User's Guide

Using the LM3645EVM Evaluation Module

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1 Trademarks

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2 Introduction

The Texas Instruments LM3645EVM evaluation module (EVM) helps designers evaluate the operation and performance of the LM3645 High-Current LED driver. The device offers configurability via I^2C-compatible interface. It can be enabled in Flash or Torch mode via the I^2C interface or externally using the STR1, STR2, TORCH/TX, TEMP1 and TEMP2 pins. The module utilizes four LEDs (D1, D2, D3 and D4) mounted on the EVM.

The EVM contains one Synchronous Boost LED Flash Driver (See Table 2-1).

Table 2-1. Device and Package Configurations

FLASH LED DRIVER	IC	PACKAGE
U1	LM3645	0.4 mm-pitch, 25-Bump DSBGA

3 Setup

This section describes the jumpers and connectors on the EVM as well as how to properly connect, set up, and use the LM3645EVM.

3.1 Input/Output Connector Description

Input / GND - These are the power input terminals for the driver. The terminal block provides a power (VIN) and ground (GND) connection to allow the user to attach the EVM to a cable harness.

EN (J7) - This is the jumper used to enable the LED driver (EN pin). The driver will be enabled when the EN pin is high and disabled when it is low (GND).

VIO (J6) - This pin provides power for the I^2C lines (Clock & Data) and for the EN pin. It is recommended that this pin is connected to the VIN pin. If desired, it can be connected to the 3.3V line provided by the USB interface connector. In this configuration, communication via the I^2C interface may not be possible if the supply voltage to the LED driver is below approximately 3 V.

D1-CON (J21 pin2 and pin3), D2-CON (J22 pin2 and pin3), D3-CON (J23 pin2 and pin3) and D4-CON (J24 pin2 and pin3) - are the jumpers used to connect the on-board flash LEDs to the LED output of the driver.

STR1(J15) and STR2(J17) - These two pins provide external methods for initiating a flash events. The STRX pin is connected to ground via a 300-kΩ resistor internal to the LM3645. To externally drive this pin, either connect a control signal directly to the STRX pin of the connector or place a jumper between connector pins STRX and PWMX. Pin PWMX can be configured as a time-adjustable voltage pulse.

TORCH/TX (J19) - This pin provides an external method for initiating a torch event. The TORCH/TX pin is connected to ground via a 300-kΩ resistor internal to the LM3645. To externally drive this pin, either connect a control signal directly to the TORCH/TX pin of the connector or place a jumper between connector pins TORCH/TX and PWM0. Pin PWM0 can be configured as ON or OFF. Removing the jumper, and setting the TORCH/TX pin to TX mode, this pin is used to initiate a TX-interrupt event. To externally drive this pin, either connect a control signal directly to the TX pin of the connector or place a jumper between connector pins TX and PWM0.

TEMP1(J28) and TEMP(J29) - These two pins provides temperature sensing and current scale back function. The TEMP function can be utilized via the externally connected NTC thermistor.

SDA(J9) and SCL (J10) - These connections allow the user to externally control the I^2C lines.

OUT (J30,) - These provide access to the regulated output of the driver. The user can measure VOUT with reference to GND。

VINL/VIN (J5) - The user can monitor the Inductor Current and Input Current waveforms by omitting this jumper and using separate wires from the power supply to the VINL and VIN pins. This will remove the Input Capacitors from the Inductor and eliminate their filtering effect to the Inductor Current.

J31, J32, J33 and J34: LED Current measurements -The LM3645EVM provides a way to accurately measure the LED current through both LEDs on board. Resistors R1,R2, R3 and R4 (0.5 Ω) are placed between the cathode of LED1, LED2, LED3 and LED4 respectively, and Ground. The user can first measure the resistor values accurately, by applying a known current through connector DxF and Ground and measuring the voltage between DxS and GNDS. Then, during normal flash or torch operation, the voltage measured across the resistor divided by the resistor value will equal the current through the resistor (and the LED).

