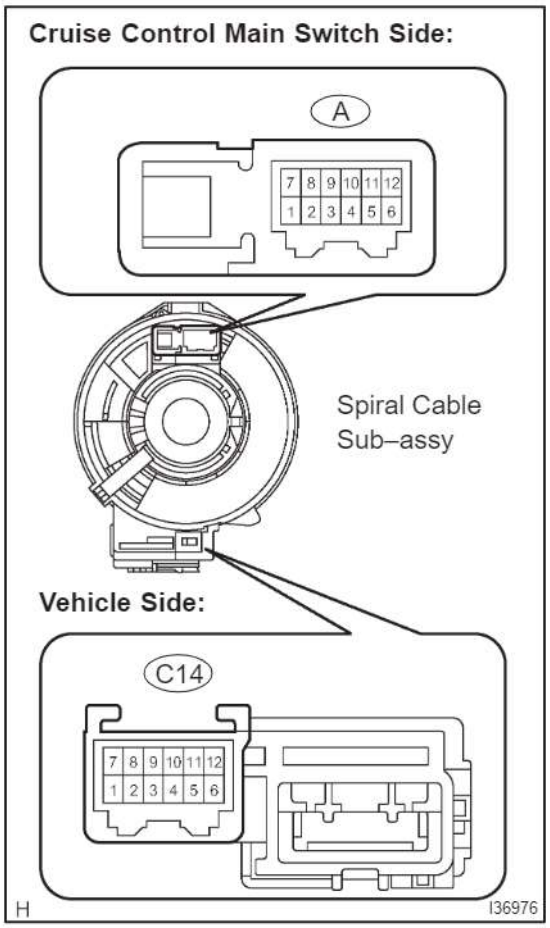
Tester Connection	Condition	Specified Condition
2 – 3	Neutral	10 kΩ or higher
2 – 3	RES/ACC	210 to 270 Ω
2 – 3	SET/COAST	560 to 700 Ω
2 – 3	CANCEL	1,380 to 1,700 Ω
2 – 3	Main Switch OFF	10 kΩ or higher
2 – 3	Main Switch ON	Below 1 Ω

NG → **REPLACE CRUISE CONTROL MAIN SWITCH ASSY**

OK

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3 INSPECT SPIRAL CABLE SUB–ASSY



(a) Disconnect the spiral cable sub–assy connector.
(b) Measure the resistance according to the value(s) in the table below.

Standard:

Tester Connection	Specified Condition
A–2 – C14–2	Below 1 Ω
A–3 – C14–3	Below 1 Ω

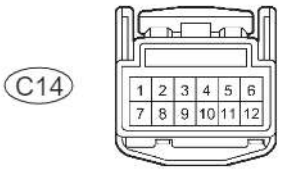
NG → **REPLACE SPIRAL CABLE SUB–ASSY (SEE PUB. NO. RM1018E, PAGE 60–26)**

OK

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4	CHECK HARNESS AND CONNECTOR (SPIRAL CABLE SUB–ASSY – ECM, BODY GROUND)

Spiral Cable Sub–assy (Vehicle Side)
Connector Front View:



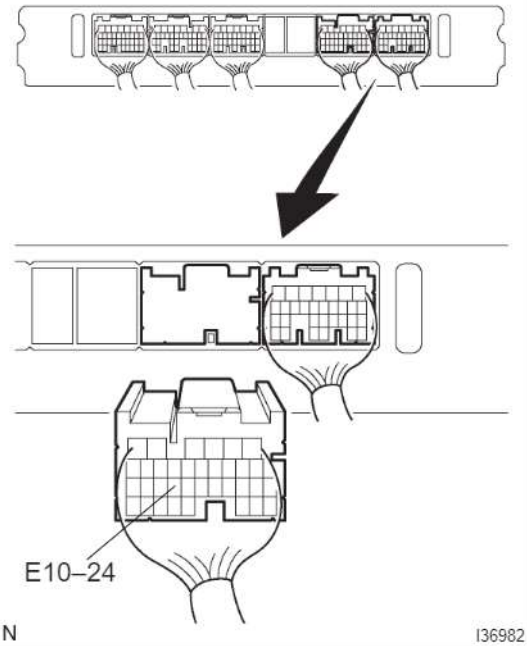
I38526

(a) Measure the resistance according to the value(s) in the table below.

Standard:

Tester Connection	Condition	Specified Condition
C14–2 – E10–24	Always	Below 1 Ω
E10–24 – Body ground	Always	10 kΩ or higher
C14–3 – Body ground	Always	Below 1 Ω

ECM
Wire Harness View:



I36982

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

PROCEED TO NEXT CIRCUIT INSPECTION SHOWN IN PROBLEM SYMPTOMS TABLE (SEE PAGE 05–316)

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CRUISE MAIN INDICATOR LIGHT CIRCUIT

CIRCUIT DESCRIPTION

- The ECM detects a cruise control switch signal and sends it to the combination meter via BEAN. Then the CRUISE main indicator light comes on.
- The CRUISE main indicator light circuit uses BEAN for communication. If there are any malfunctions in this circuit, check for DTCs in the multiplex communication system.

