

Powertrain Control Hardware

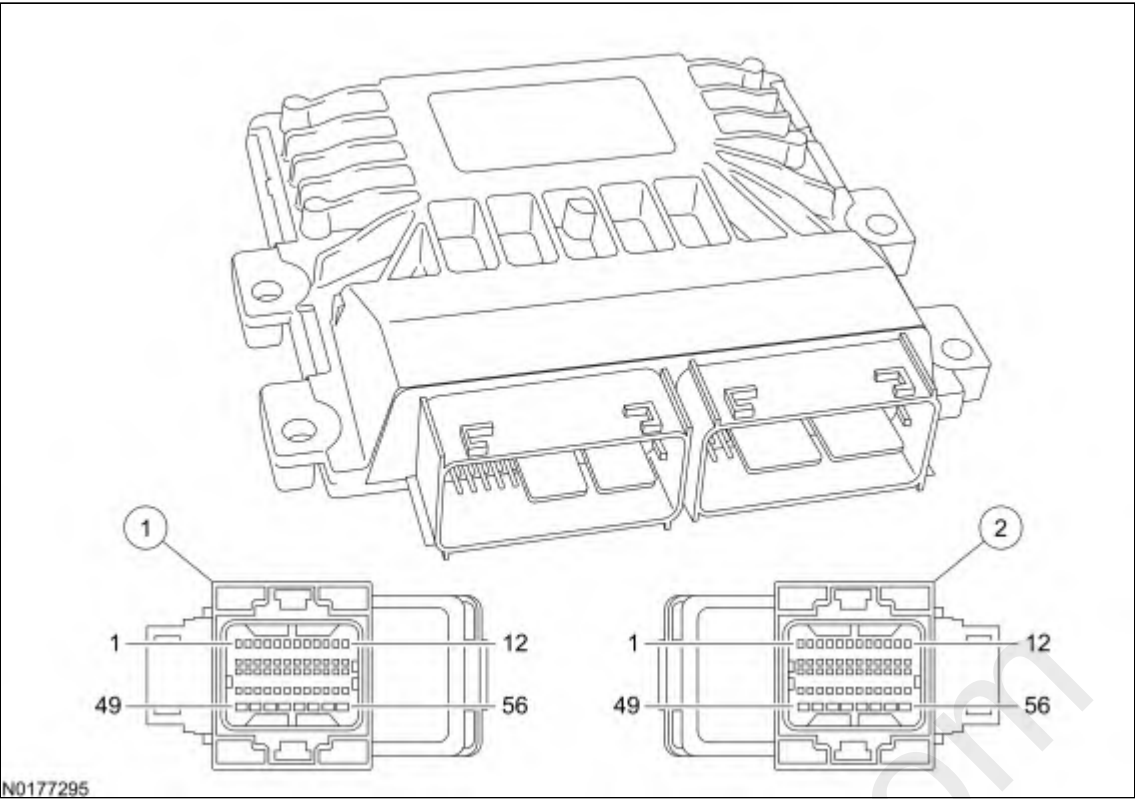
Powertrain Control Module (PCM)

The center of the engine control (EC) system is a microprocessor called the PCM. The PCM receives input from sensors and other electronic components (switches, relays). Based on the information received and programmed into its memory, the PCM generates output signals to control various relays, solenoids and actuators. There are several different types of PCMs in use for this model year. Refer to the Vehicle PCM Application Table below for PCM types and their applications.

Vehicle PCM Application Table

PCM Type	Applications
112 Pin	EcoSport (1.5L Manual Transmission), KA (1.2L, 1.5L Manual Transmission)
128 Pin	Ranger (2.5L)
198 Pin	Continental, Corsair, E-Series, EcoSport (1.0L, 1.5L Automatic Transmission, 2.0L), Edge (2.0L), Escape/Kuga, Expedition, Explorer (2.3L), F-150 (3.5L), F-650 / F-750, Flex, Ford GT, Fusion, KA (1.5L Automatic Transmission), MKZ, Mustang (2.3L, 5.2L TIVCT), Nautilus (2.0L), Navigator, Ranger (2.3L), Transit, Transit Connect
306 Pin	Aviator, Edge (2.7L), Explorer (3.0L, 3.3L), F-150 (2.7L, 3.3L, 5.0L), F-Series Super Duty, Motorhome, Mustang (5.0L, 5.2L Supercharged), Nautilus (2.7L)

