Protect your boost converter

T A Babu - January 10, 2017

Boost converters are non-isolated DC-DC converters that step up voltage. In some applications, users expect protection against reverse polarity, short circuits, and other anomalous conditions. The basic PWM boost topology is shown in Figure 1.

![Figure 1 Basic boost-converter topology](image)

Boost converters are particularly susceptible to output shorts as there is a DC path from input to output. Usually a fuse, resettable or non-resettable, protects the system, but it is not always accurate or fast enough.

This Design Idea shows a way to safeguard a boost converter from short circuits and reverse polarity application.
The added circuitry comprises opto-coupler IC1, N-channel MOSFETs T1 & T2, and a few passive components. When power is switched on, current flows through F1, L1, D1, IC1’s LED, C1, and the intrinsic diode of T1. C1’s momentary displacement current allows IC1 to turn on T1 & T2.

As soon as the boosted voltage appears at the LED of IC1, its current path through C1 is taken over by ZD1. T1 & T2 remain on as long as there is enough output voltage to breakdown ZD1. The Zener diode is chosen so during a short-circuit – or perhaps even over-current – condition, it will not break down. R3 discharges C1 when there is no source power.

In this design, the MOSFETs provide reverse-polarity protection for free, and with much less voltage drop than a simple diode.

Also see:

- Add extra output to a boost converter
- Single transistor provides short-circuit protection

—*T.A. Babu* is a design consultant and author with a strong interest in lighting who has worked in Dubai and India.