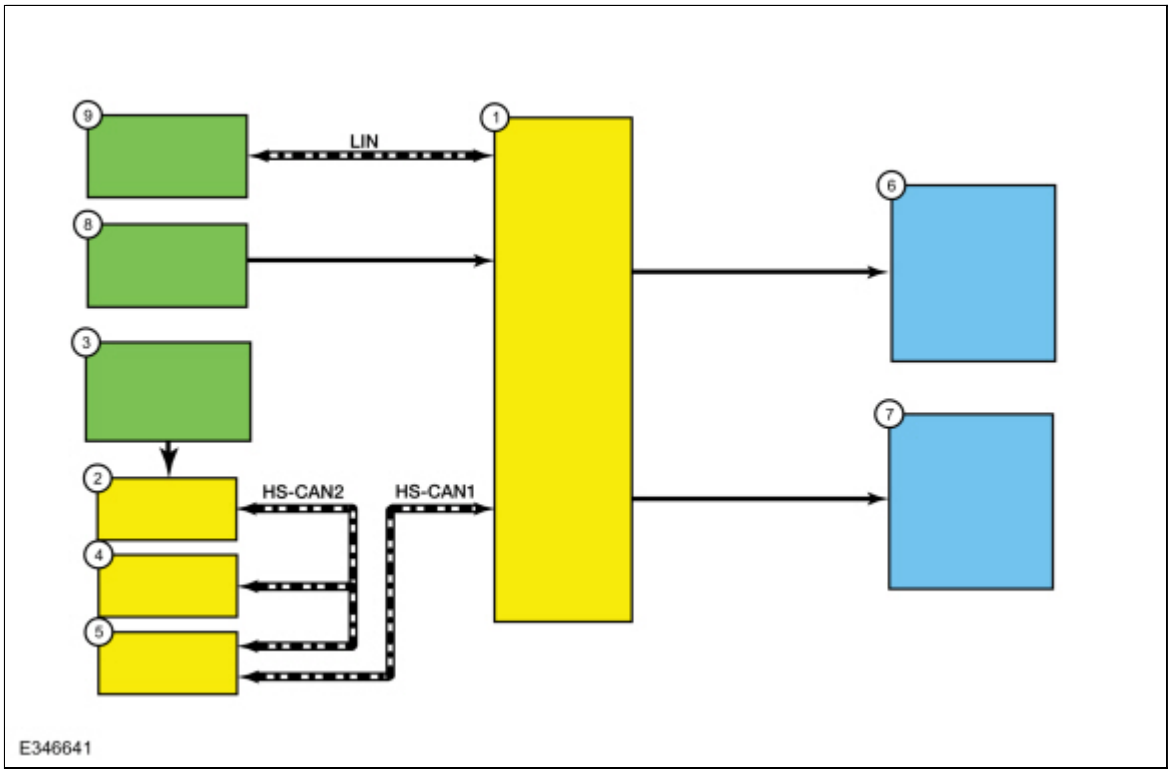
Exterior Lighting - System Operation and Component Description

System Operation

Headlamps - Halogen Headlamps

System Diagram



Item	Description
1	BCM
2	SCCM
3	LH steering column multifunction switch
4	IPMA
5	GWM
6	LH headlamp
7	RH headlamp
8	Ignition or start/stop switch
9	Headlamp switch

Network Message Chart

BCM Network Input Messages

Broadcast Message	Originating Module	Message Purpose
Headlamp flash to pass status	SCCM	Indicates to the BCM a request for the high beams or flash-to-pass.

Auto high beam request	IPMA	Indicates to the BCM a request for the high beams based on the IPMA camera input.

Low Beams

The headlamp switch sends a status message over the LIN circuit to the BCM to indicate the headlamp switch status (position or a fault with the headlamp switch). The BCM turns the parking lamps and headlamps on when the ignition is in RUN and the BCM detects a fault from the headlamp switch or wiring. This is normal behavior of the BCM when a fault has been detected with the inputs from the headlamp switch.

When the BCM reads a request for the headlamps on, it supplies voltage to the headlamp low beam bulb within each headlamp assembly.

The BCM also provides Field Effect Transistor (FET) protection of the low beam output circuits. When an excessive current draw is detected, the BCM disables the affected circuit driver.

High Beams

The SCCM monitors the LH steering column multifunction switch for a high beam request. When the LH steering column multifunction switch is in the HIGH BEAMS position, the SCCM sends a message over the HS-CAN2 to the GWM , then the GWM sends the message to the BCM over the HS-CAN1 .

When the BCM receives a request for high beams, it supplies voltage to the headlamp high beam bulb within each headlamp assembly.

The BCM also provides Field Effect Transistor (FET) protection of the exterior lamps switched voltage and high beam output circuits. When an excessive current draw is detected, the BCM disables the affected circuit driver.

Automatic High Beams

The automatic high beam system uses a camera to monitor surrounding traffic conditions and high beam usage. The camera is part of the IPMA . The IPMA communicates light information over the HS-CAN2 to the GWM then the GWM sends the information to the BCM over the HS-CAN1 .

The automatic high beam feature is active only when the headlamp switch is in the AUTOLAMPS position.

During nighttime driving, the automatic high beam system automatically turns the high beams on if it is dark enough and no other traffic is present. When the system detects an approaching vehicle's headlamps or a preceding vehicle's rear lamps, the system turns off the high beams. When the approaching vehicle's headlamps or the preceding vehicle's rear lamps are no longer detected, the high beams automatically turn back on.

The IPMA turns the high beam headlamps on when the following conditions are met:

- The feature has been enabled using the message center
- The headlamp switch is in the AUTOLAMPS position and the autolamps feature has turned the exterior lamps on
- The vehicle speed is greater than 51 km/h (32 mph)
- The IPMA determines the ambient lighting conditions are dark enough
- The IPMA does not detect any light source that can be interpreted as an illuminated vehicle lamp

The IPMA turns the high beams off if any of the following occur:

- The IPMA detects any light source that can be interpreted as an illuminated vehicle lamp
- The IPMA determines the ambient lighting conditions are not dark enough
- The vehicle speed falls below 44 km/h (27 mph)
- The autolamps are turned off
- The IPMA determines the view is blocked

Flash-To-Pass

The SCCM monitors the LH steering column multifunction switch for a flash-to-pass request. When the LH steering column multifunction switch is in the FLASH-TO-PASS position, the SCCM sends a message over the HS-CAN2 to the GWM then the GWM sends the message to the BCM over the HS-CAN1 .

When the ignition is in RUN and the flash-to-pass is requested, the high beams are activated as long as the LH steering column multifunction switch is held in the flash-to-pass position.

Headlamp Exit Delay

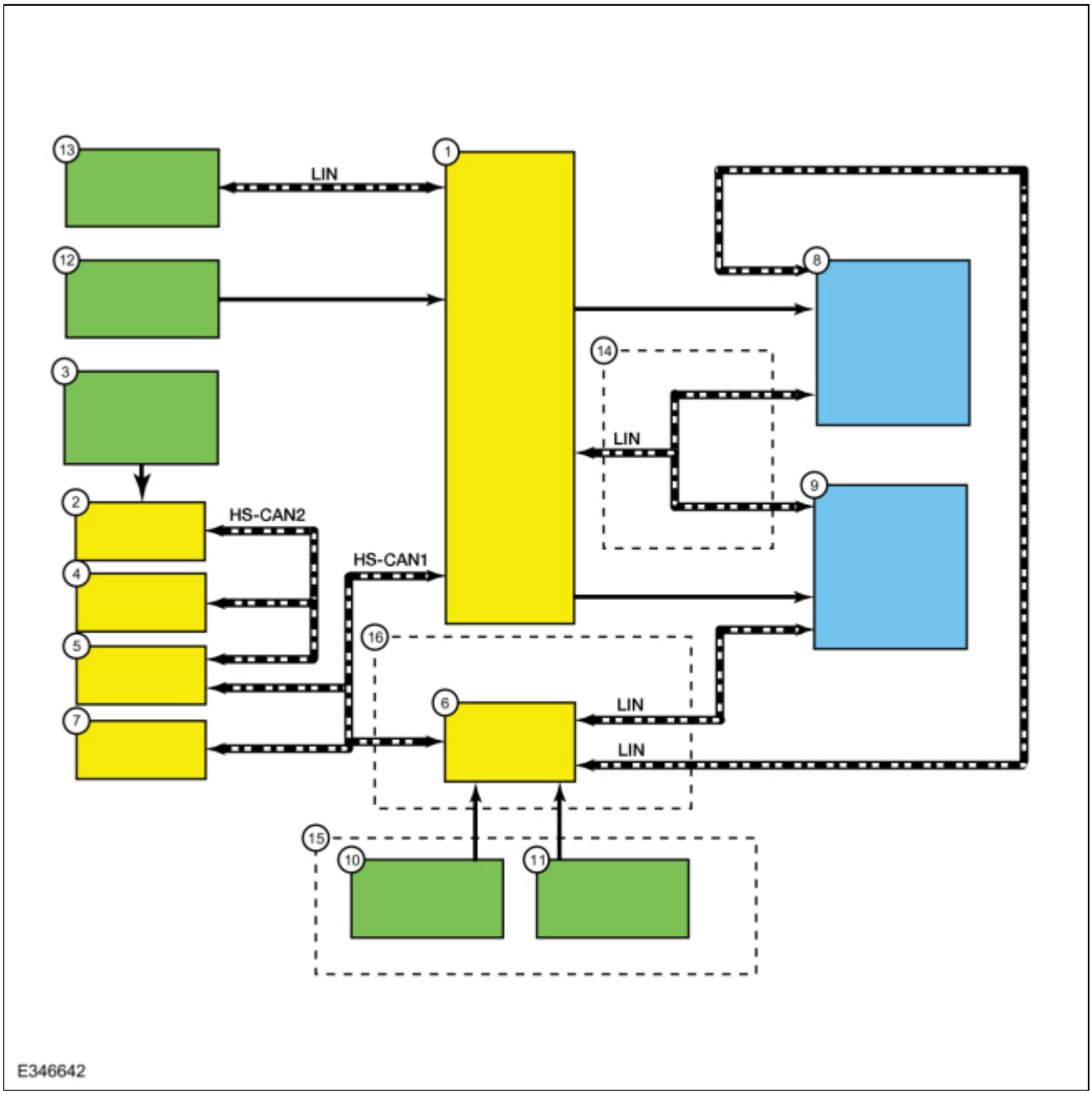
When the ignition is OFF and the LH steering column multifunction switch is placed in the FLASH-TO-PASS position and released, the parking lamps and low beams are illuminated. They remain illuminated until:

- 3 minutes have elapsed with a door open.
- 30 seconds have elapsed after all doors are closed.
- the LH steering column multifunction switch is placed in the flash-to-pass position again.
- the ignition switches to RUN.

Within the 30 second delay and all the doors closed, opening any door results in the 3 minute timer restarting.

Headlamps - LED Headlamps - Except Electric Vehicles

System Diagram



Item	Description
1	BCM
2	SCCM
3	LH steering column multifunction switch
4	IPMA
5	GWM
6	HCM
7	PCM
8	LH headlamp
9	RH headlamp
10	LH front suspension height sensor
11	LH rear suspension height sensor
12	Ignition or start/stop switch
13	Headlamp switch
14	Low series only

15	With automatic headlamp leveling
16	With headlamp leveling and/or high series headlamps

Network Message Chart

BCM Network Input Messages

Broadcast Message	Originating Module	Message Purpose
Headlamp flash to pass status	SCCM	Indicates to the BCM a request for the high beams or flash-to-pass.
Auto high beam request	IPMA	Indicates to the BCM a request for the high beams based on the IPMA camera input.

