

Delphi Wireless Charging System

Delphi is developing a Wireless Charging System that will automatically transfer power to a vehicle providing a convenient, wireless energy transfer system. The system was developed in cooperation with WiTricity Corp., a wireless energy transfer technology provider. It will enable an electric vehicle's battery to be recharged without the hassle of cords or connections. This hands-free charging technology is based on highly resonant magnetic coupling which transfers electric power over short distances without physical contact, allowing for safer and more convenient charging options for consumer and commercial electric vehicles.

The wireless technology is a product differentiator for advanced technology vehicles. The high efficiency wireless energy transfer technology will require no plugs or charging cords. Instead, a magnetic field from a source resonator on the ground is aligned with a capture resonator mounted underneath a vehicle.

Delphi has rights under a patented MIT-developed wireless energy transfer technology based on the following principle: Two properly designed devices with closely matched resonant frequencies can strongly couple into a single continuous magnetic field.

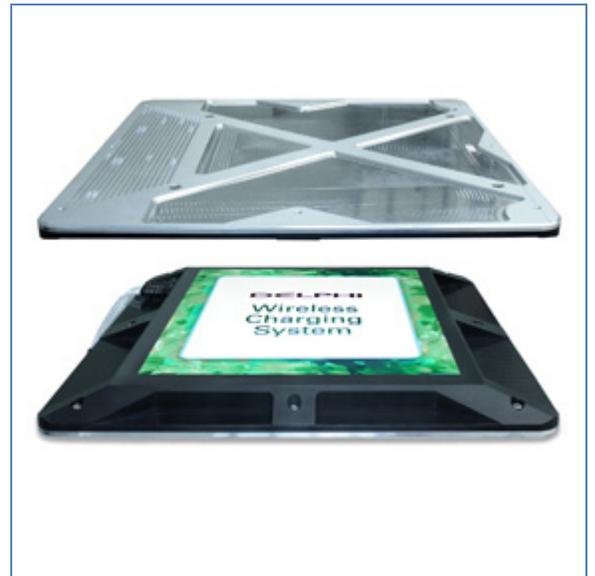
The wireless charging system is comprised of the following:

- Vehicle mounted capture resonator and interface electronics — fitted to the bottom of the vehicle
- Vehicle power and signal distribution systems
- Stationary source resonator pad — mounted on the ground
- Stationary charging controller

Compared to inductive systems, this highly resonant magnetic coupling technology will efficiently transfer power over significantly larger distances and will allow more parking-related vehicle misalignment. The system can fully charge an electric vehicle at a rate comparable to most residential plug-in chargers, which can be as fast as four hours.



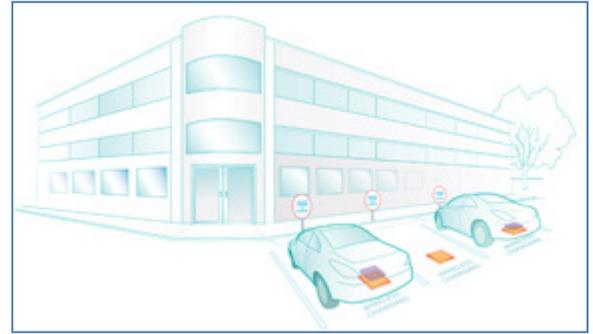
The Delphi Wireless Charging System eliminates the need for a charging cord. Drivers can park their electric vehicle over a wireless energy source that sits on the garage floor or is embedded in a paved parking spot.



The Delphi Wireless Charging System offers more practical and flexible installation than traditional inductive systems because it uses highly resonant magnetic coupling, a modern technology that safely and efficiently transfers power over significantly larger distances and can allow more misalignment due to parking.

