

GENERAL INFORMATION

1. SPECIFICATION

Operating voltage	9 to 16 V
Voltage for system diagnosis and SDM self diagnosis	9 to 16 V
Ignition voltage for side air bag and pretensioner	9 to 16 V
Communication voltage for front impact sensor	9 to 16 V
Communication voltage for side impact sensor	9 to 16 V
Operating temperature	-40°C to 85°C
Storage temperature	-40°C to 90°C
Ignition temperature	-30°C to 85°C
Over voltage protection	24 V

2. MAJOR REPLACEMENT PARTS AFTER AIR BAG DEPLOYMENT

1) In Case of Front Air Bag Deployment

Air bag unit and its wiring (including connector), seat belt pretensioner and its wiring (including connector), whole front air bags, instrument panel, front impact sensor and other damaged components

2) In Case of Curtain Air Bag Deployment

Deployed curtain air bag, air bag unit and its wiring (including connector), impact G sensor assembly for curtain air bag, damaged trim, seat and roof headlining

Modification basis	
Application basis	
Affected VIN	

3. OPERATION

1) Front Air Bag System



► **The air bag deploys when:**

- A front collision occurs, which occupants cannot be protected by seat belt.

► **The air bag can deploy when:**

- Underbody impact from the road surface, impact against the curb at a very high speed, or dropping impact onto the road surface with a large angle occurs.

► **The air bag does not deploy when:**

- The vehicle rolls over or tips over sideward, or a side/rear collision occurs.
A minor collision occurs, which occupants can be protected by seat belts.

► **The air bag seldom deploys when:**

- A collision to diagonal direction (not a front collision) occurs or the vehicle tips over.
- A weak collision, which the sensor cannot detect, occurs (under the activation requirements).
- A collision against narrow objects such as a telegraph pole or a tree occurs.
- The vehicle falls into a drainage or a puddle.
- The front of the vehicle crashes into high impact point vehicle such as a truck.
- The hood is hit by falling stones.
- The air bag warning lamp is on.
- When a oblique collision occurs, only the side air bags will be deployed, and driver/passenger's air bags will not be deployed.

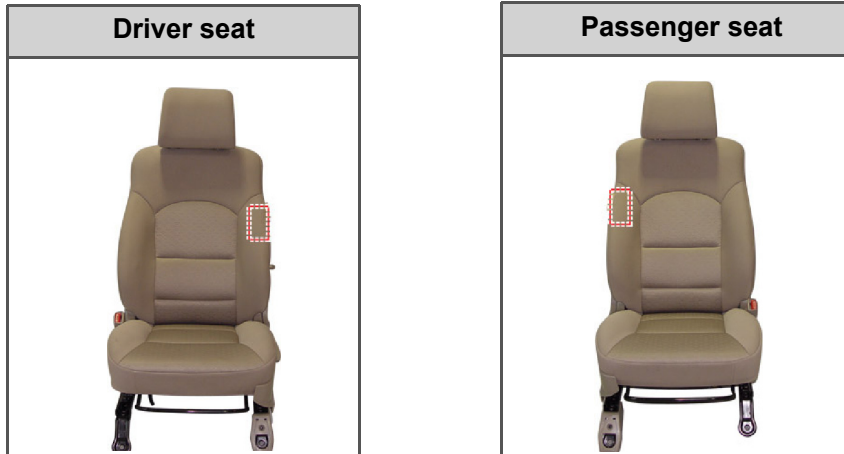
2) Side Air Bag System

► Curtain air bag



The curtain air bags, which are part of the side air bag system, are installed in both roof side rails.

► Side air bag



The side air bags are installed in the outer sides of the driver's and passenger's seats to minimize occupants' side injuries in case of a side impact.



CAUTION

Side airbags and curtain air bags operate independently from the front airbag system.

Modification basis	
Application basis	
Affected VIN	

► The air bag deploys when:

- A severe oblique collision occurs corresponding to vehicle specifications for degree, angle, speed, and position of the impact.

► The air bag can deploy when:

- The vehicle rolls over or tips over sideward by severe impact.
- The vehicle is stationary or a front collision occurs with low speed.
- A rear collision occurs.
- A minor collision occurs, which occupants can be protected by seat belts.

► The air bag does not inflate when:

- The vehicle is stationary or a front collision occurs with low speed.
- A rear collision occurs.
- A minor collision occurs, which occupants can be protected with seat belts.

► The air bag seldom inflates when:

- A collision with oblique impact to the front seat direction or a front collision to the diagonal direction occurs.
- A front/rear collision occurs.
- The vehicle rolls over or tips over sideward with minor impact.
- The air bag warning lamp is on.

3) General Warnings For Air Bag

- Do not diagnose the circuit with a circuit tester or attempt to modify any air bag components including the steering wheel, air bag mounting area and harness.
- Incorrect inspection could cause a problem with an air bag and seat belt pretensioner, and they cannot protect occupants properly. Inspection and repair service should be done only by a qualified technician.
- An infant or a child should not be seated on the front seat alone or on an adult's lap. An infant or a child could be severely injured by air bag deployed.
- A child restraint system should be placed on the rear seat which has the 3-point type seat belt.
- Never install a child restraint system on the front seat. Impact by the air bag inflation might cause severe injury or even death.
- When an occupant fastens the seat belt with unstable or inclined posture, the air bag cannot protect the occupant properly. Moreover, the occupant may be injured by the air bag.
- Do not incline toward the steering wheel while driving. If you hit the air bag before it is fully inflated, brain or neck injury, or even death can occur.
- Be careful not to strike the steering wheel, air bag mounting area, any air bag related component (including wiring) and seat belt pretensioner. You might get severely injured by sudden deployment of the air bag.

Modification basis	
Application basis	
Affected VIN	

- The air bag contains explosive materials, so handle it carefully when disposing or replacing it.
- The air bag components will be very hot immediately after deployment. Do not touch them until they cool down.
- Once the air bag system is triggered, the triggered air bag assembly should be removed from the vehicle and replaced with a new one. Once triggered air bag/seat belt pretensioner related components cannot be reused, so they should be removed from the vehicle and the whole system should be replaced with a new one.
- Do not place any object or sticker on the air bag mounting area for correct and safe activation of the air bag.
- Never incline toward the door or put your hands out of the window since it is very dangerous when the side air bag inflates.
- Do not bang the door. Otherwise, an air bag might operate erroneously.
- Hold the outer rim of the steering so that the air bag can inflate without any hindrance.
- Do not incline toward the steering wheel or hold the steering wheel with your hands crossed. It will cause a problem with the air bag activation or severe injury when the air bag inflates.
- Never put your hands or feet on the dash board. You can severely injured when the air bag inflates.
- It is normal that a loud noise, dust and smoke occur when the air bag and seat belt pretensioner operate.
- The gas come out of air bag/seat belt pretensioner activation is non-toxic nitrogen gas.
- However, if this gas occurs irritation to your skin, eyes, nose, and so on, wash it out with clean water. Seek medical help if symptoms develop.
- The windshield or windows can be broken due to impact from front or side air bag inflation.
- When any repairs are needed to the air bag mounting area or its surrounding area, or when an accident has occurred without the air bag deployment, have the air bag system/seat belt pretensioner checked for safety.
- The air bag is a unit to save an occupant's life from sudden accident and it inflates at a very fast speed by gas with high temperature, which might cause injury, such as an abrasion, bruise and burn depending on the accident conditions.
- Normal inflation of the air bag could make a loud noise and smoke (non-toxic gas).
- A minor collision, which occupants can be protected only by seat belts, will not activate the air bag system. It is because that air bag inflation at a minor collision could cause more injury such as an abrasion, bruise and burn.
- Check the air bag system even though there is no fault in the air bag system when 10 years have passed after air bag installation.

Modification basis	
Application basis	
Affected VIN	

4. CAUTIONS FOR AIR BAG OPERATION

When turning on the ignition switch, the air bag warning lamp comes on for about 6 seconds and goes off.

It should be determined as a faulty air bag system if the air bag warning lamp does not come on or go off while the vehicle is operating normally.



CAUTION

1. When there is any deployed air bag (including curtain air bag and seat belt pretensioner), the air bag unit should be replaced. Any DTC (Diagnostic Trouble Code) for the air bag unit should not be cleared since the unit has data for the status when the air bag was deployed.
2. Note that the used components related to the air bag, especially the air bag unit, should be packaged in an air tight container to prevent any damage.
3. Please do not connect a tester to any air bag connector or single item to measure the supplied power or resistance. The detonator may explode due to a sudden extra power supplied by the tester.
4. Disconnect the negative battery cable before installing or removing the part related to the air bag.

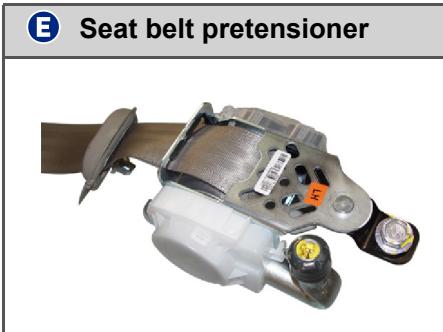
Modification basis	
Application basis	
Affected VIN	

Memo

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OVERVIEW AND OPERATING PROCESS

1. SYSTEM CONFIGURATION



AIR BAG SYSTEM

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Modification basis	
Application basis	
Affected VIN	

F Height adjuster



G Front impact sensor assembly



**Air bag warning lamp
(instrument cluster)**



I Inflatable curtain air bag module



J Side air bag sensor assembly



Modification basis	
Application basis	
Affected VIN	

2. OPERATING CONDITIONS

When the ignition switch is turned to ON, SDM starts to diagnoses the air bag system during the ignition process. If the system is OK, SDM is armed for a specific impact on the vehicle.

1) Deploying Conditions for Front Air Bag

Impact area	Front side
Driver's air bag	Deploy
Passenger's air bag	Deploy
Seat belt pretensioner-driver side	Deploy
Seat belt pretensioner-passenger side	Deploy

2) Deploying Conditions for Side Air Bag

Impact area	Left side	Right side
Seat belt pretensioner-driver side	Deploy	Deploy
Seat belt pretensioner-passenger side	Deploy	Deploy
Side air bag module-driver side	Deploy	Not deploy
Side air bag module-passenger side	Not deploy	Deploy
Inflatable curtain air bag module-driver side	Deploy	Not deploy
Inflatable curtain air bag module-passenger side	Not deploy	Deploy

3. OPERATION

1) Deployment (Firing Loop)

According to the collision deceleration rate that each collision G sensor reads, the air bag unit sends out about 2 to 4 or higher Amp current. This current generates some heat, which fires the detonator in the inflator. This table shows the basic inner resistance of the air bag related module and the basic instant current necessary for a firing.

Airbag module	Driver/ passenger air bag	Side air bag	Curtain air bag	Seat belt pretensioner
Resistance at -30 to +85°C	$2.0 \pm 0.3 \Omega$	$2.0 \pm 0.3 \Omega$	$2.0 \pm 0.3 \Omega$	$2.15 \pm 0.35 \Omega$
Non-firing current at +85°C	0.4 A for 10 sec.	0.4 A for 10 sec.	0.4 A for 10 sec.	0.2 A for 10 sec.
All-firing current at - 35°C	1.2 A for 2 ms	1.2 A for 2 ms	1.2 A for 2 ms	0.8 A for 2 ms
Periodic test current	50 mA constantly	50 mA constantly	50 mA constantly	50 mA constantly
Insulating resistance	1 MΩ at DC 500 V for 2 sec.	1 MΩ at DC 500 V for 2 sec.	1 MΩ at DC 500 V for 2 sec.	100 KΩ at DC 500 V

CAUTION

- Please do not connect a tester to any air bag connector or single item to measure the supplied power or resistance. The detonator may explode due to a sudden extra power supplied by the tester.
- Before removing or installing any air bag related components, disconnect the negative battery cable.

