

Four-Wheel Drive Systems - Vehicles With: Electronic Shift Transfer Case

Principles of Operation

The Electronic Shift-On-The-Fly (ESOF) system has 3 modes of operation: 2H (4X2), 4H (4X4 HIGH) and 4L (4X4 LOW). When 4H or 4L are selected, TCCM sends a duty cycle command to the synchronization coil which activates the clutch within the transfer case and moves the shift forks. When the 2H mode is selected, IWEs located at each front wheel are disengaged to reduce additional drag from the front driveline.

Engagement and disengagement of the front wheels is done by the IWEs. The IWEs are normally engaged (no vacuum). Vacuum is supplied to the IWEs by actuation of the IWE solenoid when commanded by the TCCM. When actuated, the IWE solenoid allows manifold vacuum to pass through to each IWE. The IWEs disengage and allow the front wheel hubs to be turned freely from the front axle.

NOTE: When shifting to 2H mode in order for the IWEs to completely disengage the vehicle steering wheel must be less than 90 degrees and 5 seconds have elapsed since the shift to 2H has been initiated.

The electric shift motor is mounted externally to the transfer case. It drives a rotary cam which moves the 2 shift forks in the transfer case to change between the 2H and 4H modes, neutral and between the 4H and 4L modes. The TCCM directly controls the electric shift motor and can reverse motor polarity to reverse rotary cam/shift fork direction. The shift motor sense plate, an integral part of the shift motor assembly, informs the TCCM of the transfer case position.

The transfer case is equipped with an electronically controlled clutch which is located inside the case. This clutch is used to synchronize the speed of the front driveline with the rear driveline during 2H to 4H shifts. When the MSS is switched between 2H and 4H modes, the TCCM energizes the synchronization clutch. When the transfer case front and rear output shafts are synchronized, the spring-loaded lockup collar mechanically engages (4H) or disengages (2H) the mainshaft hub to the drive sprocket. Finally, the front axle IWEs are engaged (4H) or disengaged (2H) and the synchronization clutch is deactivated.

The TCCM features a cold temperature strategy which is used to warm up the front axle in cold

temperatures to improve driveline synchronization. When ambient temperature is below 32 F (0 C), IWEs will engage after the initial key cycle and a driven gear is selected. Hubs will stay engaged regardless of 4x4 mode change for approximately 2 miles (3km). Once distance traveled has been achieved IWEs will disengage if vehicle is in 2H. Distance traveled will reset only if the temperature is below calibrated threshold and another key cycle has occurred or customer shifted to park and back to a driven gear within the same key cycle.

Shifts from 2H mode to 4H mode can be made at any speed. The synchronization clutch is applied to equalize output shaft speeds before 4H mode is engaged. The following are the inputs and outputs needed by the TCCM to execute a change between these modes.

Feature inputs:

- Ambient air temperature from the PCM
- MSS
- Steering wheel angle (from the ABS module)
- Wheel speed signal from ABS module
- APP from PCM
- Transfer case shift motor contact plate position inputs A, B, C and D

Feature outputs:

- Transfer case electric shift motor outputs
- PWM signal to transfer case clutch
- 4WD message center and indicators
- IWE solenoid command output

When shifting into or out of 4L mode, the TCCM requires the vehicle speed to be less than 5 km/h (3 mph) and the transmission in NEUTRAL.

The following are the inputs and outputs needed by the TCCM to execute a change into or out of 4L mode:

Feature inputs:

- MSS
- Wheel speed signal from ABS module
- TR position from PCM
- Transfer case shift motor contact plate position inputs A, B, C and D

Feature outputs:

- Transfer case electric shift motor outputs
- PWM signal to transfer case clutch
- 4WD message center and indicators
- IWE solenoid command output

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.
3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Visual Inspection Chart

Mechanical	Electrical
• Halfshafts • IWEs • Driveshaft and U-joints • Vacuum leaks • Fluid leaks • Matching tire sizes • Transfer case	• BJB ○ fuse 71 (25A) ○ fuse 63 (25A) ○ fuse 29 (10A) ○ fuse 13 (10A) • Fuse 64 (15A) (2WD vehicles with ELD only) • Wiring, terminals or connectors • MSS • Synchronization clutch • IWE solenoid • Transfer case shift motor

DTC Chart: Transfer Case Control Module (TCCM)

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.

REFER to: [Diagnostic Methods](#) (100-00 General Information, Description and Operation).

DTC	Description	Action
C1979:00	IWE Solenoid Circuit Failure: No Sub Type Information	GO to Pinpoint Test C
C1979:11	IWE Solenoid Circuit Failure: Circuit Short To Ground	GO to Pinpoint Test C
C1979:12	IWE Solenoid Circuit Failure: Circuit Short To Battery	GO to Pinpoint Test C
C1979:13	IWE Solenoid Circuit Failure: Circuit Open	GO to Pinpoint Test C
P0562:00	System Voltage Low: No Sub Type Information	GO to Pinpoint Test L
P0563:00	System Voltage High: No Sub Type Information	GO to Pinpoint Test L
P06B8:00	Internal Control Module Non- Volatile Random Access Memory (NVRAM) Error: No Sub Type Information	CLEAR the DTC. REPEAT the self-test. If the DTC still sets, INSTALL a new TCCM. REFER to: Transfer Case Control Module (TCCM) (308-07A Four-Wheel Drive Systems, Removal and Installation).
P1812:00	4-Wheel Drive Mode Select Circuit Failure: No Sub Type Information	GO to Pinpoint Test A
P1815:00	4-Wheel Drive Mode Select Short To Ground: No Sub Type Information	GO to Pinpoint Test A
P1825:00	4-Wheel Drive Clutch Relay Open Circuit: No Sub Type Information	GO to Pinpoint Test F
P1826:00	4-Wheel Drive Low Clutch Relay Circuit To Battery: No Sub Type Information	GO to Pinpoint Test F
P1827:00	4-Wheel Drive Low Clutch Relay Circuit To Ground: No Sub Type Information	GO to Pinpoint Test F
P1839:00	Transfer Case Shift Motor Open Circuit: No Sub Type Information	GO to Pinpoint Test A
P1840:00	Transfer Case Shift Motor Short Circuit To Battery: No Sub Type Information	GO to Pinpoint Test A

P1841:00	Transfer Case Shift Motor Short Circuit To Ground: No Sub Type Information	GO to Pinpoint Test A
P1849:00	Transfer Case Contact Plate 'A' Short Circuit To Ground: No Sub Type Information	GO to Pinpoint Test E
P184A:00	Transfer Case Unable To Transition Between 4x2 and 4x4 Mode: No Sub Type Information	GO to Pinpoint Test A
P184B:00	Transfer Case Unable To Transition Between 4x4 High and 4x4 Low Range: No Sub Type Information	GO to Pinpoint Test B
P1853:00	Transfer Case Contact Plate 'B' Short Circuit To Ground: No Sub Type Information	GO to Pinpoint Test A
P1857:00	Transfer Case Contact Plate 'C' Short Circuit To Ground: No Sub Type Information	GO to Pinpoint Test A
P185A:00	Differential Lock-Up Input Switch Circuit High: No Sub Type Information	REFER to: Electronic Locking Differential (ELD) (205-02A Rear Drive Axle/Differential - Vehicles With: Ford 8.8 Inch Ring Gear, Diagnosis and Testing). REFER to: Electronic Locking Differential (ELD) (205-02B Rear Drive Axle/Differential - Vehicles With: Ford 9.75 Inch Ring Gear, Diagnosis and Testing).
P185D:00	Differential Lock-Up Control Circuit Performance: No Sub Type Information	REFER to: Electronic Locking Differential (ELD) (205-02A Rear Drive Axle/Differential - Vehicles With: Ford 8.8 Inch Ring Gear, Diagnosis and Testing). REFER to: Electronic Locking Differential (ELD) (205-02B Rear Drive Axle/Differential - Vehicles With: Ford 9.75 Inch Ring Gear, Diagnosis and Testing).
P1861:00	Transfer Case Contact Plate 'D' Short Circuit To Ground: No Sub Type Information	GO to Pinpoint Test A

P1867:00	Transfer Case Contact Plate General Circuit Failure: No Sub Type Information	GO to Pinpoint Test A
P187A:00	Transfer Case Control Module System Voltage Low - Rear Locking Differential Disabled	REFER to: Electronic Locking Differential (ELD) (205-02B Rear Drive Axle/Differential - Vehicles With: Ford 9.75 Inch Ring Gear, Diagnosis and Testing).
P187C:00	Differential Lock-Up Control Circuit/Open: No Sub Type Information	REFER to: Electronic Locking Differential (ELD) (205-02A Rear Drive Axle/Differential - Vehicles With: Ford 8.8 Inch Ring Gear, Diagnosis and Testing). REFER to: Electronic Locking Differential (ELD) (205-02B Rear Drive Axle/Differential - Vehicles With: Ford 9.75 Inch Ring Gear, Diagnosis and Testing).
P187D:00	Differential Lock-Up Control Circuit Low: No Sub Type Information	REFER to: Electronic Locking Differential (ELD) (205-02A Rear Drive Axle/Differential - Vehicles With: Ford 8.8 Inch Ring Gear, Diagnosis and Testing). REFER to: Electronic Locking Differential (ELD) (205-02B Rear Drive Axle/Differential - Vehicles With: Ford 9.75 Inch Ring Gear, Diagnosis and Testing).

P187E:00	Differential Lock-Up Control Circuit High: No Sub Type Information	To diagnose the wheel speed sensor concern, REFER to: Anti-Lock Brake System (ABS) and Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control) . REFER to: Electronic Locking Differential (ELD) (205-02B Rear Drive Axle/Differential - Vehicles With: Ford 9.75 Inch Ring Gear, Diagnosis and Testing).
P1891:00	Transfer Case Contact Plate Ground Return Open Circuit: No Sub Type Information	GO to Pinpoint Test A
U0100:00	Lost Communication With ECM/PCM "A": No Sub Type Information	GO to Pinpoint Test I
U0101:00	Lost Communication With TCM "A": No Sub Type Information	GO to Pinpoint Test M
U0121:00	Lost Communication With Anti-Lock Brake System (ABS) Control Module: No Sub Type Information	GO to Pinpoint Test J
U0140:00	Lost Communication With Body Control Module (BCM): No Sub Type Information	GO to Pinpoint Test K
U0418:00	Invalid Data Received From Brake System Control Module: No Sub Type Information	To diagnose the wheel speed sensor concern, REFER to: Anti-Lock Brake System (ABS) and Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control) .

U2300:54	Central Configuration: Missing Calibration	This DTC can set if one or more expected configuration data identifications is missing (gearbox type, axle ratio, tire circumference) from the BCM. CARRY OUT a self-test of the BCM. If BCM DTCs are present, REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules) . If no BCM DTCs are present, CLEAR the DTCs. CARRY OUT a TCCM self-test. If U2300:54 returns, INSTALL a new TCCM. REFER to: Transfer Case Control Module (TCCM) (308-07A Four-Wheel Drive Systems, Removal and Installation).
U2300:55	Central Configuration: Not Configured	This DTC can set upon TCCM power up only until all expected configuration data parameters (gearbox type, axle ratio, tire circumference) are received from the BCM. CARRY OUT a self-test of the BCM. If BCM DTCs are present, REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules) . If no BCM DTCs are present, CLEAR the DTCs. CARRY OUT TCCM self-test. If U2300:55 returns, INSTALL a new TCCM. REFER to: Transfer Case Control Module (TCCM) (308-07A Four-Wheel Drive Systems, Removal and Installation).

U2300:56	Central Configuration: Invalid / Incompatible Configuration	This DTC can set if one expected configuration data parameter is out of range (gearbox type, axle ratio, tire circumference) from the BCM. CARRY OUT a self-test of the BCM. If DTCs are present, REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules) . If no DTCs are present, CLEAR the DTCs. CARRY OUT a TCCM self-test. If U2300:56 returns, INSTALL a new TCCM. REFER to: Transfer Case Control Module (TCCM) (308-07A Four-Wheel Drive Systems, Removal and Installation).
U2300:64	Central Configuration: Signal Plausibility Failure	This DTC can set if the expected axle ratio or tire circumference is out of range from the BCM. CARRY OUT a self-test of the BCM. If BCM DTCs are present, REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules) . If no BCM DTCs are present, CLEAR the DTCs. CARRY OUT a TCCM self-test. If U2300:64 returns, INSTALL a new TCCM. REFER to: Transfer Case Control Module (TCCM) (308-07A Four-Wheel Drive Systems, Removal and Installation).
U3000:04	Control Module: System Internal Failure	CLEAR the DTC. REPEAT the self-test. If DTC U3000:04 is retrieved, INSTALL a new TCCM. REFER to: Transfer Case Control Module (TCCM) (308-07A Four-Wheel Drive Systems, Removal and Installation).

