CAN COMMUNICATION

GENERAL INFORMATION

Description

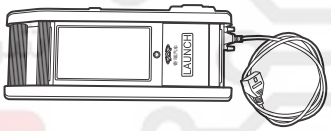
This vehicle is equipped with CAN bus. CAN bus is a kind of fieldbus, and a serial communication network which supports distributed control system effectively. It mainly consists of CAN controller, CAN transceiver, data transmission line and data transmission terminating resistor. BCM, diagnostic interfaces, audio, radar control module, IC, TCU, ECM, ABS/ESP, SAS, SRS are connected via CAN bus, CAN controller and CAN transceiver are integrated into electronic control unit. Terminating resistors are respectively integrated into IC, BCM and ECM, forming CAN bus with the IC and BCM as terminating resistors, the ECM and BCM drive CAN bus as terminating resistors.

Operation

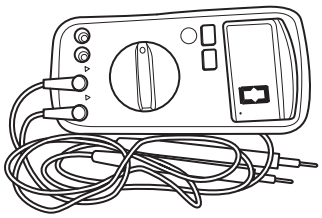
CAN bus is also called vehicle bus, and full name is "Controller Area Network" which means local area network, it connects all control units together in some way to form a complete system. Each control unit collects different signals by each sensor, and transmits data between modules under the same rules. Network information can be priority to meet different real-time requirements. Data transmitted via CAN bus control unit is level model of binary format, and data transmission line transmits the voltage signal.

Tools

Special Tools

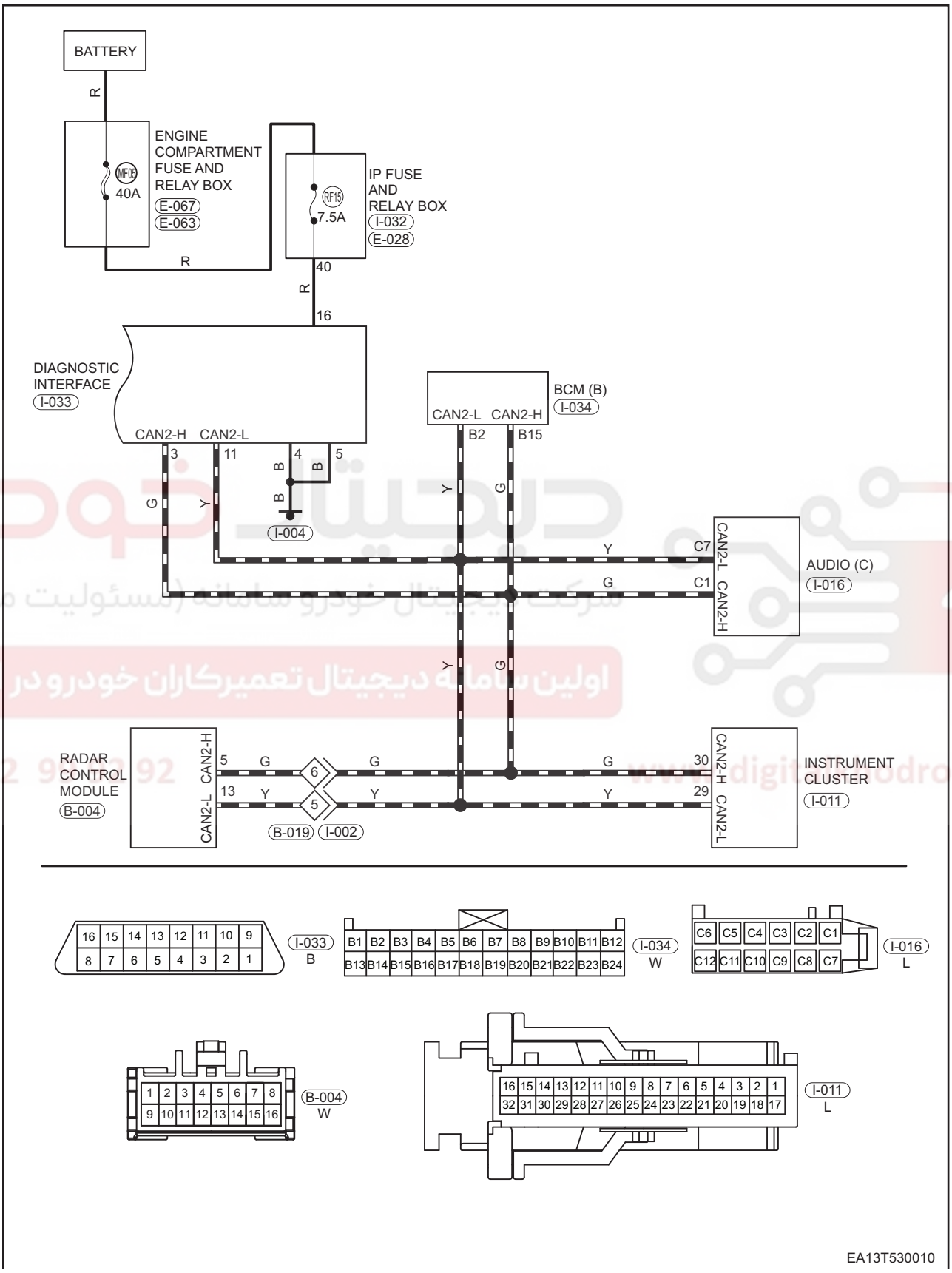
X-431 3G Diagnostic Tester	 RCH0000001
Oscilloscope	 RCH0000061