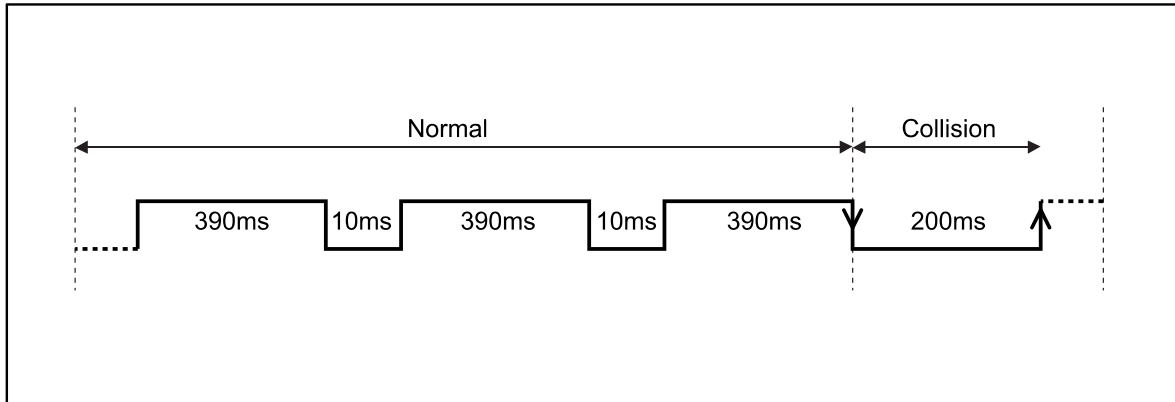
► Resistance of air bag wiring harness

Items	Driver side (or LH)	Passenger side (or RH)
Front air bag	0.0366 Ω	0.0530 Ω
Belt pretensioner	0.1477 Ω	0.1563 Ω
Side air bag	0.1074 Ω	0.1149 Ω
Curtain air bag	0.2210 Ω	0.2327 Ω

Modification basis	
Application basis	
Affected VIN	

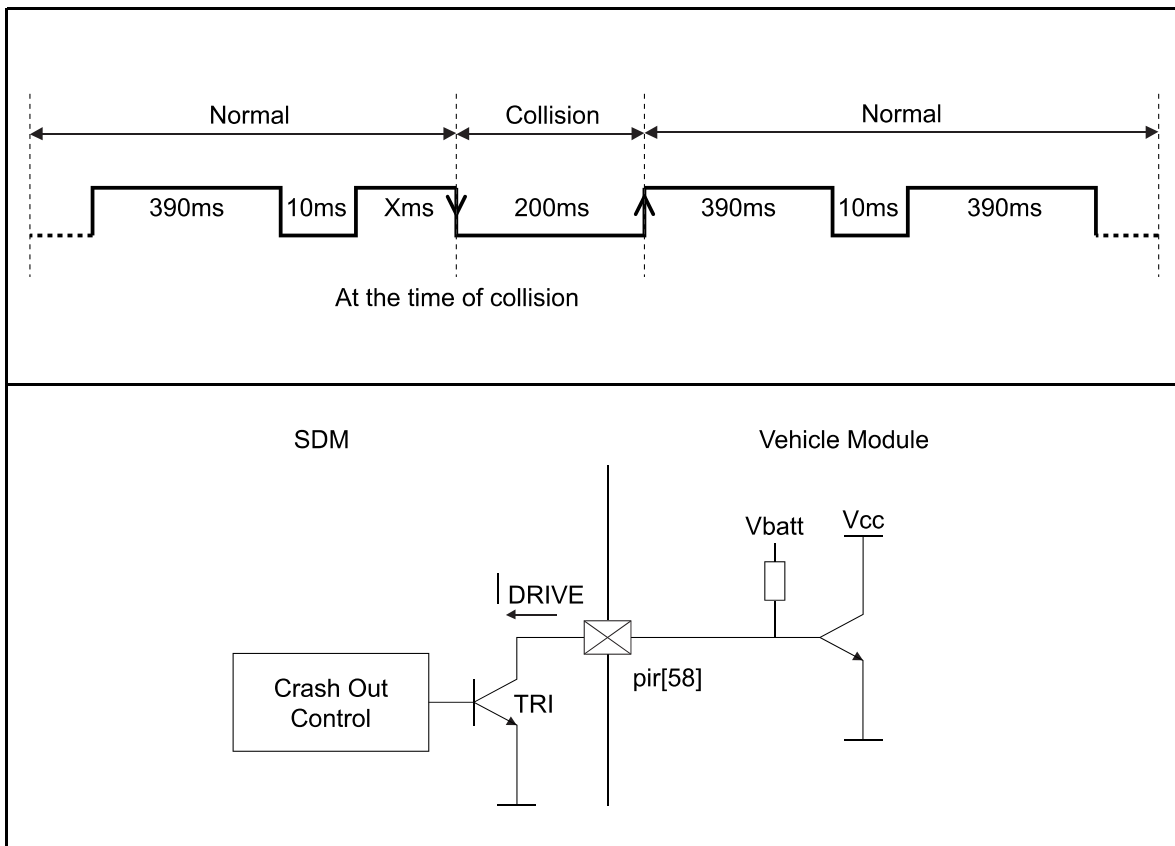
2) Air Bag Deployment Signal Output (Crash Out)

When any air bag deploys, crash out is performed. If other deployment is occurred while a deployment signal is output, another crash out is delayed until the current 200 ms crash out is completed. (The tolerance at the time of signaling is $\pm 5\%$)



The signal repeats increasing for 390 ms and decreasing for 10 ms before crash. At the time of crash, the switch is closed and the signal is kept low condition for 200 ms.

At the time of crash, the crash out signal is changed to the low condition for 200 ms immediately to indicate the crash moment.



► Collision signal interface

The open collector driver raises or lowers the voltage of the pin No. 58 by switching on and off the drive transistor. The vehicle module can be operated normally only when the rule of the open collector interface is followed and can be maintained in a pull -up state. The followings are the specifications of the electrical interface.

Items	Minimum	Average	Maximum	Remark
Driving current (current value when the transistor is turned on)	12.31 mA	19.6 mA	30 mA	Depending on the battery voltage
Leakage current (current value when the transistor is turned off)	147.6 μ A		376 μ A	No crash signal
Load resistance	590 ohms			Above than this value



NOTE

The load resistance of the SDM should be 590 ohms or higher. It may not be possible to operate the collision occurrence circuit normally if the resistance value does not reach this specified value.

Modification basis	
Application basis	
Affected VIN	

3) CAN Communication Interface (FIS and SIS)

The CAN communication interface uses PWM for the supply current and the current loop and communicates with the SDM to transmit information. The serial communication and power for the satellite are supplied through the communication line.

Stage	FIS	SIS
Initial stage	Tracking/Check (Self test)	Same as FIS
Normal operation	Checks the FIS condition and sends the result as "OK" or "NOK", and also sends the "severe level" of the crash.	Same as FIS
Voltage	The FIS hardware reset performed under 5 V, communication voltage low	Same as FIS
Fault	The fault is found in the current ignition cycle but the fault is deactivated in the next ignition cycle.	Multiple faults can be found and deactivated in the same ignition cycle.

The FIS moves to the initial stage if 'leakage to GND' is occurred in normal operating stage to shut down the power and prevent abnormal operation.

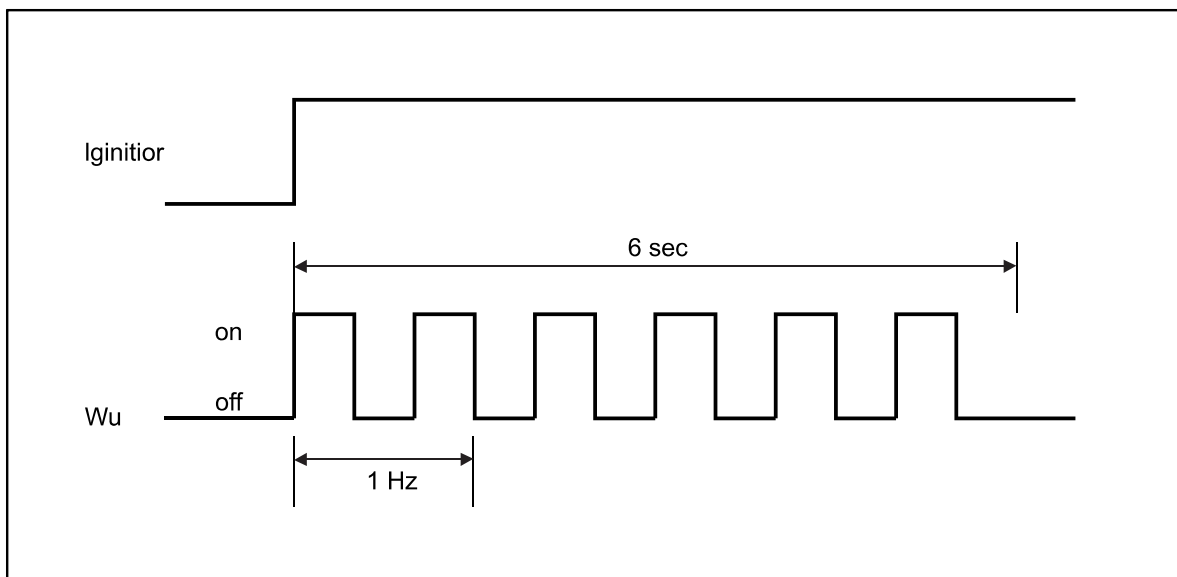
※ FIS: Front Impact Sensor

SIS: Side Air bag Sensor

4. AIR BAG WARNING LAMP OPERATIONAL CONDITION

► When there are no active and past faults

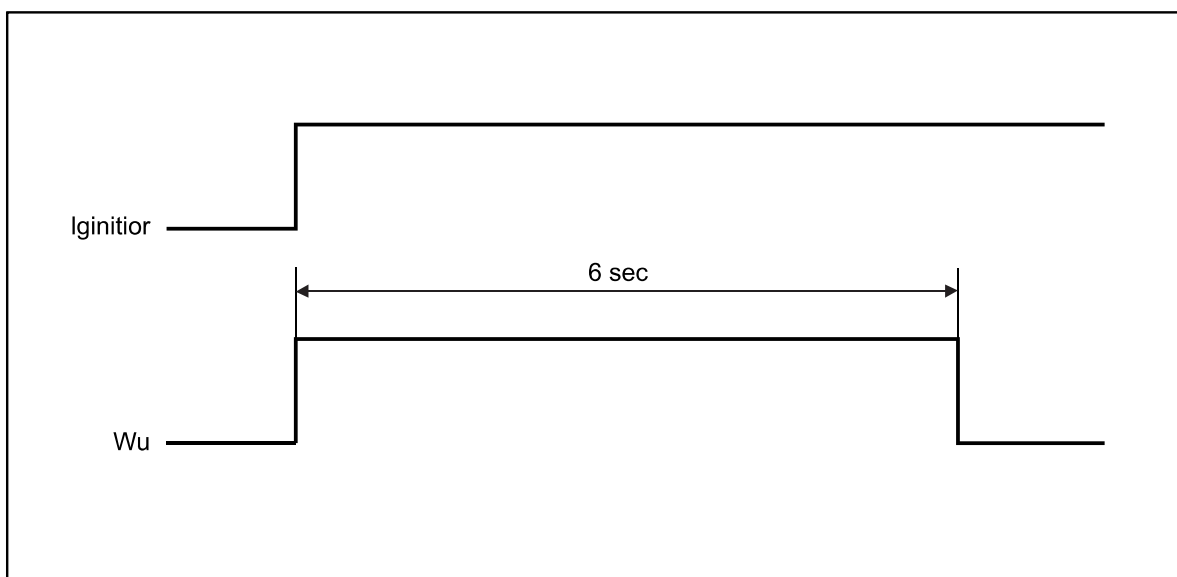
The air bag warning lamp is operated as shown below if there is no fault occurred in the previous ignition cycle and the SDM is running without any active fault right after starting in the ignition cycle.



