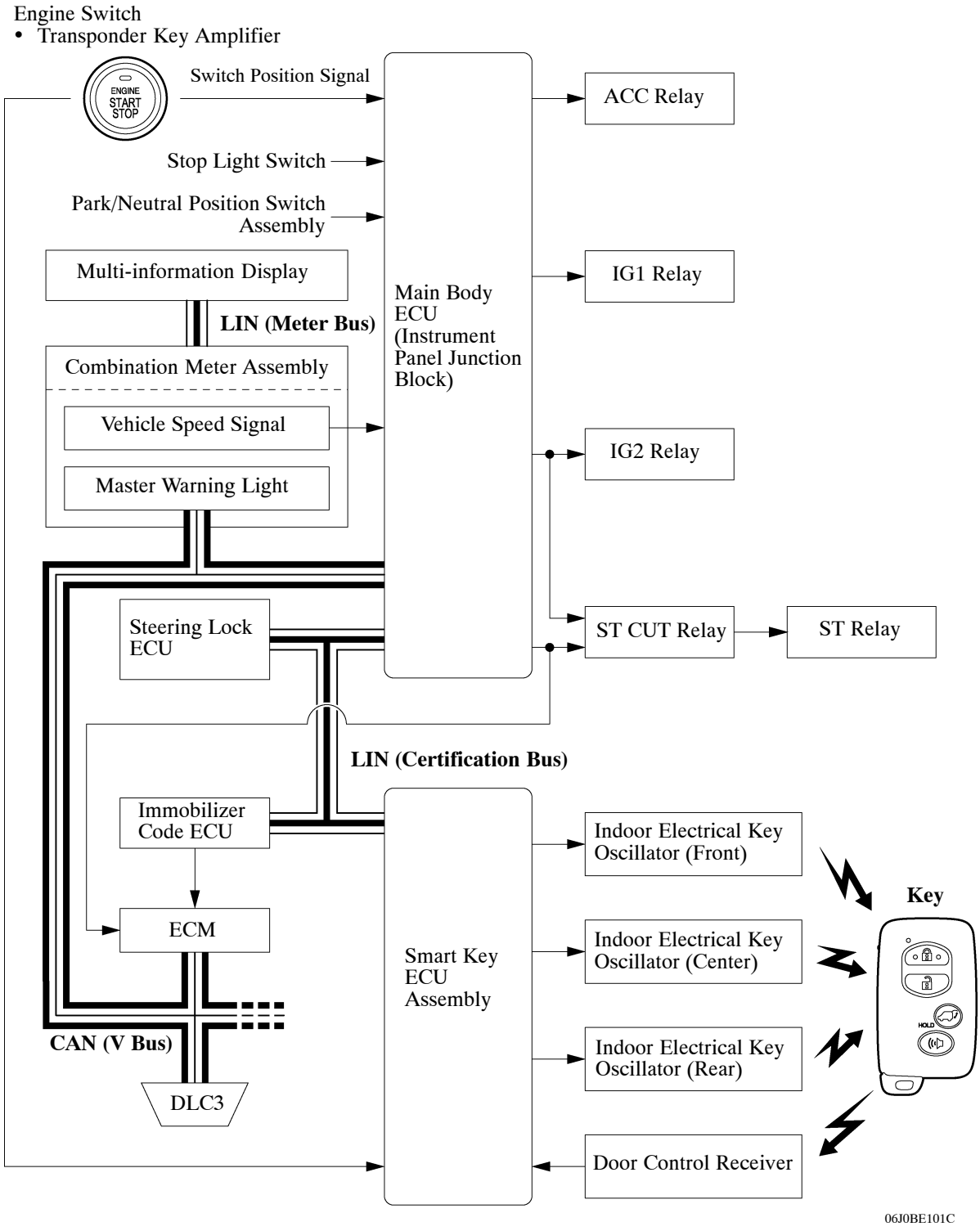
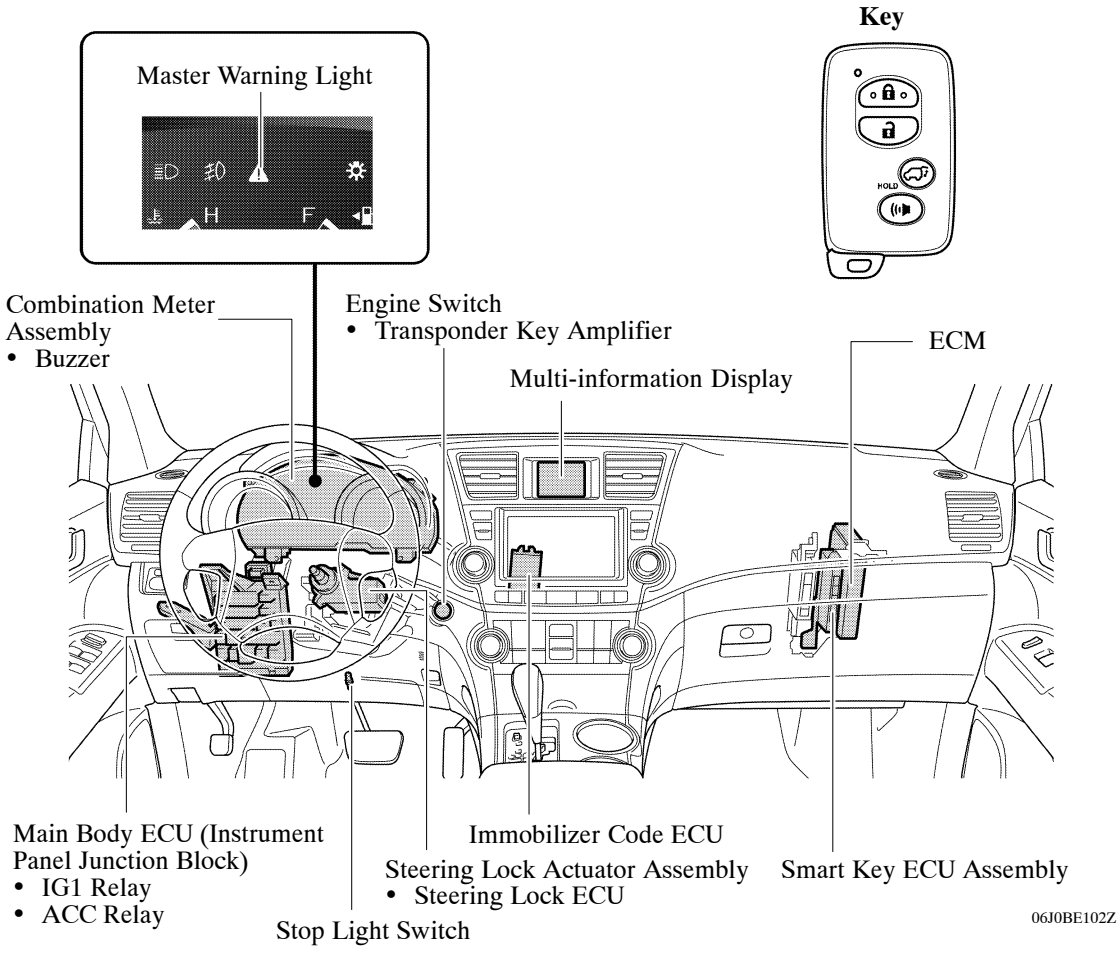
■START FUNCTION

