

TLC6984 48 × 16 Common Cathode Matrix LED Display Driver Evaluation Module



ABSTRACT

This user's guide describes the TLC6984 evaluation module used as a reference for engineering demonstration and evaluation. Included in this user's guide are setup instructions, a schematic diagram, printed board (PCB) layout, and a bill of materials (BOM).

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1 Introduction

1.1 Features

The TLC6984 is a highly integrated, common cathode matrix LED display driver with 48 constant current sources and 16 scanning FETs. One TLC6984 is capable of driving 16×16 RGB LED pixels, while stacking two TLC6984s can drive 32×32 RGB LED pixels, three TLC6984s are capable of driving 48×48 RGB LED pixels, and stacking four TLC6984s can drive 64×64 RGB LED pixels. To achieve low power consumption, the device supports separated power supplies for the red, green, and blue LEDs by its common cathode structure. Furthermore, the operation power of the TLC6984 is significantly reduced by ultra-low operation voltage range (V_{cc} down to 2.5 V) and ultra-low operation current (I_{cc} down to 3.6 mA).

The TLC6984 implements a high speed, dual-edge transmission interface to support high device count daisy-chained and high refresh rate while minimizing electrical-magnetic interference (EMI). The device supports up to 25-MHz SCLK (external) and up to 160-MHz GCLK (internal). Meanwhile, the device integrates enhanced circuits and intelligent algorithms to solve the various display challenges in Narrow Pixel Pitch (NPP) LED display applications and mini and micro-LED products. The display challenges are dim at the first scan line, upper and downside ghosting, non-uniformity in low gray scale, coupling, caterpillar caused by open or short LEDs, which make the TLC6984 a perfect choice in such applications.

The TLC6984 also implements LED open and weak, short and short detections and removals during operations and can also report this information out to the accompanying digital processor.

1.2 Applications

The TLC6984 EVM can be used as a basic function evaluation module for the following applications:

- Narrow Pixel Pitch (NPP) LED display
- Mini and micro-LED products

2 Test Setup and Results

This section describes the TLC6984EVM connections, test points, and jumpers.

2.1 TLC6984 EVM Board

Figure 2-1 shows the image of the driver IC side of the TLC6984EVM board.