Low Beams

The headlamp switch sends a status message over the LIN circuit to the BCM to indicate the headlamp switch status (position or a fault with the headlamp switch). The BCM turns the parking lamps and headlamps on when the ignition is in RUN and the BCM detects a fault from the headlamp switch or wiring. This is normal behavior of the BCM when a fault has been detected with the inputs from the headlamp switch.

The BCM supplies voltage to the LED control module mounted on each headlamp assembly when the ignition is on. The LED control module then provides the proper voltage to the low beam LED in each headlamp assembly.

The BCM also provides Field Effect Transistor (FET) protection of the exterior lamps switched voltage and low beam output circuits. When an excessive current draw is detected, the BCM disables the affected circuit driver.

High Beams - Low Series LED Headlamps

The SCCM monitors the LH steering column multifunction switch for a high beam request. When the LH steering column multifunction switch is in the HIGH BEAMS position, the SCCM sends a message over the HS-CAN2 to the GWM , then the GWM sends the message to the BCM over the HS-CAN1 .

The BCM supplies voltage to the LED control module mounted on each headlamp assembly when the ignition is on. .

When the BCM reads a request for the high beams, it sends a message through the headlamp LIN circuit to the LED control module mounted on each headlamp assembly. The LED control module then provides the proper voltage to the high beam Light Emitting Diodes (LEDs) in each headlamp assembly.

When the low beams are on and the BCM receives a request for high beams, low beam Light Emitting Diodes (LEDs) remains powered on and the high beam Light Emitting Diodes (LEDs) are also illuminated. This changes the headlamp beam pattern to illuminate a greater distance.

The BCM also provides Field Effect Transistor (FET) protection of the exterior lamps switched voltage and high beam output circuits. When an excessive current draw is detected, the BCM disables the affected circuit driver.

High Beams - High Series LED Headlamps

The SCCM monitors the LH steering column multifunction switch for a high beam request. When the LH steering column multifunction switch is in the HIGH BEAMS position, the SCCM sends a message over the HS-CAN2 to the HCM .

The BCM supplies voltage to the LED control module mounted on each headlamp assembly when the ignition is on. .

When the HCM reads a request for the high beams, it sends a message through the headlamp LIN circuit to the LED control module mounted on each headlamp assembly. The LED control module then provides the proper voltage to the high beam Light Emitting Diodes (LEDs) in each headlamp assembly.

When the low beams are on and the HCM receives a request for high beams, low beam Light Emitting Diodes (LEDs)

remains powered on and the high beam Light Emitting Diodes (LEDs) are also illuminated. This changes the headlamp beam pattern to illuminate a greater distance.

The BCM also provides Field Effect Transistor (FET) protection of the exterior lamps switched voltage and high beam output circuits. When an excessive current draw is detected, the BCM disables the affected circuit driver.

Automatic High Beams - Low Series LED Headlamps

The automatic high beam system uses a camera to monitor surrounding traffic conditions and high beam usage. The camera is part of the IPMA . The IPMA communicates light information over the HS-CAN2 to the GWM then the GWM sends the information to the BCM over the HS-CAN1 .

The automatic high beam feature is active only when the headlamp switch is in the AUTOLAMPS position.

During nighttime driving, the automatic high beam system automatically turns the high beams on if it is dark enough and no other traffic is present. When the system detects an approaching vehicle's headlamps or a preceding vehicle's rear lamps, the system turns off the high beams. When the approaching vehicle's headlamps or the preceding vehicle's rear lamps are no longer detected, the high beams automatically turn back on.

The IPMA turns the high beam headlamps on when the following conditions are met:

- The feature has been enabled using the message center
- The headlamp switch is in the AUTOLAMPS position and the autolamps feature has turned the exterior lamps on
- The vehicle speed is greater than 51 km/h (32 mph)
- The IPMA determines the ambient lighting conditions are dark enough
- The IPMA does not detect any light source that can be interpreted as an illuminated vehicle lamp

The IPMA turns the high beams off if any of the following occur:

- The IPMA detects any light source that can be interpreted as an illuminated vehicle lamp
- The IPMA determines the ambient lighting conditions are not dark enough
- The vehicle speed falls below 44 km/h (27 mph)
- The autolamps are turned off
- The IPMA determines the view is blocked

Automatic High Beams - High Series LED Headlamps

The automatic high beam system uses a camera to monitor surrounding traffic conditions and high beam usage. The camera is part of the IPMA . The IPMA communicates light information over the HS-CAN2 to the HCM .

The automatic high beam feature is active only when the headlamp switch is in the AUTOLAMPS position.

During nighttime driving, the automatic high beam system automatically turns the high beams on if it is dark enough and no other traffic is present. When the system detects an approaching vehicle's headlamps or a preceding vehicle's rear lamps, the system turns off the high beams. When the approaching vehicle's headlamps or the preceding vehicle's rear lamps are no longer detected, the high beams automatically turn back on.

The IPMA turns the high beam headlamps on when the following conditions are met:

- The feature has been enabled using the message center
- The headlamp switch is in the AUTOLAMPS position and the autolamps feature has turned the exterior lamps on
- The vehicle speed is greater than 51 km/h (32 mph)
- The IPMA determines the ambient lighting conditions are dark enough
- The IPMA does not detect any light source that can be interpreted as an illuminated vehicle lamp

The IPMA turns the high beams off if any of the following occur:

- The IPMA detects any light source that can be interpreted as an illuminated vehicle lamp
- The IPMA determines the ambient lighting conditions are not dark enough

- The vehicle speed falls below 44 km/h (27 mph)
- The autolamps are turned off
- The IPMA determines the view is blocked

Flash-To-Pass - Low Series LED Headlamps

The SCCM monitors the LH steering column multifunction switch for a flash-to-pass request. When the LH steering column multifunction switch is in the FLASH-TO-PASS position, the SCCM sends a message over the HS-CAN2 to the GWM then the GWM sends the message to the BCM over the HS-CAN1 .

When the ignition is in RUN and the flash-to-pass is requested, the high beams are activated as long as the LH steering column multifunction switch is held in the flash-to-pass position.

Flash-To-Pass - High Series LED Headlamps

The SCCM monitors the LH steering column multifunction switch for a flash-to-pass request. When the LH steering column multifunction switch is in the FLASH-TO-PASS position, the SCCM sends a message over the HS-CAN2 to the GWM then the GWM sends the message to the BCM over the HS-CAN1 HCM .

When the ignition is in RUN and the flash-to-pass is requested, the high beams are activated as long as the LH steering column multifunction switch is held in the flash-to-pass position.

Headlamp Exit Delay

When the ignition is OFF and the LH steering column multifunction switch is placed in the FLASH-TO-PASS position and released, the parking lamps and low beams are illuminated. They remain illuminated until:

- 3 minutes have elapsed with a door open.
- 30 seconds have elapsed after all doors are closed.
- the LH steering column multifunction switch is placed in the flash-to-pass position again.
- the ignition switches to RUN.

Within the 30 second delay and all the doors closed, opening any door results in the 3 minute timer restarting.

Glare-Free High Beams - High Series LED Headlamps

The high series LED headlamps are equipped with glare-free high beams. When an approaching vehicle is detected some high beam Light Emitting Diodes (LEDs) behind the projector lens turn off to change the beam pattern to prevent glare to the approaching vehicle.

The glare-free high beams will turn on when:

- the headlamp switch is in the AUTOLAMPS position.
- the ambient light level is low enough.
- the vehicle speed is greater than 32 mph (52 km/h).

The glare-free high beams will turn off when:

- the system detects reduced visibility, such as severe rain, snow or fog.
- the ambient light level is high enough.
- the vehicle speed is less than 19 mph (30 km/h).

The glare-free high-beams can be switched ON/OFF with the touchscreen.

Automatic Headlamp Leveling

The headlamp beam height is automatically adjusted according to vehicle load, speed, acceleration and braking data received from the ABS module and PCM .

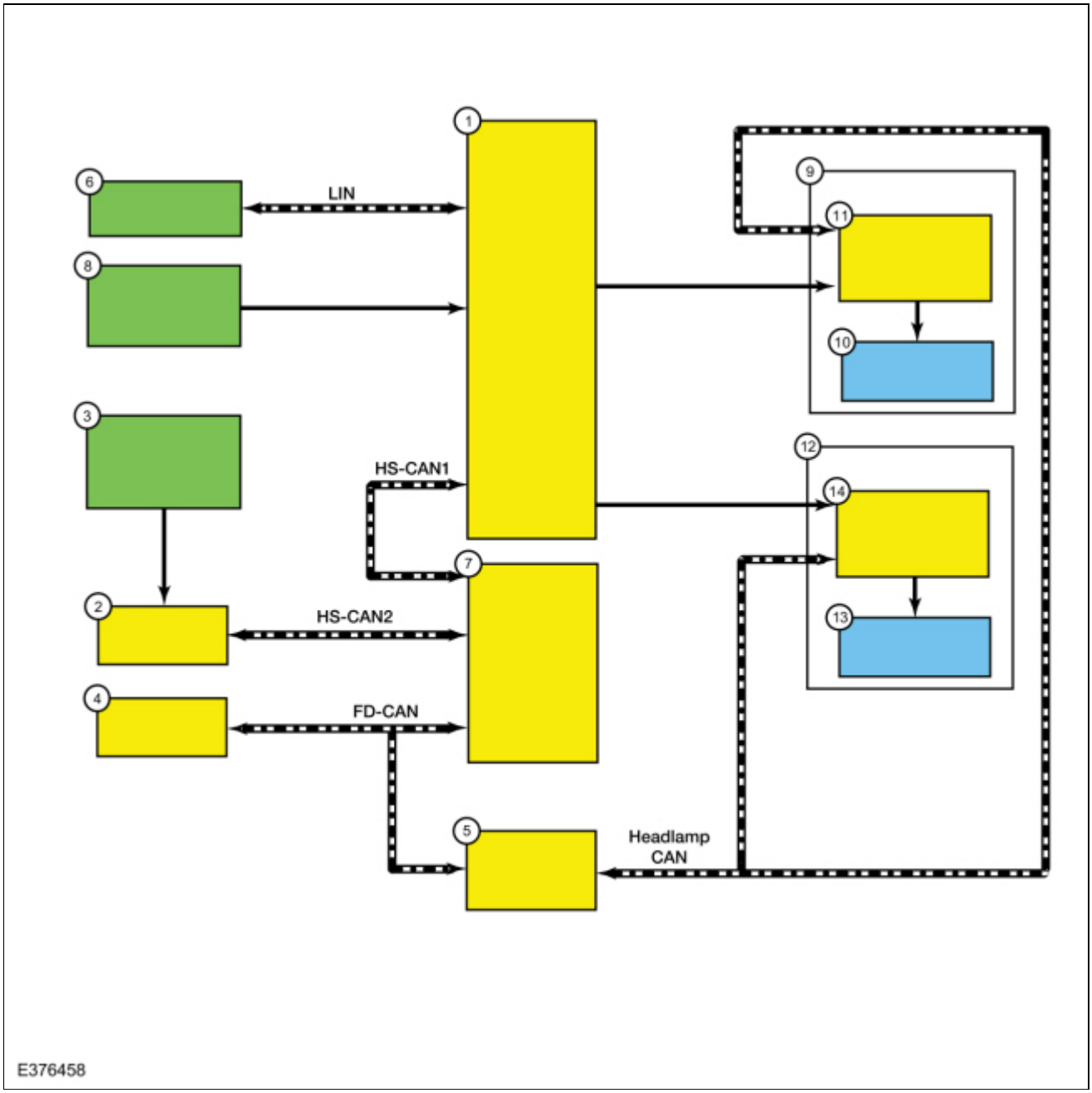
The front lighting uses a HCM to command the up/down aiming of the headlamp adaptive lighting LED through the LIN to the headlamp assemblies. The headlamp assemblies contain a module that receives the messages through the LIN from the HCM .