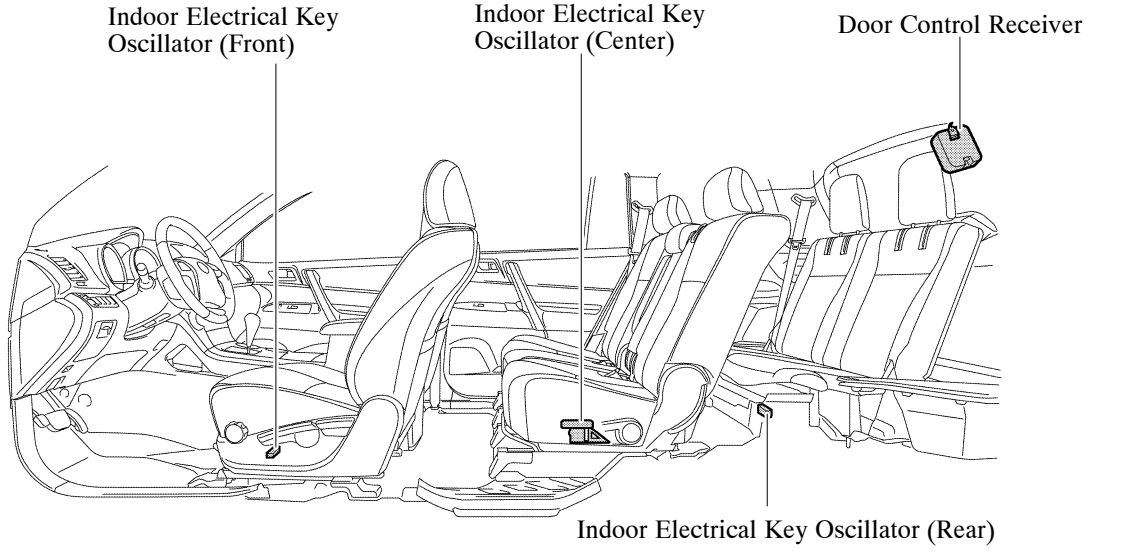
1. System Diagram

The Main Body ECU (Instrument Panel Junction Block) controls the start function. The system diagram below shows the components that relate to this function.



2. Layout of Main Components





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3. Function of Main Components

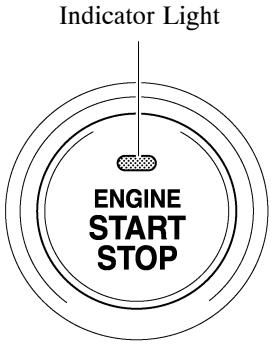
Component	Function
Engine Switch • Transponder Key Amplifier	• Transmits the engine switch signal to the Main Body ECU (Instrument Panel Junction Block). • Informs the driver of any power source or system abnormality through the illumination stage of the indicator light. • Receives the ID code and transmits it to the Smart Key ECU Assembly when the key battery is too weak to respond to the tuner based on the room oscillators.
Key	Receives the signals from the oscillators and returns the ID code to the door control receiver.
Indoor Electrical Key Oscillator • Front, Center, Rear	Receives a request signal from the Smart Key ECU Assembly and forms the actuation area in the vehicle interior.
Door Control Receiver	Receives the ID code from the key and transmits it to Smart Key ECU Assembly.
Main Body ECU (Instrument Panel Junction Block)	• Switches the power source among four modes (OFF, ACC, IG-ON, START) in accordance with the shift position and the brake pedal depressing/pressing. • Controls the smart key system in accordance with the signals received from the switches and each ECU.
Smart Key ECU Assembly	• Certifies the ID code received from the door control receiver and transmits the certification results to the Immobilizer Code ECU and Steering Lock ECU. • Transmits the steering lock/unlock request signals. • Transmits the engine immobilizer set/unset request signals.
Stop Light Switch	Outputs the state of the brake pedal to Main Body ECU (Instrument Panel Junction Block).
Immobilizer Code ECU	Receives the steering unlock or engine immobilizer disengage/engage signals from the Smart Key ECU Assembly, certifies them, and transmits each disengage/engage signal to the Steering Lock ECU or ECM.
Steering Lock ECU	Receives the steering unlock/lock signal from Immobilizer Code ECU, and activates the steering lock motor.
ECM	• Receives the engine start request signal from the Main Body ECU (Instrument Panel Junction Block), turns ON the ST relay, and starts the engine. • Receives the signal from the Immobilizer Code ECU and performs engine ignition and injection.
Combination Meter Assembly • Master Warning Light • Buzzer	Illuminates simultaneously with a buzzer in combination meter assembly sound to inform the driver of malfunctions in the smart key system.
Multi-information Display	The following warning messages appear to alert the driver. • Key is not Detected • When starting the engine, depress the brake pedal • Low Key Battery • S/T is not Unlocked • Check S/T Lock

