Overvoltage protection

TDK offers extremely compact TVS diodes for complete ESD protection of USB-C

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TDK Corporation (TSE:6762) presents new series of extremely compact TVS diodes with parameters matched to the various ports of the USB-C port as well as other high-speed interfaces. TVS diodes with very low parasitic capacitance values and low clamping voltage are required especially for the high-speed ports (Tx / Rx) of USB-C, which operate at up to 40 Gbit/s with USB4 version 1. The B74111U0033M060 and B74121U0033M060 types are suitable for this purpose, with very low capacitance values of 0.48 pF and 0.65 pF at 1 MHz, respectively, which means that signal integrity is not compromised. The clamping voltages are only 3.8 V or 3.9 V with an I_{TLP} of 8 A. The protection devices are designed for ESD discharge voltages of up to 15 kV. These TVS diodes are manufactured in the extremely compact WLCSP 01005 and WLCSP 0201 packages and are extremely flat with heights of 100 µm and 150 µm respectively. This means that the TVS diodes can also be integrated into USB-C SIP modules.

The new B74111U0055M060 and B74121U0055M060 types with maximum DC voltages of up to 5.5 V are suitable for the conventional USB2.0 data bus of USB-C (D+ / D-). Their clamping voltages are 3.9 V and 4.0 V with an I_{TLP} of 8 A. They are also designed for a high ESD discharge voltage of up to 15 kV. The housing designs and heights correspond to the types already described.

Power lines VBUS (CC / SBU) can be used to transmit a maximum of 100 W at voltages of up to 20 V and currents of 5 A. Here, too, safe ESD protection is essential. For this purpose, TDK offers the two new types B74121G0160M060 with a maximum working voltage of 16 V and B74121G0200M060 with a value of 20 V and clamping voltages of 23 V and 27 V, respectively, at an I_{TLP} of 8 A. They feature capacitance values of 6 pF and 5 pF, respectively, with high linearity and are rated for ESD contact discharge voltages of 15 kV. They are also designed in the compact WLCSP 0201 form factor with a height of 150 µm.

In total, up to three different types of TVS diodes are required for complete ESD protection of USB-C due to the different requirements. In addition to USB-C, the ESD protection components can also be used for other high-speed interfaces such as Thunderbolt, HDMI, Display Port, FireWire, DVI, S-ATA or SWP/NFC. Typical end devices are smartphones, tablets, notebooks, wearables, or network components.

Main applications

- High-speed interfaces such as USB-C, Thunderbolt, HDMI, Display Port, FireWire, DVI, S-ATA or SWP/NFC
- Smartphones, tablets, notebooks, wearables, or network components

Main features and benefits

- Low clamping voltages e.g., 3.8 V at I_{TLP} of 8 A
- Capacitance values of minimum 0.48 pF
- Compact package shapes of WLCSP 01005 and WLCSP 0201
- Extremely flat heights of 100 µm or 150 µm
- High robustness against ESD contact discharge voltages of 15 kV

About TDK Corporation

TDK Corporation is a world leader in electronic solutions for the smart society based in Tokyo, Japan. Built on a foundation of material sciences mastery, TDK welcomes societal transformation by resolutely remaining at the forefront of technological evolution and deliberately “Attracting Tomorrow.” It was established in 1935 to commercialize ferrite, a key material in electronic and magnetic products. TDK‘s comprehensive, innovation-driven portfolio features passive components such as ceramic, aluminum electrolytic and film capacitors, as well as magnetics, high-frequency, and piezo and protection devices. The product spectrum also includes sensors and sensor systems such as temperature and pressure, magnetic, and MEMS sensors. In addition, TDK provides power supplies and energy devices, magnetic heads and more. These products are marketed under the product brands TDK, EPCOS, InvenSense, Micronas, Tronics and TDK-Lambda. TDK focuses on demanding markets in automotive, industrial and consumer electronics, and information and communication technology. The company has a network of design and manufacturing locations and sales offices in Asia, Europe, and in North and South America. In fiscal 2023, TDK posted total sales of USD 16.1 billion and employed about 103,000 people worldwide.

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