

## Ignition Systems

### Overview

The ignition system is designed to ignite the compressed air/fuel mixture in an internal combustion engine by a high voltage spark delivered from an ignition coil controlled by the powertrain control module (PCM).

### Integrated Electronic Ignition System

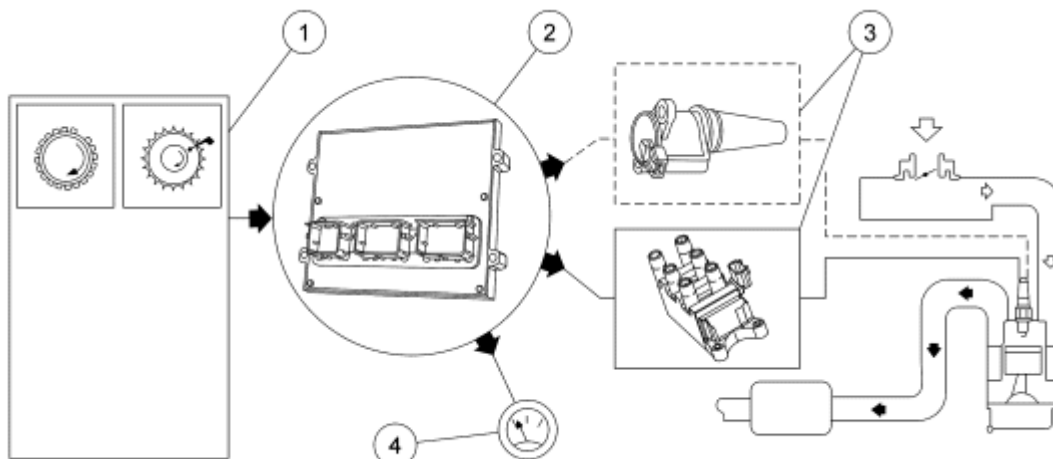
**Note:** Electronic ignition engine timing is entirely controlled by the PCM. Electronic ignition engine timing is not adjustable. Do not attempt to check base timing. You will receive false readings.

The integrated electronic ignition system consists of a crankshaft position (CKP) sensor, coil pack(s), connecting wiring, and a PCM. For additional information on the ignition system components, refer to [Engine Control Components](#) in this section. The coil on plug (COP) integrated electronic ignition system uses a separate coil per spark plug, and each coil is mounted directly onto the plug. The COP integrated electronic ignition system eliminates the need for spark plug wires, but does require input from the camshaft position (CMP) sensor. Operation of the components are as follows:

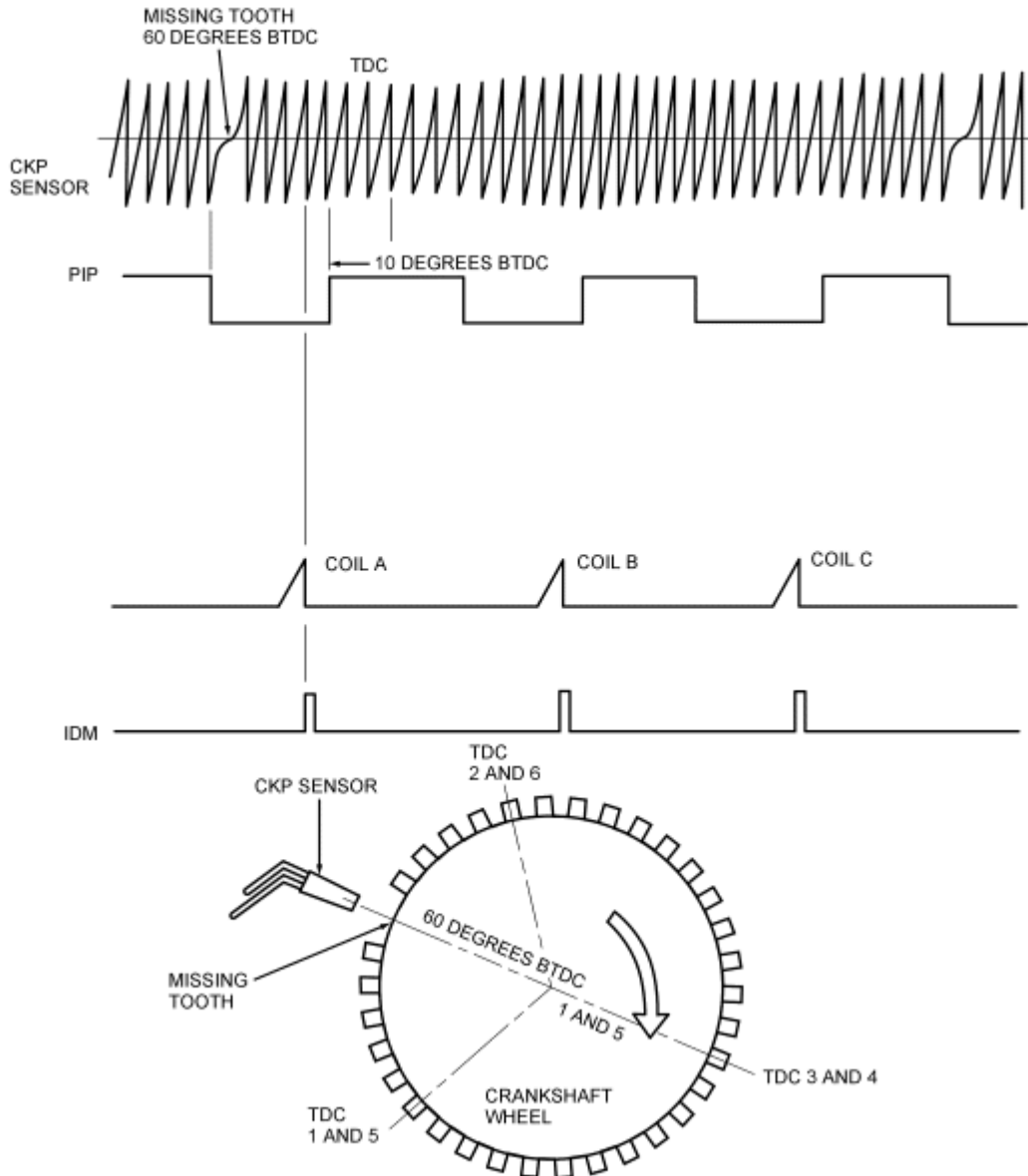
1. The CKP sensor is used to indicate the crankshaft position and speed by sensing a missing tooth on a pulse wheel mounted to the crankshaft. The CMP sensor is used by the COP integrated electronic ignition system to identify the compression stroke of cylinder 1 and to synchronize the firing of the individual coils.
2. The PCM uses the CKP signal to calculate a spark target and then fires the coil pack(s) to that target shown. The PCM uses the CMP sensor to identify the compression stroke of cylinder 1, and to synchronize the firing of the individual coils.
3. The PCM controls the ignition coils after it calculates the spark target. The COP system fires only one spark plug per coil upon synchronization during the compression stroke. For the coil pack ignition system, each coil within a pack fires two spark plugs at the same time. The plugs are paired so that as one fires during the compression stroke the other fires during the exhaust stroke. The next time the coil is fired the situation is reversed.

The current flow, or dwell, through the primary ignition coil is controlled by the PCM by providing a switched ground path through the ignition coil driver to ground. When the ignition coil driver is switched on, current rapidly builds up to a maximum value, determined by the coil inductance and resistance. When the current is switched off, the magnetic field collapses which induces a secondary high voltage surge and the spark plug is fired. This high voltage surge creates a flyback voltage which the PCM uses as a feedback during the ignition diagnostics. The PCM uses the charge current dwell time characteristics to carry out the ignition diagnostics.

4. The PCM processes the CKP signal and uses it to drive the tachometer as the clean tach output (CTO) signal.



## Integrated Electronic Ignition System



NOTE: THIS DIAGRAM DOES NOT CORRELATE TO ANY TIMING MARKS THAT MAY BE ON THE ENGINE FRONT COVER OR DAMPER

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*Six Cylinder Integrated Electronic Ignition Waveforms. 4, 8, and 10-Cylinder are Similar.*

## Engine Crank/Engine Running

During engine crank the PCM fires two spark plugs simultaneously. Of the two plugs fired, one is under compression while the other is on the exhaust stroke. Both plugs fire until camshaft position is identified by a successful CMP sensor signal. Once camshaft position is identified only the cylinder under compression is fired.

## Camshaft Position (CMP) Failure Mode Effects Management (FMEM)

During CMP FMEM the COP ignition works the same as during engine crank. This allows the engine to operate without the PCM knowing if cylinder 1 is under compression or exhaust.

