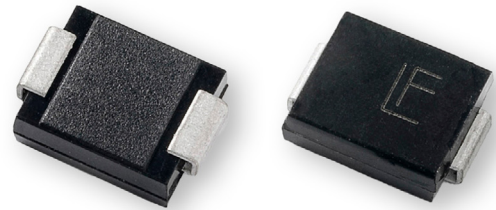


Increasing DC power line robustness with Foldback low clamping voltage TVS Diodes

Introduction

With the 5.0SMDJ-FB Series, Littelfuse introduces the latest advancement in cutting-edge protection technology. Engineered to deliver exceptional protection against overvoltage events in DC power lines, the Littelfuse Foldback technology enables designers to significantly increase the robustness of supply circuits without having to compromise on design volume. Foldback devices are especially well suited for protecting downstream components in applications like Power over Ethernet (PoE), Industrial DC Power Supplies and AI/Data centers.

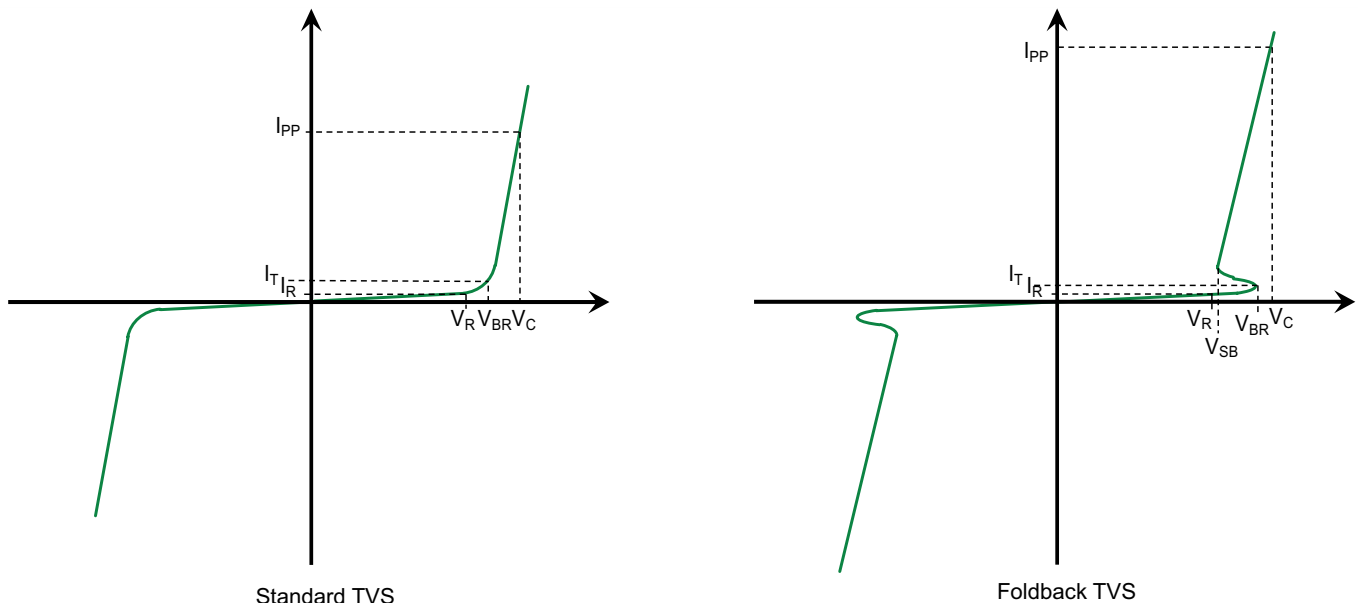
Figure 1. 5.0SMDJ-FB – series in DO-214AB – package



Foldback device characteristics

The 5.0SMDJ-FB Series are low clamping voltage TVS diodes designed with reverse standoff voltages V_R of 58, 60 and 64 V. These devices are designed to safeguard DC power lines from overvoltage events effectively. A qualitative comparison of output characteristics between the Foldback technology and standard TVS diodes is depicted in Figure 2. The Foldback devices allow a substantially higher surge current I_{PP} at similar clamping voltage V_C values for devices with identical reverse standoff voltage V_R . The minimum snapback-voltage V_{SB} remains always above V_R . This approach prevents a latch-up effect, which is especially relevant for protecting DC applications.

