

SECTION 308-07A: Four Wheel Drive (4WD) Systems
DIAGNOSIS AND TESTING

2014 F-150 Workshop Manual
Procedure revision date: 11/01/2013

Four Wheel Drive (4WD) Systems — Electronic Shift

Special Tool(s)

 ST2574-A	Flex Probe Kit NUD105-R025D or equivalent
 ST3093-A	Fluke 77-IV Digital Multimeter FLU77-4 or equivalent
 ST3094-A	Test Light SGT27000 or equivalent 250-300 mA incandescent bulb test light
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

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). Integrated Wheel Ends (IWEs) are used at each front wheel to reduce rolling resistance when 2H is selected. The Transfer Case Control Module (TCCM) sends a duty cycle command to the synchronization coil which activates the clutch within the transfer case. Refer to [Section 308-07B](#).

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.

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 and between the 4H and 4L modes. For information on transfer case mechanical operation, refer to [Section 308-07B](#). 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 Mode Select Switch (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.

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
- 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

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

Off-Road Mode

NOTE: Off-road mode is specifically calibrated for off-road driving conditions and should never be used on pavement.

The SVT Raptor comes equipped with a special off-road function. An off-road button is located on the floor console. A light on the button will illuminate when this feature is activated.

Off-road mode affects 4 vehicle functions:

- It allows unique transmission shifting that optimizes off-road performance. Off-road mode shifting differs from standard on-road shifting in several ways:
 - Transmission upshifts are delayed and occur less frequently. This ensures the best possible vehicle response and acceleration if the driver needs to briefly lift off the throttle to negotiate an obstacle or corner.
 - Transmission downshifts occur more quickly improving vehicle response.
 - Sixth gear (overdrive) will not engage. This prevents engine lugging (6.2L equipped vehicles only).
- Off-road mode provides optimized throttle response tailored for off-road performance driving.
- When off-road mode is engaged, the standard vehicle speed thresholds for the ELD are lifted and the ELD will remain locked until the operator manually disengages it with the control knob. If the operator disengages off-road mode and exceeds the standard ELD speed thresholds, the ELD will disengage.
- When off-road mode is engaged, the AdvanceTrac settings are altered for optimized off-road performance.

To engage off-road mode, slow the vehicle to a speed of 5 km/h (3 mph) or less. Release the accelerator pedal then press and release the off-road mode button. The message center will display OFF ROAD MODE ENABLED once off-road mode has been enabled. If any of the above conditions are not met, off-road mode will not enable and the message center will display information guiding the driver through the proper off-road mode enabling procedures. To disable off-road mode, press and release the off-road mode button. The message center will display EXITING OFF ROAD MODE.

The operator can engage the ELD per the following table:

Switch Position	Engage	Disengage	Re-engage
2H (off-road off) ^a	31 km/h (19 mph)	42 km/h (25 mph)	31 km/h (19 mph) ^a
2H (off-road on)	unlimited	unlimited	unlimited
4H (off-road on)	unlimited	unlimited	unlimited
4L (off-road on)	unlimited	unlimited	unlimited

^a The 4WD system engages/re-engages at or below the speed noted.

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

• Halfshafts • <u>IWEs</u> • Driveshaft and U-joints • Vacuum leaks • Fluid leaks	• <u>BJB</u> fuses: ■ 20 (20A) ■ 29 (10A) ■ 54 (5A) ■ 68 (25A)
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• Matching tire sizes • Transfer case	• <u>BCM</u> fuse 34 (10A) (vehicles with <u>ELD</u> only) • Wiring, terminals or connectors • <u>MSS</u> • Synchronization clutch • <u>IWE</u> solenoid • Transfer case shift motor
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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. **NOTE:** Make sure to use the latest scan tool software release.

If the cause is not visually evident, connect the scan tool to the Data Link Connector (DLC).

5. **NOTE:** The VCM LED prove out confirms power and ground from the DLC are provided to the VCM.

If the scan tool does not communicate with the VCM :

- check the VCM connection to the vehicle.
- check the scan tool connection to the VCM.
- refer to [Section 418-00](#), No Power To The Scan Tool, to diagnose no power to the scan tool.

6. If the scan tool does not communicate with the vehicle:

- verify the ignition is in the ON position.
- verify the scan tool operation with a known good vehicle.
- refer to [Section 418-00](#) to diagnose no response from the PCM.

7. Carry out the network test.

- If the scan tool responds with no communication for one or more modules, refer to [Section 418-00](#).
- If the network test passes, retrieve and record CMDTCs.

8. Carry out the self-test diagnostics for the TCCM.

9. If the DTCs retrieved are related to the concern, go to the TCCM DTC Chart in this section. For all other DTCs, refer to [Section 419-10](#).

10. If no DTCs related to the concern are retrieved, GO to [Symptom Chart - Four-Wheel Drive \(4WD\) System](#) or GO to [Symptom Chart - NVH](#).

DTC Charts

Transfer Case Control Module (TCCM) DTC Chart

NOTE: This module utilizes a 5-character DTC followed by a 2-character failure type code. The failure type code provides information about specific fault conditions such as opens or shorts to ground. have an additional 2-character DTC status code suffix to assist in determining DTC history.

DTC	Description	Action
B12E0:11	Off Road Indicator: Circuit	GO to Pinpoint Test J .

	Short To Ground	
B12E0:12	Off Road Indicator: Circuit Short To Battery	GO to Pinpoint Test J.
B12E0:13	Off Road Indicator: Circuit Open	GO to Pinpoint Test J.
B12E5:00	Off Road Mode Select Switch: No Sub Type Information	GO to Pinpoint Test K.
B12E5:11	Off Road Mode Select Switch: Circuit Short To Ground	GO to Pinpoint Test K.
C1979:11	IWE Solenoid Circuit Failure: Circuit Short To Ground	GO to Pinpoint Test D.
C1979:12	IWE Solenoid Circuit Failure: Circuit Short To Battery	GO to Pinpoint Test D.
C1979:13	IWE Solenoid Circuit Failure: Circuit Open	GO to Pinpoint Test D.
P0562:00	System Voltage Low: No Sub Type Information	Go to Pinpoint Test M in 2-Speed Torque-On-Demand, Diagnosis and Testing, Section 308-07A .
P0563:00	System Voltage High: No Sub Type Information	Go to Pinpoint Test M in 2-Speed Torque-On-Demand, Diagnosis and Testing, Section 308-07A .
P1812:00	4-Wheel Drive Mode Select Circuit Failure: No Sub Type Information	GO to Pinpoint Test B.
P1815:00	4-Wheel Drive Mode Select Short To Ground: No Sub Type Information	GO to Pinpoint Test B.
P1825:00	4-Wheel Drive Clutch Relay Open Circuit: No Sub Type Information	GO to Pinpoint Test G.
P1826:00	4-Wheel Drive Low Clutch Relay Circuit To Battery: No Sub Type Information	GO to Pinpoint Test G.
P1827:00	4-Wheel Drive Low Clutch Relay Circuit To Ground: No Sub Type Information	GO to Pinpoint Test G.
P1839:00	Transfer Case Shift Motor Open Circuit: No Sub Type Information	GO to Pinpoint Test B.
P1840:00	Transfer Case Shift Motor Short Circuit To Battery: No Sub Type Information	GO to Pinpoint Test B.
P1841:00	Transfer Case Shift Motor Short Circuit To Ground: No Sub Type Information	GO to Pinpoint Test B.
P1849:00	Transfer Case Contact Plate 'A' Short Circuit To	GO to Pinpoint Test B.

	Ground: No Sub Type Information	
P184A:00	Transfer Case Unable To Transition Between 4x2 and 4x4 Mode: No Sub Type Information	GO to Pinpoint Test B.
P184B:00	Transfer Case Unable To Transition Between 4x4 High and 4x4 Low Range: No Sub Type Information	GO to Pinpoint Test C.
P1853:00	Transfer Case Contact Plate 'B' Short Circuit To Ground: No Sub Type Information	GO to Pinpoint Test B.
P1857:00	Transfer Case Contact Plate 'C' Short Circuit To Ground: No Sub Type Information	GO to Pinpoint Test B.
P185A:00	Differential Lock-Up Input Switch Circuit High: No Sub Type Information	Go to Pinpoint Test Y in Electronic Locking Differential (ELD) System, Diagnosis and Testing, Section 308-07A .
P185B:00	Differential Lock-Up Indicator Circuit Low: No Sub Type Information	Go to Pinpoint Test Z in Electronic Locking Differential (ELD) System, Diagnosis and Testing, Section 308-07A .
P185C:00	Differential Lock-Up Indicator Circuit High: No Sub Type Information	Go to Pinpoint Test AA in Electronic Locking Differential (ELD) System, Diagnosis and Testing, Section 308-07A .
P185D:00	Differential Lock-Up Control Circuit Performance: No Sub Type Information	Go to Pinpoint Test AB in Electronic Locking Differential (ELD) System, Diagnosis and Testing, Section 308-07A .
P1861:00	Transfer Case Contact Plate 'D' Short Circuit To Ground: No Sub Type Information	GO to Pinpoint Test B.
P1867:00	Transfer Case Contact Plate General Circuit Failure: No Sub Type Information	GO to Pinpoint Test B.
P187C:00	Differential Lock-Up Control Circuit/Open: No Sub Type Information	Go to Pinpoint Test AC in Electronic Locking Differential (ELD) System, Diagnosis and Testing, Section 308-07A .
P187D:00	Differential Lock-Up Control Circuit Low: No Sub Type Information	Go to Pinpoint Test AC in Electronic Locking Differential (ELD) System, Diagnosis and Testing, Section 308-07A .
P187E:00	Differential Lock-Up Control Circuit High: No Sub Type Information	Go to Pinpoint Test AD in Electronic Locking Differential (ELD) System, Diagnosis and Testing, Section 308-07A .
P1891:00	Transfer Case Contact Plate Ground Return Open Circuit: No Sub	GO to Pinpoint Test B.

	Type Information	
U0100:00	Lost Communication With ECM/PCM "A": No Sub Type Information	Go to Pinpoint Test AE in Electronic Locking Differential (ELD) System, Diagnosis and Testing, Section 308-07A .
U0121:00	Lost Communication With Anti-Lock Brake System (ABS) Control Module: No Sub Type Information	Go to Pinpoint Test AF in Electronic Locking Differential (ELD) System, Diagnosis and Testing, Section 308-07A .
U0140:00	Lost Communication With Body Control Module (BCM): No Sub Type Information	Go to Pinpoint Test AG in Electronic Locking Differential (ELD) System, Diagnosis and Testing, Section 308-07A .
U0418:00	Invalid Data Received From Brake System Control Module: No Sub Type Information	REFER to Section 206-09 to diagnose the wheel speed sensor concern.
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 <u>BCM</u> . CARRY OUT a self-test of the <u>BCM</u> . If <u>BCM</u> DTCs are present, REFER to Section 419-10 . If no <u>BCM</u> DTCs are present, CLEAR the DTCs. CARRY OUT a <u>TCCM</u> self-test. If U2300:54 returns, INSTALL a new <u>TCCM</u> . REFER to Transfer Case Control Module (TCCM) in this section.
U2300:55	Central Configuration: Not Configured	This DTC can set upon <u>TCCM</u> power up only until all expected configuration data parameters (gearbox type, axle ratio, tire circumference) is received from the <u>BCM</u> . CARRY OUT a self-test of the <u>BCM</u> . If <u>BCM</u> DTCs are present, REFER to Section 419-10 . If no <u>BCM</u> DTCs are present, CLEAR the DTCs. CARRY OUT <u>TCCM</u> self-test. If U2300:55 returns, INSTALL a new <u>TCCM</u> . REFER to Transfer Case Control Module (TCCM) in this section.
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 <u>BCM</u> . CARRY OUT a self-test of the <u>BCM</u> . If DTCs are present, REFER to Section 419-10 . If no <u>BCM</u> DTCs are present, CLEAR the DTCs. CARRY OUT a <u>TCCM</u> self-test. If U2300:56 returns, INSTALL a new <u>TCCM</u> . REFER to Transfer Case Control Module (TCCM) in this section.
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 <u>BCM</u> . CARRY OUT a self-test of the <u>BCM</u> . If <u>BCM</u> DTCs are present, REFER to Section 419-10 . If no <u>BCM</u> DTCs are present, CLEAR the DTCs. CARRY OUT a <u>TCCM</u> self-test. If U2300:64 returns, INSTALL a new <u>TCCM</u> . REFER to Transfer Case Control Module (TCCM) in this section.
U3000:04	Control Module: System Internal Failure	CLEAR the DTC. REPEAT the self-test. If DTC U3000:04 is retrieved, INSTALL a new <u>TCCM</u> . REFER to Transfer Case Control Module (TCCM) in this section.
U3000:41	Control Module: General Checksum Failure	CLEAR the DTC. REPEAT the self-test. If DTC U3000:41 is retrieved, INSTALL a new <u>TCCM</u> . REFER to Transfer Case Control Module (TCCM) in this section.
U3000:46	Control Module: Calibration / Parameter Memory Failure	CLEAR the DTC. REPEAT the self-test. If DTC U3000:46 is retrieved, INSTALL a new <u>TCCM</u> . REFER to Transfer Case Control Module (TCCM) in this section.
U3000:49	Control Module: Internal	CLEAR the DTC. REPEAT the self-test. If DTC U3000:49 is

	Electronic Failure	retrieved, INSTALL a new <u>TCCM</u> . REFER to Transfer Case Control Module (TCCM) in this section.
U300D:11	Ignition Input On/Start: Circuit Short To Ground	GO to Pinpoint Test B.