Depending on the inputs received (steering wheel angle and vehicle speed for example), the HCM can command the height at which the headlamp LED is aimed (up or down) to improve nighttime visibility. Automatic headlamp leveling is activated when the headlamp switch is in the HEADLAMPS or AUTOLAMPS position.

When the LED control module first receives voltage when the ignition is on the and LED control module commands the headlamps up and down to initialize the system. During the initialization, the HCM runs diagnostics on the system and set Diagnostic Trouble Codes (DTCs) for applicable system faults.

Headlamps - LED Headlamps - Electric Vehicles Only

System Diagram



Item	Description
1	BCM
2	SCCM

3	LH steering column multifunction switch
4	IPMA
5	HCM
6	Headlamp switch
7	GWM
8	Ignition or start/stop switch
9	LH headlamp
10	Low and high beam Light Emitting Diodes (LEDs)
11	LDCMA
12	RH headlamp
13	Low and high beam Light Emitting Diodes (LEDs)
14	LDCMB

Network Message Chart

BCM Network Input Messages

Broadcast Message	Originating Module	Message Purpose
Headlamp flash to pass status	SCCM	Indicates to the BCM a request for the high beams or flash-to-pass.

SCCM Network Input Messages

Broadcast Message	Originating Module	Message Purpose
Auto high beam request	IPMA	Indicates to the SCCM a request for the high beams based on the IPMA camera input.

Low Beams

The headlamp switch sends a status message over the LIN circuit to the BCM to indicate the headlamp switch status (position or a fault with the headlamp switch). The BCM turns the parking lamps and headlamps on when the ignition is in RUN and the BCM detects a fault from the headlamp switch or wiring. This is normal behavior of the BCM when a fault has been detected with the inputs from the headlamp switch.

When the BCM receives a message requesting the headlamps on, it supplies voltage to the headlamp mounted LDCM . The LDCM sends voltage to the low beam Light Emitting Diodes (LEDs) in each headlamp assembly.

The LDCM is mounted to the outside of the headlamp assembly and is individually replaceable.

The BCM also provides Field Effect Transistor (FET) protection of the low beam output circuits. When an excessive current draw is detected, the BCM disables the affected circuit driver.

High Beams

The SCCM monitors the LH steering column multifunction switch for a high beam request. When the LH steering column multifunction switch is in the HIGH BEAMS position, the SCCM sends a message over the HS-CAN2 to the GWM , then the GWM sends the message to the BCM over the HS-CAN1 .

When the low beams are on and the BCM receives a request for high beams:

- the low beam Light Emitting Diodes (LEDs) remains powered on and high beam Light Emitting Diodes (LEDs) are also illuminated. This changes the headlamp beam pattern to illuminate a greater distance.
- the BCM sends a high beam request to the GWM through the HS-CAN1 circuit.
- the GWM sends the high beam request to the HCM through the FD-CAN circuit.
- the HCM sends the high beam request to the headlamp mounted LDCM through a private CAN circuit.

Flash-To-Pass

The SCCM monitors the LH steering column multifunction switch for a flash-to-pass request. When the LH steering column multifunction switch is in the FLASH-TO-PASS position, the SCCM sends a message over the HS-CAN2 to the GWM then the GWM sends the message to the BCM over the HS-CAN1 .

When the ignition is in RUN and the flash-to-pass is requested, the high beams are activated as long as the LH steering column multifunction switch is held in the flash-to-pass position.

Automatic High Beams

The automatic high beam system uses an interior rear view mirror mounted camera to monitor surrounding traffic conditions and high beam usage. The IPMA communicates light information over the FD-CAN to the GWM then the GWM sends the information to the BCM over the HS-CAN1 .

The automatic high beam feature is active only when the headlamp switch is in the AUTOLAMPS position.

During nighttime driving, the automatic high beam system automatically turns the high beams on if it is dark enough and no other traffic is present. When the system detects an approaching vehicle's headlamps or a preceding vehicle's rear lamps, the system turns off the high beams. When the approaching vehicle's headlamps or the preceding vehicle's rear lamps are no longer detected, the high beams automatically turn back on.

The IPMA turns the high beam headlamps on when all of the following conditions are met:

- The feature has been enabled using the message center.
- The headlamp switch is in the AUTOLAMPS position and the autolamps feature has turned the exterior lamps on.
- The vehicle speed is greater than 51 km/h (32 mph).
- The IPMA determines the ambient lighting conditions are dark enough.
- The IPMA does not detect any light source that can be interpreted as an illuminated vehicle lamp.

The IPMA turns the high beams off if any of the following occur:

- The IPMA detects any light source that can be interpreted as an illuminated vehicle lamp.
- The IPMA determines the ambient lighting conditions are not dark enough.
- The vehicle speed falls below 44 km/h (27 mph).
- The autolamps are turned off.
- The IPMA determines the view is blocked.

Headlamp Exit Delay

When the ignition is OFF and the LH steering column multifunction switch is placed in the FLASH-TO-PASS position and released, the parking lamps and low beams are illuminated. They remain illuminated until:

- 3 minutes have elapsed with a door open.
- 30 seconds have elapsed after all doors are closed.
- the LH steering column multifunction switch is placed in the flash-to-pass position again.
- the ignition switches to RUN.

Within the 30 second delay and all the doors closed, opening any door results in the 3 minute timer restarting.

Adaptive Front Lighting (Dynamic Bending)

The front lighting uses a HCM to command the left/right aiming of the bottom headlamp Light Emitting Diodes (LEDs)

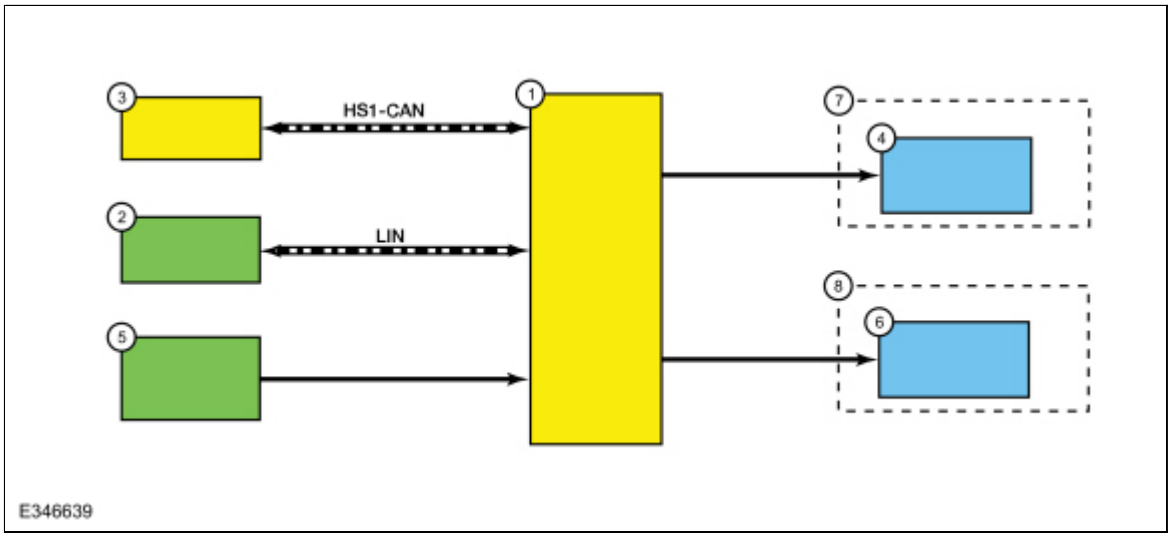
through the headlamp proprietary CAN to the headlamp assemblies.

The headlamp mounted LDCM receives the messages through the headlamp proprietary CAN from the HCM .

Depending on the inputs received (steering wheel angle and vehicle speed for example), the HCM can command the angle at which the headlamps are aimed (left or right) to improve nighttime visibility around curves. Adaptive front lighting is only activated when the headlamp switch is in the AUTOLAMPS position.

DRL - Except Electric Vehicles

System Diagram



Item	Description
1	BCM
2	Headlamp switch
3	PCM
4	Low beam bulbs
5	Ignition or start/stop switch
6	LED DRL /front parking lamps
7	Halogen headlamps
8	LED Headlamps

Network Message Chart

BCM Network Input Messages

Broadcast Message	Originating Module	Message Purpose
Gear position	PCM	Indicates the GSM request to the BCM . When the GSM has selected any position other than park, the BCM activates the DRL .

DRL

For halogen headlamps, the DRL system utilizes the existing circuitry and components from the headlamp low beam system. The DRL system operates the low beam headlamps at a reduced intensity.

For LED headlamps, the DRL system operates the DRL /parking surround Light Emitting Diodes (LEDs) at full intensity using a PWM voltage circuit.

The BCM monitors the ignition status, the headlamp switch and autolamp status.

When the ignition is in ON, the BCM supplies voltage to each headlamp assembly.

The BCM monitors the ignition status, the headlamp switch and autolamp status.

There are two types of DRL, conventional (where it is required) and configurable.

When equipped with conventional DRL, the DRL are active in any headlamp switch position except the HEADLAMPS position.

The conventional DRL are activated when all of the following conditions are met:

- The ignition is ON.
- The headlamps switch is in OFF, PARKLAMPS or AUTOLAMPS position and the headlamps have not been turned on by the autolamp system.
- The transmission is not in PARK.

When equipped with configurable DRL, the DRL may be enabled through the IPC message center. When enabled, the DRL are active only in the AUTOLAMPS headlamp position. When autolamps request the headlamps on, the DRL are deactivated.

The configurable DRL are activated when all of the following conditions are met:

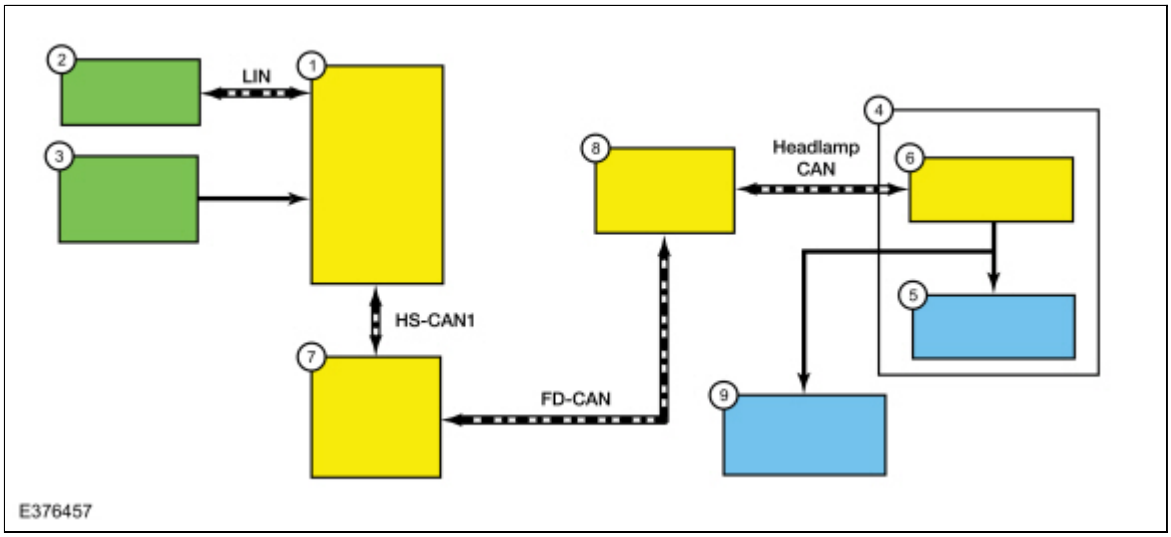
- The ignition is ON.
- The headlamps switch is in AUTOLAMPS position and the headlamps have not been turned on by the autolamp system.
- The transmission is not in PARK.