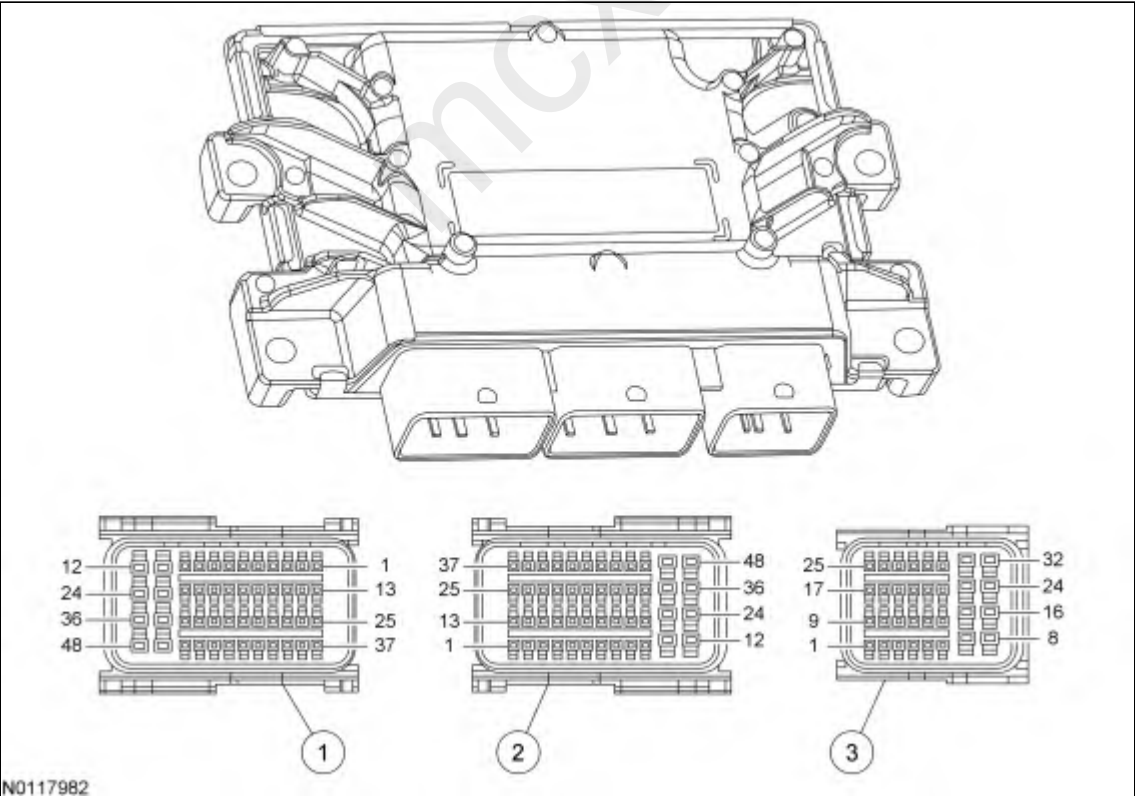
112 Pin PCM



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Item	Number	Description
1	—	B Connector
2	—	E Connector

