

SYSTEM DESCRIPTION

1. SMART KEY SYSTEM DESCRIPTION

- (a) In addition to conventional mechanical key and wireless door lock remote control functions, the smart system enables door locking/unlocking, steering lock releasing, engine starting and trunk opening without operating the key. The only requirement is that the key be in the driver's possession.
- This system is controlled by the theft warning ECU. When the theft warning ECU detects the presence of the smart key in one of the detection area, it identifies and checks the ID code, and outputs operation signals to the related ECUs in accordance with their functions.
 - The detection areas are formed by 8 oscillators (4 door oscillators, 2 trunk oscillators, and 2 room oscillators).
 - The smart function is only available for the master key and is not available for the sub-key and flat key.

2. Function of Main Component

Function	Outline
Smart Key (Master Key)	<ul style="list-style-type: none"> • Only master key can activate smart key system. • Receives signals from oscillators and returns ID code to receivers. • Consists of: 1) mechanical key that works for doors, trunk, trunk main switch and glove box, and cannot start engine; and 2) transponder chip for engine immobilizer system. • Has transmitter function for wireless door lock control.
Smart Key (Sub-key)	<ul style="list-style-type: none"> • Sub-key cannot activate smart key system. • Consists of: 1) mechanical key that only works for doors and cannot start engine; and 2) transponder chip for engine immobilizer system. • Has transmitter function for wireless door lock control.
Smart Key (Flat key)	<ul style="list-style-type: none"> • Flat key cannot activate smart key system. • Consists of: 1) key plate that works for doors, trunk, trunk main switch and glove box, and cannot start engine; and 2) electronic key that contains transponder chip for engine immobilizer system and can start engine.
Door Oscillator	Intermittently transmits key detection signals within detection area around each door upon receiving transmission request signal from theft warning ECU.
Room Oscillator (Front and Rear)	Transmits key detection signal within detection area in vehicle interior upon receiving transmission request signal from theft warning ECU.
Trunk Oscillator (Inner)	Transmits key detection signal within detection area in luggage room upon receiving transmission request signal from theft warning ECU.
Trunk Oscillator (Outer)	Transmits key detection signal within detection area in luggage room door upon receiving transmission request signal from theft warning ECU.
Trunk Oscillator Antenna (Outer)	Transmits trunk oscillator signals.
Wireless Door Lock Receiver (Built into inside rear view mirror)	Receives ID code from smart key and transmits it to theft warning ECU.
Luggage Room Receiver	Receives ID code from smart key in luggage room and transmits it to theft warning ECU.
Outside Handle (Antenna)	Transmits trunk oscillator signals.
Outside Handle (Touch Sensor)	Detects when person touches outside door handle.
Outside Handle (Lock Switch)	Transmits door lock request signals from door ECUs to theft warning ECU via BEAN.
Smart Trunk Open Switch	Transmits trunk lid open request signal from luggage room J/B ECU to theft warning ECU via BEAN.
Ignition Switch (Key Unlock Warning Switch)	Outputs push condition of ignition switch.
Ignition Switch (Push Switch)	Inputs position (OFF, ACC, ON, START) of ignition switch.
Ignition Switch	Turns smart key system ON/OFF.
Smart Key Cancel Switch	Displays warning for driver when operation signal from theft warning ECU is received.
Combination Meter (Push Switch)	Sounds warning buzzer for driver when operation signal from theft warning ECU is received.
Smart Indicator Lamp	Informs driver of condition of smart key system.
Each Door ECU	<ul style="list-style-type: none"> • Upon receiving signals from theft warning ECU, outputs door lock/unlock signals. • Transmits conditions of doors to theft warning ECU.
Luggage Room J/B ECU	<ul style="list-style-type: none"> • Upon receiving signals from theft warning ECU, outputs luggage compartment door open signal. • Based on condition of luggage compartment door courtesy switch, transmits luggage compartment door close signal to theft warning ECU.
Theft Warning ECU	<ul style="list-style-type: none"> • Identifies and checks ID codes from receivers, then transmits signals to each ECU (steering lock ECU, door ECUs, driver side J/B ECU, passenger side J/B ECU and luggage room J/B ECU) if ID codes match. • Upon receiving signals from switches and depending on certain conditions, it transmits intermittent transmission request signals to door oscillators. Transmission request signals to other oscillators.