4. Construction and Operation

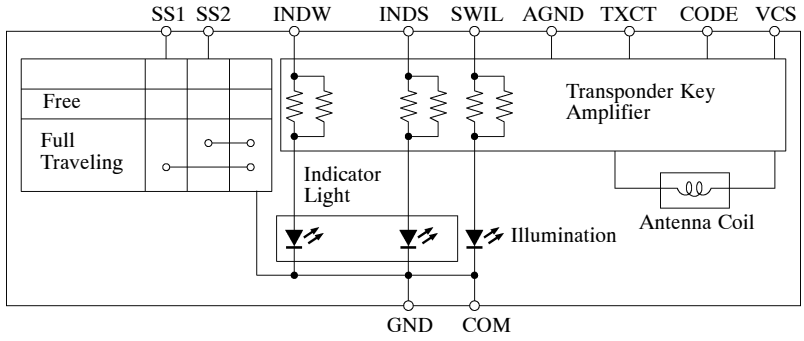
Engine Switch

The engine switch consists of a momentary type switch, indicator light (amber and green color LEDs), illumination, antenna coil, and transponder key amplifier.

- The driver can determine the present power source and check whether the engine can start or not in accordance with the illumination state of the indicator light.
- When the Main Body ECU (Instrument Panel Junction Block) detects an abnormality with the smart key system, it makes the amber indicator light flash. If the engine is stopped in this state, it might not be possible to restart it.



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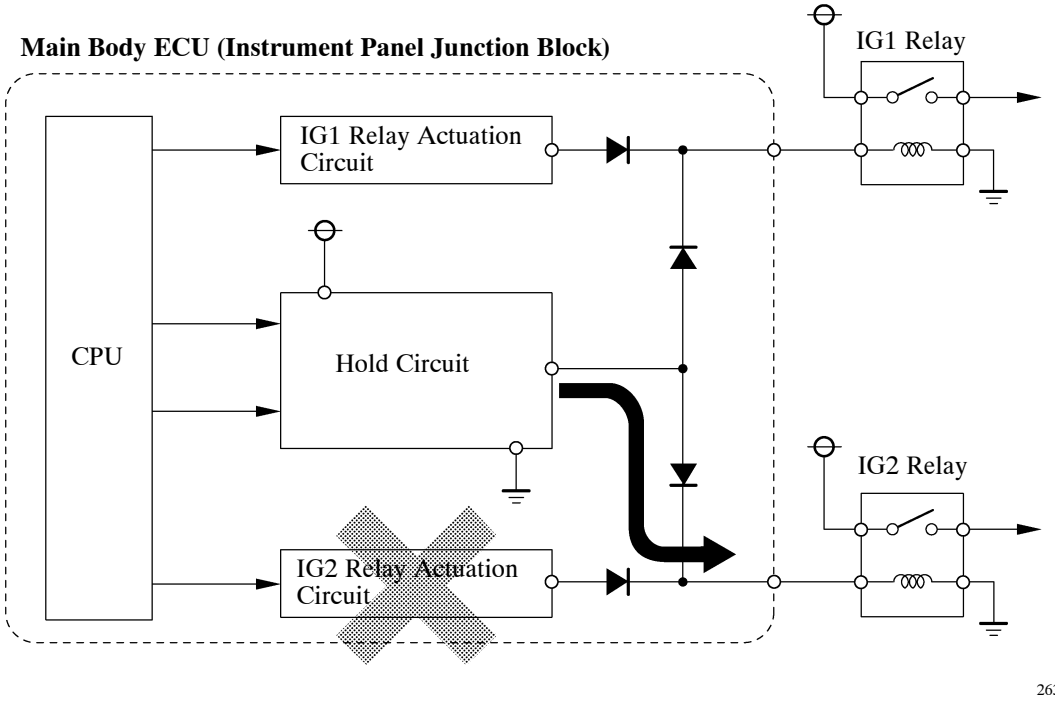
▶ Indicator Light Condition ◀

Power Source Condition	Indicator Light Condition	
	Brake pedal not depressed	Brake pedal depressed with shift lever in “P” or “N”
OFF	OFF	ON (Green)
ACC, IG-ON	ON (Amber)	ON (Green)
Engine Running	OFF	OFF
Steering lock not unlocked	Flashes (Green) for 15 seconds	Flashes (Green) for 15 seconds
Smart Key System Malfunction	Flashes (Amber) for 15 seconds	Flashes (Amber) for 15 seconds

Main Body ECU (Instrument Panel Junction Block)

Main Body ECU (Instrument Panel Junction Block) consists of the IG relay No.1 and No.2 actuation circuits, CPU, and hold circuit.

- The hold circuit is installed to prevent the power supply to the relays from being cut off when an abnormality occurs in IG Relay No.1 and/or No.2 actuation circuits while driving.



Service Tip

The Main Body ECU (Instrument Panel Junction Block) constantly stores the present power source state in its memory. Therefore, if the power to Main Body ECU (Instrument Panel Junction Block) is interrupted due to the removal of the battery, the Main Body ECU (Instrument Panel Junction Block) restores the power source after the battery is reconnected.