128 Pin PCM

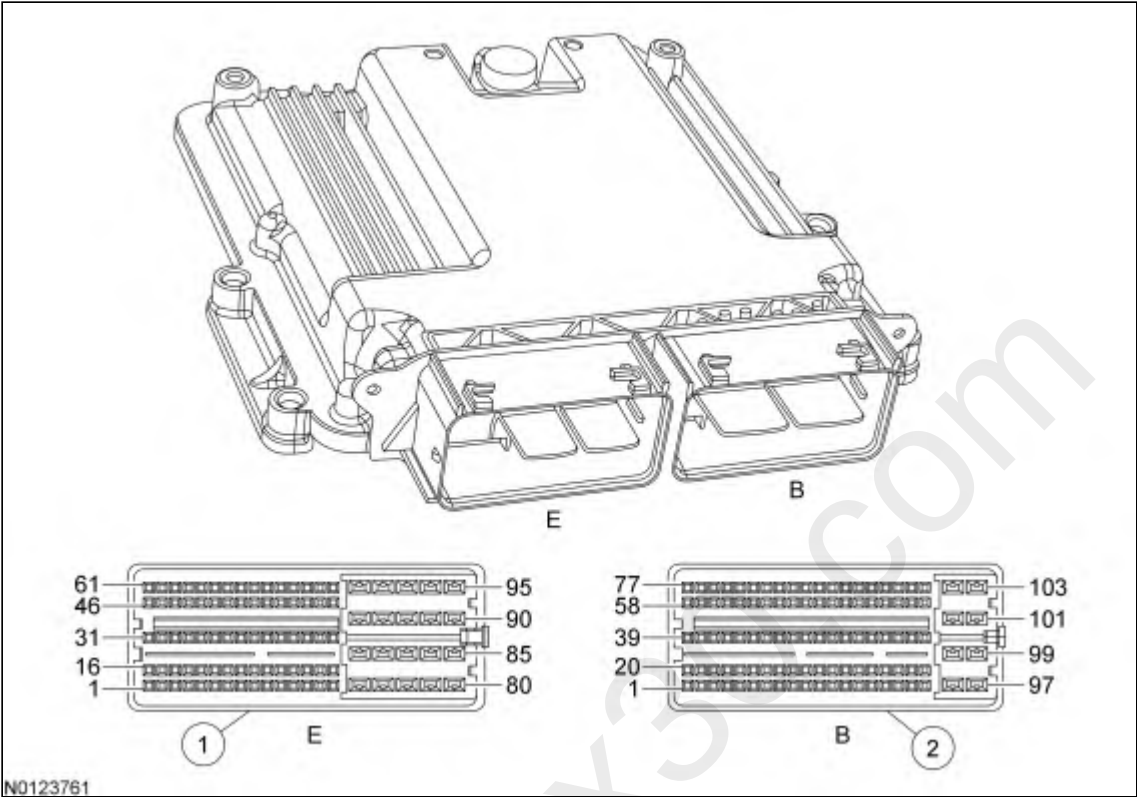


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Item	Number	Description
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1	—	E Connector
2	—	B Connector
3	—	T Connector

