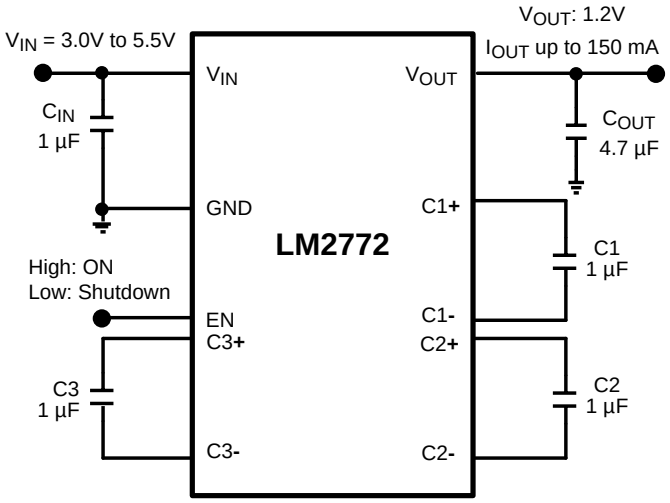
AN-1714 LM2772 Evaluation Board

1 Schematic



2 LM2772 Evaluation Board Layout

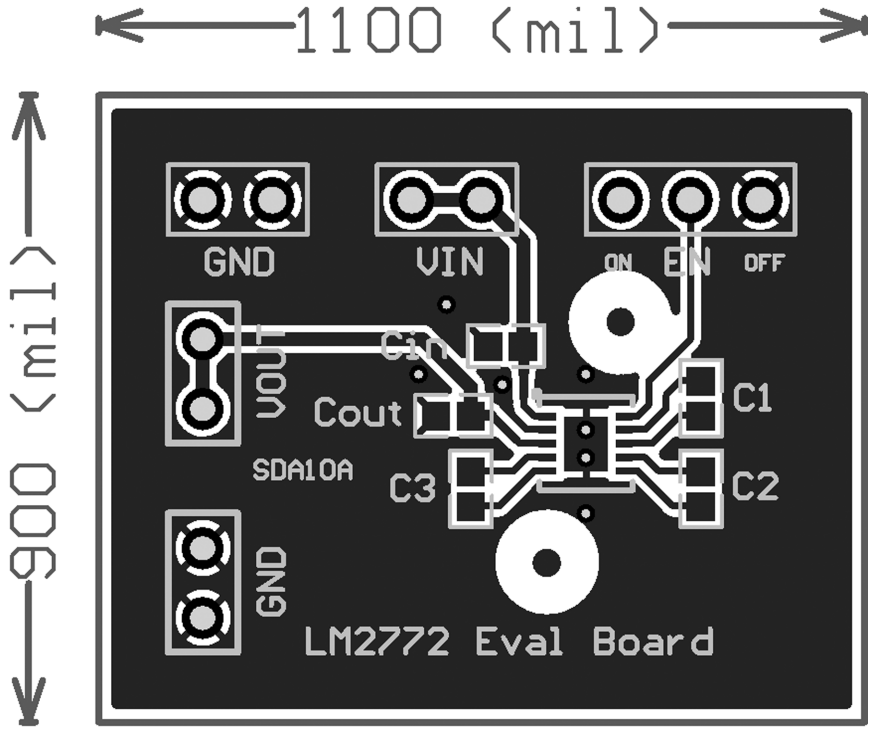


Figure 1. Top Layer

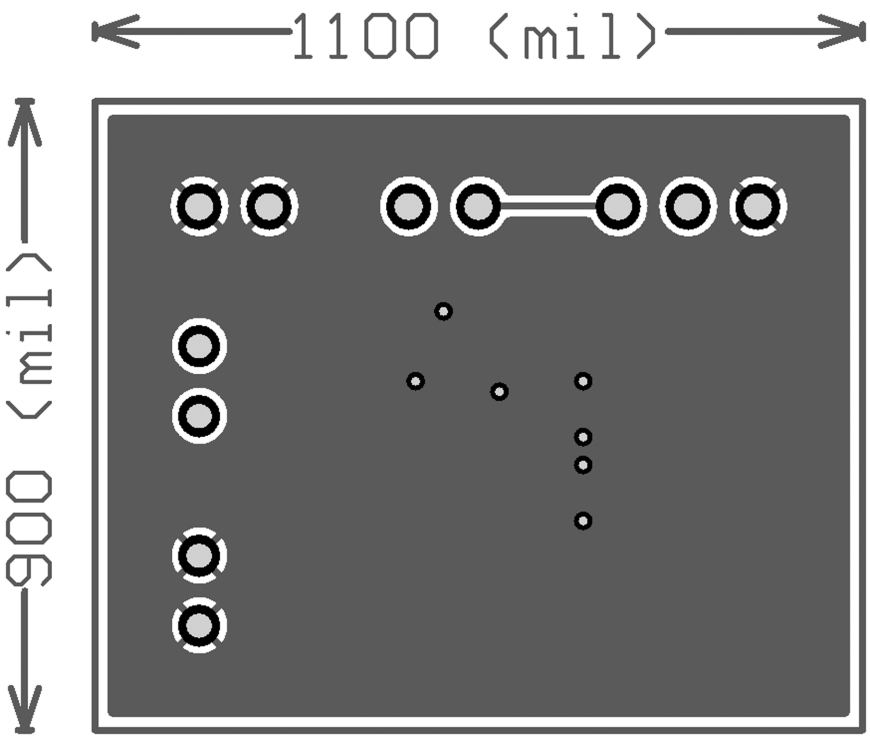


Figure 2. Bottom Layer (top view, unmirrored)

3 Bill of Materials (BOM)

Table 1. Bill of Materials (BOM)

Component Symbol	Value	Package [U.S. (Metric)]	Dimensions (mm)	Temperature Characteristic	Manufacturer	Part No
LM2772	--	WSON-10 Non-Pullback	3.0 x 3.0 x 0.8	--	Texas Instruments	LM2772
C_{IN}	1µF, 10 V	0402 (1005)	1 x 0.5 x 0.6	X5R	TDK	C1005X5R1A105K
C_{OUT}	4.7µF, 6.3 V	0603 (1608)	1.6 x 0.8 x 0.8	X5R	TDK	C1608X5R0J475K
C_1, C_2, C_3	1µF, 10 V	0402 (1005)	1 x 0.5 x 0.6	X5R	TDK	C1005X5R1A105K

4 Board Operation

4.1 Basic Connections

To operate the LM2772 evaluation board, connect a supply voltage (2.7 V-5.5 V) to the board connectors V_{IN} 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.

4.2 Circuit Description

The core of the LM2772 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, C_3) to transfer charge from the input to the output. At input voltages below 3.5V (typ.) the LM2772 operates in a 1/2x Gain, with the input current being equal to half the load current. At input voltages between 3.5 V to 4.6 V(typ.) the part utilizes a gain of 2/5x, with the input current equal to 2/5 the load current. At input voltages above 4.6 V (typ.) the part is in a gain of 1/3x, resulting in an input current equal to 1/3 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 LM2772 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 LM2772 uses fixed frequency pre-regulation to regulate the output voltage to 1.2 V 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 LM2772 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 pre-determined 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.

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