

Section 7

Safety and Security

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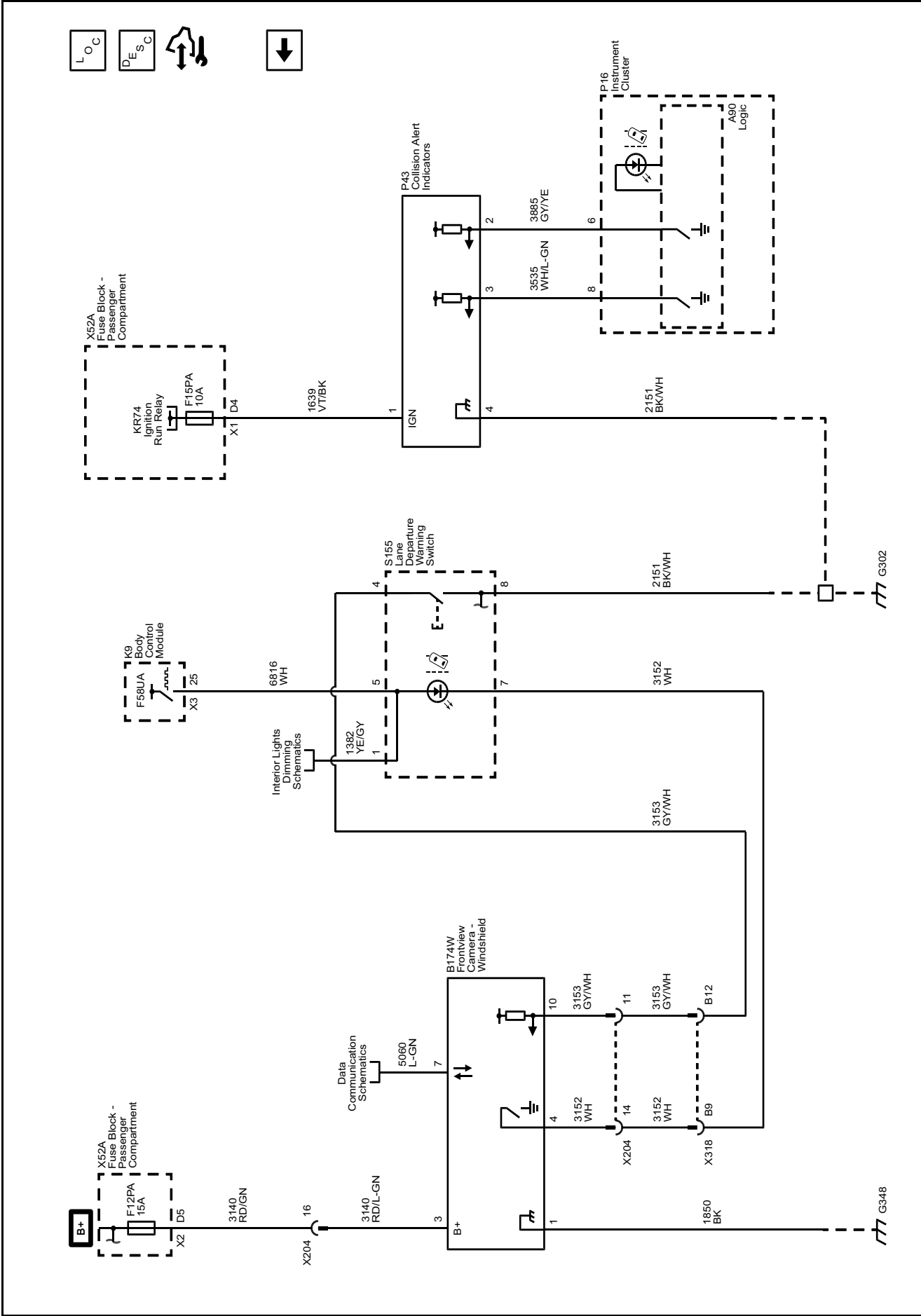
Driver Assistance Systems

Schematic and Routing Diagrams



Driver Assistance Systems Schematics (Lane Departure Warning (UFL))

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Description and Operation

Forward Collision Alert Description and Operation

The forward collision alert system is a convenience feature of the frontview camera module that issues a warning to the driver when a potential collision risk exists. The frontview camera module is located behind the windshield, looking out at the road ahead and detecting vehicles directly ahead. When the system detects a vehicle in the path ahead, the green vehicle ahead indicator is illuminated on the instrument cluster. When approaching another vehicle too rapidly, the collision alert symbol will flash in the head-up display (if equipped) or a series of red collision alert indicators will flash. An audible alert sound will simultaneously sound or the safety alert seat will provide haptic feedback. The visual alert cannot be changed, but the driver can select between audible or haptic alerts in the vehicle personalization menus. The forward collision alert system can also be turned on or off through the vehicle personalization menus. See the vehicle owner manual for more detailed information on vehicle personalization.

Forward collision alert does not provide a warning to help avoid a crash, unless it detects a vehicle. Forward collision alert may not detect a vehicle ahead if the frontview camera module is blocked by dirt, snow, or ice, or if the windshield is damaged. It may also not detect a vehicle on winding or hilly roads, or in conditions that can limit visibility such as fog, rain, or snow, or if the headlamps or windshield are not cleaned or in proper condition. Keep the windshield, headlamps, and frontview camera module clean and in good repair.

Forward collision alert may provide unnecessary alerts for turning vehicles, vehicles in other lanes, objects that are not vehicles, or shadows. These alerts are normal operation and the vehicle does not need service.

Forward Collision System Reduced Message

This message displays when Forward Automatic Braking or Front Automatic Braking has been set to the "Alert" setting. This setting disables most automatic braking functions. This is normal operation when the **Forward Collision System** setting is set to **OFF** or **ALERT**. This message is not present when the **Forward Collision System** is set to **Alert and Brake**.

Front Automatic Braking (UHY) (if equipped)

When the system detects a vehicle ahead in your path that is traveling in the same direction that you may be about to crash into, it can provide a boost to braking or automatically brake the vehicle. This can help avoid or lessen the severity of crashes when driving in a forward gear. Depending on the situation, the vehicle may automatically brake moderately or hard. This front automatic braking can only occur if a vehicle is detected.

