## Transmission Electronic Control System

### Powertrain Control System

The PCM controls the electronic functions of this transmission. A plastic molded leadframe is bolted to the main control assembly. The leadframe contains the Turbine Shaft Speed (TSS) , Output Shaft Speed (OSS) , Transmission Fluid Temperature (TFT) and Transmission Range (TR) sensors.

The PCM receives input signals from engine and transmission sensors and uses these inputs to control line pressure, shift time, Torque Converter Clutch (TCC) , and shift solenoids. The PCM also provides power and ground for the reverse lamp relay coil and provides a PARK/NEUTRAL start enable signal.

The following is a list of direct engine and driver inputs to the PCM along with module information from the vehicle Controller Area Network (CAN) :

- Engine speed
- Engine torque
- Engine coolant temperature
- Throttle position
- Accelerator pedal
- Brake pedal
- ABS wheel speed
- Traction control status

The PCM also:

- monitors inputs and outputs for the presence of faults.
- stores DTCs related to detected faults.
- provides outputs on the CAN for transmission range, output shaft speed, turbine shaft speed, transmission fluid temperature, current gear and A/C inhibit.
- provides On-Board Diagnostic (OBD) information using the CAN to illuminate the Malfunction Indicator Lamp (MIL) or Transmission Control Indicator Lamp (TCIL) .
- provides diagnostic information to a scan tool through the Data Link Connector (DLC) .

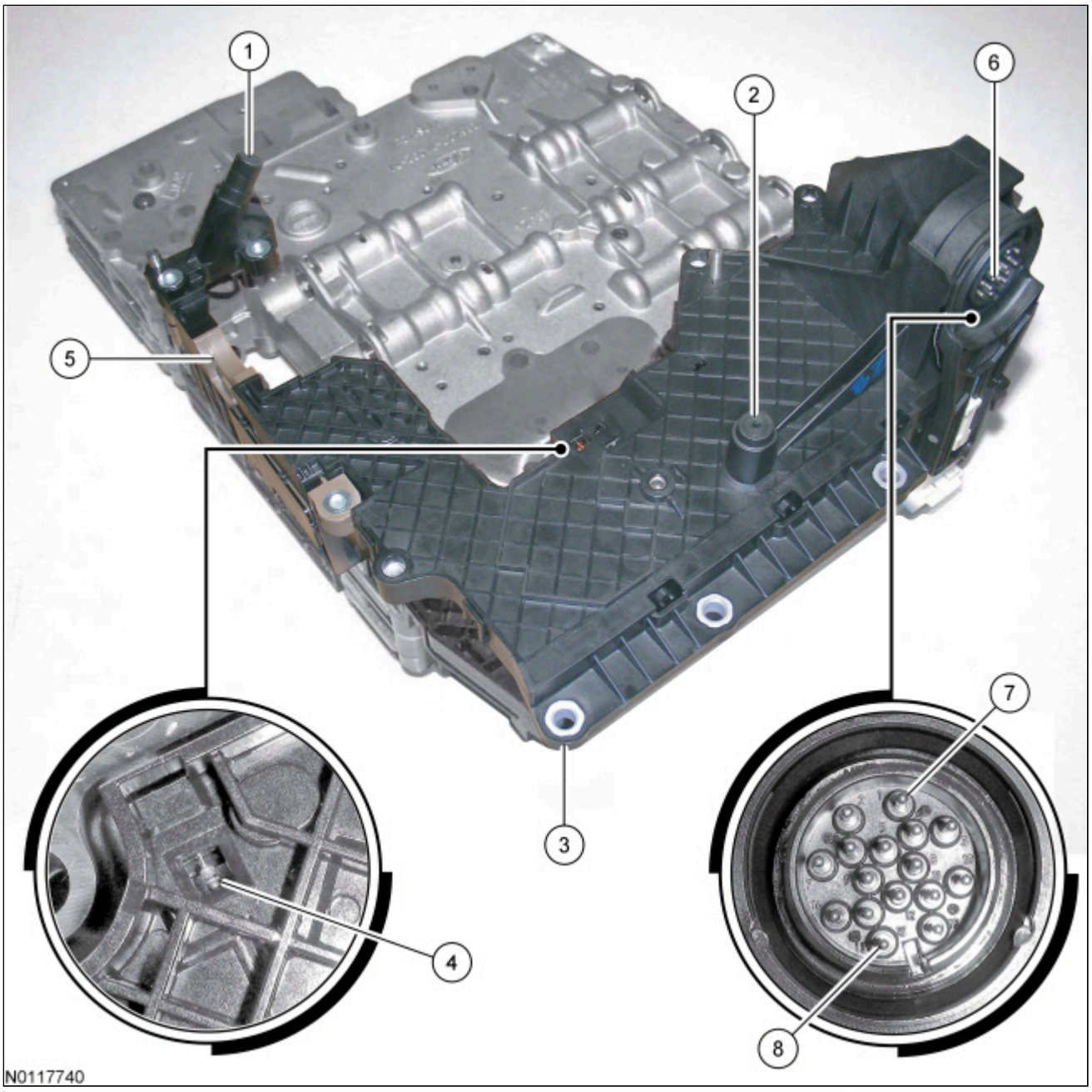
If the PCM detects a system or component fault, it substitutes a default value or signal using Failure Mode and Effect Management strategies.