General Tool

Digital Multimeter	 RCH0000002

Circuit Diagram

CAN Bus



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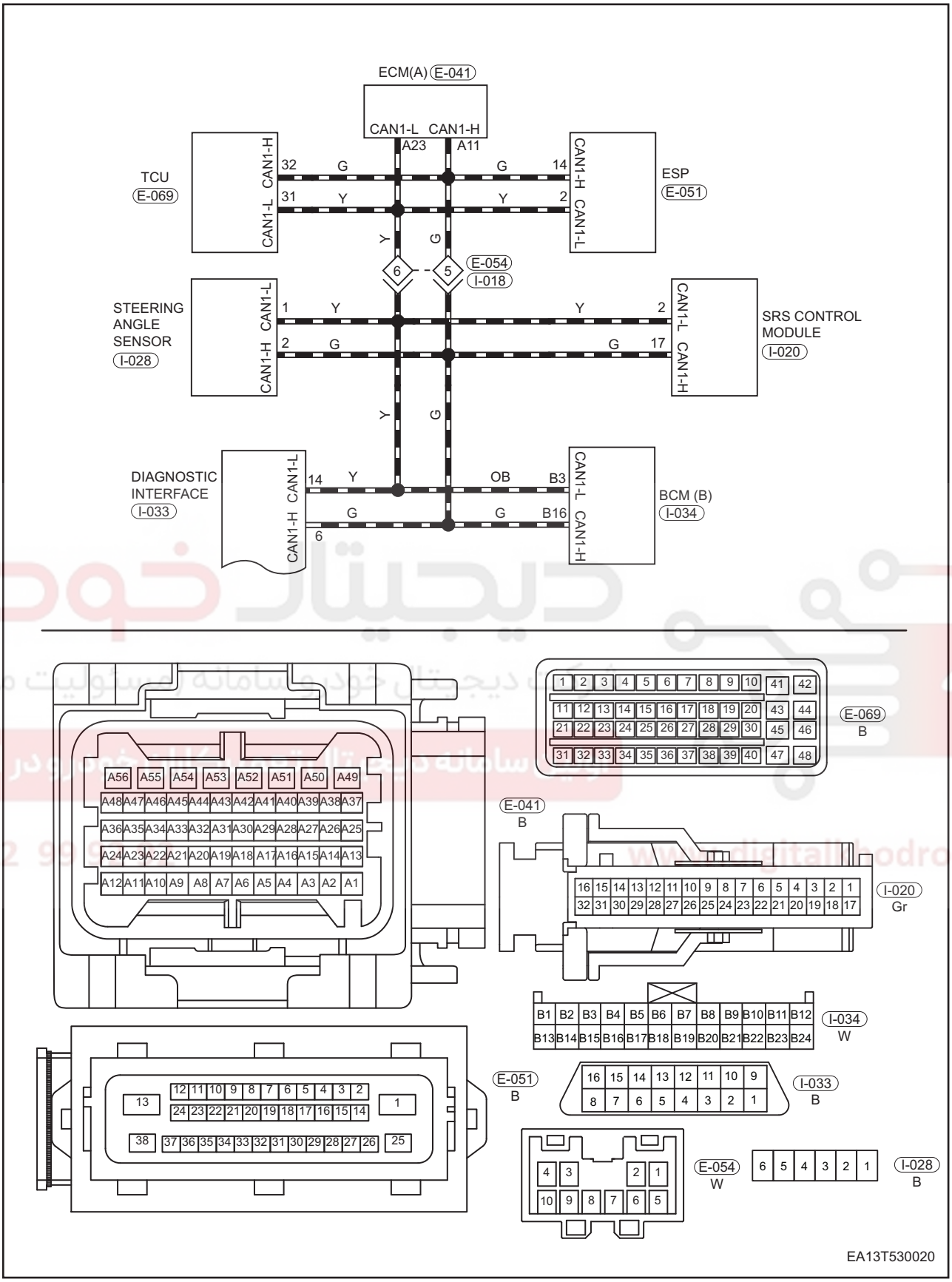


DIAGNOSIS & TESTING

Problem Symptoms Table

Symptom	Suspected Area	See page
Diagnostic interface cannot connect to system	CAN bus	53-5
	BCM failure	46-18
	Instrument cluster failure	38-49
	ECM failure	55-35
Engine control system failure	CAN bus	53-5
	Battery voltage	55-41
	Module damage	-
	Ground cable	55-44
Brake control system failure	Wheel speed	25-95
	Wire harness or connector	55-44
	Instrument cluster	38-49
Airbag system failure	Engine speed sensor	06-238
	Wire harness and connector	55-44
	Instrument cluster	38-49
	Airbag module failure	31-45
Body electrical failure	Body Control Module (BCM) failure	46-18
	Wire harness or connector	55-44
	Instrument cluster	38-49
Immobilizer system failure	Turn signal light switch (steering switch)	35-79
	Wire harness or connector	55-44
	Body Control Module (BCM)	46-18
	Instrument cluster	38-49
	Immobilizer control module failure	33-24
Transmission failure	Transmission Control Unit (TCU) failure	18-89
	Wire harness or connector	55-44
	Sensor failure	-
	Instrument cluster	38-49

Diagnosis Tools

X-431 3G Diagnostic Tester

When connecting X-431 3G diagnostic tester:

- Connect X-431 3G diagnostic tester (the latest software) to Data Link Connector (DLC) for communication with vehicle.
- DLC is located at driver side instrument panel crossmember.
- DLC uses a trapezoidal design which can hold 16 terminals.

