

TLC6983 48x16 Common Cathode Matrix LED Display Driver Evaluation Module



ABSTRACT

This User's guide describes the TLC6983 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 TLC6983 is a highly integrated common cathode matrix LED display driver with 48 constant current sources and 16 scanning FETs. A single TLC6983 is capable of driving 16 x16 RGB LED pixels while stacking two TLC6983s can drive 32 x 32 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 TLC6983 is significantly reduced by ultra-low operation voltage range (V_{cc} down to 2.5V) and ultra-low operation current (I_{cc} down to 3.9mA).

The TLC6983 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 25MHz SCLK (external) and up to 160MHz 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 / Micro-LED products : 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 TLC6983 a perfect choice in such applications.

The TLC6983 also implements LED open/weak short/short detections and removals during operations and can also report those information out to the accompanying digital processor.

1.2 Applications

The TLC6983 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 TLC6983EVM connections, test points, and jumpers.

2.1 TLC6983 EVM Board

Figure 2-1 shows the image of driver IC side of TLC6983EVM board.

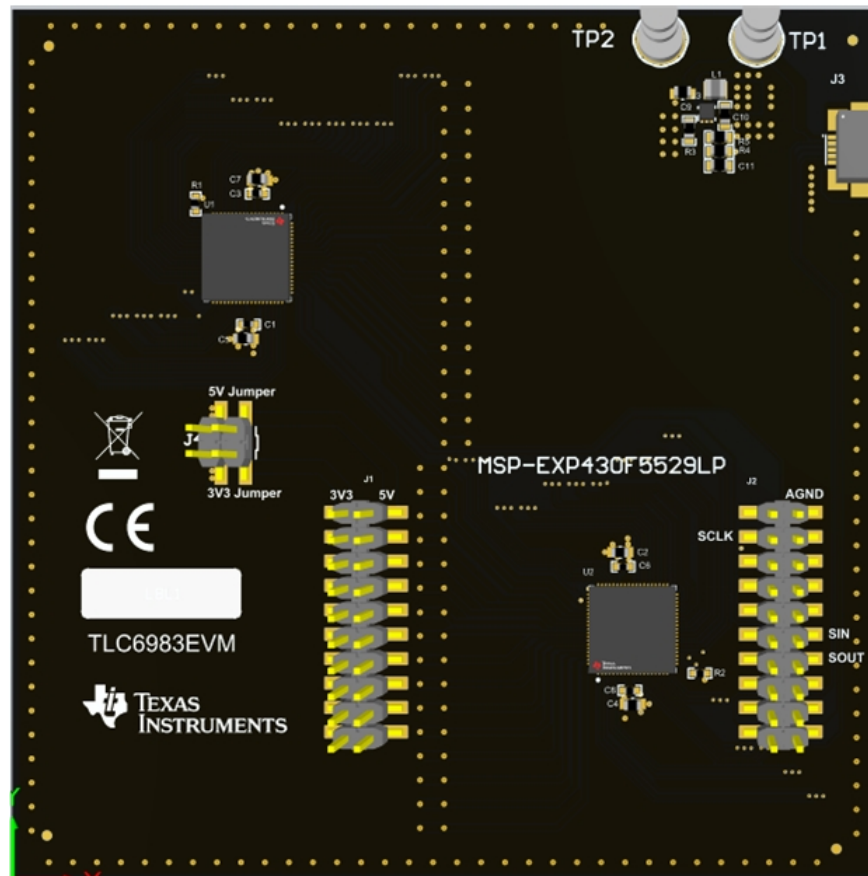


Figure 2-1. Driver IC Side of TLC6983EVM Board

2.2 Connectors

The TLC6983EVM has the following connectors:

- TP1(+5 V): Input power supply for VLEDG/VLEDB and DCDC
- 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 TLC6983EVM has the following jumpers:

- J4 (5 V Jumper): Input 5 V power supply from J3 or J1/J2
- J4 (3 V3 Jumper): Input 3 V3 power supply from J3 (DCDC) or J1/J2

3 Test Setup

Table 3-1 shows the typical parameters for TLC6983 EVM.