3.2 Setup

The input voltage range for the flash driver is 2.5 volts to 5.5 volts. The on-board LEDs or an LED module should be connected for proper operation.

3.3 Operation

For proper operation of the LM3645EVM, the jumpers should be properly configured. The recommended setting, using shorting blocks is:

VIO to VIN

EN to VIO

STR1 and STR2 to PWM1 and PWM2 or external signals

TORCH/TX to PWM0 or external signal

LEDs (J21, J22, J23 and J24) shorted

In this configuration, the device will power up when power is applied.

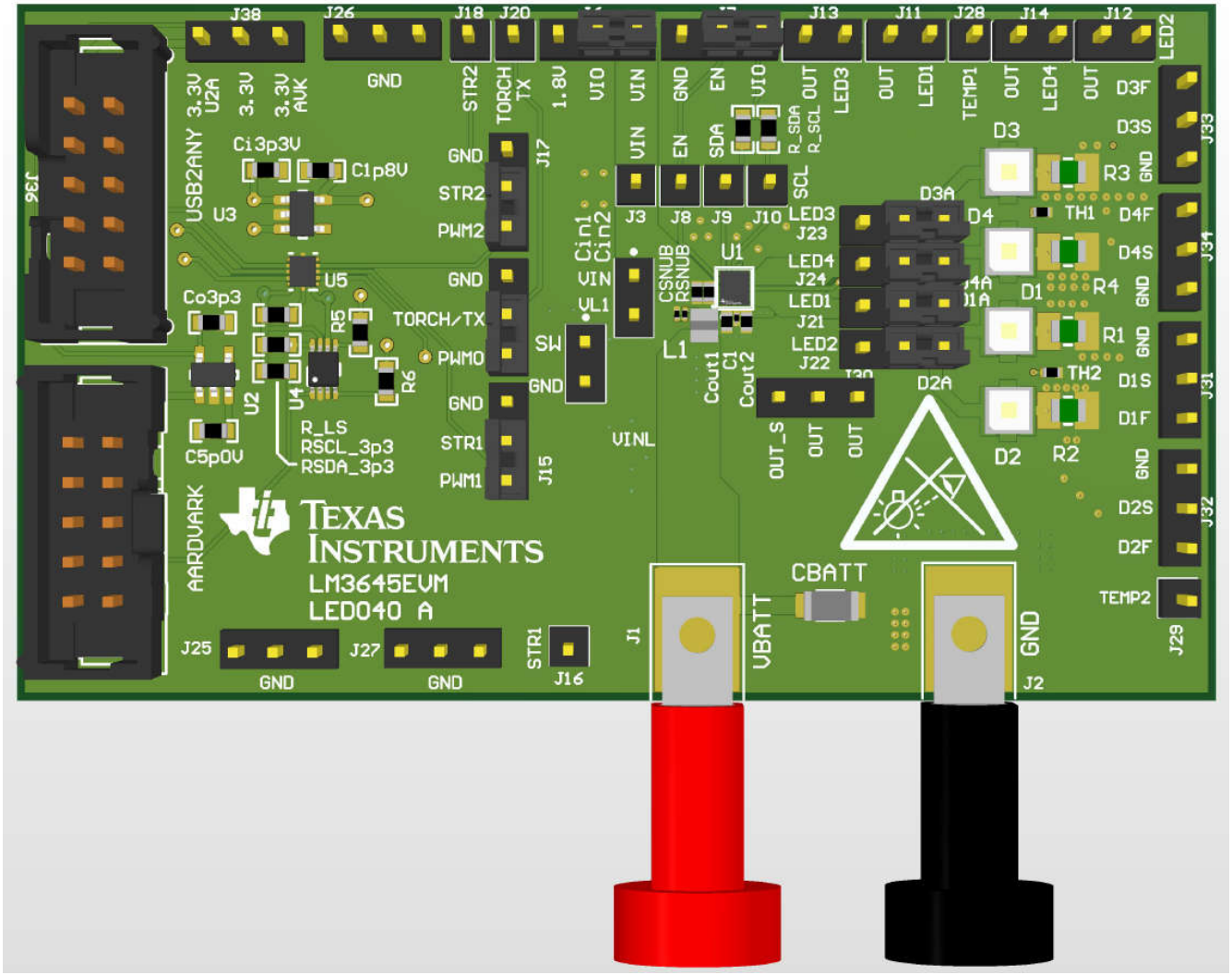

Figure 3-1. Jumper Configuration

4 Board Layout

Figure 4-1, Figure 4-2, Figure 4-3 and Figure 4-4 show the board layout for the LM3645EVM. The EVM offers resistors, capacitors, and jumpers to enable the device and to configure it as desired.

The LM3645 will dissipate power, especially during high current and long duration flash events. Power will also be dissipated on the flash LEDs. The EVM layout is designed to minimize temperature rise during operation. It is recommended that in order to prevent overheating, repeated flash events in very short time intervals is avoided.