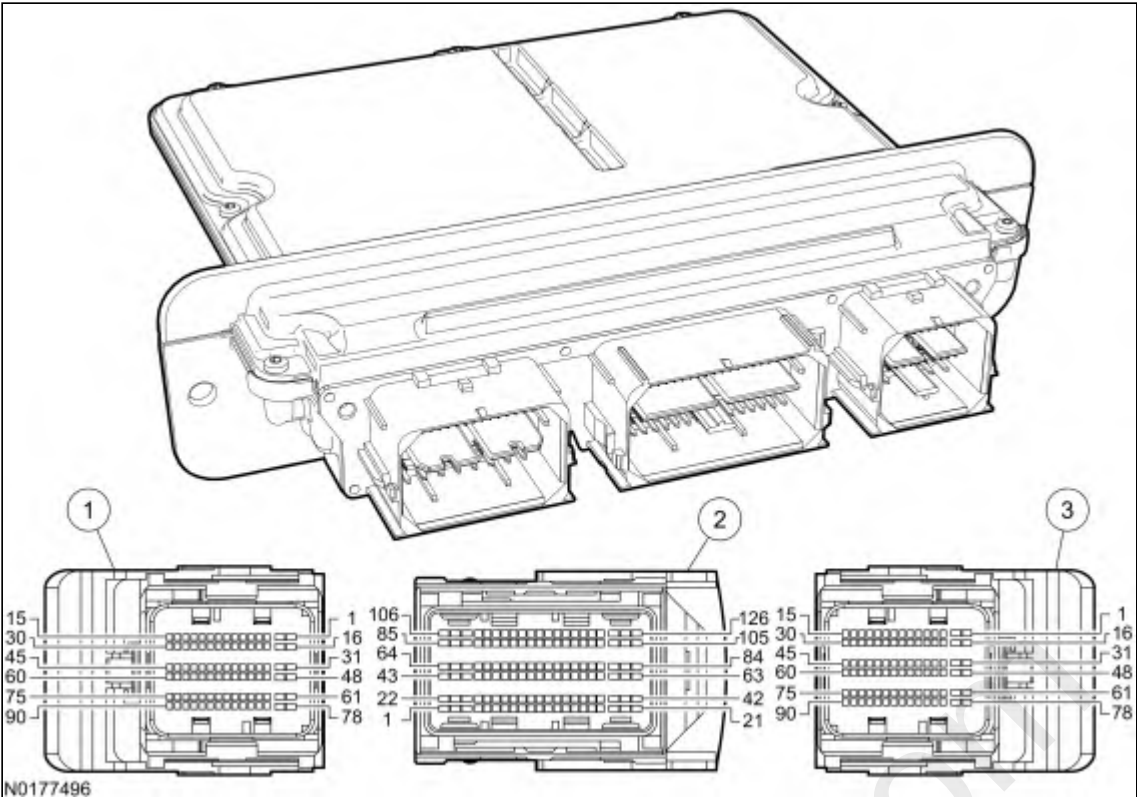
198 Pin PCM



N0123761

Item	Number	Description
1	—	E Connector
2	—	B Connector

306 Pin PCM



Item	Number	Description
1	—	B Connector
2	—	E Connector
3	—	T Connector

PCM Locations

For PCM location, removal and installation procedures, refer to the Workshop Manual Section 303-14, Electronic Engine Controls.

Fuel Pump Control Module

Note: The Continental 3.0L, Ford GT, MKZ 3.0L, and Mustang 5.2L engines use two fuel pump control modules to control fuel for the fuel delivery system. The PCM outputs only one fuel pump duty cycle on the FPC circuit. Both fuel pump control modules use this circuit. The PCM individually monitors the fuel pump control modules through the FPM and FPM2 circuits. The fuel pump control module located on the driver side of the luggage compartment is referred to as Fuel Pump Control Module 1 and the fuel pump control module located on the passenger side of the luggage compartment is referred to as Fuel Pump Control Module 2.

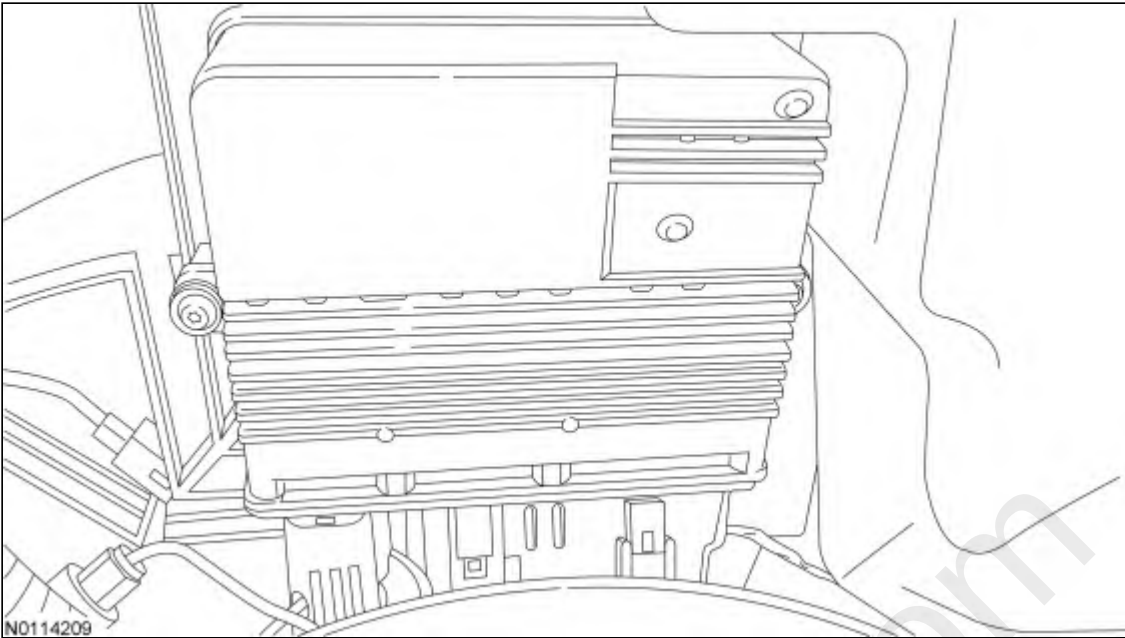
The fuel pump control module receives a duty cycle signal from the PCM and controls the fuel pump operation in relation to this duty cycle. The PCM requests low or high speed fuel pump operation depending on engine fuel demand. The fuel pump control module controls the fuel pump by switching the fuel pump power circuit ON and OFF at the required duty cycle. The fuel pump control module sends diagnostic information to the PCM on the FPM circuit. For additional information on the fuel pump control and the fuel pump monitor, refer to [Fuel Systems](#) in this section.

