

User's Guide

LM26400Y Step-Down Converter Evaluation Module User's Guide



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1 Introduction

The LM26400Y demonstration board was designed to provide two 2A outputs at 1.2V and 2.5V respectively. It uses the HTSSOP package option of the LM26400Y for easier probing. The design emphasizes on the compactness of the LM26400Y PCB layout and is thermally optimized. The total solution size is about 20mm by 30mm. The board supports the conversion from an input voltage ranging from 5V to 20V down to output voltages of 1.2V and 2.5V. With the availability of a separate 5V rail and a couple of small bootstrap diodes, the board also supports an input voltage down to 3.3V with 2A output currents. The EN pins are pulled up to VIN by default for easy evaluation but can also be easily controlled by external logic.

The board also has two small C_{FF} capacitors (C12 and C13) installed for improved load step response and elimination of output voltage overshoot after a short-circuit release.

The board's specifications are:

Input Voltage: 5V to 20V

Maximum load current: 2A/output

Peak Current Limit: $\approx 3A$ at 25°C

Nominal Switching Frequency: 520 kHz

Output Voltages: 1.2V and 2.5V

Minimum load current: 0A

Measured Efficiency: 83% ($V_{IN} = 5V$, $I_{OUT2} = 2A$)

Size: 2 in. x 2 in.

2 Powering Up The Board

Since the EN pins are directly tied to the input voltage, starting up the board is a single-step procedure. Simply connect a voltage rail between 5V and 20V to the VIN and GND terminals and there should be 1.2V and 2.5V output at the corresponding terminals. Certain bench-top power supplies upon powering up may shoot up to their maximum output voltages momentarily before settling to the programmed value. If their maximum voltage is above 22V, it can damage the LM26400Y demonstration board. In this case, either connect the board after the input power supply is powered up, or use the current limit knob of the power supply to bring up the input voltage.

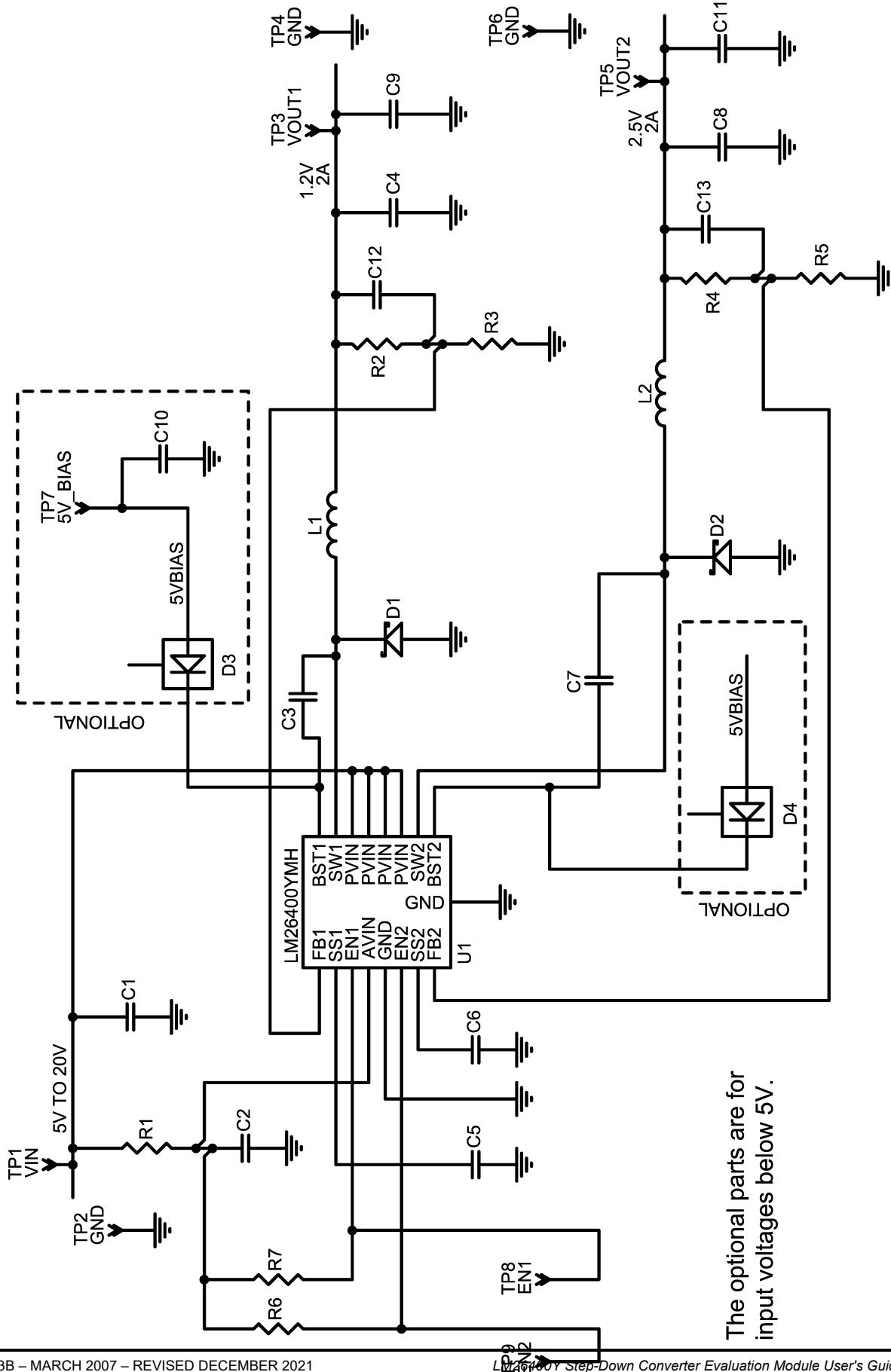
The linear soft-start ramps for the two output voltages should last about 1ms and 2ms. Load can be applied prior to power-up. If no load is applied, the two channels will operate in pulse skipping mode or discontinuous conduction mode. If an output is shorted either before or after start-up, removal of the short-circuit condition should bring the corresponding output back to normal voltage.