For this reason, if the battery is removed when the engine switch is in a state other than OFF, the power will be restored to the vehicle at the same time the power is restored to Main Body ECU (Instrument Panel Junction Block) (by reconnecting the battery).

Therefore, before removing the battery, be sure to turn the engine switch OFF.

5. Start Function Operation

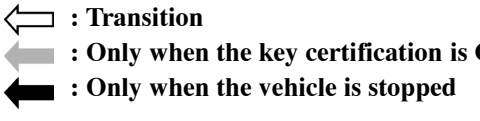
General

The start function has different power source patterns to suit the brake pedal state and shift lever position.

Pattern (See page)	Brake Pedal	Shift Lever	Power Source Pattern
A (BE-146)	Depressed	P or N Position	When the engine switch is pushed once. • OFF → IG-ON (after the engine is started)
B (BE-149)	Not Depressed	P Position	Each time the engine switch is pushed. • OFF → ACC → IG-ON → OFF
C (BE-151)		Except P Position	Each time the engine switch is pushed. • OFF → ACC → IG-ON → ACC
D (BE-151)	—	P Position	When the engine switch is pushed in the IG-ON condition. • IG-ON (engine is started or not started) → OFF
E (BE-151)	—	Except P Position	When the engine switch is pushed in the IG-ON condition. • IG-ON (engine is started or not started) → ACC

▶ Transition of Power Source ◀

Shift Position		P			N		Except P, N	
Pattern		B or D	A or D	-	C or E	A or E	C or E	-
Engine Switch		Push	Push	-	Push	Push	Push	Push
Brake		-	Depressed	-	-	Depressed	-	Depressed
Hour		-	-	After 1 hour	-	-	-	-
Power Source	OFF							
	ACC							
	IG							
	Engine Start							



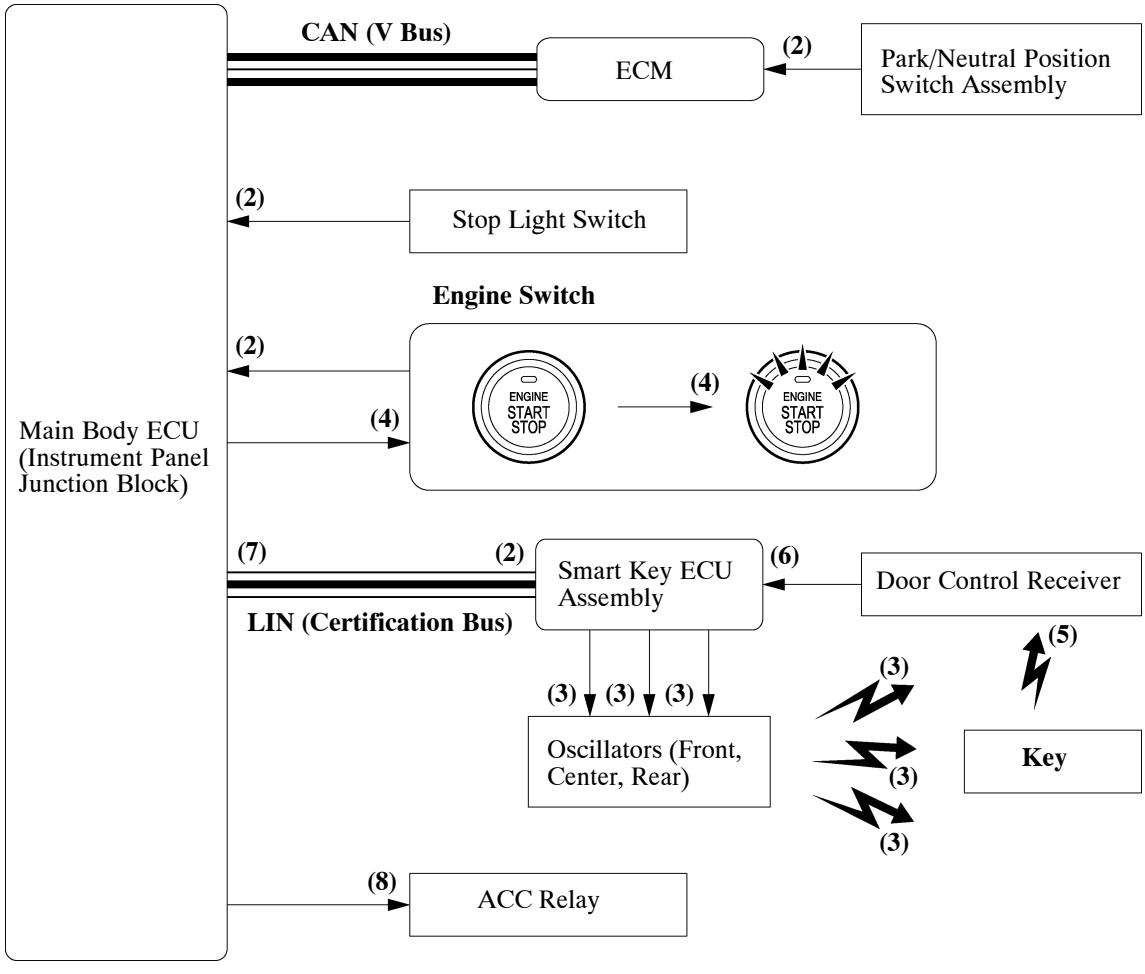
: Transition
: Only when the key certification is OK
: Only when the vehicle is stopped

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NOTE:
- Normally, the operation of the engine switch is disabled while the vehicle is being driven. However, in an emergency, by pressing the engine switch for approximately 3 seconds or more, the driver can stop the engine while the vehicle is in motion.
- If no signals are transmitted to the Main Body ECU (Instrument Panel Junction Block) due to malfunctions in the stop light switch or park/neutral position switch assembly, the engine may not start when the engine switch is pressed with the brake pedal depressed. In such cases, performing the following procedure may be enable the engine to start: 1) press the engine switch to turn the power source from OFF to ACC, and 2) press the engine switch again and hold it for 15 seconds or more.
- Above 2 operations must be applied only in emergency situations. Under normal conditions, the engine must not be stopped by pressing the engine switch during driving or started without depressing the brake pedal when the shift lever is in any position other than P or N.