► When there is no active fault and past faults occurred within 10 times

The warning lamp is operated as shown below every time the vehicle is started if the SDM is running without any active fault in the entire time and past faults in the previous ignition cycle occurred within 10 times.

"Battery voltage too low" is not counted as a past fault.

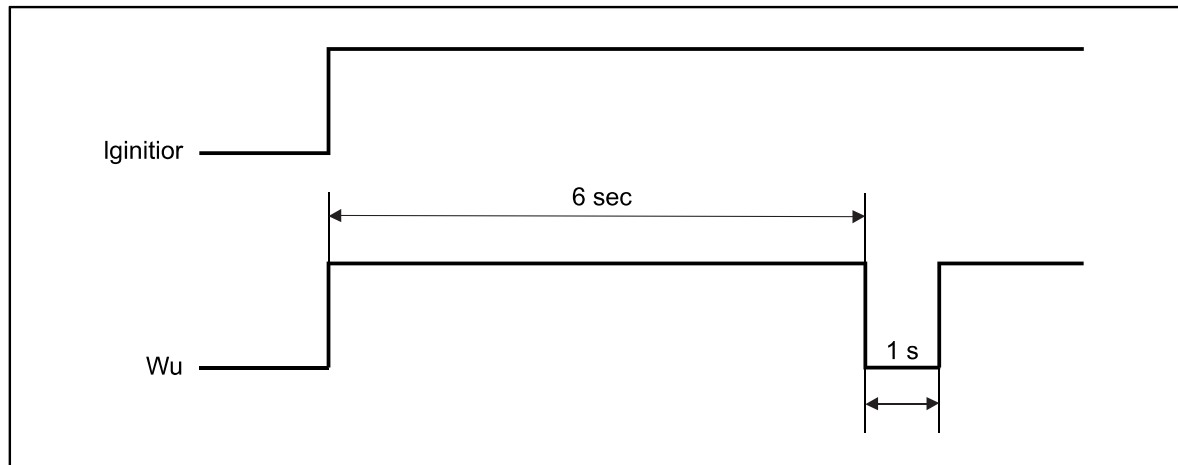


Modification basis	
Application basis	
Affected VIN	

► When there is an active fault or past faults occurred 10 times or more

If active fault or past faults which occurred 10 times or more in the last ignition cycle, the SDM operates the warning lamp as shown below. If below conditions are met, the SDM is operated in the same way.

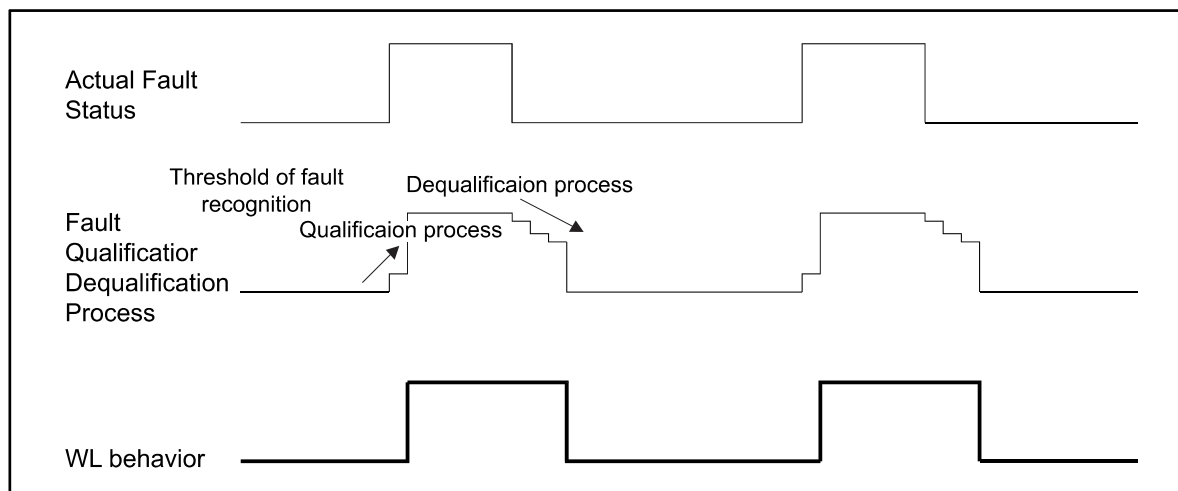
- Active fault
- When the past faults occurred 10 times or more (except 'battery voltage too low')
- Internal fault
- Impact record
- Pretensioner fired only



If the connector is not connected properly or SDM battery voltage is out of the specified range internally (battery voltage for warning lamp), the warning lamp is kept ON.

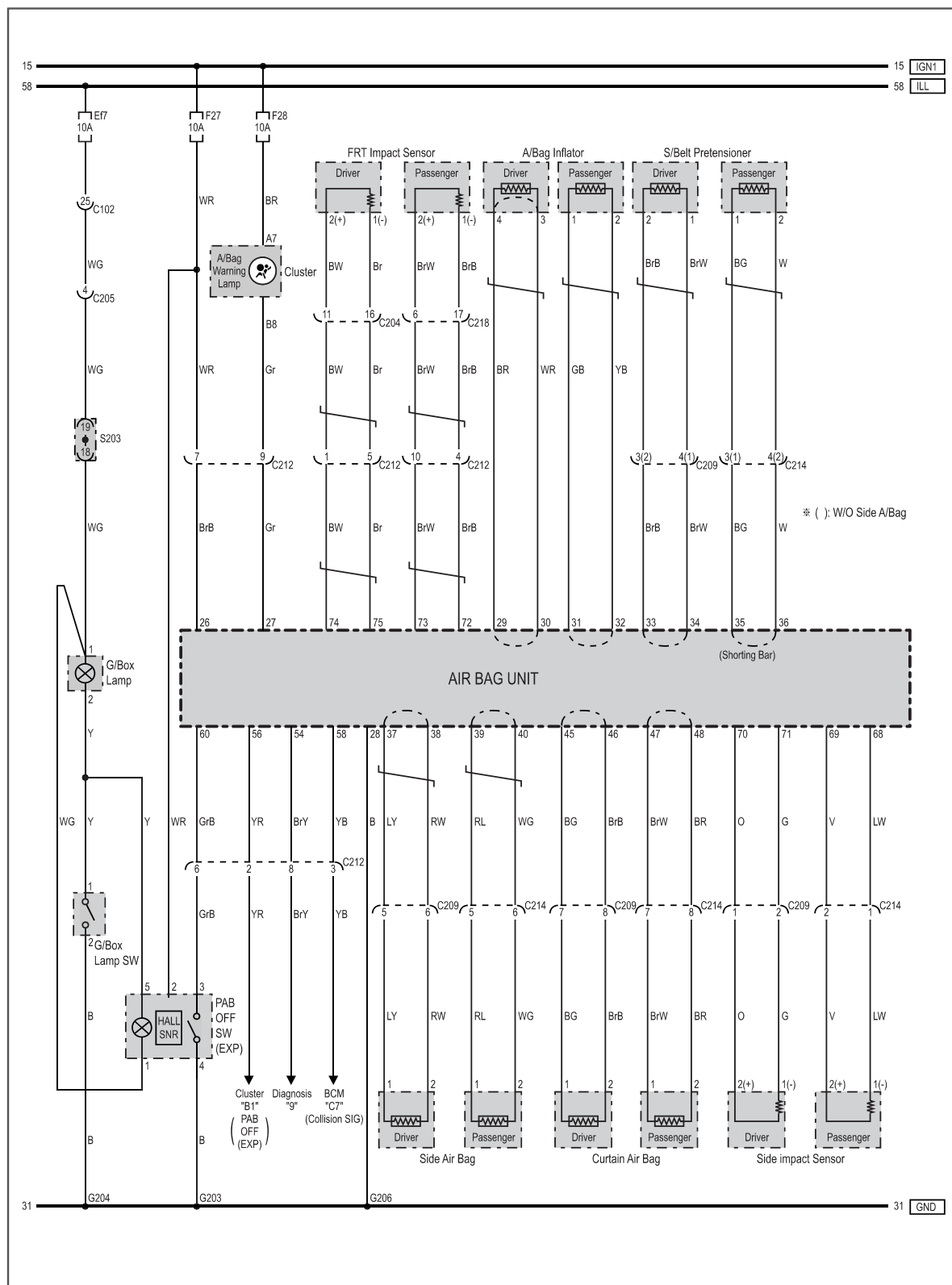
► Warning lamp condition change during operation

The warning lamp comes on or off according to the actual fault condition during SDM operation. If there is any active fault or active fault becomes past fault, the warning lamp is illuminated, and if the fault is deactivated, the warning lamp is turned off.



Modification basis	
Application basis	
Affected VIN	

4. CIRCUIT DIAGRAM



Modification basis	
Application basis	
Affected VIN	

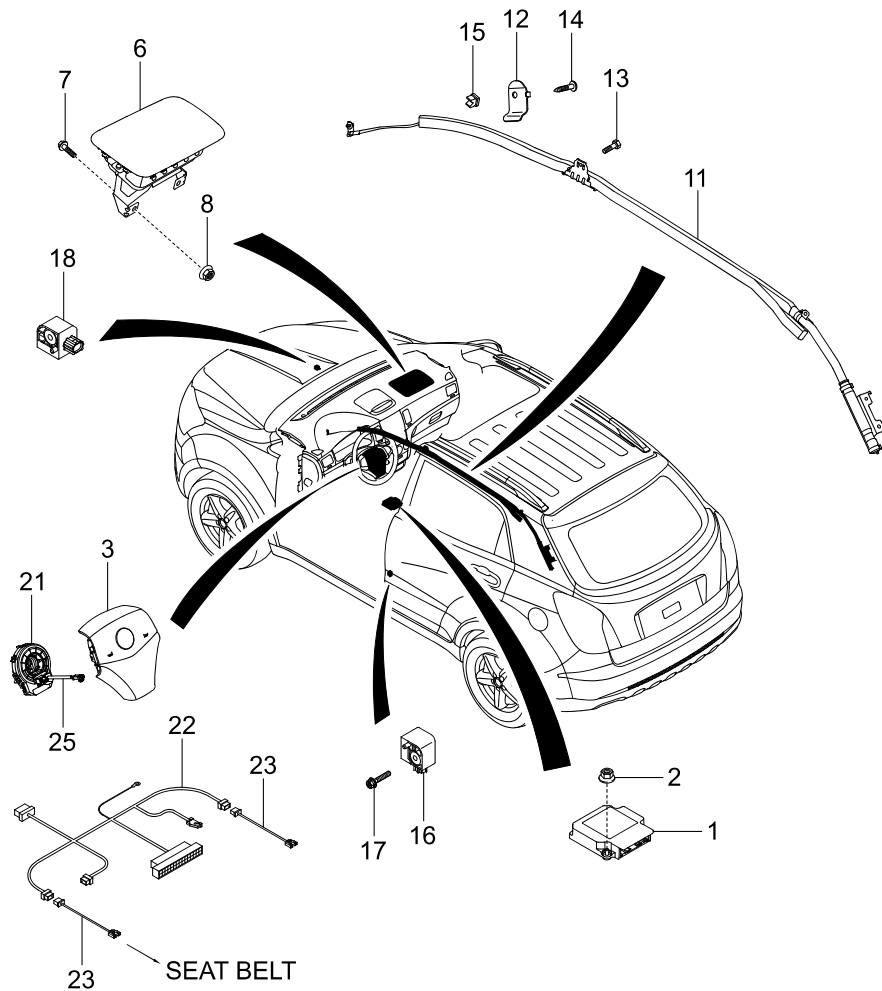
AIR BAG SYSTEM

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COMPONENT

S.G.N

8810-00 AIR BAG SYSTEM



- 1. Unit assy - SDM
- 2. Nut
- 3. Air bag module - Driver
- 6. Air bag module - Passenger
- 7. Screw
- 8. Nut
- 11. Air bag module - INF curtain
- 12. Brkt - Icab FRT

- 13. Bolt
- 14. T/screw - Truss_M4x0x12
- 15. Grommet screw_M4
- 16. Sensor assy - Side air bag
- 17. Screw
- 18. Sensor assy - FRT impact
- 22. Wiring assy - Air bag
- 23. Wiring assy - Air bag EXTN

AIR BAG SYSTEM

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Modification basis	
Application basis	
Affected VIN	

S.G.N.

