

STEERING

Steering Lock System (Diagnostic Codes & Symptom Tests) - Sienna

STEERING LOCK SYSTEM

DTC B2781: OPEN / SHORT IN STEERING LOCK ECU

DESCRIPTION

The steering lock ECU and steering lock actuator assembly are supplied as a unit.

The steering lock ECU detects the steering lock position through the signals from the lock and unlock position sensors.

The steering lock ECU activates the steering lock motor based on permission signals from the power management control ECU and the certification ECU.

The diagnosis information of the steering lock ECU is transmitted to the Techstream via the certification ECU as the steering lock ECU is not connected to the CAN communication system.

DTC Code	Detection Condition	Trouble Area
B2781	Either condition is met: • A steering lock motor drive power circuit malfunction. • The lock and unlock position sensors are detected to be on.	• Steering lock actuator assembly (steering lock ECU) • LIN communication system • Harness or connector of LIN bus line

INSPECTION PROCEDURE

HINT:

When the engine switch is off, the main body ECU may occasionally go into a non-active state called sleep mode. Therefore, before proceeding with the inspection, it is necessary to perform the following steps to wake up the ECU:

With the engine switch off, open the driver door. Then (with the engine switch still off) open and close any door several times at 1.5 second intervals.

NOTE:

- If the steering lock actuator assembly (steering lock ECU) is replaced, with the engine switch off and the shift lever in P, open and close the driver side door to record the current lock position into the steering lock ECU. If this is not performed, the engine may not start.
- When replacing the steering lock ECU, registration must be performed. Refer to REGISTRATION .

PROCEDURE

1. CHECK DTC OUTPUT (B2785)

- Check for DTCs. Refer to **DTC CHECK / CLEAR**.

RESULT

Result	Proceed to
DTC B2781 and DTC B2785 are output	A
DTC B2781 is output, but DTC B2785 is not output	B

B --> See step 3

A --> See step 2

- GO TO LIN COMMUNICATION SYSTEM (DTC B2785). Refer to DTC B2785: Communication Malfunction between ECUs Connected by LIN**
- REPLACE STEERING LOCK ACTUATOR ASSEMBLY (STEERING LOCK ECU). Refer to DISASSEMBLY**

DTC B2782: POWER SOURCE CONTROL ECU MALFUNCTION

DESCRIPTION

The steering lock ECU activates the steering lock motor with the power from the power management control ECU through the IGE circuit. This prevents the steering from being locked while the vehicle is moving.

If NG (PAST) is displayed for Power Supply Open in the Data List, perform troubleshooting according to the procedures below.

The diagnosis information of the steering lock ECU is transmitted to the Techstream via the certification ECU as the steering lock actuator assembly (steering lock ECU) is not connected to the CAN communication system.

DTC Code	Detection Condition	Trouble Area
B2782	An IGE power supply circuit malfunction.	- Steering lock actuator assembly (steering lock ECU) - Power management control ECU - Harness or connector

WIRING DIAGRAM

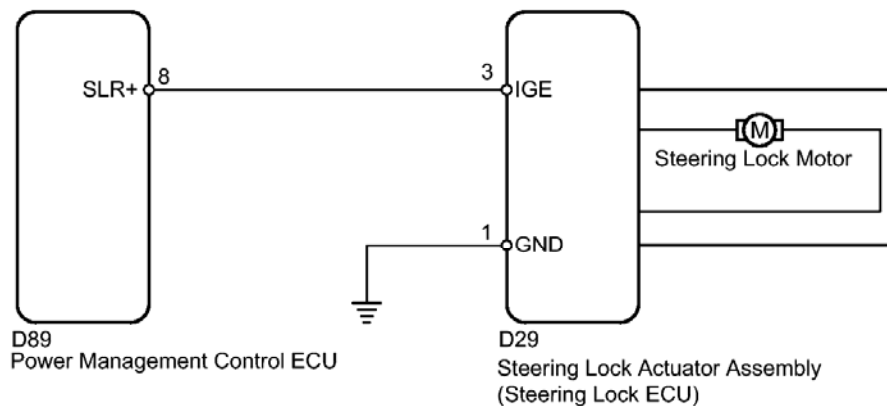


Fig. 1: IGE Power Supply Circuit Wiring Diagram
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSPECTION PROCEDURE

HINT:

When the engine switch is off, the main body ECU may occasionally go into a non-active state called sleep mode. Therefore, before proceeding with the inspection, it is necessary to perform the following steps to wake up the ECU:

With the engine switch off, open the driver door. Then (with the engine switch still off) open and close any door several times at 1.5 second intervals.

NOTE:

- If the steering lock actuator assembly (steering lock ECU) is replaced, with the engine switch off and the shift lever in P, open and close the driver side door to record the current lock position into the steering lock ECU. If this is not performed, the engine may not start.
- When replacing the steering lock ECU, registration must be performed. Refer to REGISTRATION .

- Inspect the fuses for circuits related to this system before performing the following inspection procedure.

PROCEDURE

1. CHECK HARNESS AND CONNECTOR (STEERING LOCK ECU - BODY GROUND)

- Disconnect the D29 steering lock ECU connector.
- Turn the engine switch off, make sure that the steering lock is unlocked and move the shift lever to P.
- Measure the resistance according to the value(s) in the table below.

Standard Resistance

Tester Connection	Condition	Specified Condition
D29-1 (GND) - Body ground	Always	Below 1 ohms

NG --> REPAIR OR REPLACE HARNESS OR CONNECTOR

OK: Go to next step

2. INSPECT STEERING LOCK ECU (IGE VOLTAGE)

- Reconnect the D29 steering lock ECU connector.

*a

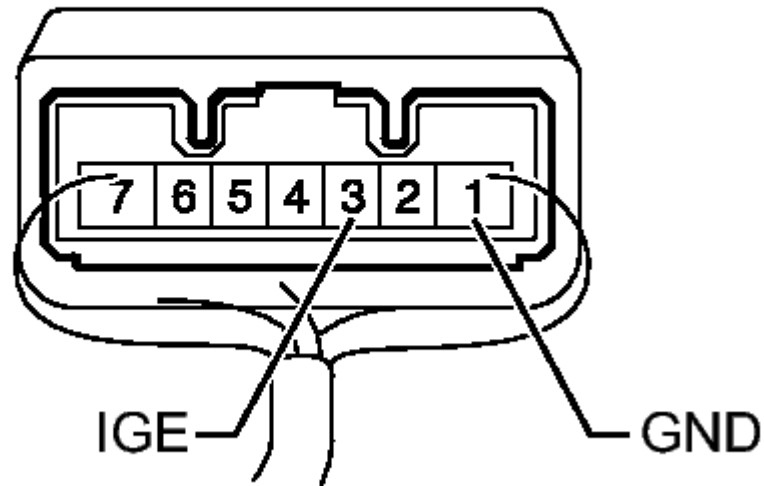


Fig. 2: Measuring Steering Lock ECU IGE Voltage
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Measure the voltage according to the value(s) in the table below.

Standard Voltage

Tester Connection	Condition	Specified Condition
D29-3 (IGE) - D29-1 (GND)	Steering lock motor operating immediately after turning engine switch from off to on (IG)	Below 1 V
D29-3 (IGE) - D29-1 (GND)	Steering lock motor not operating	11 to 14 V

HINT:

When the steering lock is locked and the engine switch is turned on (IG), the steering lock motor activates to release the steering lock. The motor operates for 2 to 15 seconds.

TEXT IN ILLUSTRATION

*a	Component with harness connected (Steering Lock ECU)
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NG --> See step 5

OK: Go to next step

3. CLEAR DTC

- Clear the DTCs. Refer to **DTC CHECK / CLEAR** .
- Disconnect and reconnect the cable to the negative (-) battery terminal to clear the malfunction history of Power Supply Open.

