

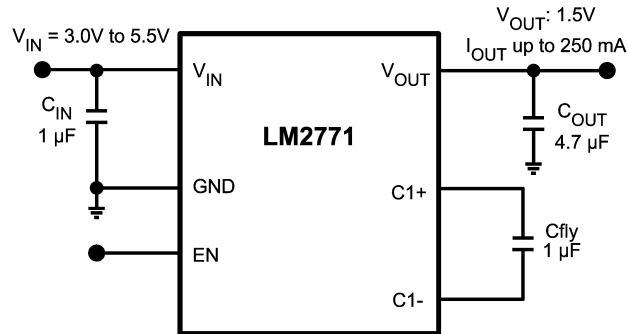
LM2771 Evaluation Board

National Semiconductor
Application Note 1547
November 2006



LM2771 Evaluation Board

Schematic



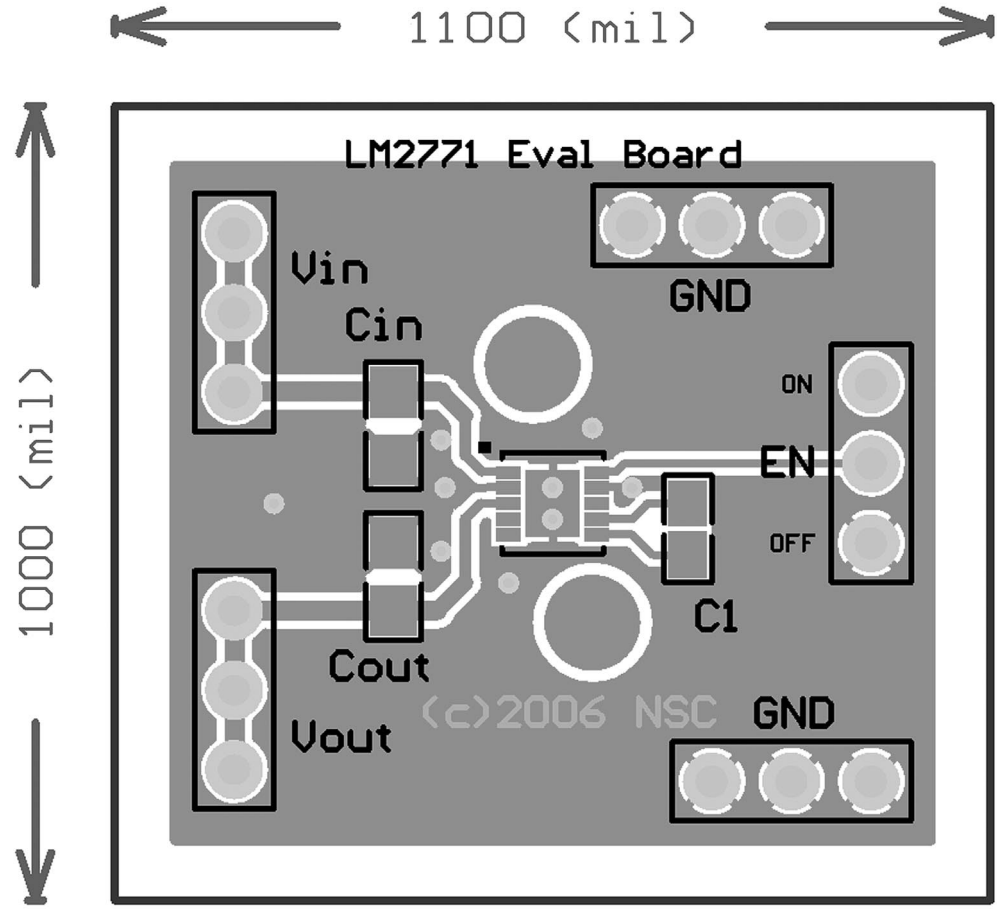
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Bill of Materials

| Component Symbol | Value | Package [U.S. (Metric)] | Dimensions (mm) | Temperature Characteristic | Manufacturer | Part # |
|------------------|---------------------------|-------------------------|-----------------|----------------------------|--------------|----------------|
| LM2771 | -- | LLP-10 Non-Pullback | 3.0 x 3.0 x 0.8 | -- | National | LM2771SDX |
| C_{IN} | $1\ \mu\text{F}$, 10V | 0402 (1005) | 1 x 0.5 x 0.6 | X5R | TDK | C1005X5R1A105K |
| C_{OUT} | $4.7\ \mu\text{F}$, 6.3V | 0603 (1608) | 1.6 x 0.8 x 0.8 | X5R | TDK | C1608X5R0J475K |
| C_1 | $1\ \mu\text{F}$, 10V | 0402 (1005) | 1 x 0.5 x 0.6 | X5R | TDK | C1005X5R1A105K |