Pattern A: OFF → IG-ON (after the engine is started)

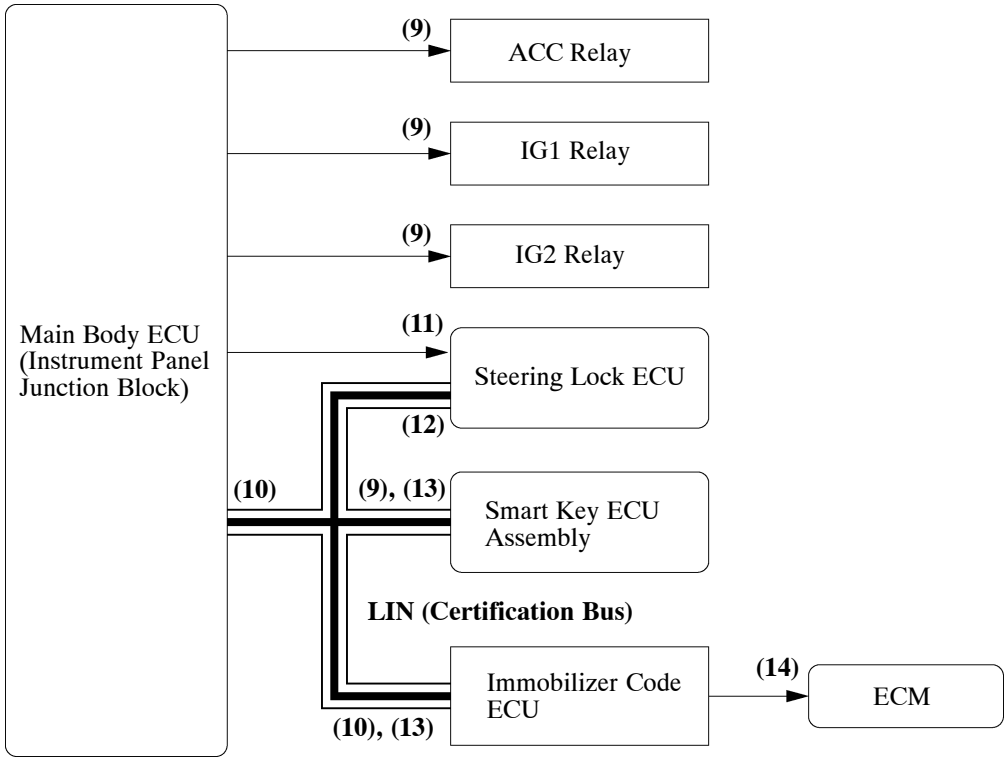
Step	System Operation
(1)	The driver holds the key and enters the vehicle.
(2)	When the driver presses the engine switch once with the following conditions satisfied, the Main Body ECU (Instrument Panel Junction Block) recognizes the engine switch signal and transmits the key certification request to the Smart Key ECU Assembly. • Shift position is “P” or “N”. • Brake pedal depressed. • Engine switch is at “OFF”.
(3)	The Smart Key ECU Assembly receives the certification request and transmits a request signal to the oscillators (Front, Center, Rear). These oscillators then transmit the request signal.
(4)	The brake pedal is depressed, so the Main Body ECU (Instrument Panel Junction Block) turns ON the green indicator light of the engine switch.
(5)	The moment the key receives the request signal, it transmits its ID code to the door control receiver. The signal includes the response code.
(6)	The door control receiver receives this code and transmits it to the Smart Key ECU Assembly.
(7)	The Smart Key ECU Assembly judges and certifies the ID code, and transmits a key certification OK signal to the Main Body ECU (Instrument Panel Junction Block).
(8)	After receiving the key certification OK signal, the Main Body ECU (Instrument Panel Junction Block) turns ON the ACC relay.



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(Continued)

Step	System Operation
(9)	The Main Body ECU (Instrument Panel Junction Block) turns ON the ACC relay, and then turns ON the IG1 relay and IG2 relay.
(10)	The Smart Key ECU Assembly checks that the power source has switched from OFF to IG-ON, and transmits a steering unlock signal to the Main Body ECU (Instrument Panel Junction Block) and Immobilizer Code ECU.
(11)	The Main Body ECU (Instrument Panel Junction Block) receives this signal and supplies power to the Steering Lock ECU.
(12)	The Steering Lock ECU receives the steering unlock signal via the Immobilizer Code ECU, and releases the steering lock.
(13)	After checking the steering unlock condition, the Smart Key ECU Assembly transmits an engine immobilizer disengage signal to the Immobilizer Code ECU.
(14)	The Immobilizer Code ECU certifies the disengage signal of the Smart Key ECU Assembly, transmits the engine immobilizer disengage signal to the ECM, and disengages the engine immobilizer.