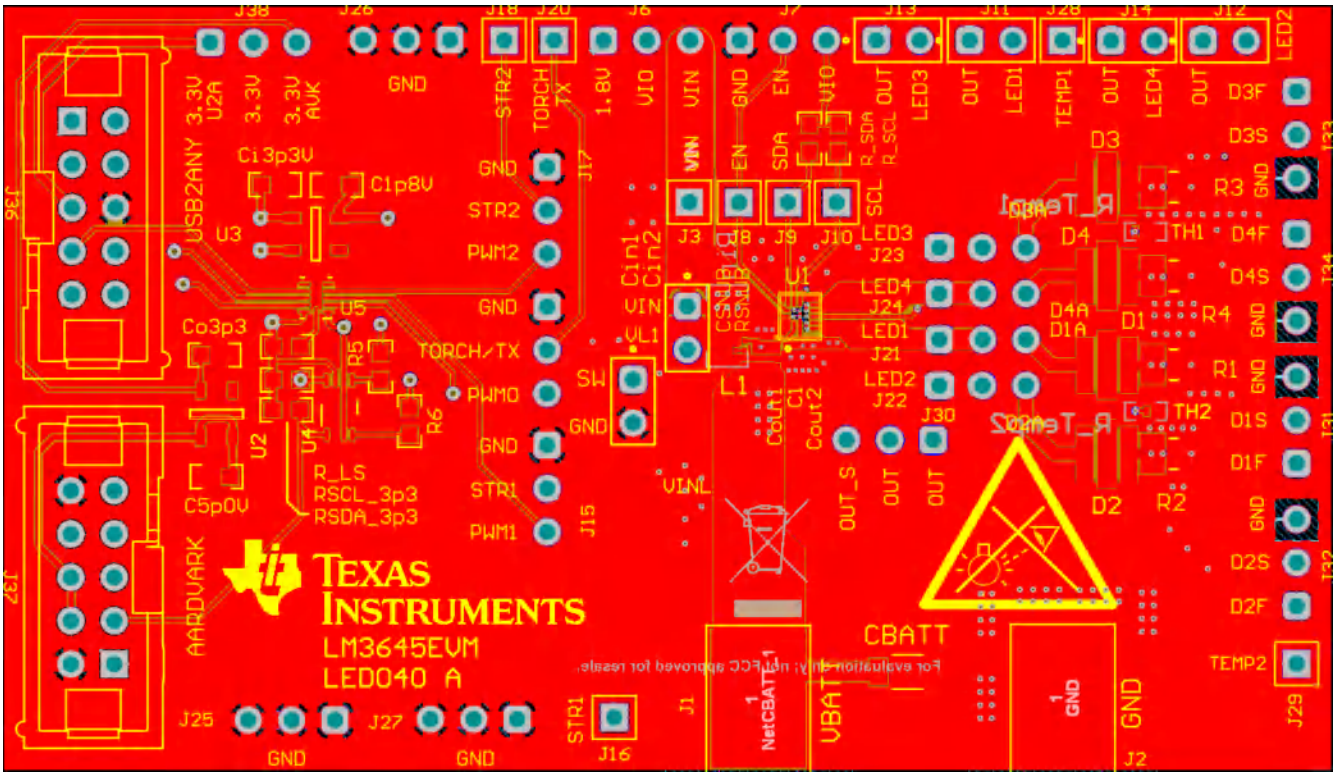

Figure 4-1. Top Assembly Layer