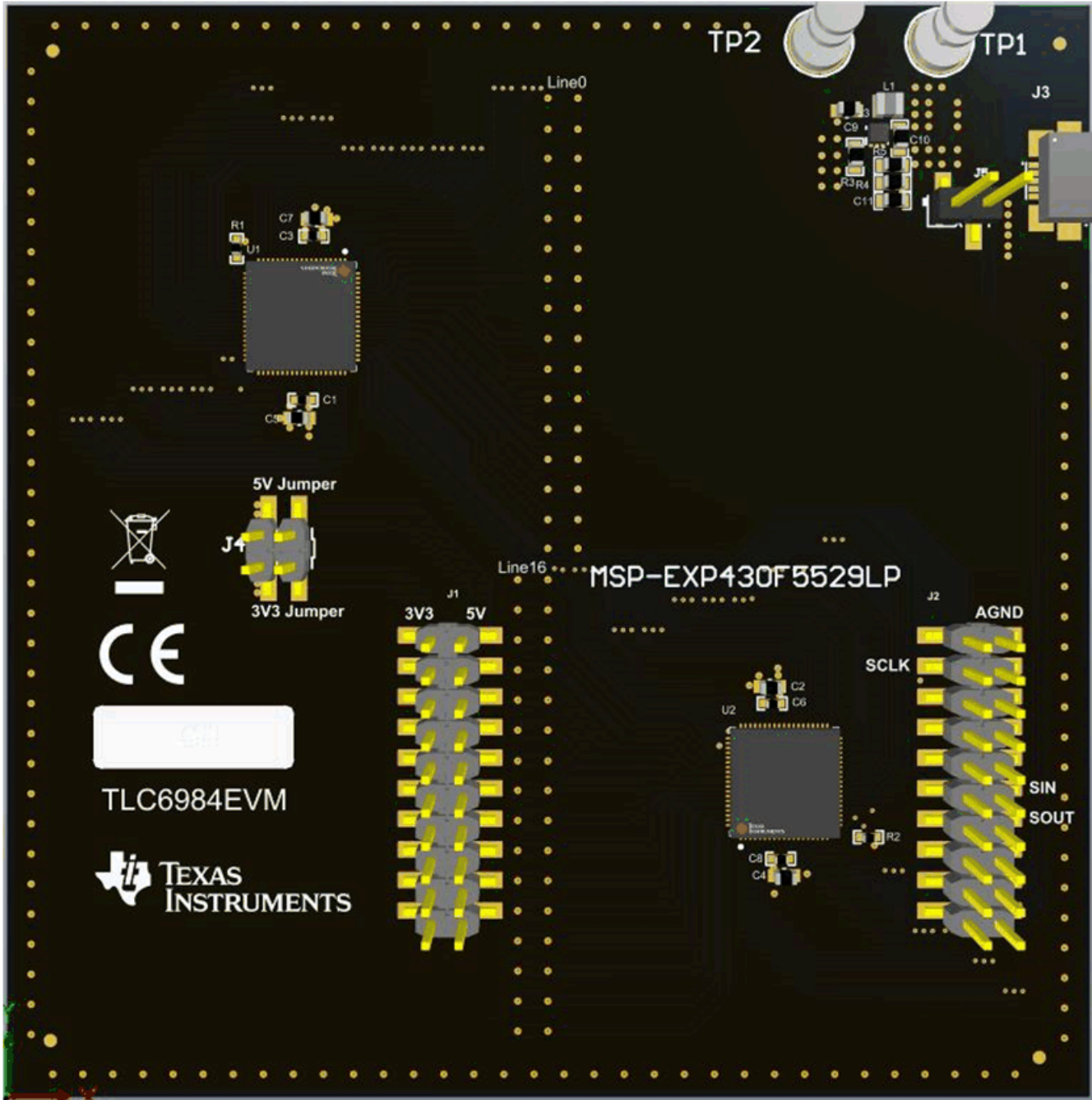


Figure 2-1. Driver IC Side of the TLC6984EVM Board

2.2 Connectors

The TLC6984EVM has the following connectors:

- TP1 (+5 V): input power supply for VLEDG/VLEDB and DC/DC
- TP2 (GND): supply ground
- J1, J2: boosterpack connectors for connecting with the MSP430F5529 LaunchPad™
- J3: mini-USB connector for 5-V power input

2.3 Jumpers

The TLC6984EVM has the following jumpers:

- J4 (5-V Jumper): input 5-V power supply from J3 or J1/J2
- J4 (3V3 Jumper): input 3V3 power supply from J3 (DC/DC) or J1/J2
- J5: 3.3-V power supply from DC/DC

3 Test Setup

Table 3-1 shows the typical parameters for TLC6984 EVM.

Table 3-1. TLC6984EVM Parameters

Parameter	Value
VCC device supply voltage	2.5–5.5 V
VLEDR/G/B supply voltage	2.5–5.5 V
ICH constant output source current	0.2–20 mA

The TLC6984EVM can be setup and tested by following these steps:

1. USB power supply
 - a. Download the code to MSP430F5529 LaunchPad with TI CCS software.
 - b. Connect boosterpack connectors (J1, J2 on EVM board) with the MSP430F5529 LaunchPad. Figure 3-1 shows the connection method.
 - c. Disconnect J4 jumpers (5 V/ 3V3) block, connect J5 jumper, and connect J3 with the mini-USB cable (the same cable with the MSP430F5529 LaunchPad).
2. External power supply
 - a. Download the code to MSP430F5529 LaunchPad with TI CCS software.
 - b. Connect boosterpack connectors (J1, J2 on EVM board) with the MSP430F5529 LaunchPad. Figure 3-1 shows the connection method.
 - c. Disconnect J4 jumpers (5 V/ 3V3), connect J5 jumper, and connect TP1/TP2 to 5V/GND power source.
 - d. Power on 5 V/GND power supply.