The PCM also uses Failure Mode and Effect Management strategies to compensate for electrical or mechanical shift solenoid and apply component faults that result in alternate shift patterns.

If the transmission loses complete electronic control, it operates in a fail-safe mode with:

- Maximum line pressure in all transmission ranges
- Functional PARK, REVERSE and NEUTRAL positions
- Operation in 3rd or 5th gear (depending on the failure conditions) when the selector lever is in the DRIVE, 3, 2 or 1 position
- TCC is released in all transmission ranges and gears

### Molded Leadframe




| Item | Part Number | Description |
|---|---|---|
| 1 | — | Turbine Shaft Speed (TSS) sensor |
| 2 | — | Output Shaft Speed (OSS) sensor |
| 3 | 7G276 | Molded leadframe |
| 4 | — | Transmission Fluid Temperature (TFT) sensor |
| 5 | — | Transmission Range (TR) sensor |
| 6 | — | Leadframe connector |
| 7 | — | Terminal 1 |
| 8 | — | Terminal 16 |

**Solenoid Operation Chart**

| Selector Lever Position | PCM Commanded Gear | Shift Solenoid | | | | | TCC NL |
|---|---|---|---|---|---|---|---|
| | | SSA NL (1,2,3,4) | SSB NH (3,5,R) | SSC NL (CB 2,6) | SSD NH (CB L,R/C 4,5,6) | SSE NC | |
| P | P | Off | On | Off | Off | Off | Off |
| R | R | Off | Off | Off | Off | Off | Off |
| N | N | Off | On | Off | Off [a] | Off | Off |
| D | 1 | On | On | Off | Off [b] | Off | Off |
| | 2 | On | On | On | On | Off | Off |
| | 3 | On | Off | Off | On | On | On/Off |
| | 4 | On | On | Off | Off | On | On/Off |
| | 5 | Off | Off | Off | Off | On | On/Off |
| | 6 | Off | On | On | Off | On | On/Off |

CB = Clutch brake

NC = Normally closed

NH = Normally high

NL = Normally low

[a] Solenoid state will change if vehicle is moving forward with the selector lever in the NEUTRAL position.

[b] Solenoid is On when vehicle is above 3 mph.

The following are brief descriptions of the sensors and actuators used to control transmission operation.