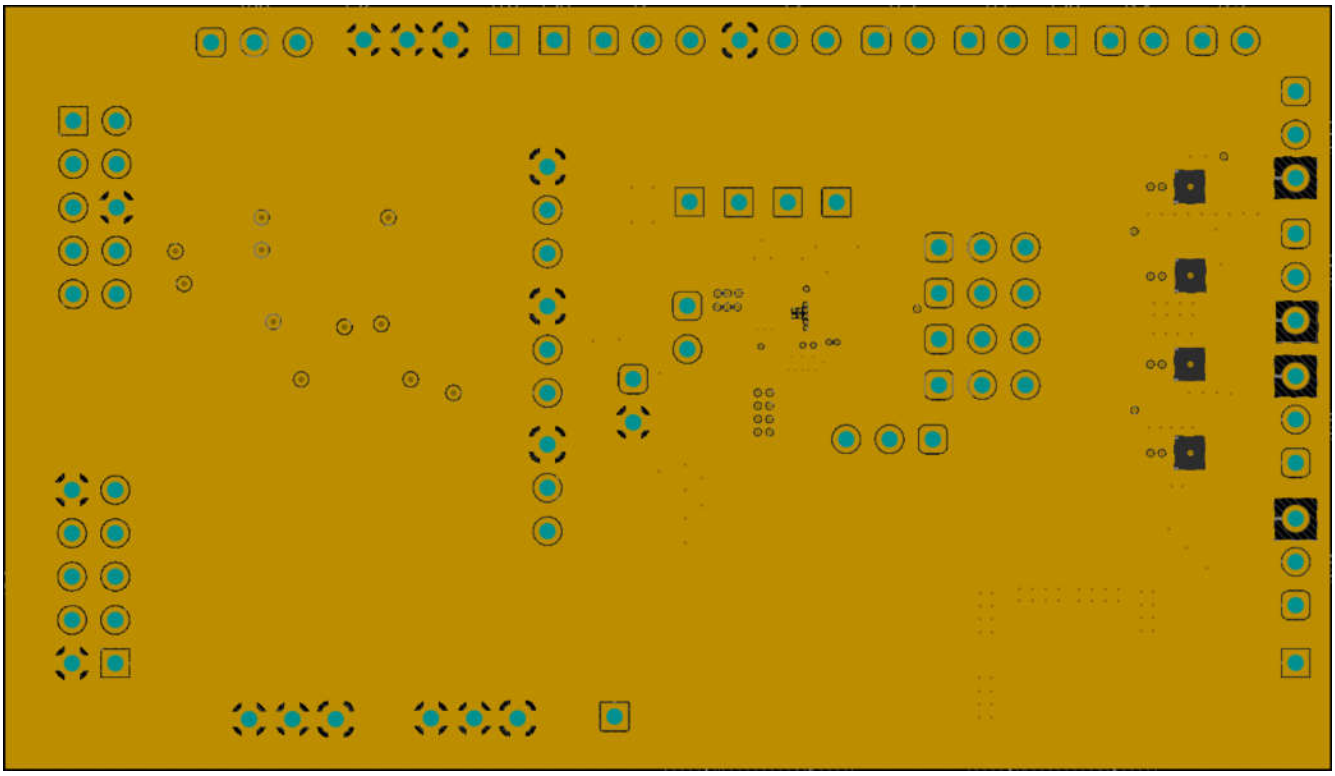

Figure 4-2. Middle Layer 1 Routing