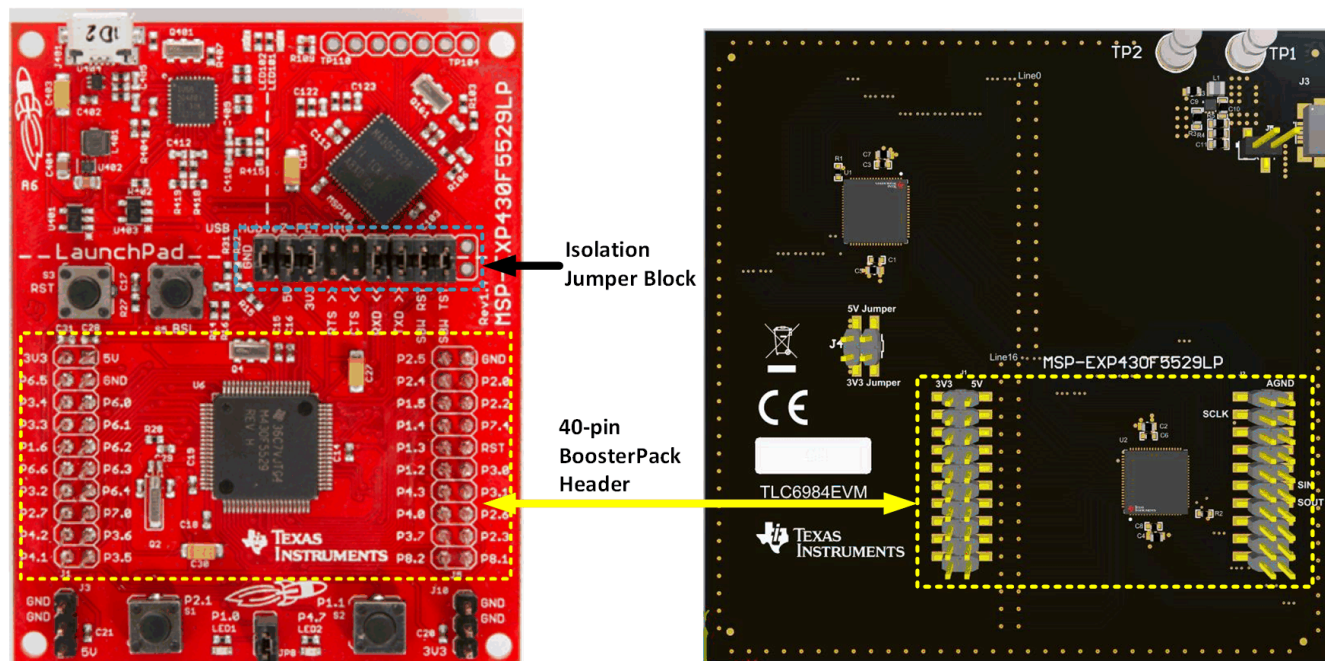


Figure 3-1. TLC6984EVM and MSP430F5529 LaunchPad™ Connector Pinout

4 Board Layout

Figure 4-1 illustrates the EVM Board Layout.