3. System Function

(a) The smart key system has the following functions:

Function	Outline
Smart Unlock	When smart key is located in detection area of vehicle exterior, door unlocks by touching of outside door handle.
Smart Unlock Mode Switching	For doors that can be unlocked with smart unlock function. 3 modes are available and can be changed with this function. <ul style="list-style-type: none"> • Individual Door Mode • One Side Door Mode • All Door Mode
Smart Lock	When smart key is located in detection area of vehicle exterior and ignition switch is OFF, door will be locked by merely pressing lock switch on outside door handle.
Smart Ignition	When smart key is located in detection area of vehicle interior, this function cancels steering lock and engine immobilizer, and engine can be started by turning ignition switch.
Smart Trunk Open	When smart key is in detection area of vehicle exterior, trunk opens by merely pressing smart trunk open switch.
Smart key Confine Prevention Inside Luggage Compartment	If smart key is confined inside luggage compartment, warning will be issued and trunk can be opened with smart trunk open switch.
Smart Memory Call	This function operates memory system in accordance with key ID.
Smart Illumination	When shift lever is in P position and smart key enters detection area of vehicle exterior, front foot lights and front interior lights illuminate.
Smart Indicator	Smart indicator illuminates or flashes to indicate condition of smart key system. <ul style="list-style-type: none"> • ON: When ignition switch is pushed (ON) and vehicle interior check passes (in condition that enables smart ignition). • Flashing: When ignition switch is not pushed (OFF) and if any door is unlocked. • OFF: Situations other than those described above.
Battery Saving	If smart key is located within vehicle exterior door detection area for long period of time, system stops communication with smart key.
Warning	System sounds warning buzzer when smart key system operates without key operation and following occurs: <ul style="list-style-type: none"> • Driver is unaware that key has been taken out of vehicle by other passenger. • Driver exits vehicle with engine running. • Driver exits vehicle with shift lever in position other than P.
Smart Cancel	Pressing smart key cancel switch stops all smart key functions. However, smart key can still be used to start engine through insertion into key slot, and it also can operate wireless door lock remote control functions.

4. Warning Function

(a) General

The smart key system is equipped with a warning function to prevent problems resulting from errors in smart key usage. The smart key system works without any requirements from the driver other than having the key in one's possession. The driver, as a result, may become unaware of the presence or location of the key and make errors (listed below) that could lead to serious problems.

Examples:

1. The driver is unaware that the key has been taken out of the vehicle by other passengers.
2. The driver exits the vehicle with its engine running.
3. The driver exits the vehicle with its shift lever in a position other than "P".

If the above situations occur, the engine may be unable to be started once it has been turned off, the vehicle may be stolen, or other problems may follow. Warning function descriptions for several smart key usage errors are below.

- (1) Assumption: While the shift lever is in P and the ignition switch is not turned to LOCK, the driver or other passenger takes the smart key out of the vehicle.

Possible result without warning: Vehicle theft or inability to restart engine.

Detection Condition	If all conditions listed below are met and vehicle interior check fails, warning will be issued. • Shift lever is in P position. • Ignition switch is not on LOCK. • Any door is opened and closed.
Warning (Buzzer – in combination meter)	Sounds once upon detection. Sounds a second time if vehicle is started to be driven in this state.
Warning (Multi-information Display)	"Key is not Detected" appears on display and disappears when ignition switch is turned to LOCK or vehicle interior check passes.
Warning (Wireless Door Lock Buzzer)	Sounds 3 times upon detection and stops when ignition switch is turned to LOCK or vehicle interior check results are OK.

- (1) Assumption: Doors are locked without turning the ignition switch to LOCK.

Possible result without warning: Vehicle theft or inability to restart engine.

Detection Condition	If all conditions listed below are met and vehicle interior check fails and exterior check passes, warning will be issued. • Shift lever is in P position. • Ignition switch is not on LOCK. • All doors are closed. • Lock switch on door outside handle is ON.
Warning (Buzzer – in combination meter)	–
Warning (Multi-information Display)	–
Warning (Wireless Door Lock Buzzer)	Sounds for 2 seconds

- (1) Assumption: While the shift lever is not in P position and the ignition switch is not turned to LOCK, the driver is about to exit the vehicle.