NEXT: Go to next step

4. READ VALUE USING TECHSTREAM (POWER SUPPLY OPEN)

- Check for DTCs. Refer to **DTC CHECK / CLEAR** .
- Use the Data List to check if the steering lock control is functioning properly. Refer to **DATA LIST / ACTIVE TEST** .

SMART KEY

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
Power Supply Open	Open in ECU record/NG (PAST) or OK	NG (PAST): Open in ECU OK: No malfunction	-

RESULT

Result	Proceed to
- B2782 is not output "OK" is displayed on the Techstream.	A
B2782 is	

output • "NG (PAST)" is displayed on the Techstream.	B
---	---

B --> See step 6

A --> See step 7

5. CHECK HARNESS AND CONNECTOR (STEERING LOCK ECU - POWER MANAGEMENT CONTROL ECU)

- a. Disconnect the D89 power management control ECU connector.
- b. Disconnect the D29 steering lock ECU connector.
- c. Measure the resistance according to the value(s) in the table below.

Standard Resistance

Tester Connection	Condition	Specified Condition
D29-3 (IGE) - D89-8 (SLR+)	Always	Below 1 ohms
D29-3 (IGE) or D89-8 (SLR+) - Body ground	Always	10 kohms or higher

NG --> REPAIR OR REPLACE HARNESS OR CONNECTOR

OK --> See step 8

6. **REPLACE STEERING LOCK ACTUATOR ASSEMBLY (STEERING LOCK ECU). Refer to DISASSEMBLY**
7. **USE SIMULATION METHOD TO CHECK. Refer to HOW TO PROCEED WITH TROUBLESHOOTING**
8. **REPLACE POWER MANAGEMENT CONTROL ECU. Refer to REMOVAL**

DTC B2788: IG2 SIGNAL MALFUNCTION

DESCRIPTION

The steering lock ECU determines the on/off status of the engine switch through the IG2 signal circuit.

The steering lock ECU does not lock the steering when it receives the IG2 relay on signal. This prevents the steering from being locked while the vehicle is moving.

The diagnosis information of the steering lock ECU is transmitted to the Techstream via the certification ECU as the steering lock ECU is not connected to the CAN communication system.

DTC Code	Detection Condition	Trouble Area
B2788	The IG2 input to the steering lock ECU does not match the LIN communication input.	• IG2 fuse • Steering lock actuator assembly (steering lock ECU) • Power management control ECU • Harness or connector

WIRING DIAGRAM

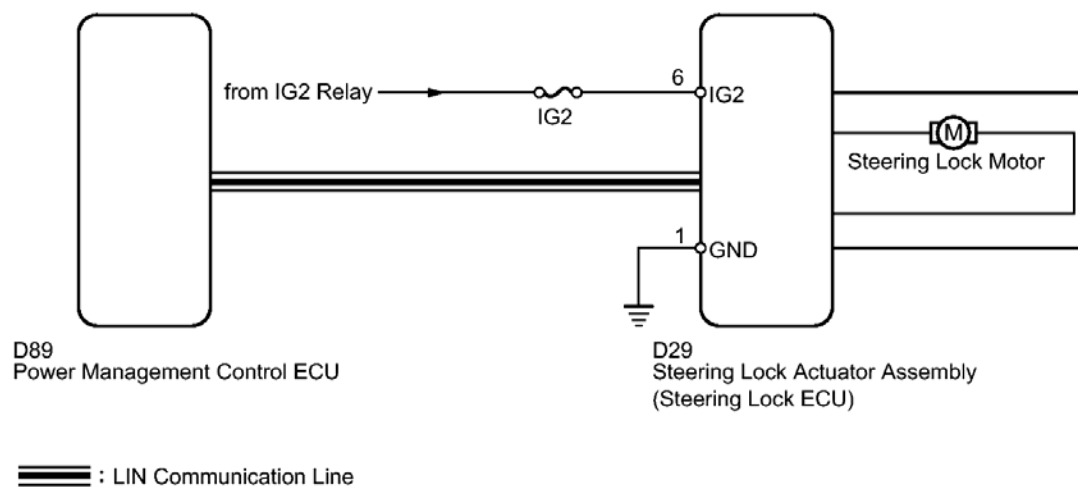


Fig. 3: Power Management Control ECU Circuit Wiring Diagram
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSPECTION PROCEDURE

HINT:

When the engine switch is off, the main body ECU may occasionally go into a non-active state called sleep mode. Therefore, before proceeding with the inspection, it is necessary to perform the following steps to wake up the ECU:

With the engine switch off, open the driver door. Then (with the engine switch still off) open and close any door

several times at 1.5 second intervals.

NOTE:

- If the steering lock actuator assembly (steering lock ECU) is replaced, with the engine switch off and the shift lever in P, open and close the driver side door to record the current lock position into the steering lock ECU. If this is not performed, the engine may not start.
- When replacing the steering lock ECU, registration must be performed. Refer to REGISTRATION .
- Inspect the fuses for circuits related to this system before performing the following inspection procedure.

PROCEDURE

1. CHECK HARNESS AND CONNECTOR (STEERING LOCK ECU - BODY GROUND)

- a. Disconnect the D29 steering lock ECU connector.
- b. Turn the engine switch off, make sure that the steering lock is unlocked and move the shift lever to P.
- c. Measure the resistance according to the value(s) in the table below.

Standard Resistance

Tester Connection	Condition	Specified Condition
D29-1 (GND) - Body ground	Always	Below 1 ohms

NG --> REPAIR OR REPLACE HARNESS OR CONNECTOR

OK: Go to next step

2. CHECK STEERING LOCK ECU (IG2 VOLTAGE)

- a. Reconnect the D29 steering lock ECU connector.

*a

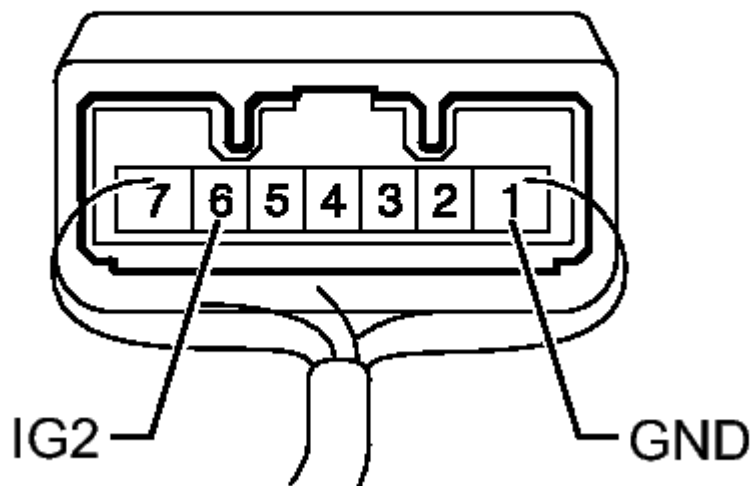


Fig. 4: Checking Steering Lock ECU (IG2 Voltage)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Measure the voltage according to the value(s) in the table below.

Standard Voltage

Tester Connection	Switch Condition	Specified Condition
D29-6 (IG2) - D29-1 (GND)	Engine switch on (IG)	11 to 14 V
D29-6 (IG2) - D29-1 (GND)	Engine switch off	Below 1 V

TEXT IN ILLUSTRATION

*a	Component with harness connected (Steering Lock ECU)
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NG --> CHECK FOR ALL HARNESSES, CONNECTORS AND COMPONENTS CONNECTED

TO IG2 FUSE

OK --> See step 3

3. REPLACE STEERING LOCK ACTUATOR ASSEMBLY (STEERING LOCK ECU). Refer to DISASSEMBLY

SYMPTOM TESTS

Unable to Lock Steering Wheel

DESCRIPTION

The steering lock ECU sends an unlock position signal to the power management control ECU. Upon receiving the signal, the power management control ECU permits an engine start. This prevents the engine from being started with the steering locked.

