

WHITE PAPER

Wireless Charging

TIME TO MAKE THE MOVE FOR
RUGGED DATA COLLECTION DEVICES.



ABSTRACT

Wireless charging technology has been in use for over a decade in consumer electronic devices – specifically smartphones. This technology is now available on rugged enterprise class hand held computers and bar code scanners. The benefits of this technology are many for both the user and the enterprise. Most importantly it eliminates the #1 cause of hardware failure for rugged hand held devices.

WIRELESS CHARGING EXPANDS

- *>90% of new smart phones use Qi technology (2019)*
- *80+ car models offer wireless charging*
- *3,500+ Qi-certified products available*
- *600+ companies back the Qi standard*⁴

Core Technology

The technology behind wireless charging has been around for over a century. Nikola Tesla first demonstrated the transmission of energy with his famous Tesla Coil which most people recognize as a shiny sphere that emits sparks of electricity. Tesla invented the coil in 1892; its technology is used extensively in radios, televisions, and countless other devices. Wireless charging utilizes wire coils in both the transmitting and receiving devices to transfer power using electromagnetic induction. Current in the transmitting device, the charger, excites electrons in the receiving device, a smartphone or other similar device, that is used to charge the batteries. The coils are designed specifically to match the application while considering various parameters such as charging voltage, charging current, distance between the devices and much more.

Most consumer's first exposure to wireless charging is likely charging of their smartphone. Samsung first launched wireless charging in 2010 with the release of its Droid Charge.¹ At that time multiple wireless charging technologies were in use with no leading standard. Since then, wireless charging use has significantly expanded. Moreover, a single industry standard has emerged, called the Qi wireless power standard (Qi is pronounced "chee").

The Wireless Power Consortium published the first Qi specification in August 2010 and the first product was certified in September 2010. Since then, the number of certified products has grown to over 3,500 products, with more added every day. Many phone models have integrated support for Qi from leading manufacturers like Apple, Google, HTC, LG, Motorola, Nokia, Samsung, Sony, Huawei, Xiaomi and others.²

Wireless charging has become mainstream in smartphones and is expanding to include many other devices including tablets, laptops, and other consumer devices. IHS Markit forecasts explosive growth of global shipments of wireless power receivers and transmitters to hit 2.2 billion units by 2023; up by nearly a factor of five from 450 million units in 2017.³

Root Cause of Failures

The physical interface between a hand held device and its charging station is a consistent point of failure. Each time a device is connected to a cable or placed into a docking station is an opportunity for damage to the device or the charger connector.

Traditionally, enterprise class rugged devices have relied on docking stations (also known as charging cradles) as the charger for hand held computers and bar code scanners. These devices are used in commercial and industrial applications where the environment is conducive to contact failure. Warehouses, distribution centers and manufacturing areas are rarely dust free. Moreover, these environments can have wide temperature and humidity fluctuations during a day or throughout the year with the change of seasons. These environmental factors, atmospheric swings and other factors such as spilled liquids and human

¹ Samsung website: <https://news.samsung.com/global/editorial-the-awesome-power-of-wireless-charging>

² Wireless Power Consortium website: <https://www.wirelesspowerconsortium.com/qi/>

³ HIS Markit <https://ihsmarkit.com/research-analysis/focus-on-two-new-power-energy-reports-solid-growth-projected.html>

error can cause the collection of foreign materials in a docking station around the charging contacts. Couple all this with a business expectation where speed and productivity are imperative and a recipe for connector damage is created.

DEVICE FAILURE INSIGHTS

Hand held devices are often the focus of charging failures but charging or docking stations are more frequently susceptible to failure.

Most charging stations have a cup-like design that naturally collects debris. Dirt, dust, moisture, or even coffee and sodas find their way into docking stations. These items act as abrasives and corrosives on the contacts. Each time the hand held device is placed into the docking station the debris is ground into the contacts of both devices. Damage happens even when the hand held device is not inserted as the debris may chemically react, causing corrosion.