U3000:41	Control Module: General Checksum Failure	CLEAR the DTC. REPEAT the self-test. If DTC U3000:41 is retrieved, INSTALL a new TCCM. REFER to: Transfer Case Control Module (TCCM) (308-07A Four-Wheel Drive Systems, Removal and Installation).
U3000:46	Control Module: Calibration / Parameter Memory Failure	CLEAR the DTC. REPEAT the self-test. If DTC U3000:46 is retrieved, INSTALL a new TCCM. REFER to: Transfer Case Control Module (TCCM) (308-07A Four-Wheel Drive Systems, Removal and Installation).
U3000:49	Control Module: Internal Electronic Failure	CLEAR the DTC. REPEAT the self-test. If DTC U3000:49 is retrieved, INSTALL a new TCCM. REFER to: Transfer Case Control Module (TCCM) (308-07A Four-Wheel Drive Systems, Removal and Installation).
U300D:11	Ignition Input On/Start: Circuit Short To Ground	GO to Pinpoint Test A

Symptom Chart

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.

REFER to: [Diagnostic Methods](#) (100-00 General Information, Description and Operation).

In most circumstances, the PCM sets DTCs to help guide with diagnostics. Refer to the DTC Chart before using the symptom chart. The Symptom column lists the vehicle condition. The Possible Sources column lists a detailed vehicle condition. The Action column lists the action to be performed to determine the cause of the condition. Each action lists the components that can cause the system and the individual components in that system. The components are listed in order of disassembly. Use the list of components and the required action to focus on disassembly inspections for the root cause of the concern.

Four-Wheel Drive (4WD) System

Symptom	Possible Sources	Action

• No communication with the TCCM	• Scan tool • DLC • TCCM • Wiring, terminals or connectors	• REFER to: Communications Network (418-00 Module Communications Network) .
• The 4X4 mode indicators do not operate correctly/do not operate	• IPC • 4WD system fault • HS-CAN • TCCM	• REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes) .
• The vehicle does not shift between 2H (2WD) and 4X4 modes correctly	• Wiring, terminals or connectors • MSS • Transfer case • TCCM	• GO to Pinpoint Test A
• The vehicle does not shift between 4H and 4L modes correctly	• Wiring, terminals or connectors • IWEs • IWE solenoid • Transfer case • Vacuum leaks • Front axle assembly	• GO to Pinpoint Test B

	• TCCM • MSS	
• The 4WD does not engage at speed correctly	• Transfer case and related components • IWEs and related components • Wheel/tire assemblies	• GO to Pinpoint Test F
• The transfer case jumps out of gear	• IWE vent lines • MSS • Transfer case	• GO to Pinpoint Test D
• Unable to duplicate customer concern	• 4WD system and/or related components	• GO to Pinpoint Test H
• Rear wheels binding when turning corners with the ELD MSS set to OFF	• Wiring, terminals or connectors • Fuses • MSS • IWEs • IWE solenoid • Transfer case • Vacuum leaks	• REFER to: Electronic Locking Differential (ELD) (205-02A Rear Drive Axle/Differential - Vehicles With: Ford 8.8 Inch Ring Gear, Diagnosis and Testing). REFER to: Rear Drive Axle and Differential (205-02B Rear Drive Axle/Differential - Vehicles With: Ford 9.75 Inch Ring Gear, Diagnosis and Testing).

	• Front axle assembly • TCCM	
• Unable to achieve flat tow (neutral tow) mode	• Wiring, terminals or connectors • HS-CAN • IPC • TCCM • Door ajar switch • Ignition switch	• REFER to: Neutral Flat Tow Activation and Deactivation (308-07A Four-Wheel Drive Systems, General Procedures).

Symptom Chart — NVH

NOTE: NVH symptoms should be identified using the diagnostic tools that are available. For a list of these tools, an explanation of their uses and a glossary of common terms, refer to Section 100-04. Since it is possible any one of multiple systems may be the cause of a symptom, it may be necessary to use a process of elimination type of diagnostic approach to pinpoint the responsible system.

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.

REFER to: [Diagnostic Methods](#) (100-00 General Information, Description and Operation).

Symptom	Possible Sources	Action
• Grinding noise during 4WD system engagement, especially at high speeds	• Front halfshaft speeds not turning at the same speed • Synchronization clutch	• GO to Pinpoint Test A

• Vehicle Pulsates or Shudders in a Straight Line (Straightline Driveline Wind-up)	• Unequal tire inflation pressures • Unmatched tire and wheel size • Unequal amounts of tire wear • Unmatched front and rear axle ratios	• GO to Pinpoint Test G
• The front axle makes noise in 2H mode only and generally under heavy throttle	• Vacuum leaks • Vacuum check valve • Vacuum reservoir • IWE solenoid • IWEs	• GO to Pinpoint Test E
• The transfer case makes noise	• Tire inflation pressure • Tire and wheel size • Tire tread wear • Internal components • Fluid level	• MAKE SURE that all tires and wheels are the same size and that the inflation pressures are correct. • CHECK tire tread wear to see if there is more than 1.6 mm (0.062 in) or 2/32 inch difference in tread wear between front and rear. INTERCHANGE one front wheel and one rear wheel. ROAD TEST again. • OPERATE the vehicle

in all transmission gears. If there is noise in the transmission in NEUTRAL, or in some gears and not in others, REMOVE and REPAIR the transmission.

REFER to: [Diagnosis](#)

[By Symptom](#) (307-01A

Automatic Transmission

- 6-Speed Automatic

Transmission - 6R80,

Diagnosis and Testing).

If there is noise in all gears, DISASSEMBLE the transfer case.

REFER to: [Transfer](#)

[Case](#) (308-07B Transfer

Case, Diagnosis and

Testing).

CHECK the planetary gears, the bearings, the upper and lower drive sprockets and drive chain for damage.

INSTALL new parts as necessary

- FILL with automatic transmission fluid.

• Transfer case whine — noise at all ranges	• Incorrect fluid level or fluid quality • Worn oil pump • Under-inflated or oversized tires	• CHECK that the transfer case is filled to the correct level and with the specified fluid. REFER to: Transfer Case (308-07B Transfer Case, Diagnosis and Testing). • DISASSEMBLE the transfer case. CHECK the oil pump for wear or damage. REPAIR as necessary. REFER to: Transfer Case (308-07B Transfer Case, Diagnosis and Testing). • CONFIRM that the tires and wheels are correct for the vehicle. CHECK that the tire inflation pressures are correct.
• Transfer case growl/rumble — noise at all ranges	• Damaged or worn bearings or planetary gear	• DISASSEMBLE the transfer case. CHECK the bearings or planetary gear for wear or damage. REPAIR as necessary. REFER to: Transfer Case (308-07B Transfer Case, Diagnosis and Testing).

• Transfer case scraping/grating — noise at all ranges	• Excessively stretched drive chain hitting the case	• DISASSEMBLE the transfer case. CHECK the drive chain for wear or damage. REPAIR as necessary. REFER to: Transfer Case (308-07B Transfer Case, Diagnosis and Testing).
• Transfer case howl/hum — noise at all ranges or 4H only	• Worn or damaged sun (input) gear, clutch pack (intermediate) gear or output shaft gear	• DISASSEMBLE the transfer case. CHECK the gears for wear or damage. REPAIR as necessary. REFER to: Transfer Case (308-07B Transfer Case, Diagnosis and Testing).

Pinpoint Tests

The Vehicle Does Not Shift Between 2H and 4H Correctly and/or Grinding Noise Heard During 4WD Engagement at High Speeds

Refer to Wiring Diagrams Cell 34 for schematic and connector information.

Normal Operation

The MSS communicates the operator's choice to the TCCM. The TCCM then controls the transfer case synchronization clutch, transfer case motor and IWEs as necessary. If the vehicle is not responding to the operator's intentions, systematically check the necessary inputs and outputs of the TCCM, components of the transfer case, IWE components and halfshafts. Check all circuits for opens and shorts to power or ground.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
P1812:00	4-Wheel Drive Mode Select Circuit Failure: No Sub Type Information	This DTC sets when the TCCM detects an open circuit or short to battery. 4WD system mode cannot be changed.
P1815:00	4-Wheel Drive Mode Select Short Circuit To Ground: No Sub Type Information	This DTC sets when TCCM detects a short to ground. 4WD system mode cannot be changed.
P1839:00	Transfer Case Shift Motor Open Circuit: No Sub Type Information	This DTC sets when TCCM detects an open circuit. Shift motor moves are prevented when this DTC is set.
P1840:00	Transfer Case Shift Motor Short Circuit To Battery: No Sub Type Information	This DTC sets when TCCM detects a short to voltage. Shift motor moves are prevented when this DTC is set.
P1841:00	P1841:00 — Transfer Case Shift Motor Short Circuit To Ground: No Sub Type Information	This DTC sets when TCCM detects a short to ground. Shift motor moves are prevented when this DTC is set.
P1849:00	Transfer Case Contact Plate 'A' Short Circuit To Ground: No Sub Type Information	This DTC sets when TCCM detects a short to ground. Shift motor moves are prevented when this DTC is set. The TCCM will not complete mode change if a change in shift motor position is required.
P184A:00	Transfer Case Unable To Transition Between 4x2 and 4x4 Mode: No Sub Type Information	This DTC sets when target shift motor position is not reached after the maximum number of allowed blocked shift retries for 4H to 4L. Requested shift motor position is not reached.
P1853:00	Transfer Case Contact Plate 'B' Short Circuit to Ground: No Sub Type Information	This DTC sets when TCCM detects a short to ground. Shift motor moves are prevented when this DTC is set. The TCCM will not complete mode change if a change in shift motor position is required.
P1857:00	Transfer Case Contact Plate 'C' Short Circuit to Ground: No Sub Type Information	This DTC sets when TCCM detects a short to ground. Shift motor moves are prevented when this DTC is set. The TCCM will not complete mode change if a change in shift motor position is required.

P1861:00	Transfer Case Contact Plate 'D' Short Circuit to Ground: No Sub Type Information	This DTC sets when TCCM detects a short to ground. Shift motor moves are prevented when this DTC is set. The TCCM will not complete mode change if a change in shift motor position is required.
P1867:00	Transfer Case Contact Plate General Circuit Failure: No Sub Type Information	This DTC sets when an invalid shift motor position is detected during selection of a new 4WD mode or during a motor movement. If the shift motor is not moving, shift motor movement will be prevented. If the shift motor is moving when this DTC sets, the shift motor will move to the high-side mechanical stop.
P1891:00	Transfer Case Contact Plate Ground Return Open Circuit: No Sub Type Information	This DTC sets when TCCM detects a short to ground, a short to voltage or open circuit. The TCCM will not complete mode change if a change in shift motor position is required.
U300D:11	Ignition Input On/Start: Circuit Short To Ground	This DTC sets when the TCCM detects a short to ground.

Possible Sources

- Wiring, terminals or connectors
- MSS
- Transfer case
- Transfer case synchronization clutch
- IWEs
- IWE solenoid
- TCCM
- Front axle assembly

PINPOINT TEST A : THE VEHICLE DOES NOT SHIFT BETWEEN 2H AND 4H CORRECTLY AND/OR GRINDING NOISE HEARD DURING 4WD ENGAGEMENT AT HIGH SPEEDS

A1 CHECK FOR TCCM DTCS



WARNING: When directed to drive the vehicle as part of this test, drive the vehicle on a hard surface in an area without traffic to prevent a crash. Failure to follow these instructions may result in personal injury.

- Ignition ON.
- Enter the following diagnostic mode on the scan tool: TCCM Self-Test.

Are any DTCs present?

Yes	For DTC P184A:00, GO to A19 For DTC P1812:00, GO to A5 For DTC P1815:00, GO to A7 For DTC P1839:00, GO to A25 For DTC P1840:00, GO to A28 For DTC P1841:00, GO to A29 For DTC P1849:00, P1853:00, P1857:00, P1861:00, GO to A21 For DTC P1867:00, GO to A20 For DTC P1891:00, GO to A22 For all other DTCs, REFER to the TCCM DTC Chart.
No	GO to A2

A2 CHECK THE TCCM IGNITION POSITION (KEY_POS_4X4) AND IGNITION STATUS (KEY_STATUS_4X4) PIDS

- Ignition ON.
- Enter the following diagnostic mode: TCCM DataLogger.
- Monitor the KEY_POS_4X4 and KEY_STATUS_4X4 PIDs while cycling through each ignition switch position.

Do the ignition PIDs match the ignition switch positions?

Yes	GO to A3
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No	If the KEY_STATUS_4X4 PID did not match, CHECK BJB fuse 13 (10A). If the fuse is OK, REPAIR circuit CBB54 (VT/OG). If the fuse is not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short. After the fault is repaired, CLEAR the DTCs. If the KEY_POS_4X4 PID did not match, to diagnose the ignition switch, REFER to: Steering Wheel and Column Electrical Components (211-05 Steering Wheel and Column Electrical Components) . After the fault is repaired, CLEAR the DTCs.
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A3 CHECK THE TCCM MODULE SUPPLY VOLTAGE (VBAT_4X4) PID

- Enter the following diagnostic mode: TCCM DataLogger.
- Start the engine and monitor the VBAT_4X4 PID.