When the transmission is in not in PARK, the PCM sends a message over the HS-CAN1 to the BCM indicating the transmission is not in PARK.

For halogen headlamps, the BCM also provides Field Effect Transistor (FET) protection of the exterior lamps switched voltage and DRL output circuits. When an excessive current draw is detected, the BCM disables the affected circuit driver.

DRL - Electric Vehicles Only

System Diagram



Item	Description
1	BCM
2	Headlamp switch

3	Ignition or start/stop switch
4	Headlamp
5	LED DRL /front parking lamps
6	LDCM
7	GWM
8	HCM
9	Grille mounted LED DRL parking lamps

DRL

The BCM monitors the ignition status, the headlamp switch and autolamp status.

When the BCM requests the DRL on:

- the BCM sends a DRL request to the GWM through the HS-CAN1 circuit.
- the GWM sends the DRL request to the HCM through the FD-CAN circuit.
- the HCM sends the DRL request to the headlamp mounted LDCM through a private CAN circuit.
- the LDCM illuminates the grille mounted and headlamp LED DRL /front parking lamps at full intensity.

There are two types of DRL , conventional (where it is required) and configurable.

When equipped with conventional DRL , the DRL are active in any headlamp switch position except the HEADLAMPS position.

The conventional DRL are activated when all of the following conditions are met:

- The ignition is ON.
- The headlamps switch is in OFF, PARKLAMPS or AUTOLAMPS position and the headlamps have not been turned on by the autolamp system.
- The transmission is not in PARK.

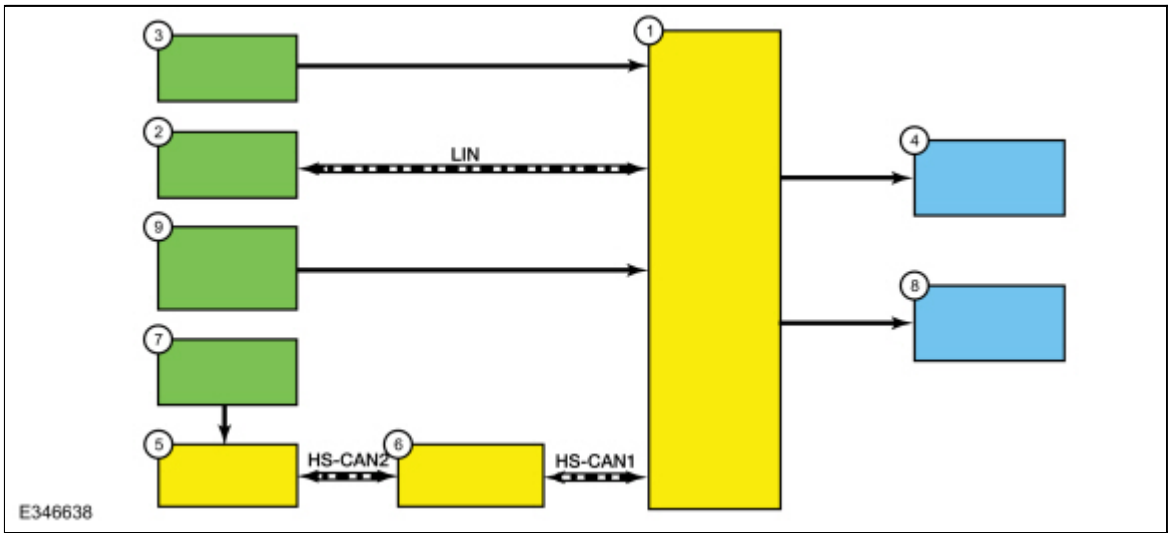
When equipped with configurable DRL , the DRL may be enabled through the IPC message center. When enabled, the DRL are active only in the AUTOLAMPS headlamp position. When autolamps request the headlamps on, the DRL are deactivated.

The configurable DRL are activated when all of the following conditions are met:

- The ignition is ON.
- The headlamps switch is in AUTOLAMPS position and the headlamps have not been turned on by the autolamp system.
- The transmission is not in PARK.

Autolamps

System Diagram



Item	Description
1	BCM
2	Headlamp switch
3	Light sensor
4	Low beams
5	SCCM
6	GWM
7	Wiper/Washer switch
8	Parking lamps
9	Ignition or start/stop switch

Network Message Chart

BCM Network Input Messages

Broadcast Message	Originating Module	Message Purpose
Front wiper status	SCCM	The BCM uses the wiper status information for the operation of the wiper activated headlamps feature.

Autolamps

The BCM monitors the light sensor with a voltage signal. The light sensor input to the BCM varies with the ambient light conditions.

The BCM monitors the headlamp switch circuits to indicate the headlamp switch position.

When the BCM receives a headlamp switch status indicating a request for the autolamps, the BCM monitors the light sensor for the ambient light condition. If the BCM determines the ambient light level is dark, the BCM supplies voltage to the exterior lamps.

Headlamps On With Wipers On Function

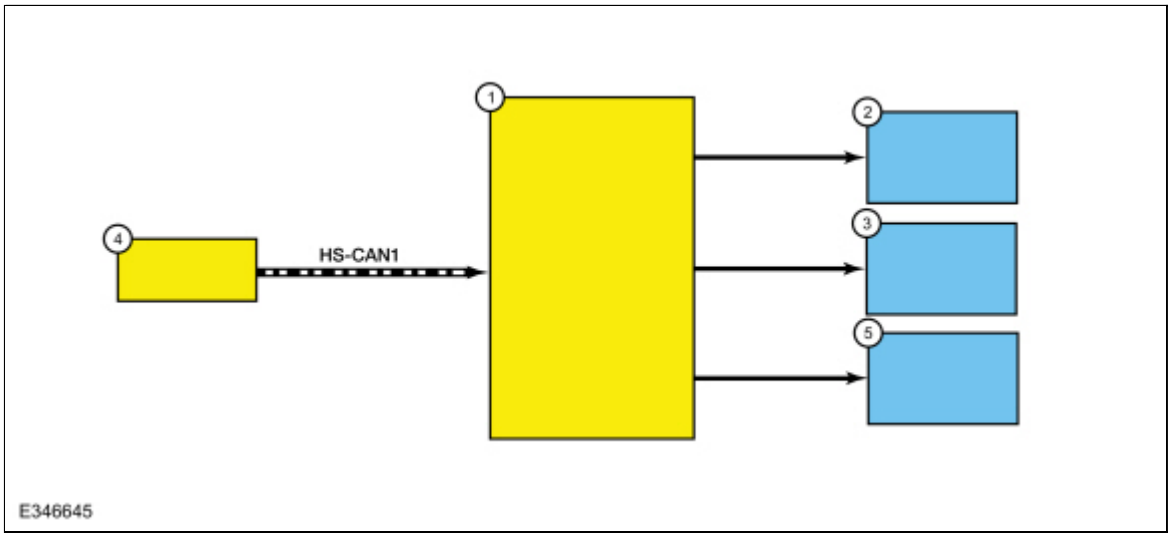
When the headlamp switch is in the autolamps position, the exterior lamps turn on when the front wipers are in low or high. This feature does not activate the exterior lamps during a mist wipe, while the wipers are on to clear washer fluid during a wash condition or if the wipers are in automatic or intermittent modes.

The exterior lamps turn off when the ignition switches OFF or to ACC mode, the headlamp switch is placed in the off

position, or the front wipers are turned off. The exception to this is when the exterior lights are on because of darkness determined by the autolamp system.

Stoplamps

System Diagram



Item	Description
1	BCM
2	LH rear lamp assembly
3	High mounted stoplamp
4	PCM
5	RH rear lamp assembly

Stoplamps

The brake pedal switch is part of the EBB . When the brake pedal is applied, the PCM sends a message over the HS-CAN1 to the BCM . When the BCM receives the message, the BCM then supplies voltage to the stoplamps.

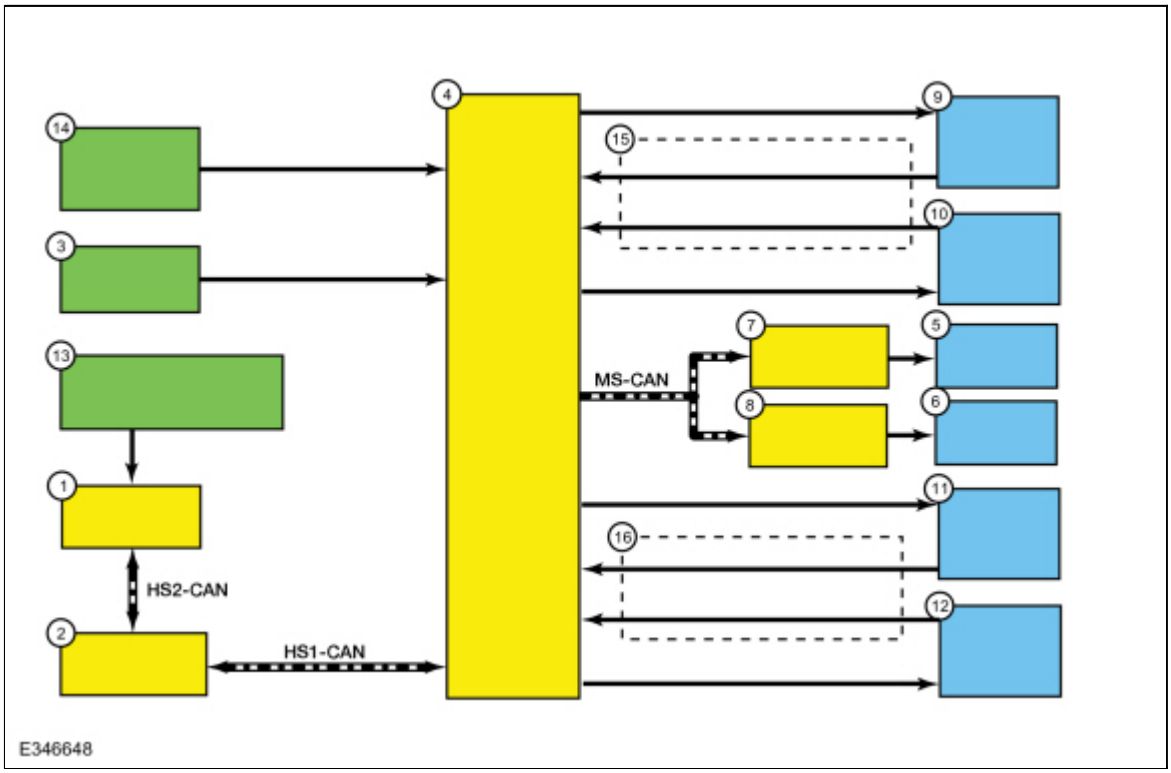
The BCM does not activate the stoplamps when the ignition is in OFF or ACC.

