



## INTRODUCTION FORD CD4E

This computer controlled four speed automatic overdrive transaxle first appeared in the 1994 Probe with the 2.0 Liter engine. This unit is also found in the Ford Contours and the Mercury Mystique. This manual covers the teardown inspection and assembly of this unit. Since it is a computer controlled unit we have included the the service codes that can be accessed with a computer scanner. In the diagnostic section the number codes for electrical and hydraulic trouble shooting should not be confused with the service codes. We thank the Ford Motor Company for the illustrations and information that have made this booklet possible.

The information and part numbers contained in this booklet have been carefully compiled from industry sources known for their reliability, but ATSG does not guarantee its accuracy.

**ROBERT D. CHERRNAY**  
TECHNICAL DIRECTOR

**FRANK MIETUS**  
TECHNICAL CONSULTANT

**ED KRUSE**  
TECHNICAL CONSULTANT

**DALE ENGLAND**  
FIELD SERVICE CONSULTANT

**WAYNE COLONNA**  
TECHNICAL SUPERVISOR

**PETE LUBAN**  
TECHNICAL CONSULTANT

**JIM DIAL**  
TECHNICAL CONSULTANT

***AUTOMATIC TRANSMISSION SERVICE GROUP***  
9200 S. DADELAND BLVD.  
SUITE 720  
MIAMI, FL 33156  
(305) 670-4161



## FORD CD4E INDEX

	Page
Description and Operation.....	3
Pressure Test.....	3
Diagnosing and Testing.....	5
Transmission Sensors.....	6
Solenoid Operation.....	13
Diagnostic Codes.....	16
Trouble Shooting.....	23
Transmission Teardown.....	49
Teardown and Assembly of Components.....	61
Valve Body.....	98
Transmission Assembly.....	104
Measurements.....	113
Adjustments.....	116

Automatic Transmission Service Group  
9200 South Dadeland Blvd.  
Suite 720  
Miami, FL 33156  
(305) 670-4161



# Technical Service Information

## CD4E Automatic Transaxle

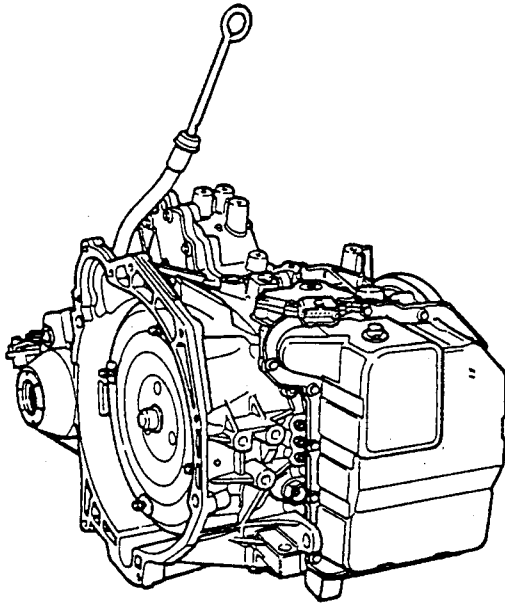
### DESCRIPTION AND OPERATION

#### Automatic Transaxle.

The CD4E transaxle is a four speed front wheel drive automatic unit with electronic controls for:

- Electronic Pressure Control (EPC) for shift quality
- Shift Scheduling
- 3-2 shift timing
- Coast braking
- Torque Converter Clutch (TCC) control

The CD4E transaxle uses a compound planetary gearset, chain drive, final drive planetary gearset and an open differential. One band, five friction clutches, and two one-way clutches provide four forward gear ratios and reverse.



The transaxle is a four speed unit with electronic control that is designed for operation in a transverse poertrain of front wheel drive vehicles.