Is the VBAT_4X4 PID greater than 12 volts?

Yes	GO to A4
No	To DIAGNOSE the low battery voltage and/or charging system concern, REFER to: Charging System - 2.7L EcoBoost (238kW/324PS) (414-00 Charging System - General Information) . REFER to: Charging System - 3.5L Duratec (209kW/284PS)/3.5L EcoBoost (272kW/370PS)/5.0L 32V Ti-VCT (414-00 Charging System - General Information) . After the repair is complete, CLEAR the DTCs.

A4 CHECK THE MSS POSITION MONITORING THE TCCM 4WD SWITCH STATUS (4X4_SW) PID

- Enter the following diagnostic mode: TCCM DataLogger.
- Monitor the 4X4_SW PID while switching to each MSS position.

Does the 4X4_SW PID match the MSS position?

Yes	GO to A11
No	GO to A5

A5 CHECK THE MSS RESISTANCE VALUES

- Ignition OFF.
- Disconnect MSS C284..
- Measure:

Click to display connectors

Positive Lead	Measurement / Action	Negative Lead
MSS C284, pin 2 component side.	Ω	MSS C284, pin 3 component side.

MSS Position	Resistance ($\pm 1\%$)
2H	619 ohms
4A	270 ohms
4H	130 ohms
4L	62 ohms

Are the resistance values within specification?

Yes	GO to A6
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No	INSTALL a new MSS. REFER to: Mode Select Switch (MSS) (308-07A Four-Wheel Drive Systems, Removal and Installation).
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A6 CHECK THE MSS CONTROL AND RETURN CIRCUITS FOR SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect TCCM C2371A..
- Ignition ON.

Is any voltage present?

Yes	REPAIR the affected circuit(s).
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No	GO to A7
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A7 CHECK THE MSS CONTROL AND RETURN CIRCUITS FOR SHORT TO GROUND

- Ignition OFF.

Are the resistances greater than 10,000 ohms?

Yes	GO to A8
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No	REPAIR the affected circuit(s).
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A8 CHECK THE MSS CONTROL AND RETURN CIRCUITS FOR AN OPEN

Are the resistances less than 3 ohms?

Yes	GO to A9
No	REPAIR the affected circuit(s).

A9 CHECK THE MSS CONTROL AND RETURN CIRCUITS FOR A SHORT TOGETHER

- Ignition OFF.

Is the resistance greater than 10,000 ohms?

Yes	GO to A10
No	REPAIR the affected circuit(s).

A10 CHECK THE TCCM AVERAGE FRONT WHEEL SPEED (FRT_WHL_SPD) AND AVERAGE REAR WHEEL SPEED (REAR_WHL_SPD) PIDS

- Connect TCCM C2371A.
- Connect MSS C284.
- Ignition ON.
- Set the MSS to 2H.
- Enter the following diagnostic mode: TCCM DataLogger.
- Monitor the FRT_WHL_SPD and REAR_WHL_SPD PIDs with the vehicle stopped and while driving.

Do the FRT_WHL_SPD and REAR_WHL_SPD PIDs match with the vehicle stopped and at all speeds?

Yes	GO to A11
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No	To diagnose the wheel speed concern, REFER to: Anti-Lock Brake System (ABS) and Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control) . After the repair is complete, CLEAR the DTCs.
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A11 CHECK THE TCCM 4WD MODES (4WD_MODES) PID WITH THE MSS IN 4H

- Start the engine.
- Enter the following diagnostic mode: TCCM DataLogger.
- Set the MSS to 4H.
- Monitor the 4WD_MODES PID.

Does the 4WD_MODES PID indicate 4WD High?

Yes	GO to A14
No	GO to A12

A12 CHECK FOR 4H WIND-UP

- Switch the MSS to 4H.
- Drive the vehicle on a dry, hard surface in turns.

Is wind-up present in turns?

Yes	GO to A15
No	GO to A13

A13 CHECK FOR TRANSFER CASE ENGAGEMENT

- With the vehicle in NEUTRAL, position it on a hoist.
REFER to: [Jacking and Lifting - Overview](#) (100-02 Jacking and Lifting, Description and Operation).
- Rotate the rear driveshaft.
- Observe the front driveshaft.

Did the front driveshaft rotate?

Yes	GO to A14
No	GO to A18

A14 CHECK FOR IWE ENGAGEMENT

- Start the engine.
- Rotate the LH front tire one revolution forward and one revolution backward while observing the LH front halfshaft and U-joint.
- Rotate the RH front tire one revolution forward and one revolution backward while observing the RH front halfshaft and U-joint.

Did both front halfshafts rotate?

Yes	CHECK that all driveline fasteners are present and tightened to specification. REFER to: Specifications (205-01 Driveshaft, Specifications).
No	GO to Pinpoint Test C

A15 CHECK THE TRANSFER CASE SHIFT TO 2H

- Ignition ON.
- Enter the following diagnostic mode: TCCM Datalogger.
- Command the Transfer Case Contact Plate Power (PLATE_PWR_OS) PID to energize the transfer case gearmotor encoder assembly.
- Monitor the Transfer Case Contact Plate Switch A (PLATE_A), B (PLATE_B), C (PLATE_C) and D (PLATE_D) PIDs for the contact plate position with the MSS in the 2H position.

MSS Position	Contact Plate Position			
	PLATE_A	PLATE_B	PLATE_C	PLATE_D
2H Mode	CLOSED	OPEN	CLOSED	CLOSED
4H Mode	OPEN	CLOSED	CLOSED	OPEN
4L Mode	OPEN	CLOSED	OPEN	CLOSED

Do the PIDs and message center indicate that vehicle shifted into 2H displayed in message center for approximately 4 seconds)?

Yes	GO to A16
No	GO to A20

A16 CHECK FOR IWE DISENGAGEMENT

- With the vehicle in NEUTRAL, position it on a hoist.
REFER to: [Jacking and Lifting - Overview](#) (100-02 Jacking and Lifting, Description and Operation).
- Rotate the LH front tire one revolution forward and one revolution backward while observing the LH front halfshaft.
- Rotate the RH front tire one revolution forward and one revolution backward while observing the RH front halfshaft.

Did either of the front halfshafts rotate?

Yes	GO to Pinpoint Test C
No	GO to A17

A17 CHECK FOR TRANSFER CASE DISENGAGEMENT

- Rotate the rear driveshaft while observing the front driveshaft.

Does the front driveshaft rotate?

Yes	CARRY OUT the Electronic Shift-On-The-Fly (ESOF) Functional Test. GO to Pinpoint Test H
No	GO to A18

A18 CHECK THE TRANSFER CASE CONTACT PLATE POSITION PIDS

- Enter the following diagnostic mode: TCCM Datalogger.
- Command the Transfer Case Contact Plate Power (PLATE_PWR_OS) PID to energize the transfer case gearmotor encoder assembly.
- Monitor the Transfer Case Contact Plate Switch A (PLATE_A), B (PLATE_B), C (PLATE_C) and D (PLATE_D) PIDs for the contact plate position with the MSS in the 4H position.

Position	Contact Plate Position			
	PLATE_A	PLATE_B	PLATE_C	PLATE_D
2H Mode	CLOSED	OPEN	CLOSED	CLOSED
4H Mode	OPEN	CLOSED	CLOSED	OPEN
4L Mode	OPEN	CLOSED	OPEN	CLOSED

Does the front driveshaft rotate?

Yes	GO to A31
No	GO to A19

A19 CHECK THE TRANSFER CASE SHIFT MOTOR OPERATION

- Remove the transfer case shift motor from the transfer case, leaving the wiring connector connected.
- Observe the transfer case shift motor while switching the MSS from 2H to 4H.

Does the transfer case shift motor rotate from the 2H position to the 4H position?

Yes	GO to A31
No	GO to A20

A20 CHECK TRANSFER CASE CONTACT PLATE CIRCUITS FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect Transfer Case .
- Disconnect TCCM C2371A.
- Ignition ON.

Is any voltage present?

Yes	REPAIR the affected circuit(s).
No	GO to A21

A21 CHECK TRANSFER CASE CONTACT PLATE CIRCUITS FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect Transfer Case .
- Disconnect TCCM C2371A.
- Ignition ON.

Are the resistances greater than 10,000 ohms?

Yes	GO to A22
No	REPAIR the affected circuit(s).

A22 CHECK THE TRANSFER CASE CONTACT PLATE CIRCUITS FOR AN OPEN

- Ignition OFF.
- Disconnect TCCM C2371A.
- Ignition ON.

Are the resistances less than 3 ohms?

Yes	GO to A23
No	REPAIR the affected circuit(s).

A23 CHECK THE SHIFT MOTOR FOR AN INTERNAL SHORT TO GROUND

Are the resistances greater than 10,000 ohms?

Yes	GO to A24
No	INSTALL a new transfer case shift motor. REFER to Transfer Case Shift Motor. CLEAR the DTCs. REPEAT the self-test, if the concern is still present, GO to A32

A24 CHECK THE SHIFT MOTOR CIRCUITS FOR POWER WHILE COMMANDING THE TCCM CW RELAY (CW_SMD_OS) AND CCW RELAY (CCW_SMD_OS) PIDS ON

- Ignition ON.
- Connect TCCM C2371A.
- Enter the following diagnostic mode: TCCM DataLogger.

Are the voltages 9 volts or greater on the circuits when commanding the PIDs ON?

Yes	GO to A31
No	GO to A25

A25 CHECK THE TCCM VOLTAGE CIRCUIT

- Ignition OFF.
- Disconnect TCCM C2371B.

Is the voltage greater than 11 volts?

Yes	GO to A28
No	VERIFY BJB fuse 63 (25A) is OK. If OK, REPAIR the open circuit. If not OK, REFER to the Wiring Diagrams manual to identify possible causes of the circuit short. CLEAR the DTCs.

A26 CHECK TCCM GROUND CIRCUIT

- Ignition OFF.
- Disconnect TCCM C2371B.

Is the resistance less than 3 ohms?

Yes	GO to A28
No	REPAIR the circuit.

A27 CHECK THE TRANSFER CASE SHIFT MOTOR CIRCUITS FOR AN OPEN

Are the resistances less than 3 ohms?

Yes	GO to A28
No	REPAIR the affected circuit.

A28 CHECK THE TRANSFER CASE SHIFT MOTOR CIRCUITS FOR SHORT TO VOLTAGE

- Disconnect Transfer Case .

Is any voltage present?

Yes	REPAIR the circuit.
No	GO to A29

A29 CHECK THE TRANSFER CASE SHIFT MOTOR CIRCUITS FOR SHORT TO GROUND

Are the resistances greater than 10,000 ohms?

Yes	GO to A30
No	REPAIR the circuit.

A30 CHECK FOR CORRECT TCCM OPERATION

- Ignition OFF.
- Disconnect and inspect all TCCM connectors.
- Check for the following:
 - corrosion (install new connector or terminals - clean module pins)
 - damaged or bent pins - install new terminals/pins
 - pushed-out pins - install new pins as necessary
- Verify module ground to vehicle ground connection.
Refer to Wiring Diagrams Cell 34 for schematic and connector information.
- Connect all TCCM connectors. Make sure they seat and latch correctly.
- Operate the system and verify the concern is still present.

Is the concern still present?

Yes	INSTALL a new TCCM. REFER to: Transfer Case Control Module (TCCM) (308-07A Four-Wheel Drive Systems, Removal and Installation).
No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of the connector or pin issues.

A31 SHIFT THE TRANSFER CASE TO 4H MANUALLY

- Remove the transfer case shift motor from the transfer case.
- Using a wrench, rotate the shift cam to the 4H position.
- Rotate the rear driveshaft and watch the front driveshaft.

Does the transfer case shift to 4H and the front driveshaft rotates?

Yes	GO to A32
No	REPAIR the transfer case. REFER to: Transfer Case (308-07B Transfer Case, Diagnosis and Testing).

A32 CHECK THE TORQUE REQUIRED TO SHIFT THE TRANSFER CASE

- Rotate the shift cam by hand through 4L, 4H and 2H positions.
- Measure the torque required to perform the shift.

Is the torque required to shift 45 Nm (33 lb-ft) or less?

Yes	GO to A33
No	REPAIR the transfer case. REFER to: Transfer Case (308-07B Transfer Case, Diagnosis and Testing).

A33 SHIFT THE TRANSFER CASE TO 2H MANUALLY

- Rotate the shift cam to the 2H position.
- Rotate the rear driveshaft and watch the front driveshaft.

Does the transfer case shift to 2H and the front driveshaft does not rotate?

Yes	GO to A34
No	REPAIR the transfer case. REFER to: Transfer Case (308-07B Transfer Case, Diagnosis and Testing).

A34 SHIFT THE TRANSFER CASE TO 4L MANUALLY

- Rotate the shift cam by hand to the 4L position.
- Rotate the rear driveshaft and watch the front driveshaft.

Does the transfer case shift to 4L and the front driveshaft rotates?

