

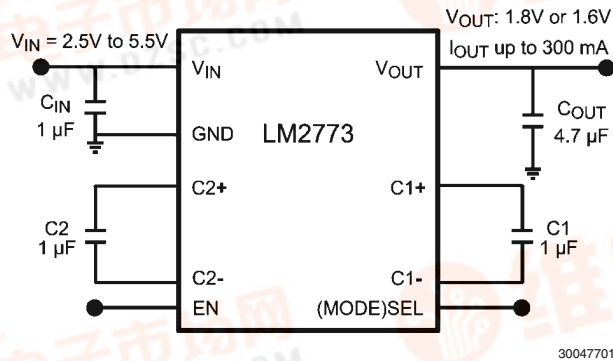
LM2773 Evaluation Board

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National Semiconductor
Application Note 1769
Karl Schlosstein
June 2, 2008



Schematic

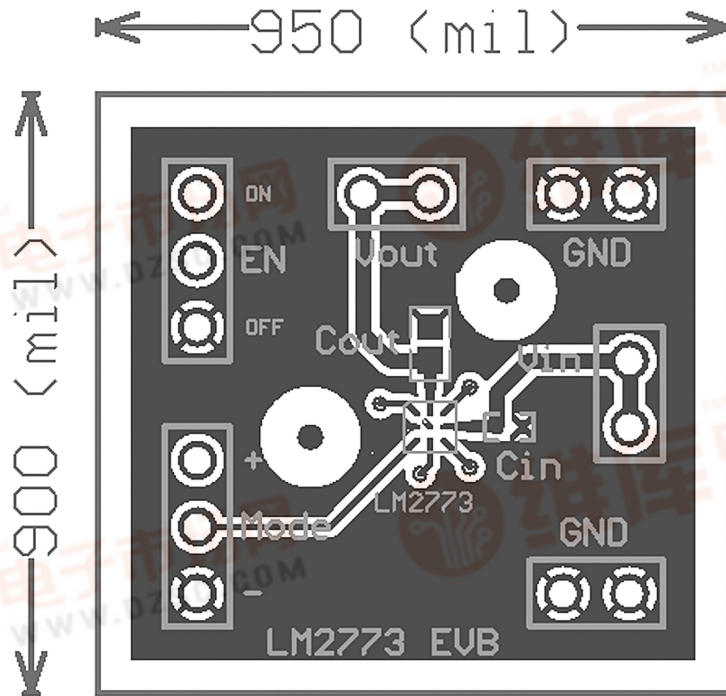


Bill of Materials

Component Symbol	Value	Package [U.S. (Metric)]	Dimensions (mm)	Temperature Characteristic	Manufacturer	Part #
LM2773	--	µSMD-9	1.511 x 1.511 x 0.6	--	National	LM2773TL
C _{IN}	1µF, 10V	0402 (1005)	1 x 0.5 x 0.6	X5R	TDK	C1005X5R1A105K
C _{OUT}	4.7µF, 6.3V	0603 (1608)	1.6 x 0.8 x 0.8	X5R	TDK	C1608X5R0J475K
C ₁ , C ₂	1µF, 10V	0402 (1005)	1 x 0.5 x 0.6	X5R	TDK	C1005X5R1A105K

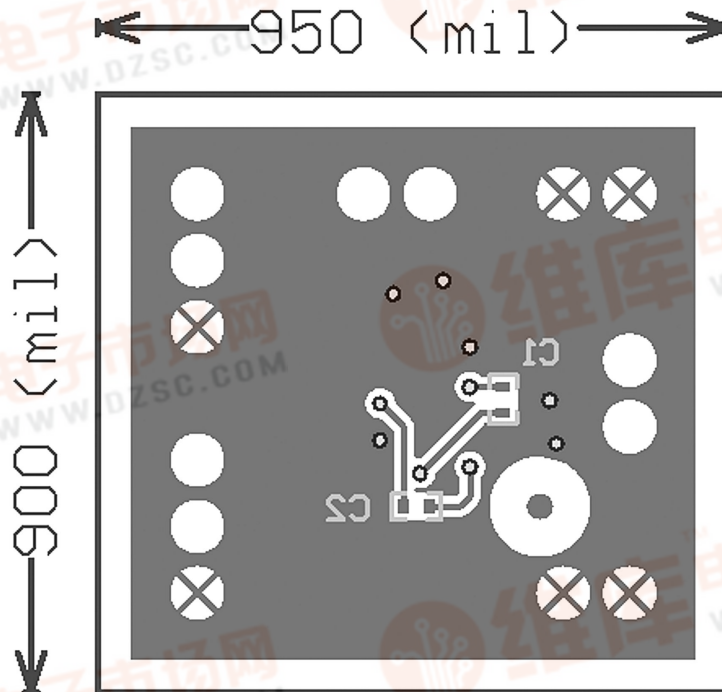


LM2773 Evaluation Board Layout

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30047702

FIGURE 1. Top Layer



30047703

FIGURE 2. Bottom Layer (top view, unmirrored)

Board Operation

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BASIC CONNECTIONS

To operate the LM2773 evaluation board, connect a supply voltage (2.7V-5.5V) to the 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. Connecting the Mode (SEL) header's center pin to "+" (Vin) selects the 1.6V output voltage mode and connecting the center pin to "-" (GND) selects the 1.8V output voltage mode.

CIRCUIT DESCRIPTION

The core of the LM2773 is a two-phase charge pump controlled by an internally generated non-overlapping clock. The charge pump operates by using external flying capacitors (C_1 , C_2) to transfer charge from the input to the output. At input voltages at or below 3.5V (typ.) for 1.8V mode or 3.3V (typ.) for 1.6V mode, the LM2773 operates in a 1x Gain, with the input current being equal to the load current. At input voltages above 3.5V (typ.) or 3.3V (typ.) for the respective input voltage mode selected, the part utilizes a gain of 2/3x with the input current equal to 2/3 the load current.

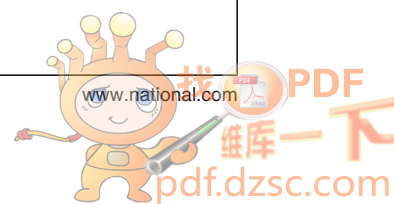
The two phases of the switched capacitor switching cycle will be referred to as the "charge phase" and the "discharge phase". During the charge phase, flying capacitors are charged by the input supply. After half of the switching cycle

[$t = 1/(2 \times F_{SW})$], the LM2773 switches to the discharge phase. In this configuration, the charge that was stored on the flying capacitors in the charge phase is transferred to the output.

The LM2773 uses fixed frequency pre-regulation to regulate the output voltage to 1.8V or 1.6V (depending on voltage mode selected) during moderate to high load currents. The input and output connections of the flying capacitors are made with internal MOS switches. Pre-regulation limits the gate drive of the MOS switch connected between the voltage input and the flying capacitors. 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 (<40mA typ.), the LM2773 automatically switches to a low-ripple Pulse Frequency Modulation (PFM) form of regulation. In PFM mode, the flying capacitors stay in the discharge phase until the output voltage drops below a predetermined trip point. When this occurs, the flying capacitors switch back to the charge phase. After being charged, the flying capacitors repeat the process of staying in the discharge phase and switching to the charge phase when necessary.

The LM2773 utilizes spread spectrum operation to distribute the peak radiated energy of the device over a wider frequency band, reducing electromagnetic interference (EMI). Spread spectrum is used during all modes of operation for the LM2773.



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Notes

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