

Delphi Multi-Charge Ignition

Delphi Multi-Charge Ignition is an ignition control feature that fires a specially designed coil multiple times to extend spark duration and increase spark energy. It is designed to support the industry's newest advanced lean burn and stratified gasoline direct injection (GDi) engine programs.

With Delphi's Multi-Charge Ignition, the initial spark is followed by several additional sparks to ensure igniting the fuel-air mixture under challenging operating conditions, such as high exhaust gas recirculation (EGR) levels and lean fuel mixtures. The very fast consecutive spark events enable ignition to occur at the desired spark timing. This results in optimal combustion and helps achieve significantly improved fuel economy and reduced emissions.

Delphi can apply the feature to various ignition coil designs to accommodate customer requirements for coil-per-cylinder applications including:

- Plug top coils
- Coil-near-plug
- Pencil coils

► Benefits

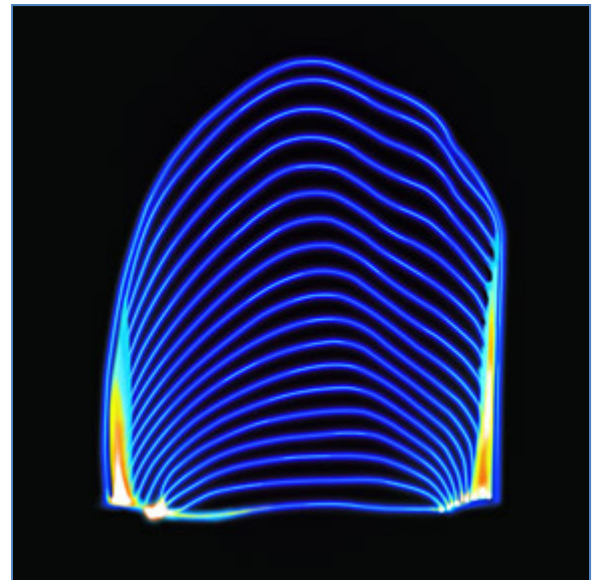
- Enables spray guided GDi engines to achieve up to 20% better fuel economy and very low engine-out emissions — virtually no soot or particulate emissions
- Helps achieve leaner injection with more dilution and EGR for enhanced engine performance
- Current-controlled ignition defines coil charge at the time of re-firing to optimize combustion
- Long burn time eliminates misfire
- Interface is compatible with a standard engine control unit
- Cost effective solution for reliable combustion in spray guided GDi engine applications

► Typical Applications

Delphi Multi-Charge Ignition is designed especially for use with advanced spray guided gasoline direct injection engines and other sophisticated gasoline engines that operate on highly diluted fuel-air mixtures. The number of cylinders in the engine program does not restrict the range of Multi-Charge Ignition applications. Delphi Multi-Charge Ignition is compatible with ethanol-blend fuel systems.



Delphi Plug Top Ignition Coil with Multi-Charge



Delphi Multi-Charge Ignition fires the ignition coil several times to extend spark duration and increase spark energy.

► **Technical Specifications**

Breakdown voltage	$U_{z, max} > 40 \text{ kV}$
Total energy	$E_{total} = f (1/\text{min})$
Total energy @ cranking speed	$E_{total} (200/\text{min}) < 800 \text{ mJ @ } 20 \text{ ms}$ $E_{total} (1,000/\text{min}) < 250 \text{ mJ @ } 6.5 \text{ ms}$ $E_{total} (2,000/\text{min}) < 130 \text{ mJ @ } 3.3 \text{ ms}$

► **Availability**

Delphi Multi-Charge Ignition is expected to begin production in 2011. Automotive manufacturers may contact Delphi for further information.

► **Performance Advantages**

Delphi Multi-Charge Ignition provides a more reliable solution for achieving optimal combustion in spray guided gasoline direct injection engine programs compared with competitive time-controlled multiple spark ignition systems. With the Delphi Multi-Charge concept, each spark is extended further into the combustion chamber. The current-controlled Multi-Charge Ignition ensures a defined coil charge to the time of re-fire to reduce the potential for misfire and, thus, minimizes NOx and hydrocarbon emissions and provides other benefits.

Delphi is developing its Multi-Charge Ignition with major European automotive manufacturers and our expertise in the field is recognized by our customers. Delphi is one of the industry's leaders in this advanced ignition system technology. Delphi engineers have already patented a number of features for this concept.



Delphi Coil-Near-Plug Ignition Coil with Multi-Charge

► **The Delphi Advantage**

Delphi has a deep understanding of ignition systems and the combustion process. We offer the benefits of more than 100 years' experience in ignition systems and today we build millions each year. We offer a low cost, global manufacturing footprint and the most comprehensive line of ignition systems in the industry. Our ignition products excel in performance, quality and durability. We provide advanced and innovative technologies designed to help our customers meet the market challenges of the future.

As a global leader in engine management systems technology, Delphi can help manufacturers meet emissions requirements, improve fuel economy and enhance performance. Delphi is a source for high value solutions and our systems expertise is built into every product. Delphi's flexible engineering approach encourages collaboration. And, Delphi has a thorough understanding of automotive markets around the world and a global network of resources.