TPS75105EVM

This user's guide describes the characteristics, operation, and use of the TPS75105EVM-174 evaluation module (EVM). The EVM demonstrates the Texas Instruments TPS75105 low-dropout, two-bank LED driver with PWM brightness control. The document Includes setup instructions, a schematic diagram, a bill of materials, and PCB layout drawings for the EVM.

Contents

1   Introduction

The Texas Instruments TPS75105EVM-174 evaluation module (EVM) helps designers evaluate the operation and performance of the TPS75105 low-dropout linear regulator (LDO), two-bank LED driver with PWM dimming. The TPS75100 contains four, current-regulated, LED driver outputs and operates from a 2.7-V to 5.5-V input supply. The IC drives the anodes of two banks of two LEDs. Each bank is enabled independently and can be dimmed using a PWM signal to the EN pin. The LED current is programmed using a resistor from ISET to GND. The EVM has jumpers for both EN input pins for easy evaluation. The LDO topology and the 9-ball chip scale package provide a small-footprint solution for battery-powered LED driver applications.

2   Setup

This section describes the jumpers and connectors on the EVM as well as how to properly connect, set up, and use the TPS75105EVM-174.

2.1   *Input/Output Connector Descriptions*

2.1.1   J1 – VIN

This is the positive input voltage connection to the converter. The EVM operates from any supply voltage between 2.7 V and 5.5 V. The leads to the input supply should be twisted and kept as short as possible to minimize EMI transmission and input voltage droop.

2.1.2 J2 – GND

This is the input return connection for the input power supply.

2.1.3 JP1 – Bank-A Enable

JP1 is used to enable the bank-A LEDs. Place a shorting bar in the ON position to turn on the bank-A LEDs. When the bank-A LEDs are enabled, the LED current through LEDs D1A and D2A is regulated to the value programmed at ISET (5 mA). Place a shorting bar in the OFF position to turn off the bank-A LEDs.

2.1.4 JP2 – Bank-B Enable

JP2 is used to enable the bank-B LEDs. Place a shorting bar in the ON position to turn on the bank-B LEDs. When the bank-B LEDs are enabled, the LED current through LEDs D1B and D2B is regulated to the value programmed at ISET (5 mA). Place a shorting bar in the OFF position to turn off the bank-B LEDs.

2.1.5 JP3 – LED D1A Cathode Connection

JP3 is used to measure the current through LED D1A. Place a current meter between the pins of JP3 to measure the current. Alternatively, a resistor can be connected between the pins of JP3 in order to measure the current as a voltage. Place a shorting bar across the pins of JP3 if current measurement is not required. PCB pads are provided to install a current-sense resistor across this jumper.

2.1.6 JP4 – LED D2A Cathode Connection

JP4 is used to measure the current through LED D2A. Place a current meter between the pins of JP4 to measure the current. Alternatively, a resistor can be connected between the pins of JP4 in order to measure the current as a voltage. Place a shorting bar across the pins of JP4 if current measurement is not required. PCB pads are provided to install a current-sense resistor across this jumper.

2.1.7 JP5 – LED D2B Cathode Connection

JP5 is used to measure the current through LED D2B. Place a current meter between the pins of JP5 to measure the current. Alternatively, a resistor can be connected between the pins of JP5 in order to measure the current as a voltage. Place a shorting bar across the pins of JP5 if current measurement is not required. PCB pads are provided to install a current-sense resistor across this jumper.

2.1.8 JP6 – LED D1B Cathode Connection

JP6 is used to measure the current through LED D1B. Place a current meter between the pins of JP6 to measure the current. Alternatively, a resistor can be connected between the pins of JP6 in order to measure the current as a voltage. Place a shorting bar across the pins of JP6 if current measurement is not required. PCB pads are provided to install a current-sense resistor across this jumper.

2.2 Setup

2.2.1 EVM Factory Configuration

The EVM is configured to provide the following nominal operating conditions:
  Input voltage: 2.5 V to 5.5 V
  LED current: 5 mA

2.2.2 Changing LED Current

R1 on the EVM is used to change the current. The EVM is provided with no resistor installed on R1. This programs the default LED current of 5 mA. In order to program a different LED current, place a 1% resistor at R1 that corresponds to the following equation:

$$R1 = (1.22 \text{ V}/I_{LED}) \times 420$$

Note that I_{LED} is the LED current through each LED.