The steering lock actuator activates the steering lock motor and moves the lock bar into the steering column to lock the steering wheel.

When the steering lock is operating, the steering lock may not lock when the lock bar is not aligned with the lock hole of the steering column. In this case, the steering lock can be locked by turning the steering wheel a little in the same manner as is done for a vehicle with a mechanical key to change the position of the lock hole.

The diagnosis information of the steering lock ECU is transmitted to the Techstream via the certification ECU as the steering lock ECU is not connected to the CAN communication system.

WIRING DIAGRAM

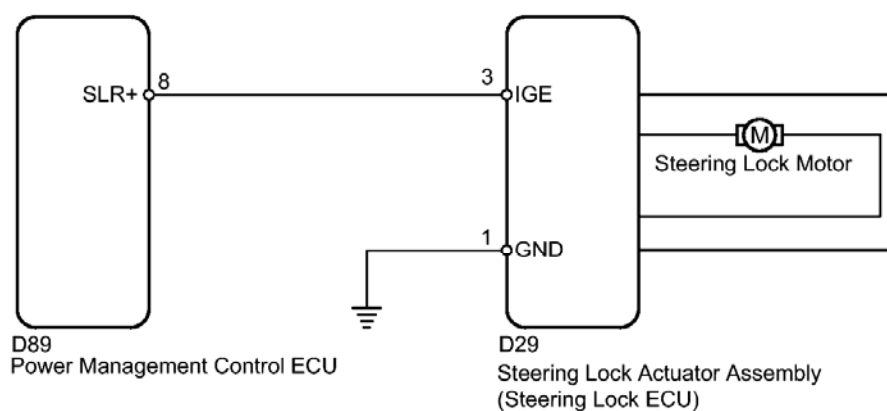


Fig. 5: Identifying IGE Power Supply Circuit Wiring Diagram
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSPECTION PROCEDURE

HINT:

When the engine switch is off, the main body ECU may occasionally go into a non-active state called sleep mode. Therefore, before proceeding with the inspection, it is necessary to perform the following steps to wake up the ECU:

With the engine switch off, open the driver door. Then (with the engine switch still off) open and close any door several times at 1.5 second intervals.

NOTE:

- If the steering lock actuator assembly (steering lock ECU) is replaced, with the engine switch off and the shift lever in P, open and close the driver side door to record the current lock position into the steering lock ECU. If this is not performed, the engine may not start.
- When replacing the steering lock ECU or certification ECU, registration must be performed. Refer to REGISTRATION .
- Inspect the fuses for circuits related to this system before performing the following inspection procedure.

PROCEDURE

1. READ VALUE USING TECHSTREAM (LOCK REQUEST RECEIVE)

- a. Use the Data List to check if the steering lock control is functioning properly. Refer to DATA LIST / ACTIVE TEST .

SMART KEY

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
Lock Request Receive	Steering lock command reception status/NG or OK	NG: Lock request not received OK: Lock request received	-

OK

The certification ECU receives a lock request signal within 10 seconds of turning the engine switch from on (IG) to off and opening a door, and OK is displayed on the Techstream screen.

NG --> See step 5

OK: Go to next step

2. CHECK HARNESS AND CONNECTOR (STEERING LOCK ECU - BODY GROUND)

- Disconnect the D29 steering lock ECU connector.
- Turn the engine switch off, make sure that the steering lock is unlocked and move the shift lever to P.
- Measure the resistance according to the value(s) in the table below.

Standard Resistance

Tester Connection	Condition	Specified Condition
D29 -1 (GND) - Body ground	Always	Below 1 ohms

NG --> REPAIR OR REPLACE HARNESS OR CONNECTOR

OK: Go to next step

3. INSPECT STEERING LOCK ECU (IGE VOLTAGE)

- Reconnect the D29 steering lock ECU connector.

*a

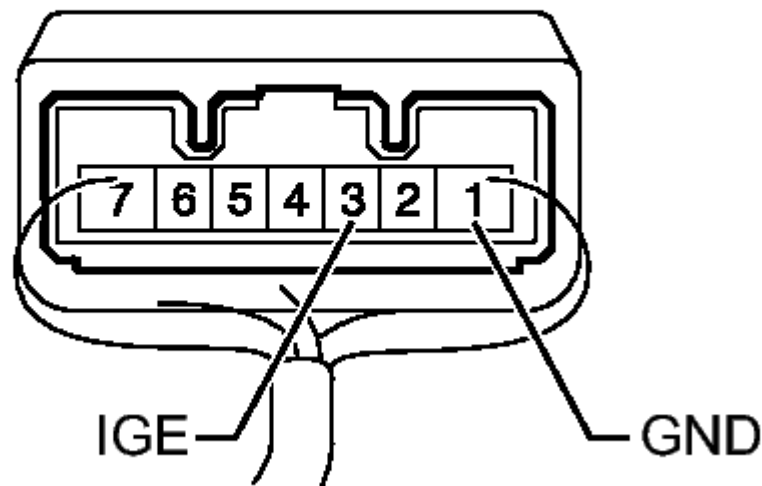


Fig. 6: Measuring Steering Lock ECU IGE Voltage
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- Measure the voltage according to the value(s) in the table below.

Standard Voltage

Tester Connection	Condition	Specified Condition
D29-3 (IGE) - D29-1 (GND)	Steering lock motor operating immediately after turning engine switch from off to on (IG)	Below 1 V
D29-3 (IGE) - D29-1 (GND)	Steering lock motor not operating	11 to 14 V

HINT:

When the steering lock is locked and the engine switch is turned on (IG), the steering lock motor activates to release the steering lock. The motor operates for 2 to 15 seconds.

TEXT IN ILLUSTRATION

*a	Component with harness connected (Steering Lock ECU)
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NG --> REPAIR OR REPLACE HARNESS OR CONNECTOR

OK: Go to next step

4. CHECK HARNESS AND CONNECTOR (STEERING LOCK ECU - POWER MANAGEMENT CONTROL ECU)

- Disconnect the D89 power management control ECU connector.
- Disconnect the D29 steering lock ECU connector.
- Measure the resistance according to the value(s) in the table below.

Standard Resistance

Tester Connection	Condition	Specified Condition

D29-3 (IGE) - D89-8 (SLR+)	Always	Below 1 ohms
D29-3 (IGE) or D89-8 (SLR+) - Body ground	Always	10 kohms or higher

NG --> REPAIR OR REPLACE HARNESS OR CONNECTOR

OK --> See step 13

5. READ VALUE USING TECHSTREAM (FL DOOR COURTESY)

- Use the Data List to check if the steering lock control is functioning properly. Refer to **DATA LIST / ACTIVE TEST** .

MAIN BODY

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
FL Door Courtesy	Front door courtesy switch LH/ON or OFF	ON: Front LH side door closed OFF: Front LH side door open	-

OK

Driver side door courtesy switch is functioning properly.

NG --> See step 14

OK: Go to next step

6. READ VALUE USING TECHSTREAM (S CODE CHECK)

- Use the Data List to check if the steering lock control is functioning properly. Refer to **DATA LIST / ACTIVE TEST** .

SMART KEY

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note

S Code Check	S code certification result/NG or OK	OK: S code certification result normal NG: S code certification result abnormal	-
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OK

OK is displayed on the Techstream.