Digital Multimeter

When using digital multimeter:

- Troubleshoot electrical malfunctions and wire harness system.
- Look for basic fault.
- Measure voltage, current and resistance.

Oscilloscope

- Troubleshoot electrical malfunctions and wire harness system.
- Look for basic fault.
- Measure the CAN network output waveform.

Diagnostic Help

1. Connect X-431 3G diagnostic tester (the latest software) to Data Link Connector (DLC), and make it communicate with vehicle electronic module through data network.
2. Confirm that malfunction is current, and carry out diagnostic test and repair procedures.
3. If DTC cannot be deleted, malfunction is current.
4. Only use a digital multimeter to measure voltage of electronic system.
5. Refer to any Technical Bulletin that may apply to the malfunction.
6. Visually check related wire harness.
7. Check and clean all DVD system grounds related to the latest DTC.
8. If multiple trouble codes were set, use circuit diagrams and look for any common ground circuit or power supply circuit applied to DTC.

Intermittent DTC Troubleshooting

If malfunction is intermittent, perform the followings:

- Check if connectors are loose.
- Check if wire harnesses are worn, pierced, pinched or partially broken.
- Wiggle related wire harnesses and connectors and observe if signal is interrupted in related circuit.
- If possible, try to duplicate the conditions under which DTC was set.
- Look for data that has changed or DTC to reset during wiggle test.
- Look for broken, bent, protruded or corroded terminals.
- Inspect the mounting areas of instrument cluster, wire harness or wire harness connector and so on for damage, foreign matter, etc. that will cause incorrect signals.
- Check and clean all wire harness connectors and grounds related to DTC.
- Remove instrument cluster from malfunctioning vehicle, and install it to a new vehicle and perform a test. If DTC cannot be cleared, instrument cluster is malfunctioning. If DTC can be cleared, reinstall instrument cluster to original vehicle.
- If multiple trouble codes were set, refer to circuit diagrams to look for any common ground circuit or power supply circuit applied to DTC.
- Refer to any Technical Bulletin that may apply to malfunction.

Ground Inspection

Groundings are very important to entire circuit system, which are normal or not can seriously affect the entire circuit system. Ground points are often exposed to moisture, dirt and other corrosive environments. Corrosion (rust) and oxidation may increase load resistance. This situation will seriously affect normal operation of circuit. Check ground points as follows:

1. Remove ground bolt or nut.
2. Check all contact surfaces for tarnish, dirt and rust, etc.
3. Clean as necessary to ensure that contacting is in good condition.
4. Reinstall ground bolt or nut securely.
5. Check if add-on accessories interfere with ground circuit.
6. If several wire harnesses are crimped into one ground terminal, check for proper crimps. Make sure all wire harnesses are clean, securely fastened and providing a good ground path.

Diagnosis Procedure

HINT:
Use following procedures to troubleshoot the power door lock control system.

1	**Vehicle brought to workshop**

NEXT

2	**Check battery voltage**

Standard voltage: 11 to 14 V

If voltage is below 11 V, recharge or replace battery before proceeding to next step.

NEXT

3	**Customer problem analysis**

NEXT

4	**Check for DTCs (current DTC and history DTC)**

DTC occurs	**For current DTC, go to step 6**
NO DTC	**For history DTC, go to step 7**

5	**Problem repair (for no DTC), then go to step8**

NEXT

6	Troubleshoot according to Diagnostic TroubleCode (DTC) chart, then go to step 8

NEXT

7	Troubleshoot according to Problem SymptomsTable, then go to step 8

NEXT

8	Adjust, repair or replace

NEXT

9	Conduct test and confirm malfunction hasbeen repaired

10	End

Diagnostic Interface cannot Connect to System

CAN-H Open to Ground
CAN-L Open to Ground
ECU Internal Open
BCM Internal Open
Instrument Cluster Internal Open

1	Check battery voltage

a. Using a digital multimeter, measure voltage between positive battery terminal and negative battery terminal.

b. Battery voltage should be between 11 and 14 V.

NG	Recharge or replace battery
OK	Check battery terminal

NEXT

2	Check battery terminal

a. Check if battery terminals are loose or corroded.

NG	Tighten or replace battery terminal
OK	Check fuse

NEXT

3	Check fuse

a. Check if engine compartment fuse box RF15 10A fuse is blown.