Yes	INSTALL a new transfer case shift motor. REFER to: Transfer Case Shift Motor (308-07A Four-Wheel Drive Systems, Removal and Installation). CLEAR the DTCs.
No	REPAIR the transfer case. REFER to: Transfer Case (308-07B Transfer Case, Diagnosis and Testing).

The Vehicle Does Not Shift Between 4H and 4L Modes Correctly

Refer to Wiring Diagrams Cell 34 for schematic and connector information.

Normal Operation

The high-low shift occurs when the reduction shift fork moves the high-low collar to lock the planetary gear set to the output shaft. The torque transmitted through the sun gear from the input shaft turns the front planetary gear set assembly. The front planetary gear set assembly, now engaged, provides transfer

case speed reduction. Certain criteria, such as vehicle speed and TR selection must be met before this shift can occur. Systematically check the necessary inputs and outputs of the TCCM, components of the transfer case, IWE components and halfshafts.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
P184B:00	Transfer Case Unable To Transition Between 4x4 High and 4x4 Low Range	This DTC sets when target shift motor position is not reached after the maximum number of allowed blocked shift retries for 4H to 4L. Requested shift motor position is not reached.

Possible Sources

- TR
- Transmission drag torque
- ABS wheel speed inputs
- HS-CAN

PINPOINT TEST B : THE VEHICLE DOES NOT SHIFT BETWEEN 4H AND 4L MODES CORRECTLY

 **WARNING:** When directed to drive the vehicle as part of this test, drive the vehicle on a hard surface in an area without traffic to prevent a crash. Failure to follow these instructions may result in personal injury.

B1 CHECK FOR TCCM DTCS

- Ignition ON.
- Enter the following diagnostic mode: TCCM Self-Test.

Are any DTCs present?

Yes	For DTC P184B:00, GO to B2 For all other DTCs, REFER to the TCCM DTC Chart.
No	GO to Pinpoint Test A

B2 CHECK THE 2H TO 4H SHIFT

- Drive the vehicle and shift MSS from 2H to 4H.

Does the vehicle shift between 2H and 4H correctly?

Yes	GO to B3
No	GO to Pinpoint Test A

B3 CHECK THE 4H TO 4L SHIFT

- **NOTE:** When shifting in or out of 4L, the transmission must be in NEUTRAL and the vehicle stopped or moving less than 5 km/h (3 mph).

Drive the vehicle and shift MSS from 4H to 4L.

Does the transfer case shift from 4H to 4L correctly and the complaint is related to a clunk noise during the shift?

Yes	Transmission neutral drag is excessive. For transmission diagnosis, REFER to: Diagnosis By Symptom (307-01A Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
No	GO to B4

B4 CHECK THE TCCM NEUTRAL INDICATOR (NEUTRAL) AND ABS MODULE WHEEL SPEED PIDS

- Enter the following diagnostic mode: TCCM DataLogger.
- Monitor the NEUTRAL PID while shifting the transmission through gear ranges.
- Enter the following diagnostic mode: ABS Module DataLogger.
- Monitor the wheel speed PIDs:
 - Left Front Wheel Speed Sensor (LF_WSPD)
 - Left Rear Wheel Speed Sensor (LR_WSPD)
 - Right Front Wheel Speed Sensor (RF_WSPD)
 - Right Rear Wheel Speed Sensor (RR_WSPD)

Does the NEUTRAL PID indicate True when the transmission is shifted to NEUTRAL and do the wheel speed PIDs indicate 0 km/h (0 mph)?

Yes	If all 5 PIDs are accurate, GO to Pinpoint Test A
No	If the Neutral PID do not indicate True when the transmission shifted to Neutral, REFER to: Diagnosis By Symptom (307-01A Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). If the wheel speed PIDs do not indicate 0 km/h (0 mph), REFER to: Anti-Lock Brake System (ABS) and Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control) .

The Front Axle Does Not Engage/Disengage Correctly

Refer to Wiring Diagrams Cell 34 for schematic and connector information.

Normal Operation

In 2H mode, the TCCM supplies a ground path to the IWE solenoid to apply vacuum to the IWEs (disengaging the front hubs from the front axle). In 4H or 4L modes, the TCCM does not supply the ground path to the IWE solenoid, vacuum is not applied to IWEs the and an internal spring in the IWEs keeps the hubs engaged.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
C1979:00	IWE Solenoid Circuit Failure: No Sub Type Information	This DTC sets when the TCCM detects there is a possible mechanical fault present with the IWE system based on wheel speed message data. When the DTC is present IWE solenoid output shall continue to operate normally.
C1979:11	IWE Solenoid Circuit Failure: Short Circuit To Ground	This DTC sets when TCCM detects a short to ground. Fault results in IWEs disengaged all the time.
C1979:12	IWE Solenoid Circuit Failure: Short Circuit To Battery	This DTC sets when TCCM detects a short to voltage. Fault results in IWEs engaged all the time.
C1979:13	IWE Solenoid Circuit Failure: Circuit Open	This DTC sets when TCCM detects an open circuit. Fault results in IWEs engaged all the time.

Possible Sources

- MSS
- IWEs
- IWE solenoid
- Transfer case
- Vacuum leaks
- Front axle assembly
- TCCM
- Wiring, terminals or connectors
- Fuses

PINPOINT TEST C : THE FRONT AXLE DOES NOT ENGAGE/DISENGAGE CORRECTLY

C1 CHECK FOR TCCM DTCS

- Enter the following diagnostic mode: TCCM Self-Test.

Are any DTCs present?

Yes	For DTC C1979:11, GO to C23 For DTC C1979:12, GO to C22 For DTC C1979:13, GO to C24 For all other DTCs, REFER to the DTC chart: TCCM.
No	GO to C2

C2 CHECK FOR GRINDING NOISES AT HIGH SPEEDS

- With the vehicle at operating temperature and the MSS in 2H mode, drive the vehicle at sustained Wide Open Throttle (WOT) for 5 seconds.

Is there a grinding noise from the axle system during Wide Open Throttle (WOT)?

Yes	GO to Pinpoint Test A
No	GO to C3

C3 CHECK TCCM OPERATION

- Ignition ON.
- Monitor the 4X4 indicator on the IPC while moving the MSS between 2H and 4H modes.

Does the 4X4 indicator illuminate when the MSS is in the 4H position and turn off when the MSS is in the 2H position?

Yes	GO to C4
No	To diagnose the 4X4 indicator, REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes) .

C4 CHECK THE IWE DISENGAGEMENT

- **NOTE:** *The engine must be idling during the following steps to supply the vacuum required for the IWEs to disengage.*

With the vehicle in NEUTRAL, position it on a hoist.

REFER to: [Jacking and Lifting - Overview](#) (100-02 Jacking and Lifting, Description and Operation).

- Place the MSS in 2H.
- Start the engine.
- Rotate the LH front tire one revolution forward and one revolution backward while observing the LH front halfshaft.
- Rotate the RH front tire one revolution forward and one revolution backward while observing the RH front halfshaft.

Did either front halfshaft rotate?

Yes	GO to C8
No	GO to C5

C5 CHECK THE IWE ENGAGEMENT

- **NOTE:** *The engine must be idling during the following steps to supply the vacuum required for the IWEs to engage and disengage.*

With the vehicle in NEUTRAL, position it on a hoist.

REFER to: [Jacking and Lifting - Overview](#) (100-02 Jacking and Lifting, Description and Operation).

- Place the MSS in 4H.
- Start the engine.
- Rotate the LH front tire one revolution forward and one revolution backward while observing the LH front halfshaft.

- Rotate the RH front tire one revolution forward and one revolution backward while observing the RH front halfshaft.

Did both front halfshafts rotate?

Yes	The front axle is operating properly at this time. CARRY OUT the 4WD Functional Test. GO to Pinpoint Test H
No	GO to C6

C6 CHECK THE IWE SOLENOID OUTPUT IN 4H

- Disconnect the output vacuum line at the IWE solenoid.
- With the engine running, measure the vacuum at the output port of the IWE solenoid.

Is the vacuum less than 25 mm-Hg (1 in-Hg)

Yes	The IWE is mechanically stuck in the disengaged position. INSTALL a new IWE on the halfshaft(s) that did not rotate. REFER to: Integrated Wheel End (IWE) (308-07A Four-Wheel Drive Systems, Removal and Installation).
No	GO to C7

C7 CHECK THE IWE SOLENOID

- Ignition OFF.
- Disconnect IWE solenoid.
- Start the engine.
- Measure the vacuum at the output port of the IWE solenoid.

Is the vacuum less than 25 mm-Hg (1 in-Hg)

Yes	GO to C24
No	INSTALL a new IWE solenoid. REFER to: Integrated Wheel End (IWE) (308-07A Four-Wheel Drive Systems, Removal and Installation).

C8 CHECK THE IWE SOLENOID OUTPUT VACUUM IN 2H

- Disconnect the output vacuum line at the IWE solenoid.
- With the engine running and the MSS in 2H, measure the vacuum at the output port of the IWE solenoid.

Is the vacuum greater than 254 mm-Hg (10 in-Hg)?

Yes	GO to C11
No	GO to C9

C9 CHECK THE IWE SOLENOID INPUT VACUUM

- Disconnect the supply vacuum line at the IWE solenoid.
- With the engine running, measure the supply line vacuum to the IWE solenoid.

Is the vacuum greater than 254 mm-Hg (10 in-Hg)?

Yes	GO to C24
No	GO to C10

C10 CHECK THE VACUUM RESERVOIR

- Ignition OFF.
- With the source vacuum line still disconnected, connect a vacuum pump to the vacuum port on the vacuum reservoir and apply 508 mm-Hg (20 in-Hg) of vacuum.

Does the vacuum maintain or drop less than 25 mm-Hg (1 in-Hg) per minute?

Yes	REPAIR or INSTALL new vacuum lines or INSTALL a check valve.
No	INSTALL a new vacuum reservoir.

C11 CHECK THE IWE VACUUM LINES

- Ignition OFF.
- Disconnect the output vacuum line from the IWE solenoid.
- Disconnect and plug the LH and RH IWE vacuum lines at the IWE.
- Connect a vacuum pump to the IWE output vacuum circuit at the IWE solenoid connection. Apply 508 mm-Hg (20 in-Hg) of vacuum and observe the vacuum reading.

Does the vacuum drop more than 25 mm-Hg (1 in-Hg) per minute?

Yes	CHECK the individual vacuum lines for potential leaks, to verify proper IWE function, GO to C18
No	GO to C12

C12 CHECK THE LH IWE VACUUM LINE FOR AN OBSTRUCTION

- Remove the plug from the vacuum line at the LH IWE.
- Connect a hand vacuum pump to the LH IWE vacuum line and attempt to draw a vacuum on the line.

Did the vacuum pump draw a vacuum on the LH IWE vacuum line?

Yes	INSTALL a new vacuum line. CLEAR the DTCs.
No	GO to C14

C13 CHECK LH IWE VACUUM LINE FOR CRACKS

- Plug the IWE output vacuum circuit at the IWE solenoid connection and apply 508 mm-Hg (20 in-Hg) of vacuum.

Did the vacuum pump draw a vacuum on the LH IWE vacuum line.

Yes	VERIFY the RH IWE vacuum line, GO to C14
No	INSTALL a new vacuum line, to verify the RH IWE vacuum line, GO to C14

C14 CHECK THE RH IWE VACUUM LINE FOR AN OBSTRUCTION

- Remove the plug from the vacuum line at the RH IWE.
- Remove the plug from the IWE output vacuum circuit at the IWE solenoid connection.
- Connect a vacuum pump to the RH IWE vacuum line and attempt to draw a vacuum on the line.

Did the vacuum pump draw a vacuum on the RH IWE vacuum line?

Yes	INSTALL a new vacuum line. CLEAR the DTCs.
No	GO to C16

C15 CHECK RH IWE VACUUM LINE FOR CRACKS

- Plug the IWE output vacuum circuit at the LH IWE solenoid connection and apply 508 mm-Hg (20 in-Hg) of vacuum.

Did the vacuum pump draw a vacuum on the RH IWE vacuum line.

Yes	GO to C16
No	INSTALL a new vacuum line, to verify the RH IWE vacuum line, GO to C16

C16 CHECK THE RH IWE LEAK RATE

- Apply 508 mm-Hg (20 in-Hg) of vacuum to the RH IWE port and observe vacuum reading.

Does the vacuum maintain or drop less than 25 mm-Hg (1 in-Hg) per minute?

Yes	GO to C17
No	INSTALL a new RH IWE. REFER to: Integrated Wheel End (IWE) (308-07A Four-Wheel Drive Systems, Removal and Installation).

C17 CHECK THE RH IWE OPERATION

- Connect a vacuum pump with gauge to the larger port of the RH IWE.
- Observe the RH halfshaft while rotating the RH front tire. Apply between 152-203 mm-Hg (6-8 in-Hg) of vacuum and release the vacuum to manually disengage and engage the RH IWE.

Did the RH IWE disengage between 152-203 mm-Hg (6-8 in-Hg) and engage when the vacuum is released?