Symptom Chart — Four-Wheel Drive (4WD) System

Symptom Chart — System

Condition	Possible Sources	Action
No communication with the <u>TCCM</u>	- Scan tool <u>DLC</u> <u>TCCM</u> - Wiring, terminals or connectors	REFER to Section 418-00.
The <u>4WD</u> indicators do not operate correctly	- Wiring, terminals or connectors <u>4WD</u> system fault <u>IPC</u> <u>TCCM</u>	GO to Pinpoint Test A.
The vehicle does not shift between 2H and 4H modes correctly	- Wiring, terminals or connectors <u>MSS</u> - Transfer case - Transfer case synchronization clutch <u>IWEs</u> <u>IWE</u> solenoid <u>TCCM</u> - Front axle assembly	GO to Pinpoint Test B.
The vehicle does not shift between 4H and 4L modes correctly	<u>TR</u> - Transmission drag torque - ABS wheel speed inputs <u>HS-CAN</u>	GO to Pinpoint Test C.
The <u>4WD</u> does not engage at speed correctly	- Transfer case synchronization clutch - Transfer case <u>TCCM</u> - Front axle assembly - Wiring, terminals or connectors	GO to Pinpoint Test G.
The front axle does not engage/disengage correctly	<u>MSS</u> <u>IWEs</u> <u>IWE</u> solenoid - Transfer case - Vacuum leaks	GO to Pinpoint Test D.

	• Front axle assembly • <u>TCCM</u> • Wiring, terminals or connectors • Fuses	
• The transfer case jumps out of gear	• <u>IWE</u> vent line(s) • <u>MSS</u> • Transfer case	• GO to Pinpoint Test E.
• Unable to duplicate customer concern	• <u>4WD</u> system and/or related components	• CARRY OUT the <u>ESOF</u> Functional Test. GO to Pinpoint Test I.
• Rear wheels binding when turning corners with the <u>MSS</u> in <u>2WD</u> or OFF	• Wiring, terminals or connectors • <u>ELD</u> field coil • Differential	• Go to Pinpoint Test AD in Electronic Locking Differential (ELD) System, Diagnosis and Testing, Section 308-07A.
• Off-road mode is inoperative	• Wiring, terminals or connectors • Off-road mode switch • <u>TCCM</u>	• GO to Pinpoint Test K.
• Off-road mode switch indicator is inoperative	• Wiring, terminals or connectors • Off-road mode switch • <u>TCCM</u>	• GO to Pinpoint Test J.
• Unable to achieve flat tow (neutral tow) mode	• Wiring, terminals or connectors • <u>HS-CAN</u> • <u>IPC</u> • <u>TCCM</u> • Door ajar switch • Ignition switch	• Go to Pinpoint Test AH in Electronic Locking Differential (ELD) System, Diagnosis and Testing, Section 308-07A.

Symptom Chart — NVH

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. If this is not the causal system for the symptom, refer back to for the next likely system and continue diagnosis.

Condition	Possible Sources	Action
• Grinding noise during <u>4WD</u> engagement, especially at high speeds	• Front halfshaft speeds not turning at the same speed • Synchronization clutch	• GO to Pinpoint Test B.

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 H.
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 F.
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 0.15 mm (0.06 in) 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 Section 307-01. If there is noise in all gears, DISASSEMBLE the transfer case. REFER to Section 308-07B. CHECK the planetary gears, the bearings, the upper and lower drive sprockets and drive chain for damage. INSTALL new parts as necessary. - FILL with transfer case fluid. REFER to Section 308-07B.
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 Section 308-07B. - DISASSEMBLE the transfer case. CHECK the oil pump for wear or damage. REPAIR as necessary. REFER to Section 308-07B. - CONFIRM that the tires and wheels are correct for the vehicle. CHECK that the tire inflation pressures are correct.
Transfer case growl/rumble —	Damaged or worn bearings or	DISASSEMBLE the transfer case. CHECK the bearings or planetary

noise at all ranges	planetary gear	gear for wear or damage. REPAIR as necessary. REFER to Section 308-07B .
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 Section 308-07B.
Transfer case howl/hum — noise at all ranges or <u>4WD</u> 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 Section 308-07B.

Pinpoint Tests

Pinpoint Test A: The 4WD Indicators Do Not Operate Correctly

Refer to Wiring Diagrams Cell [34](#), Four Wheel Drive System for schematic and connector information.

Normal Operation

Indicator status of the 4WD system is transmitted to the Instrument Panel Cluster (IPC) from the TCCM through the HS-CAN then displayed in the message center of the IPC. The message center displays 4X4 HIGH when in 4H and 4X4 LOW in 4L. When in 2H, the message center will display 4X2 for approximately 4 seconds then no longer provides 4WD system indication until another shift mode is attained. For information about HS-CAN, refer to [Section 418-00](#).

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- 4WD system fault
- IPC
- TCCM

PINPOINT TEST A: THE 4WD INDICATORS DO NOT OPERATE CORRECTLY

Test Step	Result / Action to Take
A1 CHECK FOR <u>IPC</u> DTCs	
- Ignition ON. - Enter the following diagnostic mode on the scan tool: Self-Test — <u>IPC</u>. Are any DTCs present?	Yes If DTC U0102:00 is retrieved, REFER to Section 418-00 to diagnose lost communication with <u>TCCM</u>. For all other <u>IPC</u> DTCs, REFER to Section 413-01. No GO to A2.

A2 CHECK FOR <u>TCCM</u> DTCs - Enter the following diagnostic mode on the scan tool: Self-Test — <u>TCCM</u>. Are any DTCs present?	Yes REFER to the <u>TCCM</u> DTC Chart in this section for diagnosis. No GO to A3 .
A3 CHECK THE <u>TCCM</u> IGNITION POSITION (KEY_POS_4X4) AND IGNITION STATUS (KEY_STATUS_4X4) PIDs - Enter the following diagnostic mode on the scan tool: DataLogger — <u>TCCM</u>. - Monitor the KEY_POS_4X4 and KEY_STATUS_4X4 PIDs while cycling through each position. Do the ignition PIDs match the ignition switch positions?	Yes GO to A4 . No If the KEY_STATUS_4X4 PID did not match, CHECK <u>BJB</u> fuse 54 (5A). 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. If the KEY_POS_4X4 PID did not match, REFER to Section 211-05 to diagnose the ignition switch.
A4 CHECK THE <u>4WD</u> SYSTEM INDICATION IN 2H - Switch the <u>MSS</u> to 2H while monitoring the message center. Does 4X2 display in the message center for approximately 4 seconds?	Yes GO to A5 . No GO to A6 .
A5 CHECK THE <u>4WD</u> SYSTEM INDICATION IN 4H - Switch the <u>MSS</u> to 4H while monitoring the message center. Does 4X4 HIGH display in the message center?	Yes GO to A8 . No GO to A9 .
A6 CHECK THE <u>MSS</u> USING THE <u>TCCM</u> <u>4WD</u> SWITCH STATUS (4X4_SW) PID - Enter the following diagnostic mode on the scan tool: DataLogger — <u>TCCM</u>. - Monitor the 4X4_SW PID while switching to each <u>MSS</u> position. Does the 4X4_SW PID match the <u>MSS</u> position?	Yes GO to A7 . No INSTALL a new <u>MSS</u> . REFER to Mode Select Switch (MSS) in this section. TEST the system for normal operation.
A7 CHECK THE <u>TCCM</u> PIDs IN 2H Enter the following diagnostic mode on the scan tool:	Yes

DataLogger — TCCM.

- Command the Transfer Case Shift Motor Position Sense Contact Plate Power Circuit Status (PLATE_PWR_OS) PID to energize the transfer case gearmotor encoder assembly.
- Monitor the Integrated Wheel Ends Output Control (IWE_OS) PID and the Transfer Case Contact Plate Switch A (PLATE_A), B (PLATE_B), C (PLATE_C) and D (PLATE_D) PIDs with the MSS in the 2H position.

<u>MSS</u> 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 indicate the IWE solenoid is energized (PID status No) and that the shift motor is in 2H position?

END the active command.
CHECK the IPC for faults.
REFER to [Section 413-01](#).

No

END the active command.
[GO to Pinpoint Test B](#).

A8 CHECK THE 4WD SYSTEM INDICATION IN 4L

- **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).
- With the vehicle at a stop and transmission in NEUTRAL, switch the MSS to 4L while monitoring the message center.
- Does the message center display 4X4 LOW ?

Yes

The 4WD indicators are operating correctly. CARRY OUT the ESOF Functional Test. [GO to Pinpoint Test I](#).

No

GO to [A10](#).

A9 CHECK THE TCCM PIDs IN 4H

- Switch the MSS to 4H.
- Enter the following diagnostic mode on the scan tool:
DataLogger — TCCM.
- Command the Transfer Case Shift Motor Position Sense Contact Plate Power Circuit Status (PLATE_PWR_OS) PID to energize the transfer case gearmotor encoder assembly.
- Monitor the Integrated Wheel Ends Output Control (IWE_OS) PID and the Transfer Case Contact Plate Switch A (PLATE_A), B (PLATE_B), C (PLATE_C) and D (PLATE_D) PIDs with the MSS in the 4H position.

<u>MSS</u> 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 indicate the IWE solenoid is de-energized (PID status Yes) and that the shift motor is in 4H position?

Yes

END the active command.
CHECK the IPC for faults.
REFER to [Section 413-01](#).

No

END the active command.
[GO to Pinpoint Test B](#).

A10 CHECK THE TCCM PIDs IN 4L

- Enter the following diagnostic mode on the scan tool:
DataLogger — TCCM.
- Command the Transfer Case Shift Motor Position Sense

Yes

CHECK the IPC for faults.
REFER to [Section 413-01](#).

Contact Plate Power Circuit Status (PLATE_PWR_OS) PID to energize the transfer case gearmotor encoder assembly.

- Monitor the Integrated Wheel Ends Output Control (IWE_OS) PID and the Transfer Case Contact Plate Switch A (PLATE_A), B (PLATE_B), C (PLATE_C) and D (PLATE_D) PIDs with the MSS in the 4L position.

<u>MSS</u> 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 indicate the IWE solenoid is de-energized (PID status Yes) and that the shift motor is in 4L position?

No

END the active command.
[GO to Pinpoint Test C.](#)

Pinpoint Test B: 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](#), Four-Wheel Drive Systems 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 Description	Fault Trigger Condition
• P1812:00 — 4-Wheel Drive Mode Select Circuit Failure: No Sub Type Information	Fault sets when <u>TCCM</u> C2371A pin 16 detects an open circuit or short to battery. Four-Wheel Drive (4WD) system mode cannot be changed.
• P1815:00 — 4-Wheel Drive Mode Select Short Circuit To Ground: No Sub Type Information	Fault sets when <u>TCCM</u> C2371A pin 16 detects a short to ground. <u>4WD</u> system mode cannot be changed.
• P1839:00 — Transfer Case Shift Motor Open Circuit: No Sub Type Information	Fault sets when <u>TCCM</u> C2371B pin 4 or 5 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	Fault sets when <u>TCCM</u> C2371B pin 4 or 5 detects a short to voltage. Shift motor moves are prevented when this DTC is set.
• P1841:00 — Transfer Case Shift Motor Short Circuit To Ground: No Sub Type Information	Fault sets when <u>TCCM</u> C2371B pin 4 or 5 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	Fault sets when <u>TCCM</u> C2371A pin 1 detects a short to ground. Shift motor moves are prevented when this DTC is set. The <u>TCCM</u> 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	Fault sets when target shift motor position is not reached after the maximum number of allowed blocked shift retries for 2H to 4H or 4H to 2H. Requested shift motor position is not reached.
• P1853:00 — Transfer Case Contact Plate 'B' Short Circuit to Ground: No Sub Type Information	Fault sets when <u>TCCM</u> C2371A pin 2 detects a short to ground. Shift motor moves are prevented when this DTC is set. The <u>TCCM</u> 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	Fault sets when <u>TCCM</u> C2371A pin 3 detects a short to ground. Shift motor moves are prevented when this DTC is set. The <u>TCCM</u> 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	Fault sets when <u>TCCM</u> C2371A pin 4 detects a short to ground. Shift motor moves are prevented when this DTC is set. The <u>TCCM</u> 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	Fault sets when an invalid shift motor position is detected during selection of a new <u>4WD</u> 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 or low-side mechanical stop position.
• P1891:00 — Transfer Case Contact Plate Ground Return Open Circuit: No Sub Type Information	Fault sets when <u>TCCM</u> C2371A pin 5 detects a short to ground, a short to voltage or open circuit. The <u>TCCM</u> will not complete mode change if a change in shift motor position is required.
• U300D:11 — Ignition Input On/Start: Circuit Short To Ground	Fault sets when <u>TCCM</u> C2371A pin 7 detects a short to ground.