The system works when driving in a forward gear between 8 km/h (5 mph) and 60 km/h (37 mph), or on vehicles with Adaptive Cruise Control above 2 mph (4 km/h). It can detect vehicles up to approximately 60 m (197 ft).

Pedestrian Collision Mitigation Braking (UKJ) (if equipped) is a feature subset of **Front Impact Mitigation** that aims to reduce the likelihood of collisions or reduce the impact speed with pedestrians in the forward direction by the following:

- Determining the forward path of the vehicle
- Monitoring this path with respect to pedestrians in or near the forward path
- When appropriate, providing pedestrian detection pedestrian and alerts to the driver, and if certain conditions are met, providing autonomous braking to help avoid or reducing the impact speed of a collision with the pedestrian

This system is not intended to replace the driver responsibility paying careful attention to the forward scene for pedestrian, vehicle, and other potential hazards. Its function is limited to supplemental use only to assist rather than replace the driver in responding to pedestrians in the forward scene.

The Pedestrian Collision Mitigation Braking system can detect and alert to up to 10 pedestrians in a forward gear at speeds between 5 mph (8 km/h) and 50 mph (80 km/h). During daytime driving, the system detects pedestrians up to a distance of approximately 40 m (131 ft). Pedestrians must be at least 31.5 inches (80 cm) tall to be detected.

No added components are required for Front Automatic Braking, or Pedestrian Collision Mitigation Braking. Refer to Owner Manual – Driver Assistance Systems for more details.

The forward collision alert system is made up of the following components:

- Frontview camera module
- Forward collision alert switch
- Instrument cluster
- Collision alert indicators (without UV6)
- Head-up display (with UV6)
- Infotainment system
- Safety alert seat, if equipped

Frontview Camera Module

The frontview camera module detects vehicles in front of the vehicle. The frontview camera module communicates with the instrument cluster via serial data to illuminate the appropriate amber or green vehicle ahead indicator, collision alert symbol will flash in the head-up display, or collision alert indicators. The frontview camera module also communicates via serial data with the infotainment system and memory seat module to request audible or haptic alerts.

Forward Collision Alert Switch

The forward collision alert switch provides an input to the frontview camera module to select the alert timing sensitivity when approaching another vehicle too rapidly. The forward collision alert switch is part of the steering wheel controls switch – left and provides inputs to the body control module (BCM), which then communicates with the frontview camera module via serial data.

The BCM applies a reference voltage and monitors a low signal voltage from the normally open switch. When the switch is pressed, the signal circuit is pulled low through a specific series of resistors, indicating that the system has been requested to change the alert timing sensitivity. The first button press will show the current alert timing setting on the driver information center. With every subsequent button press, the alert timing sensitivity is changed.

Instrument Cluster

The instrument cluster communicates via serial data with the frontview camera module and will illuminate the amber or green vehicle ahead indicator as requested by the frontview camera module. The instrument cluster also controls the head-up display or the collision alert indicators.

Collision Alert Indicators (without UV6) (if equipped)

The collision alert indicators are a series of red LEDs that will flash when approaching another vehicle too rapidly. The collision alert indicators are located in the upper instrument panel area and reflect off the windshield when illuminated.

The collision alert indicators receive power and ground and are discretely controlled by the instrument cluster through a pair of low control circuits. When requested by the frontview camera module, the instrument panel will pulse the low control circuits, flashing the LEDs as a visual alert that another vehicle is being approached too rapidly.

Head-up Display (with UV6) (if equipped)

The instrument cluster controls the head-up display via serial data. The instrument cluster will command the head-up display to flash the collision alert indicator as a visual alert when approaching another vehicle too rapidly as requested by the frontview camera module.

Infotainment System

The infotainment system controls the audible alerts for the forward collision alert system. If the host vehicle is approaching another vehicle too rapidly, the frontview camera module will command the infotainment system issue an audible alert to the driver.

Safety Alert Seat (if equipped)

The memory seat module controls the haptic alert provided by the seats. If the vehicle is approaching another vehicle too quickly, the frontview camera module will command the memory seat module to pulse both sides of the seat.

Lane Departure Warning Description and Operation

The lane departure warning system is a convenience feature that utilizes the frontview camera module to determine if the vehicle has unintentionally crossed a lane marking and issue a warning. The frontview camera module is located behind the windshield, looking out at the road ahead and detecting any lane markings. When the vehicle unintentionally leaves a detected lane, visual and audible or haptic (if equipped) alerts are given to the driver. The visual alert cannot be changed, but the driver can select between audible or

haptic alerts (if equipped) in the vehicle personalization menus. Refer to the vehicle owner's manual for vehicle personalization options.

The lane departure warning system utilizes the following components:

- Frontview camera module
- Lane departure warning switch
- Instrument cluster
- Infotainment system
- Safety alert seat, if equipped

Frontview Camera Module

The frontview camera module detects visual queues such as lane markings. When it is determined that the vehicle has unintentionally moved outside of the lane, visual and audible or haptic (if equipped) warning is given to the driver. The frontview camera module receives an input from the lane departure warning switch and controls the lane departure warning indicator output. The frontview camera module also communicates via serial data with the instrument cluster, infotainment system, and memory seat module to request visual, audible, and/or haptic alerts.

Lane Departure Warning Switch

The lane departure warning switch provides an input to the frontview camera module to turn the lane departure warning system on and off. The frontview camera module applies voltage and monitors the parking assist switch signal circuit. The lane departure warning switch is a normally open switch. With the switch open, voltage seen at the frontview camera module is high. When the lane departure warning switch is pressed, the switch is closed and the signal circuit is pulled to ground. With the switch closed, voltage seen at the frontview camera module is low. The frontview camera module will respond to this by activating or deactivating the lane departure warning system.

The lane departure warning switch also utilizes the lane departure warning indicator, which is part of the lane departure warning switch and is controlled by the frontview camera module to indicate the operational status of the lane departure warning system. When the lane departure warning is enabled, the frontview camera module will illuminate the indicator on the switch. The indicator receives voltage through a high control circuit from the body control module (BCM) and is controlled through a low control circuit by the frontview camera module.

