# AN-1929 LM27342 Demonstration Board

## 1 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 (PCB) consists of four 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 report contains the evaluation board schematic, a quick setup procedure, and a Bill-of-Materials (BOM). For complete circuit design information, see the *LM27341/LM27342/LM27341Q/LM27342Q 2 MHz 1.5A/2A Wide Input Range Step-Down DCDC Regulator with Frequency Synchronization* (SNVS497) data sheet.

The performance of the evaluation board is as follows:

Input Range: 5 to 20V

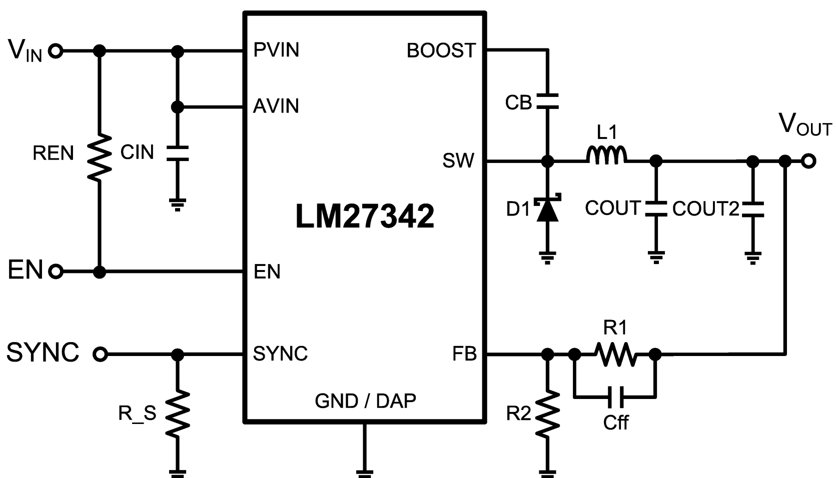
Output Voltage: 3.3V

Output Current: 0 to 2A

Frequency of Operation: 1000 kHz - 2350 kHz

Board Size: 1.1 X 1.3 inches

## 2 Evaluation Board Schematic




## 3 Powering and Loading Considerations

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

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### *3.1 Quick Start Procedure*

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.
2. Connect a load, as high as 2A, to the $V_{OUT}$ terminal. Positive connection to $V_{OUT}$ and negative connection to GND.
3. Connect a signal generator to provide a synchronization signal to the SYNC terminal. Positive connection to SYNC and negative connection to GND.
4. The EN pin should be left open for normal operation.
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.
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
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.
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.

#### 3.1.1 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.

### *3.2 Over Current Protection*

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

### *3.3 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

### *3.4 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.

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

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.

## 4 Performance Characteristics

### Efficiency Plots

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

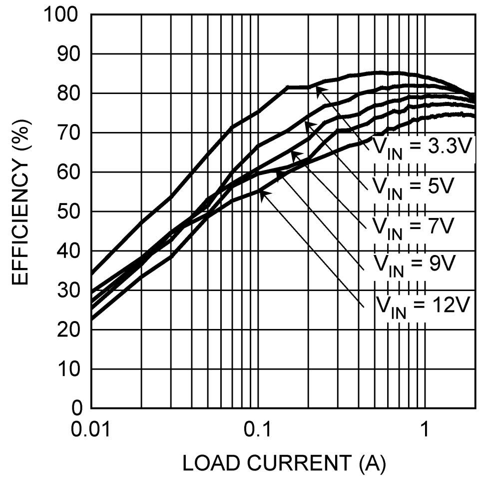
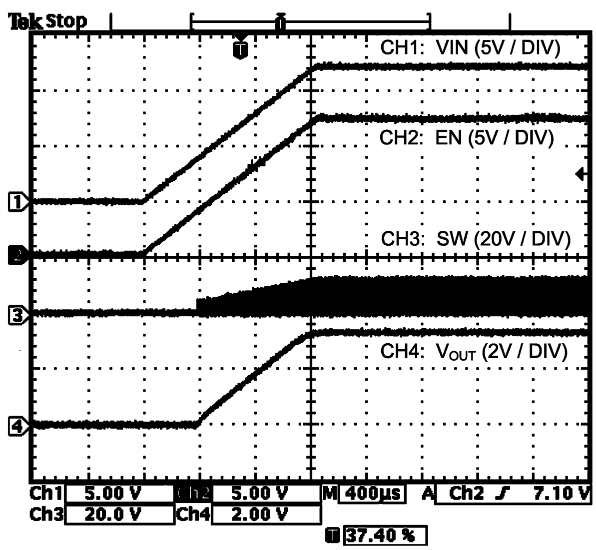



**Figure 1. Conversion Efficiency Versus Output Current**

### 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. Output Voltage During a Typical Start-Up Sequence**

## 5 Layout and Bill of Materials

The Bill of Materials is shown in Table 1, including the manufacturer and part number.

