SMART CONNECTIVITY SOLUTIONS ENABLE THE WEARABLE REVOLUTION

Samir Vasavda, Field Application Engineer

SMART CONNECTIVITY SOLUTIONS ENABLE THE WEARABLE REVOLUTION

Heart rate, calories burned, number of hours of sleep, number of steps taken - If you are an engineer, a gadget lover or a data driven person who wants to live a healthy life, you may already be using Nike FuelBand, Jawbone Up or a Fitbit type of device to track your activity level. You have probably heard the news about Facebook paying $2 billion to buy an augmented reality company called Oculus, and Intel spending more than $100 million to buy Basis, which is a company that makes a watch that tracks your heart rate, speed, sleep and other parameters. Google Glass is already in the hands of many developers, and Google has announced Android wear. Samsung has a second version of the Galaxy Gear watch. Apple recently announced a smart watch (Apple Watch) that will ship in early 2015. Motorola has already released their smart watch Moto 360 just recently. How about a Pebble watch? Microsoft Band is a new wearable device which will compete with others in the market.

“Get ready for the wearables onslaught.”

The Era of Smart Wearables is Coming

The world of technology is going through another transformation. We went from mainframes to desktop PCs in about two decades, from desktops to laptop PCs in a decade or so, and from laptops to smartphones and tablets in less than a decade. Another revolution is brewing, and it will most likely take less than a decade to happen. It’s the smart wearables that are always connected. Dr. Mudhafar Hassan-Ali, leading the product development of wearables at TE Connectivity (TE), said, “Connectivity is the name of the game.” TE’s Menlo Park campus has an entire team dedicated to develop solutions specifically for wearable products.

Special Connectivity Solutions are Enablers

Connectivity solutions will enable the consumer electronics developers to make wearables. Let’s talk about external connectivity for power and data. Standard connectors may not fit into wearables due to size, aesthetics and technology. Eyewear needs to be thin, lightweight and aesthetically pleasing. A watch or any other wearable often must meet the same criteria. From a technology standpoint, customers want hermetically sealed devices so they can perform well under water or can resist sweat, dust and other foreign objects. To make this feasible, users want devices with no holes or minimum openings. Contactless solutions can address these issues.

Real estate is also a huge challenge. Eyewear or any other wearables are designed with minimum space for other non-essential functions. To address these challenges, key connectivity industry players are designing solutions for wireless power-charging and contactless data transmission.

Wireless Power

Technology experts are seeing a trend of “increased sensing.” There will either be more functionality in the same space or the same functionality in a smaller form factor. Thus, providing power is a huge challenge as well as an opportunity.

Wireless power is based on resonant inductive coupling. This point has encouraged the creation of multiple standards consortia. A consortium called Wireless Power consortium (WPC) is working on a Qi (taken from Chinese word for natural energy and pronounced “Chi”) standard. Another consortium called Alliance for Wireless Power and Power Manage Alliance (A4WP), which now has joined by Power Matter Alliance (PMA).

There are two main hurdles to overcome in wireless charging. The first is charging from a distance where devices are not tightly coupled. Therefore, the goal is to achieve spatial freedom. The second challenge is the design of the coil (inductor or antenna) and how to make it fit inside the tiny and complex-shaped devices.

A combination of better battery technologies (flexible, thinner, lighter, faster) and power “harvesting” whether it is using solar, mechanical movement, body heat or other means is being looked at by startups and established companies in Silicon Valley and other places around the world.

Contactless Data

Contactless data is done using electromagnetic radiation. It requires close proximity between the cable and the device. It is also referred to as short-range communication and is done at extra high frequency (EHF) at 60 GHz band using the ISM (industrial, scientific and medical) bands, a non-licensed spectrum. It is used to penetrate plastic and is compatible with USB, VESA and SATA standards. The challenges are high power requirements and a need for intelligence to wake up and sleep. It also requires RF expertise for robustness, low electromagnetic interference (EMI) and regulatory compliance such as Federal Communications Commission (FCC) compliance.