Failure of charging contacts are the # 1 cause of hardware failure in rugged hand held devices. Furthermore, docking station contacts fail up to 200% more than hand held device contacts.



Charging Docking Station Contacts

Workers in heavy use enterprise applications remove and replace hand held devices into docking stations over 20 times during the course of a day. These users are focused on the task at hand, not ensuring contact cleanliness or alignment. Placement into the docking station is often done with a fast and rough motion. The result is dirty, corroded, and damaged contacts on the docking station. Similar failures are exhibited on the hand held device. The result is an incomplete charge or no charging of the hand held device. A recent report from VDC Research found that charging contacts are the No. 1 cause of hardware failure for rugged hand held devices.⁵ The inability to make a consistently good connection between the charger and the device is clearly at play.



Device Contacts

The problem is exacerbated over time as users continue to work using the compromised hand held device and charging station contacts. The result is the complete inability to charge a device and the need to replace the contacts on

⁴ Wireless Power Consortium website: : <https://www.wirelesspowerconsortium.com/about/about-wpc>

⁵ VDC Research Report: Total Cost of Ownership Models for Line of Business Mobile Solutions, VDC Research, December 2018

the device, the charging station, or both. In most cases charging stations are not repairable items and must be replaced, while devices must be sent off for repair.

Benefits of Wireless Technology

Industries such as Retail, Transportation & Logistics, and Manufacturing have a long history of relying on hand held computers and bar code scanners to increase their accuracy and efficiency. Because hand held devices were failing to charge (partially or completely), worker productivity was significantly impacted. Here, structured routine maintenance processes have been put into place to inspect and clean docking station and device contacts.

Wireless charging puts an end to charging contact failures and eliminates the cost of executing maintenance work. It also reduces the cost of implementing hand held devices: prior to wireless charging, enterprises had to plan for extra devices and docking stations due to expected failures attributed to contact maintenance and failure. Wireless charging allows enterprises to reduce the number of spare units purchased when implementing data collection systems.

Wireless charging significantly impacts the efficiency and productivity of an enterprise. Budget, manpower, and time dedicated to maintaining hand held device charging is eliminated. Processes that removed equipment from use for preventative maintenance is not needed, allowing the equipment to stay in use and the staff to focus on other tasks. Most importantly, users can operate at peak performance. They now have the confidence that their handheld devices are charging properly each time, delivering them a full shift of productivity.

Efficient Flexibility

The Qi specification for wireless charging goes beyond traditional wired charging where power is presented to a device to be charged via a cable from a transformer plugged into an outlet. Instead, Qi defines an active system with communication between the charger and device. This structure delivers superior efficiency and flexibility to enterprise applications.

When a hand held device is placed on a Qi charger, the charger initiates communications with the device. Charging does not start until the charger and device have properly established communications. Communications between both devices continues until the device is fully charged or removed from the charger.

Qi makes it easy for enterprises to efficiently deploy wireless charging throughout their facilities. The specification dictates that any Qi charger can work with any Qi device. Enterprises can pick components that match their specific requirements or combinations. Footprint, size, shape, color, and cost can vary but the specification ensures proper charging.

Wireless charging offers safety features inherent in the Qi specification. Charging is never initiated until communications between the device and charger are established. Foreign objects placed on or near the charger will not initiate charging current. When a device has reached its full charge, the system identifies this state and puts the charger into standby mode, stopping the flow of current to the device. This actively protects the device from being overcharged and damaged.

WIRELESS CHARGING IN ACTION



Maximizing uptime in self-shopping is crucial for retailers. To do this the manufacturer of the leading self-shopping solution implemented intelligent wireless charging on the hand held devices.