The transaxle features a three element torque converter with a torque converter clutch and geartrain that includes the following parts:

- Compound planetary gearset
- Chain Drive
- Planetary gearset final drive

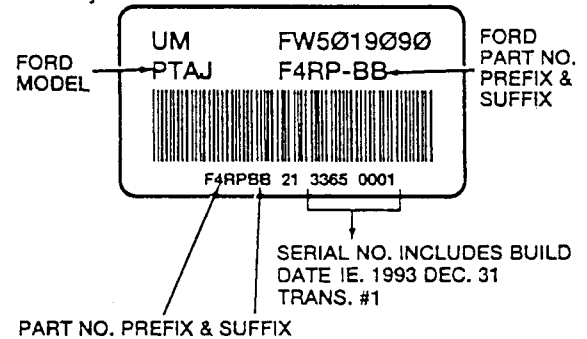
- Pinion and side gear differential

The hydraulic control system of the transaxle has five solenoids that control:

- Shift feel (through line pressure control)
- Shift scheduling (through shift valve position control)
- Modulated apply of the torque converter clutch
- Timing of 3-2 shifts
- Engine braking during coast operation

### TRANSAXLE IDENTIFICATION

When servicing the transaxle, refer to the identification tag located on the rear of the transaxle case and on the bottom of the main control cover assembly.

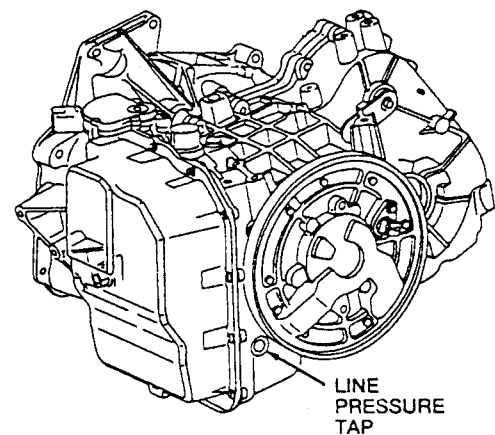


#### CAUTION:

Perform line pressure test prior to performing the stall test. If line pressure is low at stall, **DO NOT PERFORM Stall Test** or furthur transaxle damage will occur. **DO NOT MAINTAIN WOT** in any gear range **FOR MORE THAN (5) SECONDS.**

#### CAUTION:

To verify transmission oil pressure **DO NOT CONNECT THE TRANSMISSION TESTER** while making the pressure checks.





**DIAGNOSIS AND TESTING**

**CAUTION: The Transmission Tester MUST be removed from the transaxle and the vehicle harness reinstalled to verify these pressures.**

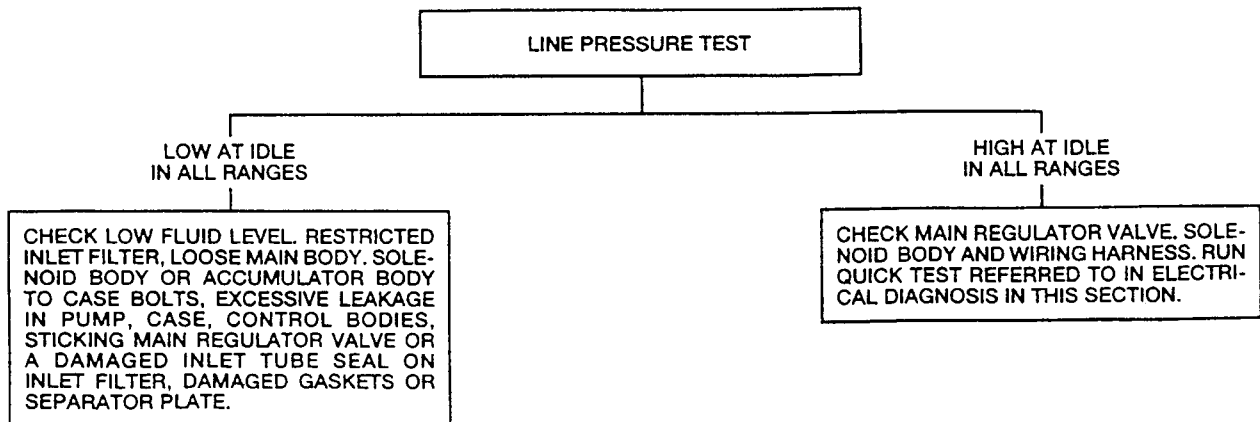
LINE PRESSURE SPECIFICATIONS				
Line Pressure Range Selector Position	Idle		Stall	
	KPA	PSI	KPA	PSI
PARK, NEUTRAL	441-524	64-76	-----	-----
REVERSE	441-524	64-76	1786-2027	259-294
D	310-365	45-63	1158-1269	168-184
2	310-365	45-63	1158-1269	168-184
1	310-365	45-63	1158-1269	168-184