Antennas

For external input/output (I/O) components, antennas have played a big role in providing freedom from wires for connectivity. Almost everything is becoming mobile. For example, one of the largest global antenna suppliers ships more than 500 million antennas every year. In the wearable space, the challenge is the shape and size of antennas, which are becoming smaller and more complex.

The solution is to make antennas using traditional methods as well as technologies like MID (molded interconnect devices) and LDS (laser direct structuring) for 3D antennas.

Some new antennas are designed using multiple protocols, i.e., LTE, Bluetooth and Wi-Fi, among others. The antennas can be either multi-band or tunable. The frequencies can be:

For WLAN / WWAN / Voice

- 802.11 (a/b/g/n): 2400 - 2483.5 & 4900 - 5875 MHz
- LTE: 700 – 3700 MHz, multiband, Metaspan antenna technology
- GSM/UMTS: 850 – 2170 MHz, single and multiband
- WiMax: 2300 – 3800 MHz

Others

- ISM 900/ZigBee: 902 - 928 MHz
- Bluetooth wireless technology: 2400 - 2483.5 MHz
- ZigBee: 2400 - 2483.5 MHz
- UWB: 3168 - 10560 MHz
- Global Navigation Satellite Systems (GNSS): GPS 1565 - 1585 MHz & Glonass
- DVB-H: 1670 - 1675 MHz
- NFC: 13.56 MHz

FCC and other agency regulatory compliance is a must.

TE has antenna development lab in Aptos, California, close to Silicon Valley, where unique and customized antenna solutions can be designed, developed and tested. The lab has engineering expertise and resources needed to make quick prototypes and changes to suit customer needs. TE also has facilities in Harrisburg-US, Taiwan, Japan, South Korea and China, which includes 7 RF chambers, CST and HSS simulation facilities.

Other Connectivity Components

For connecting multiple PCBs (rigid and flexible), board-to-board connectors are getting smaller, with the smaller pitches reaching 0.35 mm. Current can range from 1.5A for power and 0.3A for signal. Retention force can be as high as 10N while insertion force can be 15N max.

Board-to-flex connectors are very useful for devices with height constraints.

As mobile device complexity and functionality increase, there is a growing need for thinner devices with multiple antennas, higher data rates and increased operating frequencies.

EMI shields are stamped one- and two-piece metal cages that help provide isolation of board-level components, minimize crosstalk and reduce EMI susceptibility without impacting system speed.

For charging, docking and grounding, pogo pins are used because of their excellent reliability and durability in a small form factor.

Spring fingers are used for grounding to prevent EMI noise and static and isolation from vibrations.

A large portfolio of the widest variety of spring fingers is available with different heights ranging from 0.8 mm to 4.3 mm. They can be used with a low force of 0.2N – 1.0 N.

SIM-card connectors could become an essential part of wearable devices, such as mini-SIM (2FF), micro-SIM (3FF), and combined micro-SIM and micro-SD connectors.

The future is bright for smart wearables. Unique interconnect product offerings from leading industry players will certainly help this exciting revolution.

Samir Vasavda is a field application engineer for TE Connectivity Ltd. and is based in Menlo Park, California.
He holds four U.S. patents and is a mechanical engineer educated at the University of North Carolina, Charlotte.

FOR MORE INFORMATION:

TE Connectivity Technical Support Center
USA: +1 (800) 522-6752
Canada: +1 (905) 475-6222
Mexico: +52 (0) 55-1106-0800
Latin/South America: +54 (0) 11-4733-2200
Germany: +49 (0) 6251-133-1999
UK: +44 (0) 800-267666
France: +33 (0) 1-3420-8686
Netherlands: +31 (0) 73-6246-999
China: +86 (0) 400-820-6015

For other country numbers, go to te.com/supportcenter

te.com

[DOCUMENT # 1-1773856-4]