**Line Pressure Control (LPC) Solenoid**

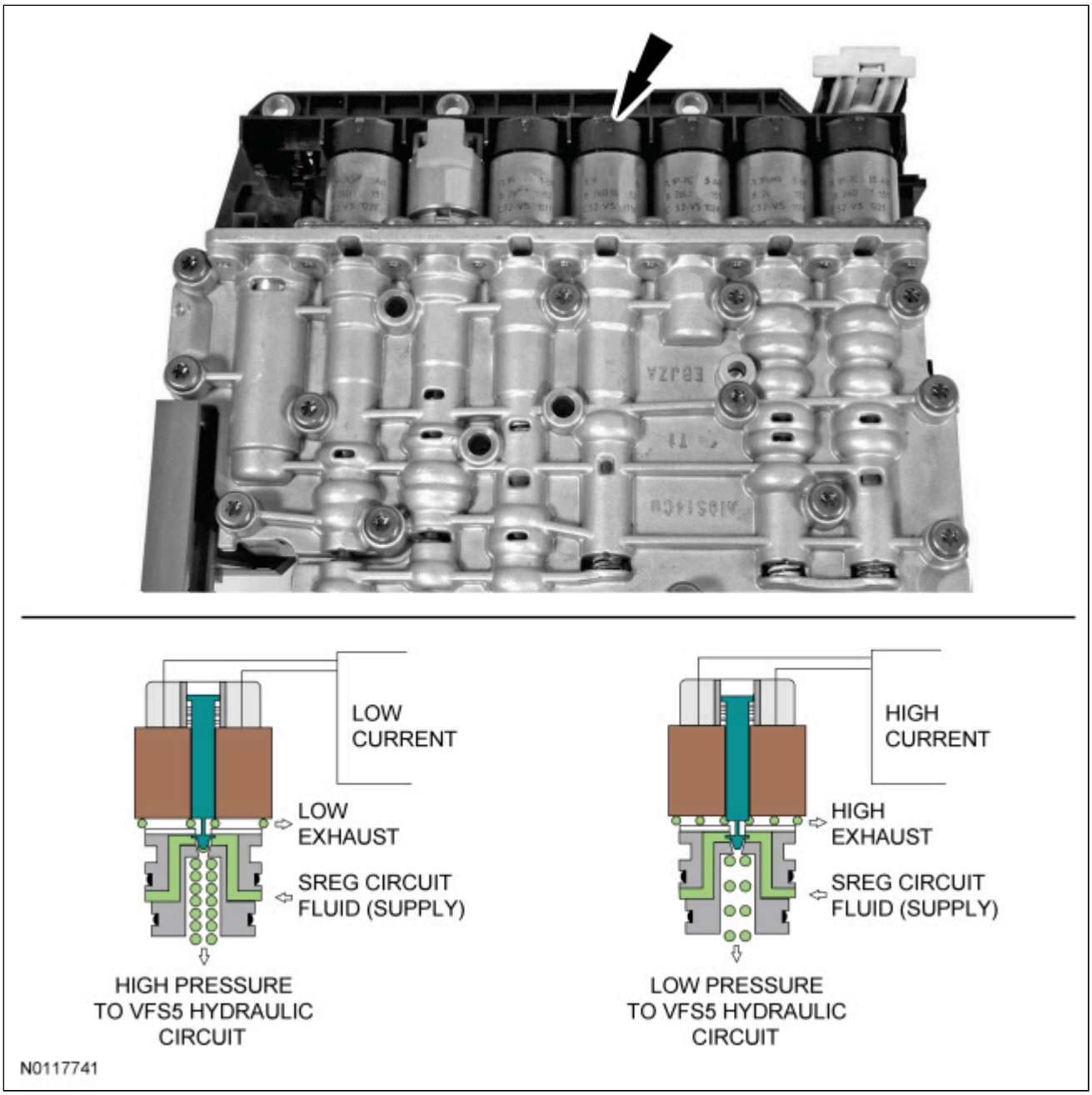
The Line Pressure Control (LPC) solenoid, is a Variable Force Solenoid (VFS) that varies hydraulic pressure by actuating a hydraulic valve.

The PCM applies variable current to the LPC solenoid which varies pressure in the VFS5 hydraulic circuit to the main regulator valve. Refer to Hydraulic Circuits in this section.

The LPC solenoid uses inversely proportional operation. As the current from the PCM decreases, the pressure from the solenoid increases. As the current from the PCM increases, the pressure from the solenoid decreases. The LPC solenoid is supplied hydraulic pressure from the SREG circuit.

With zero current, the LPC solenoid fully opens the hydraulic valve which applies the maximum amount of hydraulic pressure to the main regulator valve through the VFS5 hydraulic circuit and applies maximum line pressure in the PUMP hydraulic circuit. With maximum current to the solenoid, the hydraulic valve fully closes the outlet port for minimum pressure to the VFS5 hydraulic circuit, lowering the line pressure in the PUMP hydraulic circuit.