If additional output capacitors are desired, C8 and C9 on the back of the board are reserved for that purpose.

If it is desired to control the start-up and shutdown timing, connect the logic signals to the EN1 and/or EN2 pads on the back of the board. Make sure the voltages on the EN pads are never higher than VIN. If only a soft-start slope needs to be adjusted, simply change the corresponding SS capacitor (C5 or C6).

To operate between 3.3V and 5V of input voltage, populate D3 and D4 (on the back of the board) each with a SOT-23 Schottky diode such as the BAT54 and apply a 5V supply to the "5V_Bias" pad on the back. Do not exceed 6V on the 5V bias. The LM26400Y device itself can work with an input voltage as low as 3V. The demonstration board when using an external bootstrap bias can operate down to 3.3V under room temperature. This extra 0.3V requirement is due to the large duty cycle in the 2.5V channel being too close to the maximum allowed.

3 Board Schematic

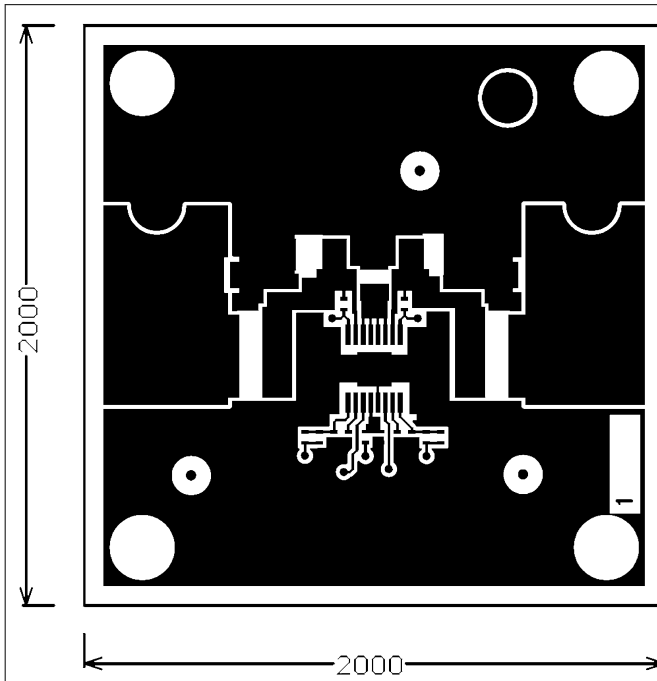


The optional parts are for input voltages below 5V.