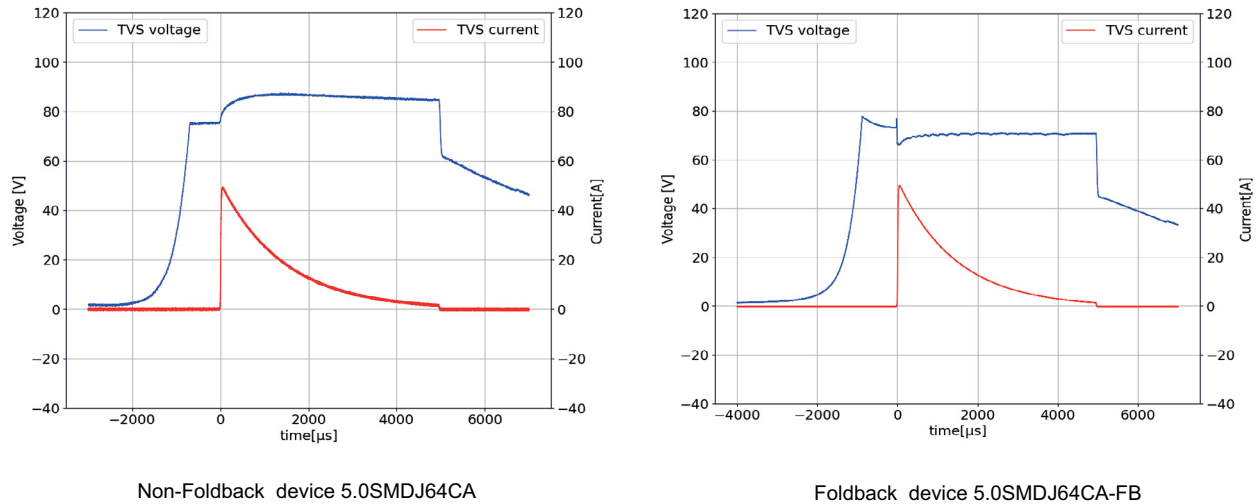
Figure 2. Static output characteristics comparison



Based on the static device characteristics, Figure 2 further clarifies the impact of the Littelfuse Foldback technology on the robustness of the protection circuit and on downstream components. The measurement of the Foldback device 5.0SMDJ64CA-FB compared to the standard device 5.0SMDJ64CA shows a significant reduction in the clamping voltage during a 10/1000 μ s surge pulse. For the measurement, the clamping voltage is reduced from 87.4 V for the standard device to 77.8 V for the Foldback device.

The reduction of clamping voltage allows for improving circuit ruggedness by using Foldback technology devices instead of standard TVS diodes. With a power rating of 5000 W, the 5.0SMDJ-FB Series is especially suitable for Electrostatic discharge (ESD), Electrical Fast Transient (EFT), and other overvoltage transients.

Figure 3. 10/1000 μ s surge test result comparison



Device selection

Available with reverse standoff voltages V_R of 58, 60, and 64 V in a DO-214AB (SMC) footprint, the newly released Foldback Series can be used as a drop-in replacement for the existing 5.0SMDJ Series devices. Depending on the application, these devices can improve circuit ruggedness or even reduce protection device count. Table 1 compares the Foldback devices with legacy devices. As referenced in the measurement and the static component characteristics, the Foldback technology can reduce clamping voltage by 11-15 %.

Table 1. Comparison of Foldback vs. Non-Foldback devices

| Part Number | Reverse Standoff Voltage V_R (V) | Minimum Snapback Voltage V_{SB} (V) | Breakdown Voltage V_{BR} (V) | | Maximum Clamping Voltage V_C @ I_{PP} (V) | Maximum Peak Pulse Current I_{PP} (A) | V_C Reduction |
|-----------------------|------------------------------------|---------------------------------------|--------------------------------|-------------|---|---|-----------------|
| | | | min | max | | | |
| 5.0SMDJ58CA | 58 | - | 64.4 | 71.2 | 93.6 | 53.5 | |
| 5.0SMDJ58CA-FB | 58 | 58 | 64.4 | 71.2 | 80.0 | 53.4 | -14.5 % |
| 5.0SMDJ60CA | 60 | - | 66.7 | 73.7 | 96.8 | 51.7 | |
| 5.0SMDJ60CA-FB | 60 | 60 | 66.7 | 73.7 | 82.2 | 51.6 | -15 % |
| 5.0SMDJ64CA | 64 | - | 71.1 | 78.6 | 103 | 48.6 | |
| 5.0SMDJ64CA-FB | 64 | 64 | 71.1 | 78.6 | 91.4 | 48.5 | -11 % |

Conclusion

The 5.0SMDJ-FB Series provides enhanced protection for sensitive electronics, offering superior performance and reliability through its advanced Foldback technology. This series ensures the safety and integrity of critical components in various applications, making it an ideal solution for Power over Ethernet (PoE), Industrial DC Power Supplies, and AI/Data centers. Its superior low clamping factor and high current capability further solidify its position as a robust and reliable choice for modern electronic systems.