**OTHER CONCERN: CLUTCH/BAND APPLICATION CHART #601**

Gear	2/4 Band	Reverse Clutch	Direct Clutch	Forward Clutch	Forward One-Way Clutch		Coast Clutch	Low/Rev Clutch	Low One-Way Clutch	
					Drive	Coast			Drive	Coast
REV		X						X		
1ST				X	X	OR			X	OR
2ND	X			X	X	OR			OR	OR
3RD			X	X	X	OR			OR	OR
4TH	X		X	X	OR	OR			OR	OR
M-2ND	X			X	X		X		OR	OR
M-1ST				X	X		X	X	X	

X = TRANSMITS TORQUE    OR = OVERRUNNING

**Line Pressure Test Chart**





DIAGNOSIS AND TESTING (Continued)

Engine Idle Speed Check

Refer to Section 03-04A for the engine idle speed adjustment procedure.

Stall Speed Test

The stall test checks the operation of the following items:

- Converter one-way clutch
- Forward clutch
- Low / reverse one-way clutch
- Reverse clutch
- Forward one-way clutch
- Engine performance

NOTE: The stall test should only be performed with the engine and transaxle at normal operating temperatures.

**WARNING: APPLY THE SERVICE AND PARKING BRAKES FIRMLY WHILE PERFORMING EACH STALL TEST. FAILURE TO SET BRAKES MAY RESULT IN DEATH OR BODILY INJURY.**

**CAUTION: Perform Line Pressure Test prior to performing stall test. If line pressure is low at stall, do not perform stall test or further transaxle damage will occur.**

1. Connect a tachometer to the engine.
2. After testing each of the following ranges, D and R, move transaxle range selector lever to N (NEUTRAL) and run engine for about 15 seconds to allow torque converter to cool before testing next range.

**CAUTION: Do not maintain WOT in any gear range for more than five seconds.**

Press accelerator pedal to floor (WOT) in each range. Record rpm reached in each range. Stall speeds should be in appropriate range.

**CAUTION: If engine rpm recorded by the tachometer exceeds maximum specified rpm, release accelerator pedal immediately. Clutch or band slippage is indicated.**

Engine	Stall Speed (rpm)
2.0L Probe	2200-2500

If the stall speeds were too high, refer to the following Stall Speed Diagnosis Chart. If the stall speeds were too low, first check engine tune-up. If engine is OK, remove torque converter and check torque converter one-way clutch for slippage.

Range	Possible Source
D, 2, 1	<ul style="list-style-type: none"> <li>● Forward Clutch</li> <li>● Forward One-Way Clutch</li> <li>● Low One-Way Clutch</li> </ul>
R	<ul style="list-style-type: none"> <li>● Reverse Clutch</li> <li>● Low / Reverse Clutch</li> </ul>