INSPECTION PROCEDURE

1	READ VALUE ON INTELLIGENT TESTER II

(a) Connect the intelligent tester II to the DLC3.
(b) Turn the ignition switch to the ON position and turn the intelligent tester II main switch on.
(c) Select the item below in the "DATA LIST", and read the display on the intelligent tester II.

CC (ECM):

Item	Measurement Item / Display (Range)	Normal Condition	Diagnostic Note
CCS Indicator M–CPU	Cruise indicator signal (Main CPU) / ON or OFF	ON : "CRUISE" ON OFF : "CRUISE" OFF	–
CCS Indicator S–CPU	Cruise indicator signal (Sub CPU) / ON or OFF	ON : "CRUISE" ON OFF : "CRUISE" OFF	–

OK:

When the cruise control main switch is operated, the display changes as shown above.

NG → **REPLACE ECM (SEE PUB. NO. RM1045E, PAGE 10–29)**

OK

PROCEED TO NEXT CIRCUIT INSPECTION SHOWN IN PROBLEM SYMPTOMS TABLE (SEE PAGE 05–316)

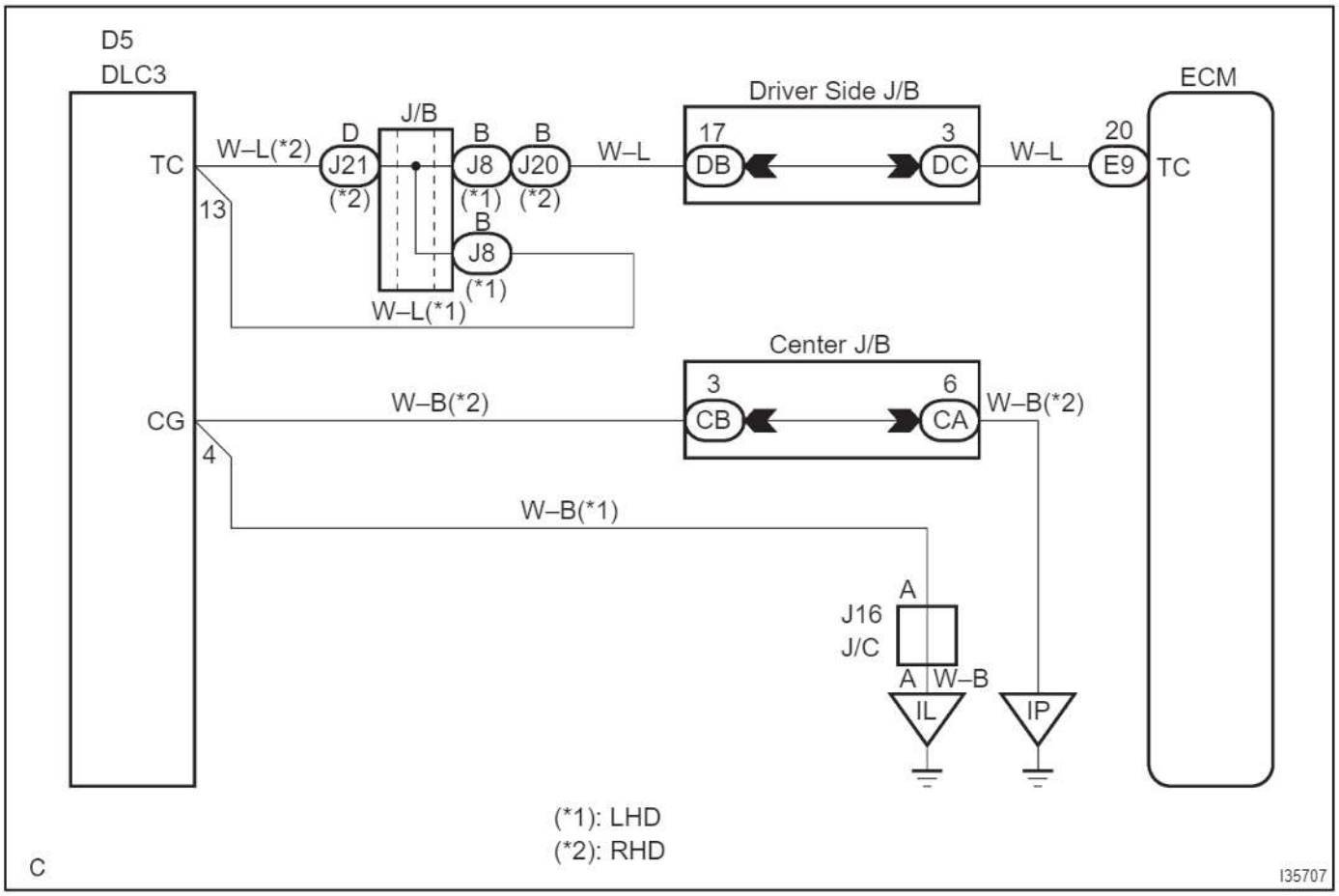
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DIAGNOSIS CIRCUIT

CIRCUIT DESCRIPTION

Making a short circuit between terminals TC and CG of the DLC3 will output DTCs from the DLC3.