Yes	CONNECT the vacuum line to the RH IWE. GO to C18
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No	INSTALL a new RH IWE. REFER to: Integrated Wheel End (IWE) (308-07A Four-Wheel Drive Systems, Removal and Installation).
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C18 CHECK THE LH IWE LEAK RATE

- Disconnect the vacuum line from the larger port at the LH IWE.
- Apply 508 mm-Hg (20 in-Hg) of vacuum to the LH IWE port and observe vacuum reading.

Does the vacuum maintain or drop less than 25 mm-Hg (1 in-Hg) per minute?

Yes	GO to C19
No	INSTALL a new LH IWE. REFER to: Integrated Wheel End (IWE) (308-07A Four-Wheel Drive Systems, Removal and Installation).

C19 CHECK THE LH IWE OPERATION

- Connect a vacuum pump with gauge to the larger port of the LH IWE.
- Observe the LH halfshaft while rotating the LH front tire. Apply between 152-203 mm-Hg (6-8 in-Hg) Hg of vacuum and release the vacuum to manually disengage and engage the LH IWE.

Did the LH IWE disengage between 152-203 mm-Hg (6-8 in-Hg) and engage when the vacuum is released?

Yes	CONNECT the vacuum line to the LH IWE. GO to C20
No	INSTALL a new LH IWE. REFER to: Integrated Wheel End (IWE) (308-07A Four-Wheel Drive Systems, Removal and Installation).

C20 CHECK THE IWE SOLENOID CONTROL CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect IWE solenoid C1291.
- Disconnect TCCM C2371A.
- Ignition ON.

Is any voltage present?

Yes	REPAIR the circuit. CLEAR the DTCs.
No	GO to C21

C21 CHECK THE IWE SOLENOID CONTROL CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.

Is the resistance greater than 10,000 ohms?

Yes	GO to C22
No	REPAIR the circuit.

C22 CHECK THE IWE SOLENOID RESISTANCE

- **NOTE:** *If the temperatures (either ambient or in the engine compartment) are exceptionally high, a higher than normal resistance reading could result. A lower temperature could result in a lower resistance reading.*

Measure:

Click to display connectors

Positive Lead	Measurement / Action	Negative Lead
Pin 1, component side.	Ω	Pin 2, component side.

Is the resistance between 44 and 70 ohms?

Yes	GO to C23
No	INSTALL a new IWE solenoid. CLEAR the DTCs.

C23 CHECK FOR VOLTAGE TO THE IWE SOLENOID

- Connect TCCM C2371A.
- Ignition ON.

Is the voltage greater than 11 volts?

Yes	GO to C24
No	CHECK BJB fuse 29 (10A). If OK, REPAIR the open circuit. If not OK, REFER to the Wiring Diagrams manual to identify possible causes of the circuit short. CLEAR the DTCs.

C24 CHECK THE IWE SOLENOID CONTROL CIRCUIT FOR AN OPEN

- Ignition OFF.
- Disconnect IWE Solenoid C1291.
- Disconnect TCCM C2371A.

Is the resistance less than 3 ohms?

Yes	GO to C25
No	REPAIR the circuit. CLEAR the DTCs.

C25 CHECK FOR CORRECT TCCM OPERATION

- Ignition OFF.
- Disconnect and inspect all TCCM connectors.
- Check for the following:
 - corrosion (install new connector or terminals - clean module pins)
 - damaged or bent pins - install new terminals/pins
 - pushed-out pins - install new pins as necessary
- Connect all TCCM connectors. Make sure they seat and latch correctly.
- Operate the system and verify the concern is still present.

Is the concern still present?

Yes	INSTALL a new TCCM. REFER to: Transfer Case Control Module (TCCM) (308-07A Four-Wheel Drive Systems, Removal and Installation).
No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of the connector or pin issues.

The Transfer Case Jumps Out of Gear

Refer to Wiring Diagrams Cell 34 for schematic and connector information.

Normal Operation

Once the 4WD system engages the user selected mode, that mode should be maintained. If the 4WD system does not stay in the selected position systematically check the 4WD system components.

 **WARNING:** When directed to drive the vehicle as part of this test, drive the vehicle on a hard surface in an area without traffic to prevent a crash. Failure to follow these instructions may result in personal injury.

PINPOINT TEST D : THE TRANSFER CASE JUMPS OUT OF GEAR

D1 CHECK FOR OBSTRUCTED IWE VENT LINES

- With the vehicle in NEUTRAL, position it on a hoist.
REFER to: [Jacking and Lifting - Overview](#) (100-02 Jacking and Lifting, Description and Operation).

- **NOTE:** *The IWE vent port is the smaller of the 2 vacuum ports.*

Disconnect the LH IWE line from the vent port.

- Attach a vacuum pump to the IWE vent line and attempt to hold a vacuum.
- Disconnect the RH IWE line from the vent port.
- Attach a vacuum pump to the IWE vent line and attempt to hold a vacuum.

Can a vacuum be held on either IWE vent line?

Yes	INSTALL new IWE vent lines as necessary.
No	GO to D2

D2 CHECK THE MSS POSITION MONITORING THE TCCM 4WD SWITCH STATUS (4X4_SW) PID

- Ignition ON.
- Enter the following diagnostic mode: TCCM Datalogger.
- Drive the vehicle.
- Dynamically monitor the 4X4_SW PID while driving the vehicle in each shift position.

Does the 4X4_SW PID always agree with the switch position?

Yes	GO to D3
No	GO to Pinpoint Test A

D3 CHECK THE 4WD INDICATORS

- Stop the vehicle.
- Transmission in NEUTRAL.
- Depress the brake pedal.
- Observe the 4WD indication in the message center while cycling through each MSS position.

Does the 4WD indicator(s) match the MSS?

Yes	GO to D4
No	To diagnose the 4WD, REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes) .

D4 CHECK FOR TCCM DTCS

- Transmission in PARK.
- Enter the following diagnostic mode: TCCM Self-Test.

Are any DTCs present?

Yes	REFER to the DTC Chart: TCCM.
No	CHECK the transfer case fluid level. If the fluid level is OK, CHECK for internal transfer case faults. REFER to: Transfer Case (308-07B Transfer Case, Diagnosis and Testing).

The Front Axle Makes Noise In 2h Mode Only And Generally Under Heavy Throttle

Refer to Wiring Diagrams Cell 34 for schematic and connector information.

Normal Operation

In 2H mode, the TCCM provides a ground path to the IWE solenoid to supply vacuum to each IWE (disengaging the front hubs from the front axle). During certain conditions such as WOT maneuvers, manifold vacuum is lower than desired. To maintain uninterrupted IWE function in 2H mode, stored engine vacuum is sourced from the vacuum reservoir. A one-way check valve is implemented between the manifold and IWE solenoid/vacuum reservoir to prevent the stored vacuum from escaping into the manifold during low engine vacuum conditions. For noise-free IWE operation under all conditions, the check valve must be operating correctly.

Possible Sources

- Fuse
- Wiring, terminals or connectors
- TCCM
- Transfer case
- Front axle assembly
- Transfer case synchronization clutch

**PINPOINT TEST E : THE FRONT AXLE MAKES NOISE IN 2H MODE ONLY AND
GENERALLY UNDER HEAVY THROTTLE**

E1 CHECK FOR TCCM DTCS	
 WARNING: When directed to drive the vehicle as part of this test, drive the vehicle on a hard surface in an area without traffic to prevent a crash. Failure to follow these instructions may result in personal injury.	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: TCCM Self-Test.	
Are any DTCs present?	
Yes	REFER to the TCCM DTC chart.
No	GO to E2

E2 CHECK FOR GRINDING NOISES AT HIGH SPEEDS

- With the vehicle warm and the MSS in 2H mode, drive the vehicle at sustained WOT for 5 seconds.

Is there a grinding noise from the axle system during WOT?

Yes	GO to E3
No	IDENTIFY the customer concern and REFER to Symptom Chart: Four-Wheel Drive Systems.

E3 CHECK THE IWE SOLENOID OUTPUT VACUUM IN 2H

- Select 2H.
- **NOTE:** *The engine must be idling during the following steps to supply vacuum to the IWE solenoid.*

Start the engine.

- Disconnect the output vacuum line at the IWE solenoid while having the vacuum supply attached to the solenoid.
- With the engine running and the in 2H mode, measure the vacuum at the output port of the solenoid.

Is the vacuum greater than 254 mm (10 in) Hg?

Yes	GO to E8
No	GO to E4

E4 CHECK THE IWE SOLENOID INPUT VACUUM

- Disconnect the supply vacuum line at the IWE solenoid.
- With the engine still running, measure the supply line vacuum to the IWE solenoid.

Is the vacuum greater than 254 mm (10 in) Hg?

Yes	INSTALL a new IWE solenoid. REFER to: Integrated Wheel End (IWE) (308-07A Four-Wheel Drive Systems, Removal and Installation).
No	GO to E5

E5 CHECK SOURCE VACUUM TO THE VACUUM RESERVOIR

- Disconnect the source vacuum line from the vacuum reservoir.
- With the engine still running, measure the source vacuum being supplied to the vacuum reservoir.

Is the vacuum greater than 254 mm (10 in) Hg?

Yes	GO to E6
No	REPAIR or INSTALL a new source vacuum line.

E6 CHECK THE VACUUM RESERVOIR

- Ignition OFF.
- Disconnect the vacuum line from the vacuum reservoir.
- Connect a hand vacuum pump to the source vacuum port on the vacuum reservoir and apply 508 mm (20 in) Hg of vacuum.

Does the vacuum maintain or drop less than 25 mm (1 in) Hg per minute?

Yes	GO to E7
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No	INSTALL a new vacuum reservoir.
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E7 CHECK THE ONE-WAY VACUUM CHECK VALVE

- **NOTE:** *The check valve is between the IWE solenoid and the vacuum reservoir.*

Connect the vacuum lines to the IWE solenoid.

- Connect a hand vacuum pump to the IWE solenoid vacuum line at the vacuum reservoir and apply 508 mm (20 in) Hg of vacuum.

Does the vacuum maintain or drop less than 25 mm (1 in) Hg per minute?

Yes	Concern not present at this time. GO to Pinpoint Test H
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No	REPAIR or INSTALL new vacuum lines or INSTALL a new one-way check valve.
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E8 CHECK THE IWE VACUUM SYSTEM

- Ignition OFF.
- Disconnect both vacuum lines from the IWE solenoid.
- Using a hand vacuum pump, apply 508 mm (20 in) Hg of vacuum to the IWE system through the apply vacuum circuit.
- Observe the vacuum reading.

Does the vacuum maintain or drop less than 25 mm (1 in) Hg per minute?

Yes	CONNECT the vacuum lines to the solenoid. GO to E12
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No	GO to E9
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E9 CHECK THE RH IWE LEAK RATE

- With the vehicle in NEUTRAL, position it on a hoist.
REFER to: [Jacking and Lifting - Overview](#) (100-02 Jacking and Lifting, Description and Operation).
- Disconnect the vacuum line from the larger port on the RH IWE.
- Apply 508 mm (20 in) Hg of vacuum to the RH port and observe vacuum reading.

Does the vacuum maintain or drop less than 25 mm (1 in) Hg per minute?

Yes	GO to E10
No	INSTALL a new RH IWE. REFER to: Integrated Wheel End (IWE) (308-07A Four-Wheel Drive Systems, Removal and Installation).

E10 CHECK THE LH IWE LEAK RATE

- Disconnect the vacuum line from the larger port at the LH IWE.
- Apply 508 mm (20 in) Hg of vacuum to the LH port and observe vacuum reading.

Does the vacuum maintain or drop less than 25 mm (1 in) Hg per minute?

Yes	GO to E11
No	INSTALL a new LH IWE. REFER to: Integrated Wheel End (IWE) (308-07A Four-Wheel Drive Systems, Removal and Installation).

E11 CHECK THE IWE VACUUM SUPPLY TUBE

- Disconnect both vacuum lines from the IWE solenoid.
- Plug both LH and RH IWE vacuum lines. Apply 508 mm (20 in) Hg of vacuum to the IWE apply vacuum circuit and observe the vacuum reading.

Does the vacuum maintain or drop less than 25 mm (1 in) Hg per minute?

Yes	CONNECT the vacuum lines to the solenoid. GO to E12
No	INSTALL new vacuum lines as necessary.

E12 CHECK THE IWE VACUUM SUPPLY AT EACH IWE IN 2H

- Connect a hand-held vacuum gauge to the LH vacuum supply tube.
- **NOTE:** *The engine must be idling during the following steps to supply the vacuum required for the IWE to disengage.*

Start the engine.

- While maintaining the steering wheel straight, switch to 2H mode and wait for approximately 5 seconds, observe the vacuum gauge.
- Repeat these steps for the RH IWE.

Are the vacuum readings greater than 254 mm (10 in) Hg after 5 seconds have elapsed?

Yes	GO to E13
No	INSTALL new vacuum lines as necessary.