NG	Replace fuse
OK	Check BCM

NEXT

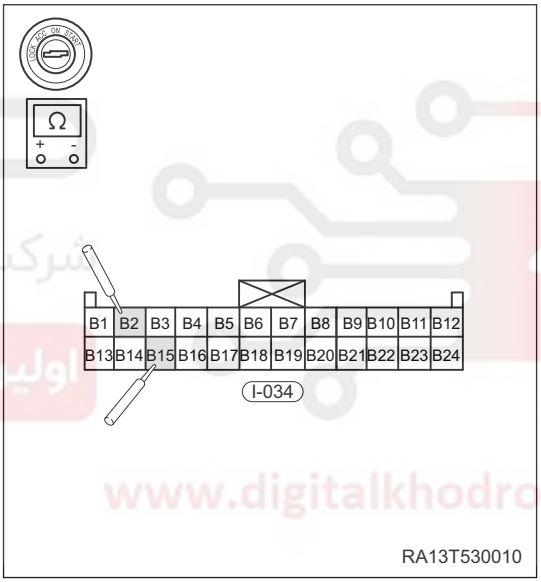
4	Check BCM

a. Disconnect the Body Control Module (BCM) connector I-034.

b. Using ohm band of multimeter, measure resistance between connectors I-034 (B2) and I-034 (B15) (standard resistance is 120 Ω).

Normal Condition

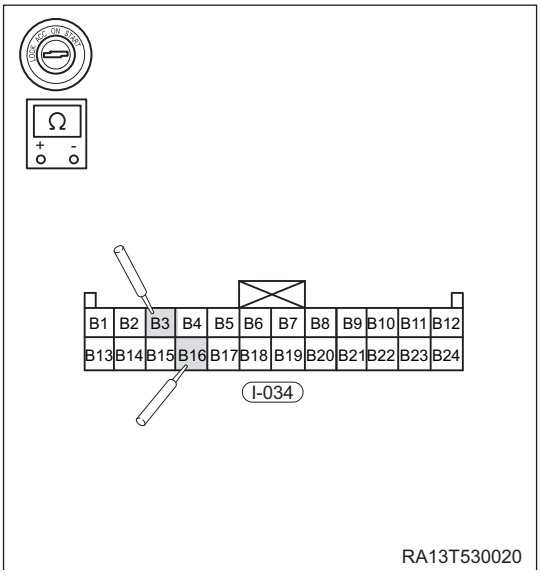
Digital Multimeter	Condition	Specified Condition
EI-034 (B2) - I-034 (B15)	Ignition switch OFF	120 Ω



c. Using ohm band of multimeter, measure resistance between connectors I-034 (B3) and I-034 (B16) (standard resistance is 120 Ω).

Normal Condition

Digital Multimeter	Condition	Specified Condition
EI-034 (B3) - I-034 (B16)	Ignition switch OFF	120 Ω



NG	Replace BCM
OK	Check instrument cluster

NEXT

5	Check instrument cluster

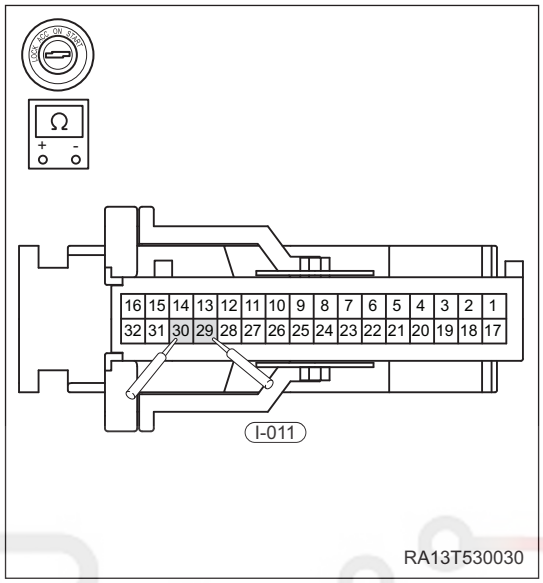
a. Disconnect the instrument cluster connector I-001.

b. Using ohm band of multimeter, measure resistance between connectors I-011 (29) and I-011 (30) (standard resistance is 120 Ω).

Normal Condition

Digital Multimeter	Condition	Specified Condition
I-011 (29) - I-011 (30)	Ignition switch OFF	120 Ω

NG	Replace instrument cluster assembly
OK	Check ECM



NEXT

6	Check ECM

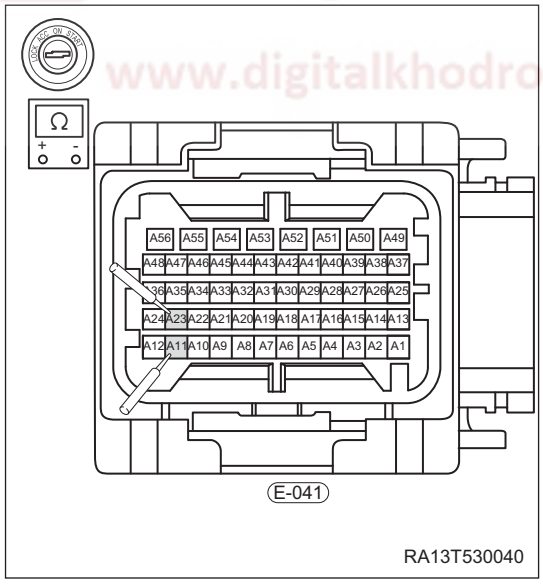
a. Disconnect the Engine Control Module (ECM) connector E-041.

b. Using ohm band of multimeter, measure resistance between connectors E-041 (A23) and E-041 (A11) (standard resistance is 120 Ω).