The BCM uses 3 separate output circuits. The LH stop lamp output circuit, RH stop lamp output circuit and high-mounted stoplamp output circuit.

The BCM also provides Field Effect Transistor (FET) protection of the stoplamp output circuits. When an excessive current draw is detected, the BCM disables the affected stoplamp circuit driver.

Turn Signal and Hazard Lamps - Except Electric Vehicles

System Diagram



Item	Description
1	SCCM
2	GWM
3	Hazard switch
4	BCM
5	LH exterior mirror
6	RH exterior mirror
7	DDM
8	PDM
9	LH front turn lamp
10	RH front turn lamp
11	LH rear turn lamp
12	RH rear turn lamp
13	LH steering column multifunction switch
14	Ignition or start/stop switch
15	High series LED headlamps only
16	LED rear lamps only

Network Message Chart

BCM Network Input Messages

Broadcast Message	Originating Module	Message Purpose
Turn signal switch status	SCCM	Indicates the turn signal stalk position on the LH steering column multifunction switch (left/right lane change or turn signal on or off). The BCM activates the left/right turn signals based on this input.

DDM and PDM Network Input Messages

Broadcast Message	Originating Module	Message Purpose
Turn indication request	BCM	A command to the DDM or PDM to activate/deactivate the exterior mirror turn indicator.

Turn Signals - Halogen Headlamps, Low Series LED Headlamps And Incandescent Rear Lamps

The SCCM monitors the LH steering column multifunction switch position. When the LH steering column multifunction switch is in the left or right turn position, the SCCM sends a message over the HS-CAN2 to the GWM then the GWM sends the message to the BCM over the HS-CAN1 indicating a request for the LH or RH turn signal.

When the BCM receives a request for a turn signal, the BCM supplies on/off voltage to the appropriate turn lamps. The BCM sends a turn indicator command message over the MS-CAN to the door modules for the exterior mirror turn lamps.

The timed on/off cycle for turn lamps is determined by the BCM and is set to flash approximately 70 times per minute if both the front and rear turn signal lamps operate correctly.

If a front or rear turn signal lamp is inoperative, the IPC fast flashes the appropriate turn indicator approximately 150 times per minute to indicate a bulb outage to the driver.

The LH steering column multifunction switch has 2 detents for the left turn position and 2 detents for the right turn position. When placed in the first detent and released, the corresponding turn signals flash 3 times and turn off. When the LH steering column multifunction switch is moved to the second detent, the turn signal flashes until the steering wheel is turned in the opposite direction and the clockspring mechanically returns the LH steering column multifunction switch to the neutral position and cancels the turn signal.

The BCM also provides Field Effect Transistor (FET) protection of the turn lamp output circuits. When an excessive current draw is detected, the BCM or BCMB disables the affected turn lamp circuit driver.

Turn Signals - High Series LED Headlamps and LED Rear Lamps

The SCCM monitors the LH steering column multifunction switch position. When the LH steering column multifunction switch is in the left or right turn position, the SCCM sends a message over the HS-CAN2 to the GWM then the GWM sends the message to the BCM over the HS-CAN1 indicating a request for the LH or RH turn signal.

When the BCM receives a request for a turn signal, the BCM supplies on/off voltage to the appropriate turn lamps. The BCM sends a turn indicator command message over the MS-CAN to the door modules for the exterior mirror turn lamps.

The timed on/off cycle for turn lamps is determined by the BCM and is set to flash approximately 70 times per minute if both the front and rear turn signal lamps operate correctly.

When equipped with LED headlamps or rear lamps, the turn lamps are Light Emitting Diodes (LEDs) and have an outage circuit that tells the BCM when the Light Emitting Diodes (LEDs) are inoperative. During normal operation, when voltage is applied to the rear turn Light Emitting Diodes (LEDs), the feedback circuit sends the same voltage back to the BCM through the outage circuit. If the Light Emitting Diodes (LEDs) are inoperative the BCM will not receive this voltage feedback through the outage circuit.

If a front or rear turn signal lamp is inoperative, the IPC fast flashes the appropriate turn indicator approximately 150 times per minute to indicate a bulb outage to the driver.

The LH steering column multifunction switch has two detents for the left turn position and 2 detents for the right turn position. When placed in the first detent and released, the corresponding turn signals flash 3 times and turn off. When the LH steering column multifunction switch is moved to the second detent, the turn signal flashes until the steering wheel is turned in the opposite direction and the clockspring mechanically returns the LH steering column multifunction switch to the neutral position and cancels the turn signal.

The headlamps utilize a LED control module, mounted to each headlamp assembly, that controls the voltage to the high beam, low beam, parking and turn Light Emitting Diodes (LEDs) within the headlamp assembly and the low beam DRL function.

The BCM also provides Field Effect Transistor (FET) protection of the turn lamp output circuits. When an excessive current draw is detected, the BCM disables the affected turn lamp circuit driver.

Hazard Lamps

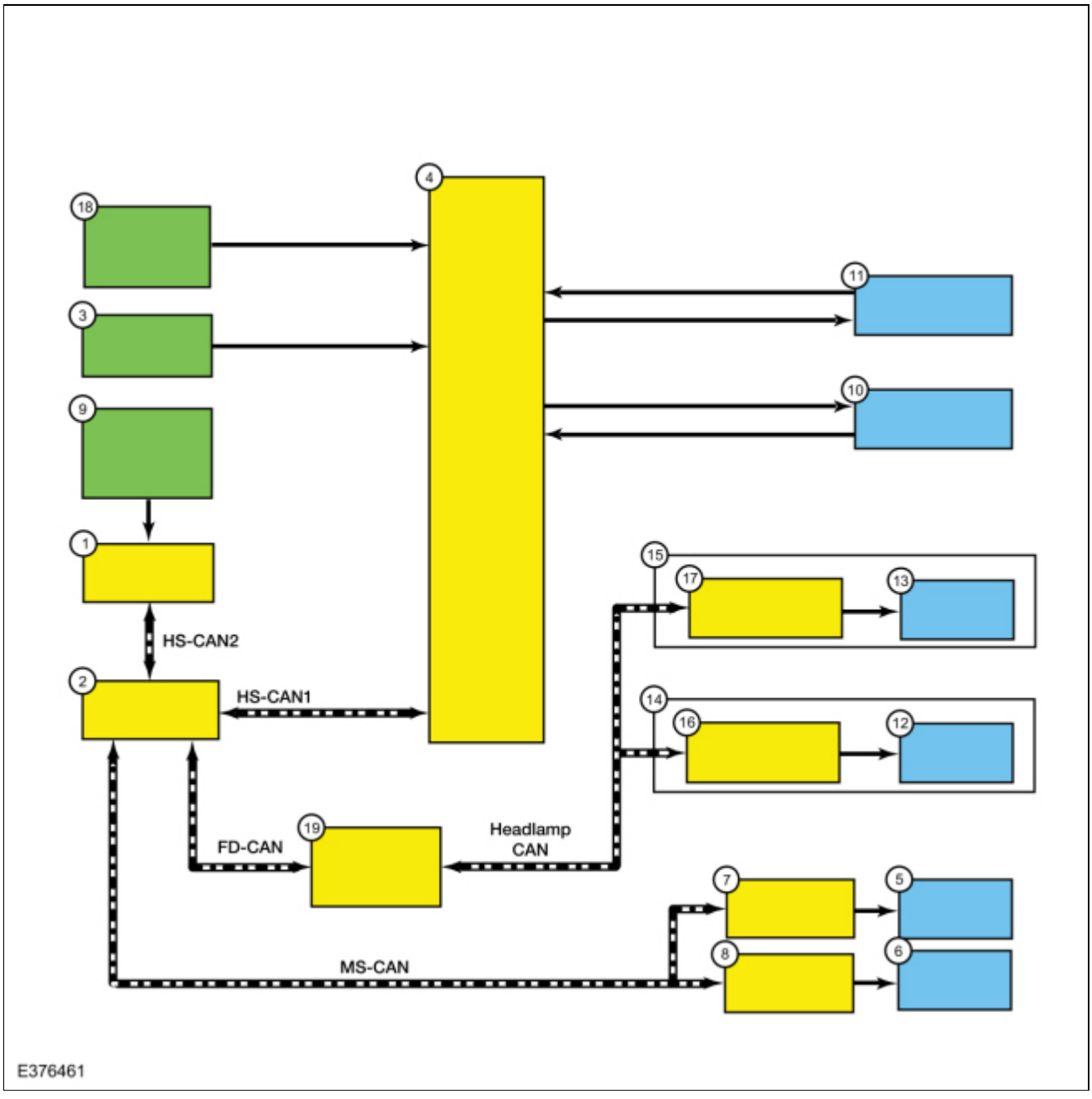
The BCM sends a voltage signal to the hazard flasher lamp switch to monitor for a hazard lamp function request. When the hazard flasher lamp switch is pressed, the voltage signal is routed to ground, indicating a request to activate or deactivate the hazard lamp function.

When the BCM receives a request for the hazard lamps, the BCM supplies on/off voltage to all the turn lamps.

The timed on/off cycle for the hazard lamps is approximately 70 times per minute, regardless of bulb outage.

Turn Signal and Hazard Lamps - Electric Vehicles Only

System Diagram



Item	Description
1	SCCM
2	GWM
3	Hazard switch
4	BCM
5	LH exterior mirror
6	RH exterior mirror
7	DDM
8	PDM
9	LH steering column multifunction switch
10	RH rear turn lamp
11	LH rear turn lamp
12	RH front turn lamp
13	LH front turn lamp
14	RH headlamp
15	LH headlamp
16	LDCMB
17	LDCMA
18	Ignition or Start/Stop switch
19	HCM

Network Message Chart

BCM Network Input Messages

Broadcast Message	Originating Module	Message Purpose
Turn signal switch status	SCCM	Indicates the turn signal stalk position on the LH steering column multifunction switch (left/right lane change or turn signal on or off). The BCM activates the left/right turn signals based on this input.

DDM and PDM Network Input Messages

Broadcast Message	Originating Module	Message Purpose
Turn indication request	BCM	A command to the DDM or PDM to activate/deactivate the exterior mirror turn indicator.

Front Turn Signals

The SCCM monitors the LH steering column multifunction switch position. When the LH steering column multifunction switch is in the LH TURN or RH TURN position, the SCCM sends a message over the HS-CAN2 to the GWM then the GWM sends the message to the BCM over the HS-CAN1 indicating a request for the LH or RH turn signal.

When the BCM requests the turn signals on:

- the BCM sends a turn signal request to the GWM through the HS-CAN1 circuit.
- the GWM sends the turn signal request to the HCM through the FD-CAN circuit.
- the HCM sends the turn signal request to the headlamp mounted LDCM through a private CAN circuit.
- the LDCM supplies on/off voltage to the turn signal lamp.

If a front turn signal lamp is inoperative, the IPC turn lamp indicator fast flashes at approximately 150 times per minute to indicate a bulb outage to the driver (the exterior turn lamps still flash at approximately 70 times per minute).