Instrument Cluster

The instrument cluster contains green and amber lane departure warning indicators. These indicators inform the driver of the current status of the lane departure warning system and are controlled via serial data by the frontview camera module. When the vehicle speed is above 56 km/h (35 MPH) and the system has detected the required lane markings and is ready to assist, the green indicator will be illuminated. If the vehicle has unintentionally left the lane, the amber indicator will flash.

Infotainment System

The infotainment system controls the audible alert for the lane departure warning. If the vehicle has unintentionally left the lane, the frontview camera module will request via serial data an audible alert to the driver through the infotainment system

Safety Alert Seat

The memory seat module controls the haptic alert provided by the seats. If the vehicle has unintentionally left the lane, the memory seat module will command pulses to the left or right side of the seat, depending on the lane departure direction.

Lane Departure Warning Operation

System Operational Modes

- **Off State:** The system has been turned off by the driver using the lane departure warning switch. The lane departure warning indicator located on the lane departure warning switch will not be illuminated.
- **Not Ready To Assist:** The system is enabled and the lane departure warning indicator located on the lane departure warning switch is illuminated, but the system is not ready to assist because one of the following conditions is true:
 - Vehicle speed is less than 56 km/h (35 MPH). The system is designed to function at speeds greater than 56 km/h (35 MPH).
 - The system cannot detect lane markings. This may be because there are no lane markings or the lane markings cannot be determined due to snow, rain, or other driving conditions.
 - The windshield area in front of the camera or the camera lens is blocked by fog, dirt, damage to the windshield, or other elements that may prevent the camera from detecting lane markings.
- **Ready To Assist:** The system is enabled and ready to warn of the unintentional lane crossing. The system is ready to assist when the green lane departure warning indicator is illuminated on the instrument cluster.

Lane Crossing Alerts

- A lane crossing alert consists of the following:
 - The amber lane departure warning indicator located on instrument cluster will flash.
 - Three chimes are activated through the infotainment system or three pulses to the left or right side of the seat, if equipped with safety alert seat
- When any of the following conditions occurs, the system will not give alerts:
 - The appropriate turn signal is activated. An activated turn signal is interpreted as an intentional lane crossing.
 - The operator makes an intentional steering maneuver.
 - The operator makes an intentional accelerating maneuver.
 - The operator makes an intentional braking maneuver.

Lane Keep Assist Description and Operation

Note:

- The Lane Keep Assist system DOES NOT continuously steer the vehicle
- The Lane Keep Assist system replaces Lane Departure Warning System
- Lane Departure Warning will have more alerts than Lane Keep Assist (visual, audible, and haptic warning)

The system assists driver to keep vehicle in-lane by providing a steering push back to the vehicle when an unintended lane departure is detected. See the user's manual for more detailed information on vehicle personalization.

The lane keep assist system is made up of the following components:

- Front view camera module
- Lane Keep Assist switch / control indicator
- Instrument cluster / Vehicle Direction Display
- Radio
- Safety Alert Seat (if equipped)
- Yaw rate sensor
- Electric power steering

Front View Camera Module

The camera detects visual queues such as lane markings. When it is determined that the vehicle has unintentionally moved outside of the lane, visual, and audible or haptic warning is given to the driver. The front view camera module receives an input from the lane keep assist switch and controls the lane keep assist switch indicator output. The front view camera module also communicates via serial data with the instrument cluster, radio, and memory seat module to request visual, and audible or haptic alerts.

Lane Keep Assist Switch

The lane keep assist switch provides an input to the front view camera module to turn the lane keep assist system ON and OFF. The front view camera module provides a signal voltage to the normally open momentary switch. When the switch is pressed, the signal circuit is pulled to ground, indicating to the front view camera module that the system has been requested to turn ON or OFF. The lane keep assist switch also contains the lane keep assist switch indicator, which is controlled by the front view camera module to indicate the ON and OFF status of the lane keep assist system. When the system has been enabled by the lane keep assist switch, the front view camera module applies ground to the switch indicator and illuminates the LED. The location of the lane keep assist switch can vary with different vehicles. For the exact location please refer to the user's manual.

Instrument Cluster

The vehicle direction display contains green and amber lane keep assist indicators. These indicate to the driver the current status of the lane keep assist system and are controlled via serial data by the front view camera module. When the vehicle speed is above 56 km/h

(35 MPH) and the system has detected the required lane markings and is ready to assist, the green indicator will be illuminated on the vehicle direction display. If the vehicle has unintentionally left the lane, the amber indicator will flash.

Radio

The radio controls the audible alert for the lane keep assist. If the vehicle has unintentionally left the lane, the radio will command three beeps as an audible alert to the driver.

Safety Alert Seat (if equipped)

The memory seat module controls the haptic alert provided by the seats. If the vehicle has unintentionally left the lane, and the Electric Power Steering determines the corrective action requires an above threshold amount of effort, the memory seat module will command three pulses to the left or right side of the seat, depending on the lane departure direction.

Yaw Rate Sensor

The steering intervention is based on the forward looking sensor outputs, such as lateral offset of the vehicle, relative yaw angle and time to line crossing. Over that, other vehicle dynamics signals are needed, e.g. velocity, steering angle, yaw rate for the purpose of a driver suppression.

Electric Power Steering

The electric power steering uses a torque sensor to detect driver inputs and relays that information to the frontview camera module. The electric power steering is used to provide steering push back.

Lane Keep Assist Operation

There is two stages of warning/intervention for the driver: The first stage is the steering push back, if the lane keep assist system detects that the vehicle will cross the lane marking despite it is intervening, a second stage warning shall be issued. The second stage warning is a chime or a haptic seat vibration, **if equipped** with haptic seats. If a haptic seat vibration is used as stage 2 warning, the vibration shall take place on the side of the seat, where the lane departure happened.