This pinpoint test is intended to diagnose the following:

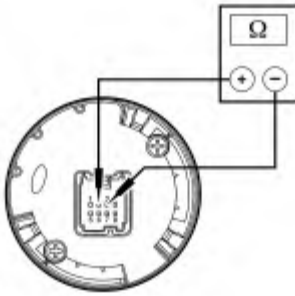
- Wiring, terminals or connectors
- MSS
- Transfer case
- Transfer case synchronization clutch
- IWEs
- IWE solenoid
- TCCM
- Front axle assembly

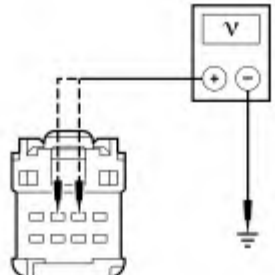
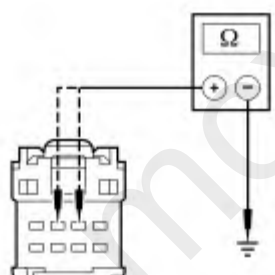
PINPOINT TEST B: THE VEHICLE DOES NOT SHIFT BETWEEN 2H AND 4H CORRECTLY AND/OR GRINDING NOISE HEARD DURING 4WD ENGAGEMENT AT HIGH SPEEDS

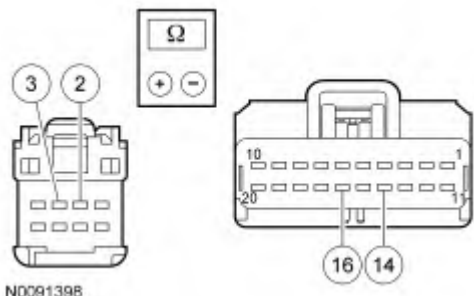
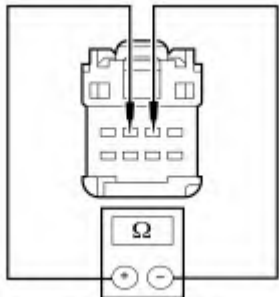


WARNING: When directed to drive the vehicle as part of this test, drive the vehicle on a hard surface in an area without traffic to prevent a crash. Failure to follow these instructions may result in personal injury.

Test Step	Result / Action to Take
B1 CHECK FOR <u>TCCM</u> DTCs • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self-Test — <u>TCCM</u>. • Are any DTCs present?	Yes For DTC P184A:00, GO to B19. For DTC P1812:00, GO to B5. For DTC P1815:00, GO to B7. For DTC P1839:00, GO to B28. For DTC P1840:00, GO to B26. For DTC P1841:00, GO to B27. For DTC P1849:00, DTC P1853:00, DTC P1857:00, DTC P1861:00, GO to B21. For DTC P1867:00, GO to B4. For DTC P1891:00, GO to B20. For DTC U300D:11, GO to B2. For all other DTCs, REFER to the DTC Chart in this section. No GO to B2.
B2 CHECK THE <u>TCCM</u> IGNITION POSITION (KEY_POS_4X4) AND IGNITION STATUS (KEY_STATUS_4X4) PIDs • Enter the following diagnostic mode on the scan tool: DataLogger — <u>TCCM</u>. • 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 B3. No If the KEY_STATUS_4X4 PID did not match, CHECK BJB fuse 54 (5A). 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. TEST the system for

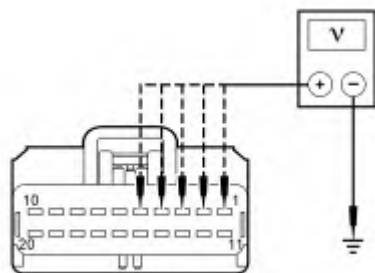
	normal operation. If the KEY_POS_4X4 PID did not match, REFER to Section 211-05 to diagnose the ignition switch. After the fault is repaired, CLEAR the DTCs. TEST the system for normal operation.								
B3 CHECK THE <u>TCCM</u> MODULE SUPPLY VOLTAGE (VBAT_4X4) PID - Enter the following diagnostic mode on the scan tool: DataLogger — <u>TCCM</u>. - Start the engine and monitor the VBAT_4X4 PID. - Is the VBAT_4X4 PID greater than 12 volts?	Yes GO to B4. No REFER to Section 414-00 to DIAGNOSE the low battery voltage and/or charging system concern. After the repair is complete, CLEAR the DTCs. TEST the system for normal operation.								
B4 CHECK THE <u>MSS</u> POSITION MONITORING THE <u>TCCM</u> 4WD SWITCH STATUS (4X4_SW) PID - Enter the following diagnostic mode on the scan tool: DataLogger — <u>TCCM</u>. - Monitor the 4X4_SW PID while switching to each <u>MSS</u> position. - Does the 4X4_SW PID match the <u>MSS</u> position?	Yes GO to B11. No GO to B5.								
B5 CHECK THE <u>MSS</u> RESISTANCE VALUES - Ignition OFF. - Disconnect: <u>MSS</u>. - Measure the resistance between <u>MSS</u> C284 pins 2 and 3, component side, while rotating the <u>MSS</u> through all positions. Refer to the following chart. <table border="1"> <thead> <tr> <th><u>MSS</u> Position</th><th>Resistance</th></tr> </thead> <tbody> <tr> <td>2H</td><td>606 - 632 ohms</td></tr> <tr> <td>4H</td><td>265 - 275 ohms</td></tr> <tr> <td>4L</td><td>127 - 133 ohms</td></tr> </tbody> </table>  N0091397	<u>MSS</u> Position	Resistance	2H	606 - 632 ohms	4H	265 - 275 ohms	4L	127 - 133 ohms	Yes GO to B6. No INSTALL a new <u>MSS</u>. REFER to Mode Select Switch (MSS) in this section. CLEAR the DTCs. TEST the system for normal operation.
<u>MSS</u> Position	Resistance								
2H	606 - 632 ohms								
4H	265 - 275 ohms								
4L	127 - 133 ohms								

Are the resistance values within specification?										
B6 CHECK THE <u>MSS</u> CONTROL AND RETURN CIRCUITS FOR SHORT TO VOLTAGE										
- Ignition OFF. - Disconnect: <u>TCCM</u> C2371A . - Ignition ON. - Measure the voltage between <u>MSS</u> C284-2, circuit RCF13 (WH/BN), harness side and ground; and between <u>MSS</u> C284-3, circuit CCF13 (WH/BU), harness side and ground.  N0091399 - Is any voltage present?	Yes REPAIR the affected circuit (s). CLEAR the DTCs. TEST the system for normal operation. No GO to B7.									
B7 CHECK THE <u>MSS</u> CONTROL AND RETURN CIRCUITS FOR SHORT TO GROUND										
- Ignition OFF. - Measure the resistance between <u>MSS</u> C284-2, circuit RCF13 (WH/BN), harness side and ground; and between <u>MSS</u> C284-3, circuit CCF13 (WH/BU), harness side and ground.  N0091400 - Is the resistance greater than 10,000 ohms?	Yes GO to B8. No REPAIR the affected circuit (s). CLEAR the DTCs. TEST the system for normal operation.									
B8 CHECK THE <u>MSS</u> CONTROL AND RETURN CIRCUITS FOR AN OPEN										
Measure the resistance between <u>MSS</u> C284 and <u>TCCM</u> C2371A as shown below: <table border="1"><thead><tr><th><u>MSS</u></th><th>Circuit</th><th><u>TCCM</u></th></tr></thead><tbody><tr><td>C284-2</td><td>RCF13 (WH/BN)</td><td>C2371A-14</td></tr><tr><td>C284-3</td><td>CCF13 (WH/BU)</td><td>C2371A-16</td></tr></tbody></table>	<u>MSS</u>	Circuit	<u>TCCM</u>	C284-2	RCF13 (WH/BN)	C2371A-14	C284-3	CCF13 (WH/BU)	C2371A-16	Yes GO to B9. No REPAIR the affected circuit (s). CLEAR the DTCs. TEST the system for normal operation.
<u>MSS</u>	Circuit	<u>TCCM</u>								
C284-2	RCF13 (WH/BN)	C2371A-14								
C284-3	CCF13 (WH/BU)	C2371A-16								

 N009139B • Are the resistances less than 3 ohms?	
B9 CHECK THE <u>MSS</u> CONTROL AND RETURN CIRCUITS FOR A SHORT TOGETHER • Ignition OFF. • Measure the resistance between <u>MSS</u> C284-2, circuit RCF13 (WH/BN), harness side and <u>MSS</u> C284-3, circuit CCF13 (WH/BU), harness side.  N013414D • Is the resistance greater than 10,000 ohms?	Yes GO to B10. No REPAIR the affected circuit (s). CLEAR the DTCs.
B10 CHECK THE <u>TCCM</u> AVERAGE FRONT WHEEL SPEED (FRT_WHL_SPD) AND AVERAGE REAR WHEEL SPEED (REAR_WHL_SPD) PIDs • Connect: <u>TCCM</u> C2371A . • Connect: <u>MSS</u>. • Ignition ON. • Set the <u>MSS</u> to 2H. • Enter the following diagnostic mode on the scan tool: DataLogger — <u>TCCM</u>. • 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 B11. No REFER to Section 206-09 to diagnose the wheel speed concern. After the repair is complete, CLEAR the DTCs. TEST the system for normal operation.
B11 CHECK THE <u>TCCM</u> 4WD MODES (4WD_MODES) PID WITH THE <u>MSS</u> IN 4H • Start the engine. • Enter the following diagnostic mode on the scan tool: DataLogger — <u>TCCM</u>. • Set the <u>MSS</u> to 4H. • Monitor the 4WD_MODES PID. • Does the 4WD_MODES PID indicate 4WD_High?	Yes GO to B14. No GO to B12.
B12 CHECK FOR 4H WIND-UP • Switch the <u>MSS</u> to 4H. • Drive the vehicle on a dry, hard surface in turns.	Yes GO to B15.

Is wind-up present in turns?	No GO to B13 .																									
B13 CHECK FOR TRANSFER CASE ENGAGEMENT																										
- With the vehicle in NEUTRAL, position it on a hoist. Refer to Section 100-02. - Rotate the rear driveshaft. - Observe the front driveshaft. Did the front driveshaft rotate?	Yes GO to B14 . No GO to B18 .																									
B14 CHECK FOR IWE ENGAGEMENT																										
NOTE: The engine must be idling during the following steps to supply the vacuum required for the <u>IWEs</u> 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. Did both front halfshafts rotate?	Yes CHECK that all driveline fasteners are present and tightened to specification. REFER to Section 205-00 for further diagnosis of the front axle. No GO to Pinpoint Test D .																									
B15 CHECK THE TRANSFER CASE SHIFT TO 2H																										
- Ignition ON. - Enter the following diagnostic mode on the scan tool: DataLogger — <u>TCCM</u>. - 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 <u>MSS</u> in the 2H position. <table border="1"><thead><tr><th></th><th colspan="4">Contact Plate Position</th></tr><tr><th><u>MSS</u> Position</th><th>PLATE_A</th><th>PLATE_B</th><th>PLATE_C</th><th>PLATE_D</th></tr></thead><tbody><tr><td>2H Mode</td><td>CLOSED</td><td>OPEN</td><td>CLOSED</td><td>CLOSED</td></tr><tr><td>4H Mode</td><td>OPEN</td><td>CLOSED</td><td>CLOSED</td><td>OPEN</td></tr><tr><td>4L Mode</td><td>OPEN</td><td>CLOSED</td><td>OPEN</td><td>CLOSED</td></tr></tbody></table> Do the PIDs and message center indicate that vehicle shifted into 2H (4X2) displayed in message center for approximately 4 seconds)?		Contact Plate Position				<u>MSS</u> 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	Yes GO to B16 . No GO to B20 .
	Contact Plate Position																									
<u>MSS</u> 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																						
B16 CHECK FOR IWE DISENGAGEMENT																										
- With the vehicle in NEUTRAL, position it on a hoist. Refer to Section 100-02. - 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 either of the front halfshafts rotate?	Yes GO to Pinpoint Test D . No GO to B17 .																									
B17 CHECK FOR TRANSFER CASE DISENGAGEMENT																										
Rotate the rear driveshaft while observing the front driveshaft.	Yes																									