8810-03 DRIVER AIR BAG MODULE

The driver's air bag is installed inside the steering wheel. If the acceleration sensor (inside the air bag unit) is activated by the deceleration from vehicle collision, the detonation is fired by the electrical signal of the air bag unit. Then, the detonation sets off explosives and nitrogen gas is generated. At this point, the air bag very quickly deploys and the gas is emitted from the relieving hole to absorb impact upon the driver.

1) Location



Front side of DAB module

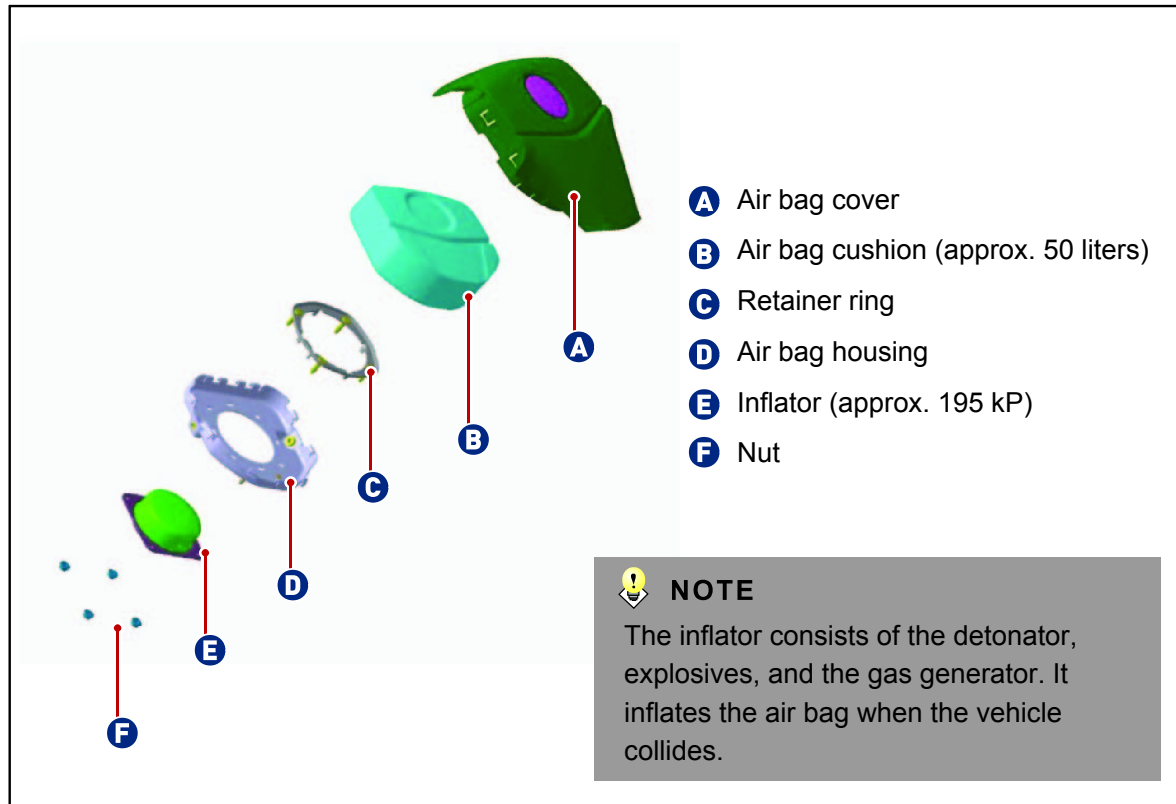


Rear side of DAB module

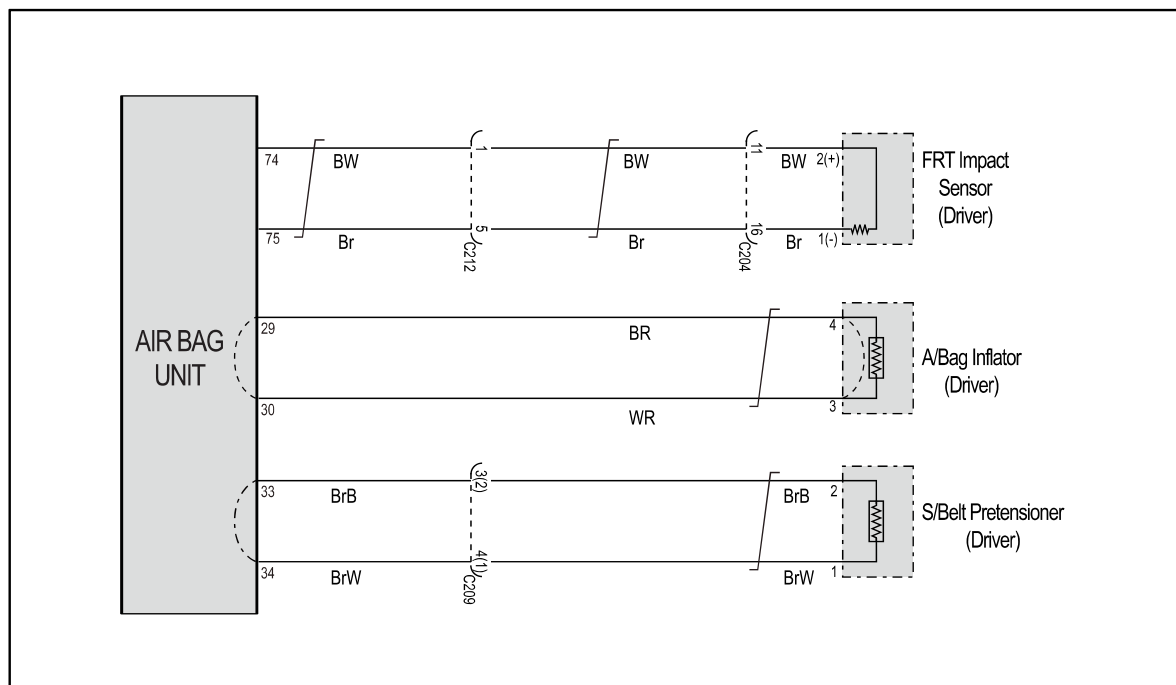


Modification basis	
Application basis	
Affected VIN	

2) Components



3) Inflator Circuit



AIR BAG SYSTEM

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Modification basis	
Application basis	
Affected VIN	

S.G.N.

8810-06 PASSENGER AIR BAG MODULE

The passenger's air bag is installed inside the instrument panel above the glove box. Its operation process is the same as the driver's one. The driver's air bag, the passenger's air bag, and the seat belt pretensioners on both seats are made to operate together. When the collision G sensor inside the air bag unit sends a collision signal, the air bag unit instantaneously applies a high current to the driver's and passenger's air bags and the seat belt pretensioners on both seats, fires the detonator in the inflator, and inflates the air bag cushions (curtain air bags independently operate in case of the side collisions).

