LM27342 Demonstration Board

National Semiconductor
Application Note 1929
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Introduction

The LM27342 demonstration board is designed to provide the power supply design engineer with a fully functional regulator design which can be synchronized to an external clock between 1000 kHz and 2350 kHz. The evaluation board provides a 3.3V output with a 2A current capability. The wide input voltage ranges from 5V to 20V. Without an external synchronization signal, the design operates at 2000 kHz reducing the solution size and keeping switching noise out of the AM radio band. The printed circuit board consists of 4 layers of copper on FR4 material. There is a ground plane on the internal layer directly beneath the LM27342, and a ground plane on the bottom layer. The LM27342 is thermally tied to the ground planes by thermal vias directly underneath the device. The second internal layer is tied half to V_{IN} and half to V_{OUT}. This application note contains the evaluation board schematic, a quick setup procedure, and a Bill-of-Materials (BOM). Refer to the LM27342 datasheet for complete circuit design information.

The performance of the evaluation board is as follows:

Input Range: 5 to 20V

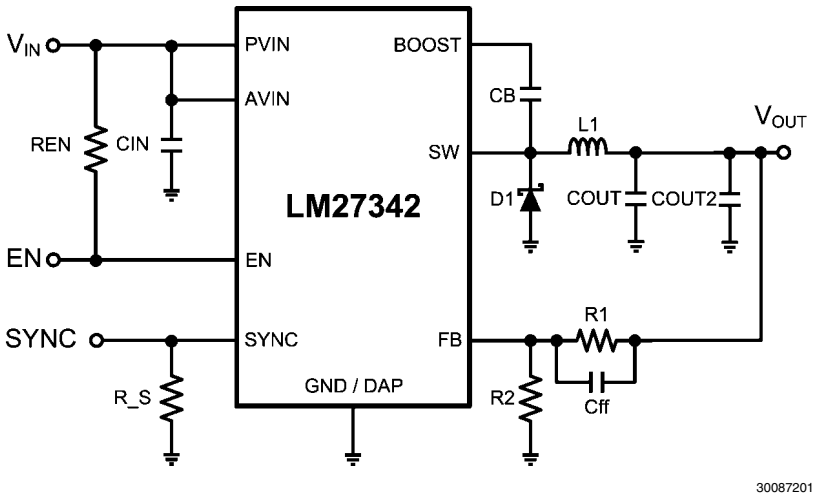
Output Voltage: 3.3V

Output Current: 0 to 2A

Frequency of Operation: 1000 kHz - 2350 kHz

Board Size: 1.1 X 1.3 inches

Evaluation Board Schematic



Powering and Loading Considerations

Read this entire page prior to attempting to power the evaluation board.

QUICK START PROCEDURE

Step 1: Set the bench power supply current limit to 2A. Set the power supply voltage to 12V. Turn off the power supply output. Connect the power supply to the LM27342 demo board. Positive connection to V_{IN} and negative connection to GND.

Step 2: Connect a load, as high as 2A, to the V_{OUT} terminal. Positive connection to V_{OUT} and negative connection to GND.

Step 3: Connect a signal generator to provide a synchronization signal to the SYNC terminal. Positive connection to SYNC and negative connection to GND.

Step 4: The EN pin should be left open for normal operation.

Step 5: Turn on the bench power supply with no load applied to the LM27342. V_{OUT} should be in regulation with a nominal 3.3V output.

Step 6: Slowly increase the load while monitoring the output voltage, V_{OUT} should remain in regulation with a nominal 3.3V output as the load is increased up to 2 Amps.

Step 7: Slowly sweep the input voltage from 5 to 20V and back to 12V, V_{OUT} should remain in regulation with a nominal 3.3V output.

Step 8: Turn on the signal generator, and synchronize the LM27342 to a 3.3V square wave at 1 MHz. V_{OUT} should remain in regulation with a nominal 3.3V output. Monitor SYNC and SW to observe the synchronization behavior.

STARTING UP

The EN pin is tied to V_{IN} to simplify start-up. The pull-up resistor allows the power supply design engineer to toggle EN independently, if desired, and observe the start-up behavior of the LM27342.