Table 3-1. Bill of Materials

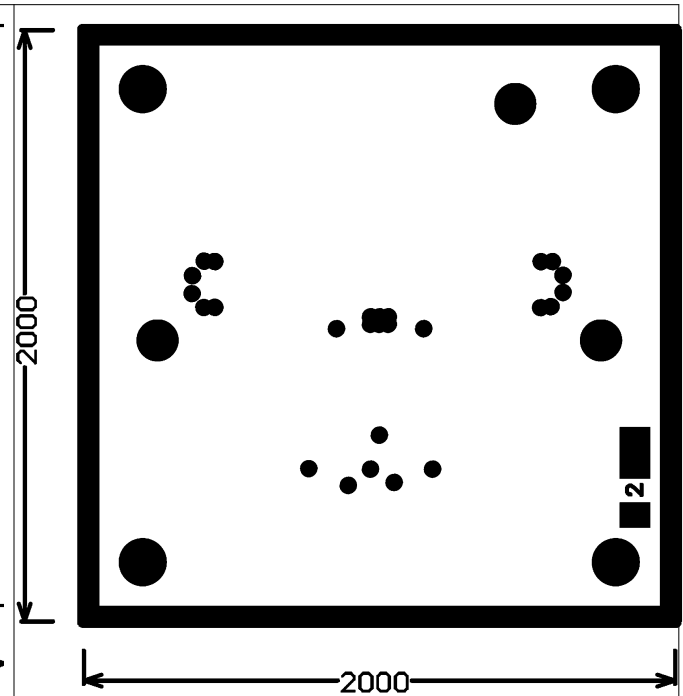
| Item | Designator | Description | Manufacturer | Part No. | Qty. |
|------|------------------|--|--------------|-------------------|------|
| 1 | C5, C6, C12, C13 | 0.022 μ F, 6.3V, X5R, 10%, 0402 | Kemet | C0402C223K9PACTU | 4 |
| 2 | C2, C3, C7 | 0.1 μ F, 25V, X5R, 10%, 0402 | Taiyo Yuden | TMK105BJ104KV-F | 3 |
| 3 | C1 | 10 μ F, 25V, X5R, 20%, 1210 | Taiyo Yuden | TMK325BJ106MM-T | 1 |
| 4 | C11 | 47 μ F, 6.3V, X5R, 20%, 1210 | Taiyo Yuden | JMK325BJ476MM-T | 1 |
| 5 | C4 | 100 μ F, 6.3V, X5R, 20%, 1210 | Taiyo Yuden | JMK325BJ107MM-T | 1 |
| 6 | D1, D2 | 2A, 30V, SMB | IR | 20BQ030TRPBF | 2 |
| 7 | L1 | 5 μ H, 2.2A, 23m Ω , 7x7x2.8mm ³ | Sumida | CDRH6D26NP-5R0NC | 1 |
| 8 | L2 | 8.7 μ H, 2.2A, 25m Ω , 7x7x4mm ³ | Sumida | CDRH6D38NP-8R7NC | 1 |
| 9 | R1 | 4.7 Ω , 1%, 0402 | Vishay | CRCW04024R70FNED | 1 |
| 10 | R2, R3, R5 | 5.9k Ω , 1%, 0402 | Vishay | CRCW040259R0FKED | 3 |
| 11 | R4, R6, R7 | 18.7k Ω , 1%, 0402 | Vishay | CRCW0402187RFKED | 3 |
| 12 | TP1-TP6 | 0.094" Diameter Solder Terminal | Cambion | 160-1026-02-01-00 | 6 |
| 13 | U1 | Dual 2A, 20V, 500kHz PWM Switcher, HTSSOP-16 | TI | LM26400 | 1 |