1) Location



Front side of PAB module

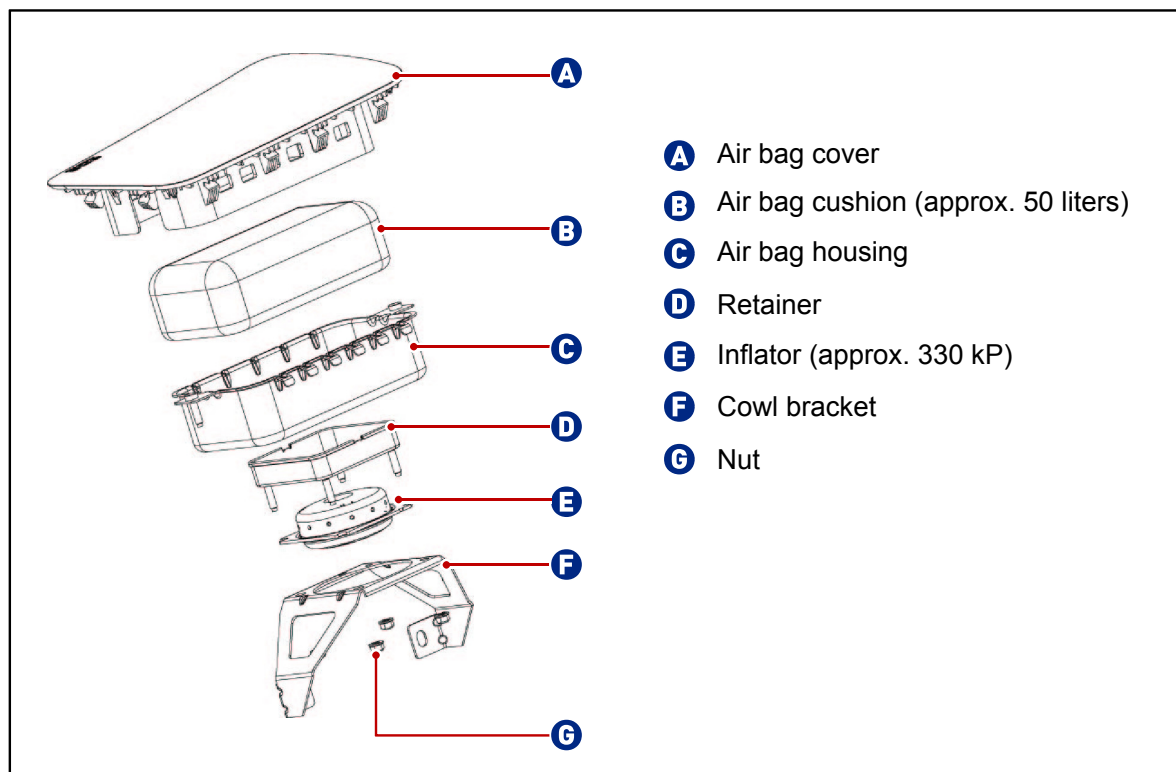


Rear side of PAB module

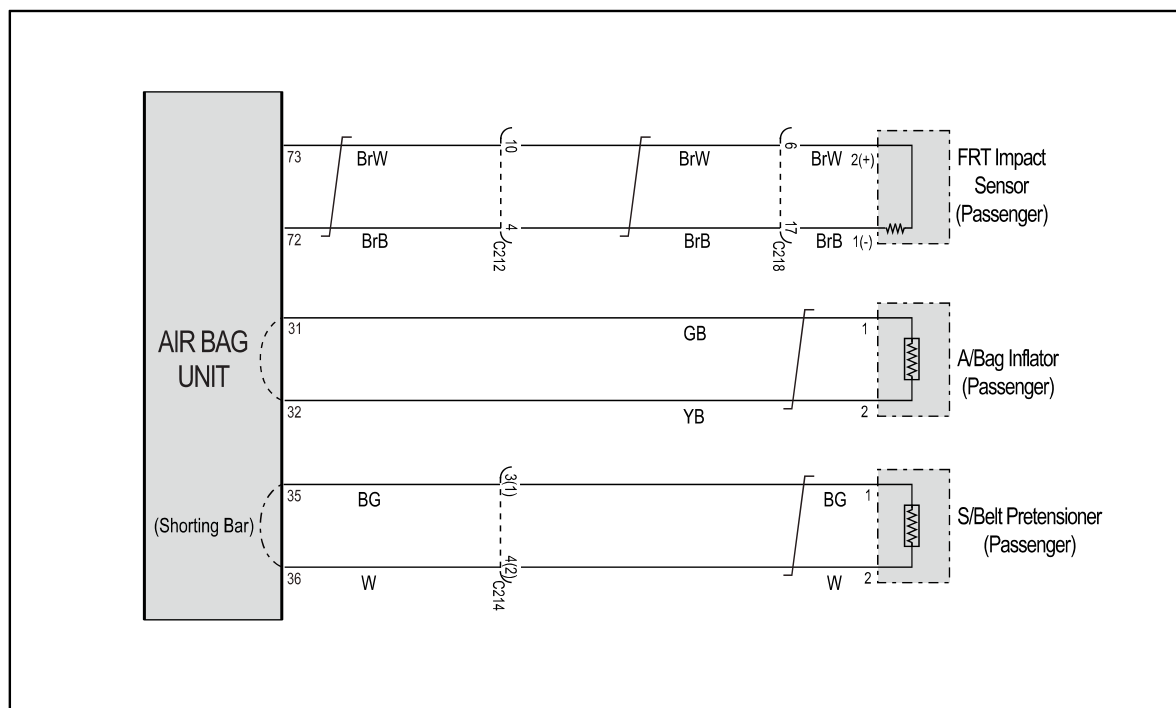


Modification basis	
Application basis	
Affected VIN	

2) Components



3) Inflator Circuit



AIR BAG SYSTEM

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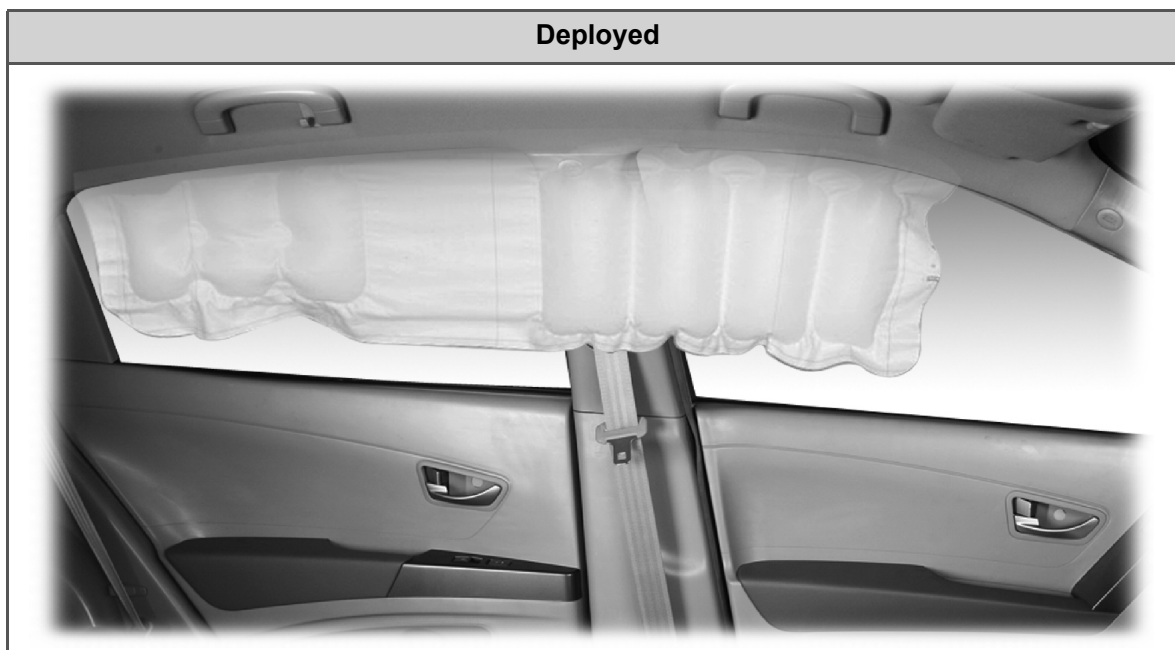
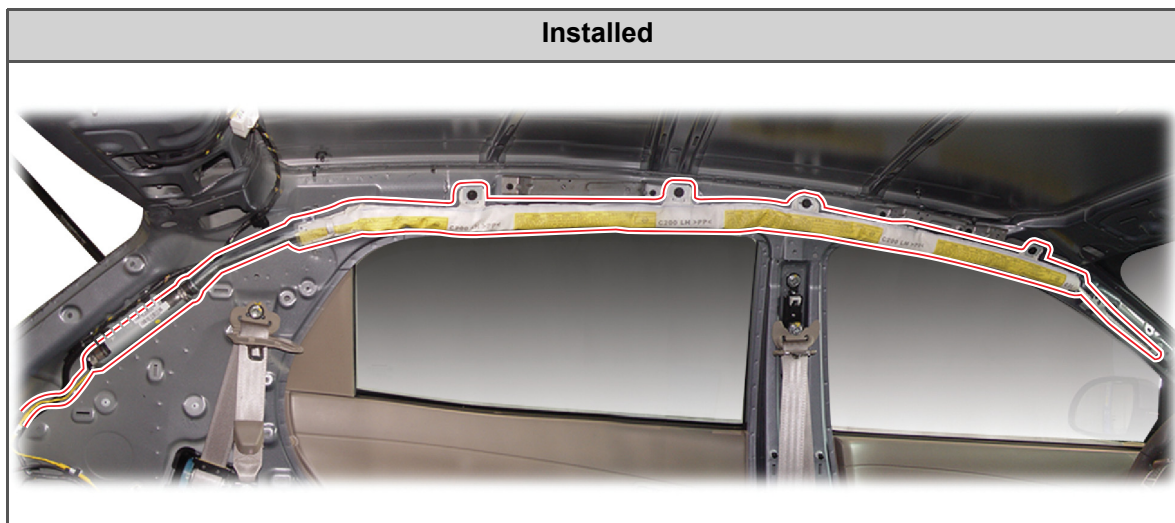
Modification basis	
Application basis	
Affected VIN	

S.G.N.

8810-11 INFLATABLE CURTAIN AIR BAG MODULE

The curtain air bags are installed on both sides of the roof side rails and inside the headlinings. Each curtain air bag is also composed of the air bag cushion and the inflator that has the detonator, explosives, and the gas generator.

1) Location



Modification basis	
Application basis	
Affected VIN	

AIR BAG SYSTEM

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AIR
CONDITIO

AIR BAG
SYSTEM

SEAT

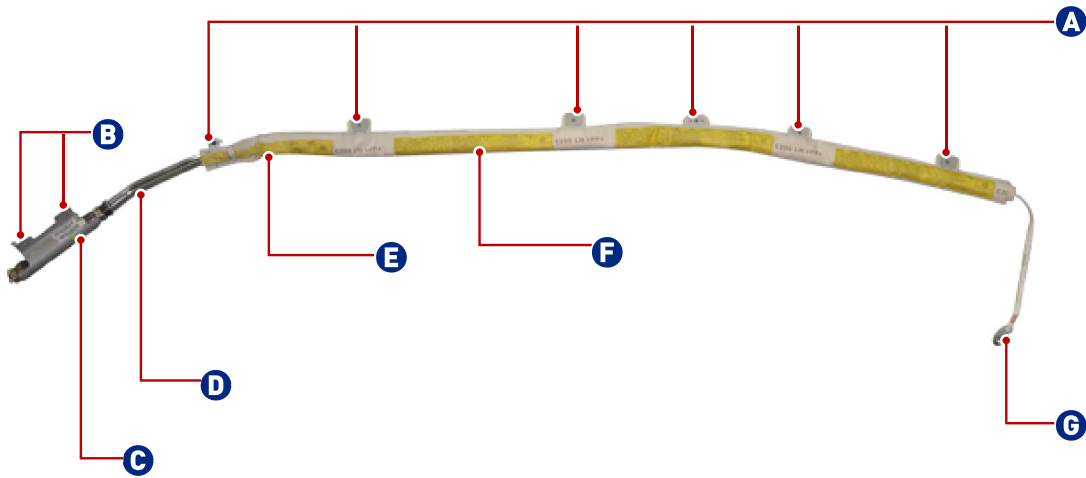
SUNROO
F

BODY
INTERIOR

BODY
EXTERIO

BODY
REPAIR

2) Components



A Curtain air bag mountings (6 points)

E Air bag cushion

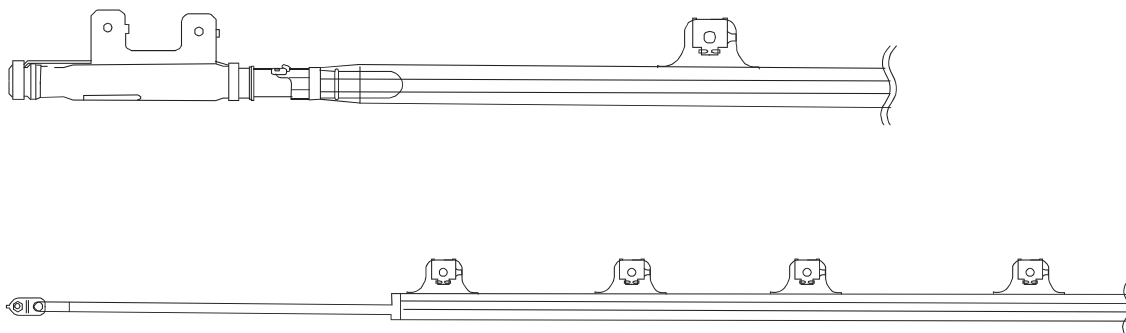
B Inflator mountings

F Cover - curtain air bag

C Inflator

G Bolt

D Gas guide



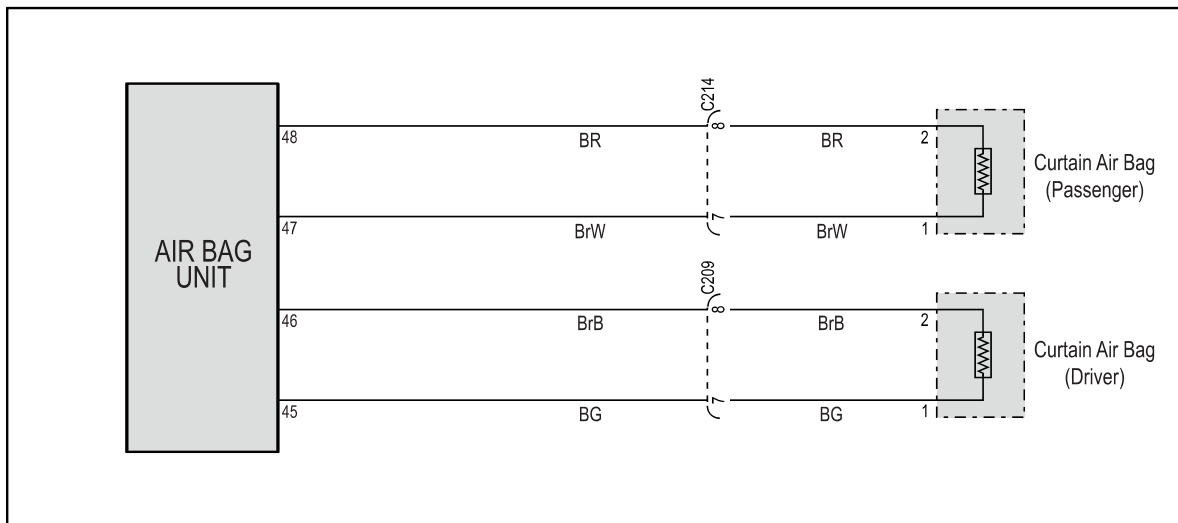
Tightening torque 8 to 10 Nm

AIR BAG SYSTEM

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Modification basis	
Application basis	
Affected VIN	