**LPC Inversely Proportional VFS**




**Torque Converter Clutch (TCC) Solenoid**

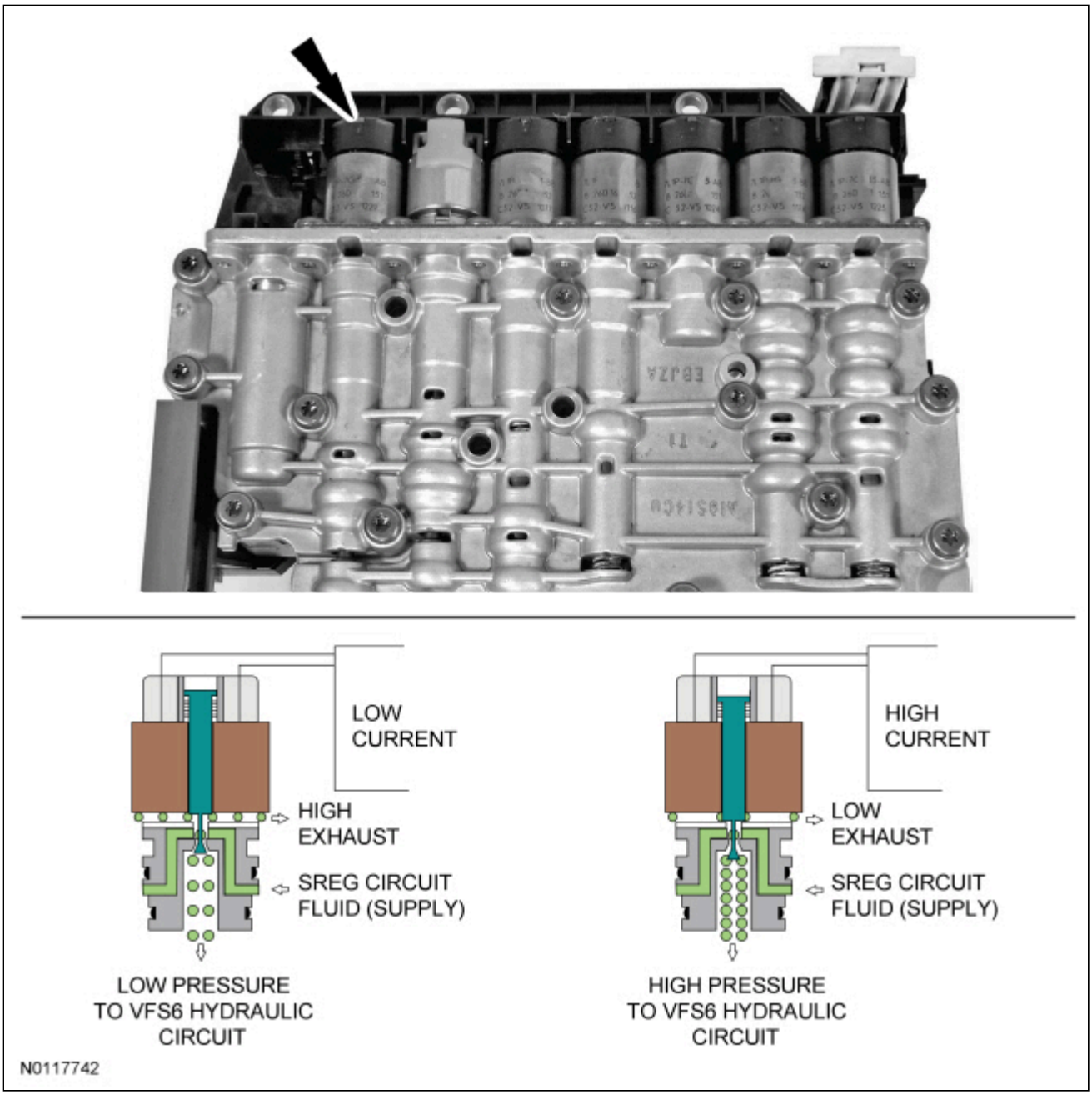
The TCC solenoid is a VFS that varies hydraulic pressure by actuating a hydraulic valve.

The PCM applies variable current to the TCC solenoid which varies pressure in the VFS6 hydraulic circuit to the converter release regulator valve and the bypass clutch control regulator valve. Refer to Hydraulic Circuits in this section.

The TCC solenoid uses proportional operation. As the current from the PCM decreases, the pressure from the solenoid decreases. As the current from the PCM increases, the pressure from the solenoid increases. The TCC solenoid is supplied hydraulic pressure from the SREG circuit.