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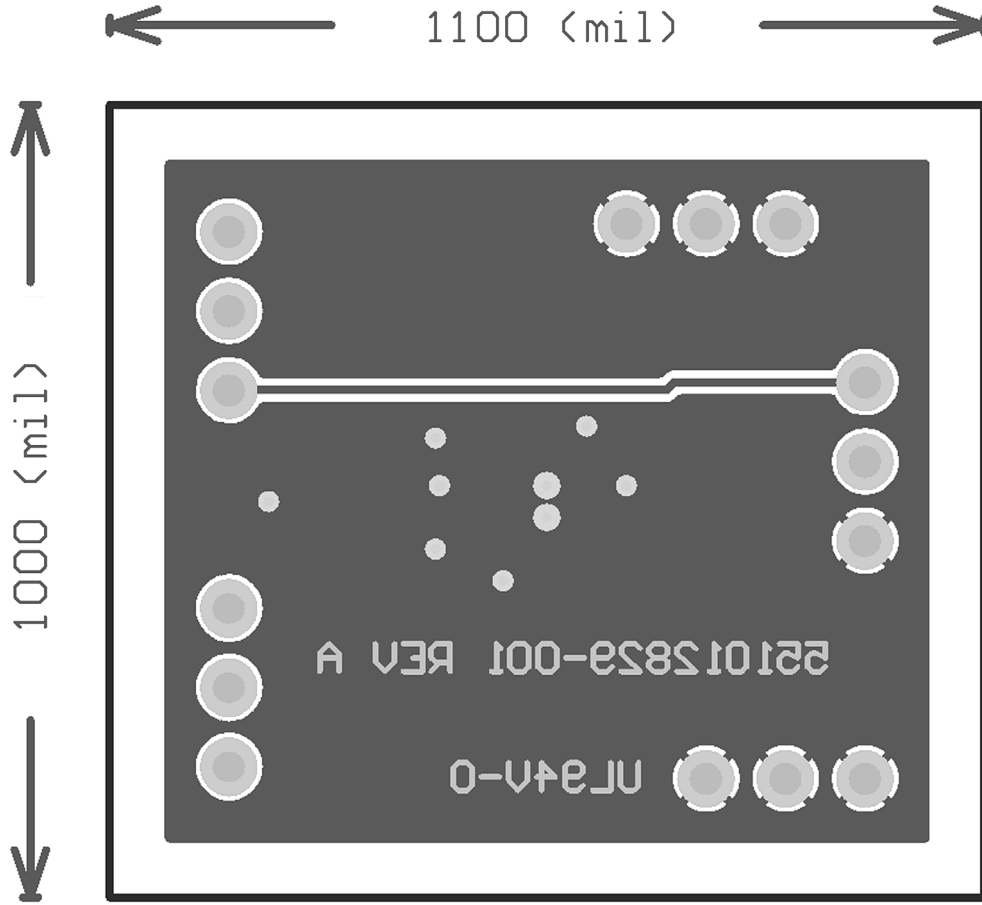
LM2771 Evaluation Board Layout



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FIGURE 1. Top Layer

LM2771 Evaluation Board Layout (Continued)



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FIGURE 2. Bottom Layer (top view, unmirrored)

Board Operation

BASIC CONNECTIONS

To operate the LM2771 evaluation board, connect a supply voltage (2.7V-5.5V) between board connectors Vin and GND. Connecting the EN header's center pin to ON position (V_{IN}) enables the device, and connecting it to OFF position (GND) disables the device.

CIRCUIT DESCRIPTION

The core of the LM2771 is a two-phase charge pump controlled by an internally generated non-overlapping clock. The charge pump operates by using an external flying capacitor, C1, to transfer charge from the input to the output. At input voltages below 3.5V (typ.) the LM2771 operates in a "pass mode", with the input current being equal to the load current. At input voltages above 3.5V (typ.) the part utilizes a gain of $\frac{1}{2}$, resulting in an input current equal to half the load current.

The two phases of the switched capacitor switching cycle will be referred to as the "charge phase" and the "discharge phase". During the charge phase, the flying capacitor is charged by the input supply. After half of the switching cycle [$t = 1/(2 \times F_{SW})$], the LM2771 switches to the discharge

phase. In this configuration, the charge that was stored on the flying capacitor in the charge phase is transferred to the output.

The LM2771 uses fixed frequency pre-regulation to regulate the output voltage to 1.5V during moderate to high load currents. The input and output connections of the flying capacitor is made with internal MOS switches. Pre-regulation limits the gate drive of the MOS switch connected between the voltage input and the flying capacitor. Controlling the on resistance of this switch limits the amount of charge transferred into and out of the flying capacitor during the charge and discharge phases, and in turn helps to keep the output ripple very low.

When output currents are low (<30mA typ.), the LM2771 automatically switches to a low-ripple Pulse Frequency Modulation (PFM) form of regulation. In PFM mode, the flying capacitor stays in the discharge phase until the output voltage drops below a predetermined trip point. When this occurs, the flying capacitor switches back to the charge phase. After being charged, the flying capacitor repeats the process of staying in the discharge phase and switching to the charge phase when necessary.

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