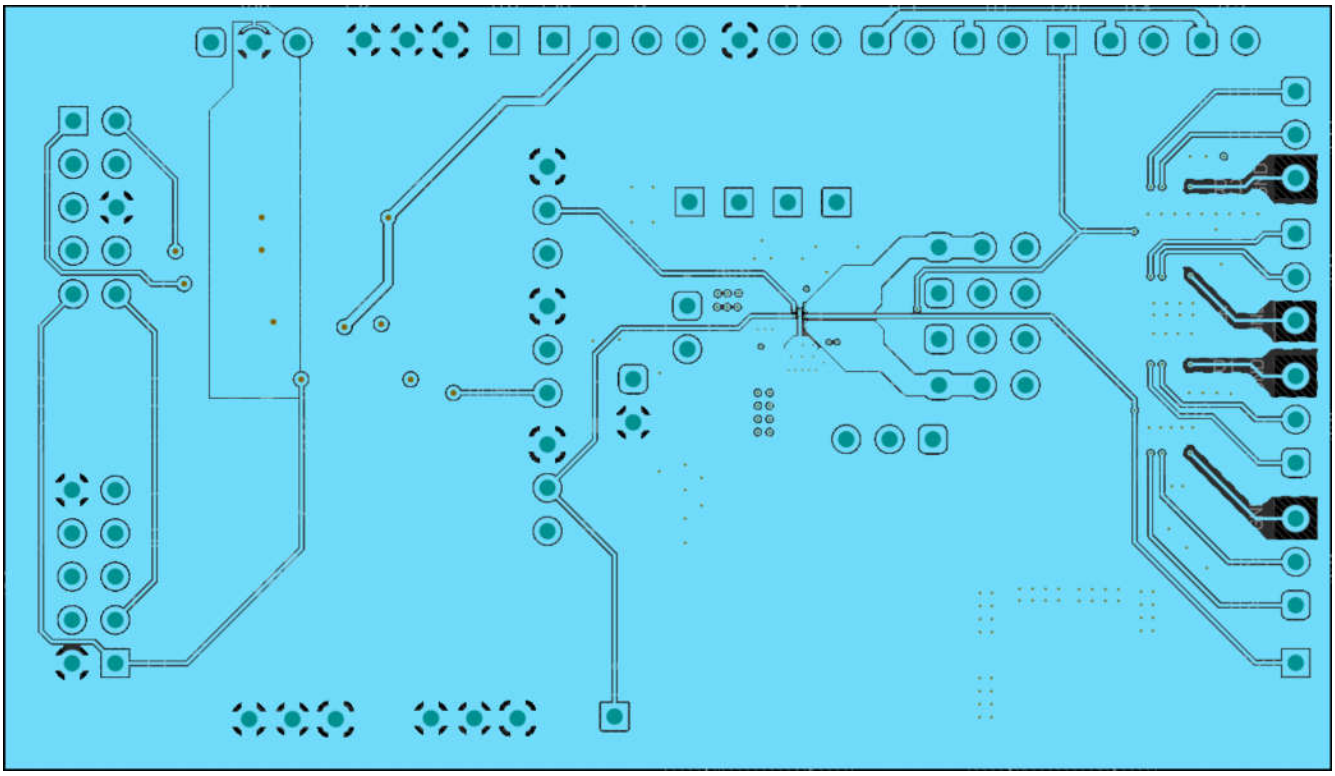

Figure 4-3. Middle Layer 2 Routing