4 PCB Layout



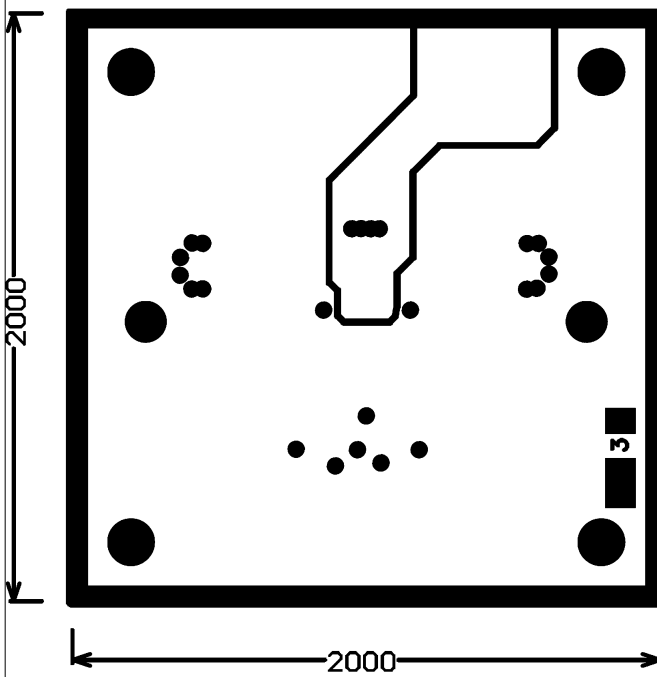
880013055-003 rev A

Figure 4-1. Top Copper



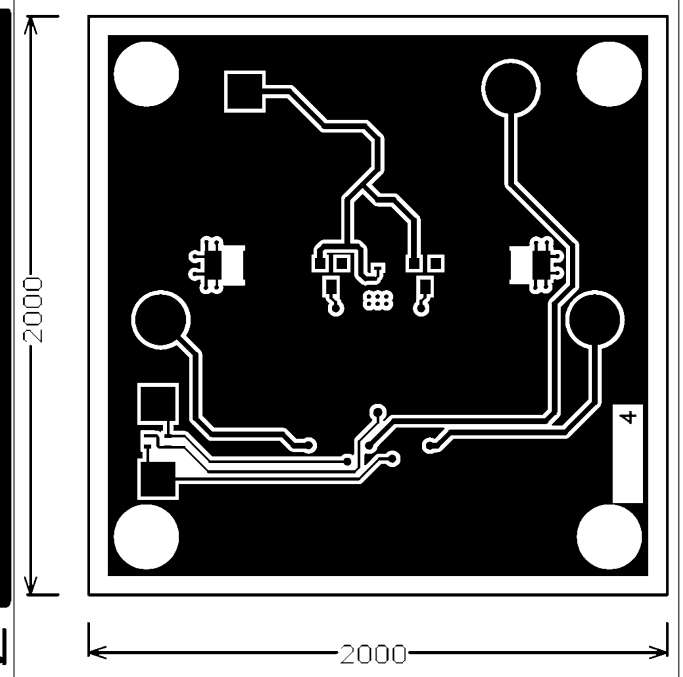
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Figure 4-2. Ground Plane



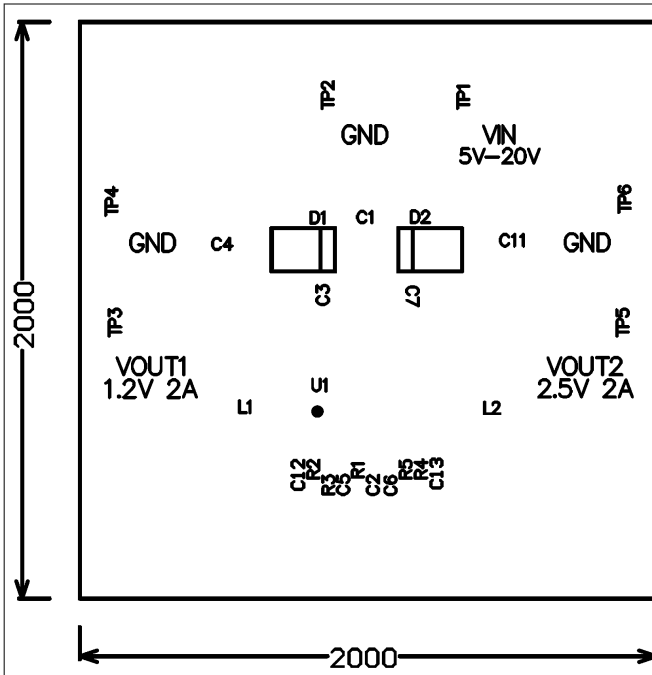
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Figure 4-3. Power Plane