E13 CHECK THE LH IWE VACUUM LINE FOR AN OBSTRUCTION

- Ignition OFF.
- Disconnect both vacuum lines from the IWE solenoid.
- With the vehicle in NEUTRAL, position it on a hoist.
- Disconnect the vacuum line at the LH IWE.
- Connect a hand vacuum pump to the LH IWE vacuum line and attempt to draw a vacuum on the line.

Did the hand vacuum pump draw a vacuum on the LH IWE vacuum line?

Yes	INSTALL a new vacuum line.
No	CONNECT the vacuum line to the LH IWE. GO to E14

E14 CHECK THE RH IWE VACUUM LINE FOR AN OBSTRUCTION

- Disconnect the larger vacuum line at the RH IWE.
- Connect a hand vacuum pump to the RH IWE vacuum line and attempt to draw a vacuum on the line.

Did the hand vacuum pump draw a vacuum on the RH IWE vacuum line?

Yes	INSTALL a new vacuum line.
No	CONNECT the vacuum line to the RH IWE. GO to E15

E15 CHECK THE LH IWE OPERATION

- Ignition OFF.
- Connect a hand vacuum pump with gauge to the larger port of the LH IWE.
- Observe the LH halfshaft while rotating the LH front tire. Apply between 152 and 203 mm (6 to 8 in) Hg of vacuum and release the vacuum to manually disengage and engage the LH IWE.

Did the LH IWE disengage between 152 and 203 mm (6 to 8 in) Hg and engage when the vacuum is released?

Yes	GO to E16
No	INSTALL a new LH IWE. REFER to: Integrated Wheel End (IWE) (308-07A Four-Wheel Drive Systems, Removal and Installation).

E16 CHECK THE RH IWE OPERATION

- Connect a hand vacuum pump with gauge to the larger port of the RH IWE.
- Observe the RH halfshaft while rotating the RH front tire. Apply between 152 and 203 mm (6 to 8 in) Hg of vacuum and release the vacuum to manually disengage and engage the RH IWE.

Yes	GO to Pinpoint Test H
No	INSTALL a new RH IWE. REFER to: Integrated Wheel End (IWE) (308-07A Four-Wheel Drive Systems, Removal and Installation).

The 4WD Does Not Engage at Speed Correctly

Refer to Wiring Diagrams Cell 34 for schematic and connector information.

Normal Operation

When the operator selects a transfer case mode from 2H mode, the TCCM engages the synchronization clutch for approximately 5 seconds to synchronize the front and rear driveshafts allowing a further mechanical engagement of the transfer case. The TCCM also removes the ground path from the IWE solenoid, which removes vacuum from the IWEs, allowing them to engage. Systematically check the necessary inputs and outputs at the TCCM , internal components of the transfer case, IWE components and drive axles.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
P1825:00	4-Wheel Drive Clutch Relay Open Circuit: No Sub Type Information	This DTC sets when TCCM detects an open circuit. The TCCM disables transfer case synchronization clutch operation.
P1826:00	4-Wheel Drive Low Clutch Relay Circuit To Battery: No Sub Type Information	This DTC sets when TCCM detects a short to voltage. Transfer case synchronization clutch operation, though disabled by the TCCM, is fully engaged when this DTC is present.
P1827:00	4-Wheel Drive Low Clutch Relay Circuit To Ground	This DTC sets when TCCM detects a short to ground. The TCCM disables transfer case synchronization clutch operation.

Possible Sources

- Transfer case synchronization clutch
- Transfer case
- TCCM
- Front axle assembly
- Wiring, terminals or connectors

 **WARNING:** When directed to drive the vehicle as part of this test, drive the vehicle on a hard surface in an area without traffic to prevent a crash. Failure to follow these instructions may result in personal injury.

PINPOINT TEST F : THE 4WD DOES NOT ENGAGE AT SPEED CORRECTLY

F1 CHECK FOR TCCM DTCS

- Ignition ON.
- Enter the following diagnostic mode: TCCM Self-Test.

Are any DTCs present?

Yes	For DTC P1825:00, GO to F8 or DTC P1826:00, GO to F10 For DTC P1827:00, GO to F9 For all other DTCs, REFER to the DTC Chart: TCCM.
No	GO to F2

F2 CHECK 4H ENGAGEMENT AT REST

- Switch the MSS from 2H to 4H.
- Confirm 4H engagement by driving the vehicle and check for wind-up in turns.

Does 4H engage at rest correctly?

Yes	GO to F3
No	GO to Pinpoint Test A

F3 CHECK 2H TO 4H SHIFT AT SPEED

- Switch the MSS to 2H.
- Drive the vehicle and carry out a 2H to 4H shift while driving approximately at 16 km/h (10 mph).
- **NOTE:** When performing 2H to 4H or 4H to 2H shift, release the accelerator pedal prior to the shift and wait until Shift in Progress disappears.

Stop the vehicle, shift to 2H, drive the vehicle and carry out a 2H to 4H shift while driving at approximately 64 km/h (40 mph).

Does 4H engage correctly (or much better) at 16 km/h (10 mph) than at 64 km/h (40 mph)?

Yes	GO to Pinpoint Test C
No	GO to F4

F4 CHECK THE TCCM AVERAGE FRONT WHEEL SPEED (FRT_WHL_SPD) AND AVERAGE REAR WHEEL SPEED (REAR_WHL_SPD) PIDS

- Enter the following diagnostic mode: TCCM DataLogger.
- Monitor the FRT_WHL_SPD and REAR_WHL_SPD PIDs while driving in a straight line.

Do the FRT_WHL_SPD and REAR_WHL_SPD PIDs match?

Yes	GO to F5
No	REFER to: Anti-Lock Brake System (ABS) and Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control) .

F5 CHECK THE TRANSFER CASE SYNCHRONIZATION CLUTCH LOCK-UP USING THE TCCM 4WD PWM CLUTCH STATUS (4WD_CLTCH_OS) PID

- Ignition ON.
- Switch the MSS to 4H.
- Active command the 4WD_CLTCH_OS PID to 98%.
- With the vehicle in NEUTRAL, position it on a hoist.
REFER to: [Jacking and Lifting - Overview](#) (100-02 Jacking and Lifting, Description and Operation).
- Remove the transfer case shift motor from the transfer case, leaving the electrical connector connected.
- Using a wrench, shift the transfer case shift cam to 2H.

- Rotate the rear driveshaft while observing the front driveshaft.

Does the front driveshaft rotate when the rear driveshaft is rotated?

Yes	GO to F6
No	GO to F7

F6 CHECK THE TRANSFER CASE SYNCHRONIZATION CLUTCH RELEASE USING THE TCCM 4WD PWM CLUTCH STATUS (4WD_CLTCH_OS) PID

- Active command the 4WD_CLTCH_OS PID to 0%.
- Rotate the rear driveshaft while observing the front driveshaft.

Does the front driveshaft rotate when the rear driveshaft is rotated?

Yes	GO to F10
No	END the active command. GO to F7

F7 CHECK FOR VOLTAGE TO THE TRANSFER CASE SYNCHRONIZATION CLUTCH USING THE TCCM 4WD PWM CLUTCH STATUS (4WD_CLTCH_OS) PID

- Ignition ON.
- Enter the following diagnostic mode: TCCM DataLogger.
- Using the 4WD_CLTCH_OUT active command, command the transfer case clutch to 98%.

Is the voltage greater than 9 volts?

Yes	END the active command. INSTALL a new transfer case synchronization clutch. REFER to: Transfer Case (308-07B Transfer Case, Diagnosis and Testing). CLEAR the DTCs.
No	GO to F8

F8 CHECK THE TRANSFER CASE SYNCHRONIZATION CLUTCH CONTROL CIRCUIT FOR AN OPEN

Is the resistance less than 3 ohms?

Yes	GO to F9
No	REPAIR the circuit. CLEAR the DTCs.

F9 CHECK THE TRANSFER CASE SYNCHRONIZATION CLUTCH CONTROL CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect Transfer Case.
- Ignition ON.
- Disconnect TCCM C2371B.

Is the resistance greater than 10,000 ohms?

Yes	GO to F10
No	REPAIR the circuit.

F10 CHECK THE TRANSFER CASE SYNCHRONIZATION CLUTCH CIRCUIT FOR A SHORT TO VOLTAGE

Is any voltage present?

Yes	REPAIR the circuit.
No	GO to F11

F11 CHECK TRANSFER CASE SYNCHRONIZATION CLUTCH

- Ignition OFF.

Is the resistance between 1-3 ohms?

Yes	GO to F12
No	INSTALL a new transfer case synchronization clutch. REFER to: Transfer Case (308-07B Transfer Case, Diagnosis and Testing).

F12 CHECK FOR CORRECT TCCM OPERATION

- Ignition OFF.
- Disconnect and inspect all TCCM connectors.
- Repair:
 - corrosion (install new connector or terminals - clean module pins)
 - damaged or bent pins - install new terminals/pins
 - pushed-out pins - install new pins as necessary
- Connect all TCCM connectors. Make sure they are seated correctly.
- Operate the system and verify the concern is still present.

Is the concern still present?

Yes	INSTALL a new TCCM. REFER to: Transfer Case Control Module (TCCM) (308-07A Four-Wheel Drive Systems, Removal and Installation).
No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of the connector or pin issues.

Vehicle Pulsates Or Shudders In A Straight Line (Straightline Driveline Wind-Up)

Refer to Wiring Diagrams Cell 34 for schematic and connector information.

Normal Operation

In order for the 4WD system to function correctly, tires and wheels must be the same size, be in good condition and the front and rear axle ratios must match.

Possible Sources

- Unequal tire inflation pressures
- Unmatched and wheel size
- Unequal amounts of tire wear
- Unmatched front and rear axle ratios

PINPOINT TEST G : VEHICLE PULSATES OR SHUDDERS IN A STRAIGHT LINE
(STRAIGHTLINE DRIVELINE WIND-UP)

 **WARNING:** When directed to drive the vehicle as part of this test, drive the vehicle on a hard surface in an area without traffic to prevent a crash. Failure to follow these instructions may result in personal injury.

G1 VERIFY THE CONCERN

NOTE: 4X4 high/low (4H/4L) is not intended for driving on hard/dry surfaces.

- Drive the vehicle and shift from 2H to 4H. There should be minimal wind-up in 4H mode during straight line maneuvers (wind-up in turns is normal; 4X4 high/low is not intended for driving on hard/dry surfaces).

Is excessive wind-up present?

Yes	GO to G2
No	RETURN the vehicle to the customer. ADVISE about correct system operation and normal vehicle behavior.

G2 CHECK FOR MATCHING WHEEL AND TIRE SIZES

- Check the wheel and tire sizes.

Do the 4 wheel and tire sizes match?

Yes	GO to G3
No	ADVISE the customer that 4WD systems require 4 matched, correctly inflated, correctly maintained tires to operate correctly.

G3 CHECK TIRE WEAR

- Check each of the 4 tires for wear.

Are the 4 tires worn evenly?

Yes	GO to G4
No	ADVISE the customer that 4WD systems require 4 matched, correctly inflated, correctly maintained tires to operate correctly.

G4 CHECK TIRE INFLATION PRESSURE

- Check the inflation pressure in each tire. Refer to VC label.

Are the tire inflation pressures correct?

Yes	GO to G5
No	ADJUST the tire pressure as necessary. ADVISE the customer that 4WD systems require 4 matched, correctly inflated, correctly maintained tires to operate correctly.

G5 CHECK THE FRONT AND REAR AXLE RATIOS

- Check that front and rear axle ratios match.

Do the front and rear axle ratios match?

Yes	RETURN the vehicle to the customer and ADVISE about correct 4WD usage and normal vehicle behavior.
No	CHECK the vehicle VC label. INSTALL the correct axle(s). REFER to: Rear Drive Axle and Differential (205-02A Rear Drive Axle/Differential - Vehicles With: Ford 8.8 Inch Ring Gear, Diagnosis and Testing). REFER to: Front Drive Axle (205-03 Front Drive Axle/Differential, Diagnosis and Testing).

Electronic Shift-On-The-Fly (ESOF) Functional Test

Locator views for the vacuum lines and vacuum reservoir are located in Description and Operation.
REFER to: Four-Wheel Drive Systems (308-07 Four-Wheel Drive Systems) .

Refer to Wiring Diagrams Cell 34 for schematic and connector information.

Normal Operation

When operating in 4H or 4L mode, the transfer case and both IWEs are locked. When in 4L mode, the transfer case low range gear set provides an additional 2.64 gear reduction. When operating in 2H mode, the transfer case and both IWEs are unlocked.

NOTE:

Possible Sources

- 4WD system and/or related components

 **WARNING:** When directed to drive the vehicle as part of this test, drive the vehicle on a hard surface in an area without traffic to prevent a crash. Failure to follow these instructions may result in personal injury.

PINPOINT TEST H : ELECTRONIC SHIFT-ON-THE-FLY (ESOF) SYSTEM

FUNCTIONAL TEST

NOTE: 4X4 High and 4X4 Low are not intended for driving on hard/dry surfaces; using these modes while driving on these surfaces may produce noises like intermittent clunking, but will not damage driveline components.