System operation can be described by the following modes:

- Off State: The system has been turned off by the driver using the lane keep assist switch. The lane keep assist indicator will not be illuminated.
- Not Ready To Assist: The system is enabled and the lane keep assist indicator is illuminated, but not ready to assist when any of the following conditions is true:
 - Vehicle speed is less than 37 MPH (60 km/h) . The system is designed to function at speeds greater than 37 MPH (60 km/h).
 - The system cannot detect lane markings. This may be because there are no lane markings, as on a country road or that the lane markings cannot be determined due to snow, rain, or other driving conditions.
 - The windshield area in front of the camera or the camera lens is blocked by fog, dirt, damage to the windshield or other elements that may prevent the camera from detecting lane markings.
- Ready To Assist: The system is enabled and ready to warn of the unintentional lane crossing. The system is ready to assist when the green lane keep assist indicator is illuminated on the vehicle direction display.

Lane Crossing Alerts

- When one of the following conditions are met, the system will not give alerts:
 - The correct turn signal is activated. An activated turn signal is interpreted as an intentional lane crossing.
 - The operator makes an intentional steering maneuver.
 - The operator makes an intentional accelerating maneuver.
 - The operator makes an intentional braking maneuver.
- Lane crossing alert consists of the following:
 - The amber lane keep assist indicator will flash.
 - “push-back” steering torque input (or nudge) from Electric Power Steering to help prevent a lane departure
 - Three chimes are activated through the radio.
 - or **if equipped**, three pulses to the left or right side of the seat.

Lane Keep Assist System Driver Information Center Messages

The front view camera module can command the driver information center to display the various messages to alert the driver of a system concern or status information. For detailed information about the possible messages please refer to the user's manual.

Side Blind Zone Alert Description and Operation

Note: When the vehicle is new, or the system has been programmed, there may be intermittent false alerts for up to 644 km (400 miles). The system is in an auto learn mode at this time.

The side blind zone alert system is a lane-changing aid that assists drivers with avoiding crashes that occur with vehicles in the side blind zone (or spot) areas. When the vehicle is moving forward, the left or right side mirror display will illuminate if a vehicle is detected in the blind zone. If the turn signal is activated and a vehicle is also detected on the same side, the display will flash as an extra warning not to change lanes. The side blind zone alert monitors the blind spot area along side the vehicle, approximately 3.5 m (11 ft) from the side of the vehicle, extending 5 m (16 ft) behind the mid-point of the vehicle.

The lane change alert system is a lane-changing aid that assists drivers with avoiding lane change crashes that occur with vehicles rapidly approaching the side blind zone (or spot) areas from behind. The lane change alert warning display will illuminate in the corresponding outside rearview mirror and will flash as an extra warning not to change lanes if the turn signal is on. The lane change alert system monitors the lane area along side the vehicle, approximately 3.5 m (11 ft) from the side of the vehicle, extending up 70 m (230 ft) beyond the rear bumper.

While in reverse, the rear cross traffic alert system displays a triangle with a left or right pointing arrow on the info display module to warn of traffic coming from the left or right. This system detects objects coming from up to 20 m (65 ft) from the left or right side of the vehicle. When an object is detected, either three beeps sound from the left or right or three safety alert seat pulses occur on the left or right side, depending on the direction of the detected vehicle.

Side Blind Zone Alert System Components

The side blind zone alert system is made up of the following components:

- Side object sensor module – left
- Side object sensor module – right
- Driver outside rearview mirror
- Passenger outside rearview mirror
- Infotainment system
- Safety alert seat (If equipped)

Side Object Sensor Module

The side object sensor modules are located on each side of the vehicle behind the rear fascia and are not directly visible from outside the vehicle. The sensors use radar to determine the presence of objects nearby. The side object sensor module – left is the master that communicates on vehicle serial data bus. There is a private serial data bus between the left and right sensors. The scan tool is able to communicate only with the left sensor. The sensors are unique and not interchangeable from side to side.

The side object sensor module – right controls both side blind zone indicators located on the left and right outside rearview mirrors. Each indicator receives ground at all times. When an object has been detected in the vehicle's blind spot or a vehicle is fast approaching from the rear, the side object sensor module – right will apply voltage to the appropriate indicator, illuminating it. If the turn signal is on, indicating the driver intends to change lanes, side object sensor module – right will flash the appropriate indicator as an additional means of alert.

Outside Rearview Mirrors

The outside rearview mirrors contain an icon that is backlit with high intensity, amber-colored LED's located on the mirror surface. The display brightness adapts to day and night conditions. The side object sensor module – right controls both side blind zone indicators.

Infotainment System

The infotainment system controls the audible alerts for the rear cross traffic alert system. If cross traffic is present, the side object sensor module – left will command the infotainment system issue an audible alert to the driver. The audible alert will sound from the side of the vehicle where traffic is approaching from.

The infotainment system also includes the info display module. When in R, any cross traffic warnings will be overlaid over the rear vision camera image on the info display module.

Safety Alert Seat (If Equipped)

The memory seat module controls the haptic alert provided by the seats. If cross traffic is present, the side object sensor module – left will command the safety alert seat issue a haptic alert to the driver on the side of the seat where traffic is approaching from.

Side Blind Zone Alert Operation

When the vehicle is started, both side blind zone indicators located on the left and right outside rearview mirrors will briefly illuminate to indicate that the system is operating. The system is designed to detect objects in an area approximately between 0.5 m (1.5 ft) and 2 m (6 ft) off the ground. The side blind zone alert monitors the blind spot area along side the vehicle, approximately 3.5 m (11 ft) from the side of the vehicle, extending 5 m (16 ft) behind the mid-point of the vehicle. The system may light up an indicator due to guardrails, signs, trees, shrubs, and other non-moving objects. This is normal system operation; the vehicle does not need service.

When the system detects a vehicle in the side blind zone while driving forward, an amber warning symbol will illuminate on the appropriate outside mirror. This indicates that it may be unsafe to change lanes. If the driver activates the turn signal, the amber warning symbol starts flashing as an extra warning not to change lanes.

Foul weather may affect the operation of the side blind zone system. Occasional missed alerts can occur under normal circumstances and will increase in wet conditions. The number of missed alerts will increase with increased rainfall or road spray. Heavy rainfall, as well as mud, dirt, snow, ice, or slush build-up on the rear fascia, can completely disable the system.