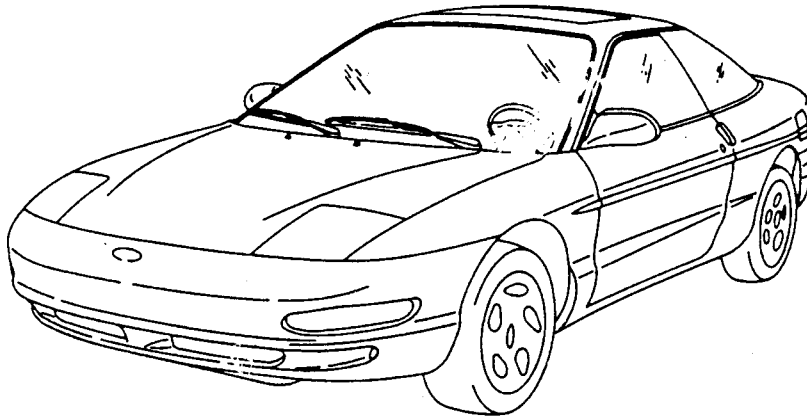
Shift Point Road Test

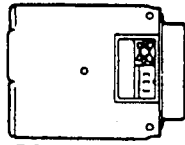
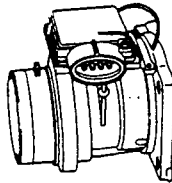
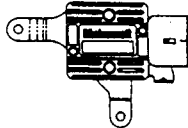
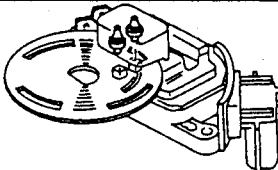

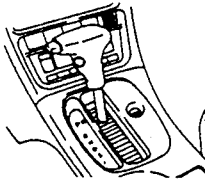
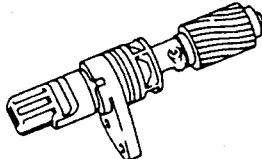
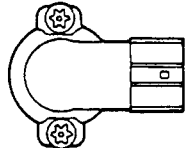
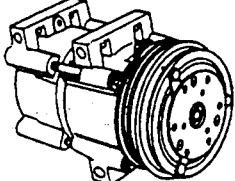

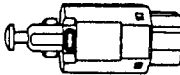
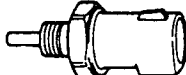
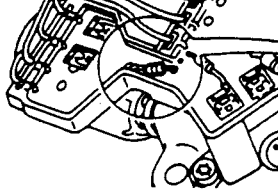
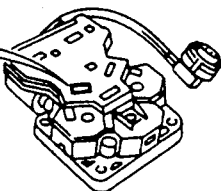
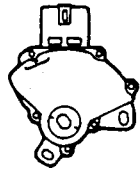
This test verifies that the shift control system is operating properly.

1. Bring engine and transaxle up to normal operating temperature.
2. Operate the vehicle with the transaxle range selector lever in D position.
3. Apply minimum throttle and observe the speeds at which the upshift occurs and the torque converter engages. (Refer to Automatic Transmission Specifications Issue FPS-12 180-94).
4. With the vehicle in D (4th gear), depress the Transmission Control Switch. The transaxle should downshift to 3rd gear. Remove foot from accelerator pedal; engine braking should occur. Torque converter clutch should disengage and then reapply.
5. Depress accelerator pedal to floor (WOT). Transaxle should shift from 3rd to 2nd gear, or 3rd to 1st depending on vehicle speed.
6. With vehicle D range above 80 km/h (50 mph) and less than half throttle, move the transaxle range selector lever from D range to manual 2 range and remove foot from accelerator pedal. The transaxle should immediately downshift into 2nd gear. With the vehicle remaining in manual 2 range, move transaxle range selector lever into manual 1 range, and release accelerator pedal. Transaxle should downshift into first gear at speeds BELOW 48-56 km/h (28-32 mph).
7. If transaxle fails to upshift / downshift or torque converter clutch does not apply and release, refer to Diagnosis by Symptom Charts for possible causes.

