

## **AN-1578 LM25575 Evaluation Board**

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### **1 Introduction**

The LM25575 evaluation board is designed to provide the design engineer with a fully functional power converter based on emulated current mode control to evaluate the LM25575 regulator IC. The evaluation board provides a 5V output with a 1.5A current capability. The ultra-wide input voltage ranges from 7V to 42V. The design operates at 300kHz, a good compromise between conversion efficiency and solution size. The printed circuit board consists of 2 layers of 2 ounce copper on FR4 material with a thickness of 0.06 inches. This application note contains the evaluation board schematic, Bill-of-Materials (BOM) and a quick setup procedure. Refer to the *LM25575/LM25575Q SIMPLE SWITCHER® 42V, 1.5A Step-Down Switching Regulator* ([SNVS479](#)) data sheet for complete circuit design information.

#### **1.1 Evaluation Board Performance**

The performance of the evaluation board is as follows:

Input Range: 7 to 42V

Output Voltage: 5V

Output Current: 0 to 1.5A

Frequency of Operation: 300 KHz

Board Size: 2.6 X 1 X 0.4 inches

Load Regulation: 1%

Line Regulation: 0.1%

Over Current Limiting



### 3.3 Powering Up

Using the shutdown pin provided will allow powering up the source supply with the current level set low. It is suggested that the load be kept low during the first power up. Set the current limit of the source supply to provide about 1.5 times the anticipated wattage of the load. As you remove the connection from the shutdown pin to ground, immediately check for 5 volts at the output.

A quick efficiency check is the best way to confirm that everything is operating properly. If something is amiss you can be reasonably sure that it will affect the efficiency adversely. Few parameters can be incorrect in a switching power supply without creating losses and potentially damaging heat.

### 3.4 Over Current Protection

The evaluation board is configured with over-current protection. The output current is limited to approximately 2.1A. The thermal stress is quite severe while in an overloaded condition, limit the duration of the overload and provide sufficient cooling (airflow).

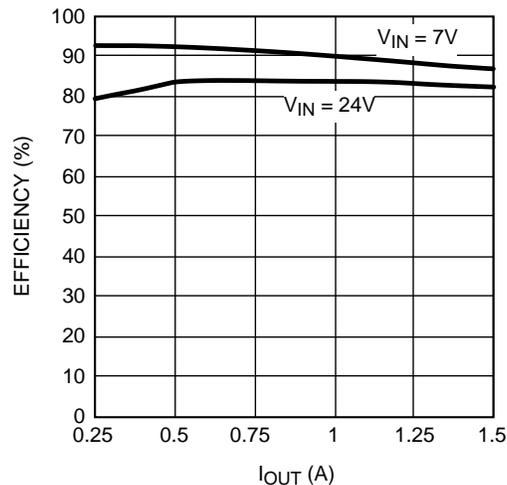
### 3.5 Synchronization

A SYNC pin has been provided on the evaluation board. This pin can be used to synchronize the regulator to an external clock or multiple evaluation boards can be synchronized together by connecting their SYNC pins together. Refer to the LM25575 data sheet ([SNVS479](#)) for complete information.

## 4 Performance Characteristics

### Efficiency Plots

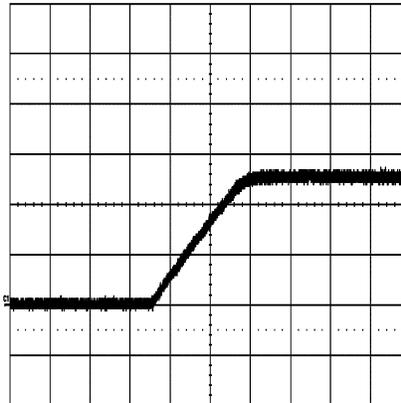
Figure 2 shows the conversion efficiency versus output current for several input voltage conditions.



**Figure 2. Conversion Efficiency vs Output Current**

### Turn-on Waveform

When applying power to the LM25575 evaluation board a certain soft-start sequence occurs. [Figure 3](#) shows the output voltage during a typical start-up sequence.

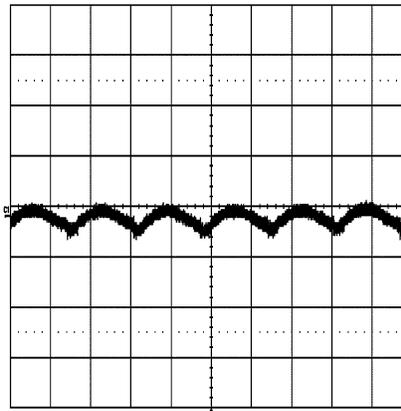


Conditions: Input Voltage = 36VDC, Output Current = 1A  
 Trace 1: Output Voltage Volts/div = 2V  
 Horizontal Resolution = 500  $\mu$ sec/div

**Figure 3. Output Voltage During Typical Startup**

### Output Ripple Waveform

[Figure 4](#) shows the output voltage ripple. This measurement was taken with a very short ground clip and 20MHz bandwidth limiting.



Conditions: Input Voltage = 36VDC Output Current = 1A Bandwidth Limit = 20 MHz  
 Trace 1: Output Ripple Voltage Volts/div = 50 mV  
 Horizontal Resolution = 2  $\mu$ sec/div

**Figure 4. Output Voltage Ripple**

## 5 Layout and Bill of Materials

The Bill of Materials is shown in [Table 1](#), including the manufacturer and part number.