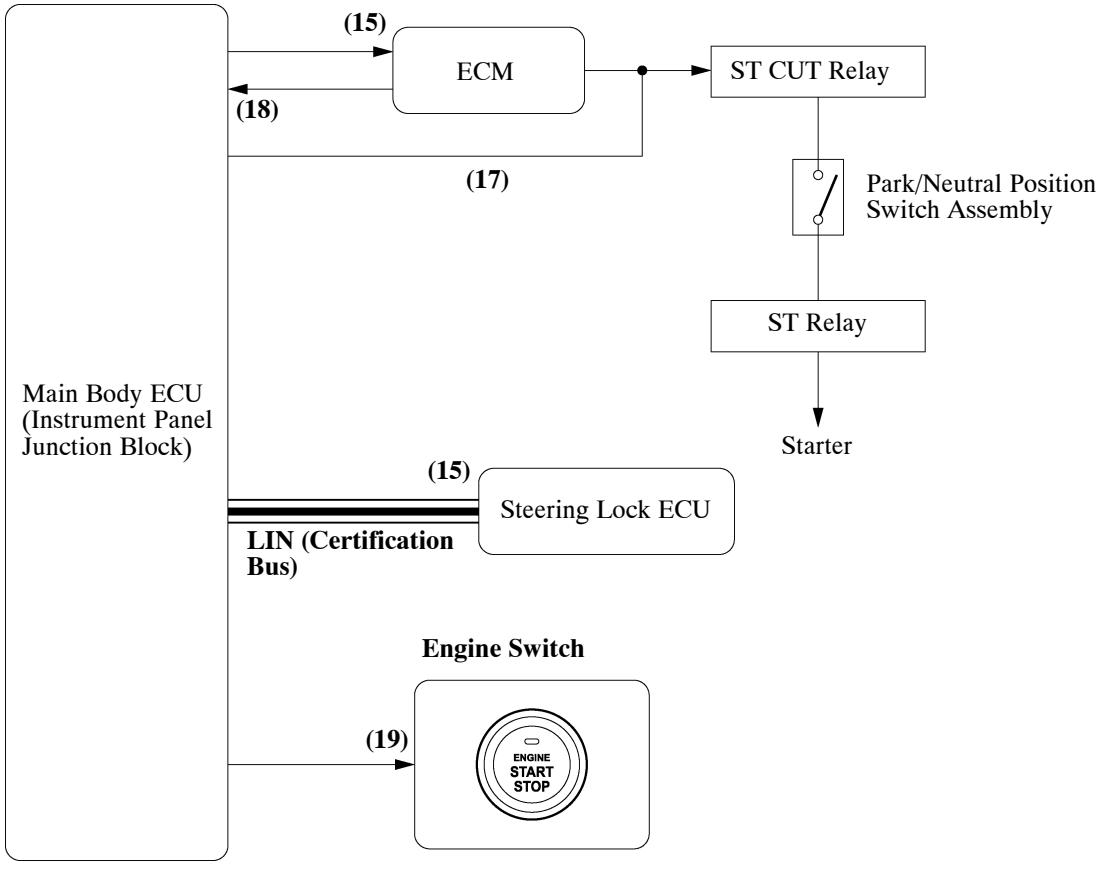


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(Continued)

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Step	System Operation
(15)	After checking that the steering is in the unlocked condition, the Main Body ECU (Instrument Panel Junction Block) transmits a starter request (STSW) signal to the ECM.
(16)	The ECM receives this signal, outputs an ST relay (STAR) signal, and actuates the starter. (For details see the cranking hold function on page EG-82.)
(17)	The ECM and Main Body ECU (Instrument Panel Junction Block) both output the starter relay signal in order to actuate the starter. Both the ECM and Main Body ECU (Instrument Panel Junction Block) output the signal in order to prevent situations where the starter may fail to operate, such as when the battery voltage supplied to the ECM is low.
(18)	When the ECM judges from the engine speed that engine start is completed, it stops the starter relay (STAR) signal, and stops the starter.
(19)	The Main Body ECU (Instrument Panel Junction Block) receives this signal, checks that engine start is completed, and turns OFF the indicator light of the engine switch.



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Pattern B: OFF → ACC → IG-ON → OFF

1) OFF → ACC

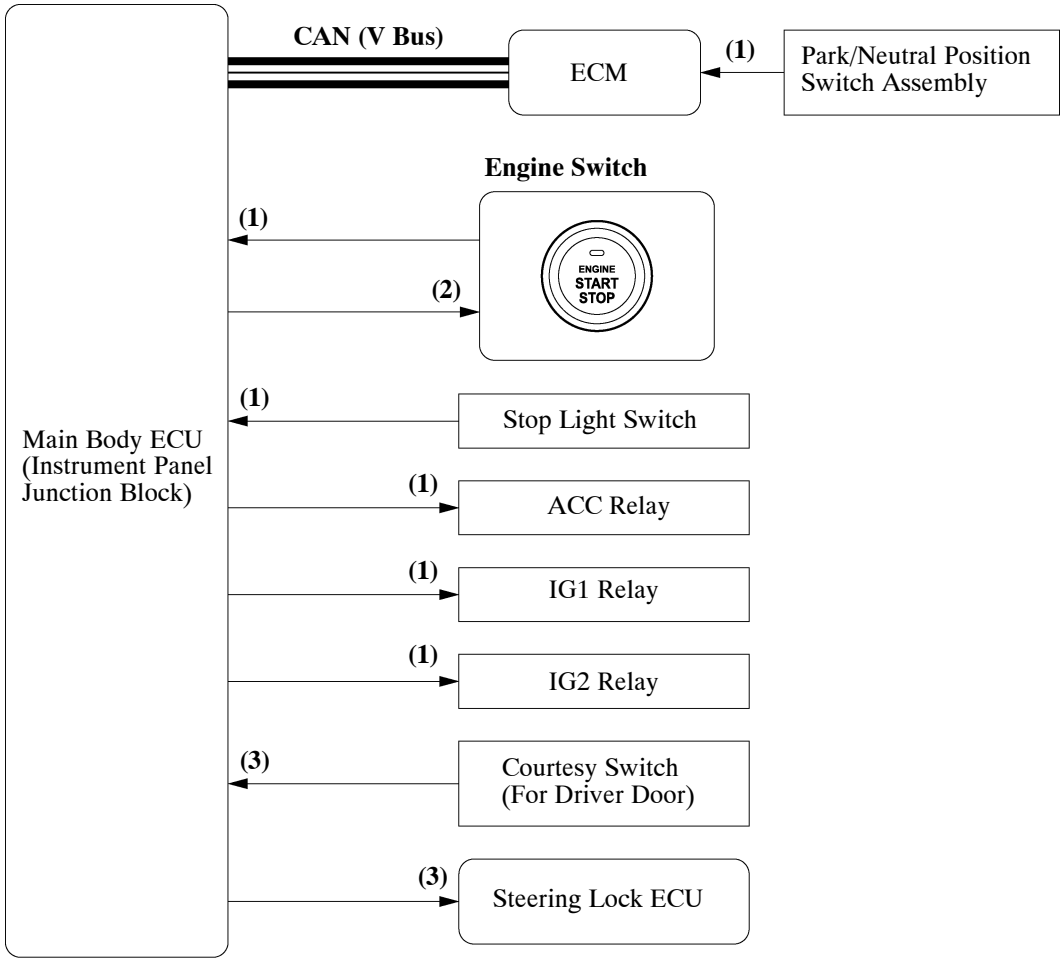
Step	System Operation
(1)	The driver has the key in their possession and enters the vehicle.
(2)	When the driver presses the engine switch once with the following conditions satisfied, the Main Body ECU (Instrument Panel Junction Block) recognizes the engine switch signal and transmits the key certification request to the Smart Key ECU Assembly. • Shift position is "P". • Brake pedal is not depressed. • Engine switch is "OFF".
(3)	Due to the brake pedal not being depressed, the Main Body ECU (Instrument Panel Junction Block) will turn ON the amber indicator light of the engine switch.
(4)	The rest of the system operation is the same as **(4) to (8) in pattern "A"**. For details, see page BE-146.