WIRING DIAGRAM



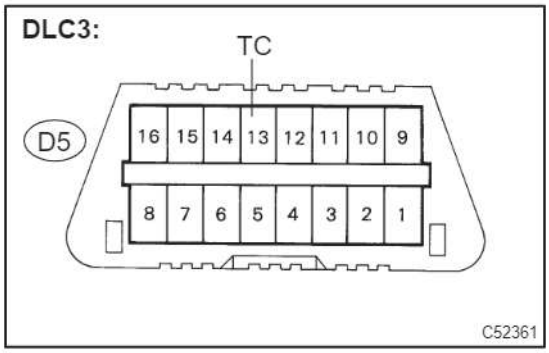
HINT:

When a particular warning light stays blinking, a ground short in the wiring of terminal TC of the DLC3 or an internal ground short in the relevant ECU is suspected.

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INSPECTION PROCEDURE

1	CHECK HARNESS AND CONNECTOR (TC of DLC3 – ECM)

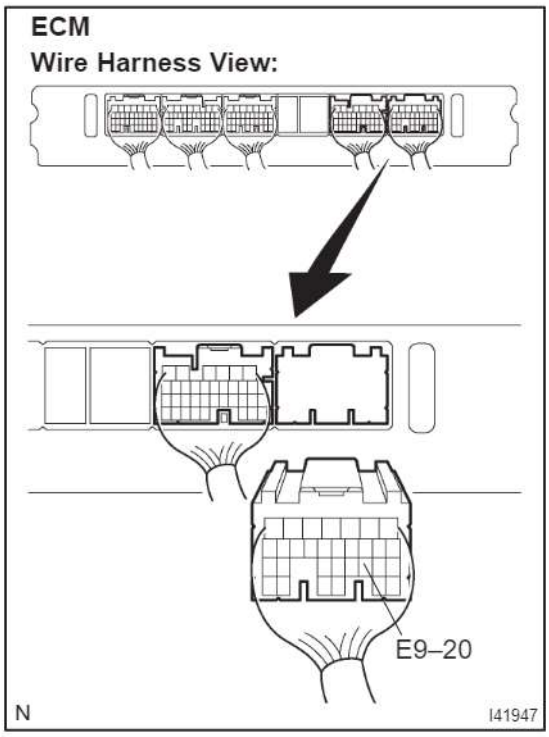


(a) Disconnect the E9 connector from the ECM.

(b) Measure the resistance according to the value(s) in the table below.

Standard:

Tester Connection	Condition	Specified Condition
D5–13 – E9–20	Always	Below 1 Ω

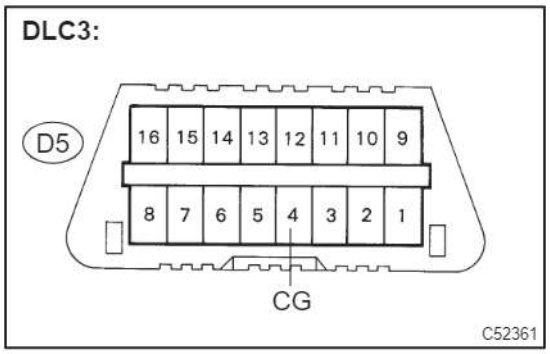


NG → REPAIR OR REPLACE HARNESS OR CONNECTOR (DLC3 – ECM)

OK

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2 CHECK HARNESS AND CONNECTOR (CG of DLC3 – BODY GROUND)



(a) Measure the resistance according to the value(s) in the table below.

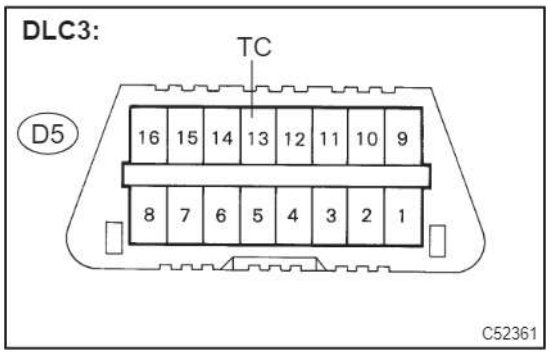
Standard:

Tester Connection	Condition	Specified Condition
4 – Body ground	Always	Below 1 Ω

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR (DLC3 – BODY GROUND)**

OK

3 CHECK HARNESS AND CONNECTOR (TC of DLC3 – BODY GROUND)



(a) Measure the resistance according to the value(s) in the table below.

Standard:

Tester Connection	Condition	Specified Condition
13 – Body ground	Ignition switch off	10 kΩ or higher

NG → **REPAIR OR REPLACE WIRE HARNESS OR EACH ECU**

OK

REPLACE ECM (SEE PUB. NO. RM1045E, PAGE 10–29)

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