If the vehicle is towing a trailer or has an object such as a bicycle rack attached to the rear of the vehicle, the side blind zone system may not function properly and the indicators may illuminate intermittently or remain illuminated all the time.

Lane Change Alert Operation

Lane Change Alert (LCA) can be disabled in vehicle personalized settings, this will also disable the Side Blind Zone Alert (SBZA) system. When disabled, the bulb check of the mirror indicators will also be disabled. A driver information center message will be displayed at start up when the LCA system is disabled. This feature must be enabled prior to trying to diagnose the system.

The lane change alert system shall detect and report objects in the driver's blind zone, or approaching on either side of the vehicle, within a specified lane change zone. The system is designed to alert the driver, with a visual display placed on the side view mirror, to the presence of objects of interest that may not be visible in the inside rearview mirror and outside rear view mirrors. Although this system is intended to help drivers avoid lane change crashes, it does not replace driver vision and therefore should be considered a lane change aid. Even with the lane change alert system, the driver must check carefully for objects outside of the reporting zone before changing lanes. In the event that the system senses a malfunction through its diagnostic routines, the system will be disabled and the driver will be visually notified.

When the vehicle is started, both outside mirror displays will briefly come on to indicate that the system is operating. The warning symbols will vary brightness based on the ambient light conditions. Lane change alert is active when the vehicle is out of park or the parking brake is off on manual transmission vehicles. When the system detects a vehicle in the side blind zone or approaching in the lane change alert zone while driving forward, an amber warning symbol will light up in the appropriate outside mirror. This indicates that it may be unsafe to change lanes. If the driver then activates the turn signal, the amber warning symbol starts flashing as an extra warning not to change lanes.

The system is designed to detect objects of interest as small as a 125cc motorcycle with rider. The detection zone starts at the outside rearview mirror and extends out to 3.5 m (11 ft) at the back corner of the vehicle and 70 m (230 ft) behind the vehicle at a height between 0.5 m (1.5 ft) and 2.0 m (6 ft) above the ground. The system may light up an indicator due to guardrails, signs, trees, shrubs, and other non-moving objects. This is normal system operation; the vehicle does not need service.

If the vehicle is towing a trailer or has an object such as a bicycle rack attached to the rear of the vehicle, the lane change alert system may not function properly and the indicators may illuminate intermittently or remain illuminated all the time. The driver information center may display "SIDE DETECTION SYSTEM UNAVAILABLE".

Foul weather may affect the operation of the lane change alert system. Occasional missed alerts can occur under normal circumstances and will increase in wet conditions. The number of missed alerts will

increase with increased rainfall or road spray. Heavy rainfall, as well as mud, dirt, snow, ice, or slush build-up on the rear fascia, can completely disable the system. The warning symbols will vary brightness based on the ambient light conditions.

Rear Cross Traffic Alert Operation

The rear cross traffic alert system is designed to detect moving objects approaching the side of the vehicle while backing up. The detection zone extends approximately 30 m (99 ft) from the rear corner of the car and covers an area from behind the vehicle to 125 degrees towards the front at a height of 0.45 m (1.5 ft) to 2 m (6.5 ft) above ground. The system operates when vehicle speed is 10 km/h (6 mph) or less and is designed to detect objects moving at speeds up to 36 km/h (22 mph).

When the vehicle is backing up, the side object sensors receive energy that is reflected from external objects and determine if the objects are objects of interest or not. The system may at times detect pedestrians, shopping carts, or similar moving objects. This is normal and should not be considered as a false alert or problem with the system. The rear cross traffic alert system will estimate vehicle travel trajectory and use the information in conjunction with object travel trajectory information to determine if there is a potential collision between the vehicle and the object of interest. The rear cross traffic alert function will only alert on objects that pose a potential collision with the host vehicle. The system is not designed to provide an alert to objects that have no potential collision with vehicle.

If the vehicle is towing a trailer or has an object such as a bicycle rack attached to the rear of the vehicle, the rear cross traffic alert system may not function properly. Foul weather may affect the operation of the rear cross traffic alert system. Occasional missed alerts can occur under normal circumstances and will increase in wet conditions. The number of missed alerts will increase with increased rainfall or road spray. Heavy rainfall, as well as mud, dirt, snow, ice, or slush build-up on the rear fascia, can completely disable the system.

Side Blind Zone Alert Driver Information Center Messages

Note: Not all messages will apply

SIDE BLIND ZONE ALERT OFF

This message indicates that the system has been disabled through the driver information center. Refer to the vehicle owners manual for instructions on how to set personalization options on the driver information center.

LANE CHANGE ALERT OFF

This message indicates that the system has been disabled through the driver information center. Refer to the vehicle owners manual for instructions on how to set personalization options on the driver information center.

REAR CROSS TRAFFIC ALERT OFF

This message indicates that the system has been disabled through the driver information center. Refer to the vehicle owners manual for instructions on how to set personalization options on the driver information center.

SERVICE SIDE DETECTION SYSTEM

This message indicates that the system requires service. When the message is displayed, the indicators will remain illuminated at all times, notifying the driver that the side blind zone and lane change alert should not be relied upon when changing lanes and the rear cross traffic alert will also be inoperative