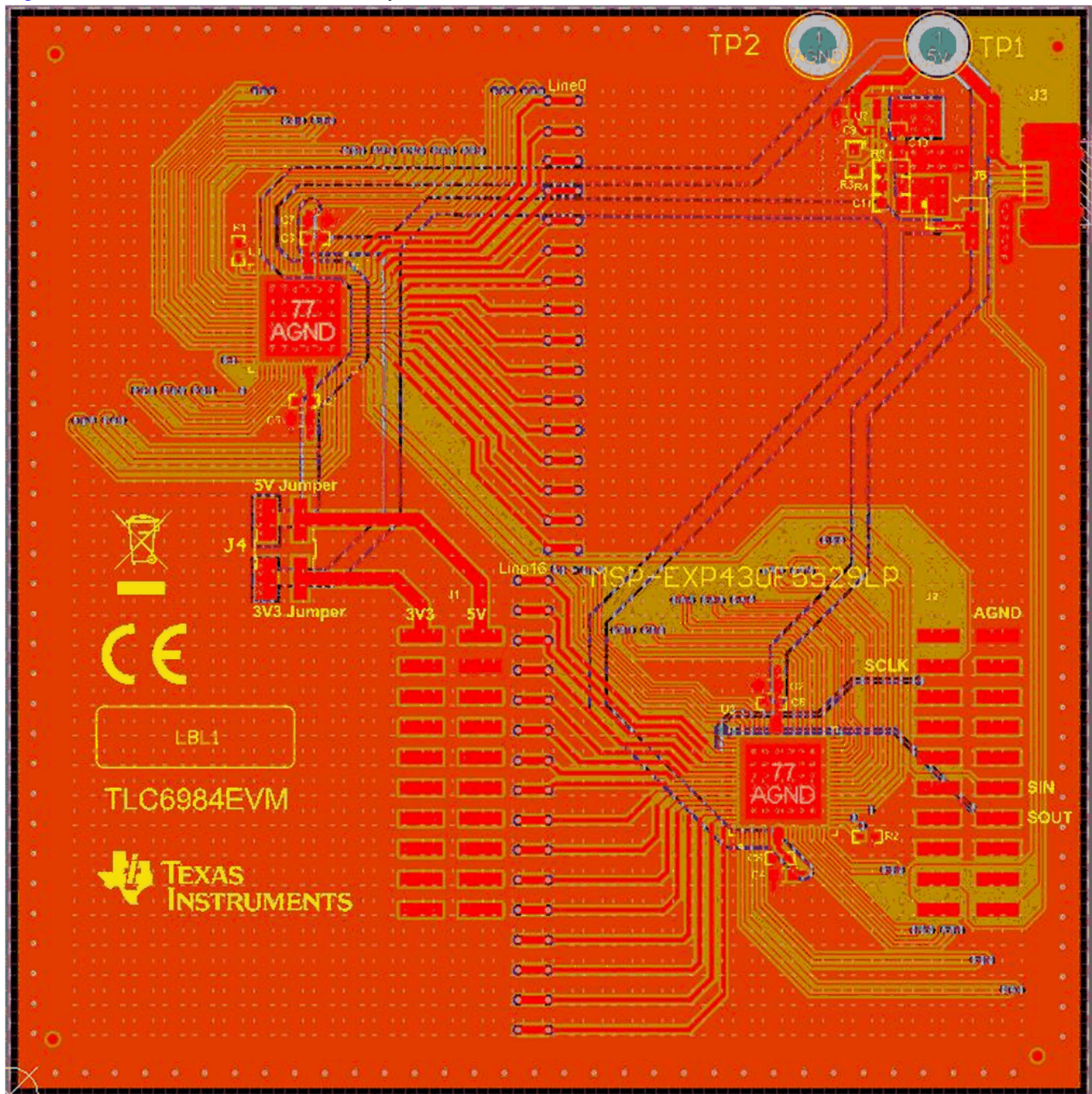


Figure 4-1. TLC6984EVM Layout

5 Schematics and Bill of Materials

5.1 Schematics

EVM schematics are shown as below.