2) ACC → IG-ON

Step	System Operation
(1)	When the engine switch is at "ACC" and the driver pressed the engine switch again, the Main Body ECU (Instrument Panel Junction Block) recognizes the engine switch signal and turns ON the IG relays.
(2)	The rest of the system operation is the same as **(10) to (14) in pattern "A"**. For details, see page BE-147.

3) IG-ON → OFF

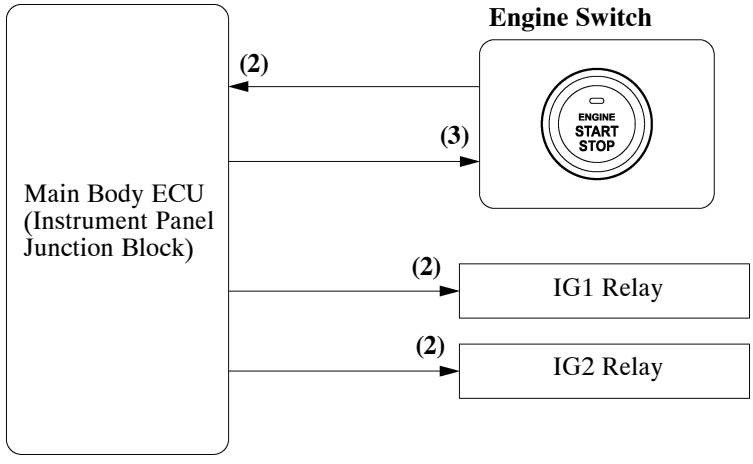
Step	System Operation
(1)	When the engine switch is pressed once with the following conditions satisfied, the Main Body ECU (Instrument Panel Junction Block) recognizes the engine switch signal and turns OFF the ACC, IG relays. • Shift position is “P”. • Brake pedal is not depressed. • Vehicle speed is 0 km/h (0 mph). • Engine switch is in “IG-ON”.
(2)	When the engine switch is switched from IG-ON to OFF, the Main Body ECU (Instrument Panel Junction Block) will turn OFF the indicator light of the engine switch.
(3)	If the driver’s door is opened, the Main Body ECU (Instrument Panel Junction Block) receives a signal from the courtesy switch (for driver door). Then, the power supply to the Steering Lock ECU stops in order to lock the steering.



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Pattern C: OFF → ACC → IG-ON → ACC

Step	System Operation
(1)	The system operations for the pattern C (OFF → ACC → IG-ON) are the same as those in **pattern "B"**. For details, see page BE-149.
(2)	When the engine switch is pressed once with the following conditions satisfied, the Main Body ECU (Instrument Panel Junction Block) recognizes the engine switch signal and turns OFF the IG relays. • Shift position is in any position except "P". • Brake pedal is not depressed. • Vehicle speed is 0 km/h (0 mph). • Engine switch is in "IG-ON".
(3)	Even after the engine switch switches from IG-ON to ACC, the indicator light of the engine switch will remain illuminated in amber.



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Pattern D: IG-ON → OFF

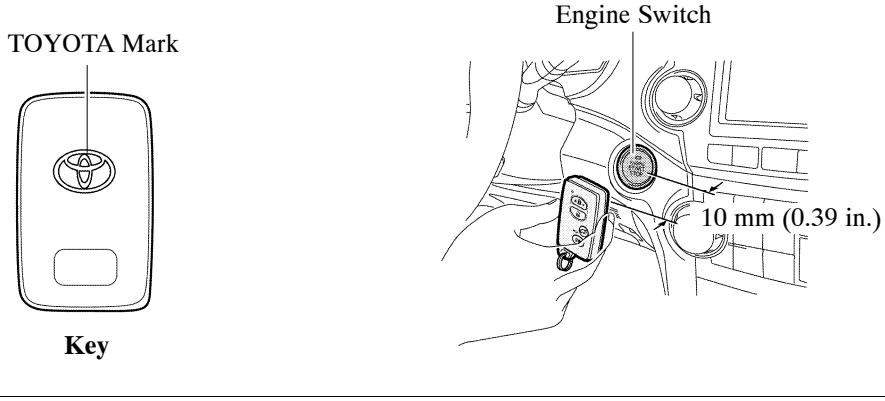
This system operation is the same as IG-ON → OFF for **pattern "B"**. For detail, see page BE-150.