With zero current, the TCC solenoid fully closes the hydraulic valve which applies the minimum amount of hydraulic pressure to the converter release regulator valve and the bypass clutch control regulator valve through the VFS6 hydraulic circuit and releases the TCC . With maximum current to the solenoid, the hydraulic valve fully opens the outlet port for maximum pressure to the VFS6 hydraulic circuit to apply the TCC .

**Torque Converter Clutch (TCC) Proportional VFS**




**Shift Solenoid A (SSA) , Shift Solenoid B (SSB) , Shift Solenoid C (SSC) and Shift Solenoid D (SSD)**

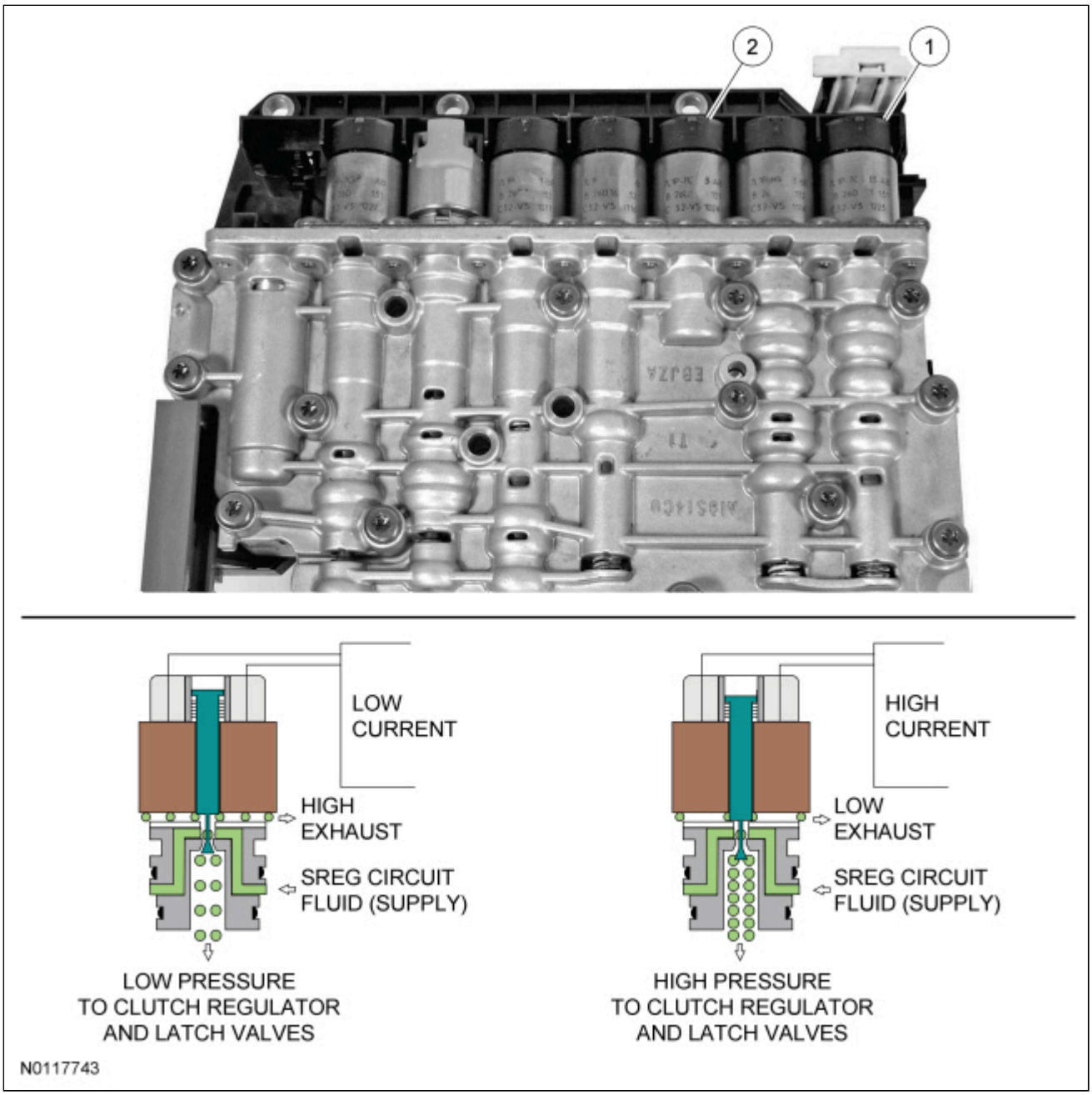
Shift solenoids A through D are VFS that vary hydraulic pressure by actuating a hydraulic valve.