2.2.3 Using PWM Dimming

An easy dimming solution is implemented by connecting a PWM signal to ENA or ENB to dim the respective bank of LEDs. The PWM signal may be up to 1 kHz. The scale of the LED current corresponds directly to the duty cycle of the signal. For example, a 50% duty cycle provides 50% of the programmed LED current. The two banks may be independently dimmed.

2.2.4 Operation

1. Configure JP1 to enable or disable the bank-A LEDs as desired.
2. Configure JP2 to enable or disable the bank-B LEDs as desired.
3. Configure JP3–JP6 to measure LED current.
4. Connect the input voltage return to J2.
5. Connect the positive input voltage to J1.
6. Turn on input voltage.
7. The LEDs that were enabled by JP1 and JP2 are on.

3 Board Layout

This section provides the TPS75105EVM-174 board layout and illustrations.

3.1 Layout

Figure 1, Figure 2, and Figure 3 show the board layout for the TPS75105EVM-174 PWB.
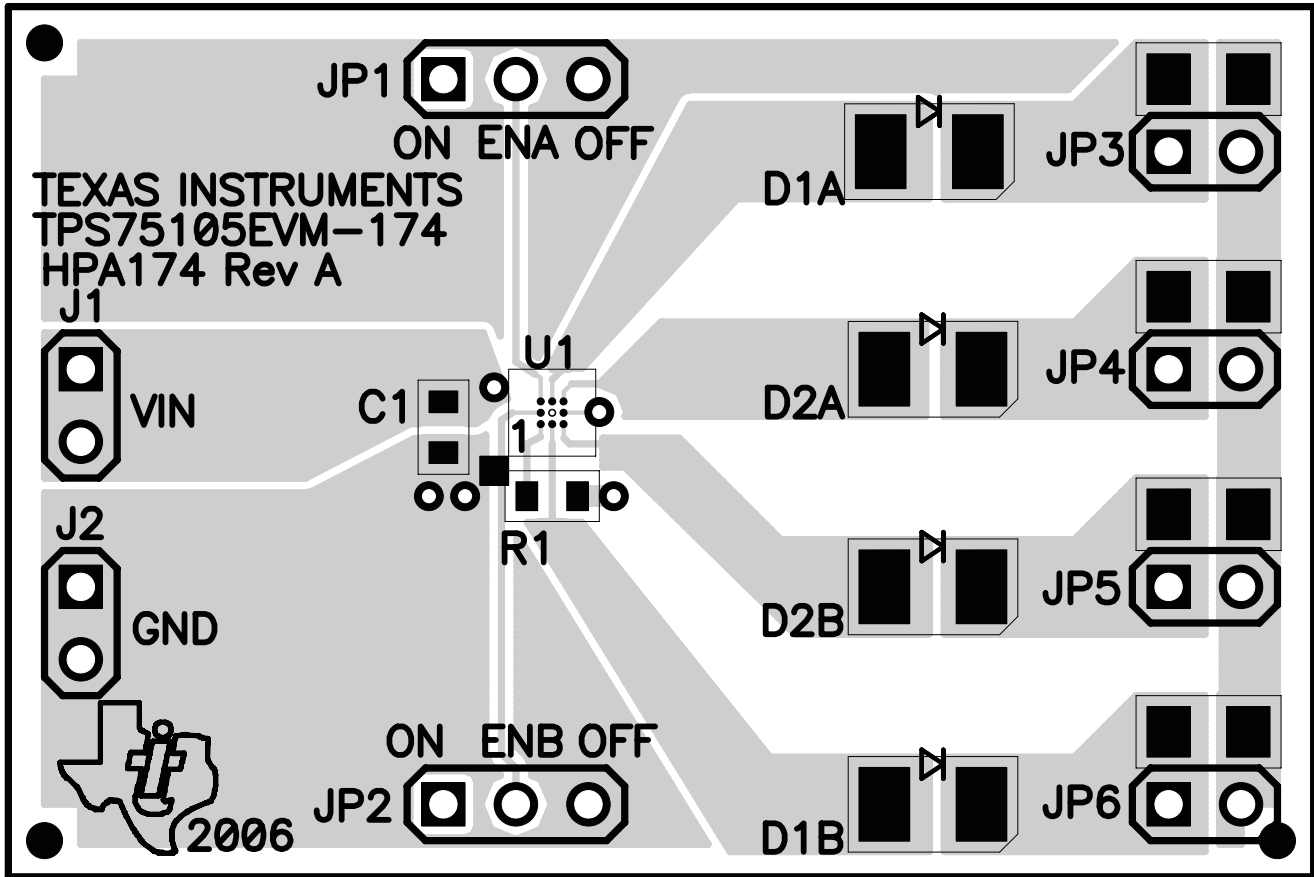
Figure 1. Assembly Layer
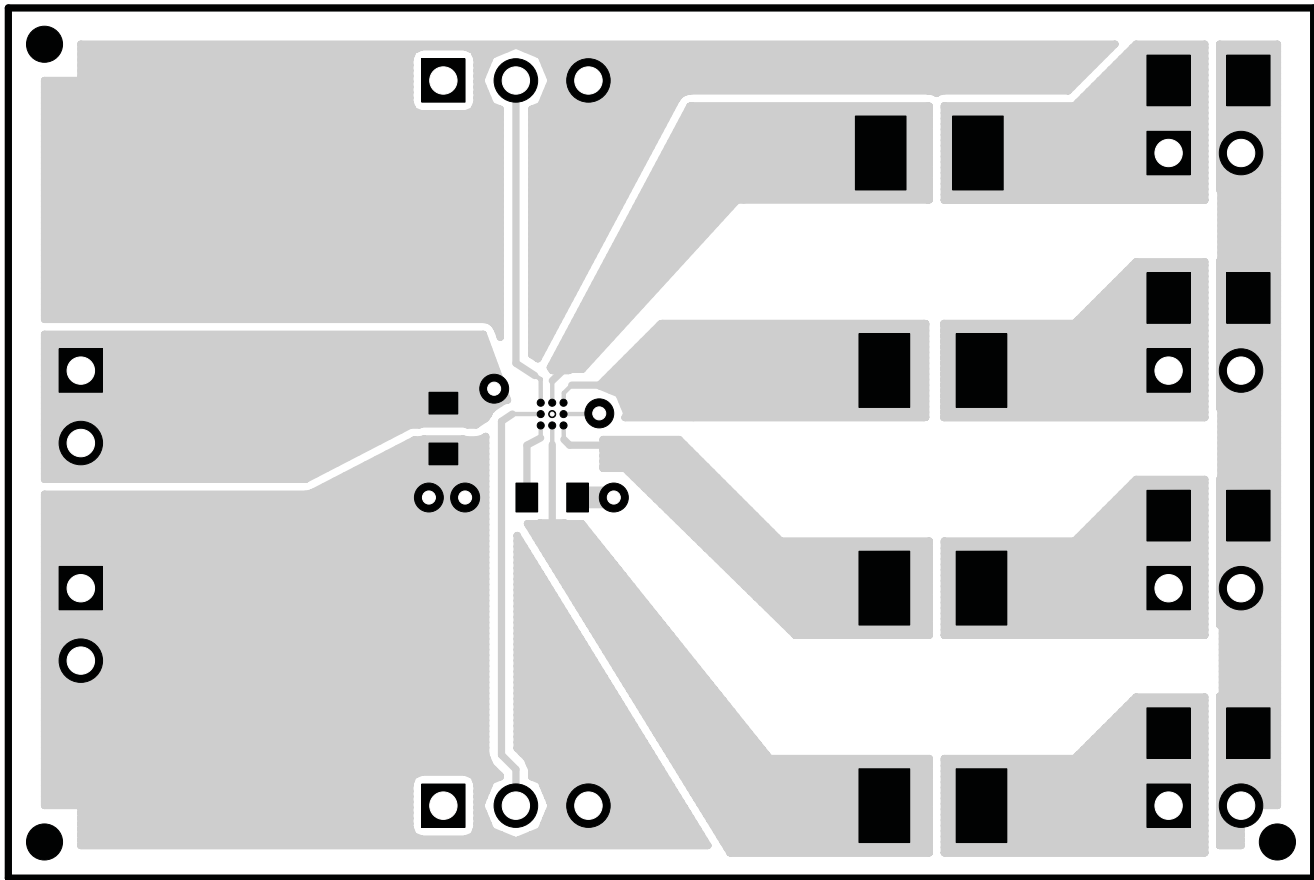
Figure 2. Top Layer Routing
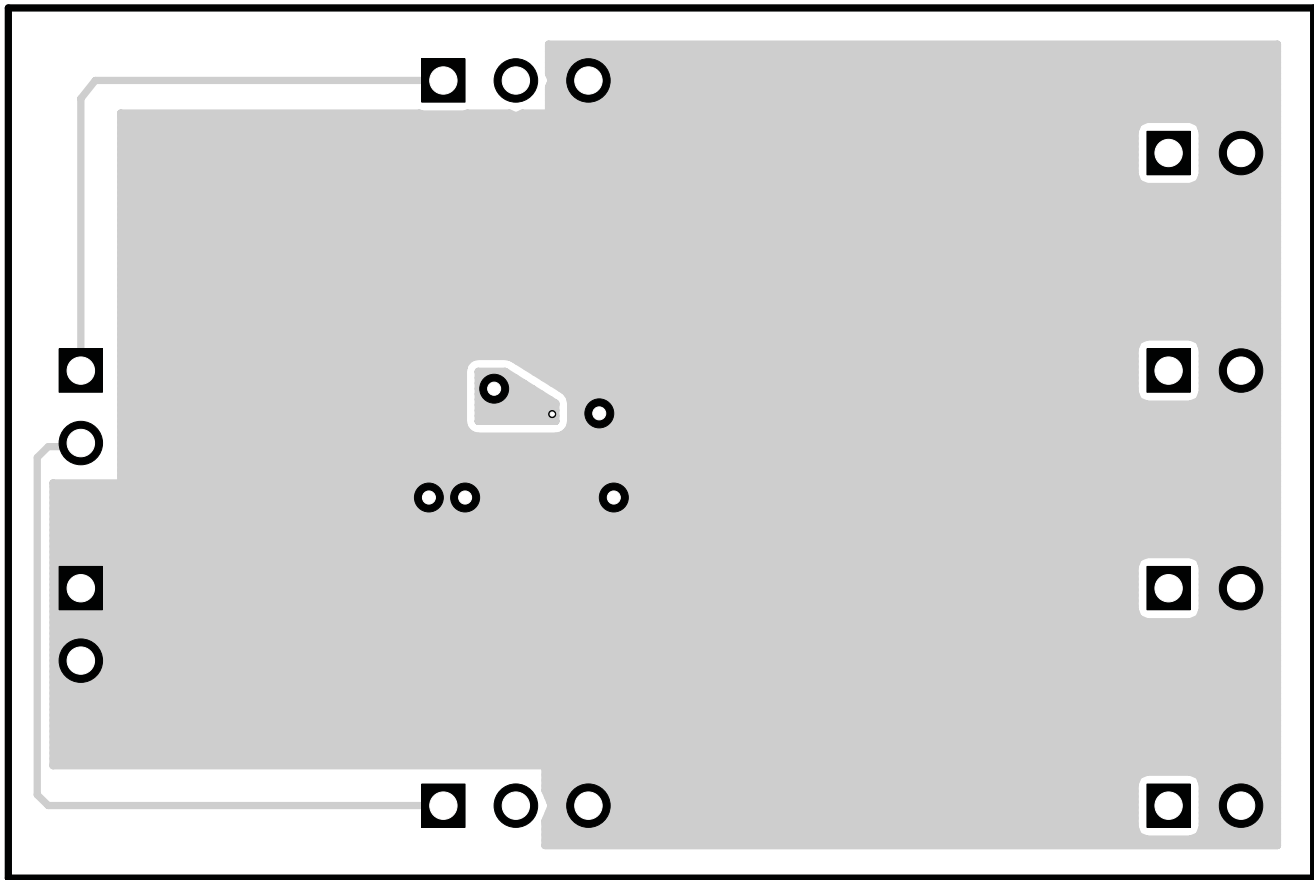
Figure 3. Bottom Layer Routing