► Benefits

- Convenience and simplicity for electric vehicle owners
 - Enables easy, automatic charging by simply parking a vehicle in a garage or parking spot
 - System activates the moment a vehicle is aligned with the charging pad
 - Minimal driver action needed
 - Hands-free
 - No plugs or charging cords needed
 - Keeps clothing and hands away from dirt and debris that accumulates on the exterior of vehicle
 - No loose charging cord to step over or wind
 - No need to plug in or unplug
 - Simply drive into position and exit the vehicle as usual
 - Accommodates drivers with physical challenges
- Engineered to provide a safe, robust, reliable, and quick charge
 - Safe technology
 - Non-radiative power transfer uses a magnetic near field
 - Very little energy transferred to extraneous or off-resonant objects
 - More than 3,300 watts can be wirelessly transferred
 - Can fully charge an electric vehicle at a rate comparable to most residential plug-in chargers, which can be as fast as 4 hours
 - Weather resistant
 - Environmental factors such as snow or rain would have no effect on the wireless energy transfer
 - Less vulnerable to tampering or accidental damage when compared to corded charging alternatives
 - Low maintenance for commercial and public installations
 - No moving / mechanical parts
 - Delphi is a member of the SAE J2954 Wireless Charging Task Force
 - Designs comprehend applicable safety regulations and guidelines
- Superior technology when compared to inductive charging
 - Effective across larger air gaps, allowing for a greater vehicle ground clearance
 - System can transfer 3.3 KW efficiently across air gaps in excess of 20 cm
 - Precise vehicle positioning is not required
 - Accommodates greater misalignment between vehicle resonator and stationary resonator, meaning that perfect parking accuracy is not required
- Green technology
 - Helps advance the establishment of a global infrastructure for electric vehicle charging
 - Can help increase fuel economy of plug-in hybrids by increasing the frequency of having a fully charged battery



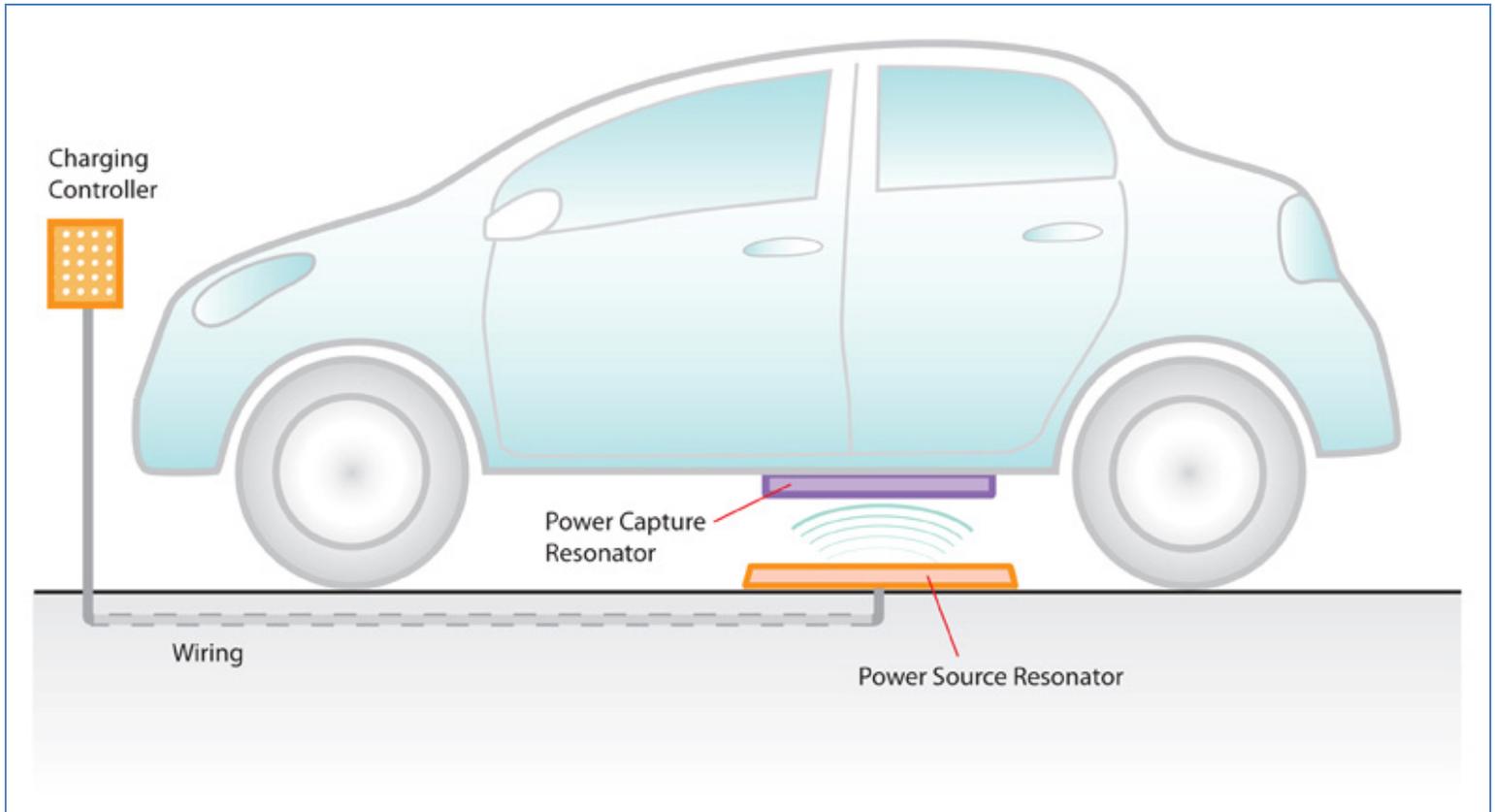
The source of the power can be located on a garage floor or embedded in a paved parking spot. The energy receiver will be located under the vehicle.