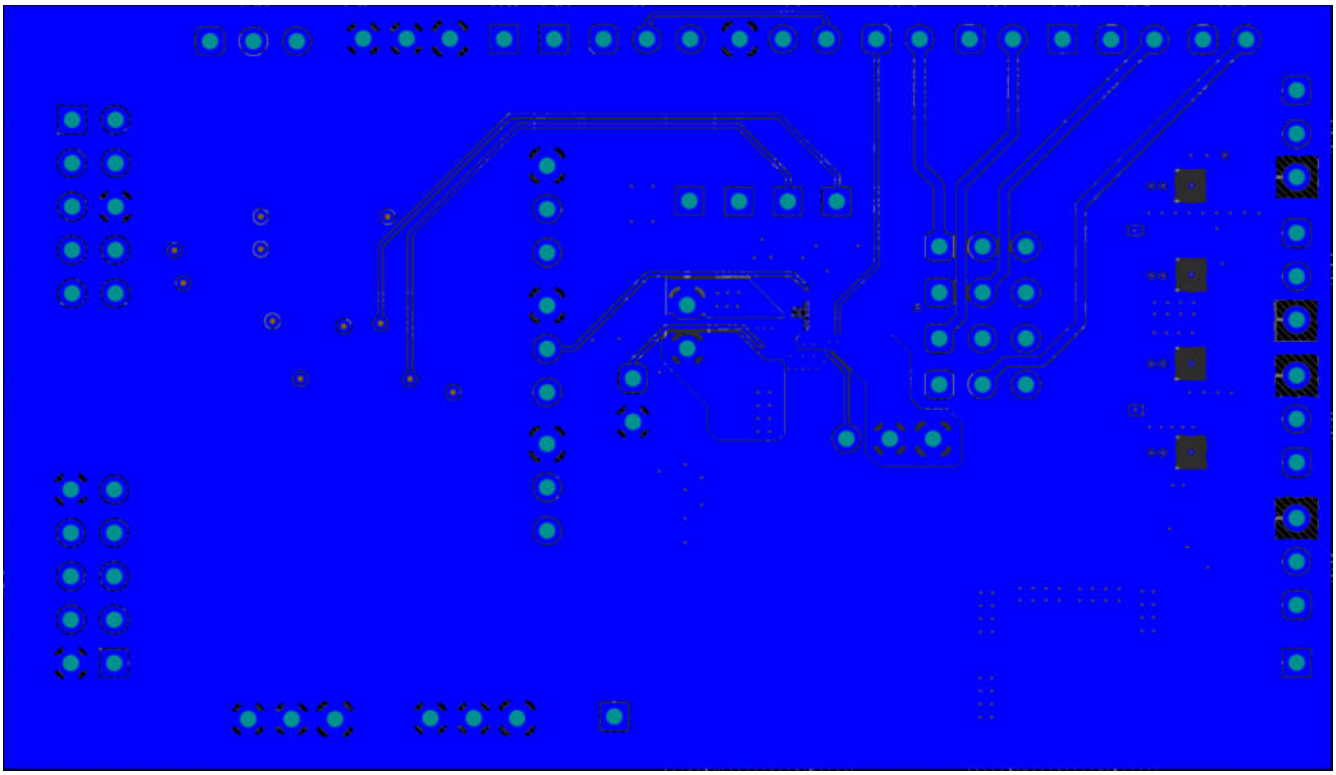

Figure 4-4. Bottom Assembly Layer (UNMIRRORED)