The power of the Qi specification provides the charge status of each device. In times of heavy use, charging profiles can be tailored to ensure plenty of power for the user. Here's how it works (an example in a grocery store setting):

A shopper scans their loyalty card and the system queries its inventory for the optimal device to select/use. The selection criteria are defined by the grocer to maximize the shopping experience (typically battery charge state). A device is identified and released by the system to the shopper (this all happens behind the scenes to enhance the shopper experience).

With no physical contacts, there is no worry of damaged, corroded, or dirty contacts preventing charging. Wireless charging is ideal for applications where devices are removed and replaced in their cradle/dock multiple times per day

A well-designed wireless charging system also monitors the temperature of the battery and automatically adjusts the charging rate. This ensures safety, preventing the battery from overheating while charging. Monitoring the battery temperature also maximizes the life of the battery.

Designing for optimal efficiency is a critical element of best in class wireless charging systems. Using a complete energy analysis that measures total energy into the battery vs. total energy into the transmitter shows that wireless charging is very efficient.⁶ A device manufacturer can achieve a highly efficient wireless charging system on a par with wired charging while delivering many more benefits.

The Qi specification allows for a flexible implementation of its charging system and is well suited to varying environments. In enterprise applications, different use cases and industries may have different requirements for device charging. A retail POS application where a hand held scanner spends a high percentage of time in a docking station has very different requirements from a distribution cross docking application where semi-truck trailers loaded with goods are scanned continuously.

Best in class design of a wireless charging system should also include charging profiles to optimize battery autonomy or life. These profiles or modes allow enterprises to prioritize battery life, battery capacity, or charging speed to best fit their use case and application. Depending on the charging profile selected, a hand held device with a high capacity battery can be fully recharged overnight or in as little as two hours.

The Qi standard also allows device manufacturer's the ability to implement fast charging, leveraging 10 watt or even 15 watt systems (the base Qi standard supports 5 watts). The higher the wattage, the faster the battery will charge.

Charging profiles and fast charging provide the flexibility to increase worker efficiency by ensuring devices have the right amount of charge at the right time. Prior to wireless charging, enterprises could experience a significant loss in productivity from a device failing to complete a mission critical task or running out of charge prior to the end of a shift.

Make the Move to Wireless Charging

Wireless charging started more than a decade ago in the consumer market with products like electric toothbrushes. Today, consumers easily, successfully, and inexpensively wirelessly charge many things, including their cell phones, tablets, and smart watches. Moreover, the use of this technology is expanding into larger devices. Laptops are just starting to hit the market featuring wireless charging. Kitchen appliances are also being designed to take advantage of wireless charging. The ever-growing number of electric vehicles also look to wirelessly charge – imagine parking your car in a lot while you shop, or work and the battery is automatically charged!

The Qi specification, an open interface standard that wirelessly transfers power using inductive charging when a device is placed on a pad, cradle, or docking



Honda displays wireless charging at the Consumer Electronics Show 2019

⁶ Wireless Power Consortium: Measuring Wireless Charging Efficiency in the Real World, WPC Trade Conference Seoul, 2015

station, provides a solid foundation for the implementation of wireless charging. Qi is the de facto global standard for wireless charging and is in use today by major companies globally including Apple, Google, and Samsung. Wireless charging enables a fast and safe charge that preserves the battery's health, offering a long life.

Rugged data collection devices have been delivering benefits to Retail, Transportation & Logistics, Manufacturing and Healthcare industries for over 30 years. Throughout this time, enterprises have battled with the shortcomings caused by charging contacts and connectors on charging stations and hand held devices. These devices have suffered from dirty, damaged, and corroded contacts that have significant impact on worker productivity and customer service.

The future of charging is wireless, based upon the Qi specification. Wireless charging and the power of the Qi specification eliminate the No. 1 cause of hardware failure for rugged hand held devices such as mobile computers and bar code scanners. Enterprises must future-proof their investments and maximize the ROI of their rugged device purchases by insisting the devices they use have wireless charging.

It is time to make the move to wireless charging for rugged data collection devices.

Learn more at www.datalogic.com.

Datalogic Group

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