The PCM applies variable current to the shift solenoids which varies pressure in the hydraulic circuit to the regulator and latch valves of the clutch that it controls. Refer to Hydraulic Circuits in this section.

SSA and SSC use proportional operation. As the current from the PCM decreases, the pressure from the solenoid decreases. As the current from the PCM increases, the pressure from the solenoid increases. SSA and SSC are supplied hydraulic pressure from the SREG circuit.

With zero current, SSA and SSC fully close the hydraulic valves which applies zero amount of hydraulic pressure to the regulator and latch valves of the clutch that it controls and releases the clutch. With maximum current to the solenoids, the hydraulic valves fully open for maximum pressure to the regulator and latch valves to apply the clutch.

**Shift Solenoid A (SSA) and Shift Solenoid C (SSC) Proportional VFS**

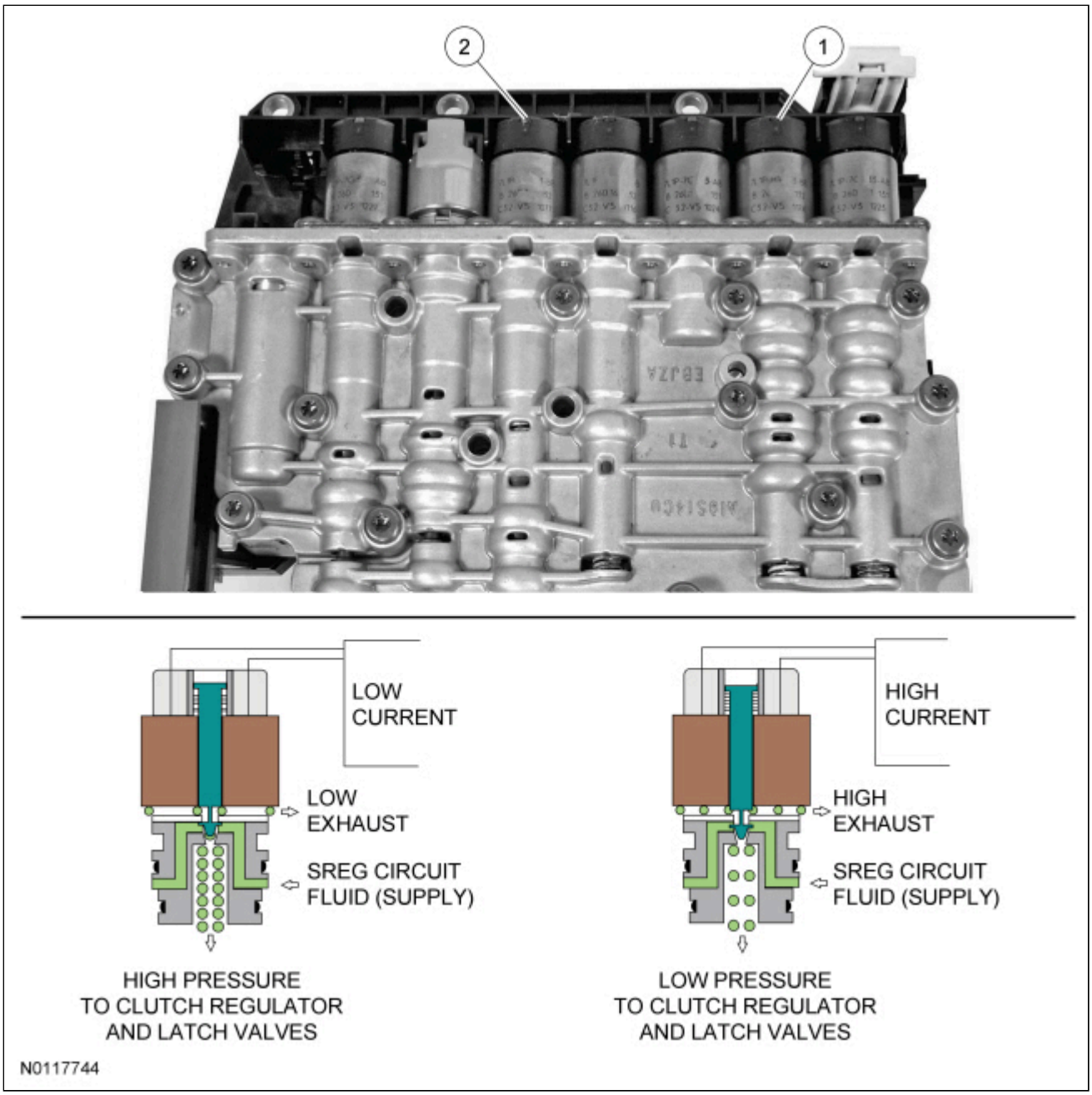



| Item | Description |
|---|---|
| 1 | Shift Solenoid A (SSA) Variable Force Solenoid (VFS) |
| 2 | Shift Solenoid C (SSC) VFS |

SSB and SSD use inverse proportional operation. As the current from the PCM decreases, the pressure from the solenoid increases. As the current from the PCM increases, the pressure from the solenoid decreases. SSB and SSD are supplied hydraulic pressure from the SREG circuit.

With zero current, SSB and SSD fully open the hydraulic valves which applies maximum hydraulic pressure to the regulator and latch valves to apply the clutch that it controls. With maximum current to the solenoids, the hydraulic valve fully closes to apply zero amount of hydraulic pressure to the regulator and latch valves of the clutch that it controls and releases the clutch.