Table 3-1. TLC6983EVM 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	0.2-20mA

The TLC6983EVM can be setup and tested by following 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™, the connection method is shown as below figure.
 - c. Disconnect J4 jumpers(5V/ 3V3) block 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™, the connection method is shown in Figure 3-1.
 - c. Disconnect J4 jumpers(5V/ 3V3) and connect TP1 and TP2 to 5V/GND power source.
 - d. Power on 5V/GND power supply.

Figure 3-2 shows the hardware setup of the TLC6983 by using USB Power.

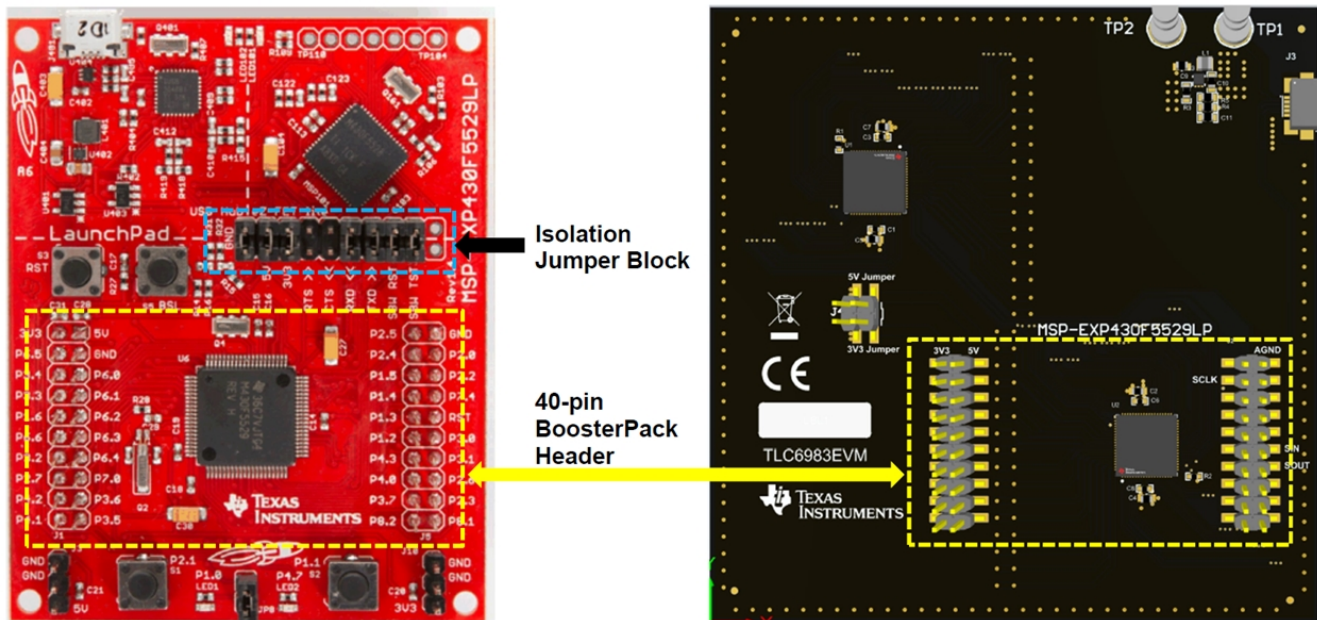


Figure 3-1. TLC6983EVM and MSP430F5529 LaunchPad™ connector pinout

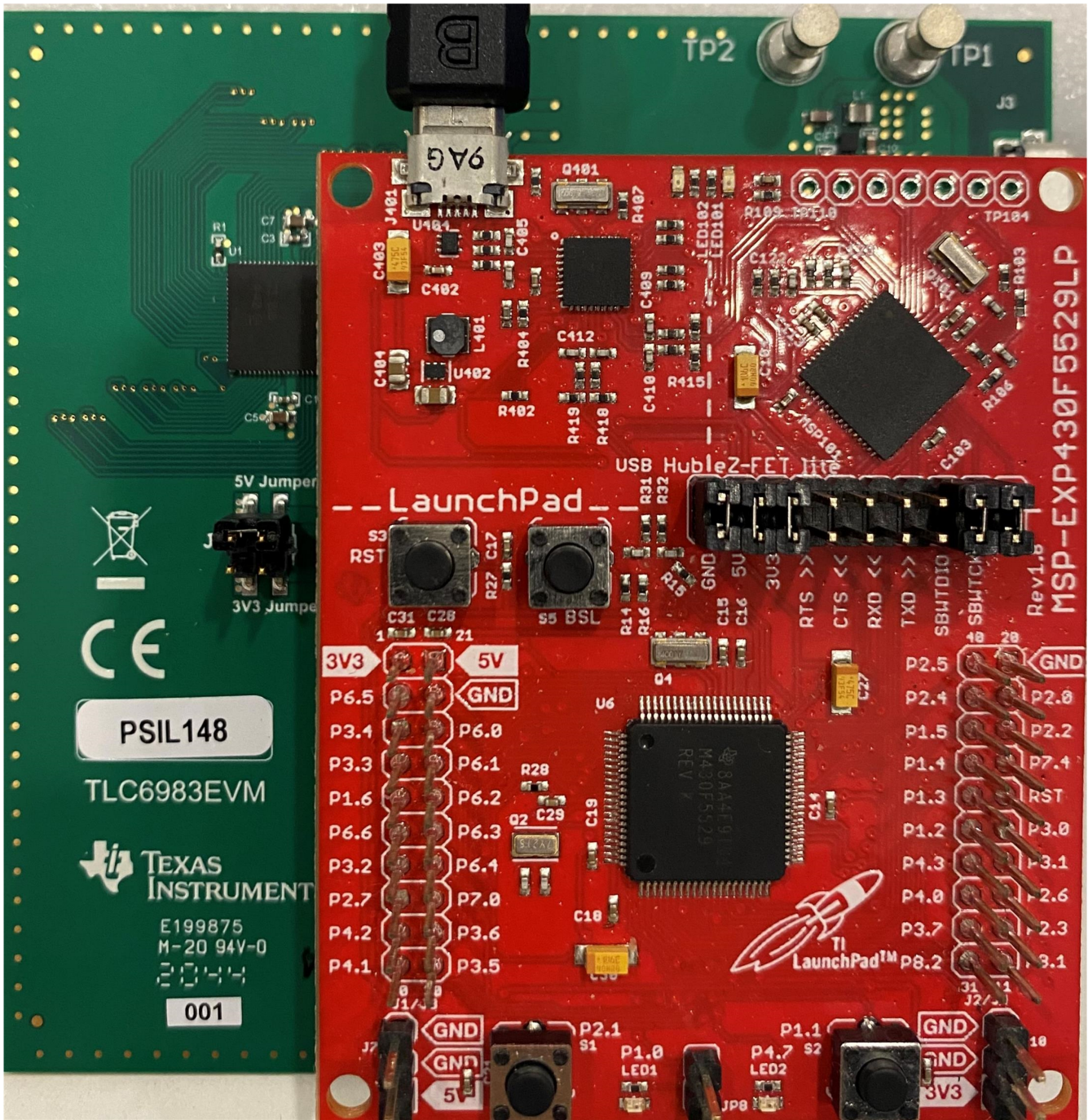


Figure 3-2. TLC6983EVM hardware setup

4 Board Layout

Figure 4-1 illustrates the EVM Board Layout.