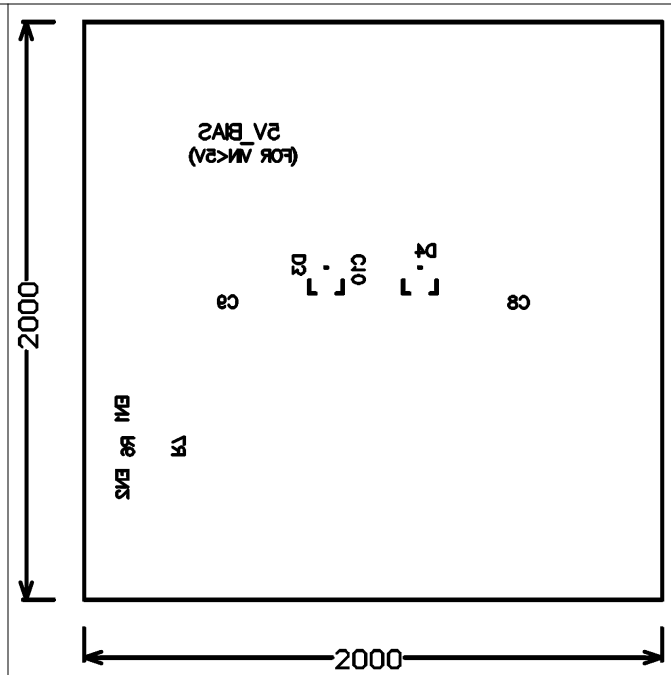
880013055-003 rev A

Figure 4-4. Bottom Copper



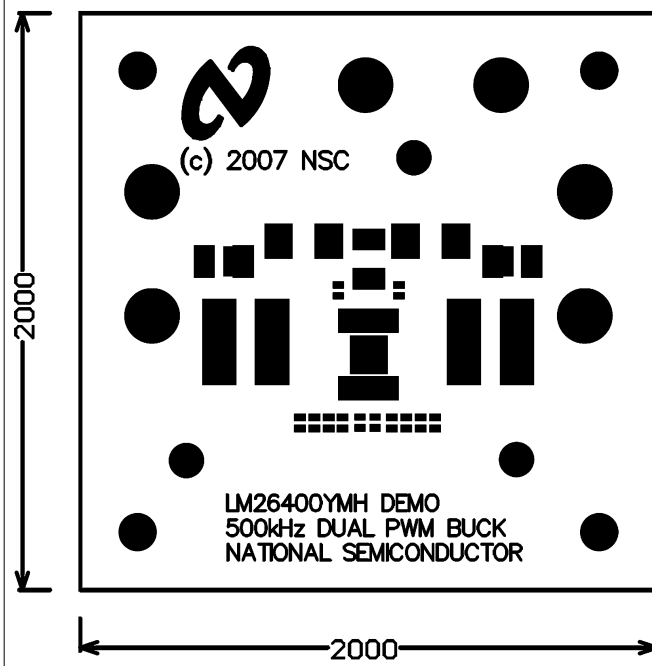
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Figure 4-5. Top Silkscreen



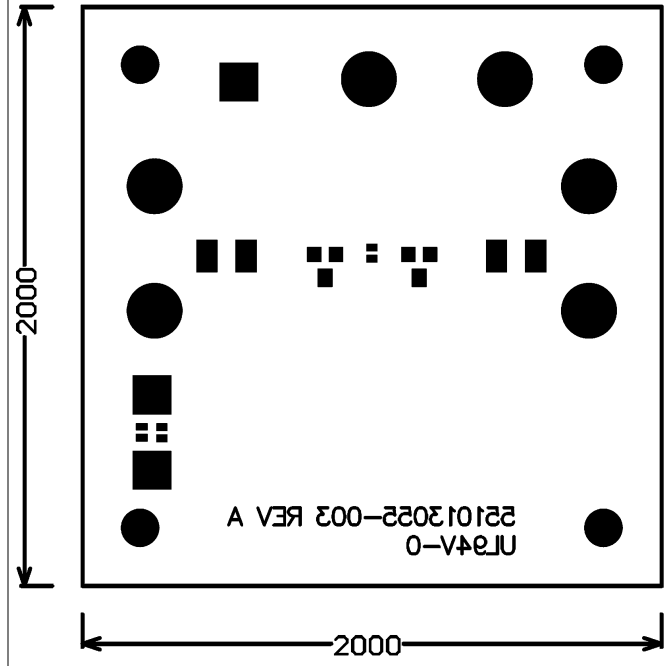
880013055-003 rev A

Figure 4-6. Bottom Silkscreen



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Figure 4-7. Top Soldermask



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Figure 4-8. Bottom Soldermask