## DESCRIPTION AND OPERATION

### Component Illustrations



 <p><b>POWERTRAIN CONTROL MODULE (PCM)</b> 12A650</p>	 <p><b>MASS AIR FLOW (MAF) SENSOR</b> 12B579</p>	 <p><b>IGNITION CONTROL MODULE (ICM)</b> 12A297</p>	 <p><b>CRANKSHAFT POSITION (CKP) SENSOR (PART OF 12127)</b></p>
 <p><b>TRANSMISSION CONTROL INDICATOR LAMP (TCIL)</b></p>	 <p><b>TRANSMISSION CONTROL SWITCH (TCS)</b> 7Z247</p>	 <p><b>VEHICLE SPEED SENSOR (VSS)</b> 9E731</p>	 <p><b>THROTTLE POSITION (TP) SENSOR</b> 9B989</p>
 <p><b>AIR CONDITIONING CLUTCH (ACC)</b></p>	 <p><b>TRANSMISSION SPEED SENSOR (TSS)</b> 7M101</p>	 <p><b>BRAKE ON/OFF (BOO) SWITCH</b> 13480</p>	 <p><b>ENGINE COOLANT TEMPERATURE (ECT) SENSOR</b> 12A648</p>
 <p><b>TRANSMISSION OIL TEMPERATURE (TOT) SENSOR</b> 7H141</p>	 <p><b>SOLENOID BODY ASSEMBLY</b></p> <p><b>SOLENOID BODY ASSEMBLY INCLUDES:</b></p> <ul style="list-style-type: none"> <li>• ELECTRONIC PRESSURE CONTROL SOLENOID (EPC),</li> <li>• TORQUE CONVERTER CLUTCH SOLENOID (TCC)</li> <li>• TRANSMISSION OIL TEMPERATURE (TOT) SENSOR</li> <li>• 2 SHIFT SOLENOIDS (SS1 &amp; SS2)</li> <li>• 3-2 TIMING/COAST CLUTCH SOLENOID (3-2T/CCS)</li> </ul>	 <p><b>MANUAL LEVER POSITION (MLP) SENSOR</b> 7F293</p>	

## DESCRIPTION AND OPERATION (Continued)

### INPUTS TO PCM

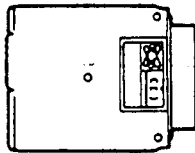
- Transmission Oil Temperature (TOT) sensor
- Manual Lever Position (MLP) sensor
- Brake On/Off (BOO) switch
- Distributor Ignition (DI) System
  - Crankshaft Position (CKP) sensor
  - Ignition Control Module (ICM)(12A297)
- Mass Airflow Sensor
- Throttle Position Sensor
- Vehicle Speed Sensor
- Transmission Control Switch (TCS)
- Air Conditioning Clutch (ACC)
- Engine Coolant Temperature Sensor
- Transmission Speed Sensor (TSS)

### OUTPUTS FROM PCM

- Transaxle Solenoid Body Assembly
  - Shift Solenoid #1 (SS1)
  - Shift Solenoid #2 (SS2)
  - Electronic Pressure Control (EPC) Solenoid
  - Torque Converter Clutch (TCC) Solenoid
  - 3-2 Timing/Coast Clutch Solenoid (3-2T/CCS)
- Transmission Control Indicator Lamp (TCIL)

### Powertrain Control Module (PCM) 12A650:

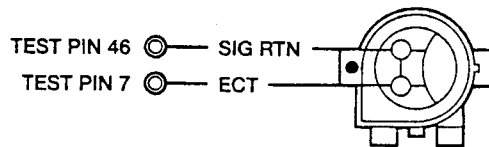
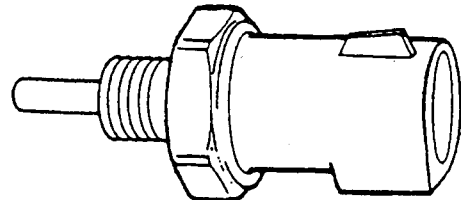
The operation of the transaxle is controlled by the Powertrain Control Module (PCM). Many input sensors provide information to the PCM. The PCM then controls the actuators which affect transaxle operation.



**DTCs:** 511, 512 and 513

### Engine Coolant Temperature (ECT) Sensor 12A648:

The Engine Coolant Temperature Sensor (ECT) detects the temperature of the engine coolant and supplies the information to the Powertrain Control Module (PCM).



