Application Brief

Using an eFuse to Meet IEC62368-3 for USB 2.0 and USB 3.1 Power Sourcing Ports

Jim Perkins, Kunal Goel

USB 2.0 and USB 3.1 power sourcing ports have traditionally been protected with current limiting power switches. Such devices can also incorporate short circuit and reverse current/voltage protection. Texas Instruments has a wide range of fixed and adjustable current limit power switches such as TPS25221 which offer this protection.

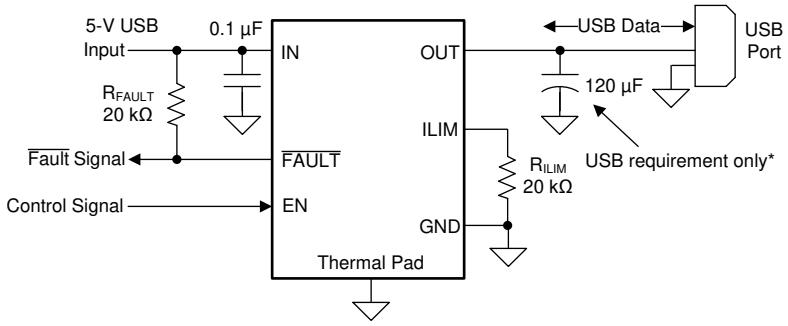

Figure 1. Typical Application use as USB Power Switch

More recently IEC62368-3 *Safety aspects for DC power transfer through communication cables and ports* has emerged. This standard mandates that under single fault conditions in the PSE with a fixed, single output voltage, the output of the PSE shall not exceed 130% of the nominal rated output voltage.

In practice, this means that if an upstream voltage regulator fails and applies a higher voltage to the USB power switch, the output must not exceed 6.5 V. Most traditional USB power switches are rated for 5 V with an absolute maximum voltage rating in the range of 6 V. If the upstream failure applies 12 V to the USB switch it is likely to fail and it cannot be guaranteed that it will not fail in short thus applying the 12 V to output port.

To meet IEC62368-3, a different kind of power switch device is required. TPS259472 is a 28 mΩ eFuse with an adjustable current limit that can be programmed between 0.5 A and 6 A. Supplied in a tiny 2mm x 2 mm QFN package, it is rated for operation from 2.7 V to 23 V. Additionally, this device has a pin selectable 5.7 V output overvoltage clamp option. In this case, where the single fault condition applies a voltage up to 23 V to the power switch, the output clamp ensures that the output of the PSE continues to meet IEC62368-3 requirements as shown in Figure 2.

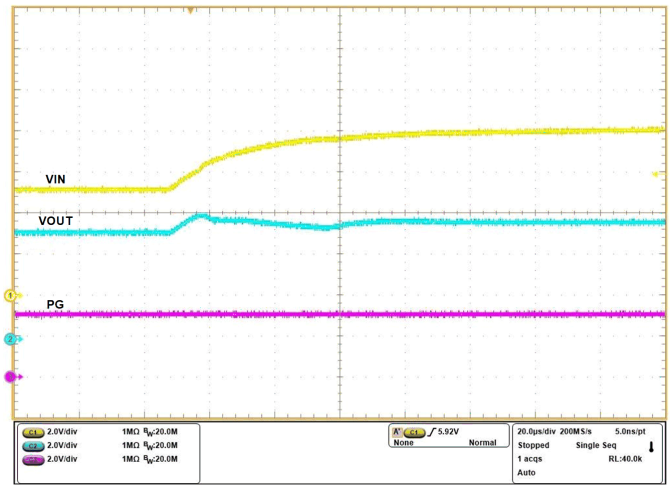

Figure 2. Output Overvoltage Clamp Response

Figure 3 shows a simplified application circuit. A TPS563202 buck converter generates a 5 V rail to be passed by the TPS259472 to the USB port. If a fault with the dc/dc converter circuit allows 12 V to be applied to the input of TPS259472, the overvoltage clamp (OVC) set by resistor to be 5.7 V, ensures the output voltage never exceeds 130% of its nominal value, meeting IEC62368-3.

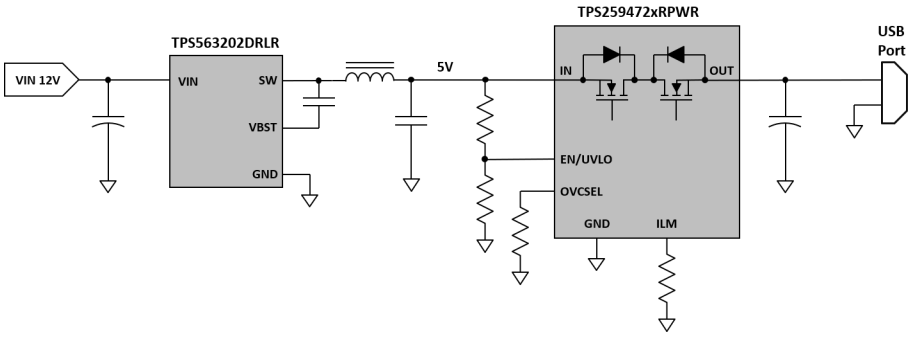

Figure 3. Simplified USB 2.0 and 3.1 Circuit with OVC to Meet IEC62368-3

The TPS25947x CB Test Certificate IEC62368-1 can be found in the technical documentation section of the TPS259472 product page.

IEC62368-3 is a system level certification standard and cannot be obtained at device level. However, TPS259472 has been tested successfully to meet the requirements for IEC62368-3. The full IEC62368-3 test report can only be shared under NDA. Please use the TI E2E™ design support forum to request this test report.

Additional Resources

- For details on selecting the right e-fuse, read the technical article *eFuses: Clamping and Cutoff and Auto Retry, Oh My!*
- Download the applications note *eFuse: Safety Certification and Why it Matters*
- Download the application brief *Fast Role Swap, Linear ORing with TPS25947 and LM73100 in USB Type-C Systems*

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Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265