**Shift Solenoid B (SSB) and Shift Solenoid D (SSD) Inverse Proportional VFS**



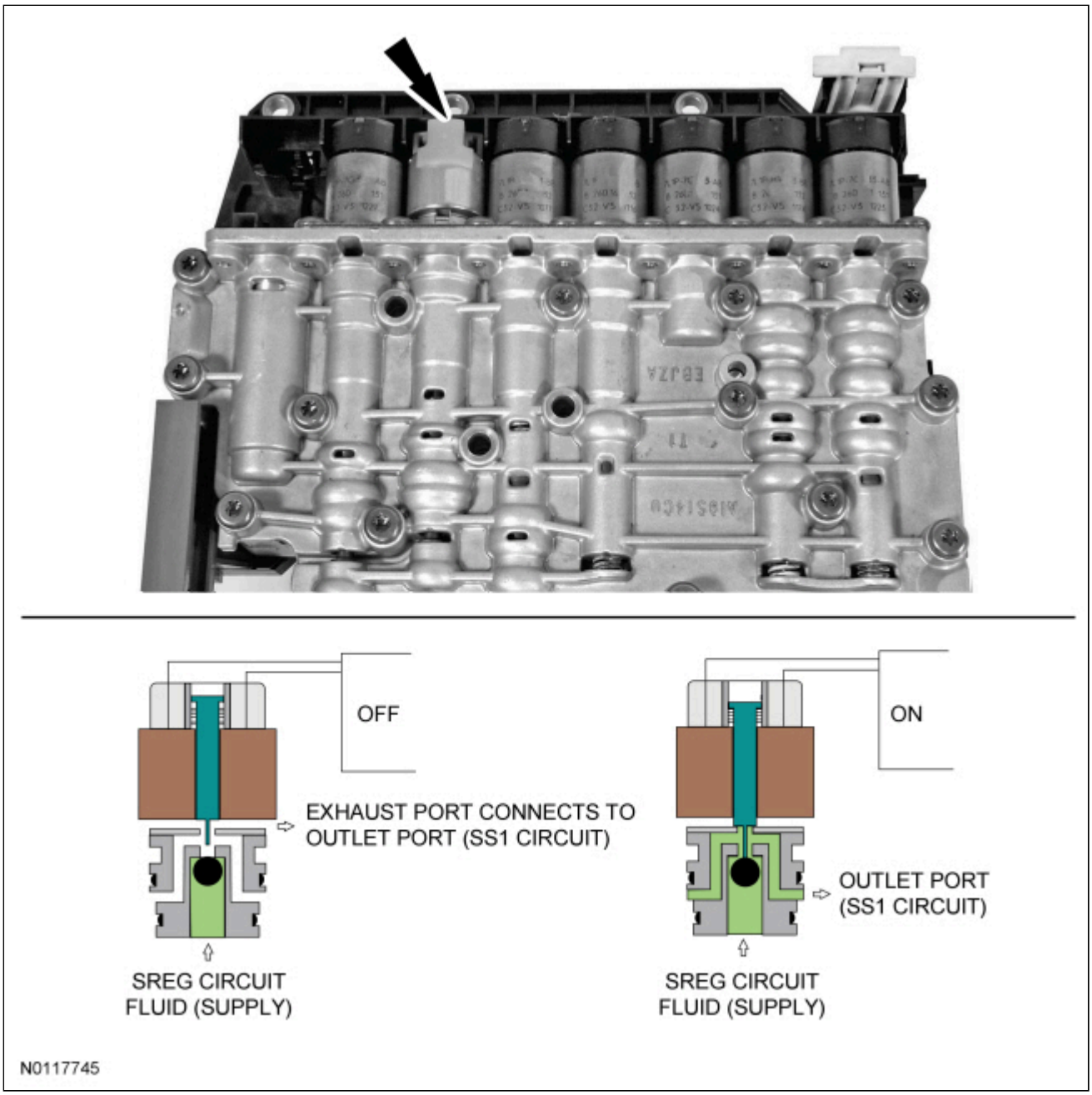

| Item | Description |
|---|---|
| 1 | Shift Solenoid B (SSB) Variable Force Solenoid (VFS) |
| 2 | Shift Solenoid D (SSD) VFS |

**Shift Solenoid E (SSE)**

SSE is an ON/OFF solenoid. When SSE is in the OFF position, SSD controls the regulator and latch valves to apply the low/reverse clutch. When SSE is in the ON position, SSD controls the regulator and latch valves to apply the overdrive (456) clutch. Refer to Hydraulic Circuits in this section.

SSE is supplied hydraulic pressure from the SREG circuit. When SSE is OFF, the solenoid supply is blocked and the outlet port (SS1 circuit) is connected to the exhaust port. When SSE is ON, the exhaust port is blocked and the solenoid supply is connected to the outlet port (SS1 circuit).

**Shift Solenoid E (SSE) ON/OFF Solenoid**




**Turbine Shaft Speed (TSS) Sensor**

The TSS sensor is a Hall-effect type sensor that provides a signal to the PCM that changes in frequency as the rotating speed of the forward (1,2,3,4) clutch cylinder varies.

The PCM compares the TSS sensor signal with the engine speed information to determine the amount of slip occurring in the torque converter.

The PCM also compares the TSS sensor signal with the OSS sensor signal to determine the gear ratio provided by the rear planetary gearset.

The PCM uses the TSS sensor signal as an input for its strategies for shifts and TCC operation. The PCM also uses the TSS sensor signal for transmission fault detection and diagnostics.

Refer to the component illustration at the beginning of this procedure for the location of the TSS sensor.