Rear Turn Signals

The SCCM monitors the LH steering column multifunction switch position. When the LH steering column multifunction switch is in the LH TURN or RH TURN position, the SCCM sends a message over the HS-CAN2 to the GWM then the GWM sends the message to the BCM over the HS-CAN1 indicating a request for the LH or RH turn signal.

When the BCM receives a request for a turn signal, the BCM supplies on/off voltage to the appropriate turn lamps.

When the BCM supplies voltage to the rear turn lamp assembly, the rear lamp assembly sends the same voltage back to the BCM through the outage circuit. If the Light Emitting Diodes (LEDs) are inoperative the BCM does not receive this voltage feedback through the outage circuit.

If a rear turn signal lamp is inoperative, the IPC turn lamp indicator fast flashes at approximately 150 times per minute to indicate a bulb outage to the driver (the exterior turn lamps still flash at approximately 70 times per minute).

The BCM also provides Field Effect Transistor (FET) protection of the turn lamp output circuits. When an excessive current draw is detected, the BCM disables the affected turn lamp circuit driver.

Mirror Turn Signals

The SCCM monitors the LH steering column multifunction switch position. When the LH steering column multifunction switch is in the LH TURN or RH TURN position, the SCCM sends a message over the HS-CAN2 to the GWM then the GWM sends the message to the BCM over the HS-CAN1 indicating a request for the LH or RH turn signal.

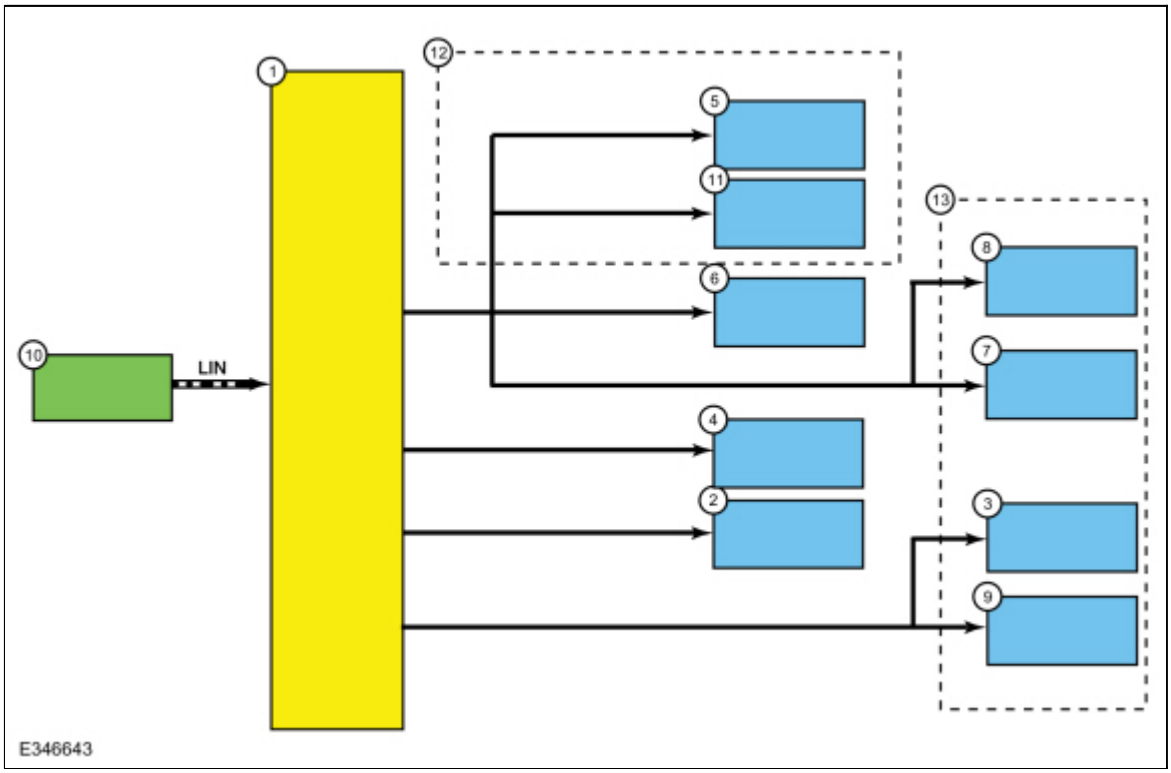
When the BCM receives a request for a turn signal, the BCM sends a turn indicator command message over the HS-CAN1 to the GWM then the MS-CAN to the door modules for the exterior mirror turn lamps.

Hazard Lamps

The BCM sends a voltage signal to the hazard flasher lamp switch to monitor for a hazard lamp function request. When the hazard flasher lamp switch is pressed, the voltage signal is routed to ground, indicating a request to activate or deactivate the hazard lamp function.

Parking, Rear, and License Plate Lamps - Except Electric Vehicles

System Diagram



Item	Description
1	BCM
2	License plate lamps
3	High-mounted stoplamp parking lamp
4	Rear parking lamps
5	LH front side marker lamp
6	Front parking lamps
7	Grille marker lamps
8	Front side fender marker lamps
9	Mirror parking lamps
10	Headlamp switch
12	Halogen and low series LED headlamps only
13	If equipped

Parking Lamps

The headlamp switch sends a status message over the LIN circuit to the BCM to indicate the headlamp switch status (position or a fault with the headlamp switch). The BCM turns the parking lamps and headlamps on when the ignition is in RUN and the BCM detects a fault from the headlamp switch or wiring. This is normal behavior of the BCM when a fault has been detected with the inputs from the headlamp switch.

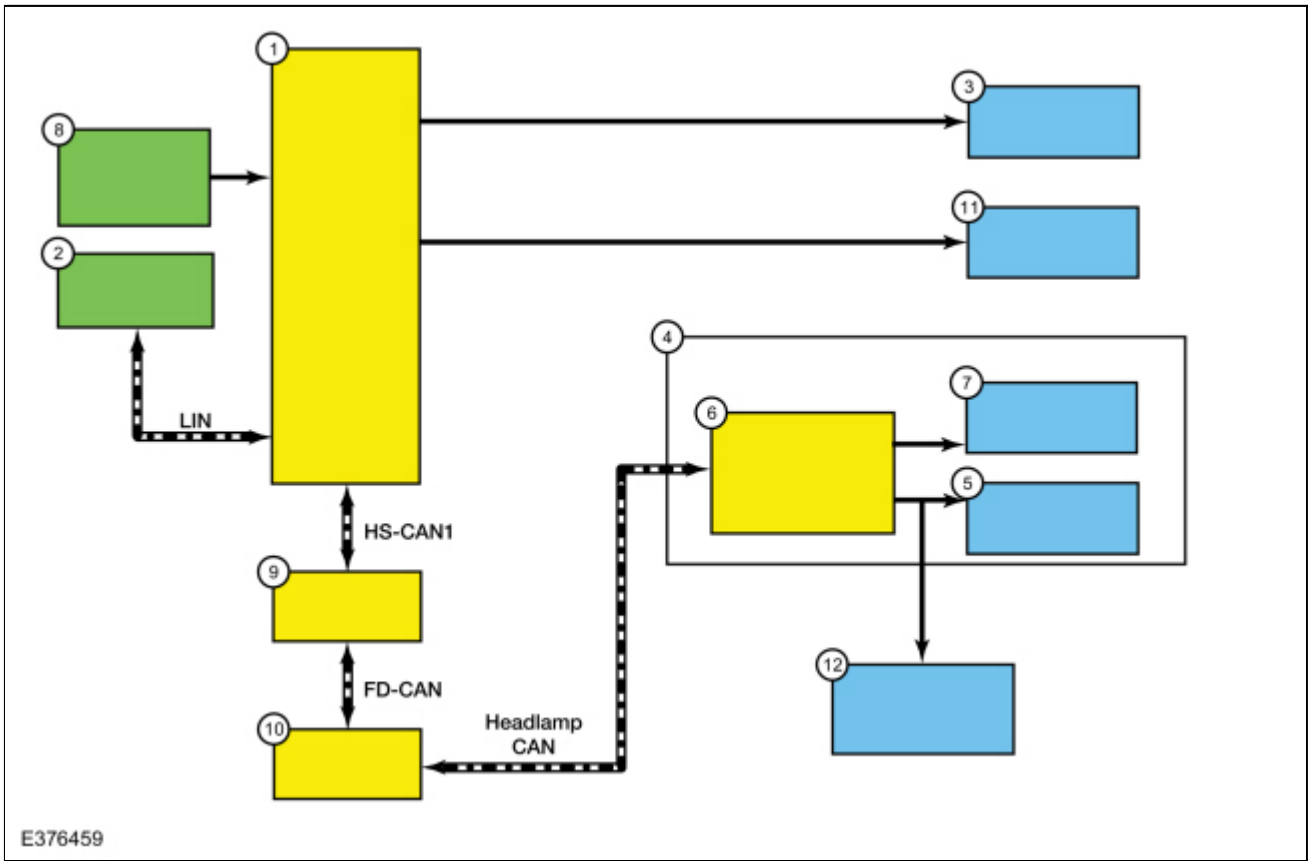
When the BCM receives an input requesting the parking lamps on, it provides voltage to the parking lamps.

Vehicles with LED headlamps utilize a LED control module mounted to each headlamp assembly, that controls the voltage to the parking lamp Light Emitting Diodes (LEDs) within the headlamp assembly.

The BCM also provides Field Effect Transistor (FET) protection of the parking lamps output circuits. When an excessive current draw is detected, the BCM disables the affected parking lamps circuit driver.

Parking, Rear, and License Plate Lamps - Electric Vehicles Only

System Diagram



Item	Description
1	
1	BCM
2	Headlamp switch
3	License plate lamps
4	Headlamp
5	LED DRL /front parking lamps
6	LDCM
7	Front side marker Light Emitting Diodes (LEDs)
8	Ignition or start/stop switch
9	GWM
10	HCM
11	Rear parking lamps
12	Grille mounted LED DRL parking lamps

Parking Lamps

The headlamp switch sends a status message over the LIN circuit to the BCM to indicate the headlamp switch status (position or a fault with the headlamp switch). The BCM turns the parking lamps and headlamps on when the ignition is in RUN and the BCM detects a fault from the headlamp switch or wiring. This is normal behavior of the BCM when a fault has been detected with the inputs from the headlamp switch.