H1 CHECK FOR IPC DTCS

- Ignition ON.
- Enter the following diagnostic mode: IPC Self-Test.

Does the message center display 4X2 for approximately 4 seconds?

Yes	If DTC U0102:00 is retrieved, REFER to: Communications Network (418-00 Module Communications Network) . For all other DTCs, REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes) .
No	GO to H2

H2 CHECK 2H OPERATION

- Switch the MSS from 4H to 2H while monitoring the message center.

Does the message center display 4X2 for approximately 4 seconds?

Yes	GO to H5
No	GO to H3

H3 CHECK FOR TCCM DTCS

- Ignition ON.
- Enter the following diagnostic mode: TCCM Self-Test.

Are DTCs present?

Yes	REFER to the TCCM DTC Chart
No	GO to H4

H4 CHECK FOR WIND-UP IN 2H

- Drive the vehicle on a dry, hard surface while executing turns.

Is wind-up present in turns?

Yes	GO to Pinpoint Test A
No	To diagnose the indicator light, REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes) .

H5 CHECK FOR STRAIGHTLINE WIND-UP IN 4H MODE

- Drive the vehicle on a dry, hard surface.

Is straightline wind-up present?

Yes	GO to Pinpoint Test G
No	GO to H6

H6 CHECK WIND-UP IN TURNS IN 4H MODE

- Drive the vehicle in 4H mode while turning.

Is wind-up present in turns?

Yes	GO to H7
No	GO to Pinpoint Test A

H7 CHECK 4L OPERATION

- Bring the vehicle to a stop with the transmission in NEUTRAL and switch the MSS to 4L.

Does the 4X4 LOW indicator illuminate correctly?

Yes	GO to H10
No	GO to H8

H8 CHECK FOR TCCM DTCS

- Ignition ON.
- Enter the following diagnostic mode: TCCM Self-Test.

Are DTCs present?

Yes	REFER to the TCCM DTC Chart
No	GO to H9

H9 CHECK FOR WIND-UP IN 4L

- Drive the vehicle on a dry, hard surface while executing turns.

Is wind-up present in turns?

Yes	GO to Pinpoint Test A
No	GO to Pinpoint Test B

H10 CHECK FOR 4L WIND-UP IN TURNS

- Drive the vehicle on a dry, hard surface while executing turns.

Is wind-up present and 4L functioning?

Yes	GO to H11
No	CHECK for TCCM DTCs. REFER to the TCCM DTC Chart.

H11 CHECK 4L TO 2H SHIFT

- With the vehicle at a stop and transmission in NEUTRAL, switch the MSS from 4L to 2H.

Does the message center display 4X2 for approximately 4 seconds?

Yes	GO to H14
No	GO to H12

H12 CHECK FOR TCCM DTCS

- Select PARK.
- Enter the following diagnostic mode: TCCM Self-Test .

Are DTCs retrieved?

Yes	REFER to the TCCM DTC Chart.
No	GO to H13

H13 CHECK FOR WIND-UP IN 2H

- Switch the MSS to 2H.
- Drive the vehicle on a dry, hard surface while executing turns.

Is wind-up present in turns?

Yes	GO to Pinpoint Test B
No	To diagnose the 4WD indicators do not operate correctly, REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes) .

H14 CHECK FOR TRANSFER CASE DISENGAGEMENT

- With the vehicle in NEUTRAL, position it on a hoist.
REFER to: [Jacking and Lifting - Overview](#) (100-02 Jacking and Lifting, Description and Operation).
- Rotate the rear driveshaft while observing the front driveshaft.

Does the front driveshaft rotate?

Yes	REFER to: Transfer Case (308-07B Transfer Case, Diagnosis and Testing).
No	GO to H15

H15 CHECK FOR AND RH IWE DISENGAGEMENT

NOTE: The engine must be idling during the following steps to supply the vacuum required for the IWEs to engage and disengage.

- Start the engine.
- Rotate the LH front tire one revolution forward and one revolution backward while observing the LH front halfshaft and U-joint.
- Rotate the RH front tire one revolution forward and one revolution backward while observing the RH front halfshaft and U-joint.

Does the LH or RH front halfshaft rotate?

Yes	GO to Pinpoint Test C
No	GO to H16

H16 CHECK FOR IWE VACUUM LEAKS

- Ignition OFF.
- Disconnect both vacuum lines from the IWE solenoid.
- Using a vacuum pump, apply 508 mm (20 in) Hg of vacuum to the IWE apply vacuum circuit.
- Observe the vacuum reading.

Did the vacuum drop more than 25 mm (1 in) Hg per minute?

Yes	CHECK the IWE and related components for leaks. GO to Pinpoint Test C
No	GO to H17

H17 CHECK 2H TO 4H SHIFT AT SPEED ABOVE 32 KM/H (20 MPH)

- Switch the MSS to 2H.
- **NOTE:** *When performing 2H to 4H or 4H to 2H shift, release the accelerator pedal prior to the shift and wait until Shift in Progress disappears.*

Drive the vehicle on the road and shift from 2H to 4H while driving above 32 km/h (20 mph).

Does the transfer case shift to 4H satisfactorily?

Yes	The 4WD system is functioning correctly.
No	GO to Pinpoint Test F

DTC U0100

Refer to Wiring Diagrams Cell 34 for schematic and connector information.

Normal Operation

The TCCM sets DTC U0100 when it has not received messages from the PCM for more than 5 seconds. Other modules that require data from the PCM all set communication DTCs and may also exhibit system function concerns.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0100	Lost Communication With ECM/PCM "A": No Sub-Type Information	Sets in continuous memory in the TCCM if powertrain data messages received from the PCM over the HS-CAN are missing for longer than 5 seconds.

Possible Sources

- Communication concern
- Battery voltage concern
- PCM
- TCCM

PINPOINT TEST I : U0100

I1 VERIFY THE SCAN TOOL COMMUNICATES WITH THE PCM (POWERTRAIN CONTROL MODULE)

- Ignition ON.
- Connect a diagnostic scan tool.
- Check that a vehicle session can be established using a diagnostic scan tool.

Can a vehicle session be established?

Yes	GO to I2
No	REFER to: Communications Network (418-00 Module Communications Network) .

I2 CHECK THE TCCM (TRANSFER CASE CONTROL MODULE) CONTINUOUS MEMORY DTC (DIAGNOSTIC TROUBLE CODE) S

- Using a diagnostic scan tool, perform the TCCM self-test.
- Clear the DTCs.
- Wait 10 seconds.
- Repeat the TCCM self-test.

Is DTC U0100?

Yes	GO to I3
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

I3 RETRIEVE THE RECORDED DTC (DIAGNOSTIC TROUBLE CODE) S FROM THE PCM (POWERTRAIN CONTROL MODULE) KOEO (KEY ON, ENGINE OFF) SELF-TEST

- Using a diagnostic scan tool, perform the PCM KOEO self-test.

Are any DTCs recorded?

Yes	REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.7L EcoBoost (238kW/324PS)) . REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 3.5L EcoBoost (272kW/370PS)) . REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 3.5L Duratec (209kW/284PS)) . REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 5.0L 32V Ti-VCT) .
No	GO to I4

I4 RETRIEVE THE RECORDED DTC (DIAGNOSTIC TROUBLE CODE) S FROM THE TCCM (TRANSFER CASE CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the TCCM self-test.

Is DTC P0562:00 or P0563:00 recorded?

Yes	GO to Pinpoint Test L
No	GO to I5

I5 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) S U0100 SET IN OTHER MODULES

- Using a diagnostic scan tool, clear all DTCs.
- Ignition OFF.
- Ignition ON.
- Wait 10 seconds.
- Using a diagnostic scan tool, perform the continuous memory self-test.
- Retrieve the CMDTCs from all modules.

Are any of the DTCs U0100 set in other modules on the network?

Yes	GO to I6
No	GO to I7

I6 CHECK FOR CORRECT PCM (POWERTRAIN CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all PCM connectors.
- Repair:
 - corrosion (install new connector or terminals - clean module pins)
 - damaged or bent pins - install new terminals/pins
 - pushed-out pins - install new pins as necessary
- Reconnect the PCM connectors. Make sure they seat and latch correctly.
- Operate the system and verify the concern is still present

Is the concern still present?

Yes	CHECK OASIS for any applicable TSBs. If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no TSBs address this concern, INSTALL a new PCM. REFER to: Powertrain Control Module (PCM) (303-14 Electronic Engine Controls - 2.7L EcoBoost (238kW/324PS)) . REFER to: Powertrain Control Module (PCM) (303-14C Electronic Engine Controls - 3.5L EcoBoost (272kW/370PS), Removal and Installation). REFER to: Powertrain Control Module (PCM) (303-14 Electronic Engine Controls - 3.5L Duratec (209kW/284PS)) . REFER to: Powertrain Control Module (PCM) (303-14 Electronic Engine Controls - 5.0L 32V Ti-VCT) . PROGRAM the PCM with the latest calibration level.
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

I7 CHECK FOR CORRECT TCCM (TRANSFER CASE CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the TCCM connector.
- Repair:
 - corrosion (install new connector or terminals - clean module pins)
 - damaged or bent pins - install new terminals/pins
 - pushed-out pins - install new pins as necessary
- Reconnect the TCCM connector. Make sure it seats and latches correctly.
- Operate the system and verify the concern is still present

Is the concern still present?

Yes	CHECK OASIS for any applicable TSBs. If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no TSBs address this concern, INSTALL a new TCCM. REFER to: Transfer Case Control Module (TCCM) (308-07A Four-Wheel Drive Systems, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

U0121

Refer to Wiring Diagrams Cell 34 for schematic and connector information.

Normal Operation

The TCCM sets the DTC U0121 when key messages such as wheel speed, brake pressure or torque are not received for longer than 5 seconds. This loss of key messages degrades the 4x4 system performance and/or inability to change 4x4 modes. Other modules that require data from the ABS module all set communication DTCs and may also exhibit system function concerns.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0121	Lost Communication With Anti-Lock Brake System (ABS) Control Module	Sets in continuous memory in the TCCM if ABS data messages received from the ABS Module over the HS-CAN are missing for longer than 5 seconds.

Possible Sources

- Communication concern
- Battery voltage concern
- ABS module
- TCCM

PINPOINT TEST J : U0121

J1 VERIFY THE SCAN TOOL COMMUNICATES WITH THE ABS (ANTI-LOCK BRAKE SYSTEM) MODULE

- Ignition ON.
- Connect a diagnostic scan tool.
- Check that a vehicle session can be established using a diagnostic scan tool.

Can a vehicle session be established?

Yes	GO to J2
No	REFER to: Communications Network (418-00 Module Communications Network) .

J2 CHECK THE TCCM (TRANSFER CASE CONTROL MODULE) CMDTC (CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODE) S

- Using a diagnostic scan tool, perform the TCCM self-test.
- Clear the DTCs.
- Wait 10 seconds.
- Repeat the TCCM self-test.

Is DTC U0121 retrieved again?

Yes	GO to J3
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

J3 RETRIEVE THE RECORDED DTC (DIAGNOSTIC TROUBLE CODE) S FROM THE ABS (ANTI-LOCK BRAKE SYSTEM) MODULE SELF-TEST

- Using a diagnostic scan tool, perform the ABS module self-test.

Are any DTCs recorded?

Yes	REFER to: Anti-Lock Brake System (ABS) and Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control) .
No	GO to J4

J4 RETRIEVE THE RECORDED DTC (DIAGNOSTIC TROUBLE CODE) S FROM THE TCCM (TRANSFER CASE CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the TCCM self-test.

Is DTC P0562:00 or P0563:00 recorded?

Yes	GO to Pinpoint Test L
No	GO to J5

J5 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0121 SET IN OTHER MODULES

- Using a diagnostic scan tool, clear all DTCs.
- Ignition OFF.
- Ignition ON.
- Wait 10 seconds.
- Using a diagnostic scan tool, perform the continuous memory self-test.
- Retrieve the CMDTCs from all modules.

Is DTC U0121 set in other modules on the network?

Yes	GO to J6
No	GO to J7

J6 CHECK FOR CORRECT ABS (ANTI-LOCK BRAKE SYSTEM) MODULE OPERATION

- Ignition OFF.
- Disconnect and inspect the ABS module connector.
- Repair:
 - corrosion (install new connector or terminals - clean module pins)
 - damaged or bent pins - install new terminals/pins
 - pushed-out pins - install new pins as necessary
- Reconnect the ABS module connector. Make sure it seat and latches correctly.
- Operate the system and verify the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable TSBs. If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no TSBs address this concern, INSTALL a new ABS module. REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

J7 CHECK FOR CORRECT TCCM (TRANSFER CASE CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the TCCM connector.
- Repair:
 - corrosion (install new connector or terminals - clean module pins)
 - damaged or bent pins - install new terminals/pins
 - pushed-out pins - install new pins as necessary
- Reconnect the TCCM connector. Make sure it seats and latches correctly.
- Operate the system and verify the concern is still present

Is the concern still present?

