Application Report
SLVA191A–May 2004–Revised February 2017

Load Disconnect for the TPS6510x

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ABSTRACT

Many boost converters have an external rectifier diode. The input voltage of the TPS6510x main boost converter is connected to the output voltage when the device is disabled. Due to the direct pass from the input to the output, the converter has no short-circuit protection. This application report describes how to use a PNP transistor and some passive components to disconnect the boost converter's input voltage from the output voltage (known as load disconnect) when the device is disabled as well as when under short-circuit conditions.

Trademarks

1 Description

Figure 1 shows a portion of the schematic for the TPS65100EVM that has been modified to include PNP transistor $Q_{(LD)}$, resistor $R_{(LD)}$, and capacitor $C_{(LD)}$, all of which form the load disconnect circuit.

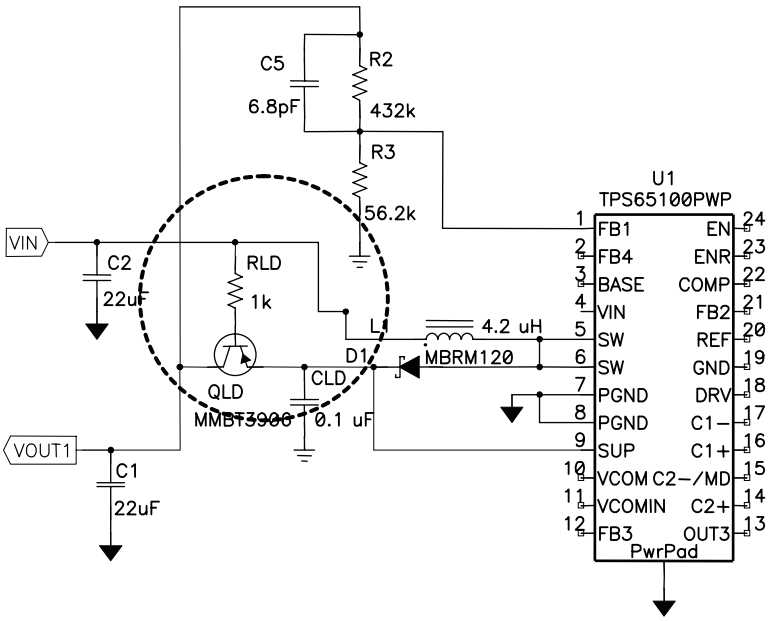

Figure 1. TPS65100 With Load Disconnect

The SUP is connected before $Q_{(LD)}$, but the feedback network and output capacitor are connected after $Q_{(LD)}$. This allows a regulated output voltage even with the use of the transistor $Q_{(LD)}$. Select $Q_{(LD)}$ to have a low saturation voltage ($V_{(SAT)}$) and high beta (B) in order to prevent degradation of efficiency. $C_{(LD)}$ is required to set a defined bias operation point for $Q_{(LD)}$, and should be between 0.1 µF and 1 µF. $R_{(LD)}$ should be sized according to the following equation:

$$R_{(LD)} \leq \frac{B_{(MIN)} \times (V_{(OUT1)} + V_{(SAT)}\,\text{min} - V_{IN}\,\text{max} - V_{(be)}\,\text{max})}{I_{OUT}\,\text{max}}$$

where $B_{(MIN)}$ is the minimum beta, $V_{(SAT)}$min min is the minimum saturation voltage, $V_{(be)}$max is the maximum base to emitter voltage of $Q_{(LD)}$ and I_{OUT}max is the desired short-circuit current limit. The selected I_{OUT}max should be at least higher than the maximum load current in the application to allow design margin for load transient.

Figure 2 shows the output voltage (CH1, set to 10 V), the output current (CH3, set to 100 mA) and the input current (CH4) before and after a short-circuit event.

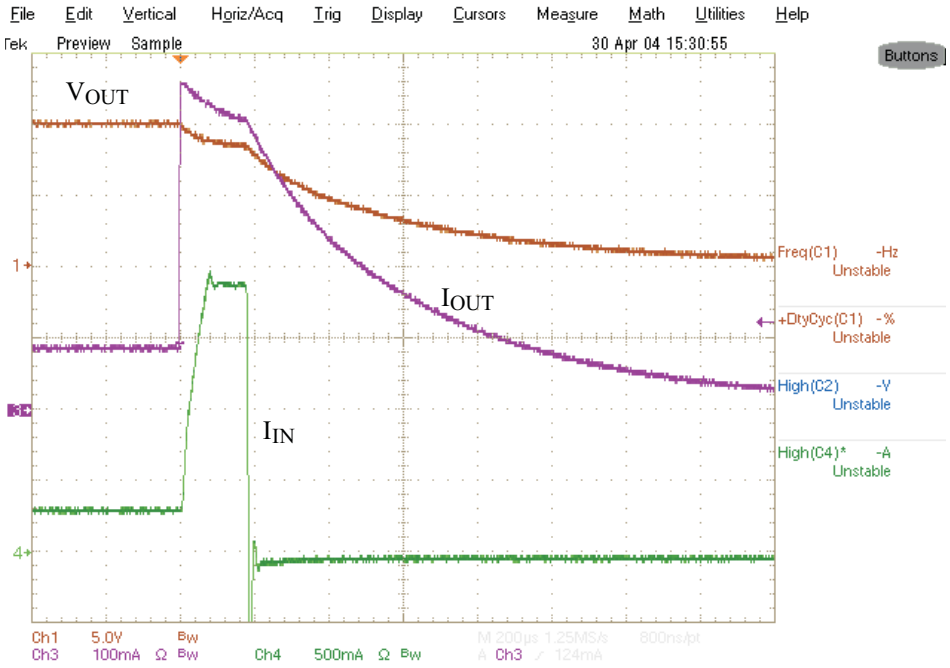

Figure 2. TPS65100 Before and After Short Circuit

The TPS6510x must be reenabled or the input voltage power cycled after a short-circuit event in order to reset the IC internal-protection circuitry and restart the device.

Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from Original (May 2004) to A Revision	Page
• Deleted references to TPS6514x throughout document.	1

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