SIDE DETECTION SYSTEM UNAVAILABLE

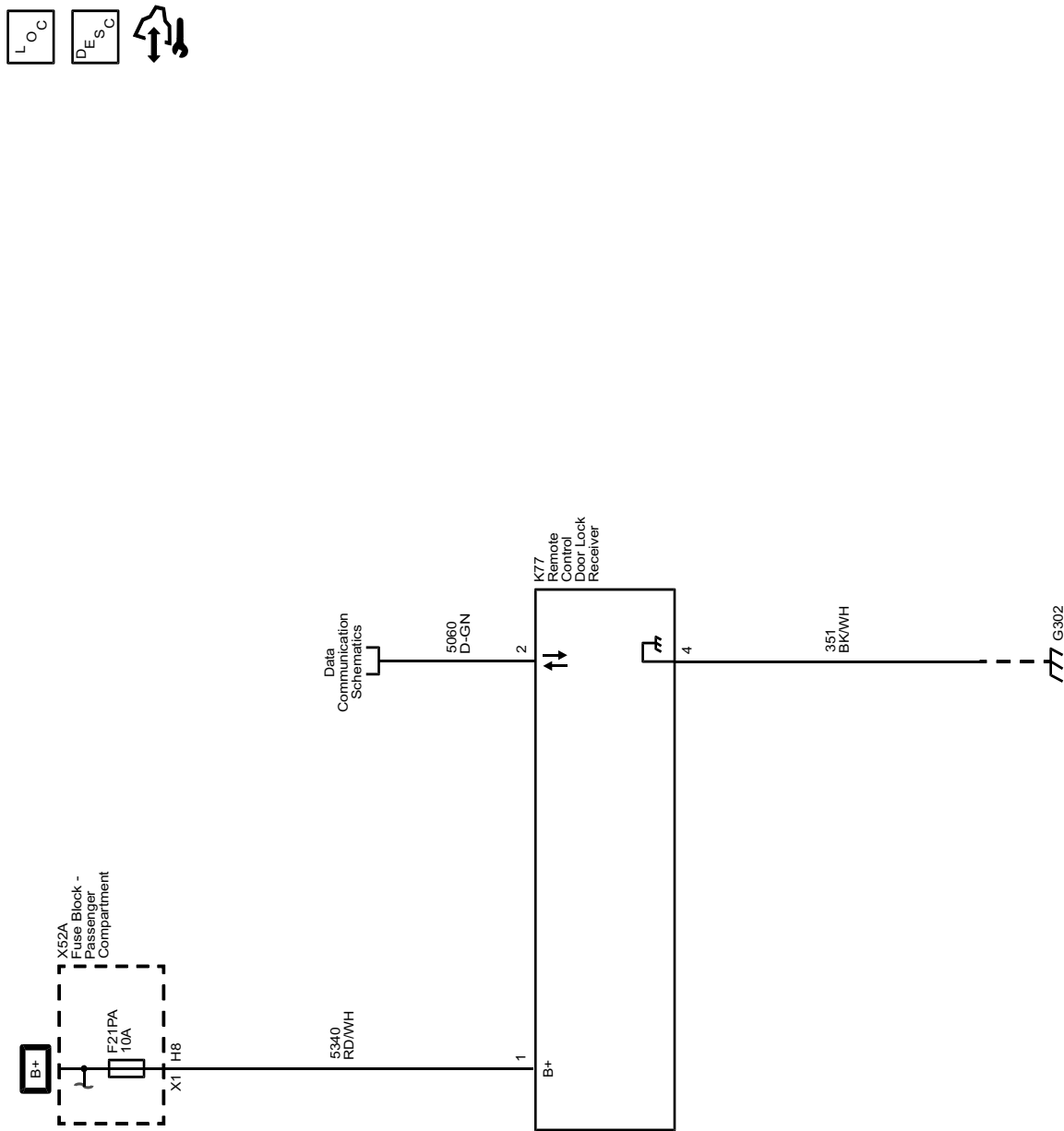
This message indicates that the system has been temporarily disabled because the sensor is blocked or can otherwise not accurately detect vehicles or objects. Such instances may be mud, dirt, snow, ice, or slush build-up on the rear fascia, heavy rainfall, excessive road spray, fascia damage or stickers.

The rear cross traffic alert system will read the GPS latitude and longitude on the serial data bus and calculate if the vehicle is within a Radio Astronomy zone. These zones are located in **Europe** and **Japan** and require the sensors to be turned off. The "Side Detection System Unavailable" message will be displayed to the driver when this occurs.

Remote Functions

Schematic and Routing Diagrams

Remote Function Schematics (Keyless Entry (ATG or UJM))



Description and Operation

Keyless Entry System Description and Operation

The keyless entry system is a vehicle entry device. The keyless entry system is used in conjunction with the body control module (BCM) to remotely activate certain vehicle features. Keyless entry will lock/unlock the doors when a corresponding button on the keyless entry transmitter is pressed. This is accomplished by the transmitter sending a radio frequency to the remote control door lock receiver (RCDLR). The RCDLR interprets the signal and activates the requested function via a serial data message to the BCM. A low transmitter or vehicle battery or radio frequency (RF) interference from aftermarket devices, such as 2-way radios, power inverters, computers, etc., may cause a system malfunction. High RF traffic areas may also cause interference that could lead to a malfunction. Keyless entry allows you to operate the following components:

- Door locks
- Cargo door unlock
- Vehicle locator/Panic alarm
- Illuminated entry lamps

The keyless entry system has the following components:

- Keyless entry transmitters
- BCM
- RCDLR

Keyless Entry Transmitters

The keyless entry transmitter are used to lock and unlock the vehicle doors from a distance of up to 65 feet (20 m) away. Up to 8 transmitters may be programmed to a single vehicle.

OnStar® Remote Link

A vehicle operator may have the ability to perform some of the keyless entry functions using applications on personal devices such as smart phones. Refer to OnStar Description and Operation.

Remote Control Door Lock Receiver (RCDLR)

The remote control door lock receiver (RCDLR) is a multifunction module that operates both the keyless entry system as well as the tire pressure monitoring (TPM) system. The RCDLR has an internal antenna that is used to receive radio frequency (RF) communications sent by the keyless entry transmitters. When an RF message is received from a keyless entry transmitter, the RCDLR interprets this signal and will request via serial data that the body control module (BCM) perform the specific function, i.e. door lock, door unlock, or vehicle locate. The RCDLR also receives RF signals from the TPM sensors located at each wheel.

Unlock Driver Door Only

Momentarily press the transmitter UNLOCK button in order to perform the following functions:

- Unlock only the driver door.
- Illuminate the interior lamps for a determined length of time, or until the ignition is turned ON.
- Flash the exterior lights, if enabled through personalization.