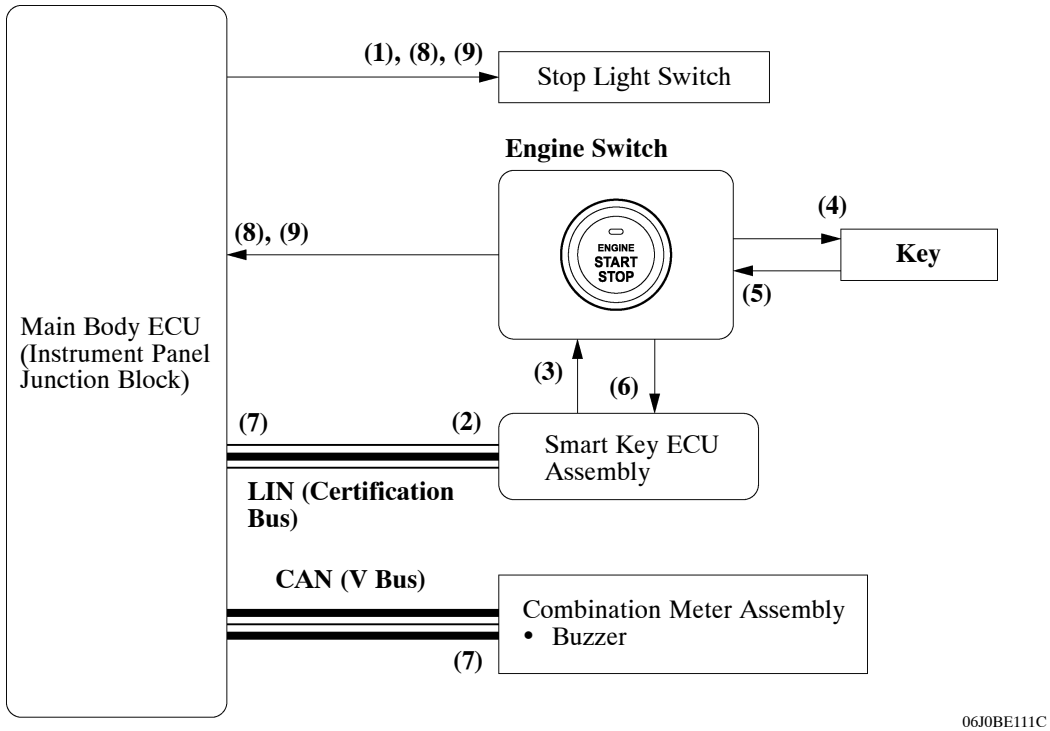
Pattern E: IG-ON → ACC

This system operation is the same as **pattern "C"**. However, the indicator light of the engine switch will illuminate as follows:

- When the engine switch is switched from IG-ON to ACC, the Main Body ECU (Instrument Panel Junction Block) makes the amber indicator light of the engine switch continue to illuminate.
- When the engine switch is switched from engine running to OFF, the Main Body ECU (Instrument Panel Junction Block) turns OFF the indicator light of the engine switch.

When key battery is low

Step	System Operation
(1)	To operate the smart key system when the key battery is low, hold the key against the engine switch as shown below while depressing the brake pedal.
	
(2)	The Main Body ECU (Instrument Panel Junction Block) receives the stop light switch signal and transmits a key certification request signal to the Smart Key ECU Assembly.
(3)	The Smart Key ECU Assembly does not receive an ID code response from the door control receiver, so it actuates the transponder key amplifier built into the engine switch.
(4)	The transponder key amplifier outputs an engine immobilizer radio wave to the key.
(5)	The key receives the radio wave, and returns a radio wave response to the transponder key amplifier.
(6)	The transponder key amplifier combines the key ID codes with the radio wave response, and transmits it to the Smart Key ECU Assembly.
(7)	The Smart Key ECU Assembly judges and verifies the ID code, and transmits a key certification OK signal to the Main Body ECU (Instrument Panel Junction Block). The buzzer in the combination meter assembly sounds at the same time.
(8)	After the buzzer sounds, if the engine switch is pressed within 5 seconds while the brake pedal is depressed, the engine switch switches to start the engine running, the same as with normal smart key operation.
(9)	After the buzzer sounds, if the engine switch is pressed within 5 seconds while the brake pedal is not depressed, the engine switch will be switched to ACC or IG-ON, the same as with normal smart key operation.


Main Body ECU
(Instrument Panel
Junction Block)
(1), (8), (9)
Stop Light Switch
Engine Switch
ENGINE
START
STOP
(4)
Key
(5)
(8), (9)
(3)
(6)
(7)
(2)
Smart Key ECU
Assembly
LIN (Certification
Bus)
CAN (V Bus)
Combination Meter Assembly
• Buzzer
(7)
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6. Diagnosis

The Main Body ECU (Instrument Panel Junction Block) and Smart Key ECU Assembly can detect malfunction in the smart key system when the power source is in the IG-ON mode.
When the ECUs detect a malfunction, the amber indicator light of the engine switch flashes to warn the driver. At the same time, the ECUs store 5-digit DTC (Diagnostic Trouble Code) in their memories.

- The indicator light warning continues for 15 seconds even after the engine switch is switched to OFF.
- The 5-digit DTCs can be read after connecting an intelligent tester or Techstream* to DLC3.
- The smart key system may not operate successfully if a malfunction occurs.

*: Techstream is the name for the diagnostic tester in North America, but other countries will continue to use the intelligent tester.