3) Inflator Circuit



AIR
CONDITIO

AIR BAG
SYSTEM

SEAT

SUNROO
F

BODY
INTERIOR

BODY
EXTERIO

BODY
REPAIR

Modification basis	
Application basis	
Affected VIN	

AIR BAG SYSTEM

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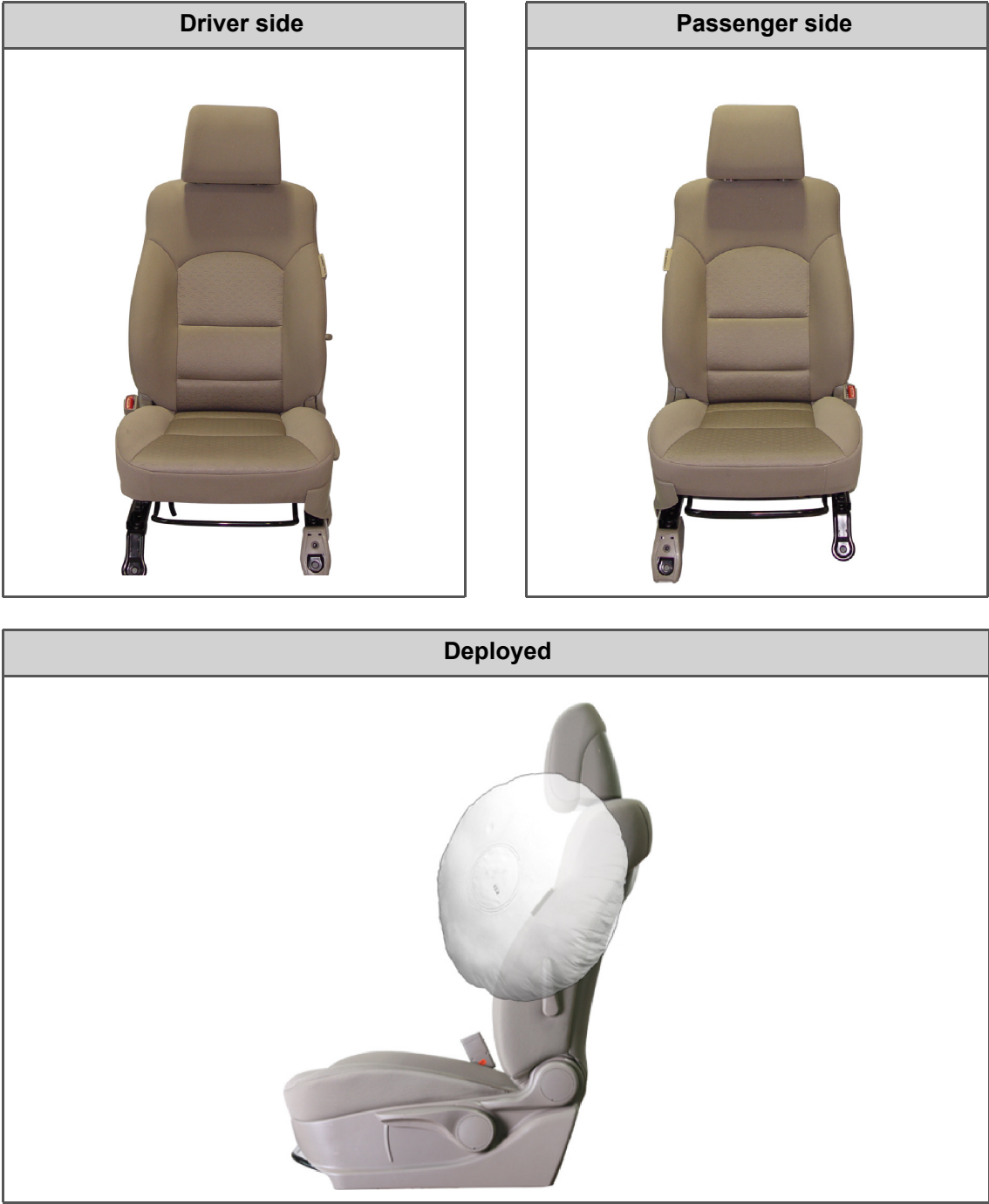
SGN

8810-16

SAB (SIDE AIR BAG)

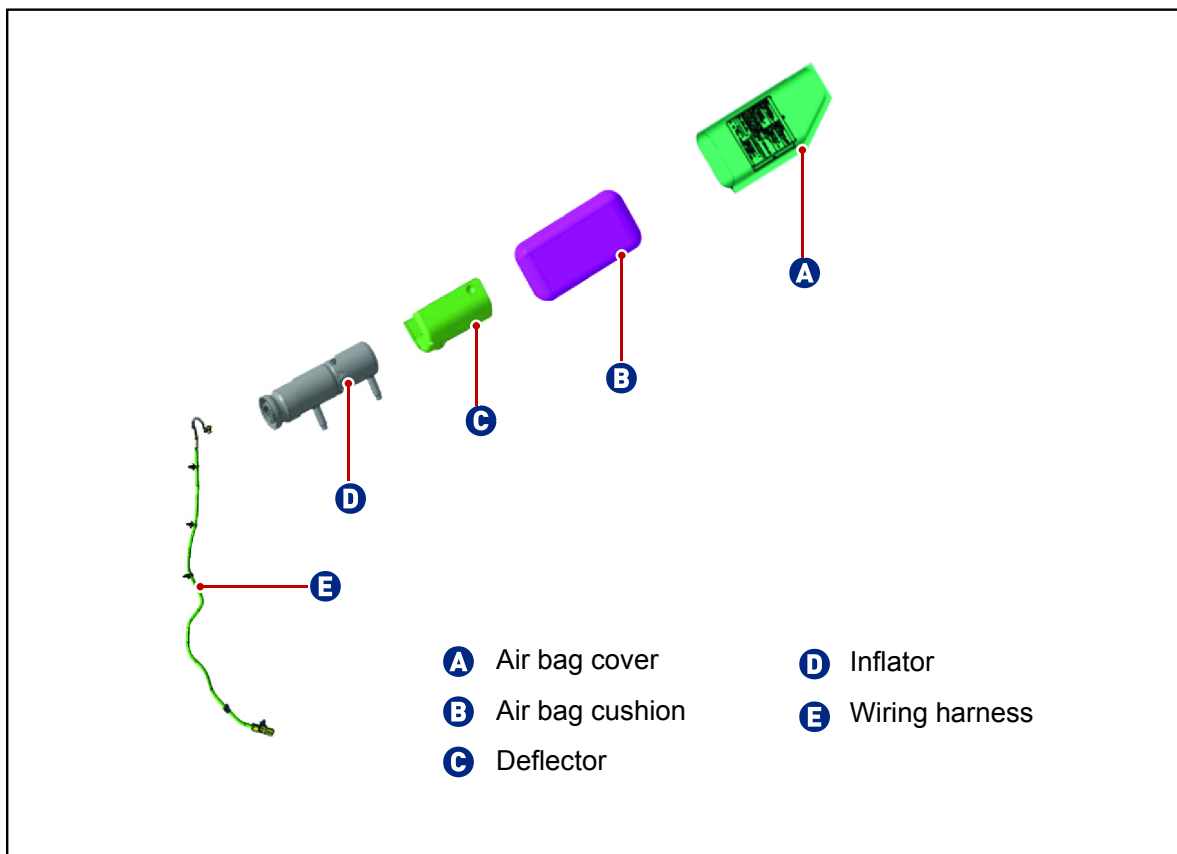
The side air bags are installed in the outer sides of the driver, passenger and rear seats to minimize the side impact applied to the occupant. The Side air bags and curtain air bags are operated independently from the front air bag system.