Does the front driveshaft rotate?	The system is functioning correctly. CARRY OUT the <u>ESOF</u> Functional Test. GO to Pinpoint Test I. No GO to B18.																								
B18 CHECK THE TRANSFER CASE CONTACT PLATE POSITION PIDs - Enter the following diagnostic mode on the scan tool: DataLogger — <u>TCCM</u>. - 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 <u>MSS</u> in the 4H position. <table><tr><th rowspan="2"><u>MSS</u> Position</th><th colspan="4">Contact Plate Position</th></tr><tr><th>PLATE_A</th><th>PLATE_B</th><th>PLATE_C</th><th>PLATE_D</th></tr><tr><td>2H Mode</td><td>CLOSED</td><td>OPEN</td><td>CLOSED</td><td>CLOSED</td></tr><tr><td>4H Mode</td><td>OPEN</td><td>CLOSED</td><td>CLOSED</td><td>OPEN</td></tr><tr><td>4L Mode</td><td>OPEN</td><td>CLOSED</td><td>OPEN</td><td>CLOSED</td></tr></table> - Do the transfer case contact plate PIDs indicate 4H?	<u>MSS</u> 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	Yes GO to B29. No GO to B19.
<u>MSS</u> 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																					
B19 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 <u>MSS</u> from 2H to 4H. - Does the transfer case shift motor rotate from the 2H position to the 4H position?	Yes GO to B29. No GO to B20.																								
B20 CHECK TRANSFER CASE CONTACT PLATE CIRCUITS FOR A SHORT TO VOLTAGE - Ignition OFF. - Disconnect: Transfer Case . - Disconnect: <u>TCCM</u> C2371A . - Ignition ON. - Measure the voltage between the following circuits at <u>TCCM</u> C2371A, harness side and ground: <table><tr><th>Circuit</th><th>C2371A Pin</th></tr><tr><td>CCF14 (GN/OG)</td><td>1</td></tr><tr><td>CCF15 (BN/YE)</td><td>2</td></tr><tr><td>CCF16 (VT/GN)</td><td>3</td></tr><tr><td>CCF17 (WH/OG)</td><td>4</td></tr><tr><td>RCF09 (BN/WH)</td><td>5</td></tr></table>	Circuit	C2371A Pin	CCF14 (GN/OG)	1	CCF15 (BN/YE)	2	CCF16 (VT/GN)	3	CCF17 (WH/OG)	4	RCF09 (BN/WH)	5	Yes REPAIR the affected circuit (s). CLEAR the DTCs. TEST the system for normal operation. No GO to B21.												
Circuit	C2371A Pin																								
CCF14 (GN/OG)	1																								
CCF15 (BN/YE)	2																								
CCF16 (VT/GN)	3																								
CCF17 (WH/OG)	4																								
RCF09 (BN/WH)	5																								



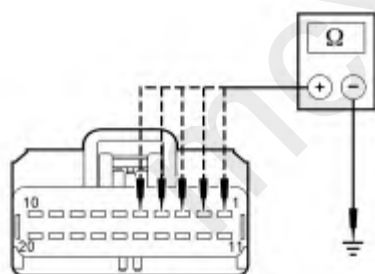
N0091402

- Is any voltage present?

B21 CHECK TRANSFER CASE CONTACT PLATE CIRCUITS FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect: Transfer Case .
- Disconnect: TCCM C2371A .
- Measure the resistance between the following circuits at TCCM C2371A, harness side and ground:

Circuit	C2371A Pin
CCF14 (GN/OG)	1
CCF15 (BN/YE)	2
CCF16 (VT/GN)	3
CCF17 (WH/OG)	4
RCF09 (BN/WH)	5



N0091403

- Are the resistances greater than 10,000 ohms?

B22 CHECK THE TRANSFER CASE CONTACT PLATE CIRCUITS FOR AN OPEN

- Ignition OFF.
- Disconnect: Transfer Case .
- Disconnect: TCCM C2371A .
- Measure the resistance of the following circuits between TCCM C2371A, harness side and transfer case C350, harness side:

C2371A Pin	Circuit	C350 Pin
1	CCF14 (GN/OG)	5
2	CCF15 (BN/YE)	1

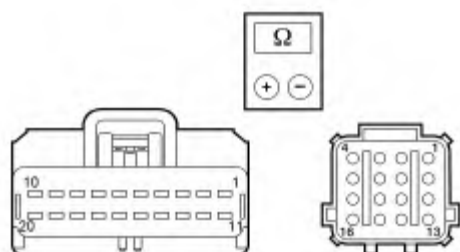
Yes
GO to [B22](#) .

No
REPAIR the affected circuit (s). CLEAR the DTCs. TEST the system for normal operation.

Yes
GO to [B23](#) .

No
REPAIR the affected circuit (s). CLEAR the DTCs. TEST the system for normal operation.

3	CCF16 (VT/GN)	9
4	CCF17 (WH/OG)	13
5	RCF09 (BN/WH)	10

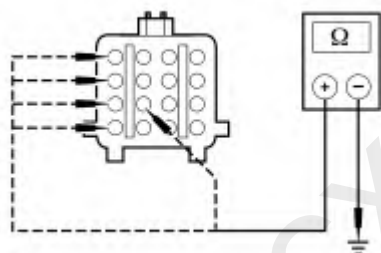


N0091401

- Are the resistances less than 3 ohms?

B23 CHECK THE SHIFT MOTOR FOR AN INTERNAL SHORT TO GROUND

- Measure the resistance between transfer case C350 pins 1, 5, 9, 10 and 13, component side and ground.



N0091404

- Are the resistances greater than 10,000 ohms?

B24 CHECK THE SHIFT MOTOR CIRCUITS FOR POWER WHILE COMMANDING THE TCCM CW RELAY (CW_SMD_OS) AND CCW RELAY (CCW_SMD_OS) PIDs ON

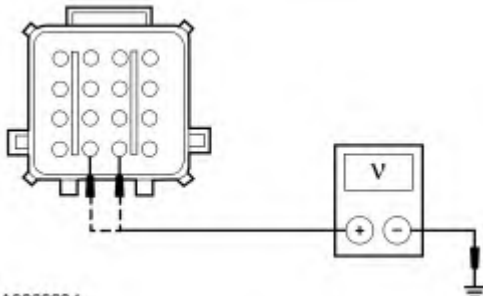
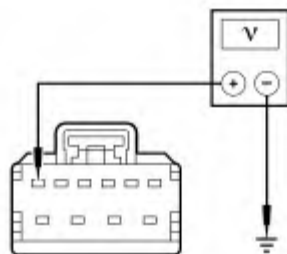
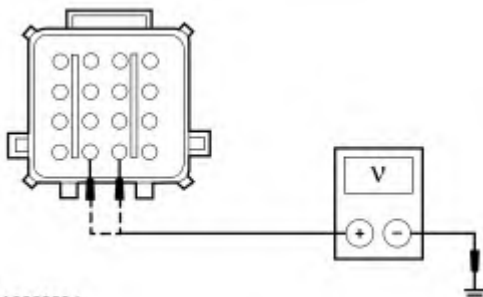
- Ignition ON.
- Connect: TCCM C2371A .
- Enter the following diagnostic mode on the scan tool: DataLogger — TCCM .
- Command the CW_SMD_OS PID ON and OFF while measuring the voltage between transfer case C350-14, circuit CCF08 (GY/OG), harness side and ground. Then command the CCW_SMD_OS PID ON and OFF while measuring the voltage between transfer case C350-15, circuit CCF07 (BN/GN), harness side and ground.

Yes
GO to [B24](#).

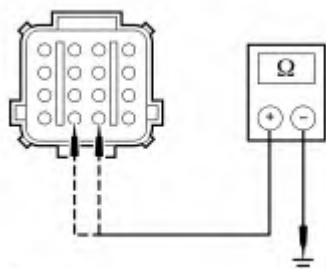
No
INSTALL a new transfer case shift motor. REFER to [Transfer Case Shift Motor](#) in this section. CLEAR the DTCs. REPEAT the self-test, if the concern is still present, GO to [B30](#).

Yes
GO to [B29](#).

No
GO to [B25](#).

 A0069234 Are the voltages 9 volts or greater on the circuits when commanding the PIDs ON?	
B25 CHECK THE <u>TCCM</u> VOLTAGE CIRCUIT - Ignition OFF. - Disconnect: <u>TCCM</u> C2371B . - Measure the voltage between <u>TCCM</u> C2371B-6, circuit SBB20 (GN/RD), harness side and ground.  N0091405 - Is the voltage greater than 11 volts?	Yes GO to B26. No VERIFY <u>BJB</u> fuse 20 (20A) is OK. If OK, REPAIR circuit SBB20 (GN/RD). If not OK, REFER to the Wiring Diagrams manual to identify possible causes of the circuit short. CLEAR the DTCs. TEST the system for normal operation.
B26 CHECK THE TRANSFER CASE SHIFT MOTOR CIRCUITS FOR SHORT TO VOLTAGE - Ignition ON. - Disconnect: <u>TCCM</u> C2371B . - Disconnect: <u>Transfer Case</u> . - Measure the voltage between transfer case C350-14, circuit CCF08 (GY/OG), harness side and ground; and between transfer case C350-15, circuit CCF07 (BN/GN), harness side and ground.  A0069234 - Is any voltage present?	Yes REPAIR the affected circuit (s). CLEAR the DTCs. TEST the system for normal operation. No GO to B27.
B27 CHECK THE TRANSFER CASE SHIFT MOTOR CIRCUITS FOR SHORT TO GROUND Ignition OFF.	Yes

- Disconnect: TCCM C2371B .
- Disconnect: Transfer Case .
- Measure the resistance between transfer case C350-14, circuit CCF08 (GY/OG), harness side and ground; and between the transfer case C350-15, circuit CCF07 (BN/GN), harness side and ground.



- Are the resistances greater than 10,000 ohms?

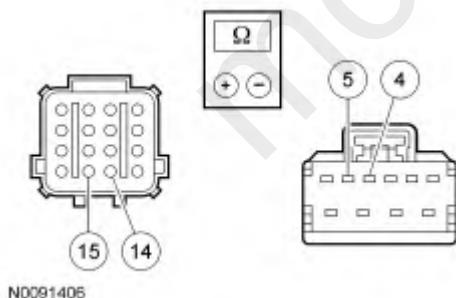
GO to [B28](#) .

No
REPAIR the affected circuit (s). CLEAR the DTCs. TEST the system for normal operation.

B28 CHECK THE TRANSFER CASE SHIFT MOTOR CIRCUITS FOR AN OPEN

- Ignition OFF.
- Disconnect: TCCM C2371B .
- Disconnect: Transfer Case .
- Measure the resistance between transfer case C350 and TCCM C2371B as shown below:

Transfer Case	Circuit	<u>TCCM</u>
C350-14	CCF08 (GY/OG)	C2371B-5
C350-15	CCF07 (BN/GN)	C2371B-4



- Are the resistances less than 3 ohms?

Yes
GO to [B29](#) .

No
REPAIR the affected circuit. CLEAR the DTCs. TEST the system for normal operation.

B29 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.

Yes
INSTALL a new TCCM. REFER to [Transfer Case Control Module \(TCCM\)](#) in this section. TEST the system for normal operation.

No

• Operate the system and verify the concern is still present. • Is the concern still present?	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.
B30 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 B31. No REPAIR the transfer case. REFER to Section 308-07B.
B31 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 B32. No REPAIR the transfer case. REFER to Section 308-07B.
B32 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 B33. No REPAIR the transfer case. REFER to Section 308-07B.
B33 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 in this section. CLEAR the DTCs. TEST the system for normal operation. No REPAIR the transfer case. REFER to Section 308-07B.

Pinpoint Test C: The Vehicle Does Not Shift Between 4H and 4L Modes Correctly

Refer to Wiring Diagrams Cell [34](#), Four-Wheel Drive Systems 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 P184B:00 (Transfer Case Unable To Transition Between 4x4 High and 4x4 Low Range) — Fault 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.

This pinpoint test is intended to diagnose the following:

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

PINPOINT TEST C: 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.

Test Step	Result / Action to Take
C1 CHECK FOR <u>TCCM</u> DTCs • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self-Test — <u>TCCM</u>. • Are any DTCs present?	Yes For DTC P184B:00, GO to C2. For all other DTCs, REFER to the <u>TCCM</u> DTC Chart in this section. No GO to Pinpoint Test B.
C2 CHECK THE 2H TO 4H SHIFT • Drive the vehicle and shift <u>MSS</u> from 2H to 4H. • Does the vehicle shift between 2H and 4H correctly?	Yes GO to C3. No GO to Pinpoint Test B.
C3 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 <u>MSS</u> 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. REFER to Section 307-01 for transmission diagnosis. No GO to C4.
C4 CHECK THE <u>TCCM</u> NEUTRAL INDICATOR (NEUTRAL) AND ABS MODULE WHEEL SPEED PIDs • Enter the following diagnostic mode on the scan tool: DataLogger — <u>TCCM</u>. • A. Monitor the NEUTRAL PID while shifting the transmission through gear ranges. • Enter the following diagnostic mode on the scan tool:	Yes If all 5 PIDs are accurate, GO to Pinpoint Test B. No A. REFER to Section 307-01 for

DataLogger — ABS Module . • B. 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) • A. Does the NEUTRAL PID indicate True when the transmission is shifted to NEUTRAL? B. Do the wheel speed PIDs indicate 0 km/h (0 mph)?	further diagnosis of the <u>TR</u> sensor. B. REFER to Section 206-09 for further diagnosis of the ABS system.
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Pinpoint Test D: The Front Axle Does Not Engage/Disengage Correctly

Refer to Wiring Diagrams Cell [34](#), Four-Wheel Drive Systems for schematic and connector information.