Unlock All Doors – Second Operation

Momentarily press the transmitter UNLOCK button a second time, within 5 seconds of the first press, to perform the following functions:

- Unlock the remaining doors.
- Unlock the cargo doors.

Cargo Door Unlock

Momentarily press the transmitter cargo door unlock button a second time, within 5 seconds of the first press, to perform the following function:

Unlock only the cargo doors.

Lock All Doors

Press the transmitter LOCK button to perform the following functions:

- Lock all vehicle doors.
- Immediately turn OFF the interior lamps.
- Flash the exterior lights, if enabled through personalization.
- Chirp the horn, if enabled through personalization.

Vehicle Locator/Panic Alarm

A single press of the panic button performs the following functions. Some functions may be dependent on personalization settings:

- Pulse the horn three times.
- Flash the exterior lamps three times.

A press and hold of the panic button performs the following functions:

- Illuminate the interior lamps.
- Pulse the horn and flash the exterior lamps for 30 second or until the following conditions occur:
 - The panic button is pressed.
 - The ignition switch is turned to the RUN position with a valid key.

Remote Vehicle Start (RVS) – if equipped

The remote vehicle start (RVS) function allows engine starting while not in the vehicle. It also allows the vehicle HVAC system and other vehicle systems to enable, providing a comfortable vehicle upon entry. RVS functions have an operating range of up to 195 feet, depending on conditions. The RVS sequence begins by pressing and releasing the lock button and then pressing and holding the RVS buttons on the keyless entry transmitter. The turn signal lamps will illuminate to indicate the vehicle has received the remote start request. Each time an RVS is performed, the vehicle doors are locked, however they may then be unlocked/locked with the transmitter or vehicle key

at any time. Once activated, the engine is allowed to run for 10 minutes. The RVS time may be extended by an additional 10 minute by again pressing and releasing the lock button and then pressing and holding the RVS buttons on the transmitter. This feature is called a RVS continue and allows a maximum of 20 minutes of engine running. If the RVS continue is performed at 7 minutes into the initial 10 minute time-out, a total of 17 minutes of engine running would occur. The RVS event may be suspended at any time by pressing only the RVS button on the transmitter or by entering the vehicle and turning ON the hazard lamps.

In between ignition cycles, only two RVS events may occur or be attempted. Once two events or attempts have been made, future RVS events will be suspended until the vehicle is started using the ignition.

Enable/Disable RVS

Using the driver information center (DIC), RVS may be enabled or disabled as a part of vehicle personalization. Refer to the vehicle owners manual for more information.

Hood Ajar Switch

The hood switch provides status of the hood to the BCM for RVS purposes. The switch is integrated into the hood latch assembly. The hood ajar switch provides 2 separate inputs to the BCM. These separate inputs allow the BCM to actively monitor for a hood ajar switch fault.

RVS Circuit Description

The RCDLR receives a signal from the keyless entry transmitter indicating a RVS request. A message is then sent to the BCM which determines if a crank request message will be sent to the ECM to allow engine starting. To determine if conditions are correct for an RVS event, the BCM will ensure the following conditions are met:

- All vehicle doors are closed
- A valid hood ajar switch closed signal is present
- The doors are locked
- The hazard switch is OFF
- The vehicle power mode is correct
- No content theft deterrent (CTD) alarm triggers are present
- The vehicle is not in valet mode (if equipped)

When the BCM determines all conditions meet those required for an RVS event, a message is sent via serial data to the ECM. The ECM relies on the RVS message

from BCM to enable RVS when the crank request signal is received. If the ECM does not receive a valid RVS message, it will not attempt to start the engine. While the ECM is in RVS mode it will suspend engine operation if any of the following additional conditions occur:

- Vehicle speed is greater than 0
- Transmission is not in PARK
- Excessive engine coolant temperature
- Low oil pressure
- The malfunction indicator lamp (MIL) is commanded ON
- Engine crank time is greater than 30 seconds
- Excessive engine speed
- Accelerator pedal position too high
- Remote start timer equals 0
- Immobilizer system indicates tamper

Keyless Entry Personalization

Vehicle lock/unlock functions and remote vehicle start (RVS) settings may be personalized. For functional descriptions and personalization instructions, refer to the vehicle owners manual.

Rolling Code

The Keyless Entry System uses rolling code technology. Rolling code technology prevents anyone from recording the message sent from the transmitter and using the message in order to gain entry to the vehicle. The term "rolling code" refers to the way that the Keyless Entry System sends and receives the signals. The transmitter sends the signal in a different order each time. The transmitter and the remote control door lock receiver (RCDLR) are synchronized to the appropriate order. If a programmed transmitter sends a signal that is not in the order that the RCDLR expects, then the transmitter is out of synchronization. This occurs after 256 presses of any transmitter button when it is out of range of the vehicle.