► Typical Applications

The Delphi Wireless Charging System can be used with fully electric vehicles (EVs).

► Availability

The Delphi Wireless Charging System is currently under development. Contact Delphi for further information.



The wireless charging system would involve no plugs or charging cords. Electric power flows upward from a power source resonator to a power capture resonator installed on a vehicle.

► **Performance Advantages**

Delphi is committed to advancing wireless charging for EVs and has made significant technology development steps:

- Successful implementation of wireless charging on an existing vehicle
- Development of automotive-grade versions of source and capture coils underway
- Integration of robust control hardware/software into vehicle systems for seamless operation
- Validation according to specific OEM requirements, all applicable safety regulations, and SAE J2954 Wireless Charging Task Force recommendations

Delphi can bridge the gap between the laboratory and the highway by providing electrical/electronic systems integration expertise, a global manufacturing and engineering footprint and high-voltage, high-power components specifically engineered for the hybrid and electric vehicles of today and tomorrow. Delphi's expertise in global engineering, validation and manufacturing coupled with rights to WiTricity's patented wireless energy transfer technology uniquely positions us to make wireless charging of electric vehicles a reality.

Wireless charging technology will need to co-exist with plug-in charging solutions, so that electric vehicle drivers have the ability to charge their vehicle when they are away from a wireless charging source. Delphi makes a Portable Electric Vehicle Charger that fits conveniently in the trunk of an electric vehicle, as well as other technologies for the hybrid and electric vehicle market.

▶ The Delphi Advantage

Delphi has a thorough understanding of system specifications and requirements, spanning multiple markets and serving a diverse customer base. Global innovation is supported through Delphi's worldwide engineering and development centers. Our engineers are experts in materials, products, and processes for hybrid and electric vehicle applications and our flexible engineering approach encourages collaboration. The Delphi Champion Technical Center's testing laboratories are A2LA (The American Association for Laboratory Accreditation) accredited for tests listed on certificate numbers 1913.01 and 1913.02.

Delphi has global experience with hybrid and electric vehicle OEMs and tier one suppliers. We are a source for high value solutions and our systems approach is built into every product in our growing portfolio. Delphi is committed to making electric vehicles accessible and practical for the average consumer and is investing in technology to help facilitate a global infrastructure for electric vehicles, at home or away.