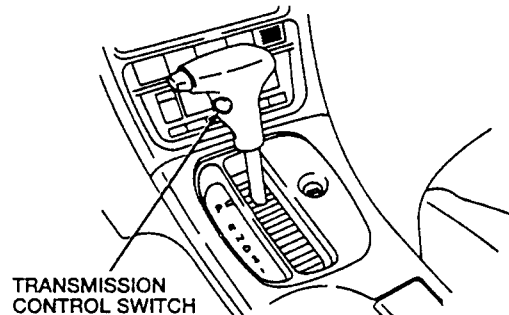
**Transaxle Function:** ECT sensor is used to control Torque Converter Clutch (TCC) operation.

**Symptoms:** TCC will always be "OFF" if ECT sensor reads cold or normal, resulting in reduced fuel economy.

**DTCs:** 116, 117 and 118

### Transmission Control Switch (TCS) 7Z247:

The Transmission Control Switch (TCS) is a momentary contact switch. When this switch is pressed, a signal is sent to the Powertrain Control Module (PCM). The PCM then energizes the Transmission Control Indicator Lamp (TCIL) and engages or disengages 4th gear operation and provides coast braking in 2nd and 3rd.



**Transaxle Function:** Disable fourth gear operation and energizes CCS solenoid in 2nd and 3rd gear for engine braking.

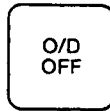
**Symptoms:** No overdrive cancel when switch in cycled.

**DTC:** 653

## DESCRIPTION AND OPERATION (Continued)

### Transmission Control Indicator Lamp (TCIL)

The Transmission Control Indicator Lamp (TCIL) is located in the instrument panel and is labeled O/D OFF. The Transmission Control Switch (TCS) controls the ON/OFF operation of the TCIL.



#### INSTRUMENT CLUSTER GRAPHICS

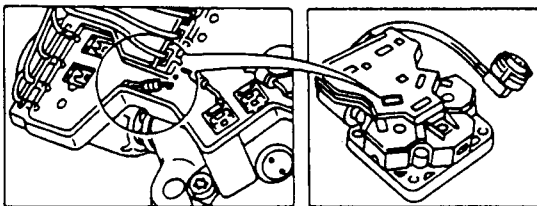
**Transaxle Function:** When the driver initially presses the button of the TCS, the TCIL turns ON to indicate that transaxle operation in 4th gear is disabled. When the driver presses the TCS again, the TCIL turns OFF.

**Symptoms:** If the TCIL fails ON or OFF, the driver may have an incorrect indication of transaxle operation.

**DTCs:** None

### Transmission Oil Temperature (TOT) Sensor

The Transmission Oil Temperature (TOT) sensor is located on the solenoid valve body. It is a temperature-sensitive device called a thermistor. The resistance value of the TOT sensor will vary with temperature. The Powertrain Control Module (PCM) monitors the voltage across the TOT sensor to determine the temperature of the transmission oil.



**Transaxle Function:** The PCM uses this signal to determine shift scheduling and control of line pressure for cold and hot temperatures operation. The PCM also inhibits Torque Converter Clutch (TCC) operation at low transmission temperature. Adjusts Electronic Pressure Control (EPC) pressures for temperature.

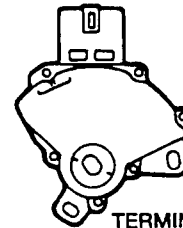
**Symptoms:** Improper TCC operation and EPC pressure.

**DTCs:** 636, 637, 638 and 657

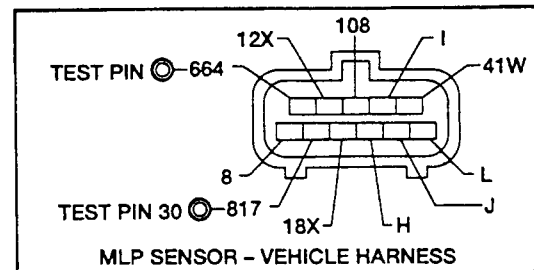
### Manual Lever Position (MLP) Sensor 7A247:

The Powertrain Control Module (PCM) sends a voltage signal to the Manual Lever Position (MLP) sensor. The MLP sensor incorporates a series of step down resistors which act as a voltage divider. The PCM monitors this voltage which corresponds to the position of the transaxle range selector lever (P, R, N, D, 2, 1). The MLP sensor is located on the top of the transaxle.

