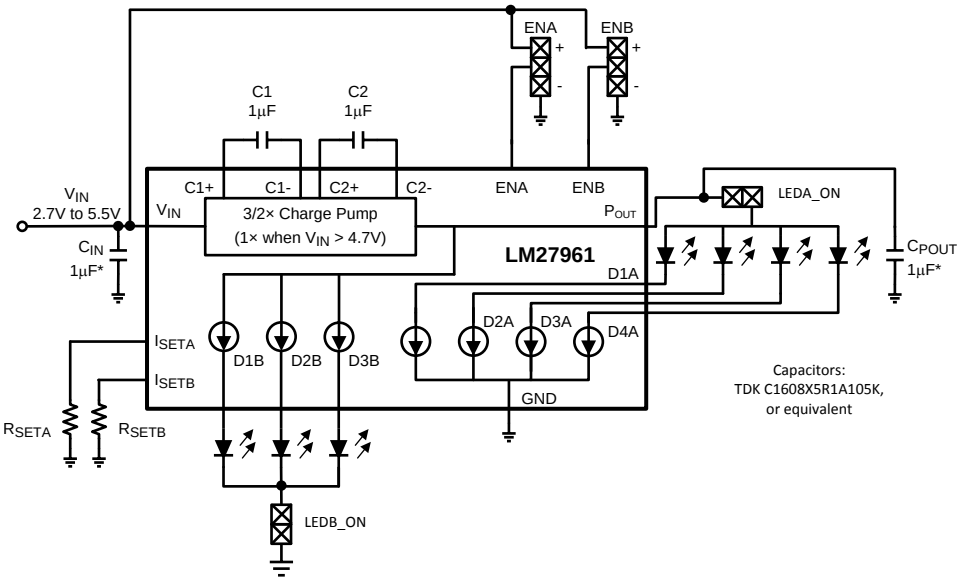
AN-1362 LM27961- Dual-Display White LED Driver with 3/2x Switched Capacitor Boost

1 Schematic

This application note describes how to operate the LM27961 Evaluation Module.



2 Bill of Materials

Table 1. Bill of Materials

Component Symbol	Value	Package [U.S. (Metric)]	Dimensions (mm)	Temperature Characteristic	Manufactrurer	Part #
LM27961	--	YZR-18 DSBGA	2.1 x 2.4 x 0.6	--	TI	LM27961
Cin, Cout, C1, C2	1µF, 10V	0603 (1608)	1.6 x 0.8 x 0.8	X5R	TDK	C1608X5R1A105K
Dxx	White LEDs	--	1.5 x 2.3 x 1.4	--	OSRAM	LWM67C-T1U1-3C5D
Rset	8.3kΩ	0603 (1608)	1.6 x 0.8 x 0.8	--	Vishay-Dale	CRCW06048251F
Rset'	none	--	--	--	--	--

3 LM27961 Evaluation Board Layout

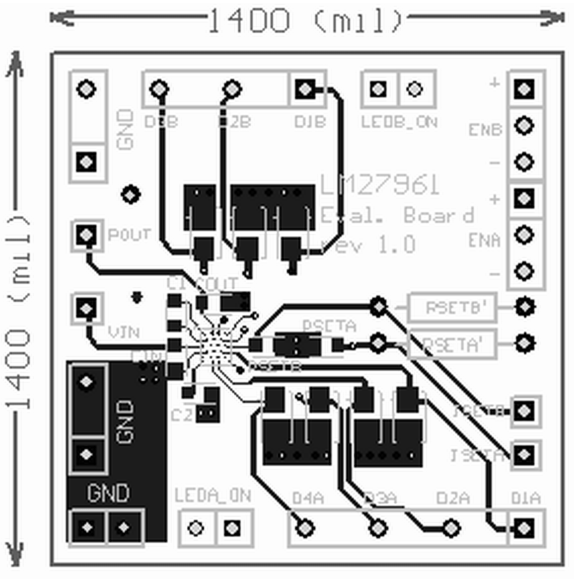


Figure 1. Top Layer

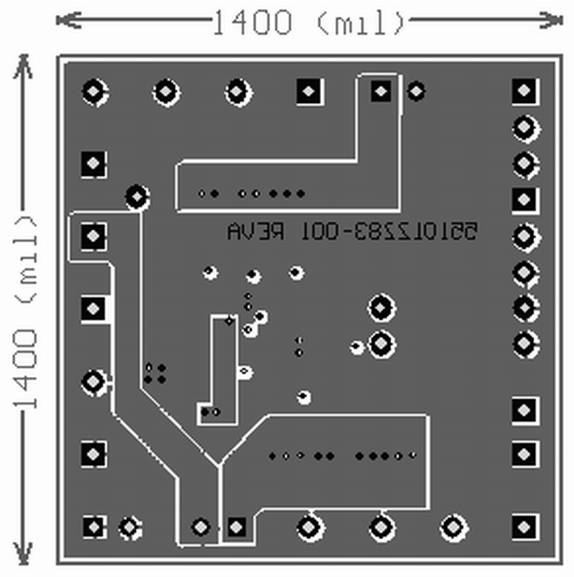


Figure 2. Bottom Layer (top view, unmirrored)