Normal Condition

Digital Multimeter	Condition	Specified Condition
E-041 (A23) - E-041 (A11)	Ignition switch OFF	120 Ω

NG	Replace ECM
OK	Check CAN network resistance



NEXT

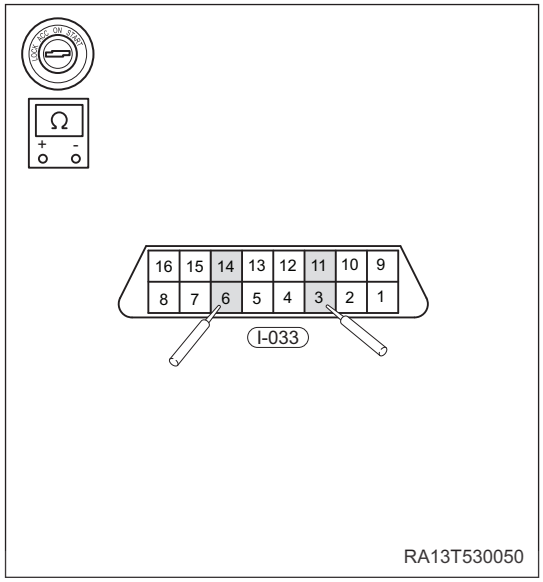
7	Check CAN network resistance

a. Using an ohmmeter, measure resistance between connectors I-033 (3) and I-033 (11) (standard resistance is 60 Ω).

b. Using an ohmmeter, measure resistance between connectors I-033 (6) and I-033 (14) (standard resistance is 60 Ω).

Normal Condition

Digital Multimeter	Condition	Specified Condition
I-033 (3) - I-033 (11)	Ignition switch OFF	60 Ω
I-033 (6) - I-033 (14)	Ignition switch OFF	60 Ω



NG → Replace instrument panel wire harness

OK → Check connector

NEXT

8	Check BCM and connector

a. Turn ignition switch to LOCK.

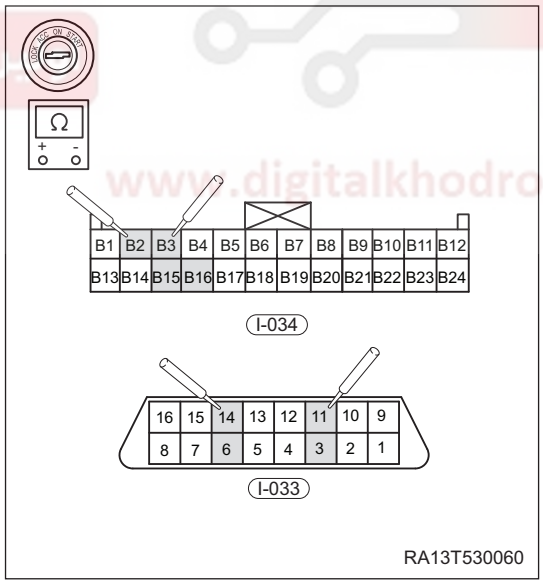
b. Disconnect the negative battery cable.

c. Disconnect the Body Control Module (BCM) connector I-034.

d. Check for continuity between connectors I-034 (B2) and I-033 (11), and connectors I-034 (B15) and I-033 (3).

Normal Condition

Digital Multimeter	Condition	Specified Condition
I-034 (B2) - I-033 (11)	Ignition switch OFF	Continuity
I-034 (B15) - I-033 (3)	Ignition switch OFF	Continuity
I-034 (B3) - I-033 (14)	Ignition switch OFF	Continuity
I-034 (B16) - I-033 (6)	Ignition switch OFF	Continuity



NG → Replace instrument panel wire harness

OK → Check connector and instrument cluster

NEXT

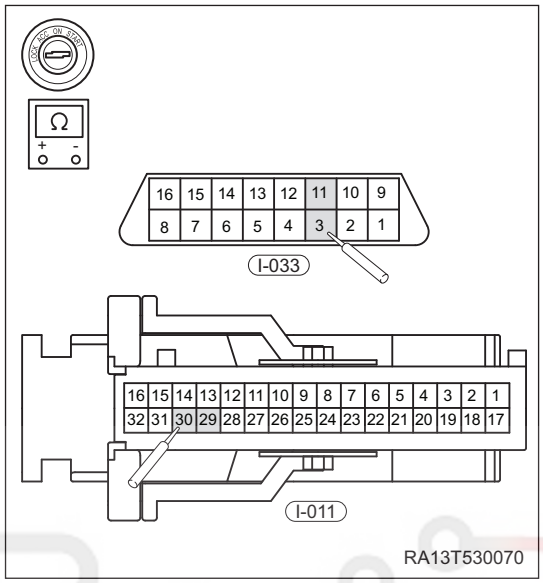
9	Check connector and instrument cluster

a. Disconnect the instrument cluster connector I -011.

b. Check for continuity between connectors I-033 (3) and I-011 (30), and connectors I-033 (11) and I-011 (29).