**NOTE:** The MLP sensor also contains the neutral/start, and backup lamp circuits.



TERMINAL LOCATIONS



**Transaxle Function:** Determine desired gear and Electronic Pressure Control (EPC) pressure.

**Symptoms:** Harsh engagements and firm shift feel. Engine may not crank. May downshift to a lower gear. 2nd or 3rd gear operation. Transaxle not indicating the proper gear. No 4th gear operation, no manual 1st gear.

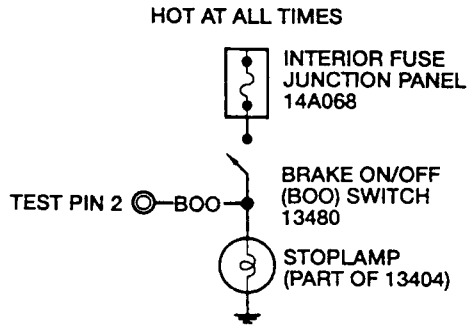
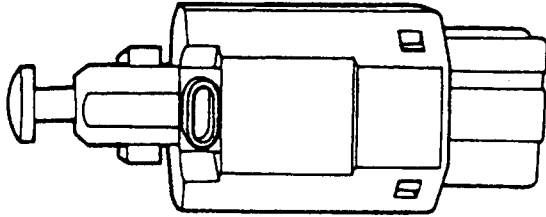
**DTCs:** 522, 634, 659, 667, 668 and 675



## DESCRIPTION AND OPERATION (Continued)

### Brake On/Off (BOO) Switch 13480:

The Brake On/Off (BOO) Switch signals the Powertrain Control Module (PCM) when the brakes are applied. The BOO switch is closed when the brakes are depressed and open when they are released.



**Transaxle Function:** Disengage Torque Converter Clutch (TCC) when brake is applied.

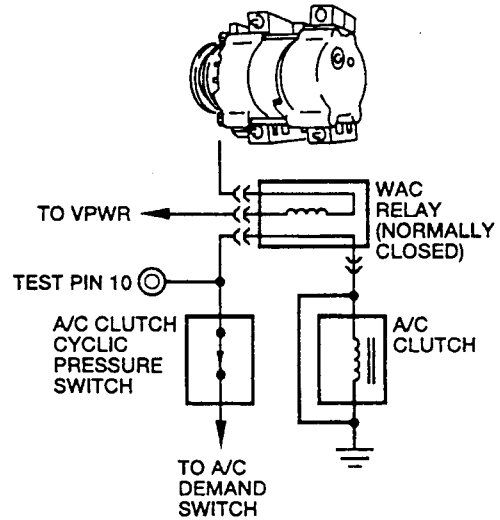
**Symptoms:** Failed "ON" - TCC will not engage at less the 1/3 throttle.

Failed "OFF" or Not Connected - TCC will not disengage when brake is applied.

**DTC: 526**

### Air Conditioning Clutch (ACC) 2884:

The A/C Cyclic Switch is located on the suction accumulator/drier of an OEM factory-installed air conditioning system. When the ACC switch contacts close, the Powertrain Control Module (PCM) receives a signal voltage from the ACC switch indicating that the air conditioning compressor clutch is engaged.



**Transaxle Function:** The PCM uses the ACC switch signal to adjust line pressure to compensate for the additional engine load.

**Symptoms:** If the ACC switch fails with closed contacts, line pressure will be slightly low with air conditioning OFF. If the ACC switch fails with open contacts, line pressure will be slightly high with air conditioning ON.