Locator views for the vacuum lines and vacuum reservoir are located in Description and Operation. Refer to [Section 308-07A](#).

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 and an internal spring in the IWEs keeps the hubs engaged.

- DTC C1979:11 (IWE Solenoid Circuit Failure: Short Circuit To Ground) — Fault sets when TCCM C2371A pin 6 detects a short to ground. Fault results in IWEs hubs disengaged all the time.
- DTC C1979:12 (IWE Solenoid Circuit Failure: Short Circuit To Battery) — Fault sets when TCCM C2371A pin 6 detects a short to voltage. Fault results in IWEs hubs engaged all the time.
- DTC C1979:13 (IWE Solenoid Circuit Failure: Circuit Open) — Fault sets when TCCM C2371A pin 6 detects an open circuit. Fault results in IWEs hubs engaged all the time.

This pinpoint test is intended to diagnose the following:

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

PINPOINT TEST D: THE FRONT AXLE DOES NOT ENGAGE/DISENGAGE 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.

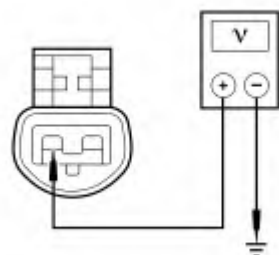
Test Step	Result / Action to Take
D1 CHECK FOR <u>TCCM</u> DTCs	
- Ignition ON. - Enter the following diagnostic mode on the scan tool: Self-Test — <u>TCCM</u>. Are any DTCs present?	Yes For DTC C1979:11, GO to D19. For DTC C1979:12, GO to D18. For DTC C1979:13, GO to D20. For all other DTCs, REFER to the <u>TCCM</u> DTC Chart in this section. No GO to D2.
D2 CHECK FOR GRINDING NOISES AT HIGH SPEEDS	
- With the vehicle warm and the <u>MSS</u> in 2H mode, drive the vehicle at sustained <u>WOT</u> for 5 seconds. Is there a grinding noise from the axle system during <u>WOT</u> ?	Yes GO to Pinpoint Test F. No GO to D3.
D3 CHECK <u>TCCM</u> OPERATION	
- Ignition ON. - Monitor the 4X4 indicator on the <u>IPC</u> while moving the <u>MSS</u> between 2H and 4H modes. Does the 4X4 indicator illuminate when the <u>MSS</u> is in the 4H position and turn off when the <u>MSS</u> is in the 2H position?	Yes GO to D4. No GO to Pinpoint Test B.
D4 CHECK THE <u>IWE</u> DISENGAGEMENT	
NOTE: The engine must be idling during the following steps to supply the vacuum required for the <u>IWEs</u> to engage and disengage. - With the vehicle in NEUTRAL, position it on a hoist. Refer to Section 100-02. - Place the <u>MSS</u> 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 D8. No GO to D5.
D5 CHECK THE <u>IWE</u> ENGAGEMENT	
- With the vehicle in NEUTRAL, position it on a hoist. Refer to Section 100-02. - With the engine running, place the <u>MSS</u> in 4H. - 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 <u>ESOF</u> Functional Test. GO to Pinpoint Test I. No GO to D6.
D6 CHECK THE <u>IWE</u> SOLENOID OUTPUT IN 4H	
- Disconnect the output vacuum line at the <u>IWE</u> solenoid. - With the engine running and the <u>MSS</u> in 4H, measure the	Yes The <u>IWE</u> is mechanically stuck in

vacuum at the output port of the <u>IWE</u> solenoid. Is the vacuum less than 25 mm (1 in) Hg?	the disengaged position. INSTALL a new <u>IWE</u> on the halfshaft(s) that did not rotate. REFER to Integrated Wheel End (IWE) in this section. TEST the system for normal operation. No GO to D7.
D7 CHECK THE <u>IWE</u> SOLENOID	
- Ignition OFF. - Disconnect: <u>IWE</u> Solenoid . - Start the engine. - Measure the vacuum at the output port of the <u>IWE</u> solenoid. - Is the vacuum less than 25 mm (1 in) Hg?	Yes GO to D20. No INSTALL a new <u>IWE</u> solenoid. TEST the system for normal operation.
D8 CHECK THE <u>IWE</u> SOLENOID OUTPUT VACUUM IN 2H	
- Disconnect the output vacuum line at the <u>IWE</u> solenoid. - With the engine running and the <u>MSS</u> in 2H, measure the vacuum at the output port of the <u>IWE</u> solenoid. - Is the vacuum greater than 254 mm (10 in) Hg?	Yes GO to D11. No GO to D9.
D9 CHECK THE <u>IWE</u> SOLENOID INPUT VACUUM	
- Disconnect the supply vacuum line at the <u>IWE</u> solenoid. - With the engine running, measure the supply line vacuum to the <u>IWE</u> solenoid. - Is the vacuum greater than 254 mm (10 in) Hg?	Yes GO to D20. No GO to D10.
D10 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 (20 in) Hg of vacuum. - Does the vacuum maintain or drop less than 25 mm (1 in) Hg per minute?	Yes REPAIR or INSTALL new vacuum lines or INSTALL a check valve. TEST the system for normal operation. No INSTALL a new vacuum reservoir. TEST the system for normal operation.
D11 CHECK THE <u>IWE</u> VACUUM LINES	
- Ignition OFF. - Disconnect the output vacuum line from the <u>IWE</u> solenoid. - Disconnect and plug the LH and RH <u>IWE</u> vacuum lines at the <u>IWEs</u>. - Connect a vacuum pump to the <u>IWE</u> output vacuum circuit at the <u>IWE</u> solenoid connection. Apply 508 mm (20 in) Hg of vacuum and observe the vacuum reading. - Does the vacuum drop more than 25 mm (1 in) Hg per minute?	Yes GO to D14. No GO to D12.
D12 CHECK THE LH <u>IWE</u> VACUUM LINE FOR AN OBSTRUCTION	
REMOVE the plug from the vacuum line at the LH <u>IWE</u>.	Yes

• Connect a hand vacuum pump to the LH <u>IWE</u> vacuum line and attempt to draw a vacuum on the line. • Did the vacuum pump draw a vacuum on the LH <u>IWE</u> vacuum line?	INSTALL a new vacuum line. CLEAR the DTCs. TEST the system for normal operation. No GO to D13.
D13 CHECK THE RH <u>IWE</u> VACUUM LINE FOR AN OBSTRUCTION	
• REMOVE the plug from the vacuum line at the RH <u>IWE</u>. • Connect a vacuum pump to the RH <u>IWE</u> vacuum line and attempt to draw a vacuum on the line. • Did the vacuum pump draw a vacuum on the RH <u>IWE</u> vacuum line?	Yes INSTALL a new vacuum line. CLEAR the DTCs. TEST the system for normal operation. No GO to D14.
D14 CHECK THE RH <u>IWE</u> LEAK RATE	
• Apply 508 mm (20 in) Hg of vacuum to the RH <u>IWE</u> port and observe vacuum reading. • Does the vacuum maintain or drop less than 25 mm (1 in) Hg per minute?	Yes GO to D15. No INSTALL a new RH <u>IWE</u>. REFER to Integrated Wheel End (IWE) in this section. TEST the system for normal operation.
D15 CHECK THE RH <u>IWE</u> OPERATION	
• Connect a vacuum pump with gauge to the larger port of the RH <u>IWE</u>. • 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 <u>IWE</u>. • Did the RH <u>IWE</u> disengage between 152 and 203 mm (6 to 8 in) Hg and engage when the vacuum is released?	Yes CONNECT the vacuum line to the RH <u>IWE</u>. GO to D16. No INSTALL a new RH <u>IWE</u>. REFER to Integrated Wheel End (IWE) in this section. TEST the system for normal operation.
D16 CHECK THE LH <u>IWE</u> LEAK RATE	
• Disconnect the vacuum line from the larger port at the LH <u>IWE</u>. • Apply 508 mm (20 in) Hg of vacuum to the LH <u>IWE</u> port and observe vacuum reading. • Does the vacuum maintain or drop less than 25 mm (1 in) Hg per minute?	Yes GO to D17. No INSTALL a new LH <u>IWE</u>. REFER to Integrated Wheel End (IWE) in this section. TEST the system for normal operation.
D17 CHECK THE LH <u>IWE</u> OPERATION	
• Connect a vacuum pump with gauge to the larger port of the LH <u>IWE</u>. • 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 <u>IWE</u>. • Did the LH <u>IWE</u> disengage between 152 and 203 mm (6 to 8 in) Hg and engage when the vacuum is released?	Yes CONNECT the vacuum line to the LH <u>IWE</u>. GO to D18. No INSTALL a new LH <u>IWE</u>. REFER to Integrated Wheel End (IWE) in this section. CLEAR the DTCs. TEST the system for normal operation.

D18 CHECK THE IWE SOLENOID CONTROL CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect: IWE Solenoid .
- Disconnect: TCCM C2371A .
- Ignition ON.
- Measure the voltage between IWE solenoid C1291-2, circuit CCF05 (BN/BU), harness side and ground.



N0091392

- Is any voltage present?

Yes

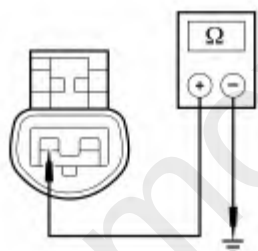
REPAIR circuit CCF05 (BN/BU).
CLEAR the DTCs. TEST the system for normal operation.

No

GO to [D19](#).

D19 CHECK THE IWE SOLENOID CONTROL CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect: IWE Solenoid C1291 .
- Disconnect: TCCM C2371A .
- Measure the resistance between solenoid C1291-2, circuit CCF05 (BN/BU), harness side and ground.



N0091394

- Is the resistance greater than 10,000 ohms?

Yes

GO to [D20](#).

No

REPAIR circuit CCF05 (BN/BU).
CLEAR the DTCs. TEST the system for normal operation.

D20 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.

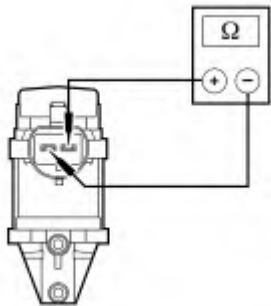
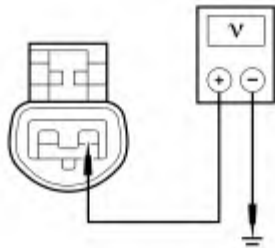
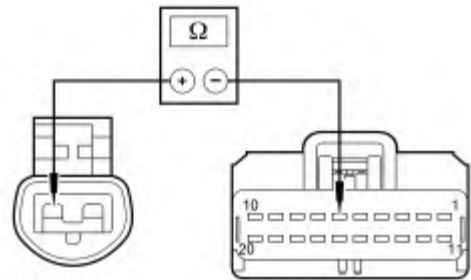
- Measure the resistance between IWE solenoid C1291 pins 1 and 2, component side.

Yes

GO to [D21](#).

No

INSTALL a new IWE solenoid.
CLEAR the DTCs. TEST the system for normal operation.

 N0091395 Is the resistance between 44 and 70 ohms?	
D21 CHECK FOR VOLTAGE TO THE <u>IWE</u> SOLENOID - Ignition OFF. - Disconnect: <u>IWE</u> Solenoid . - Measure the voltage between <u>IWE</u> solenoid C1291-1, circuit SBB29 (GY/RD), harness side and ground.  N0091391 - Is the voltage greater than 11 volts?	Yes GO to D22. No CHECK BJB fuse 29 (10A). If OK, REPAIR circuit SBB29 (GY/RD). If not OK, REFER to the Wiring Diagrams manual to identify possible causes of the circuit short. CLEAR the DTCs. TEST the system for normal operation.
D22 CHECK THE <u>IWE</u> SOLENOID CONTROL CIRCUIT FOR AN OPEN - Ignition OFF. - Disconnect: <u>IWE</u> Solenoid . - Disconnect: <u>TCCM</u> C2371A . - Measure the resistance between <u>IWE</u> solenoid C1291-2, circuit CCF05 (BN/BU), harness side and <u>TCCM</u> C2371A-6, circuit CCF05 (BN/BU), harness side.  N0091393 - Is the resistance less than 3 ohms?	Yes GO to D23. No REPAIR circuit CCF05 (BN/BU). CLEAR the DTCs. TEST the system for normal operation.
D23 CHECK FOR CORRECT <u>TCCM</u> OPERATION - Ignition OFF. - Disconnect and inspect all <u>TCCM</u> connectors. - Repair: - corrosion (install new connector or terminals - clean	Yes INSTALL a new <u>TCCM</u> . REFER to Transfer Case Control Module (TCCM) in this section. TEST the

- module pins) ■ damaged or bent pins - install new terminals/pins ■ pushed-out pins - install new pins as necessary • Connect all <u>TCCM</u> connectors. Make sure they are seated correctly. • Operate the system and verify the concern is still present. • Is the concern still present?	system for normal operation. 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.
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Pinpoint Test E: The Transfer Case Jumps Out of Gear

Locator views for the vacuum lines and vacuum reservoir are located in Description and Operation. Refer to [Section 308-07A](#).

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.