Normal Condition

Digital Multimeter	Condition	Specified Condition
I-033 (3) - I-011(30)	Ignition switch OFF	Continuity
I-033 (11) - I-011(29)	Ignition switch OFF	Continuity



NG → Replace instrument panel wire harness

OK → Check audio and connector

NEXT

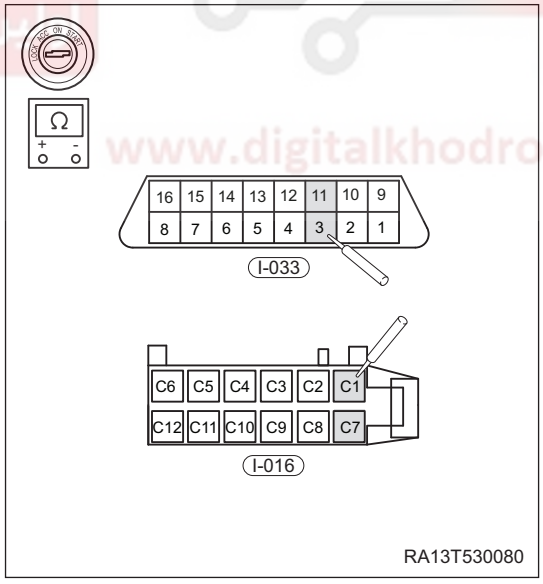
10	Check audio and connector

a. Disconnect the audio system connector I-016.

b. Check for continuity between connectors I-033 (3) and I-016 (C1), and connectors I-033 (11) and I-016 (C7).

Normal Condition

Digital Multimeter	Condition	Specified Condition
I-033 (3) - I-016 (C1)	Ignition switch OFF	Continuity
I-033 (11) - I-016 (C7)	Ignition switch OFF	Continuity



NG → Replace instrument panel wire harness

OK → Check radar module and connector

NEXT

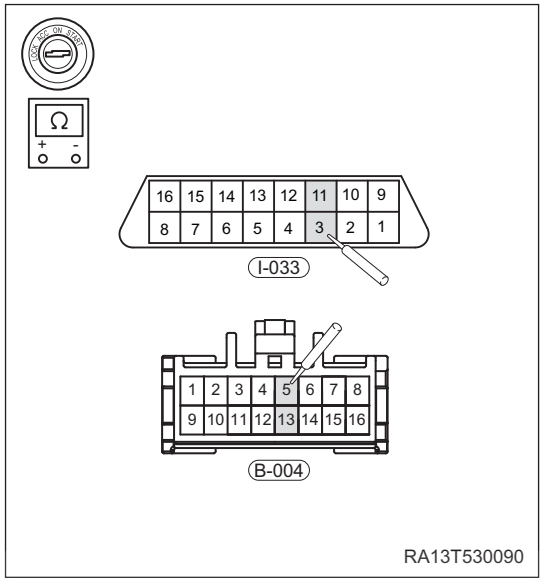
11	Check radar module and connector

a. Disconnect the reversing radar module connector B-004.

b. Check for continuity between connectors I-033 (3) and B-004 (5), and connectors I-033 (11) and B-004 (13).

Normal Condition

Digital Multimeter	Condition	Specified Condition
I-033 (3) - B-004 (5)	Ignition switch OFF	Continuity
I-033 (11) - B-004 (13)	Ignition switch OFF	Continuity



NG → Replace instrument panel wire harness

OK → Check airbag module

NEXT

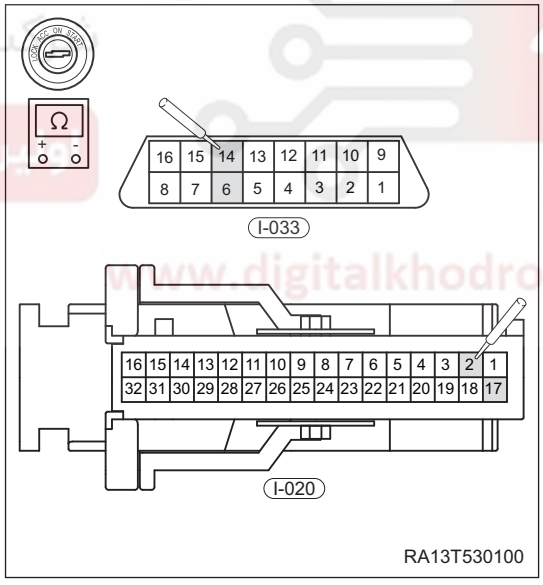
12	Check airbag module

a. Disconnect the SRS control module connector I-020.

b. Check for continuity between connectors I-033 (14) and I-020 (2), and connectors I-033 (6) and I-020 (17).

Normal Condition

Digital Multimeter	Condition	Specified Condition
I-033 (14) - I-020 (2)	Ignition switch OFF	Continuity
I-033 (6) - I-020 (17)	Ignition switch OFF	Continuity



NG → Replace instrument panel wire harness

OK → Check ESP control module

NEXT

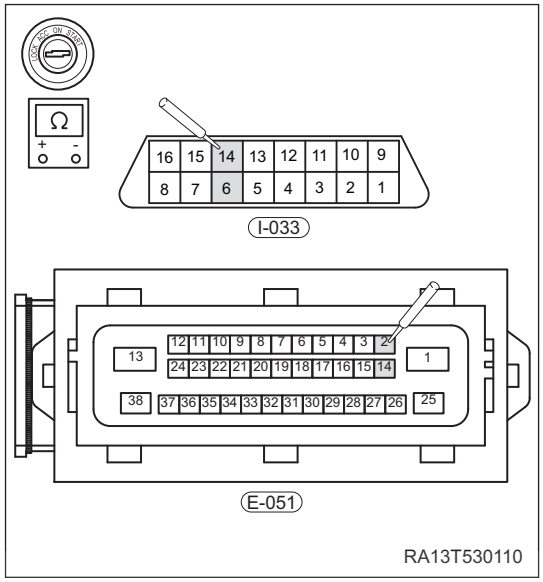
13	Check ESP control module

a. Disconnect the ABS/ESP control module connector E-051.

b. Check for continuity between connectors I-033 (14) and E-051 (2), and connectors I-033 (6) and E-051 (14).