Possible result without warning: Vehicle theft or inability to restart engine.

Detection Condition	If all conditions listed below are met and vehicle interior check fails, warning will be issued. • Ignition switch is on ACC or ON. • Shift lever is in P. • Driver's door is opened and closed.
Warning (Buzzer – in combination meter)	Sounds continuously and stops when shift lever is in P position or vehicle interior check results are OK.
Warning (Multi-information Display)	• "Shift to P Range" and "Key is not Detected" appear alternately. • "Shift to P Range" disappears when shift lever is moved to P position, • "Key is not Detected" disappears when ignition switch is turned to LOCK or vehicle interior check check passes.
Warning (Wireless Door Lock Buzzer)	Sounds continuously and stops when shift lever is in P position or vehicle interior check results are OK.

- (1) Assumption: While the shift lever is not in P position, other passenger takes the smart key out of the vehicle.

Possible result without warning: Inability to restart engine.

Detection Condition	If all conditions listed below are met and vehicle interior check fails, warning will be issued. • Shift lever is not on P position. • Ignition switch is not OFF • Any door other than driver's door is opened and closed.
Warning (Buzzer – in combination meter)	Sounds once upon detection. Sounds a second time if vehicle is driven in this state.
Warning (Multi-information Display)	"Key is not Detected" appears on display and disappears when ignition switch is turned to LOCK or vehicle interior check results are OK.
Warning (Wireless Door Lock Buzzer)	Sounds 3 times upon detection and stops when ignition switch is turned to LOCK or vehicle interior check passes.

- (1) Assumption*: A passenger takes the smart key out of the vehicle together with luggage.

HINT:

This assumption is not default setting.

Possible result without warning: Inability to restart engine.

Detection Conditions	If all conditions listed below are met and vehicle interior check fails, warning is will be issued. • Ignition switch is on LOCK. • Any doors is opend and closed.
Warning (Buzzer – in combination meter)	Sounds once upon detection. Sounds a second time if vehicle is started to be driven in this state.
Warning (Multi-information Display)	"Key is not Detected" appears on display and disappears when ignition switch is turned to LOCK or vehicle interior check passes.
Warning (Wireless Door Lock Buzzer)	–

- (1) Assumption: An attempt is made to lock the doors while the smart key is inside the vehicle.

Possible result without warning: Vehicle theft

Detection Condition	If all conditions listed below are met and vehicle interior check fails, warning will be issued. • Ignition switch is on LOCK. • Any door is closed. • Lock switch on door outside handle is pressed ON.
Warning (Buzzer – in combination meter)	–
Warning (Multi-information Display)	–
Warning (Wireless Door Lock Buzzer)	Sounds for 2 seconds

- (1) Assumption: An attempt is made to lock a door that is ajar.

Possible result without warning: Vehicle theft or battery depleted

Detection Condition	If all conditions listed below are met and vehicle interior check fails, warning is issued. • Ignition switch is on LOCK. • Any door is closed. • Lock switch on door outside handle is turned pressed ON.
Warning (Buzzer – in combination meter)	–
Warning (Multi-information Display)	–
Warning (Wireless Door Lock Buzzer)	Sounds for 10 seconds and stops when one of conditions listed below occurs. • Wireless door lock remote control unlock signal is input. • Ignition switch is pushed. • All doors are closed.

(1) Assumption: The voltage of the smart key has dropped.

Possible result without warning: Smart control is suddenly disabled.

Detection Condition	When condition given below is met, vehicle interior check is performed and code indicating voltage drop of smart key battery is received, warning is issued. • When ignition switch has been ON for approximately 20 minutes or more, and then turned OFF.
Warning (Buzzer – in combination meter)	Sounds once upon detection.
Warning (Multi-information Display)	"Low Key Battery" appears for approximately 5 seconds.
Warning (Wireless Door Lock Buzzer)	–

(1) Assumption: The smart key is placed outside the smart key detection area (in the glove box or on the floor mat).

Possible result without warning: Driver confusion.

Detection Condition	If condition given below is met and vehicle interior check fails, warning is issued. • Ignition switch is pushed.
Warning (Buzzer – in combination meter)	Sounds once upon detection.
Warning (Multi-information Display)	"Key is not Detected" appears for approximately 5 seconds.
Warning (Wireless Door Lock Buzzer)	–