This pinpoint test is intended to diagnose the following:

- Integrated Wheel Ends (IWEs) vent line(s)
- MSS
- Transfer case

PINPOINT TEST E: THE TRANSFER CASE JUMPS OUT OF GEAR



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.

Test Step	Result / Action to Take
E1 CHECK FOR OBSTRUCTED <u>IWE</u> VENT LINES • With the vehicle in NEUTRAL, position it on a hoist. Refer to Section 100-02. • NOTE: The <u>IWE</u> vent port is the smaller of the 2 vacuum ports. • Disconnect the LH <u>IWE</u> line from the vent port. • Attach a vacuum pump to the <u>IWE</u> vent line and attempt to hold a vacuum. • Disconnect the RH <u>IWE</u> line from the vent port. • Attach a vacuum pump to the <u>IWE</u> vent line and attempt to hold a vacuum. • Can a vacuum be held on either <u>IWE</u> vent line?	Yes INSTALL new <u>IWE</u> vent lines as necessary. TEST the system for normal operation. No GO to E2.
E2 VERIFY THE CONCERN	Yes

• Drive the vehicle and attempt to duplicate the concern. • Is the concern an uncommanded range shift (in or out of low range)?	GO to E5. No GO to E3.
E3 CHECK THE <u>MSS</u> POSITION MONITORING THE <u>TCCM 4WD</u> SWITCH STATUS (4X4_SW) PID	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: DataLogger — <u>TCCM</u>. • 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 E4. No GO to Pinpoint Test B.
E4 CHECK FOR <u>TCCM</u> DTCs	
• Enter the following diagnostic mode on the scan tool: Self-Test — <u>TCCM</u>. • Are any DTCs present?	Yes REFER to the <u>TCCM</u> DTC Chart in this section. No CARRY OUT the <u>ESOF</u> Functional Test. GO to Pinpoint Test I.
E5 CHECK THE <u>4WD</u> INDICATORS	
• Stop the vehicle. • Transmission in NEUTRAL. • Depress the brake pedal. • Observe the <u>4WD</u> indication in the message center while cycling through each <u>MSS</u> position. • Does the <u>4WD</u> indicator(s) match the <u>MSS</u> ?	Yes GO to E6. No GO to Pinpoint Test A.
E6 CHECK FOR <u>TCCM</u> DTCs	
• Transmission in PARK. • Enter the following diagnostic mode on the scan tool: Self-Test — <u>TCCM</u>. • Are any DTCs present?	Yes REFER to the <u>TCCM</u> DTC Chart in this section. No CHECK the transfer case fluid level. REFER to Section 308-07B. If the fluid level is OK, CHECK for internal transfer case faults. REFER to Section 308-07B.

Pinpoint Test F: The Front Axle Makes Noise in 2H Mode Only and Generally Under Heavy Throttle

Refer to Wiring Diagrams Cell [34](#), Four-Wheel Drive Systems for schematic and connector information.

Locator views for the vacuum lines and vacuum reservoir are located in Description and Operation. Refer to [Section 308-07A](#).

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.

This pinpoint test is intended to diagnose the following:

- Vacuum leaks
- Vacuum check valve
- Vacuum reservoir
- IWE solenoid
- IWEs

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



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.

Test Step	Result / Action to Take
F1 CHECK FOR GRINDING NOISES AT HIGH SPEEDS	
• With the vehicle warm and the <u>MSS</u> in 2H mode, drive the vehicle at sustained <u>WOT</u> for 5 seconds. • Is there a grinding noise from the axle system during <u>WOT</u>?	Yes GO to F2. No IDENTIFY the customer concern and GO to Symptom Chart - Four-Wheel Drive (4WD) System or GO to Symptom Chart - NVH in this section.
F2 CHECK THE <u>IWE</u> SOLENOID OUTPUT VACUUM IN 2H	
• NOTE: The engine must be idling during the following steps to supply the vacuum required for the <u>IWEs</u> to engage and disengage. • Start the engine. • Disconnect the output vacuum line at the <u>IWE</u> solenoid while having the vacuum supply attached to the solenoid. • With the engine running and the transfer case in 2H mode, measure the vacuum at the output port of the <u>IWE</u> solenoid. • Is the vacuum greater than 254 mm (10 in) Hg?	Yes GO to F7. No GO to F3.
F3 CHECK THE <u>IWE</u> SOLENOID INPUT VACUUM	
• Disconnect the supply vacuum line at the <u>IWE</u> solenoid. • NOTE: The engine must be idling during the following steps to supply the vacuum required for the <u>IWEs</u> to engage and disengage. • With the engine still running, measure the supply line vacuum to the <u>IWE</u> solenoid.	Yes INSTALL a new <u>IWE</u> solenoid. TEST the system for normal operation. No GO to F4.

• Is the vacuum greater than 254 mm (10 in) Hg?	
F4 CHECK SOURCE VACUUM TO THE VACUUM RESERVOIR	
• Disconnect the source vacuum line from the vacuum reservoir. • NOTE: The engine must be idling during the following steps to supply the vacuum required for the <u>IWEs</u> to engage and disengage. • 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 F5. No REPAIR or INSTALL a new source vacuum line. TEST the system for normal operation.
F5 CHECK THE VACUUM RESERVOIR	
• Ignition OFF. • Disconnect the vacuum line from the vacuum reservoir. • Connect a 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 F6. No INSTALL a new vacuum reservoir. TEST the system for normal operation.
F6 CHECK THE VACUUM CHECK VALVE	
• NOTE: The check valve is between the vacuum source and the <u>IWE</u> solenoid and vacuum reservoir. • Connect the vacuum lines to the <u>IWE</u> solenoid. • Connect a vacuum pump to the <u>IWE</u> 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. CARRY OUT the <u>ESOF</u> Functional Test. GO to Pinpoint Test I. No REPAIR or INSTALL new vacuum lines or INSTALL a new check valve. TEST the system for normal operation.
F7 CHECK THE <u>IWE</u> VACUUM SYSTEM	
• Ignition OFF. • Disconnect both vacuum lines from the <u>IWE</u> solenoid. • Using a vacuum pump, apply 508 mm (20 in) Hg of vacuum to the <u>IWE</u> 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 <u>IWE</u> solenoid. GO to F11. No GO to F8.
F8 CHECK THE RH <u>IWE</u> LEAK RATE	
• With the vehicle in NEUTRAL, position it on a hoist. Refer to Section 100-02. • Disconnect the vacuum line from the larger port on the RH <u>IWE</u>. • Apply 508 mm (20 in) Hg of vacuum to the RH <u>IWE</u> port and observe vacuum reading. • Does the vacuum maintain or drop less than 25 mm (1 in) Hg per minute?	Yes GO to F9. No INSTALL a new RH <u>IWE</u>. REFER to Integrated Wheel End (IWE) in this section. TEST the system for normal operation.
F9 CHECK THE LH <u>IWE</u> LEAK RATE	
• Disconnect the vacuum line from the larger port at the LH <u>IWE</u>. • Apply 508 mm (20 in) Hg of vacuum to the LH <u>IWE</u>	Yes GO to F10.

port and observe vacuum reading. • Does the vacuum maintain or drop less than 25 mm (1 in) Hg per minute?	No INSTALL a new LH <u>IWE</u>. REFER to Integrated Wheel End (IWE) in this section. TEST the system for normal operation.
F10 CHECK THE <u>IWE</u> VACUUM SUPPLY TUBE	
• Disconnect both vacuum lines from the <u>IWE</u> solenoid. • Plug both LH and RH <u>IWE</u> vacuum lines. Apply 508 mm (20 in) Hg of vacuum to the <u>IWE</u> apply vacuum circuit and observe the vacuum reading. • Does the vacuum maintain or drop less than 25 mm (1 in) Hg per minute?	Yes GO to F11. No INSTALL new vacuum lines as necessary. TEST the system for normal operation.
F11 CHECK THE <u>IWE</u> VACUUM SUPPLY AT EACH <u>IWE</u> IN 2H	
• Connect the vacuum lines to the <u>IWE</u> solenoid. • Connect a hand-held vacuum gauge to the LH <u>IWE</u> vacuum supply tube. • NOTE: The engine must be idling during the following steps to supply the vacuum required for the <u>IWEs</u> to engage and disengage. • Start the engine. • Switch the <u>MSS</u> to 2H mode while observing the vacuum gauge. • Repeat these steps for the RH <u>IWE</u>. • Are the vacuum readings greater than 254 mm (10 in) Hg?	Yes GO to F12. No INSTALL new vacuum lines as necessary. TEST the system for normal operation.
F12 CHECK THE LH <u>IWE</u> VACUUM LINE FOR AN OBSTRUCTION	
• Ignition OFF. • Disconnect both vacuum lines from the <u>IWE</u> solenoid. • With the vehicle in NEUTRAL, position it on a hoist. Refer to Section 100-02. • Disconnect the vacuum line at the LH <u>IWE</u>. • Connect a hand vacuum pump to the LH <u>IWE</u> vacuum line and attempt to draw a vacuum on the line. • Did the vacuum pump draw a vacuum on the LH <u>IWE</u> vacuum line?	Yes INSTALL a new vacuum line. TEST the system for normal operation. No CONNECT the vacuum line to the LH <u>IWE</u>. GO to F13.
F13 CHECK THE RH <u>IWE</u> VACUUM LINE FOR AN OBSTRUCTION	
• Disconnect the larger vacuum line at the RH <u>IWE</u>. • Connect a vacuum pump to the RH <u>IWE</u> vacuum line and attempt to draw a vacuum on the line. • Did the vacuum pump draw a vacuum on the RH <u>IWE</u> vacuum line?	Yes INSTALL a new vacuum line. TEST the system for normal operation. No CONNECT the vacuum line to the RH <u>IWE</u>. GO to F14.
F14 CHECK THE LH <u>IWE</u> OPERATION	
• Connect a vacuum pump with gauge to the larger port of the LH <u>IWE</u>. • Observe the LH halfshaft while rotating the LH front tire. Apply between 152 and 203 mm (6 to 8 in) Hg	Yes GO to F15. No

of vacuum and release the vacuum to manually disengage and engage the LH <u>IWE</u>. • Did the LH <u>IWE</u> disengage between 152 and 203 mm (6 to 8 in) Hg and engage when the vacuum is released?	INSTALL a new LH <u>IWE</u>. REFER to Integrated Wheel End (IWE) in this section. TEST the system for normal operation.
F15 CHECK THE RH <u>IWE</u> OPERATION • Connect a vacuum pump with gauge to the larger port of the RH <u>IWE</u>. • 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 <u>IWE</u>. • Did the RH <u>IWE</u> disengage between 152 and 203 mm (6 to 8 in) Hg and engage when the vacuum is released?	Yes CARRY OUT the <u>ESOF</u> Functional Test. GO to Pinpoint Test I. No INSTALL a new RH <u>IWE</u>. REFER to Integrated Wheel End (IWE) in this section. TEST the system for normal operation.

Pinpoint Test G: The 4WD Does Not Engage at Speed Correctly

Refer to Wiring Diagrams Cell [34](#), Four-Wheel Drive Systems for schematic and connector information.

Normal Operation

When the operator selects a transfer case mode from 2H mode, the Transfer Case Control Module (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 P1825:00 (4-Wheel Drive Clutch Relay Open Circuit: No Sub Type Information) — Fault sets when TCCM C2371B pin 1 detects an open circuit. The TCCM disables transfer case synchronization clutch operation.
- DTC P1826:00 (4-Wheel Drive Low Clutch Relay Circuit To Battery: No Sub Type Information) — Fault sets when TCCM C2371B pin 1 detects a short to voltage. Transfer case synchronization clutch operation, though disabled by the TCCM, is fully engaged when this DTC is present.
- DTC P1827:00 (4-Wheel Drive Low Clutch Relay Circuit To Ground) — Fault sets when TCCM C2371B pin 1 detects a short to ground. The TCCM disables transfer case synchronization clutch operation.