NG --> See step 10

OK: Go to next step

7. READ VALUE USING TECHSTREAM (L CODE CHECK)

- Use the Data List to check if the steering lock control is functioning properly. Refer to **DATA LIST / ACTIVE TEST**.

SMART KEY

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
L Code Check	L code certification result/NG or OK	OK: L code certification result normal NG: L code certification result abnormal	-

OK

OK is displayed on the Techstream.

NG --> See step 10

OK: Go to next step

8. REPLACE STEERING LOCK ACTUATOR ASSEMBLY (STEERING LOCK ECU)

- Replace the steering lock actuator assembly (steering lock ECU). Refer to **DISASSEMBLY**.

NEXT: Go to next step

9. CHECK STEERING LOCK RELEASE OPERATION

- a. Turn the engine switch on (IG).
- b. Operate the steering wheel and check the steering lock condition.

OK

Steering lock is released.

NG --> See step 12

OK --> END (STEERING LOCK ACTUATOR ASSEMBLY (STEERING LOCK ECU) IS DEFECTIVE)

10. REPLACE CERTIFICATION ECU

- a. Replace the certification ECU. Refer to **REMOVAL** .

NEXT: Go to next step

11. READ VALUE USING TECHSTREAM (L CODE CHECK)

- a. Use the Data List to check if the steering lock control is functioning properly. Refer to **DATA LIST / ACTIVE TEST** .

SMART KEY

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
L Code Check	L code certification result/NG or OK	OK: L code certification result normal NG: L code certification result abnormal	-

OK

OK is displayed on the Techstream.

NG --> See step 13

OK --> END (CERTIFICATION ECU IS DEFECTIVE)

12. REPLACE CERTIFICATION ECU. Refer to **REMOVAL**

13. REPLACE STEERING LOCK ACTUATOR ASSEMBLY (STEERING LOCK ECU). Refer to **DISASSEMBLY**

14. GO TO LIGHTING SYSTEM (DOOR COURTESY SWITCH CIRCUIT). Refer to Door Courtesy Switch Circuit

Unable to Unlock Steering Wheel (Engine cannot Start)

DESCRIPTION

The power management control ECU supplies the power to activate the motor of the steering lock actuator assembly.

The steering lock actuator activates the steering lock motor and moves the lock bar into the steering column to lock the steering wheel.

The steering lock may not release when the lock bar gets stuck in the lock hole of the steering column. In this case, if an engine start operation is performed while shaking the steering wheel in the same manner as is done for a vehicle with a mechanical key, the lock bar will release.

The diagnosis information of the steering lock ECU is transmitted to the Techstream via the certification ECU as the steering lock ECU is not connected to the CAN communication system.

WIRING DIAGRAM

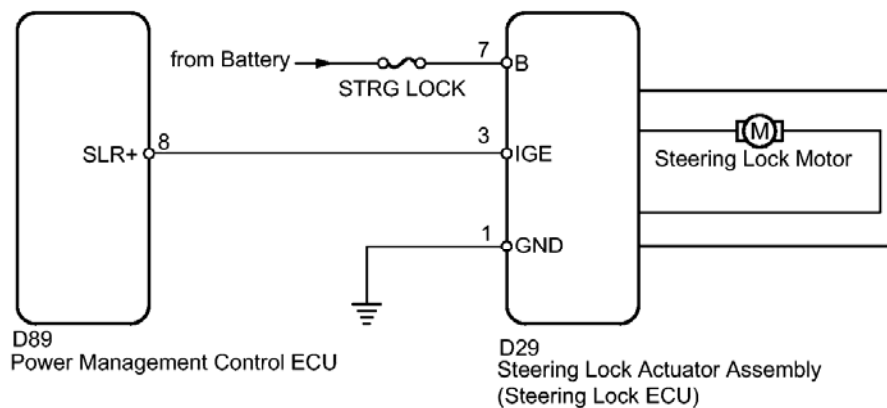


Fig. 7: Identifying Steering Lock ECU Wiring Diagram
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSPECTION PROCEDURE

HINT:

When the engine switch is off, the main body ECU may occasionally go into a non-active state called sleep mode. Therefore, before proceeding with the inspection, it is necessary to perform the following steps to wake

up the ECU:

With the engine switch off, open the driver door. Then (with the engine switch still off) open and close any door several times at 1.5 second intervals.

NOTE:

- If the steering lock actuator assembly (steering lock ECU) is replaced, with the engine switch off and the shift lever in P, open and close the driver side door to record the current lock position into the steering lock ECU. If this is not performed, the engine may not start.
- When replacing the steering lock ECU or certification ECU, registration must be performed. Refer to REGISTRATION .
- Inspect the fuses for circuits related to this system before performing the following inspection procedure.

PROCEDURE

1. CHECK ENGINE SWITCH (SWITCH CONDITION)

- a. Check the power source mode change.

1. When the key is inside the vehicle and the shift lever is in P, check that pressing the engine switch causes the power source mode to change as follows:

OK

off --> on (ACC) --> on (IG) --> off

NG --> See step 12

OK: Go to next step

2. READ VALUE USING TECHSTREAM (UNLOCK REQUEST RECEIVE)

- a. Use the Data List to check if the steering lock control is functioning properly. Refer to DATA LIST / ACTIVE TEST .

SMART KEY

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
Unlock Request Receive	Steering lock unlock command reception status/NG or OK	NG: Unlock request not received OK: Unlock request received	-

OK

The certification ECU receives an unlock request signal within 10 seconds of starting the engine, and OK is displayed on the Techstream screen.

NG --> See step 6

OK: Go to next step

3. CHECK HARNESS AND CONNECTOR (STEERING LOCK ECU - BODY GROUND)

- a. Disconnect the D29 steering lock ECU connector.
- b. Measure the resistance according to the value(s) in the table below.

Standard Resistance

Tester Connection	Condition	Specified Condition
D29-1 (GND) - Body ground	Always	Below 1 ohms

NG --> REPAIR OR REPLACE HARNESS OR CONNECTOR

OK: Go to next step

4. CHECK HARNESS AND CONNECTOR (STEERING LOCK ECU - BATTERY)

- a. Measure the voltage according to the value(s) in the table below.

*a

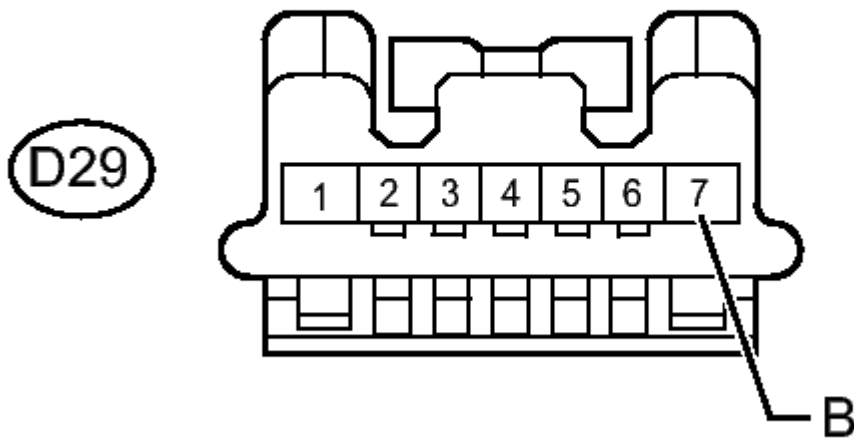


Fig. 8: Checking Harness And Connector (Steering Lock ECU - Battery)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard Voltage

Tester Connection	Condition	Specified Condition
D29-7 (B) - Body ground	Always	11 to 14 V

TEXT IN ILLUSTRATION

*a	Front view of wire harness connector (to Steering Lock ECU)
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NG --> REPAIR OR REPLACE HARNESS OR CONNECTOR

OK: Go to next step

5. INSPECT STEERING LOCK ECU (IGE VOLTAGE)

- a. Reconnect the D29 steering lock ECU connector.
- b. Move the shift lever to P.