**Table 1. Bill of Materials**

| Part Name | Part ID | Part Value | Part Number | Manufacturer |
|---|---|---|---|---|
| Buck Regulator | U1 | 2A Buck Regulator | LM27342 | Texas Instruments |
| $C_{IN}$ | 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 |

## 6 PCB Layout

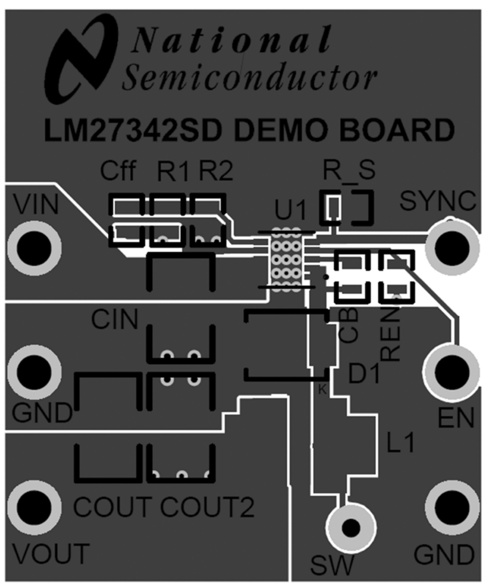



**Figure 3. Top Layer and Overlay**

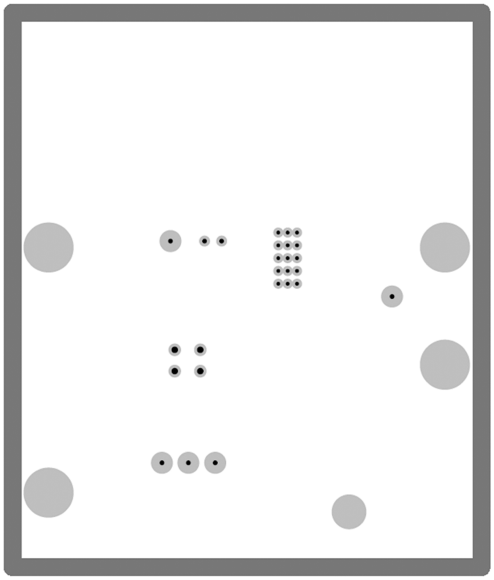


**Figure 4. Internal Layer 1**

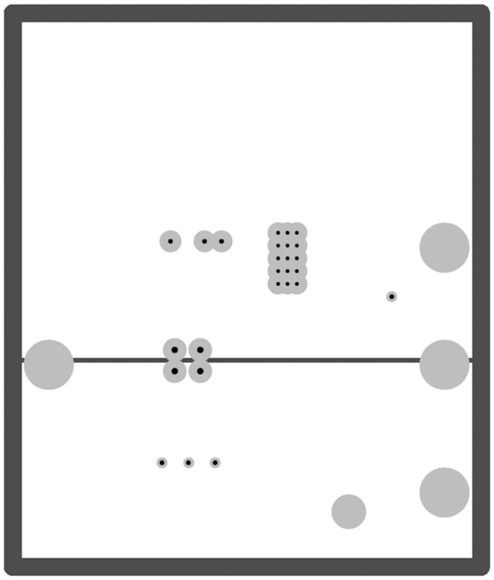


**Figure 5. Internal Layer 2**

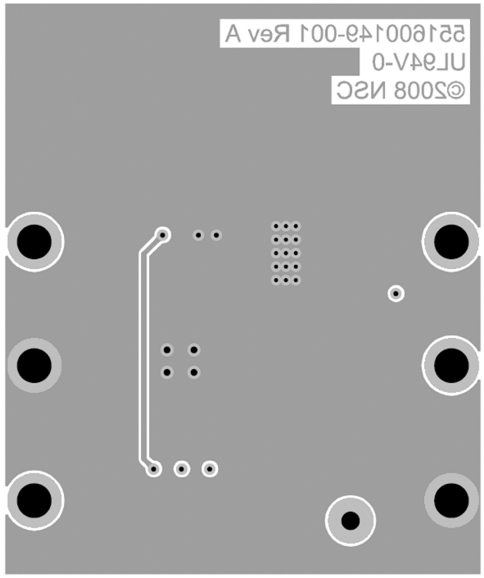



**Figure 6. Bottom Layer**

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