OVER CURRENT PROTECTION

The evaluation board is configured with over-current protection. The inductor current is limited to 4.0A (max).

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 LM27342 datasheet for complete information

ADJUSTING THE OUTPUT VOLTAGE

The output voltage is set using the following equation where R2 is connected between the FB pin and GND, and R1 is connected between V_{OUT} and FB.

$$R1 = \left(\frac{V_{OUT}}{V_{REF}} - 1 \right) \times R2$$

Adjusting the output voltage will affect the performance of the LM27342. In addition, output capacitors might not be rated for the new output voltage. Refer to the LM27342 datasheet for more information.

Performance Characteristics

EFFICIENCY PLOTS

Figure 1 shows the conversion efficiency versus output current for several input voltage conditions.

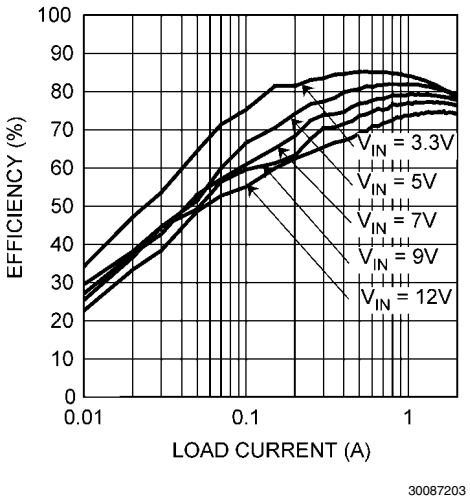
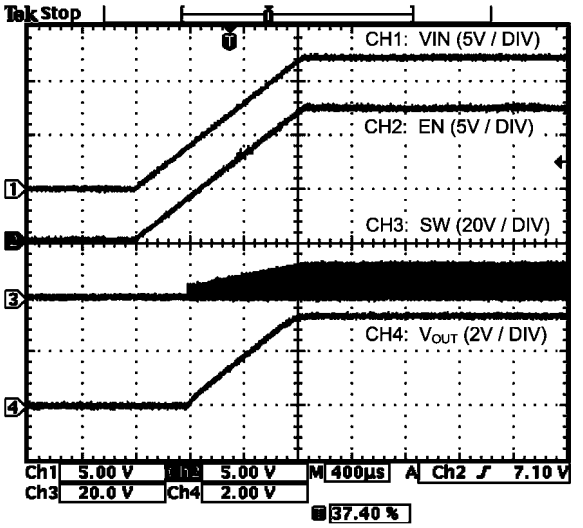


FIGURE 1.

TURN-ON WAVEFORM

When applying power to the LM27342 evaluation board a soft-start sequence occurs. Figure 2 shows the output voltage during a typical start-up sequence.



Output Current = 1A

FIGURE 2.

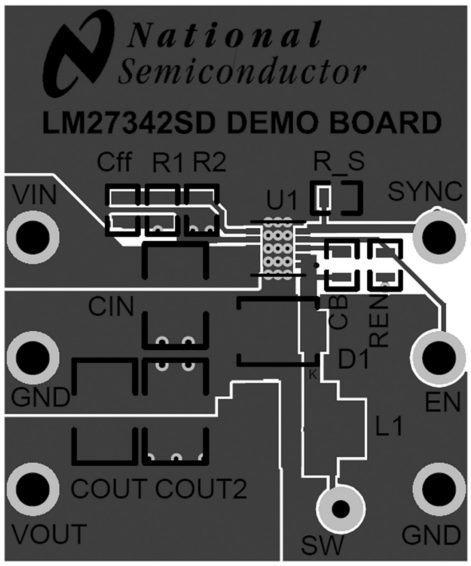
Layout and Bill of Materials

The Bill of Materials is shown below, including the manufacturer and part number.