*a

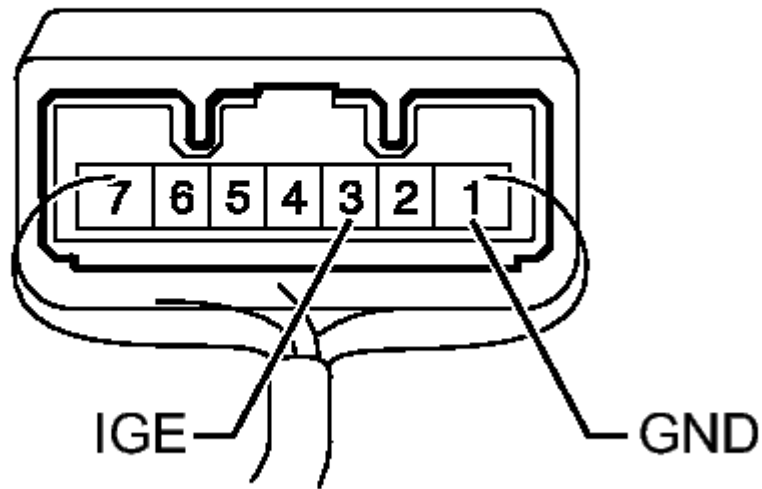


Fig. 9: Measuring Steering Lock ECU IGE Voltage
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Measure the voltage according to the value(s) in the table below.

Standard Voltage

Tester Connection	Condition	Specified Condition
D29-3 (IGE) - D29-1 (GND)	Steering lock motor operating immediately after turning engine switch from off to on (IG)	Below 1 V
D29-3 (IGE) - D29-1 (GND)	Steering lock motor not operating	11 to 14 V

HINT:

When the steering lock is locked and the engine switch is turned on (IG), the steering lock motor activates to release the steering lock. The motor operates for 2 to 15 seconds.

TEXT IN ILLUSTRATION

*a	Component with harness connected (Steering Lock ECU)
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NG --> REPAIR OR REPLACE HARNESS OR CONNECTOR

OK --> See step 13

6. READ VALUE USING TECHSTREAM (S CODE CHECK)

- Use the Data List to check if the steering lock control is functioning properly. Refer to **DATA LIST / ACTIVE TEST**.

SMART KEY

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
S Code Check	S code certification result/NG or OK	OK: S code certification result normal NG: S code certification result abnormal	-

OK

OK is displayed on the Techstream.

NG --> See step 14

OK: Go to next step

7. READ VALUE USING TECHSTREAM (L CODE CHECK)

- Use the Data List to check if the steering lock control is functioning properly. Refer to **DATA LIST / ACTIVE TEST**.

SMART KEY

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Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
L Code Check	L code certification result/NG or OK	OK: L code certification result normal NG: L code certification result abnormal	-

OK

OK is displayed on the Techstream.

NG --> See step 10

OK: Go to next step

8. REPLACE STEERING LOCK ACTUATOR ASSEMBLY (STEERING LOCK ECU)

- Replace the steering lock actuator assembly (steering lock ECU). Refer to **DISASSEMBLY** .

NEXT: Go to next step

9. CHECK STEERING LOCK RELEASE OPERATION

- Turn the engine switch on (IG).
- Operate the steering wheel and check the steering lock condition.

OK

Steering lock is released.

NG --> See step 14

OK --> END (STEERING LOCK ECU IS DEFECTIVE)

10. REPLACE CERTIFICATION ECU

- Replace the certification ECU. Refer to **REMOVAL** .

NEXT: Go to next step

11. READ VALUE USING TECHSTREAM (L CODE CHECK)

- Use the Data List to check if the steering lock control is functioning properly. Refer to **DATA LIST / ACTIVE TEST** .

SMART KEY

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
L Code Check	L code certification result/NG or OK	OK: L code certification result normal NG: L code certification result abnormal	-

OK

OK is displayed on the Techstream.

NG --> See step 13

OK --> END (CERTIFICATION ECU IS DEFECTIVE)

12. **GO TO SMART KEY SYSTEM (FOR START FUNCTION) (PROBLEM SYMPTOMS TABLE). Refer to PROBLEM SYMPTOMS TABLE**
13. **REPLACE STEERING LOCK ACTUATOR ASSEMBLY (STEERING LOCK ECU). Refer to DISASSEMBLY**
14. **REPLACE CERTIFICATION ECU. Refer to REMOVAL**

STEERING

Steering Lock System (Diagnostics - Introduction) - Sienna

STEERING LOCK SYSTEM

PRECAUTION

PRECAUTION

1. PRECAUTIONS WHEN WORKING ON ELECTRIC STEERING LOCK

- a. After replacing the steering lock actuator assembly (steering lock ECU), perform key ID code registration.
- b. After replacing the steering lock actuator assembly (steering lock ECU), confirm the lock/unlock operation of the steering lock.

Operation Confirmation

Steering Lock Condition	Procedure
Lock	With the engine switch off, open and close any door.
Unlock	Turn the engine switch from off to on (ACC) or on (IG).

- c. If checking for DTCs of the smart key system or if checking the Data List with the engine switch off, make sure that the driver door is open.

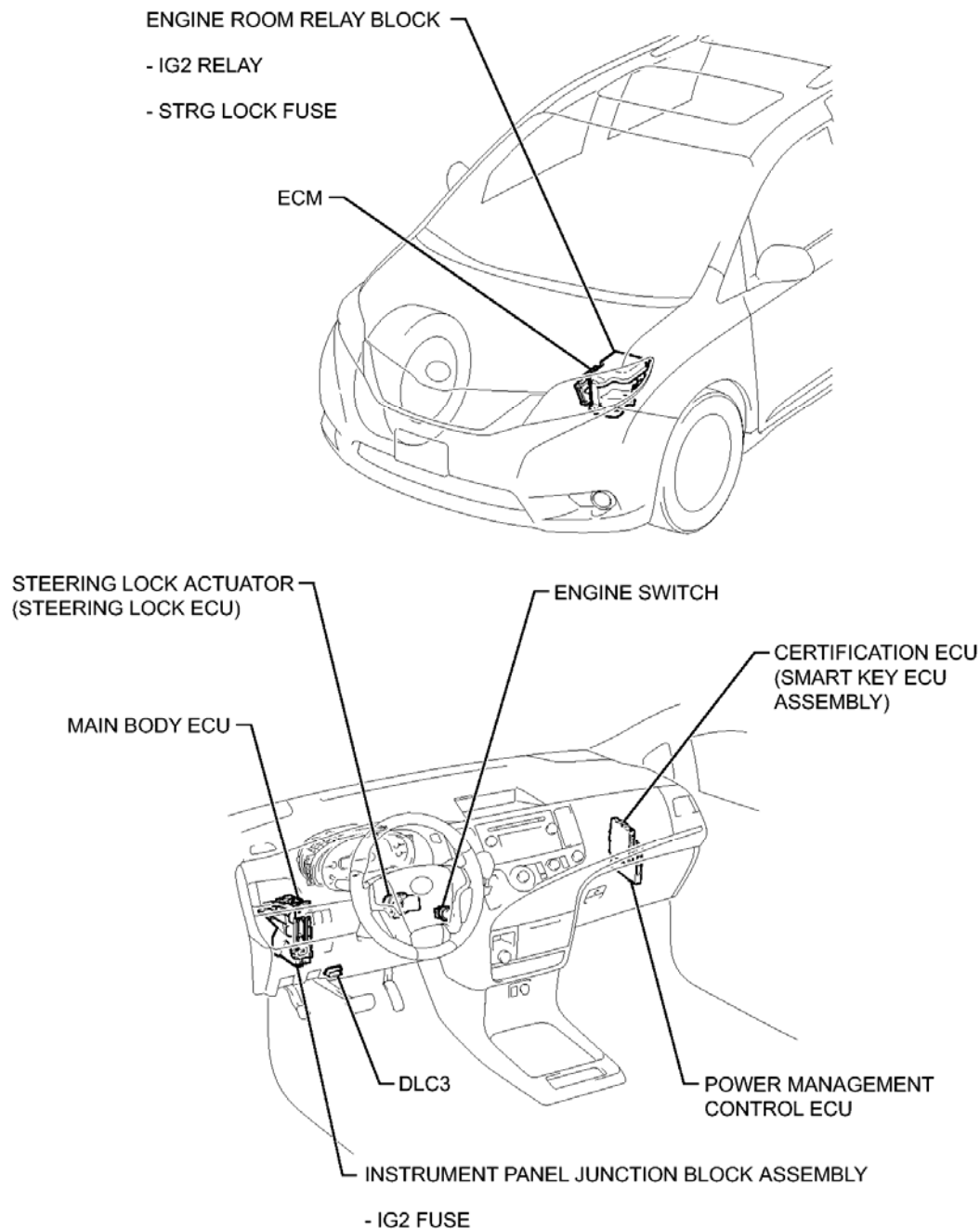
HINT:

When using the Techstream with the engine switch off to troubleshoot, connect the Techstream to the vehicle and turn a courtesy light switch on and off at 1.5 second intervals until communication between the Techstream and vehicle begins.

- d. When a steering lock system DTC is output, confirm and record the DTCs before turning the engine switch off or clearing the DTCs, as past DTCs are not stored in the certification ECU.

PARTS LOCATION

ILLUSTRATION



P

Fig. 1: Steering Lock System Components Location
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

SYSTEM DIAGRAM

SYSTEM DIAGRAM

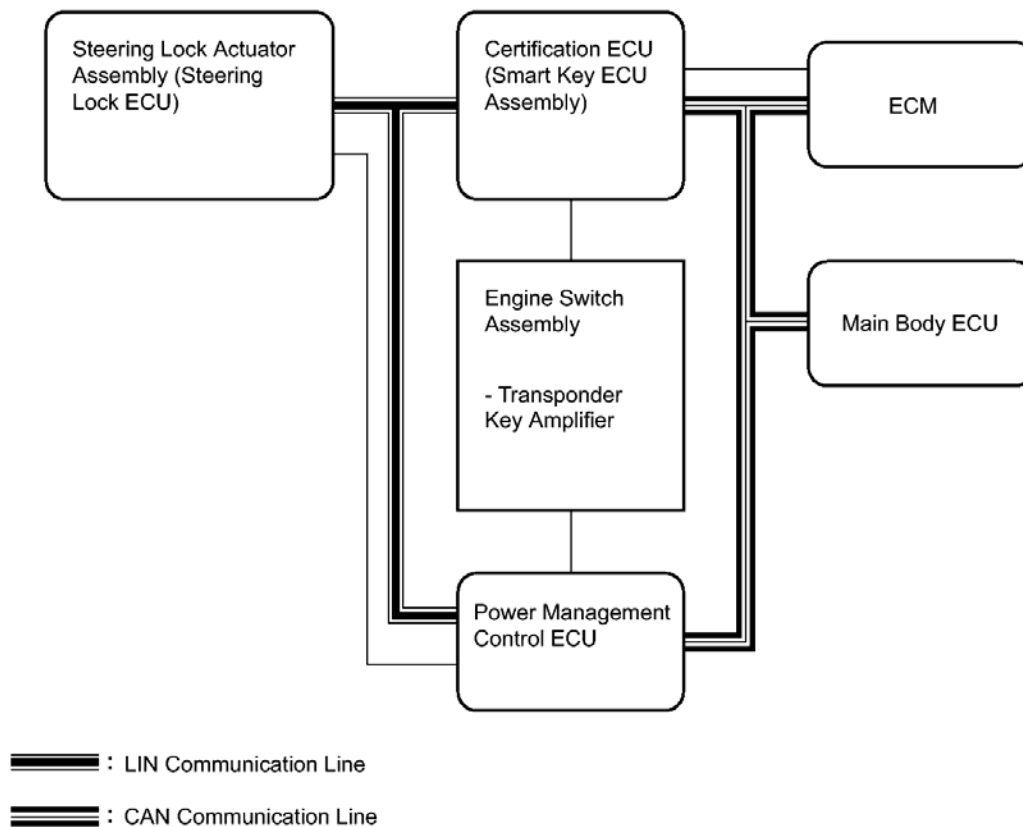


Fig. 2: Steering Lock System Diagram
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INPUT AND OUTPUT SIGNAL OF EACH ECU

Transmitting ECU (Transmitter)	Receiving ECU (Receiver)	Signal	Communication Method
Power management control ECU	Steering lock actuator assembly (steering lock ECU)	Power supply status (to steering lock motor)	LIN
Steering lock actuator assembly (steering lock ECU)	- Certification ECU - Power management control ECU	Sleep available status	LIN
Steering lock actuator assembly (steering lock ECU)	- Certification ECU - Power management control ECU	Lock/unlock sensor status	LIN
Steering lock actuator assembly (steering lock ECU)	- Certification ECU - Power management	Steering lock status	LIN

	control ECU		
Steering lock actuator assembly (steering lock ECU)	• Certification ECU • Power management control ECU	Motor control status	LIN
Steering lock actuator assembly (steering lock ECU)	• Certification ECU • Power management control ECU	Diagnostic response status	LIN
Steering lock actuator assembly (steering lock ECU)	• Certification ECU • Power management control ECU	Lock/unlock sensor malfunction	LIN
Steering lock actuator assembly (steering lock ECU)	• Certification ECU • Power management control ECU	Power supply malfunction (to steering lock motor)	LIN
Steering lock actuator assembly (steering lock ECU)	• Certification ECU • Power management control ECU	Motor driver malfunction	LIN
Steering lock actuator assembly (steering lock ECU)	• Certification ECU • Power management control ECU	Lock bar (stuck) status	LIN
Steering lock actuator assembly (steering lock ECU)	• Certification ECU • Power management control ECU	Push start status	LIN
Steering lock actuator assembly (steering lock ECU)	• Certification ECU • Power management control ECU	Lock/unlock relay drive status	LIN
Steering lock actuator assembly (steering lock ECU)	• Certification ECU • Power management control ECU	Engine start control status	LIN
Certification ECU	Steering lock actuator assembly (steering lock ECU)	Lock/unlock request	LIN
Main body ECU	• Certification ECU • Power management control ECU	Driver side door courtesy switch signal	CAN

SYSTEM DESCRIPTION

SYSTEM DESCRIPTION

1. DESCRIPTION

- a. The steering lock system locks or unlocks the steering by activating the steering lock bar with a

motor. The steering lock ECU activates the motor based on signals from the certification ECU and power management control ECU.

- b. A Local Interconnect Network (LIN) is used for communication between different ECUs in this system.