4 Schematic and Bill of Materials

This section provides the TPS75105EVM-174 schematic and bill of materials.
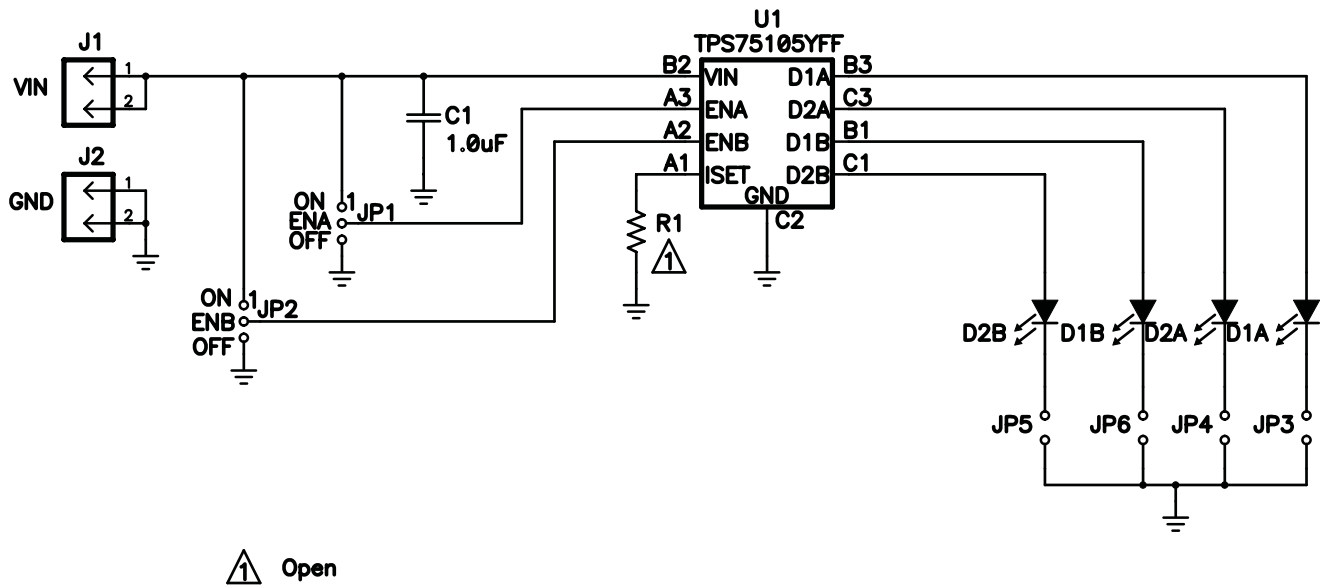
4.1 Schematic

Figure 4. TPS75105EVM-174 Schematic

4.2 Bill of Materials

Table 1. TPS75105EVM-174 Bill of Materials

Count	Ref Des	Value	Description	Size	Part Number	MFR
1	C1	1.0 μF	Capacitor, Ceramic, 16V, X5R, 10%	0603	C1608X5R1C105K	TDK
4	D1A, D1B, D2A, D2B		Diode, LED, White, 30 mA	1210	SML-LX2832UWC-TR	Lumex
2	J1, J2		Header, 2 pin, 100 mil spacing, (36-pin strip)	0.100 × 2	PTC36SAAN	Sullins
2	JP1, JP2		Header, 3 pin, 100 mil spacing, (36-pin strip)	0.100 × 3	PTC36SAAN	Sullins
4	JP3–JP6		Header, 2 pin, 100 mil spacing, (36-pin strip)	0.100 × 2	PTC36SAAN	Sullins
0	R1	Open	Resistor, Cip, 1/16W, 1%	0603		
1	U1		IC, LDO, Two Bank LED Driver 1/PWM Brightness Control	WCSP-0	TPS75105YFF	TI
1	—		PCB, 1.8 In × 1.2 In × 0.062 In		HPA174	Any
6	—		Shunt, 100 mil, Black	0.100	929950-00	3M

4.3 Related Documentation From Texas Instruments

TPS7510x, Low Dropout, Two-Bank LED Driver with PWM Brightness Control data sheet (SBVS080)

4.4 If You Need Assistance

Contact your local TI sales representative.

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EVM WARNINGS AND RESTRICTIONS

It is important to operate this EVM within the input voltage range of 2.7 V to 5.5 V.

Exceeding the specified input range may cause unexpected operation and/or irreversible damage to the EVM. If there are questions concerning the input range, please contact a TI field representative prior to connecting the input power.

Applying loads outside of the specified output range may result in unintended operation and/or possible permanent damage to the EVM. Please consult the EVM User's Guide prior to connecting any load to the EVM output. If there is uncertainty as to the load specification, please contact a TI field representative.

During normal operation, some circuit components may have case temperatures greater than 85°C. The EVM is designed to operate properly with certain components above 60°C as long as the input and output ranges are maintained. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors. These types of devices can be identified using the EVM schematic located in the EVM User's Guide. When placing measurement probes near these devices during operation, please be aware that these devices may be very warm to the touch.

IMPORTANT NOTICE