ESD PROTECTION OPPORTUNITIES IN WEARABLE ELECTRONICS DESIGN

The touch screen, antenna, USB interfaces and other functions of wearable devices are particularly vulnerable to electrostatic discharge (ESD). Numerous opportunities exist to employ Littelfuse PESD devices to help provide reliable performance.

ESD PROTECTION IN WEARABLE ELECTRONICS

The market for smart watches, smart glasses, smart bracelets, smart necklaces, wearable medical products, and other wearable devices is developing very rapidly. This class of devices presents a unique requirement for robust ESD protection

Since wearable products often come into contact with the human body, they are frequently subjected to electrostatic discharge (ESD). For the wearable products to be small enough and power saving, the most advanced semiconductor process technology is necessary. The insulating oxide layer between the crystals of the semiconductor is very thin and easily damaged by ESD breakdown Therefore, such electronics often need to be equipped with ESD protection devices to ensure system stability and to avoid hardware damage.

Considering the features of the wearable products, the ESD protection device needs to satisfy following requirements:

1. The size should be as small and thin as possible. Compared to handheld products, wearable products have more stringent requirements for the size of the device, so the 0201 package can be the best choice.
2. The parasitic capacitance of the ESD protection device should be small, as higher capacitance may cause a lack of signal integrity. For the ESD protection devices used in RF and USB3.0 applications, the desired value of capacitance is often less than 0.5pF.
3. The protection devices need to be able to withstand multiple ESD events.
4. The ESD protection devices need to have high voltage withstand levels. They need to withstand at least the 8kV contact discharge requirement as specified in the IEC61000-4-2 standard.
5. The ESD device should have a low clamping voltage. The magnitude of the clamping voltage relates to the level of protection. Besides helping to keep the chip undamaged in case of ESD events, the ESD protection products need to prevent the signal from being interfered with by ESD events.

Application of ESD protection in each module of wearable devices:

1. **Touch panel module.**
   The touch panel human-machine interface (HMI) is vulnerable to ESD disturbances. In PCB design, the ESD protection device may be added at the position where a connector appears on the flexible PC board to help prevent the ESD from entering via the connector. In addition, there may be ESD risk from the shielding layer around the edge of the touch panel. An ESD protection device between the shielding layer and the ground will help avoid signal interference.

2. **Display and camera module interfaces.**
   The multilayer flexible PC and connectors of the display and camera module present potential EMI and signal integrity issues. Because this module is relatively large, it may come into contact with a number of mechanisms in the narrow space of the wearable device. During use or manufacturing, it often is subject to direct or coupled impacts due to ESD on the human body or in the use environment, thus endangering the control IC. At this point, an EMI filter with ESD protection may be used to help prevent the damage from these problems.

3. **RF and NFC antenna.**
   ESD from the human body or from the environment entering the device via the RF and NFC antenna can cause damage to the electronic components at the receiving end of the antenna. The RF signal is very sensitive to the value of capacitance. In PCB design, the ESD protection should be placed as close to the antenna as possible to maximize the frontline protection by leveraging the ESD device's lower clamping voltage and resistance to high surge current.

4. **Physical keys.**
   Most of the current wearable devices have a touch screen HMI, but some also have physical keys, such as a volume key, lock key, menu key, etc. The users need to operate these by directly touching the physical keys and an ESD can occur between the gaps of these keys. ESD components should be placed as close to the key touching point as possible.

5. **User Interfaces.**
   User interfaces, such as a headphone jack, USB interface, SIM card, TF card, etc., may frequently come into direct contact with the user, and may bring about ESD issues. Some earphone jacks have wireless connections, while USB interfaces provide high-speed data, so low capacitance ESD protection devices should be used to maintain the signal integrity. Since SIM cards' and TF cards' signaling rates are not high, the protection may be achieved by using ESD devices with ordinary capacitance.

For more detailed ESD protection solutions for wearable electronics, visit Littelfuse website (www.littelfuse.com) or contact Littelfuse representative for technical support.