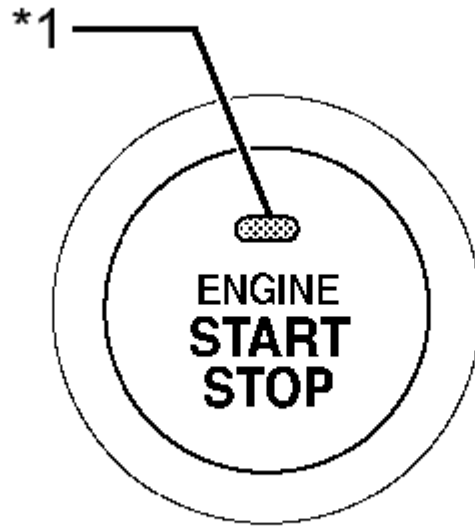
2. FUNCTIONS OF COMPONENTS

- a. The steering lock ECU controls the system based on information from the following components:

Item	Function
Steering lock actuator assembly	Consists of a motor, lock bar, lock and unlock position sensors, etc. activated by the steering lock ECU.
Steering lock ECU	• Included in the steering lock actuator assembly. This ECU activates the steering lock motor based on permission signals from the certification ECU. • Records ECU verification codes.
Power management control ECU	• Permits the steering lock ECU to supply power to activate the motor. • Performs power supply switching

	control. • Controls the engine switch indicator. • Operates the IG2 relay.
Certification ECU	• Performs key verification (checks whether the correct key is present). • Controls the security indicator and the illumination of the lettering on the engine switch. • Records ECU verification codes.
IG2 relay	Controlled by the power management control ECU. Signals indicating the on/off status of this relay are sent to the power management control ECU and steering lock ECU.

3. WARNING FUNCTION OF ENGINE SWITCH INDICATOR



Y

Fig. 3: Identifying Engine Switch Indicator Light
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*1	Indicator Light
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- a. The power management control ECU blinks the indicator light LED of the engine switch when any of the following problems occur in the system.

Detection Item	Indicator Blink Pattern	Indication Status	Countermeasure
Steering lock release malfunction	- Blinks in green at 1-second intervals - Goes off 15 seconds after blinking starts	Motor operates to release steering lock, but steering lock cannot be released (lock bar stuck in steering column).	Push engine switch while turning steering wheel to right and left
	Blinks in amber	Short in devices for	Troubleshoot by

Malfunction in push button start function	at 2-second intervals Goes off 15 seconds after blinking starts	activating motor Problem in steering lock ECU or power management control ECU	following "How to Proceed with Troubleshooting". Refer to <u>HOW TO PROCEED WITH TROUBLESHOOTING</u>
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HOW TO PROCEED WITH TROUBLESHOOTING

HOW TO PROCEED WITH TROUBLESHOOTING

HINT:

- Use the following procedures to troubleshoot the steering lock system.
- *: Use the Techstream.

1. VEHICLE BROUGHT TO WORKSHOP

NEXT: Go to next step

2. INSPECT BATTERY VOLTAGE

Standard voltage

11 to 14 V

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

NEXT: Go to next step

3. CHECK DTC*

- Check for DTCs and make a note of any codes that are output. Refer to **DTC CHECK / CLEAR**.
- Clear the DTCs. Refer to **DTC CHECK / CLEAR**.
- Recheck for DTCs. Refer to **DTC CHECK / CLEAR**. Based on the DTCs output above, try to cause the output of the same wireless door lock control system DTC, LIN communication system DTC, steering lock system DTC, engine immobiliser system DTC or smart key system (for entry function) DTC by reproducing the symptoms indicated by the DTC.

RESULT

Result	Proceed to
DTC is not	A

output.	
Wireless door lock control system DTC is output.	B
LIN communication system DTC is output.	C
Steering lock system DTC is output.	D
Engine immobiliser system DTC is output.	E
Smart key system (for entry function) DTC is output.	F

B --> Go to WIRELESS DOOR LOCK CONTROL SYSTEM (DIAGNOSTIC TROUBLE CODE CHART). Refer to DIAGNOSTIC TROUBLE CODE CHART

C --> Go to LIN COMMUNICATION SYSTEM (DIAGNOSTIC TROUBLE CODE CHART). Refer to DIAGNOSTIC TROUBLE CODE CHART

D --> Go to DIAGNOSTIC TROUBLE CODE CHART. Refer to DIAGNOSTIC TROUBLE CODE CHART

E --> Go to ENGINE IMMOBILISER SYSTEM (DIAGNOSTIC TROUBLE CODE CHART). Refer to DIAGNOSTIC TROUBLE CODE CHART

F --> Go to SMART KEY SYSTEM (DIAGNOSTIC TROUBLE CODE CHART). Refer to DIAGNOSTIC TROUBLE CODE CHART

A: Go to next step

4. PROBLEM SYMPTOMS TABLE

- a. Refer to **PROBLEM SYMPTOMS TABLE**.

RESULT

Result	Proceed to
Fault is not listed	

in problem symptoms table.	A
Fault is listed in problem symptoms table.	B

B --> Go to step 6

A: Go to next step

5. OVERALL ANALYSIS AND TROUBLESHOOTING*

- a. Terminals of ECU. Refer to **TERMINALS OF ECU.**
- b. Data List / Active Test. Refer to **DATA LIST / ACTIVE TEST.**

NEXT: Go to next step

6. REPAIR OR REPLACE

NEXT: Go to next step

7. CONFIRMATION TEST

NEXT --> END

PROBLEM SYMPTOMS TABLE

PROBLEM SYMPTOMS TABLE

HINT:

- Use the table below to help determine the cause of problem symptoms. If multiple suspected areas are listed, the potential causes of the symptoms are listed in order of probability in the "Suspected Area" column of the table. Check each symptom by checking the suspected areas in the order they are listed. Replace parts as necessary.
- Inspect the fuses and relays related to this system before inspecting the suspected areas below.

STEERING LOCK SYSTEM

Symptom	Suspected Area	See
Steering wheel cannot unlock (engine cannot start)	Refer to "Unable to Unlock Steering Wheel (Engine cannot Start)"	Refer to <u>Unable to Unlock Steering Wheel (Engine cannot Start)</u>
	Refer to "Unable to Lock Steering	Refer to <u>Unable to Lock</u>

Steering wheel cannot lock	Wheel"	<u>Steering Wheel</u>
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TERMINALS OF ECU

TERMINALS OF ECU

1. CHECK STEERING LOCK ECU

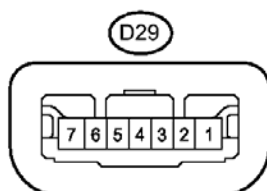


Fig. 4: Steering Lock ECU Connector Terminal Identification
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- Disconnect the D29 steering lock ECU connector.
- Measure the voltage and resistance according to the value(s) in the table below.

Terminal No. (Symbol)	Wiring Color	Terminal Description	Condition	Specified Condition
D29-1 (GND) - Body ground	W-B - Body ground	Ground	Always	Below 1 ohms
D29-6 (IG2) - D29-1 (GND)	B - W-B	IG2 signal input	Engine switch off --> engine switch on (IG)	Below 1 V --> 11 to 14 V
D29-7 (B) - D29-1 (GND)	R - W-B	Power source	Always	11 to 14 V

If the result is not as specified, there may be a malfunction on the wire harness side.

- Reconnect the D29 steering lock ECU connector.
- Measure the voltage according to the value(s) in the table below.

Terminal No.	Wiring	Terminal	Condition	Specified
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(Symbol)	Color	Description		Condition
D29-3 (IGE) - D29-1 (GND)	V - W- B	Power source for motor drive	When all conditions are met: - Steering lock unlocked - Engine switch off - Shift lever in P - Driver side door closed -- > opened	11 to 14 V (Steering lock motor not operating) --> Below 1 V (Steering lock motor operating) --> 11 to 14 V (Steering lock motor not operating)
D29-4 (SLP1) - D29-1 (GND)	G - W- B	Unlock position sensor output signal	Steering lock locked --> steering lock unlocked	11 to 14 V --> Below 1.2 V

If the result is not as specified, there may be a malfunction in the steering lock ECU.