For front parking lamps, when the BCM requests the parking lamps on:

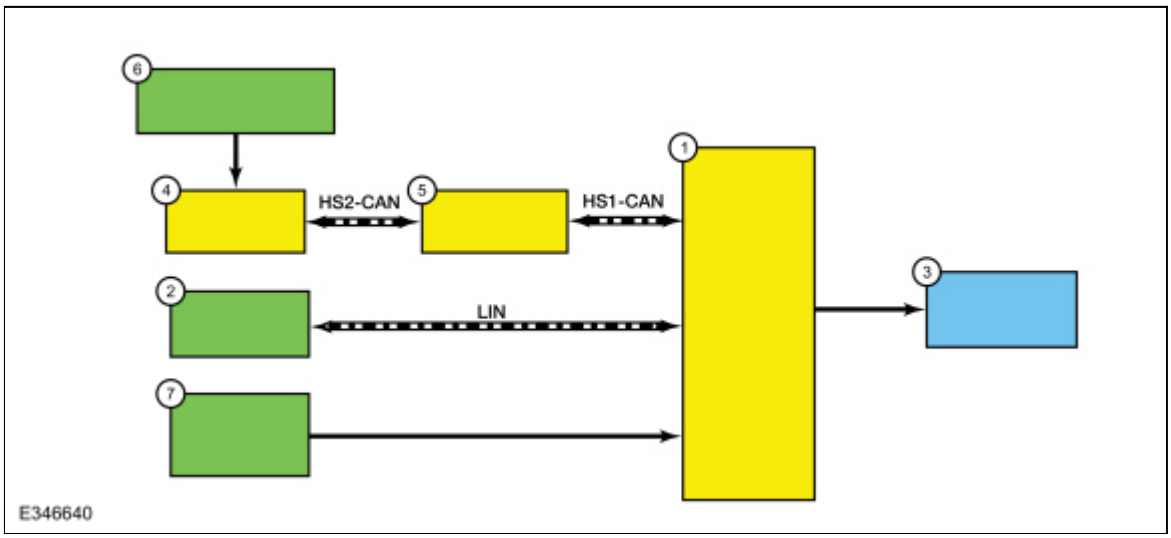
- the BCM sends a parking lamps request to the GWM through the HS-CAN1 circuit.
- the GWM sends the parking lamps request to the HCM through the FD-CAN circuit.
- the HCM sends the parking lamps request to the headlamp mounted LDCM through a private CAN circuit.
- the LDCM illuminates the grille mounted and headlamp LED DRL /front parking lamps at a reduced intensity.

For rear parking lamps, when the BCM receives a request for a parking lamps, the BCM supplies voltage to the rear parking lamps.

The BCM also provides Field Effect Transistor (FET) protection of the parking lamps output circuits. When an excessive current draw is detected, the BCM disables the affected parking lamps circuit driver.

Fog Lamps

System Diagram



Item	Description
1	BCM
2	Headlamp switch
3	Front fog lamps
4	SCCM
5	GWM
6	LH steering column multifunction switch
7	Ignition or start/stop switch

Fog Lamps

The headlamp switch sends a status message over the LIN circuit to the BCM to indicate the headlamp switch status (position or a fault with the headlamp switch). The BCM turns the parking lamps and headlamps on when the ignition is in RUN and the BCM detects a fault from the headlamp switch or wiring. This is normal behavior of the BCM when a fault has been detected with the inputs from the headlamp switch.

When the BCM receives input from the headlamp switch indicating a request for the fog lamps, the BCM provides voltage to the fog lamps.

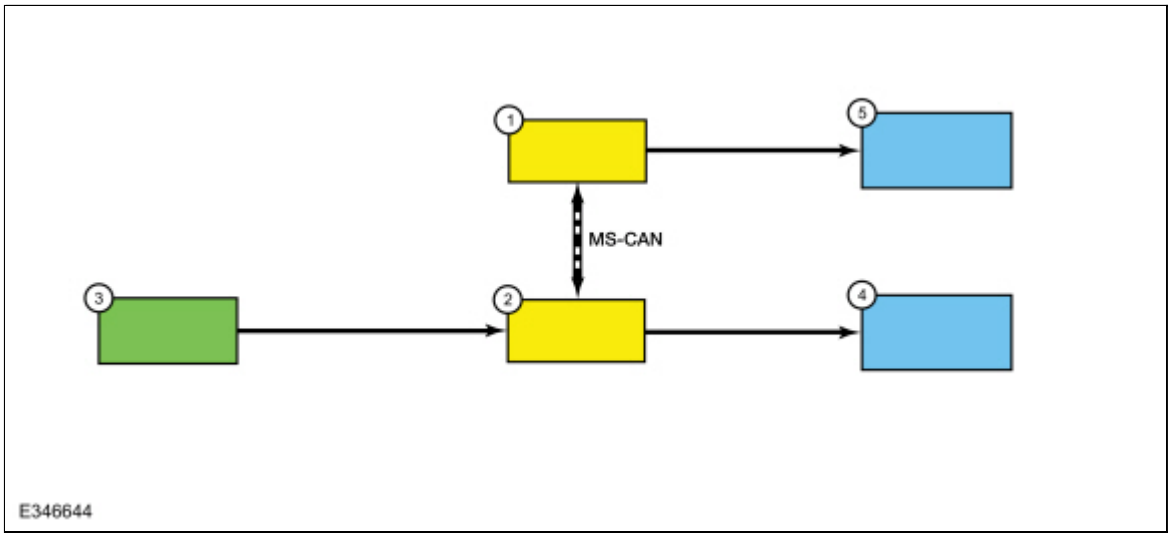
If equipped, when the vehicle is in snow plow mode, the front fog lamps are disabled.

The BCM also provides Field Effect Transistor (FET) protection of the rear fog lamp output circuit. When an excessive current draw is detected, the BCM disables the front fog lamp output circuit driver.

The fog lamps have a cornering function in which under certain conditions and inputs either lamp might turn on or off independently to aid visibility during cornering. The cornering lamps illuminate the inside of a corner when turning the steering wheel. If the steering wheel is slightly turned left or right with the headlamp switch on, cornering function will activate. The fog light will be activated in the direction the steering wheel is positioned, even if fog light switch is off. This is an operating characteristic to improve customer visibility while turning. This function is independent of fog lamp operation.

Spot Lamps

System Diagram



Item	Description
1	DDM
2	PDM
3	Spot lamp switch
4	RH spot lamp
5	LH spot lamp

Spot Lamps

When a spot lamp switch is pressed, a ground is provided to the PDM .

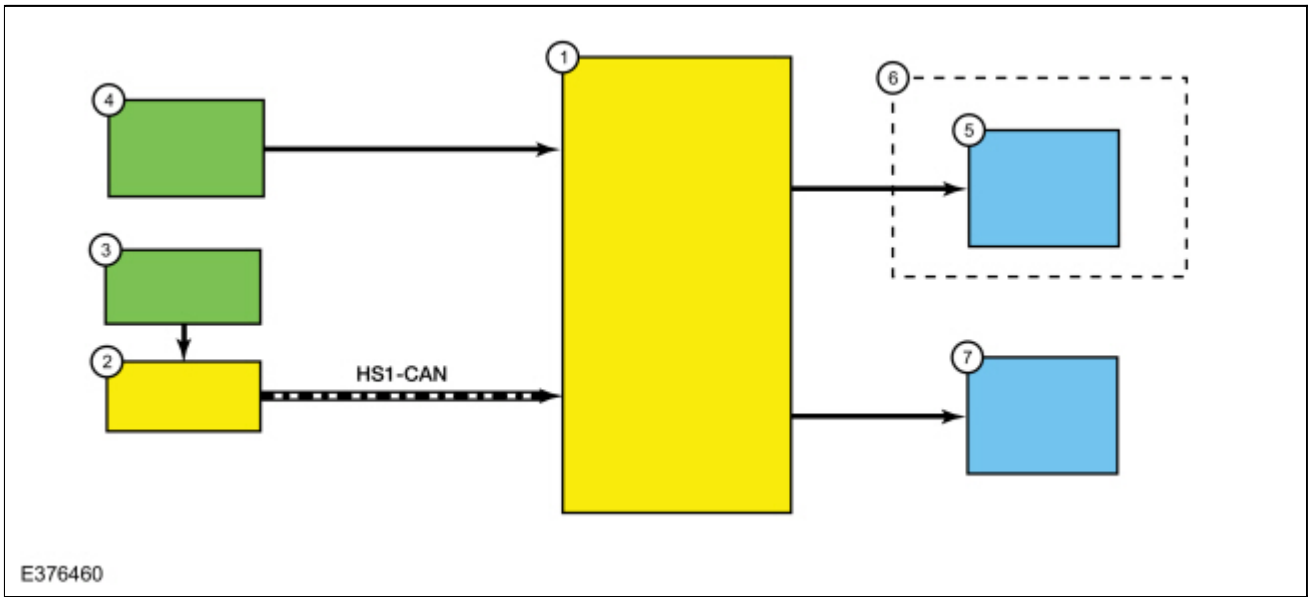
When the PDM detects that the LH spot lamp switch has been pressed, it sends voltage to the spot lamp switch LH indicator and the PDM sends a spot lamps request message over the MS-CAN to the DDM . When the DDM receives the spot lamp request message the DDM voltage to the LH spot lamp (integrated into the exterior mirror turn lamp)

When the PDM detects that the RH spot lamp switch has been pressed, it sends voltage to the spot lamp switch RH indicator and the PDM sends voltage to the RH spot lamp (integrated into the exterior mirror turn lamp)

The PDM enables the spot lamps for use when the vehicle speed is less than 6 mph (10 km/h) and the parking lamps are on.

Reversing Lamps

System Diagram



Item	Description
1	BCM
2	PCM
3	TR sensor
4	Ignition or start/stop switch
5	Liftgate mounted reversing lamps
6	Electric vehicles only
7	Body mounted reversing lamps

Network Message Chart

BCM Network Input Messages

Broadcast Message	Originating Module	Message Purpose
Gear position	PCM	Indicates the transmission is in reverse gear to the BCM. When the transmission is in REVERSE and the ignition in RUN, the BCM provides voltage to the reversing lamps.

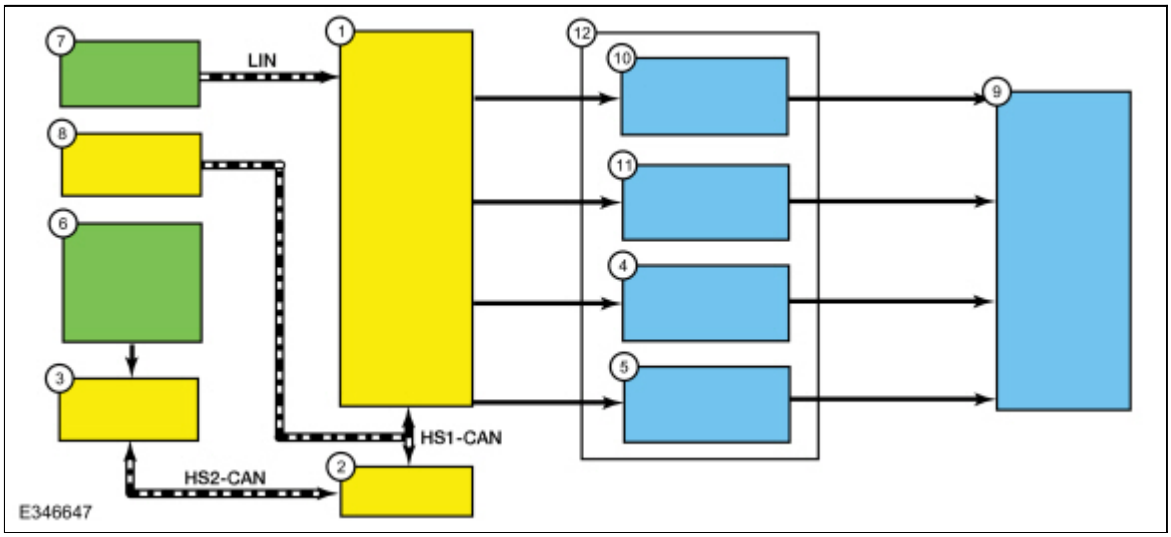
Reversing Lamps

When the transmission is in REVERSE, the PCM sends a message over the HS-CAN1 to the BCM indicating the transmission is in REVERSE. The BCM provides voltage to the reversing lamps when it receives the message that the transmission is in REVERSE and the ignition is in RUN.

The BCM also provides Field Effect Transistor (FET) protection of the reversing lamps output circuit. When an excessive current draw is detected, the BCM disables the affected reversing lamps circuit driver.