**Table 1. 5V, 1.5A Demo Board Bill of Materials**

ITEM		PART NUMBER	DESCRIPTION	VALUE
C	1	C3225X7R2A105M	CAPACITOR, CER, TDK	1 $\mu$ , 100V
C	2	C3225X7R2A105M	CAPACITOR, CER, TDK	1 $\mu$ , 100V
C	3	C0805A471K1GAC	CAPACITOR, CER, KEMET	470p, 100V
C	4	C2012X7R2A103K	CAPACITOR, CER, TDK	0.01 $\mu$ , 100V
C	5	C2012X7R2A103K	CAPACITOR, CER, TDK	0.01 $\mu$ , 100V
C	6	OPEN	NOT USED	
C	7	C2012X7R2A223K	CAPACITOR, CER, TDK	0.022 $\mu$ , 100V
C	8	C2012X7R1C474M	CAPACITOR, CER, TDK	0.47 $\mu$ , 16V
C	9	C3225X7R1C106M	CAPACITOR, CER, TDK	10 $\mu$ , 16V
C	10	APXE6R3ARA121ME61G	CAPACITOR, AL, NIPPON	120 $\mu$ , 6.3V
C	11	C0805C331G1GAC	CAPACITOR, CER, KEMET	330p, 100V
C	12	OPEN	NOT USED	
D	1	CMSH3-60	DIODE, 60V, CENTRAL	
L	1	DR125-470	INDUCTOR, COOPER	47 $\mu$ H
R	1	OPEN	NOT USED	
R	2	OPEN	NOT USED	
R	3	CRCW08052102F	RESISTOR	21k $\Omega$
R	4	CRCW08054992F	RESISTOR	49.9k $\Omega$
R	5	CRCW08055111F	RESISTOR	5.11k $\Omega$
R	6	CRCW08051651F	RESISTOR	1.65k $\Omega$
R	7	CRCW2512100J	RESISTOR	10, 1W
U	1	LM25575	REGULATOR, Texas Instruments	

6 PCB Layout

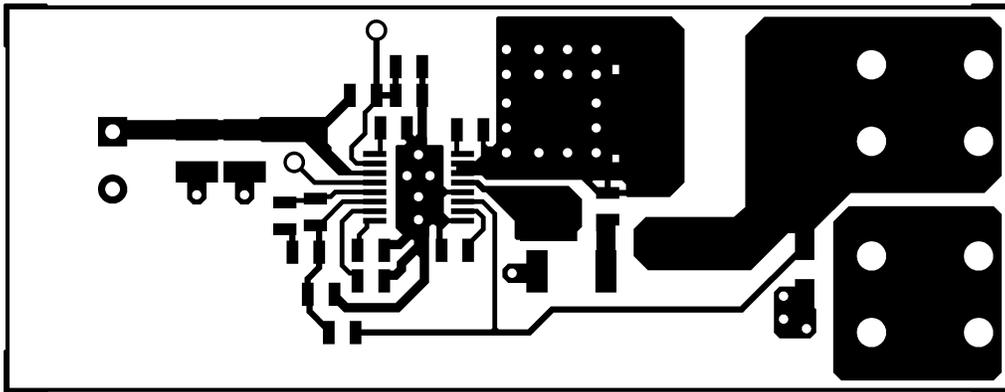


Figure 5. Component Side

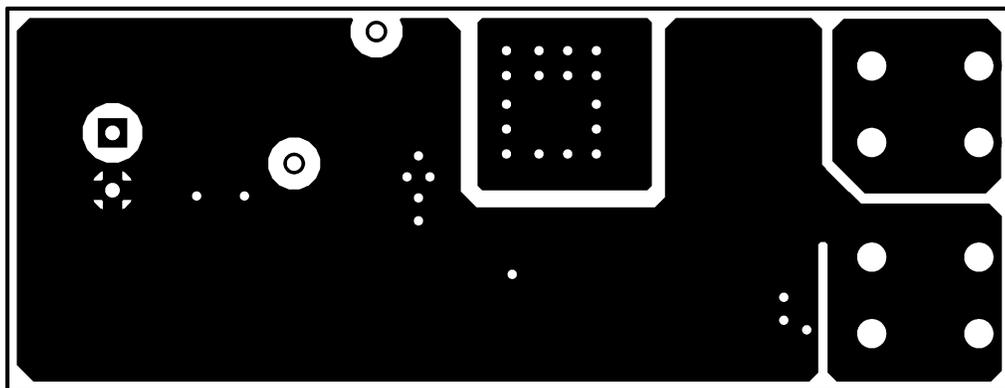


Figure 6. Solder Side

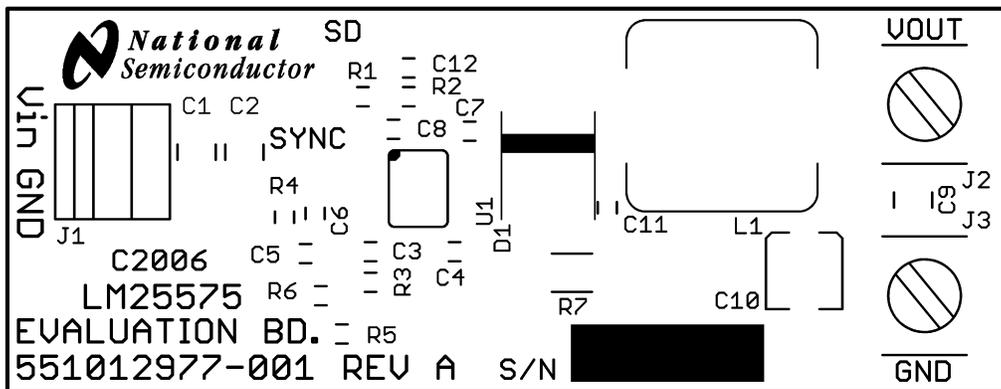


Figure 7. Silkscreen

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