1) Mounting Location

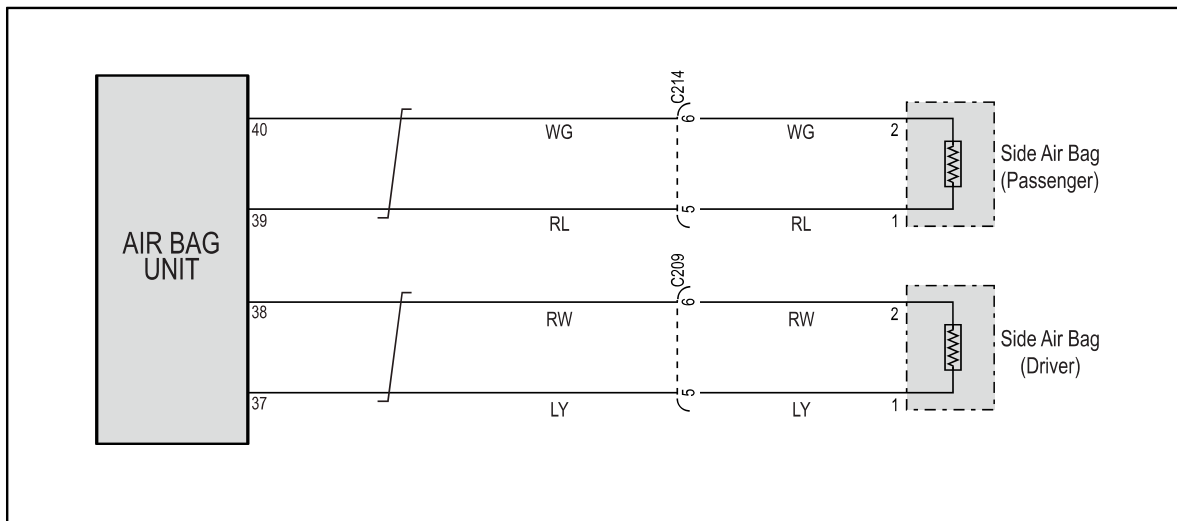


Modification basis	
Application basis	
Affected VIN	

2) Components



3) Inflator Circuit

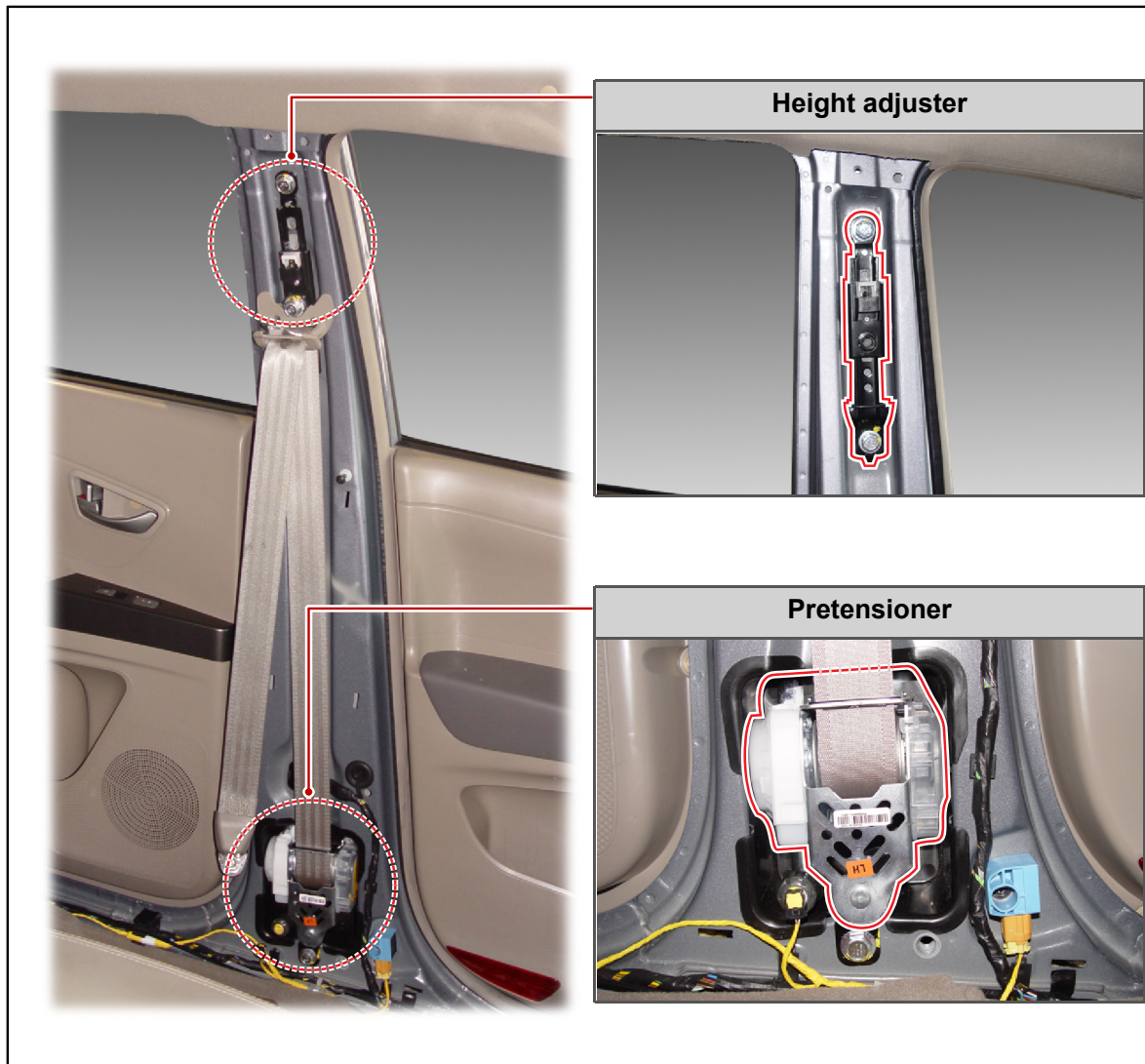


Modification basis	
Application basis	
Affected VIN	

S.G.N.

7430-00 SEAT BELT PRETENSIONER

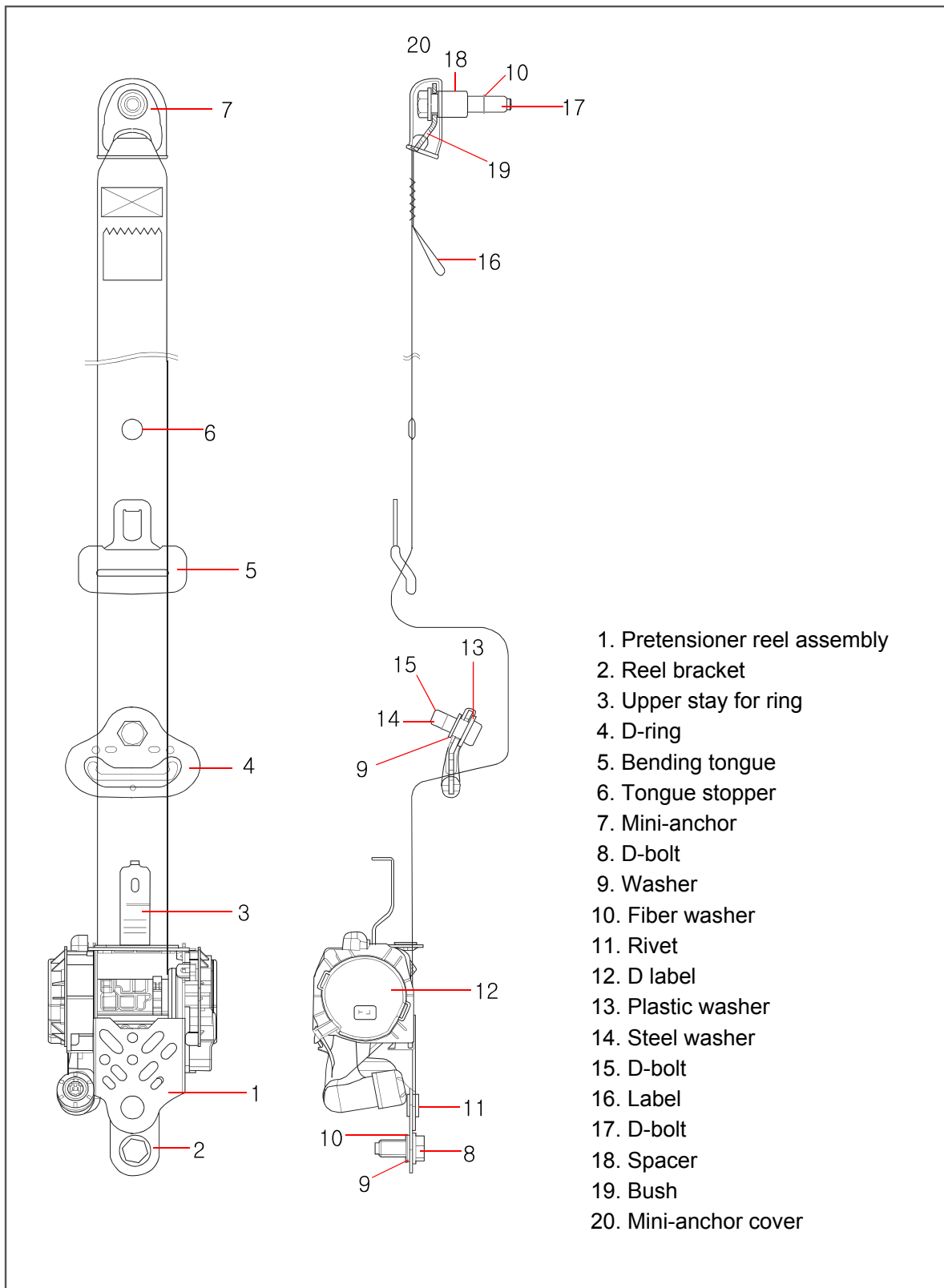
The belt pretensioner retracts the seat belt to tighten or take up slack in the wearer's belt. When a collision occurs or when brakes are applied, a seat belt with a pretensioner detects the stopping action and tightens the belt before the wearer is propelled forward. This holds the occupant more securely in the seat.

1) Location**NOTE****► Height adjuster**

It is to improve comfort and optimize restrictive performance in case of a collision by adjusting the belt position to the occupant's shoulder.

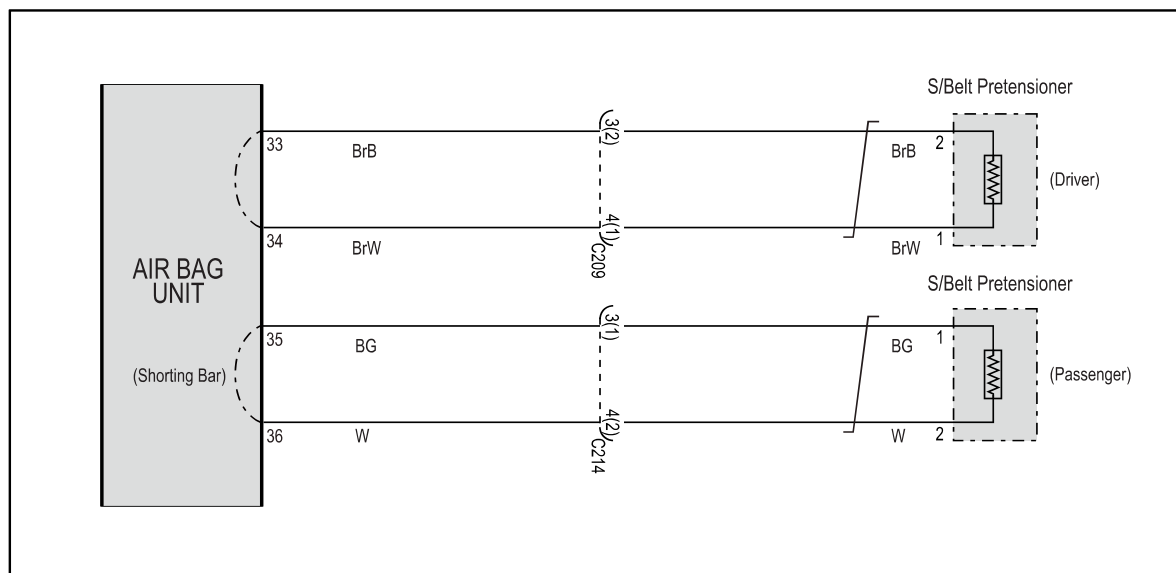
Modification basis	
Application basis	
Affected VIN	

2) Components



Modification basis	
Application basis	
Affected VIN	

3) Inflator Circuit



Modification basis	
Application basis	
Affected VIN	

S.G.N

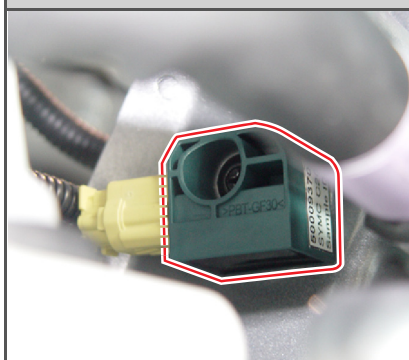
8810-18 FRONT IMPACT SENSOR ASSEMBLY

The front air bag system is activated mainly by the signal from the front impact sensor assembly. The SDM unit assembly compares this signal with its longitudinal/lateral G sensor values to inflate the front air bag.