5 Schematic

LM3645EVM Schematic

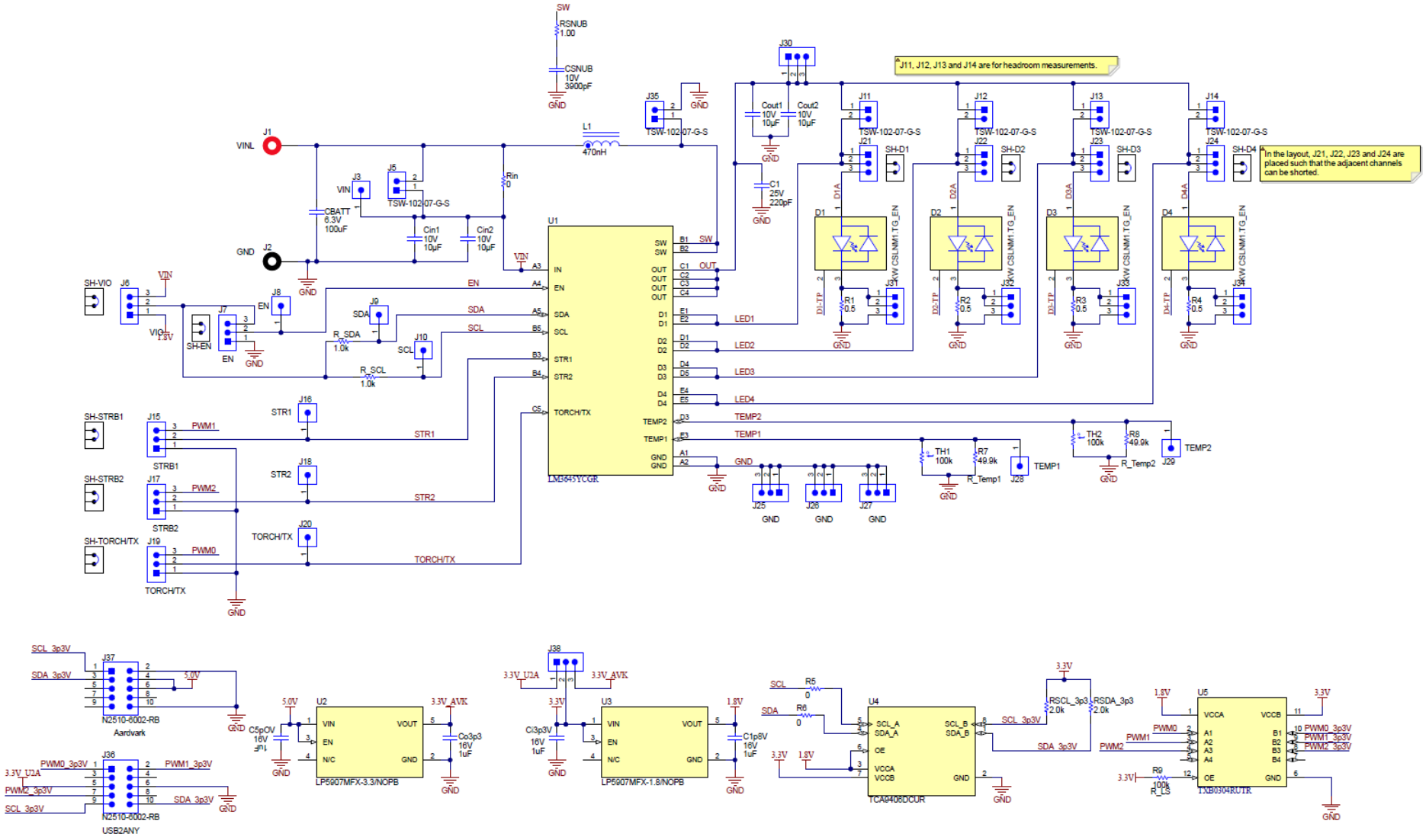

Table 5-1. Bill of Materials

Designator	Quantity	Value	Description	PackageReference	PartNumber	Manufacturer
!PCB1	1		Printed Circuit Board		LED-040	Any
C1	1	220pF	CAP, CERM, 220 pF, 25 V, +/- 10%, X7R, 0201	0201	GRM033R71E221KA01D	MuRata
C1p8V, C5pOV, Ci3p3V, Co3p3	4	1uF	CAP, CERM, 1 uF, 16 V, +/- 10%, X7R, 0603	0603	C1608X7R1C105K080AC	TDK
CBATT	1	100uF	CAP, CERM, 100 uF, 6.3 V, +/- 20%, X5R, 1206	1206	GRM31CR60J107ME39L	MuRata
Cin1, Cin2, Cout1, Cout2	4	10uF	CAP, CERM, 10 µF, 10 V,+/- 20%, X5R, 0402	0402	GRM155R61A106ME44	MuRata
CSNUB	1	3900pF	CAP, CERM, 3900 pF, 10 V, +/- 10%, X7R, 0201	0201	GRM033R71A392KA01D	MuRata
D1, D2, D3, D4	4		LED Lighting OSRAM OSTAR White 3V 1.4A 120° 1212 (3030 Metric)	1212	KW CSLPM1.TG-8N7P-EBVF46FCBB46-15B5-S	OSRAM
J1	1		Standard Banana Jack, Insulated, Red	6091	6091	Keystone
J2	1		Standard Banana Jack, Insulated, Black	6092	6092	Keystone
J3, J8, J9, J10, J16, J18, J20, J28, J29	9		Header, 100mil, 1pos, Gold, TH	Testpoint	TSW-101-07-G-S	Samtec
J5, J11, J12, J13, J14, J35	6		Header, 100mil, 2x1, Gold, TH	2x1 Header	TSW-102-07-G-S	Samtec
J6, J7, J15, J17, J19, J21, J22, J23, J24, J25, J26, J27, J30, J31, J32, J33, J34, J38	18		Header, 100mil, 3x1, Gold, TH	3x1 Header	TSW-103-07-G-S	Samtec
J36, J37	2		Header (shrouded), 100mil, 5x2, High-Temperature, Gold, TH	5x2 Shrouded header	N2510-6002-RB	3M
L1	1	470nH	Inductor, 470 nH, 4.8 A, 0.022 ohm, SMD	2x1.6mm	HTEK20161T-R47MSR	Cyntec
R1, R2, R3, R4	4	0.5	RES, 0.5, 1%, .33 W, 0805	0805	RL1220S-R50-F	Susumu Co Ltd