Normal Condition

Digital Multimeter	Condition	Specified Condition
I-033 (14) - E-051 (2)	Ignition switch OFF	Continuity
I-033 (6) - E-051 (14)	Ignition switch OFF	Continuity



NG	Replace instrument panel wire harness
OK	Check TCU module and connector

NEXT

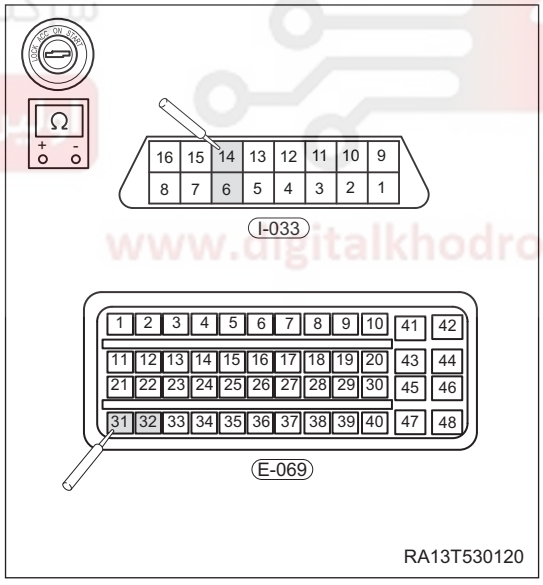
14	Check TCU module connector E-069

a. Disconnect the TCU connector E-069.

b. Check for continuity between connectors I-033 (14) and E-069 (31), and connectors I-033 (6) and E-069 (32).

Normal Condition

Digital Multimeter	Condition	Specified Condition
I-033 (14) - E-069 (31)	Ignition switch OFF	Continuity
I-033 (6) - E-069 (32)	Ignition switch OFF	Continuity



NG	Replace body wire harness
OK	Check steering angle sensor

NEXT

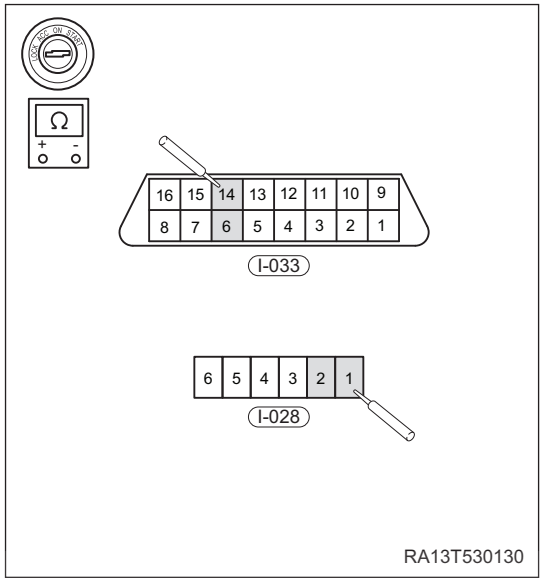
15	Check steering angle sensor and connector

a. Disconnect the steering angle sensor connector I-028.

b. Check for continuity between connectors I-033 (14) and I-028 (1), and connectors I-033 (6) and I-028 (2).

Normal Condition

Digital Multimeter	Condition	Specified Condition
I-033 (14) - I-028 (1)	Ignition switch OFF	Continuity
I-033 (6) - I-028 (2)	Ignition switch OFF	Continuity



NG → **Replace body wire harness**

OK

End

CAN Network Short

- CAN-H Short to Ground
- CAN-L Short to Ground
- CAN-H Short to Power Supply
- CAN-L Short to Power Supply
- Short Between CAN-H and CAN-L

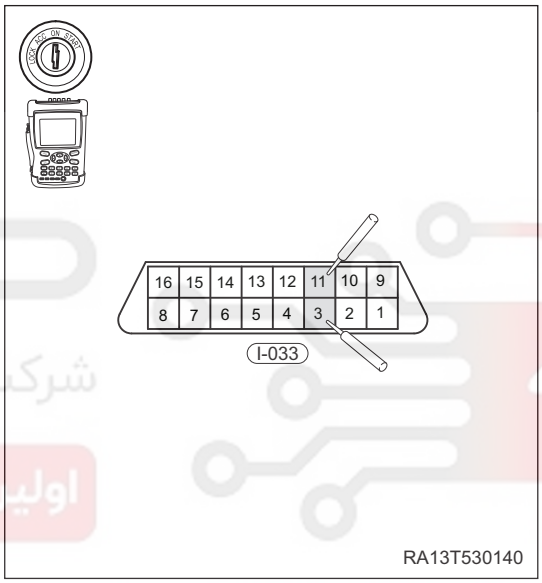
Problem causes:

- BCM internal short circuit
- Instrument cluster internal short circuit
- ECM internal short circuit
- Short circuit between CAN-H and CAN-L

1	Check connector

a. Connect oscilloscope to terminals 3, 11 of diagnostic interface connector I-033, and observe waveform of oscilloscope (standard for CAN-H: 2.5 V to 3.5 V, standard for CAN-L: 1.5 V to 2.5 V).