DIAGNOSIS SYSTEM

DIAGNOSIS SYSTEM

1. DESCRIPTION

- When troubleshooting a vehicle with a diagnosis system, connect the Techstream to the DLC3 of the vehicle and read various data output from the steering lock actuator assembly (steering lock ECU).

The steering lock actuator assembly (steering lock ECU) stores DTCs when the ECU detects a malfunction in itself or in its circuits.

- The diagnosis information of the steering lock actuator assembly (steering lock ECU) is transmitted to the Techstream via the certification ECU as the steering lock actuator assembly (steering lock ECU) is not connected to the CAN communication system.
- The steering lock actuator assembly (steering lock ECU) does not store DTCs regarding past problems.
- When the engine switch is off, the main body ECU may occasionally go into a non-active state

called sleep mode. Communication with the Techstream is not possible if the main body ECU is in sleep mode. Therefore, before proceeding with the inspection, it is necessary to perform the following steps to wake up the ECU: With the engine switch off, open the driver door. Then (with the engine switch still off) open and close any door several times at 1.5 second intervals.

- e. As the steering lock actuator assembly (steering lock ECU) memory data is cleared, do not remove the fuses or disconnect the cable from the battery terminals until the DTCs are checked and noted.
- f. Malfunctions related to systems other than the steering lock actuator assembly (steering lock ECU) system may cause DTCs to be output. Note any DTCs related to other systems.

DTC CHECK / CLEAR

DTC CHECK / CLEAR

1. CHECK DTC

- a. Connect the Techstream to the DLC3.
- b. Turn the engine switch on (IG).
- c. Turn the Techstream on.
- d. Enter the following menus: Body Electrical / Smart Key / Trouble Codes.
- e. Check for DTCs.

2. CLEAR DTC

- a. Connect the Techstream to the DLC3.
- b. Turn the engine switch on (IG).
- c. Turn the Techstream on.
- d. Enter the following menus: Body Electrical / Smart Key / Trouble Codes.
- e. Clear the DTCs.

DATA LIST / ACTIVE TEST

DATA LIST / ACTIVE TEST

1. READ DATA LIST

HINT:

Using the Techstream to read the Data List allows the values or states of switches, sensors, actuators and other items to be read without removing any parts. This non-intrusive inspection can be very useful because intermittent conditions or signals may be discovered before parts or wiring is disturbed. Reading the Data List information early in troubleshooting is one way to save diagnostic time.

NOTE: 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 engine switch off.

- b. Connect the Techstream to the DLC3.
- c. Turn the engine switch on (IG).
- d. Turn the Techstream on.
- e. Enter the following menus: Body Electrical / (desired system) / Data List.
- f. According to the display on the Techstream, read the Data List.

SMART KEY

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
Ignition Switch	Engine switch status/ON or OFF	ON: Engine switch on (IG) OFF: Engine switch off	-
#Codes	Number of diagnostic trouble codes/0 to 255	-	-
Steering Lock Sleep Cond	Steering lock ECU sleep mode possible/Yes or No	Yes: Sleep mode possible No: Sleep mode not possible	-
Steering Lock Start Cond	Steering lock ECU wake up signal sent/Yes or No	Yes: Wake up signal sent No: Wake up signal not sent	-
Engine Start Condition	Engine start status/OK or NG	NG: Engine start not possible OK: Engine start possible	-
Sensor Value	Sensor malfunction record/NG (PAST) or OK	NG (PAST): Sensor malfunction OK: No malfunction	-
Power Supply Short	Short in ECU record/NG (PAST) or OK	NG (PAST): Short in ECU OK: No malfunction	-
Power Supply Open	Open in ECU record/NG (PAST) or OK	NG (PAST): Open in ECU OK: No malfunction	-
		NG (PAST):	If NG (PAST) is displayed,

Motor Driver Short	Short in driver ECU record/NG (PAST) or OK	Short in driver ECU OK: No malfunction	proceed to troubleshooting for DTC B2782.
Motor Driver Open	Open in driver ECU record/NG (PAST) or OK	NG (PAST): Open in driver ECU OK: No malfunction	If NG (PAST) is displayed, proceed to troubleshooting for DTC B2782.
Lock/Unlock Receive	Steering lock command reception record/YES or NO	YES: Steering lock/unlock signal received NO: Steering lock/unlock signal not received	-
Lock Bar Stuck Error	Lock bar stuck malfunction record/NG (PAST) or OK	NG (PAST): Lock bar stuck malfunction OK: No malfunction	-
Push Start Error	Push button start function malfunction/NG (PAST) or OK	NG (PAST): Malfunction in push button start OK: No malfunction	-
IG2 Status	IG2 voltage status/ON or OFF	ON: 11 to 14 V OFF: Below 1 V	-
IG(Lin)	IG signal via LIN communication/ON or OFF	ON: IG signal sent via LIN communication OFF: IG signal not sent via LIN communication	-
S Code Check	S code certification result/NG or OK	NG: S code certification result abnormal OK: S code certification result normal	-
		NG: L code	

L Code Check	L code certification result/NG or OK	certification result abnormal OK: L code certification result normal	-
Unlock Request Receive	Steering lock unlock command reception status/NG or OK	NG: Unlock request not received OK: Unlock request received	-
Lock Request Receive	Steering lock command reception status/NG or OK	NG: Lock request not received OK: Lock request received	-
S Code Check(Past)	S code certification result/NG (PAST) or OK	NG (PAST): S code certification result abnormal OK: S code certification result normal	-
L Code Check(Past)	L code certification result/NG (PAST) or OK	NG (PAST): L code certification result abnormal OK: L code certification result normal	-

MAIN BODY

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
FL Door Courtesy	Front door courtesy switch LH/ON or OFF	ON: Front LH side door closed OFF: Front LH side door open	-

2. PERFORM ACTIVE TEST

HINT:

Using the Techstream to perform Active Tests allows relays, VSVs, actuators and other items to be operated without removing any parts. This non-intrusive functional inspection can be very useful because intermittent operation may be discovered before parts or wiring is disturbed. Performing Active Tests early in troubleshooting is one way to save diagnostic time. Data List information can be displayed while performing Active Tests.

- Connect the Techstream to the DLC3.
- Turn the engine switch on (IG).
- Turn the Techstream on.
- Enter the following menus: Body Electrical / Power Source Control / Active Test.
- According to the display on the Techstream, perform the Active Test.

POWER SOURCE CONTROL

Tester Display	Test Part	Control Range	Diagnostic Note
P Supply for Steering Lock	Power management control ECU	Supply or Stop	This test supplies or stops power to the steering lock motor.

DIAGNOSTIC TROUBLE CODE CHART

DIAGNOSTIC TROUBLE CODE CHART

HINT:

If a trouble code is output during the DTC check, inspect the trouble areas listed for that code. For details of the code, refer to the appropriate information below.

STEERING LOCK SYSTEM

DTC Code	Detection Item	Trouble Area	See
B2781	Open / Short in Steering Lock ECU	- Steering lock actuator assembly (steering lock ECU) - LIN communication system - Harness or connector of LIN bus line	Refer to <u>DTC B2781: Open / Short in Steering Lock ECU</u>
		- Steering lock actuator assembly	

B2782	Power Source Control ECU Malfunction	(steering lock ECU) - Power management control ECU - Harness or connector	Refer to <u>DTC B2782:</u> <u>Power Source Control</u> <u>ECU Malfunction</u>
B2788	IG2 Signal Malfunction	- IG2 fuse - Steering lock actuator assembly (steering lock ECU) - Power management control ECU - Harness or connector	Refer to <u>DTC B2788: IG2</u> <u>Signal Malfunction</u>