R5, R6	2	0	RES, 0, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	RMCF0603ZT0R00	Stackpole Electronics Inc
R7, R8	2	49.9k	RES, 49.9 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW040249K9FKED	Vishay-Dale
R9	1	100k	RES, 100 k, 5%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	ERJ-3GEYJ104V	Panasonic

Table 5-1. Bill of Materials (continued)

R_SCL, R_SDA	2	1.0k	RES, 1.0 k, 5%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW06031K00JNEA	Vishay-Dale
Rin	1	0	RES, 0, 5%, 0.25 W, 1206	1206	RC1206JR-070RL	Yageo America
RSCL_3p3, RSDA_3p3	2	2.0k	RES, 2.0 k, 5%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW06032K00JNEA	Vishay-Dale
RSNUB	1	1	RES, 1.00, 1%, 0.05 W, 0201	0201	RC0201FR-071RL	Yageo America
SH-D1, SH-D2, SH-D3, SH-D4, SH-EN, SH-STRB1, SH-STRB2, SH-TORCH/TX, SH-VIO	9		Shunt, 100mil, Gold plated, Black	Shunt 2 pos. 100 mil	881545-2	TE Connectivity
TH1, TH2	2	100k	Thermistor NTC, 100k ohm, 5%, 0402	0402	NCP15WF104J03RC	MuRata
U1	1		Synchronous Boost Quad LED Flash Driver with 2A High-Side Current Sources	DSBGA25	LM3645YCGR	Texas Instruments
U2	1		250-mA Ultra-Low-Noise, Low-IQ LDO, DBV0005A (SOT-23-5)	DBV0005A	LP5907MFX-3.3/NOPB	Texas Instruments
U3	1		250-mA Ultra-Low-Noise, Low-IQ LDO, DBV0005A (SOT-23-5)	DBV0005A	LP5907MFX-1.8/NOPB	Texas Instruments
U4	1		2-Bit Bidirectional 1-MHz I2C Bus and SMBus Voltage-Level Shifter, DCU0008A (VSSOP-8)	DCU0008A	TCA9406DCUR	Texas Instruments
U5	1		4-bit Bidirectional Auto-direction Sensing Translator with Fully Symmetric 0.9V to 3.6V Range, RUT0012A (UQFN-12)	RUT0012A	TXB0304RUTR	Texas Instruments

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