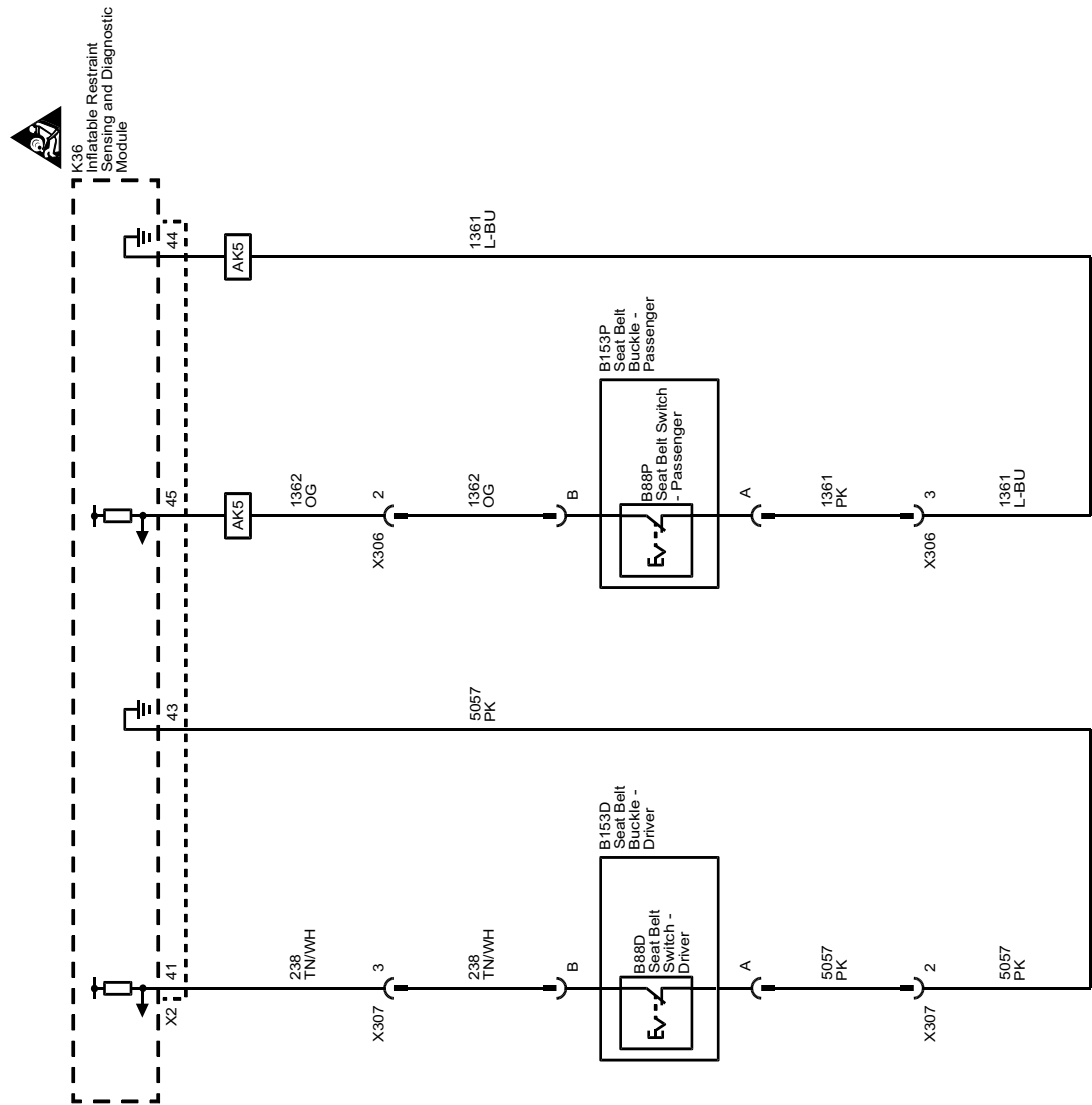
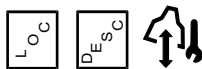
Automatic Synchronization

The keyless entry transmitters do not require a manual synchronization procedure. If needed, the transmitters automatically re-synchronize when any button on the transmitter is pressed within range of the vehicle. The transmitter will operate normally after the automatic synchronization.

Seat Belts

Schematic and Routing Diagrams

Seat Belt Schematics (Seat Belt Schematics)



Description and Operation

Seat Belt System Description and Operation

Restraint System

Seat belts are the primary means of occupant restraint. Seat belts help to keep occupants inside the passenger compartment and to gradually reduce the impact forces.

All seat belt retractors have emergency locks. The retractors remain unlocked during normal operation and under normal driving conditions. The retractors remain unlocked during normal conditions in order to allow free movement of the upper body of each occupant.

A pendulum locks the seat belt webbing into position. The pendulum causes a locking bar to engage a cog on the spool of the retractor mechanism when the following conditions occur:

- A rapid extraction of the seat belt webbing from the retractor
- An abrupt change in the vehicle speed
- An abrupt change in the vehicle direction
- Operation of the vehicle on a steep upgrade
- Operation of the vehicle on a steep downgrade

The seat belts, except for the driver seat belt, have an automatic locking feature, or a cinch feature. The cinch feature is recommended for securing a child seat. The cinch feature is engaged by fully extending the seat belt from the retractor. Once engaged, the seat belt can retract, but cannot be extended again until the cinch feature is cancelled. The cinch feature is cancelled when the seat belt has fully retracted.

This vehicle is also equipped with a supplemental inflatable restraint (SIR) system. Refer to Supplemental Inflatable Restraint System Description and Operation for a description of the seat belt retractor pretensioner.

Front Seat Belt System

The front seat belt system includes the following components:

- The driver and passenger seat belt buckles, attached to the inboard side of the seat frame
- The driver and passenger seat belt retractor pretensioners
- The driver and passenger seat belt switch located in the seat belt buckles

Seat Belt System Circuit Description

There are two fasten safety belt indicators for this vehicle. The driver fasten safety belt indicator is located on the instrument panel cluster (IPC) and the passenger fasten safety belt indicator is located in the passenger ON/OFF indicator. Both indicators are controlled by the IPC at the request of the inflatable restraint sensing and diagnostic module (SDM). The driver indicator, when initiated, will illuminate for 20 seconds followed by 55 seconds of flashing. Audible warnings will initiate simultaneously with visual warnings and last for 8 seconds. Subsequently, similar events will occur until the seat belts are buckled or the ignition is returned to the OFF position.

The driver fasten safety belt indicator will illuminate when any of the following occur:

- The driver seat belt is unbuckled while the ignition is ON.
- The driver seat belt remains unbuckled and vehicle speed is greater than 8 km/h (5 mph).
- Three minutes after previous seat belt status reminder event
- The IPC performs the displays test at the start of each ignition cycle.

Important: The front passenger seat is equipped with a passenger presence system (PPS), which detects an occupant. If the PPS detects an empty front passenger seat, then the passenger fasten safety belt indicator will be disabled.

The passenger fasten safety belt indicator will illuminate when any of the following occur:

- Twenty-five seconds after the ignition is ON and the front passenger seat belt remains unbuckled with passenger present
- The front passenger seat belt remains unbuckled with passenger present and vehicle speed is greater than 5 mph (8 km/h).
- Three minutes after previous seat belt status reminder event
- The IPC performs the displays test at the start of each ignition cycle.

Refer to Symptoms - Seat Belts in order to diagnose faults of the fasten safety belt indicators.

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