5 Typical Performance Characteristics

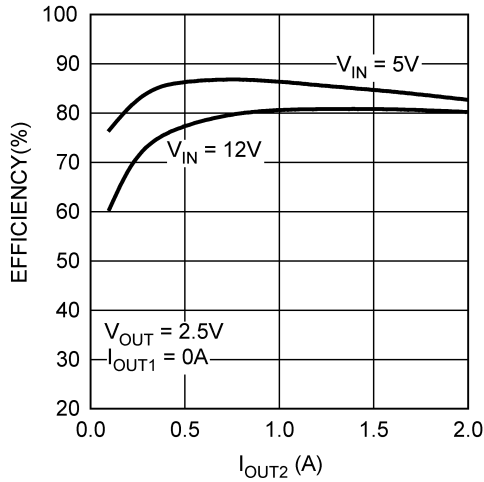


Figure 5-1. Efficiency

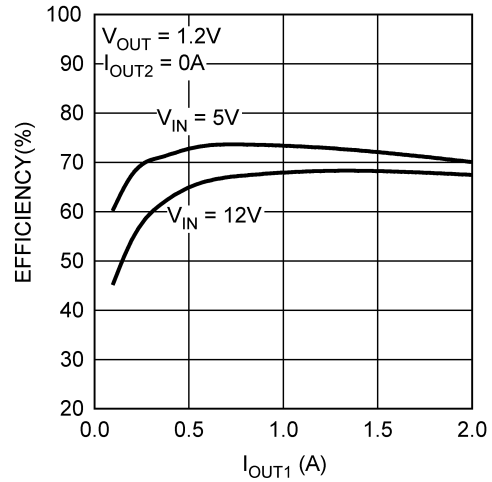


Figure 5-2. Efficiency

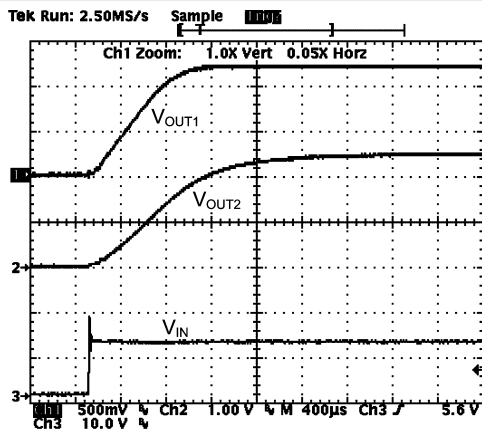


Figure 5-3. Start-up

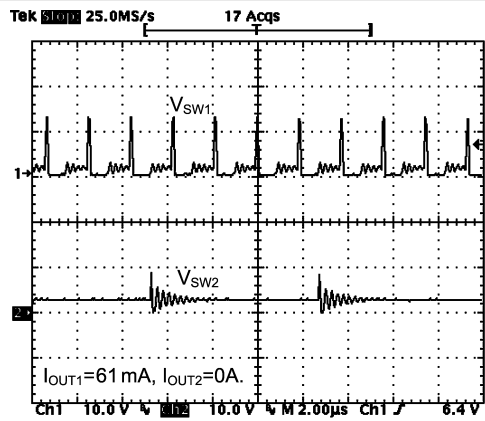


Figure 5-4. Steady State (Ch1 = DCM, Ch2 = Pulse Skipping)

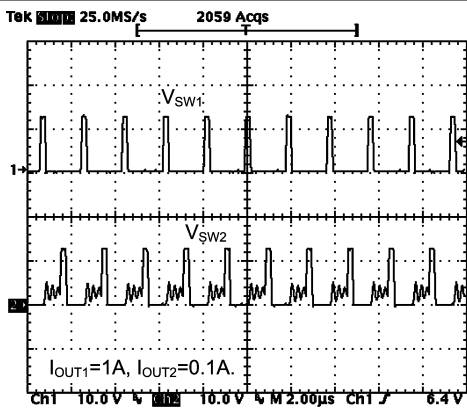


Figure 5-5. Steady State (Ch1 = CCM, Ch2 = DCM)

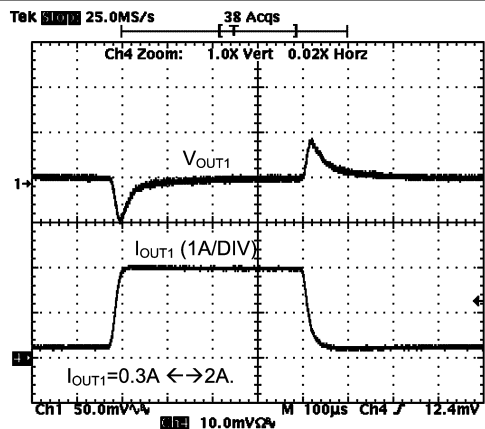


Figure 5-6. Load Step Response (Slew Rate = 0.25A/ μ s)

6 Revision History

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

| Changes from Revision A (April 2013) to Revision B (December 2021) | Page |
|--|-------------------|
| • Updated the numbering format for tables, figures, and cross-references throughout the document. | 2 |
| • Updated the user's guide title..... | 2 |

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