**Output Shaft Speed (OSS) Sensor**

The OSS sensor is a Hall-effect type sensor that provides a signal to the PCM that changes in frequency as the rotating speed of the output shaft ring gear varies.

The PCM also compares the OSS sensor signal with the TSS sensor signal to determine the gear ratio provided by the rear planetary gearset.

The PCM uses the OSS sensor signal as an input for its strategies for shifts and TCC operation. The PCM also uses the OSS sensor signal for transmission fault detection and diagnostics.

Refer to the component illustration at the beginning of this procedure for the location of the OSS sensor.

**Transmission Fluid Temperature (TFT) Sensor**

The TFT sensor is a temperature dependent resistor that is in contact with transmission fluid in the transmission sump area.

The PCM monitors the voltage across the TFT sensor, which changes as transmission fluid temperature varies.

The PCM uses the TFT sensor signal as an input for its strategy for shifting and TCC operation. The PCM also uses the TFT sensor signal for transmission fault detection and diagnostics.

Refer to the component illustration at the beginning of this procedure for the location of the TFT sensor.

**Transmission Range (TR) Sensor**

The TR sensor has a set of Hall-effect sensors that have a pattern of ON/OFF states which are dependant on the PARK, REVERSE, NEUTRAL, DRIVE, 3, 2 or 1 position of the manual valve.

The TR sensor also provides signals for the starting system and the reverse lights.

The PCM uses the TR sensor signal as an input for its strategy for shifting and TCC operation. The PCM also uses the TR sensor signal for transmission fault detection and diagnostics.

Refer to the component illustration at the beginning of this procedure for the location of the TR sensor.

© Copyright 2024, Ford Motor Company.