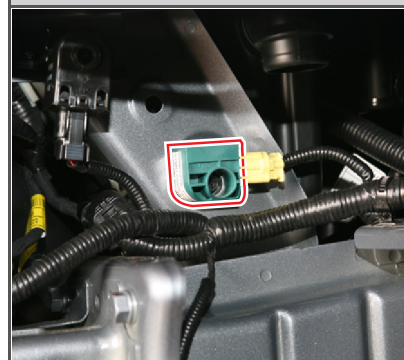
1) Mounting Location



Front impact sensor assembly (RH)



Front impact sensor assembly (LH)



Modification basis	
Application basis	
Affected VIN	

AIR BAG SYSTEM

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AIR
CONDITIO

AIR BAG
SYSTEM

SEAT

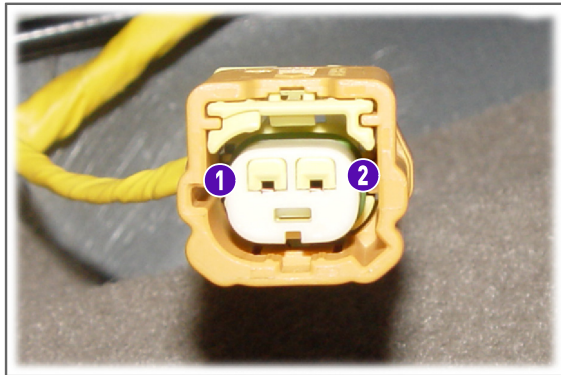
SUNROO
F

BODY
INTERIOR

BODY
EXTERIO

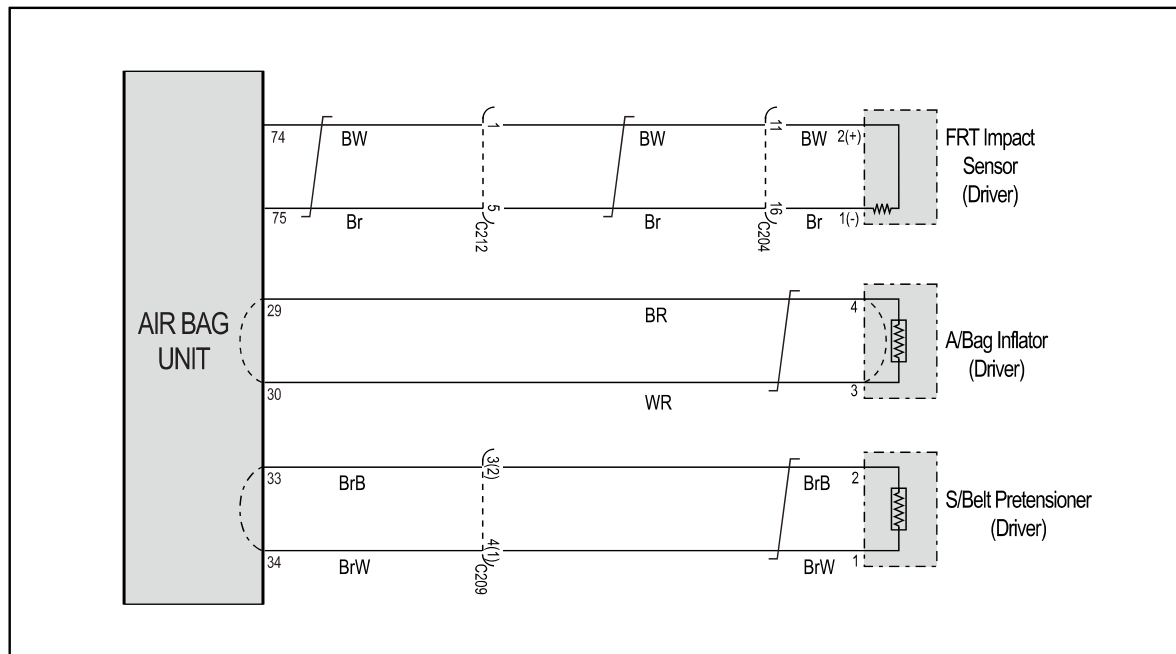
BODY
REPAIR

2) Front Impact Sensor Connector



Pin No.	Function
1	Signal
2	Ground

3) Front Impact Sensor Circuit



S.G.N.

8810-16 SIDE AIR BAG SENSOR ASSEMBLY

The side air bag sensor assembly receives an ignition signal from the SDM unit assembly independently from the front air bag system. The ignition signals of the side air bag system are supplied from the 2 side air bag sensors installed to the side center of the vehicle body.

1) Location

<Left>



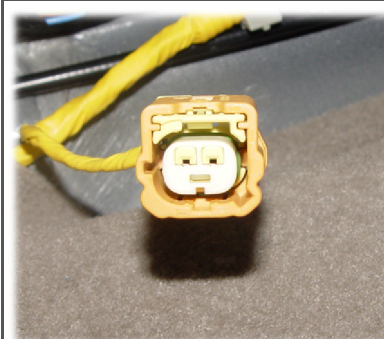
<Right>



Side air bag sensor assembly



Side air bag sensor connector



Modification basis	
Application basis	
Affected VIN	

AIR BAG SYSTEM

korando 2010.10

AIR
CONDITIO

AIR BAG
SYSTEM

SEAT

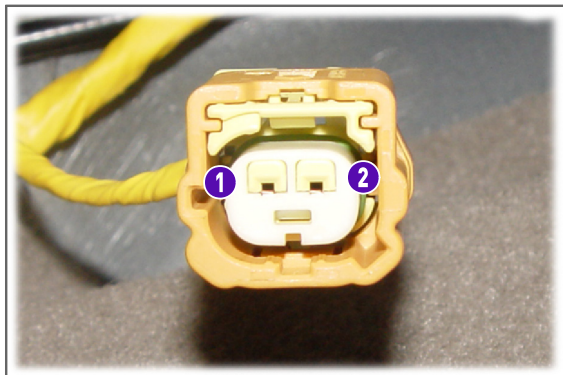
SUNROO
F

BODY
INTERIOR

BODY
EXTERIO

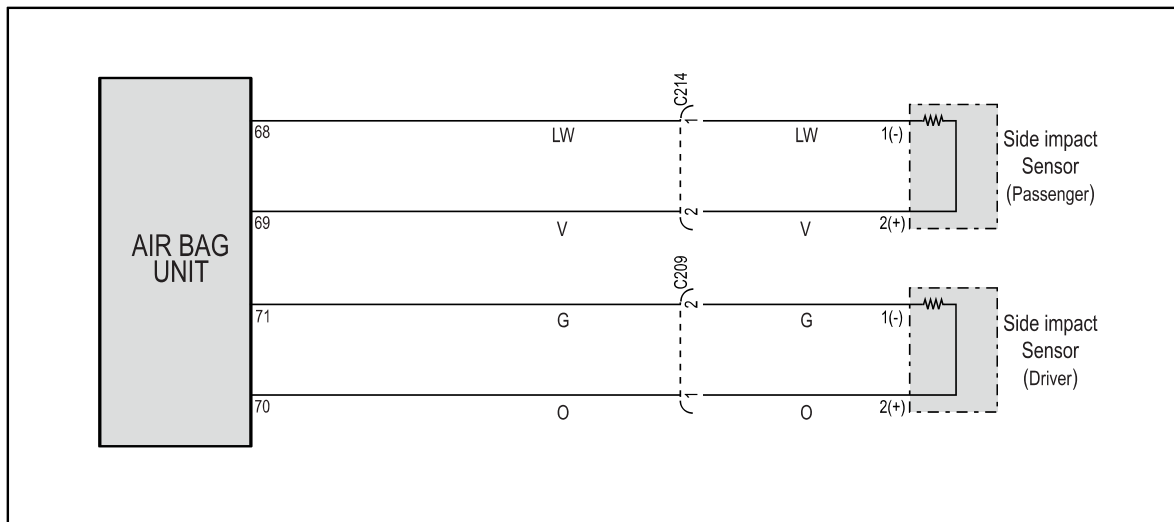
BODY
REPAIR

2) Side Air Bag Sensor Connector



Pin No.	Function
1	Signal
2	Ground

3) Side Air Bag Sensor Circuit



S.G.N.

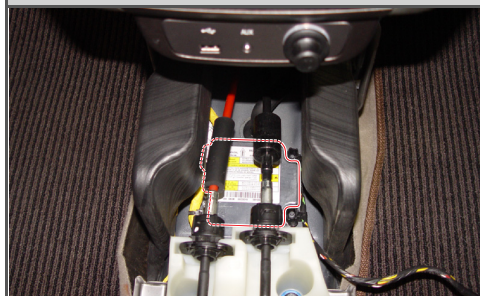
8810-01 SDM UNIT ASSEMBLY

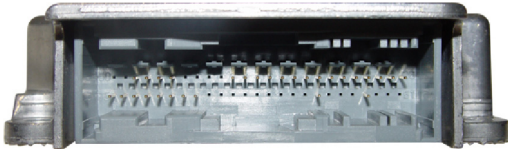
1) Location

The SDM unit assembly is mounted under the front of the front console.



Location



SDM unit assembly	Connector
	

Modification basis	
Application basis	
Affected VIN	

2) Major Functions

- Detects crash
- Activates the front air bag, side air bag, curtain air bag and belt pretensioners
- Monitors the safety system
- Indicates system readiness and faults to the driver by means of a fault warning lamp
- Facilitates servicing capability via a serial diagnostic communication interfaces
- Diagnoses the system including internal system monitoring and ambient sensor monitoring
- Automatic activation
- Records crash data
- Reserves electric energy for deploying the air bag in the event of frontal crash with power cut off

3) Components

- Longitudinal and orthogonal acceleration sensors
- Two inflator circuits with energy reserve function for driver and passenger front air bags
- Two inflator circuits without energy reserve function for front belt pretensioner
- Two inflator circuits without energy reserve function for front side air bag
- Two inflator circuits without energy reserve function for curtain air bag
- Warning lamp indicating system fault
- One service communication interface (KWP2000)
- Two SIS (Side Impact Sensor) interfaces
- Two FIS (Front Impact Sensor) interfaces
- Crash output interface

4) Function

► DC/DC converter

The DC/DC converter (Combined ASIC) of the power supply has step up and step down converters, and supplies the firing voltage for the two firing circuits and the internal operating voltage of the SDM. If the internal operating voltage falls below a defined threshold, a reset is executed.

► Watchdog

The watchdog checks the micro controller (μC) periodically. If there is any fault in the micro controller, it will be reset and firing loop will be locked. Then, the warning lamp will come on.

Modification basis	
Application basis	
Affected VIN	

► Orthogonal acceleration sensor

The integrated electrical acceleration sensor provides an electrical signal of the vehicle's acceleration along the orthogonal axis and longitudinal axis. The electrical signals are proportional to the acceleration. Those signals are evaluated by the micro controller via the A/D converter. The firing threshold is adjustable by parameter setting for the corresponding algorithm. If the adjusted value exceeds the threshold value, the SDM will drive the high side and low side transistors of the corresponding firing loops.

► Arming/Safety circuit

The trigger switch which controls power is implemented as an arming/safety sensor in the SDM. It is only used in the front air bag firing loops and it puts the front air bag firing circuits to the armed status under the air bag deployment conditions and maintains the air bag firing circuits unarmed under the normal driving conditions. All components in the safety circuit can be tested, so a high level of reliability can be achieved. The trigger sensor is continuously monitored to prevent the belt pretensioner loop from activating with the operating conditions not satisfied. It is allowed to be activated only when a loop closing is detected.

► Firing loop phase - Front air bag

Each firing loop consists of a high side and low side switch. The current is limited by the ASIC to 2 to 4 A. Both stages of the front air bags are fired by the energy reserve capacitors.

► Firing loop - Side air bag

The firing loop consists of a high side and low side switch. The current is limited by the ASIC to 2 to 4 A. The side air bag is fired by the battery power supply.

► Firing loop - Belt pretensioner

The firing loop consists of a high side and low side switch. The current is limited by the ASIC to 2 to 4 A. The belt pretensioner is fired by the battery power supply.

► Energy reserve and autonomous operating time

The SDM has an energy reserve function that ensures the internal operation of the central unit and buffering firing circuits for a minimum of 150 ms after loss of battery power. The SDM cannot detect a crash or deploy the air bag for up to 5 sec after cutting off the battery voltage from the SDM. Full energy reserve capability is available for 10 sec after the minimum specified operating voltage has been applied to the SDM power line. The SDM checks for charging and discharging conditions by measuring the energy reserve capacitor. If there is any problem in the energy reserve capacitor, it sets a diagnostic trouble code associated with an energy reserve function.

Modification basis	
Application basis	
Affected VIN	