

Design of UVLO for LM27313

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ABSTRACT

This application note describes a novel and economic design of an undervoltage lockout (UVLO) for LM27313. The UVLO is designed to prevent switching current from increasing beyond the maximum rated limit, hence, preventing the device from overheating.

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1 Introduction

The LM 27313 is a boost converter with a fixed switching frequency of 1.6 MHz. The design illustrated in [Figure 1](#) is for a mobile charging application. The charging is being performed with an output current of 500 mA.

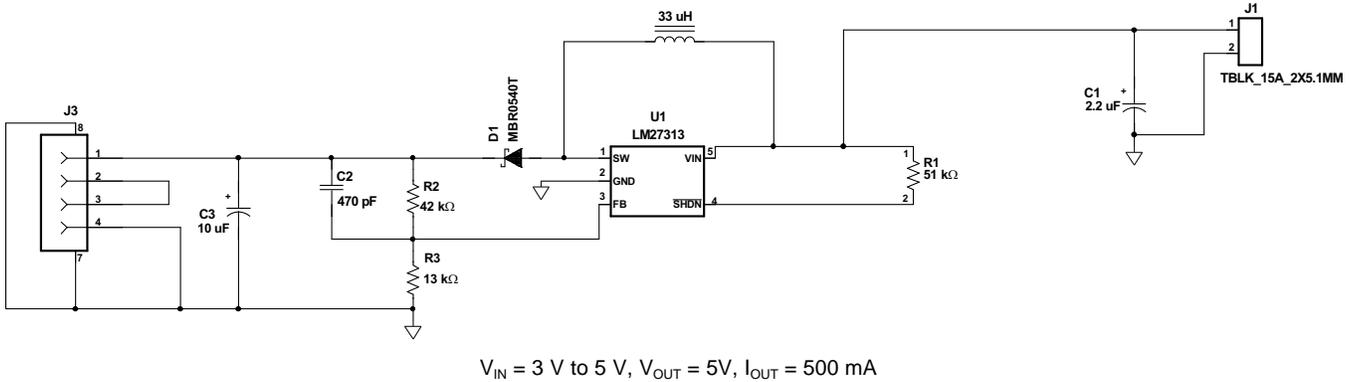


Figure 1. Initial Boost Converter Design

2 Need for Undervoltage Shutdown

Now observations on efficiency for variations in input voltages were made on this design and are listed in [Table 1](#).

Table 1. Design Efficiency

V_{IN}	I_{IN}	V_{OUT}	I_{OUT}	P_{IN}	P_{OUT}	Efficiency
2.989	0.99	4.799	0.398	2.95911	1.910002	64.546502
3.464	0.71	4.915	0.41	2.45944	2.01515	81.935319
3.766	0.62	4.922	0.411	2.33492	2.022942	86.6386
4.025	0.57	4.927	0.411	2.29425	2.024997	88.264008
4.234	0.54	4.931	0.411	2.28636	2.026641	88.640503

From the observations in [Table 1](#), it is evident that the input current increases above 700 mA for an input voltage below 3.5 V. Also, the efficiency of the same reduces rapidly to as low as 64.5% at $V_{IN} = 3\text{ V}$.

This increase in input current exceeds the current limit of the device (1.25 A – peak current) and causes the device to heat up, therefore, the IC must be shut down when the input voltage falls below 3.5 V. This can be achieved by utilizing the characteristics of the shutdown pin of LM27313.

3 Characteristics of the Shutdown Pin

The device's state of operation (ON/OFF) can be decided by the voltage at the shutdown pin (V_{SHDN}).

Table 2 shows its characteristics:

Table 2. Operating State at the Shutdown Pin

V_{SHDN}	Operating State	Units
≤ 0.5	OFF	Volts
≥ 1.5	ON	Volts

Hence, a circuit is to be designed such that the $V_{SHDN} \leq 0.5$ V for $V_{IN} \leq 3.5$ V and $V_{SHDN} > 1.5$ V for $V_{IN} > 3.5$ V.

4 UVLO Circuit

Figure 2 shows a UVLO circuit.

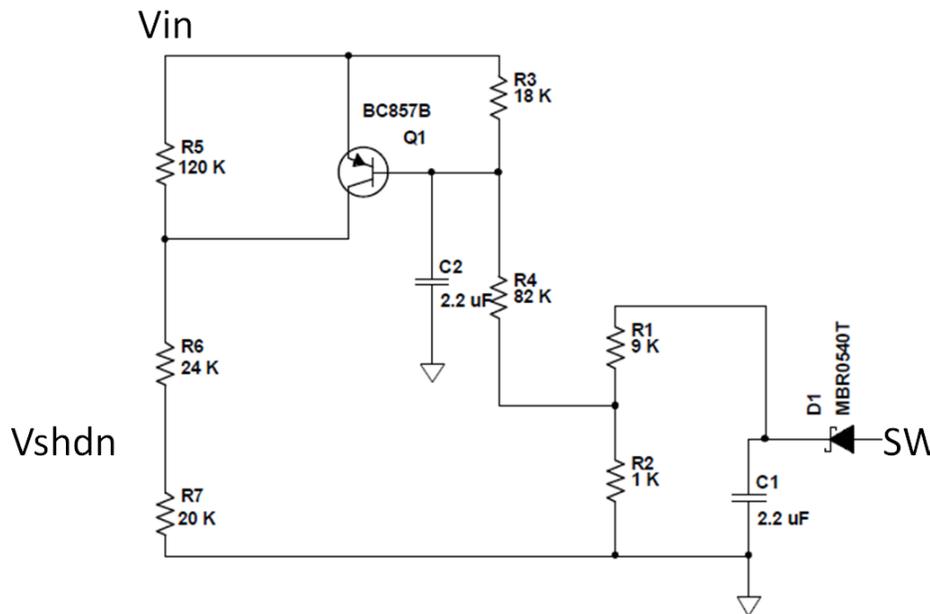


Figure 2. UVLO Circuit

4.1 Circuit Behavior

When the voltage across $V_{IN} \geq 3.6$ V, the transistor T1 turns on, hence bypassing resistor R5. This causes the voltage at the SHDN pin to go above 1.5 V, turning the IC on. But when $V_{IN} \leq 3.5$ V, the device turns OFF.

Revision History

Changes from Original (April 2014) to A Revision	Page
• Changed quality of image, improved position of values and units.	2
• Changed quality of image, improved position of values and units.	4
• Deleted TPS61241 and TPS61240 from the conclusion section	4
• Added LMR62421 and LM4510 to the conclusion section.....	4

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

Revision History

Changes from A Revision (April 2014) to B Revision	Page
• Changed <i>UVLO Circuit</i> image, was missing V_{in} and V_{shdn}	3
• Changed equation in third step of the <i>Design Procedure</i> section.....	4
• Changed equation in fourth step of the <i>Design Procedure</i> section.	4

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

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