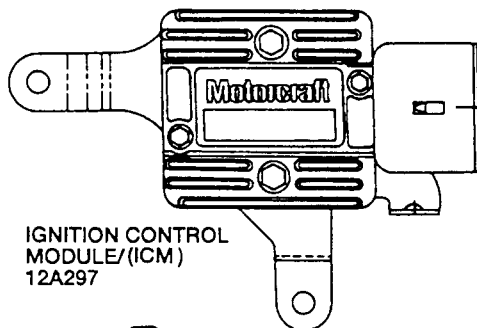
**DTC: 539**



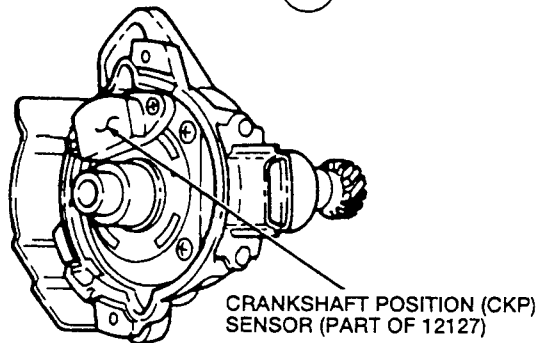
DESCRIPTION AND OPERATION (Continued)

Distributor Ignition (DI) System

The Distributor Ignition (DI) system has a Crankshaft Position (CKP) sensor and an Ignition Control Module (ICM). The CKP sensor sends crankshaft position information to the ICM, which sends an engine speed signal to the Powertrain Control Module (PCM).



IGNITION CONTROL MODULE/(ICM) 12A297



CRANKSHAFT POSITION (CKP) SENSOR (PART OF 12127)

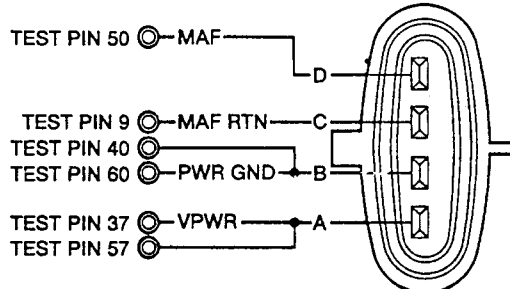
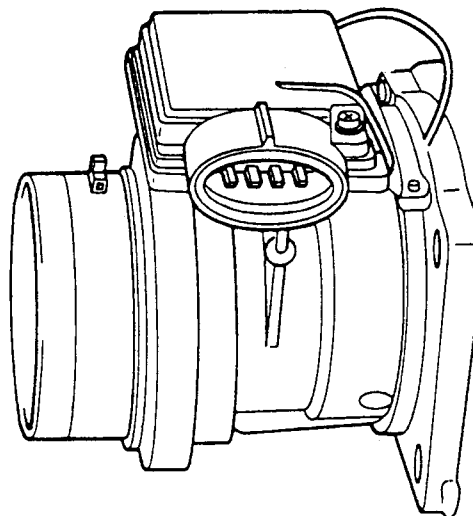
**Transaxle Function:** The PCM uses the engine speed signal from the DI system for control of line pressure, shift scheduling and Torque Converter Clutch (TCC). Wide Open Throttle (WOT) shift control is also affected by the DI system input.

**Symptoms:** If the engine speed signal has a fault, harsh engagements, firm shifts, or late WOT shifts may occur. Also, TCC apply may not occur.

**DTCs:** 211-217 and 225-241

Mass Air Flow (MAF) Sensor 12B579:

The Mass Airflow Sensor (MAF) directly measures the mass of the air flowing into the engine. The MAF sensor output is a D.C. (analog) signal ranging from about 0.5 volts to 5.0 volts used by the Powertrain Control Module (PCM) to calculate the injector pulse width for stoichiometry. For transaxle strategies, the MAF sensor is used for Electronic Pressure Control (EPC) pressure control, shift and Torque Converter Clutch (TCC) scheduling.



**Transaxle Function:** EPC Pressure Control, Shift and TCC scheduling.

**Symptoms:** Incorrect shift schedule, EPC pressure hi or low, incorrect TCC engagement scheduling and symptoms similar to a Throttle Position (TP) Sensor malfunction. Malfunction Indicator Lamp (MIL) on.

**DTCs:** 157, 158, 159, 184 and 185