Bill of Materials

Part Name	Part ID	Part Value	Part Number	Manufacturer
Buck Regulator	U1	2A Buck Regulator	LM27342	National Semiconductor
C_{IN}	CIN	10 µF	TMK325B7106MM-T	Taiyo Yuden
C_{BOOST}	CB	0.1 µF	C0603C104K8RACTU	Kemet
C_{OUT}	COUT	22 µF	GRM32ER71A226KE20L	Murata
C_{OUT2}	COUT2	22 µF	GRM32ER71A226KE20L	Murata
Catch Diode	D1	Schottky Diode Vf = 0.32V	CMS06	Toshiba
Inductor	L1	2.7 µH	CDRH5D18BHHPNP-2R7M	Sumida
Feedback Resistor	R1	430 Ω	MCR03EZPFX4300	Rohm
Feedback Resistor	R2	187 Ω	MCR03EZPFX1870	Rohm
Pull-up Resistor	REN	4.7 kΩ	MCR03EZPFX4701	Rohm
Pull-down Resistor	R_S	4.7 kΩ	MCR03EZPFX4701	Rohm
Connectors	VIN, GND, GND, VOUT, EN, SYNC	Turret	160-2043-02-01-00	Cambion
Test Point	SW	Miniature Test Point	5000	Keystone

PCB Layout



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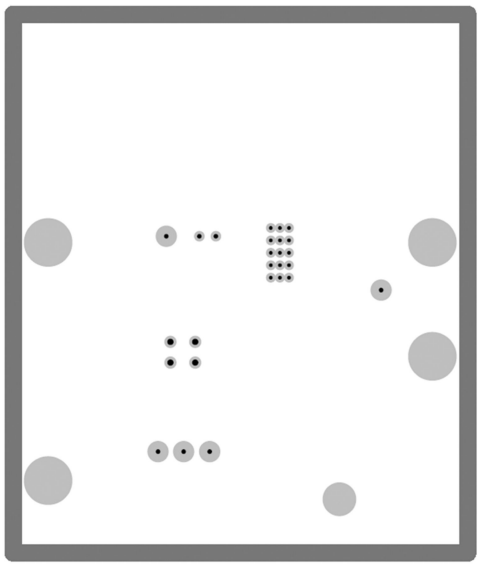
Top Layer and Overlay



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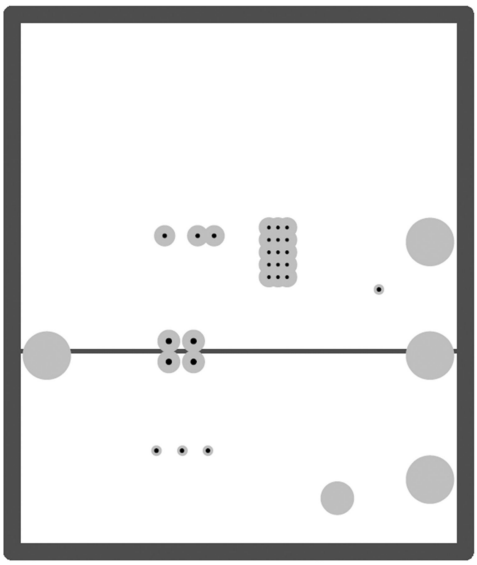
Internal Layer 1



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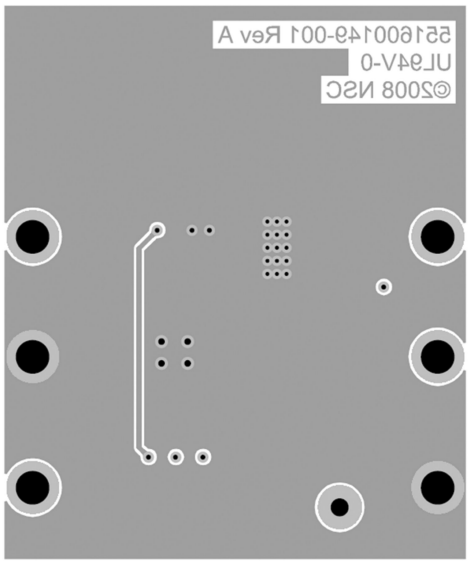
Internal Layer 2



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Bottom Layer

Notes

Notes

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