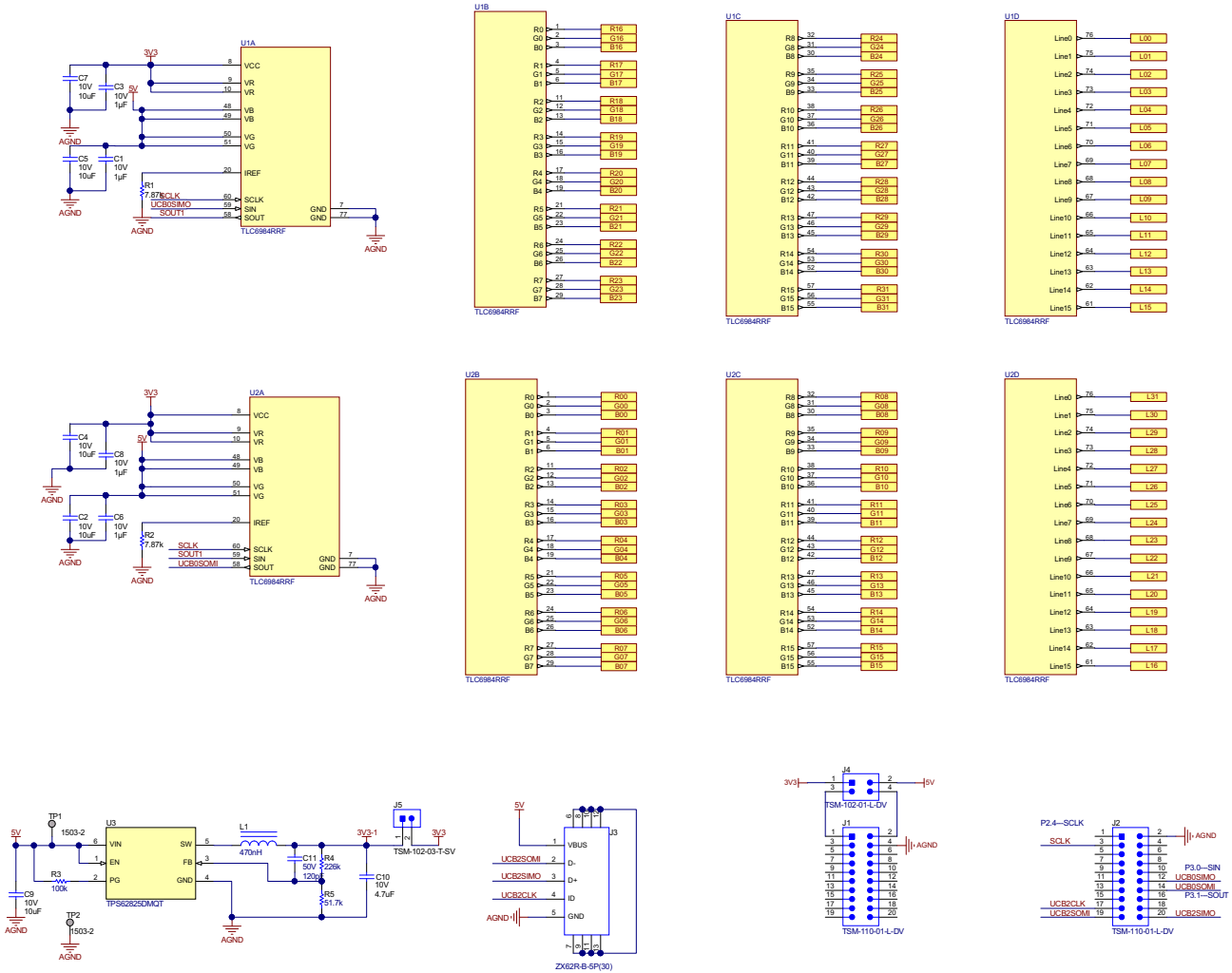


Figure 5-1. TLC6984EVM Schematic (1 of 3)