This pinpoint test is intended to diagnose the following:

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

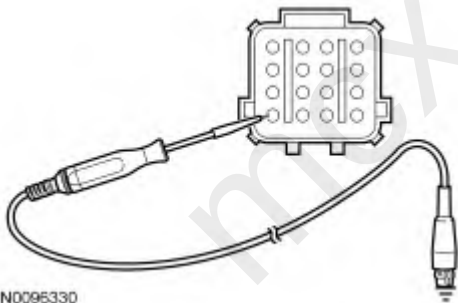
PINPOINT TEST G: THE 4WD DOES NOT ENGAGE AT SPEED CORRECTLY

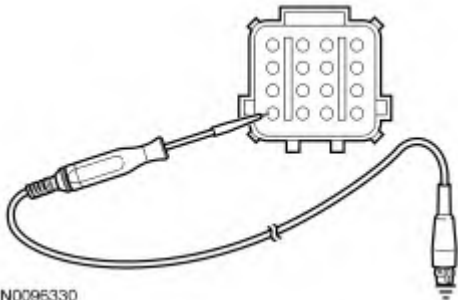
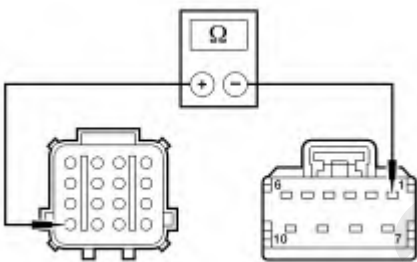
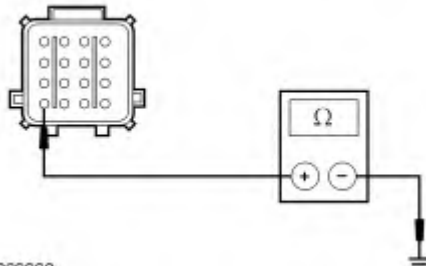


WARNING: When directed to drive the vehicle as part of this test, drive the vehicle on a hard surface in an area without traffic to prevent a crash. Failure to follow these instructions may result in

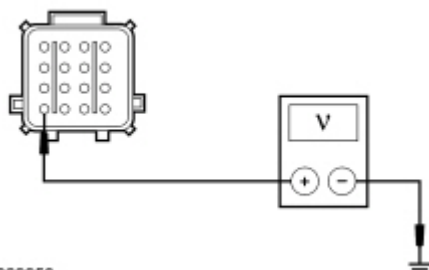
personal injury.

Test Step	Result / Action to Take
G1 CHECK FOR <u>TCCM</u> DTCs	
- Ignition ON. - Enter the following diagnostic mode on the scan tool: Self-Test — <u>TCCM</u>. Are any DTCs present?	Yes For DTC P1825:00, GO to G7. For DTC P1826:00, GO to G12. For DTC P1827:00, GO to G10. For all other DTCs, REFER to the <u>TCCM</u> DTC Chart for diagnosis. No GO to G2.
G2 CHECK 4H ENGAGEMENT AT REST	
- Switch the <u>MSS</u> 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 G3. No GO to Pinpoint Test B.
G3 CHECK 2H TO 4H SHIFT AT SPEED	
- Switch the <u>MSS</u> to 2H. - Drive the vehicle and carry out a 2H to 4H shift while driving approximately at 16 km/h (10 mph). - 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 D. No GO to G4.
G4 CHECK THE <u>TCCM</u> AVERAGE FRONT WHEEL SPEED (FRT_WHL_SPD) AND AVERAGE REAR WHEEL SPEED (REAR_WHL_SPD) PIDs	
- Enter the following diagnostic mode on the scan tool: DataLogger — <u>TCCM</u>. - 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 G5. No REFER to Section 206-09 to diagnose the wheel speed sensor concern.
G5 CHECK THE TRANSFER CASE SYNCHRONIZATION CLUTCH LOCK-UP USING THE <u>TCCM</u> 4WD PWM CLUTCH STATUS (4WD_CLTCH_OUT) PID	
- Ignition ON. - Switch the <u>MSS</u> to 4H. - Active command the 4WD_CLTCH_OUT PID to 98%. - With the vehicle in NEUTRAL, position it on a hoist. Refer to Section 100-02. - Remove the transfer case shift motor from the transfer case, leaving the electrical connector connected.	Yes GO to G6. No GO to G7.

• 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?	
G6 CHECK THE TRANSFER CASE SYNCHRONIZATION CLUTCH RELEASE USING THE <u>TCCM 4WD PWM CLUTCH STATUS (4WD_CLTCH_OUT)</u> PID	
• Active command the 4WD_CLTCH_OUT 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 G11 . No END the active command. GO to G7 .
G7 CHECK FOR VOLTAGE TO THE TRANSFER CASE SYNCHRONIZATION CLUTCH USING THE <u>TCCM 4WD PWM CLUTCH STATUS (4WD_CLTCH_OUT)</u> PID	
NOTICE: The following step uses a test light to simulate normal circuit loads. Use only the test light recommended in the Special Tools table at the beginning of this section. To avoid connector terminal damage, use the Flex Probe Kit for the test light probe connection to the vehicle. Do not use the test light probe directly on any connector. • Ignition OFF. • Disconnect: Transfer Case . • Ignition ON. • Enter the following diagnostic mode on the scan tool: DataLogger — <u>TCCM</u>. • Active command the 4WD_CLTCH_OUT PID at 98%.  N0095330 • Connect a 12-volt incandescent test light between transfer case C350-16, circuit CCF03 (GY/BN), harness side and the transfer case housing. • Does the test light illuminate?	Yes END the active command. INSTALL a new transfer case synchronization clutch. REFER to Section 308-07B . CLEAR the DTCs. TEST the system for normal operation. No GO to G8 .
G8 CHECK THE TRANSFER CASE CHASSIS GROUND USING THE <u>TCCM 4WD PWM CLUTCH STATUS (4WD_CLTCH_OUT)</u> PID	
NOTICE: The following step uses a test light to simulate normal circuit loads. Use only the test light recommended in the Special Tools table at the beginning of this section. To avoid connector terminal damage, use the Flex Probe Kit for the test light probe connection to the vehicle. Do not use the test light probe directly on any connector. • Active command the 4WD_CLTCH_OUT PID at 98%.	Yes END the active command. REPAIR the transfer case ground connection between the transfer case and the chassis. CLEAR the DTCs. TEST the system for normal operation.

 N0095330 • Connect a 12-volt incandescent test light between transfer case C350-16, circuit CCF03 (GY/BN), harness side and chassis ground. • Does the test light illuminate?	No END the active command. GO to G9.
G9 CHECK THE TRANSFER CASE SYNCHRONIZATION CLUTCH CONTROL CIRCUIT FOR AN OPEN • Measure the resistance between transfer case C350-16, circuit CCF03 (GY/BN), harness side and <u>TCCM</u> C2371B-1, circuit CCF03 (GY/BN), harness side.  N0093125 • Is the resistance less than 3 ohms?	Yes GO to G10. No REPAIR circuit CCF03 (GY/BN). CLEAR the DTCs. TEST the system for normal operation.
G10 CHECK THE TRANSFER CASE SYNCHRONIZATION CLUTCH CONTROL CIRCUIT FOR A SHORT TO GROUND • Ignition OFF. • Disconnect: <u>TCCM</u> C2371B . • Disconnect: Transfer Case . • Measure the resistance between transfer case C350-16, circuit CCF03 (GY/BN), harness side and ground.  A0069960 • Is the resistance greater than 10,000 ohms?	Yes GO to G13. No REPAIR circuit CCF03 (GY/BN) for a short to ground. CLEAR the DTCs. TEST the system for normal operation.
G11 CHECK THE TRANSFER CASE SYNCHRONIZATION CLUTCH CONTROL CIRCUIT FOR VOLTAGE USING THE <u>TCCM 4WD PWM CLUTCH STATUS (4WD_CLTCH_OUT)</u> PID	

- Ignition OFF.
- Disconnect: Transfer Case .
- Ignition ON.
- Enter the following diagnostic mode on the scan tool: DataLogger — TCCM.
- Active command the 4WD_CLTCH_OUT PID 98%.



- Measure the voltage between transfer case C350-16, circuit CCF03 (GY/BN), harness side and ground.
- **Is any voltage present?**

Yes

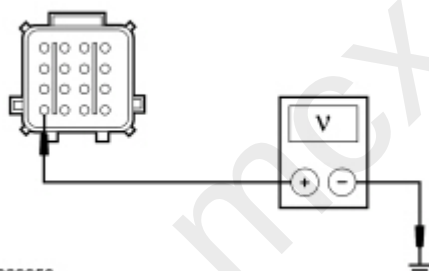
END the active command.
GO to [G12](#).

No

END the active command.
INSTALL a new transfer case synchronization clutch. REFER to [Section 308-07B](#). CLEAR the DTCs. TEST the system for normal operation.

G12 CHECK THE TRANSFER CASE SYNCHRONIZATION CLUTCH CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect: Transfer Case .
- Disconnect: TCCM C2371B .
- Ignition ON.
- Measure the voltage between transfer case C350-16, circuit CCF03 (GY/BN), harness side and ground.



- **Is any voltage present?**

Yes

REPAIR circuit CCF03 (GY/BN). CLEAR the DTCs. TEST the system for normal operation.

No

GO to [G13](#).

G13 CHECK TRANSFER CASE SYNCHRONIZATION CLUTCH

- Ignition OFF.
- Measure the resistance between transfer case C350-16, component side and the transfer case housing.
- **Is the resistance between 1-3 ohms?**

Yes

GO to [G14](#).

No

INSTALL a new transfer case synchronization clutch. REFER to Transfer Case Disassembly and Assembly in [Section 308-07B](#). CLEAR the DTCs. TEST the system for normal operation.

G14 CHECK FOR CORRECT TCCM OPERATION

• Ignition OFF. • Disconnect and inspect all <u>TCCM</u> 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 <u>TCCM</u> connectors. Make sure they are seated correctly. • Is the concern still present?	Yes INSTALL a new <u>TCCM</u>. REFER to Transfer Case Control Module (TCCM) in this section. TEST the system for normal operation. 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.
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Pinpoint Test H: Vehicle Pulsates or Shudders in a Straight Line (Straightline Driveline Wind-up)

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.

This pinpoint test is intended to diagnose the following:

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

PINPOINT TEST H: 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.

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

Test Step	Result / Action to Take
H1 VERIFY THE CONCERN	
• 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 H2. No RETURN the vehicle to the customer. ADVISE about correct system operation and normal vehicle behavior.
H2 CHECK FOR MATCHING WHEEL AND TIRE	

SIZES	
- Check the wheel and tire sizes. Do the 4 wheel and tire sizes match?	Yes GO to H3. No ADVISE the customer that <u>4WD</u> systems require 4 matched, correctly inflated, correctly maintained tires to operate correctly.
H3 CHECK TIRE WEAR	
- Check each of the 4 tires for wear. Are the 4 tires worn evenly?	Yes GO to H4. No ADVISE the customer that Four-Wheel Drive (4WD) systems require 4 matched, correctly inflated, correctly maintained tires to operate correctly.
H4 CHECK TIRE INFLATION PRESSURE	
- Check the inflation pressure in each tire. Refer to <u>VC</u> label. Are the tire inflation pressures correct?	Yes GO to H5. No ADJUST the tire pressure as necessary. TEST the vehicle for normal operation. ADVISE the customer that <u>4WD</u> systems require 4 matched, correctly inflated, correctly maintained tires to operate correctly.
H5 CHECK THE FRONT AND REAR AXLE RATIOS	
- Check that front and rear axle ratios match. Refer to Section 205-00. Do the front and rear axle ratios match?	Yes RETURN the vehicle to the customer and ADVISE about correct <u>4WD</u> usage and normal vehicle behavior. No CHECK the vehicle VC label. INSTALL the correct axle(s). REFER to Section 205-00.

Pinpoint Test I: 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 [Section 308-07A](#).

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.

This pinpoint test is intended to diagnose the following:

- 4WD system and/or related components

PINPOINT TEST I: ESOF FUNCTIONAL TEST

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.

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

Test Step	Result / Action to Take
I1 CHECK FOR <u>IPC</u> DTCs	
- Ignition ON. - Enter the following diagnostic mode on the scan tool: Self-Test — <u>IPC</u>. Are any DTCs present?	Yes If DTC U0102:00 is retrieved, REFER to Section 418-00 to diagnose lost communication with <u>TCCM</u>. For all other DTCs, REFER to Section 413-01. No GO to I2.
I2 CHECK 2H OPERATION	
- Switch the <u>MSS</u> to 2H while monitoring the message center. Does the message center display 4X2 for approximately 4 seconds?	Yes GO to I5. No GO to I3.
I3 CHECK FOR <u>TCCM</u> DTCs	
- Enter the following diagnostic mode on the scan tool: Self-Test — <u>TCCM</u>. Are any DTCs present?	Yes REFER to the <u>TCCM</u> DTC Chart in this section. No GO to I4.
I4 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 B. No GO to I5.
I5 CHECK 4H OPERATION	
- Switch the <u>MSS</u> to 4H while monitoring the message center. Does the message center display 4X4 HIGH?	Yes GO to I8. No GO to I6.
I6 CHECK FOR <u>TCCM</u> DTCs	
- Transmission in PARK. - Enter the following diagnostic mode on the scan tool: Self-Test — <u>TCCM</u>. Are any DTCs present?	Yes REFER to the <u>TCCM</u> DTC Chart in this section. No GO to I7.
I7 CHECK FOR WIND-UP IN 4H	
Drive the vehicle on a dry, hard surface	Yes

- while executing turns. Is wind-up present in turns?	Go to Pinpoint Test AB in Electronic Locking Differential (ELD) System, Diagnosis and Testing, Section 308-07A. No Go to Pinpoint Test AC in Electronic Locking Differential (ELD) System, Diagnosis and Testing, Section 308-07A.
I8 CHECK FOR STRAIGHT LINE 4H WIND-UP	
- Drive the vehicle on a dry, hard surface. Is straightline wind-up present?	Yes GO to Pinpoint Test H. No GO to I9.
I9 CHECK 4H WIND-UP IN TURNS	
- Drive the vehicle in 4H while turning. Is wind-up present in turns?	Yes GO to I10. No GO to Pinpoint Test B.
I10 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 I13. No GO to I11.
I11 CHECK FOR TCCM DTCs	
- Transmission in PARK. - Enter the following diagnostic mode on the scan tool: Self-Test — TCCM. Are any DTCs present?	Yes REFER to the TCCM DTC Chart in this section. No GO to I12.
I12 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 C.
I13 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 I14. No CHECK for TCCM DTCs. REFER to the TCCM DTC Chart in this section. If no DTCs are present, GO to Pinpoint Test C.
I14 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 I17. No GO to I15.