Yes	CHECK OASIS for any applicable TSBs. If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no TSBs address this concern, INSTALL a new TCCM. REFER to: Transfer Case Control Module (TCCM) (308-07A Four-Wheel Drive Systems, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

U0140

Refer to Wiring Diagrams Cell 34 for schematic and connector information.

Normal Operation

The TCCM sets the DTC U0140 when key messages are not received from the BCM for longer than 90 seconds. This loss of key messages degrades the 4X4 system functionality. Other modules that require data from the BCM module all set communication DTCs and may also exhibit system function concerns.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0140	Lost Communication With Body Control Module (BCM): No Sub Type Information	Sets in continuous memory in the TCCM if BCM data messages received from the BCM over the HS-CAN are missing for longer than 90 seconds.

Possible Sources

- Communication concern
- Battery voltage concern
- BCM module

- TCCM

PINPOINT TEST K : U0140

K1 VERIFY THE SCAN TOOL COMMUNICATES WITH THE BCM (BODY CONTROL MODULE)

- Ignition ON.
- Connect a diagnostic scan tool.
- Check that a vehicle session can be established using a diagnostic scan tool.

Can a vehicle session be established?

Yes	GO to K2
No	REFER to: Communications Network (418-00 Module Communications Network) .

K2 CHECK THE TCCM (TRANSFER CASE CONTROL MODULE) CMDTC (CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODE) S

- Using a diagnostic scan tool, perform the TCCM self-test.
- Clear the DTCs.
- Wait 100 seconds.
- Repeat the TCCM self-test.

Is DTC U0140 retrieved again?

Yes	GO to K3
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

K3 RETRIEVE THE RECORDED DTC (DIAGNOSTIC TROUBLE CODE) S FROM THE BCM (BODY CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the BCM self-test.

Are any DTCs recorded?

Yes	REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules, Diagnosis and Testing).
No	GO to K4

K4 RETRIEVE THE RECORDED DTC (DIAGNOSTIC TROUBLE CODE) S FROM THE TCCM (TRANSFER CASE CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the TCCM self-test.

Is DTC P0562:00 or P0563:00 recorded?

Yes	GO to Pinpoint Test L
No	GO to K5

K5 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0140 SET IN OTHER MODULES

- Using a diagnostic scan tool, clear all DTCs.
- Ignition OFF.
- Ignition ON.
- Wait 10 seconds.
- Using a diagnostic scan tool, perform the continuous memory self-test.
- Retrieve the CMDTCs from all modules.

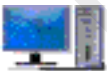
Is DTC U0140 set in other modules on the network?

Yes	GO to K6
No	GO to K7

K6 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) MODULE OPERATION

- Ignition OFF.
- Disconnect and inspect the BCM module connector.
- Repair:
 - corrosion (install new connector or terminals - clean module pins)
 - damaged or bent pins - install new terminals/pins
 - pushed-out pins - install new pins as necessary
- Reconnect the BCM module connector. Make sure it seat and latches correctly.
- Operate the system and verify the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable TSBs. If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no TSBs address this concern,   Click here to access Guided Routine (BCM).
No	The system is operating correctly at this time. The concern may have been caused by poor module connections. ADDRESS the root cause of any connector or pin issues.

K7 CHECK FOR CORRECT TCCM (TRANSFER CASE CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the TCCM connector.
- Repair:
 - corrosion (install new connector or terminals - clean module pins)
 - damaged or bent pins - install new terminals/pins
 - pushed-out pins - install new pins as necessary
- Reconnect the TCCM connector. Make sure it seats and latches correctly.
- Operate the system and verify the concern is still present

Is the concern still present?

Yes	CHECK OASIS for any applicable TSBs. If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no TSBs address this concern, INSTALL a new TCCM. REFER to: Transfer Case Control Module (TCCM) (308-07A Four-Wheel Drive Systems, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

DTCS P0562:00 or P0563:00

Refer to Wiring Diagrams Cell 34 for schematic and connector information.

Normal Operation and Fault Conditions

If the TCCM observes an overpower or a low voltage condition, a DTC is set and all TCCM outputs are turned off (IWEs engaged).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
P0562:00	Battery Voltage Low: No Sub Type Information	This DTC sets when the TCCM detects battery voltage less than 9 volts for 5 seconds or more at TCCM.
P0563:00	Battery Voltage High: No Sub Type Information	This DTC sets when the TCCM detects battery voltage greater than 16 volts for 5 seconds or more at TCCM.

Possible Sources

- Fuse
- Wiring, terminals or connectors
- TCCM

PINPOINT TEST L : DTCS P0562:00 OR P0563:00

L1 RETRIEVE ALL CMDTCS IN ALL MODULES

NOTE: DTC P0562:00 or P0563:00 can be set if the vehicle has been recently jump started, the battery has been recently charged or the battery has been discharged. The battery may become discharged due to excessive load(s) on the charging system from aftermarket accessories or if the battery has been left unattended with the accessories on.

- Ignition ON.
- Enter the following diagnostic mode: Retrieve All CMDTCs.

Is DTC P0562:00 or P0563:00 present in one or more modules and P0563, P0620, P0625, P0626 or P065B present in the PCM?

Yes	For diagnosis of the battery and charging system, REFER to: Charging System - 2.7L EcoBoost (238kW/324PS) (414-00 Charging System - General Information) . REFER to: Charging System - 3.5L Duratec (209kW/284PS)/3.5L EcoBoost (272kW/370PS)/5.0L 32V Ti-VCT (414-00 Charging System - General Information) .
No	GO to L2

L2 CHECK BATTERY CONDITION

- Ignition OFF.
- Carry out the Battery — Condition Test,
REFER to: [Battery](#) (414-01 Battery, Mounting and Cables, Diagnosis and Testing).

Does the battery pass the condition test?

Yes	GO to L3
No	CHARGE or INSTALL a new battery. REFER to: Battery (414-01 Battery, Mounting and Cables, Diagnosis and Testing).

L3 CHECK THE CHARGING SYSTEM VOLTAGE

- **NOTE:** *Do not allow the engine rpm to increase above 2,000 rpm while performing this step or the generator may self excite and result in default charging system output voltage. If engine rpm has gone above 2,000 rpm, shut the vehicle OFF and restart the engine before performing this step.*

Start the engine

- Measure the voltage of the battery:
 - For DTC P0562:00, turn on headlights and HVAC fan on high and run engine at 1,500 rpm for a minimum of 2 minutes.
 - For DTC P0563:00, turn off all accessories and run the engine at 1,500 rpm for a minimum of 2 minutes.

Is the battery voltage between 13-15.2 volts?

Yes	For DTC P0562:00, GO to L4 For DTC P0563:00, GO to L6
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No	To DIAGNOSE the charging system, REFER to: Charging System - 2.7L EcoBoost (238kW/324PS) (414-00 Charging System - General Information) . REFER to: Charging System - 3.5L Duratec (209kW/284PS)/3.5L EcoBoost (272kW/370PS)/5.0L 32V Ti-VCT (414-00 Charging System - General Information) . CLEAR all CMDTCs.
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L4 CHECK VOLTAGE AND GROUND TO THE TCCM

- Ignition OFF.
- Disconnect TCCM C2371B.
- Ignition ON.

Is the voltage greater than 11 volts?

Yes	GO to L6
No	GO to L5

L5 CHECK VOLTAGE TO THE TCCM

Is the voltage greater than 11 volts?

Yes	REPAIR the circuit. CLEAR all CMDTCs .
No	VERIFY BJB fuse 71 (25A) is OK. If OK, REPAIR the open circuit. If not OK, REFER to the Wiring Diagrams manual to identify possible causes of the circuit short. CLEAR all CMDTCs.

L6 CHECK FOR CORRECT TCCM OPERATION

- Ignition OFF.
- Disconnect and inspect all TCCM connectors.
- Check for the following:
 - corrosion (install new connector or terminals - clean module pins)
 - damaged or bent pins - install new terminals/pins
 - pushed-out pins - install new pins as necessary
- Connect all TCCM connectors. Make sure they seat and latch correctly.
- Operate the system and verify the concern is still present.

Is the concern still present?

Yes	INSTALL a new TCCM. REFER to: Transfer Case Control Module (TCCM) (308-07A Four-Wheel Drive Systems, Removal and Installation).
No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of the connector or pin issues.

DTC U0101

Refer to Wiring Diagrams Cell 34 for schematic and connector information.

Normal Operation

The TCCM sets DTC U0101 when it has not received messages from the TCM for more than 5 seconds with ignition in RUN and battery voltage in range. Other modules that require data from the TCM all set communication DTCs and may also exhibit system function concerns.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0101	Lost Communication With TCM "A": No Sub-Type Information	Sets in continuous memory in the TCCM if powertrain data messages received from the TCM over the HS-CAN are missing for longer than 5 seconds with ignition in RUN and battery voltage in range.

Possible Sources

- Communication concern
- Battery voltage concern
- TCM
- TCCM

PINPOINT TEST M : DTC U0101

M1 VERIFY THE SCAN TOOL COMMUNICATES WITH THE TCM (TRANSMISSION CONTROL MODULE)

- Ignition ON.
- Connect a diagnostic scan tool.
- Check that a vehicle session can be established using a diagnostic scan tool.

Can a vehicle session be established?

Yes	GO to M2
No	REFER to: Communications Network (418-00 Module Communications Network) .

M2 CHECK THE TCCM (TRANSFER CASE CONTROL MODULE) CONTINUOUS MEMORY DTC (DIAGNOSTIC TROUBLE CODE) S

- Using a diagnostic scan tool, perform the TCCM self-test.
- Clear the DTCs.
- Wait 10 seconds.
- Repeat the TCCM self-test.

Is DTC U0101?

Yes	GO to M3
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

M3 RETRIEVE THE RECORDED DTC (DIAGNOSTIC TROUBLE CODE) S FROM THE TCM (TRANSMISSION CONTROL MODULE) KOEO (KEY ON, ENGINE OFF) SELF-TEST

- Using a diagnostic scan tool, perform the TCM KOEO self-test.

Are any DTCs recorded?

Yes	REFER to: Diagnostic Trouble Code (DTC) Charts and Pinpoint Tests - 3.5L EcoBoost (272kW/370PS) (307-01B Automatic Transmission - 10-Speed Automatic Transmission - 10R80, Diagnosis and Testing).
No	GO to M4

M4 RETRIEVE THE RECORDED DTC (DIAGNOSTIC TROUBLE CODE) S FROM THE TCCM (TRANSFER CASE CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the TCCM self-test.

Is DTC P0562:00 or P0563:00 recorded?

Yes	REFER to: Charging System - 2.7L EcoBoost (238kW/324PS) (414-00 Charging System - General Information) . REFER to: Charging System - 3.5L Duratec (209kW/284PS)/3.5L EcoBoost (272kW/370PS)/5.0L 32V Ti-VCT (414-00 Charging System - General Information) .
No	GO to M5

M5 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) S U0101 SET IN OTHER MODULES

- Using a diagnostic scan tool, clear all DTCs.
- Ignition OFF.
- Ignition ON.
- Wait 10 seconds.
- Using a diagnostic scan tool, perform the continuous memory self-test.
- Retrieve the CMDTCs from all modules.

Is the DTC U0101 set in other modules on the network?

Yes	GO to M6
No	GO to M7

M6 CHECK FOR CORRECT TCM (TRANSMISSION CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all TCM connectors.
- Check for the following:
 - corrosion (install new connector or terminals - clean module pins)
 - damaged or bent pins - install new terminals/pins
 - pushed-out pins - install new pins as necessary
- Reconnect the TCM connectors. Make sure they seat and latch correctly.
- Operate the system and verify the concern is still present

Is the concern still present?

Yes	CHECK OASIS for any applicable TSBs. If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no TSBs address this concern, INSTALL a new TCM, REFER to: Transmission Control Module (TCM) - 3.0L Power Stroke Diesel/3.5L EcoBoost (272kW/370PS) (307-01B Automatic Transmission - 10-Speed Automatic Transmission - 10R80, Removal and Installation). PROGRAM the TCM with the latest calibration level. PERFORM the Solenoid Body Strategy Data Download procedure. REFER to: Transmission Strategy Download (307-01A Automatic Transmission - 6-Speed Automatic Transmission - 6R80, General Procedures).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

M7 CHECK FOR CORRECT TCCM (TRANSFER CASE CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the TCCM connector.
- Check for the following:
 - corrosion (install new connector or terminals - clean module pins)
 - damaged or bent pins - install new terminals/pins
 - pushed-out pins - install new pins as necessary
- Reconnect the TCCM connector. Make sure they seat and latch correctly.
- Operate the system and verify the concern is still present

Is the concern still present?

Yes	CHECK OASIS for any applicable TSBs. If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no TSBs address this concern, INSTALL a new TCCM. REFER to: Transfer Case Control Module (TCCM) (308-07A Four-Wheel Drive Systems, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.