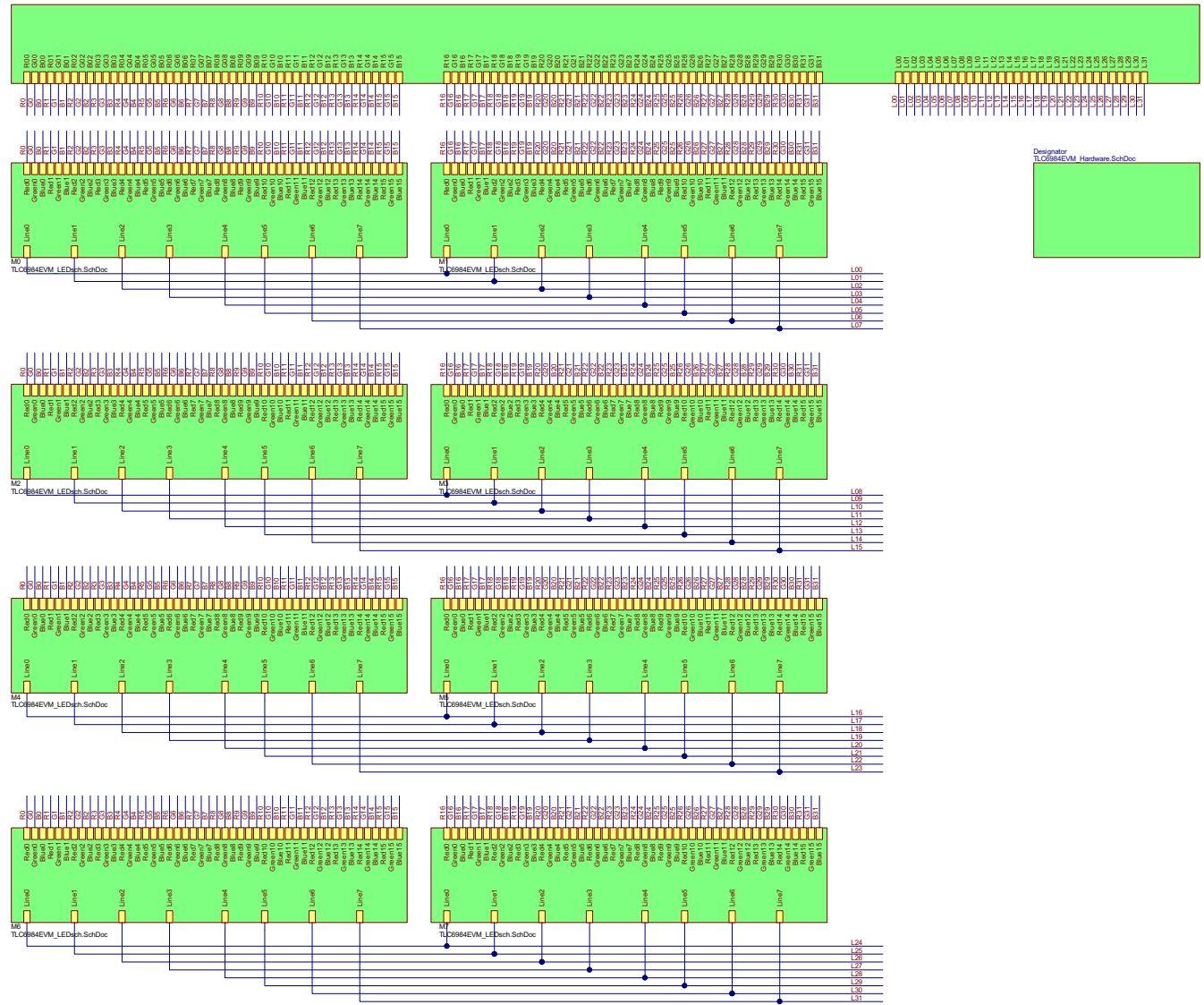


Figure 5-3. TLC6984EVM Schematic (3 of 3)

5.2 Bill of Materials

Table 5-1 lists the TLC6984 EVM BOM.

Table 5-1. TLC6984 EVM Bill of Materials

Item No.	Designator	QTY	Value	Part Number	Manufacturer	Description	Package Reference
1	C1, C3, C6, C8	4	1 uF	CL05A105MP5NNNC	Walsin	CAP, CERM, 1 μ F, 10 V, +/- 20%, X5R, 0402	0402
2	C2, C4, C5, C7, C9	5	10 uF	ZRB18AD71A106KE01L	MuRata	CAP, CERM, 10 uF, 10 V, +/- 10%, X7T, 0603	0603
3	C10	1	4.7 uF	CGB3B1X5R1A475K055A C	TDK	CAP, CERM, 4.7 uF, 10 V, +/- 10%, X5R, 0603	0603
4	C11	1	120 pF	VJ0603A121FXACW1BC	Vishay-Sprague	CAP, CERM, 120 pF, 50 V, +/- 1%, C0G/NP0, 0603	0603
5	D1_M0... D128_M7	1024	RGB	EAST1616RGBA8	Everlight	LED, RGB, SMD	1.6x1.6mm
6	J1, J2	2		TSM-110-01-L-DV	Samtec	Header, 2.54mm, 10x2, Gold, SMT	Header, 2.54mm, 10x2, SMT
7	J3	1		ZX62R-B-5P(30)	Hirose Electric Co. Ltd.	Connector, Receptacle, Micro-USB Type B, Top Mount SMT	Connector USB Mini B
8	J4	1		TSM-102-01-L-DV	Samtec	Header, 2.54 mm, 2x2, Gold, SMT	Header, 2.54mm, 2x2, SMT
9	J5	1		TSM-102-03-T-SV	Samtec	Header, 2.54 mm, 2x1, Tin, SMT	Header, 2.54mm, 1x2, SMT
10	L1	1	470 nH	DFE201610E-R47M=P2	MuRata	Inductor, Shielded, Metal Composite, 470 nH, 3.6 A, 0.032 ohm, SMD	1.6x2mm
11	LBL1	1		THT-14-423-10	Brady	Thermal Transfer Printable Labels, 0.650" W x 0.200" H - 10,000 per roll	PCB Label 0.650 x 0.200 inch
12	R1, R2	2	7.87 k	CRCW04027K87FKED	Vishay-Dale	RES, 7.87 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	0402
13	R3	1	100 k	CRCW0603100KFKEA	Vishay-Dale	RES, 100 k, 1%, 0.1 W, 0603	0603
14	R4	1	226 k	CRCW0603226KFKEA	Vishay-Dale	RES, 226 k, 1%, 0.1 W, 0603	0603
15	R5	1	51.7 k	RT0603BRD0751K7L	Yageo America	RES, 51.7 k, 0.1%, 0.1 W, 0603	0603
16	TP1, TP2	2		1503-2	Keystone	Terminal, Turret, TH, Double	Keystone1503-2
17	U1, U2	2		TLC6984RRF	Texas Instruments	48x16 Common Cathode Matrix LED Display Driver with Ultra Low Power	VQFN76
18	U3	1		TPS62825DMQT	Texas Instruments	2-A High Efficiency Synchronous Buck Converter, DMQ0006A (VSON-HR-6)	DMQ0006A

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