4 Board Operation

4.1 Basic Connections

To operate the LM27961 evaluation board, connect a supply voltage (2.7V-5.5V) between board connectors VIN and GND.

Default Jumper Connections:

- ENA: Connects the “+” post to the middle post of the ENA header strip. This connects VIN to the ENA pin of the LM27961, enabling the part and the D1A-D4A outputs.
- ENB: Connects the “-” post to the middle post of the ENB header strip. This connects GND to the ENB pin of the LM27961, disabling D1B-D3B outputs.

- ENB: Connects the "-" post to the middle post of the ENB header strip. This connects GND to the ENB pin of the LM2796, disabling D1B-D3B outputs.
- LEDx_ON: Jumper connects the two posts of the LEDx_ON header strips. LEDA_ON connects the anodes of all 4 DxA LEDs to POUT, establishing the LED current path. LEDB_ON connects the cathodes of all 3 DxB LEDs to GND, establishing the LED current path.

When these connections are all made correctly, the main bank of LEDs will be ON (D1A-D4A). The secondary bank of 3 LEDs will be OFF.

4.2 R_{SET} Setting LET Currents

The resistance of the R_{SET} resistor sets the DC output currents of the LM27961 according to the following equation:

$$I_{Dxx} = 100 \text{ X } (1.25V / R_{SET}) \text{ (typical)} \quad (1)$$

The default R_{SET} on the evaluation board is 8.3kΩ, resulting in a typical DC output current of 15mA.

Component R_{SET}' is an optional leaded (axial) resistor replacement for the surface mount R_{SET}.

4.3 EN, ENA, AND ENB Headers: LED Activation and PWM Brightness Adjustment

The header strips ENA and ENB can be used to enable/disable the LM27961 and/or the output currents. The connections to the ENx pins provided by these posts can also be used to connect pulse-width modulated (PWM) signals to the LM27961 in order to adjust the average brightness of the LEDs.

On each of these header strips, the post labeled "+" is connected to V_{IN}. The post labeled "-" is connected to GND. The middle post connects to ENA and ENB, respectively.

Jumpers can be used to connect each ENx pin to either VIN or GND. Connecting ENA or ENB to VIN enables the charge pump and other internal circuitry of the LM27961. Connecting both ENA and ENB to GND places the part in Shutdown mode.

Connecting ENA to V_{IN} enables the D1A-D4A LEDs. Connecting ENA to GND disables these LEDs. Similarly, connecting ENB to V_{IN} enables the D1B-D3B LEDs, and connecting ENB to GND disables the DxB LEDs.

Connecting a pulse signal to the ENA and/or ENB pins can be used to adjust the brightness of each bank of LEDs. The duty cycle of the pulse signal determines the net brightness, as perceived by the human eye. For example, with a duty cycle of 50%, the LEDs will only be ON for 50% of the time, and the perceived brightness will be approximately half of what the brightness is when the output current flows continuously through the LEDs. Recommended frequency range for PWM signals: 100Hz to 1kHz.

4.4 Using the LEDS on Headers to Measure Output Currents

By removing the LEDx_ON jumpers, LM27961 output currents can easily be measured. Removing the jumpers disconnects the anodes (DxA) and cathodes (DxB) of all LEDs from POUT (DxA) or GND (DxB), breaking the LED current paths. By placing a current meter between the two header pins the sum total of all LED currents can be measured.

With the LEDx_ON jumpers removed, the current of an individual output can be measured by placing a current meter between a DxA header and POUT or DxB and GND.

With such a connection, the voltage on pin Dxx will be almost 0V because the series resistance of the current meter is likely to be quite small. Since the regulated output currents of the LM27961 are almost completely independent of Dxx pin voltage (provided V_{Dxx} is not too high for regulation to be achieved), this measurement will still be quite accurate. For an even more precise measurement, however, a resistor or LED can be placed in series with the current meter so that the voltage at pin Dxx more closely resembles the expected forward voltage of the LED in the normal application configuration.

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