Trailer Lamps - Without TRM

System Diagram



Item	Description
1	BCM
2	GWM
3	SCCM
4	Trailer tow LH stop/turn relay
5	Trailer tow RH stop/turn relay
6	LH steering column multifunction switch
7	Headlamp switch
8	PCM
9	Trailer tow connector
10	Trailer tow reversing lamp relay
11	Trailer tow parking lamp relay
12	BJB

Network Message Chart

BCM Network Input Messages

Broadcast Message	Originating Module	Message Purpose
Gear position	PCM	Indicates the transmission is in reverse gear to the BCM . When the transmission is in REVERSE and the ignition in RUN, the BCM provides voltage to the reversing lamps.
Turn signal switch status	SCCM	Indicates the turn signal stalk position on the LH steering column multifunction switch (left/right lane change or turn signal on or off). The BCM activates the left/right turn signals based on this input.

Trailer Stop-Turn Lamps

The SCCM monitors the LH steering column multifunction switch position. When the LH steering column multifunction switch is in the left or right turn position, the SCCM sends a message over the HS-CAN2 to the GWM then the GWM sends the message to the BCM over the HS-CAN1 indicating a request for the LH or RH turn signal.

When the BCM receives a request for a turn signal, the BCM provides a switched ground path to the LH or RH stop/turn trailer tow relay (integral to the BJB). When the BCM provides ground the LH or RH stop/turn trailer tow relay, the relay is energized and the relay provides turn lamp voltage to the trailer tow connector.

When the BCM receives input from the stoplamp switch indicating that the brake pedal is being pressed, the BCM provides a

ground path to the LH and RH stop/turn trailer tow relay (integral to the BJB). When the BCM provides ground the LH and RH stop/turn trailer tow relay, the relay is energized and the relay provides stop lamp voltage to the trailer tow connector.

Trailer Parking Lamps

The headlamp switch sends a headlamp switch status message over the LIN to the BCM to indicate the headlamp switch status (position or a fault with the headlamp switch).

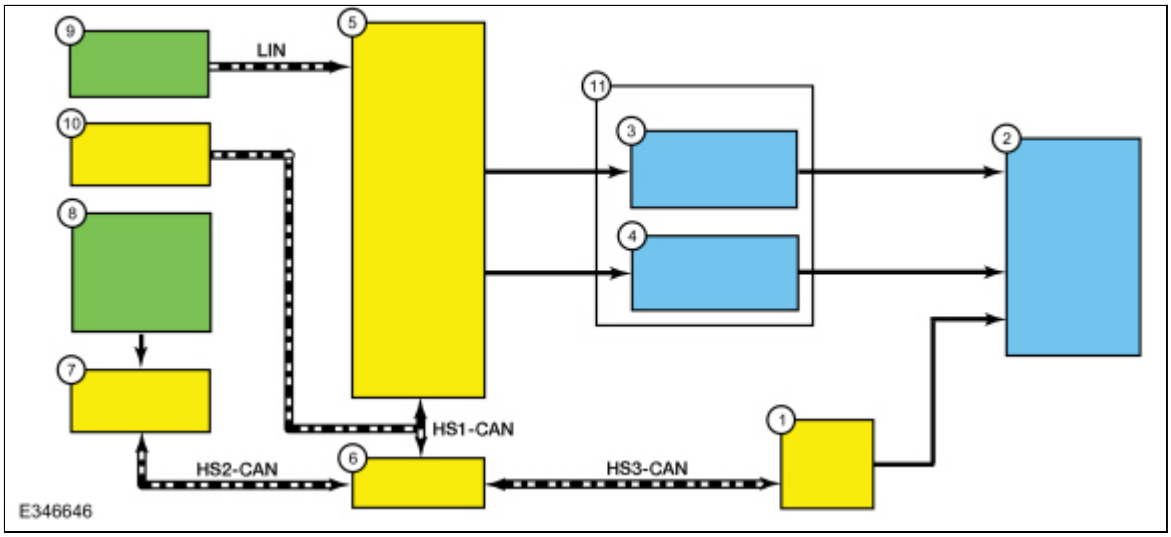
When the parking lamps or headlamps position is selected, the BCM provides a ground path to the parking lamps trailer tow relay. When the BCM provides ground the parking lamps trailer tow relay, the relay is energized and the relay provides parking lamp voltage to the trailer tow connector.

Trailer Reversing Lamps

When the transmission is in REVERSE, the PCM sends a message over the HS-CAN1 to the BCM indicating the transmission is in REVERSE. The BCM provides voltage to the reversing lamps trailer tow relay (integral to the BJB) when it receives the message that the transmission is in REVERSE and the ignition is in RUN. When the BCM provides voltage to the reversing lamps trailer tow relay, the relay is energized and the relay provides reversing lamp voltage to the trailer tow connector.

Trailer Lamps - With TRM

System Diagram



Item	Description
1	TRM
2	Trailer tow connector
3	Trailer tow reversing lamp relay
4	Trailer tow parking lamp relay
5	BCM
6	GWM
7	SCCM
8	LH steering column multifunction switch
9	Headlamp switch
10	PCM
11	BJB

Network Message Chart

BCM Network Input Messages

Broadcast Message	Originating Module	Message Purpose
Gear position	PCM	Indicates the transmission is in reverse gear to the BCM . When the transmission is in REVERSE and the ignition in RUN, the BCM provides voltage to the reversing lamps.
Turn signal switch status	SCCM	Indicates the turn signal stalk position on the LH steering column multifunction switch (left/right lane change or turn signal on or off).

TRM Network Input Messages

Broadcast Message	Originating Module	Message Purpose
Turn indication request	BCM	A command to the TRM to activate/deactivate the turn indicator output to the trailer tow connector.
Stoplamp request	BCM	A command to the TRM to activate/deactivate the stop lamps output to the trailer tow connector.

Trailer Stop-Turn Lamps

The SCCM monitors the LH steering column multifunction switch position. When the LH steering column multifunction switch is in the left or right turn position, the SCCM sends a message over the HS-CAN2 to the GWM then the GWM sends the message to the BCM over the HS-CAN1 indicating a request for the LH or RH turn signal.

When the BCM receives a request for a turn signal, the BCM sends a turn indicator command message over the HS-CAN1 to the GWM , then the GWM sends a turn indicator command message over the HS-CAN3 to the TRM to activate the requested stop/turn indicator output to the trailer tow connector.

When the BCM receives input from the stoplamp switch indicating that the brake pedal is being pressed, the TRM receives a stoplamp activation message over the HS-CAN3 to activate the requested stop/turn indicator output to the trailer tow connector.

Trailer Parking Lamps

The headlamp switch sends a headlamp switch status message over the LIN to the BCM to indicate the headlamp switch status (position or a fault with the headlamp switch).

When the parking lamps or headlamps position is selected, the BCM provides a ground path to the BJB parking lamps trailer tow relay. When the BCM provides ground the parking lamps trailer tow relay, the relay is energized and the relay provides parking lamp voltage to the trailer tow connector.

Trailer Reversing Lamps

When the transmission is in REVERSE, the PCM sends a message over the HS-CAN1 to the BCM indicating the transmission is in REVERSE. The BCM provides voltage to the reversing lamps trailer tow relay (integral to the BJB) when it receives the message that the transmission is in REVERSE and the ignition is in RUN. When the BCM provides voltage to the reversing lamps trailer tow relay, the relay is energized and the relay provides reversing lamp voltage to the trailer tow connector.

Trailer Battery Charging

NOTE: *For vehicles equipped with push-button start, the trailer battery charging output is disabled when the drivers door is ajar.*

The TRM provides voltage to the trailer tow connector for trailer battery charging when all the following are true:

- The TRM detects that a trailer is connected.
- The ignition is in ACC or ON.
- The BCM load shed strategy is not active (a message is displayed in the instrument cluster, such as Low Battery Features Temporarily Turned Off or Turn Power Off To Save Battery, to indicate that BCM load shed strategy is active).

Trailer And Lamp Outage Detection

The TRM senses resistance in the LH and RH brake/turn signal output circuits that is within a calibrated range. If the resistance is higher than the calibrated range on either the LH or RH brake/turn signal output circuits, the TRM reports a trailer lamp fault message. If the resistance is lower than the calibrated range on one of the LH or RH brake/turn signal output circuits when the brake is pressed during the ignition cycle, the TRM reports a trailer lamp fault message and the TRM sets a DTC .

Field Effect Transistor (FET) Protection

The BCM and TRM utilizes a Field Effect Transistor (FET) protective circuit strategy for its lamp output circuits. Output loads (current level) are monitored for excessive current (typically short circuits) and are shut down (turns off the voltage or ground provided by the module) when a fault event is detected.

A Field Effect Transistor (FET) is a type of transistor that the control module software uses to control and monitor current flow on module outputs. The Field Effect Transistor (FET) protection strategy prevents module damage in the event of excessive current flow.

Output loads (current level) are monitored for excessive current draw (typically short circuits). When a fault event is detected the Field Effect Transistor (FET) turns off and a short circuit DTC sets. The module resets the Field Effect Transistor (FET) protection and allows the circuit to function when the fault is corrected or the ignition state is cycled off and then back on.

When the excessive circuit load occurs often enough, the module shuts down the output until a repair procedure is carried out. Each Field Effect Transistor (FET) protected circuit has 3 predefined levels of short circuit tolerance based on a module lifetime level of fault events based upon the durability of the Field Effect Transistor (FET).

When each level is reached, the DTC associated with the short circuit sets along with DTC U1000:00. These Diagnostic Trouble Codes (DTCs) can be cleared using the module on-demand self-test, then the Clear DTC operation on the scan tool (if the on-demand test shows the fault corrected). The module never resets the fault event counter to zero and continues to advance the fault event counter as short circuit fault events occur.

If the number of short circuit fault events reach the third level, then Diagnostic Trouble Codes (DTCs) U1000:00 and U3000:49 set along with the associated short circuit DTC . DTC **U3000:49 cannot be cleared** , the module **must** be replaced after the repair.

Component Description

Headlamp Assembly

Exterior lamps are vented to accommodate normal changes in pressure. Condensation can be a natural by-product of this design. When moist air enters the lamp assembly through the vents, there is a possibility that condensation can occur if the temperature is cold. When normal condensation occurs, a thin mist forms on the interior of the lens. The thin mist eventually clears and exits through the vents during normal operation. The amount of time it takes to clear the lens of acceptable mist varies with ambient humidity and lamp types. Normal condensation clears from any lamp in 48 hours under dry conditions.

Do not replace a lamp assembly with acceptable levels of condensation such as:

- presence of thin mist (no streaks, drip marks or droplets are present)
- fine mist covers less than 50% of the lens

Examples of unacceptable moisture (usually caused by a lamp housing leak):

- water puddling inside the lamp
- large water droplets, drip marks or streaks present on the interior of the lens

Headlamp Switch

The headlamp switch sends a headlamp switch status message over the LIN to the BCM to indicate the headlamp switch status (position or a fault with the headlamp switch).

Light Sensor

The BCM sends a voltage signal to the light sensor. The light sensor provides resistance between the voltage signal and ground. The resistance varies depending on the amount of ambient light detected by the light sensor. The brighter the ambient light, the lower the resistance. By varying the resistance, the BCM can determine the amount of ambient light.

TRM

The TRM receives inputs from the BCM to control voltage to the trailer tow connector for the LH stop/turn, RH stop/turn lamps and trailer battery charging.