NG	Check BCM
OK	Check instrument panel wire harness



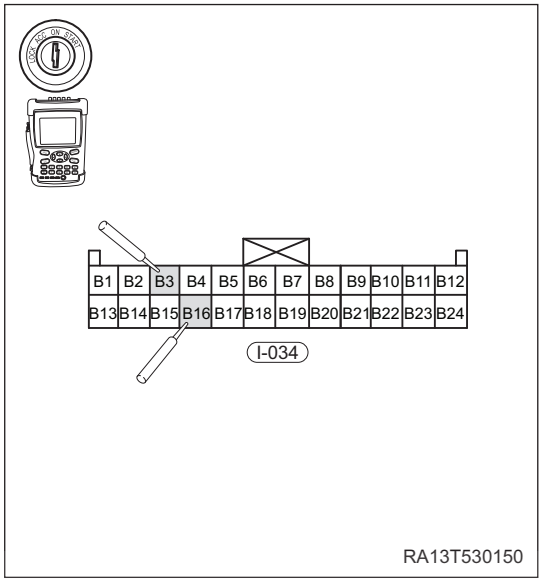
NEXT

2	Check BCM

a. Connect the Body Control Module connector I-034.

b. Connect oscilloscope to terminals B3, B16 of body control module connector I-034, and observe waveform (standard for CAN-H: 2.5 V to 3.5 V, standard for CAN-L: 1.5 V to 2.5 V).

NG	Check instrument cluster
OK	Replace BCM



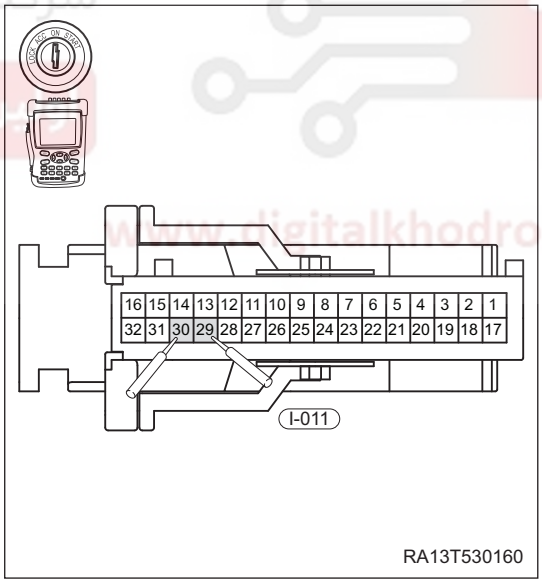
NEXT

3	Check instrument cluster

a. Connect the instrument cluster connector I-011.

b. Connect oscilloscope to terminals 29, 30 of instrument cluster connector I-011, and observe waveform (standard for CAN-H: 2.5 V to 3.5 V, standard for CAN-L: 1.5 V to 2.5 V).

NG	Check ECM
OK	Replace instrument cluster

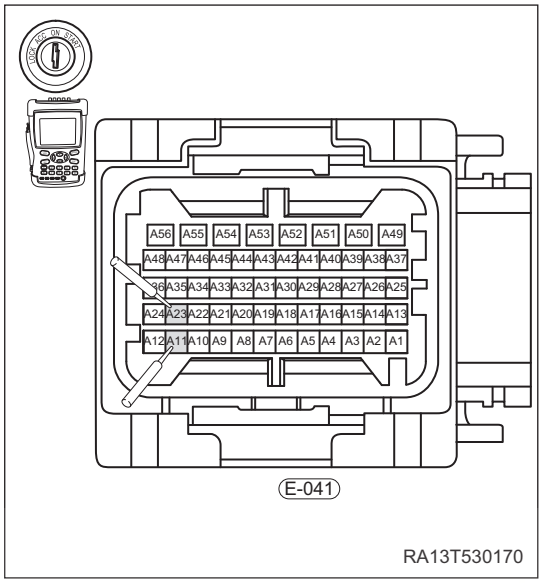


NEXT

4	Check ECM

a. Connect the ECM connector E-041.

b. Connect oscilloscope to terminals A23, A11 of ECM connector E-041, and observe waveform (standard for CAN-H: 2.5 V to 3.5 V, standard for CAN-L: 1.5 V to 2.5 V).



NG	Check audio module
OK	Replace ECM

NEXT

5	Check audio module

a. Disconnect the audio module connector.

OK	Replace audio module
NG	Check steering angle sensor

NEXT

6	Check steering angle sensor

a. Disconnect the steering angle sensor connector.

OK	Replace steering angle sensor
NG	Check TCU

NEXT

7	Check TCU

a. Disconnect the TCU connector.

OK	Replace TCU module
NG	Check ESP module

NEXT

8	Check ESP module

a. Disconnect the ESP module connector.

OK → Replace ESP module

NG → Check reversing radar module connector

NEXT

9	Check reversing radar module connector

a. Disconnect the reversing radar module connector.

OK → Replace reversing radar module

NG → Check airbag module

NEXT

10	Check airbag module

a. Disconnect the airbag module connector.

OK → Replace airbag module

NG → Check steering angle sensor

NEXT

11	Check steering angle sensor

a. Disconnect the steering angle sensor connector.

OK → Replace steering angle sensor

NEXT

End

- MEMO -