I15 CHECK FOR <u>TCCM</u> DTCs	
• Transmission in PARK. • Enter the following diagnostic mode on the scan tool: Self-Test — <u>TCCM</u>. • Are any DTCs present?	Yes REFER to the <u>TCCM</u> DTC Chart in this section. No GO to I16.
I16 CHECK FOR WIND-UP IN 2H	
• Switch the <u>MSS</u> to 2H. • Drive the vehicle on a dry, hard surface while executing turns. • Is wind-up present in turns?	Yes GO to Pinpoint Test C. No GO to Pinpoint Test A.
I17 CHECK FOR TRANSFER CASE DISENGAGEMENT	
• With the vehicle in NEUTRAL, position it on a hoist. Refer to Section 100-02. • Rotate the rear driveshaft while observing the front driveshaft. • Does the front driveshaft rotate?	Yes REFER to Section 308-07B. No GO to I18.
I18 CHECK FOR LH AND RH <u>IWE</u> DISENGAGEMENT	
NOTE: The engine must be idling during the following steps to supply the vacuum required for the <u>IWEs</u> 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 D. No GO to I19.
I19 CHECK FOR <u>IWE</u> VACUUM LEAKS	
• Ignition OFF. • Disconnect both vacuum lines from the <u>IWE</u> solenoid. • Using a vacuum pump, apply 508 mm (20 in) Hg of vacuum to the <u>IWE</u> apply vacuum circuit. • Observe the vacuum reading. • Did the vacuum drop more than 25 mm (1 in) Hg per minute?	Yes CHECK the <u>IWE</u> and related components for leaks. GO to Pinpoint Test D. No GO to I20.
I20 CHECK 2H TO 4H SHIFT AT SPEED ABOVE 32 KM/H (20 MPH)	
• Switch the <u>MSS</u> to 2H. • 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 <u>4WD</u> system is functioning correctly. No GO to Pinpoint Test G.

Pinpoint Test J: Off-Road Mode Switch Indicator Is Inoperative

Refer to Wiring Diagrams Cell [34](#), Four-Wheel Drive Systems for schematic and connector information.

Normal Operation

When the off-road switch is depressed, a signal is sent to the TCCM which alerts other modules along the HS-CAN that off-road mode is being requested. Other vehicle functions change to accommodate off-road mode and an indicator illuminates on the off-road mode switch confirming off-road mode.

- DTC B12E0:11 (Off Road Indicator: Circuit Short to Ground) — When in off-road mode, the TCCM senses the indicator circuit has low voltage and is always illuminated.
- DTC B12E0:12 (Off Road Indicator: Circuit Short to Battery) — When in off-road mode, the TCCM senses the indicator circuit has high voltage and never illuminates.
- DTC B12E0:13 (Off Road Indicator: Circuit Open) — When in off-road mode, the TCCM senses the indicator lamp circuit is open and never illuminates.

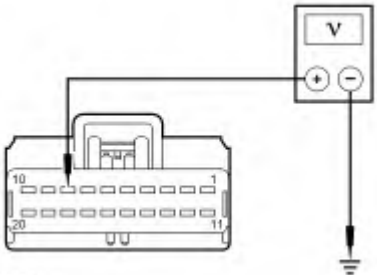
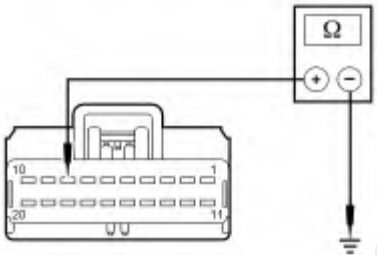
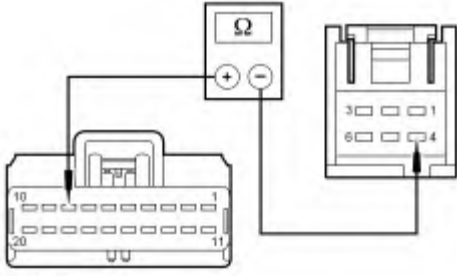
This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Off-road mode switch
- TCCM

PINPOINT TEST J: OFF-ROAD MODE SWITCH INDICATOR IS INOPERATIVE

NOTE: Make sure the battery is fully charged before performing this pinpoint test.

Test Step	Result / Action to Take
J1 CHECK FOR <u>TCCM</u> DTCs • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self-Test — <u>TCCM</u>. • Are any DTCs present?	Yes For DTC B12E0:11, GO to J3. For DTC B12E0:12, GO to J2. For DTC B12E0:13, GO to J4 For all other DTCs, REFER to the <u>TCCM</u> DTC Chart in this section. No IDENTIFY the customer concern and GO to Symptom Chart - Four-Wheel Drive (4WD) System in this section.
J2 CHECK THE OFF-ROAD MODE INDICATOR CIRCUIT FOR A SHORT TO VOLTAGE • Ignition OFF. • Disconnect: <u>TCCM</u> C2371A . • Disconnect: Off-Road Mode Switch . • Ignition ON. • Measure the voltage between <u>TCCM</u> C2371A-8, circuit CCF01 (BN), harness side and ground.	Yes REPAIR circuit CCF01 (BN). CLEAR the DTCs. TEST the system for normal operation. No GO to J3.

 N0102798 • Is any voltage present?	
J3 CHECK THE OFF-ROAD MODE INDICATOR CIRCUIT FOR A SHORT TO GROUND • Ignition OFF. • Disconnect: <u>TCCM</u> C2371A . • Disconnect: Off-Road Mode Switch . • Measure the resistance between <u>TCCM</u> C2371A-8, circuit CCF01 (BN), harness side and ground.  N0102795 • Is the resistance greater than 10,000 ohms?	Yes GO to J4 . No REPAIR circuit CCF01 (BN). CLEAR the DTCs. TEST the system for normal operation.
J4 CHECK THE OFF-ROAD MODE INDICATOR CIRCUIT FOR AN OPEN • Ignition OFF. • Disconnect: <u>TCCM</u> C2371A . • Disconnect: Off-Road Mode Switch . • Measure the resistance between <u>TCCM</u> C2371A-8, circuit CCF01 (BN), harness side and off-road mode switch C3393-4, circuit CCF01 (BN), harness side.  N0102796 • Is the resistance less than 3 ohms?	Yes GO to J5 . No REPAIR circuit CCF01 (BN). CLEAR the DTCs. TEST the system for normal operation.
J5 CHECK THE <u>TCCM</u> OFF-ROAD INPUT SWITCH STATUS (OFF_RD_SW) PID • Connect: <u>TCCM</u> C2371A .	Yes

• Connect: Off-Road Mode Switch . • Ignition ON. • Enter the following diagnostic mode on the scan tool: DataLogger — <u>TCCM</u>. • Monitor the OFF_RD_SW PID. • Does the OFF_RD_SW PID status indicate Not Pressed?	GO to J6 . No INSTALL a new off-road mode switch. REFER to the Console — Floor exploded view in Section 501-12 . PRESS the tab on each side of the switch to remove it from the bezel. CLEAR the DTCs. TEST the system for normal operation.
J6 CHECK THE <u>TCCM</u> OFF-ROAD STATUS (OFF_RD_STAT) PID • Ignition ON. • Enter the following diagnostic mode on the scan tool: DataLogger — <u>TCCM</u>. • Press the off-road mode switch button. • Monitor the OFF_RD_STAT PID. • Does the PID status indicate Off-Road Mode?	Yes GO to J7 . No INSTALL a new off-road mode switch. REFER to the Console — Floor exploded view in Section 501-12 . PRESS the tab on each side of the switch to remove it from the bezel. CLEAR the DTCs. TEST the system for normal operation.
J7 CHECK FOR CORRECT <u>TCCM</u> OPERATION • Ignition OFF. • Disconnect and inspect all <u>TCCM</u> 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 <u>TCCM</u> 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 <u>TCCM</u> . REFER to Transfer Case Control Module (TCCM) in this section. TEST the system for normal operation. 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.

Pinpoint Test K: Off-Road Mode Is Inoperative

Refer to Wiring Diagrams Cell [34](#) , Four-Wheel Drive Systems for schematic and connector information.

Normal Operation

When the off-road switch is depressed, a signal is sent to the TCCM which alerts other modules along the HS-CAN that off-road mode is being requested. Other vehicle functions change to accommodate off-road mode and an indicator illuminates on the off-road mode switch confirming off-road mode.

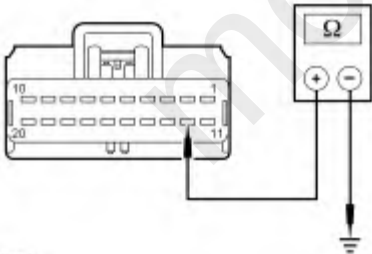
- DTC B12E5:00 (Off Road Mode Select Switch: No Sub Type Information) — When in off-road mode, the TCCM C2371A-12 senses if the switch is pressed for more than 30 seconds or if a short to ground on the switch circuit has occurred.
- DTC B12E5:11 (Off Road Mode Select Switch: Circuit Short To Ground) — The TCCM C2371A-12 senses a short to ground on the switch control circuit.

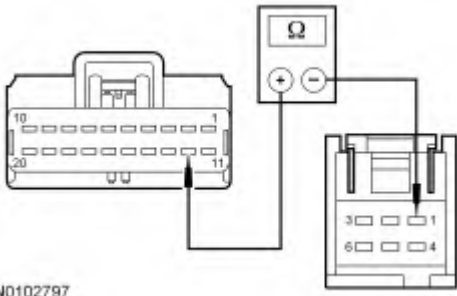
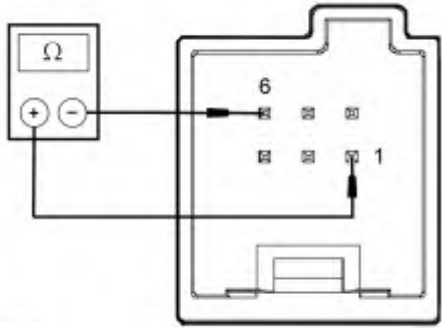
This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors
- Off-road mode switch
- TCCM

PINPOINT TEST K: OFF-ROAD MODE IS INOPERATIVE

NOTE: Make sure the battery is fully charged before performing this pinpoint test.

Test Step	Result / Action to Take
K1 CHECK FOR <u>TCCM</u> DTCs • Ignition ON. • Enter the following diagnostic mode on the scan tool: Self-Test — <u>TCCM</u>. • Are any DTCs present?	Yes If DTCs B12E5:00 or B12E5:11 are retrieved, GO to K2. For all other DTCs, REFER to the <u>TCCM</u> DTC Chart in this section. No IDENTIFY the customer concern and GO to Symptom Chart - Four-Wheel Drive (4WD) System in this section.
K2 CHECK THE OFF-ROAD MODE SWITCH CIRCUIT FOR A SHORT TO GROUND • Ignition OFF. • Disconnect: <u>TCCM</u> C2371A . • Disconnect: Off-Road Mode Switch . • Measure the resistance between <u>TCCM</u> C2371A-12, circuit CCF11 (YE/VT), harness side and ground.  N0102794 • Is the resistance greater than 10,000 ohms?	Yes GO to K3. No REPAIR circuit CCF11 (YE/VT). CLEAR the DTCs. TEST the system for normal operation.
K3 CHECK THE OFF-ROAD MODE SWITCH CIRCUIT FOR AN OPEN • Measure the resistance between <u>TCCM</u> C2371A-12, circuit CCF11 (YE/VT), harness side and off-road mode switch C3393-1, circuit CCF11 (YE/VT), harness side.	Yes GO to K4. No REPAIR circuit CCF11 (YE/VT). CLEAR the DTCs. TEST the system for normal operation.

 N0102797 • Is the resistance less than 3 ohms?	
K4 CHECK THE OFF-ROAD MODE SWITCH • Measure the resistance between off-road mode switch C3393-6, circuit CCF11, component side and off-road mode switch C3393-1, circuit CCF11, component side.  N0133483 • Is the resistance greater than 10,000 ohms?	Yes GO to K5. No INSTALL a new off-road mode switch. REFER to the Console — Floor exploded view in Section 501-12. PRESS the tab on each side of the switch to remove it from the bezel. CLEAR the DTCs. TEST the system for normal operation.
K5 CHECK FOR CORRECT <u>TCCM</u> OPERATION • Ignition OFF. • Disconnect and inspect all <u>TCCM</u> 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 <u>TCCM</u> 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 <u>TCCM</u>. REFER to Transfer Case Control Module (TCCM) in this section. TEST the system for normal operation. 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.

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