On vehicles with gasoline direct fuel injection, the high pressure fuel system may be under vacuum after several hours of cold soak. Fuel vapor may collect at the fuel injection pump, causing a long start condition. To prevent this, the fuel pump relay is energized for 1 or 2 seconds, depending on application, as soon as the dome light is commanded ON. This causes the fuel pump control module and the fuel pump to cycle for 1 or 2 seconds and purge any trapped air or fuel vapor from the high pressure fuel system.

Fuel Injector Heater Control Module

The fuel injector heater control module supplies direct battery voltage to the individual fuel injector heaters. The fuel injector heater ON time varies depending on ambient and engine coolant temperatures. The PCM may activate the fuel injector heaters any time the engine is running during cold ambient temperatures. The PCM monitors the fuel injector

heater functionality and control. If a concern is present, a DTC will set. For additional information, refer to [Cold Start System](#) in this section.



Fuel Injector Heater Control Module

Keep Alive Memory (KAM)

The PCM stores information about vehicle operating conditions in the KAM (a memory integrated circuit chip) and then uses this information to compensate for component variability. The KAM remains powered when the ignition is in the OFF position so the information is not lost.

Power and Ground Signals

Accelerator Pedal Position Reference Voltage (APPVREF)

The APPVREF is a consistent positive voltage (5 volts plus or minus 0.5 volt) circuit.

Accelerator Pedal Position Return (APPRTN)

The APPRTN is a return path for APPVREF circuit.

Electronic Throttle Control Reference Voltage (ETCREF)

The ETCREF is a consistent positive voltage (5 volts plus or minus 0.5 volt) circuit.

Electronic Throttle Control Return (ETCRTN)

The ETCRTN is a return path for ETCREF circuit.

Gold Plated Pins

Some engine control hardware has gold plated pins within the connectors and mating harness connectors to improve electrical stability for low current draw circuits and to enhance corrosion resistance. The engine control (EC) components equipped with gold plated pins vary by vehicle application. Only replace gold plated pins with new gold plated pins.

Keep Alive Power (KAPWR)

The KAPWR provides a constant voltage input independent of ignition switch state to the PCM. This voltage is used by the PCM to maintain the KAM.

Mass Airflow Return (MAFRTN)

The MAFRTN is a signal return circuit from the mass airflow (MAF) sensor.

Power Ground (PWRGND)

The PWRGND circuits provides a return path for the PCM vehicle power (VPWR) circuits.

Signal Return (SIGRTN)

The SIGRTN is a dedicated return path for VREF applied components.

Starter Motor Request (SMR) Circuit

The SMR circuit provides the PCM with a signal from the ignition switch to the PCM. The input is pulled high when the ignition is in the START position and the transmission range (TR) sensor ignition lockout circuit allows the starter to engage.

Variable Reluctance Sensor Return (VRSRTN)

The VRSRTN circuit is a dedicated return path for variable reluctance (VR) type sensors.

Vehicle Buffered Power (VBPWR)

The VBPWR is a regulated voltage supplied by the PCM to vehicle sensors. These sensors require a constant 12 volts for operation and cannot withstand VPWR voltage variations. VBPWR is regulated to VPWR minus 1.5 volts and is also current limited to protect the sensors.

Vehicle Power (VPWR)

The VPWR is the primary source of PCM power. VPWR is switched through the PCM power relay.

Vehicle Reference Voltage (VREF)

The VREF is a consistent positive voltage (5 volts plus or minus 0.5 volt) provided by the PCM. VREF is typically used by 3 wire sensors and some digital input signals.