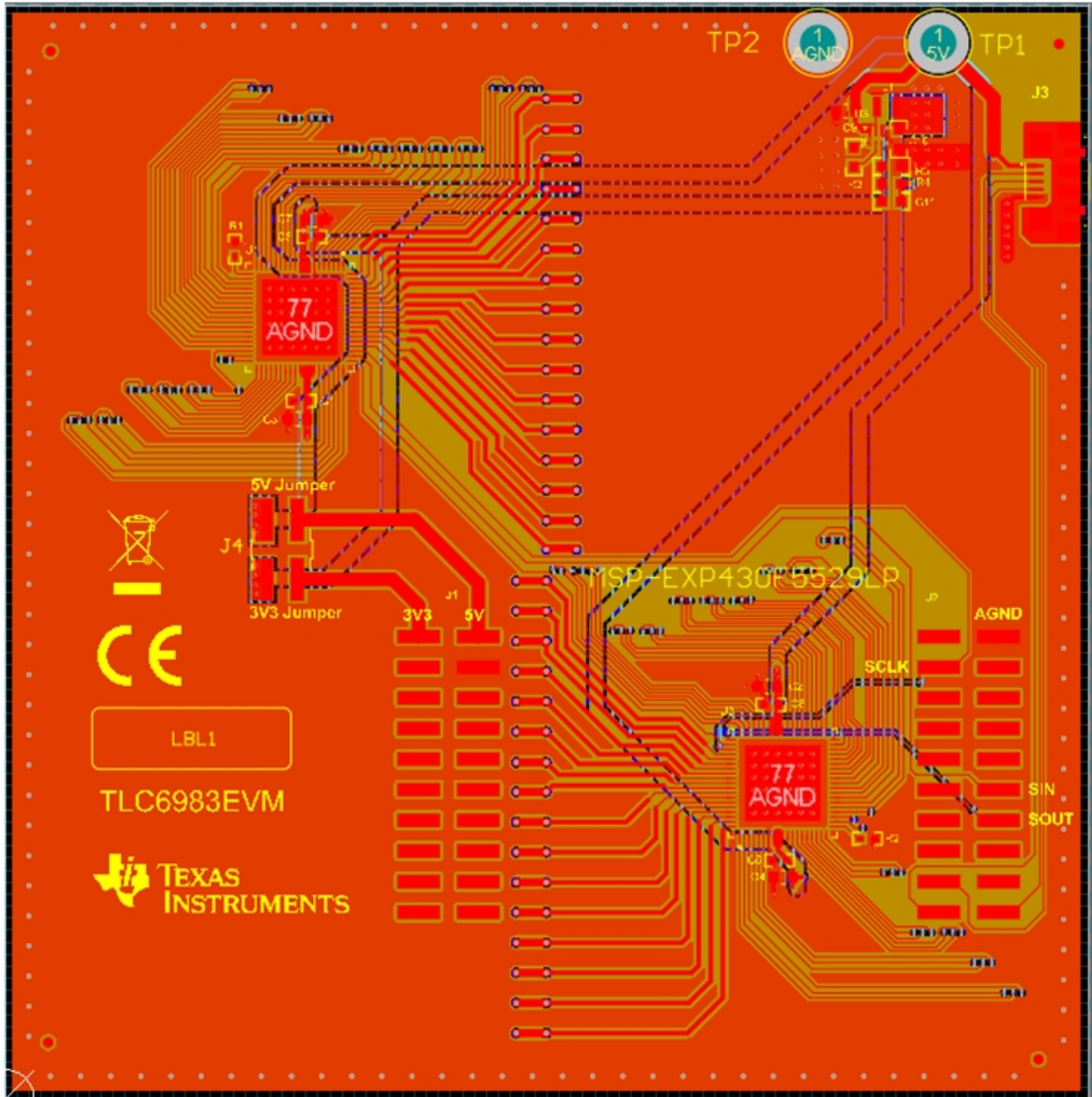


Figure 4-1. TLC6983EVM Layout

Schematic and Bill of Materials

5.1 Schematic

TLC6983 EVM Schematic shows the EVM schematic.

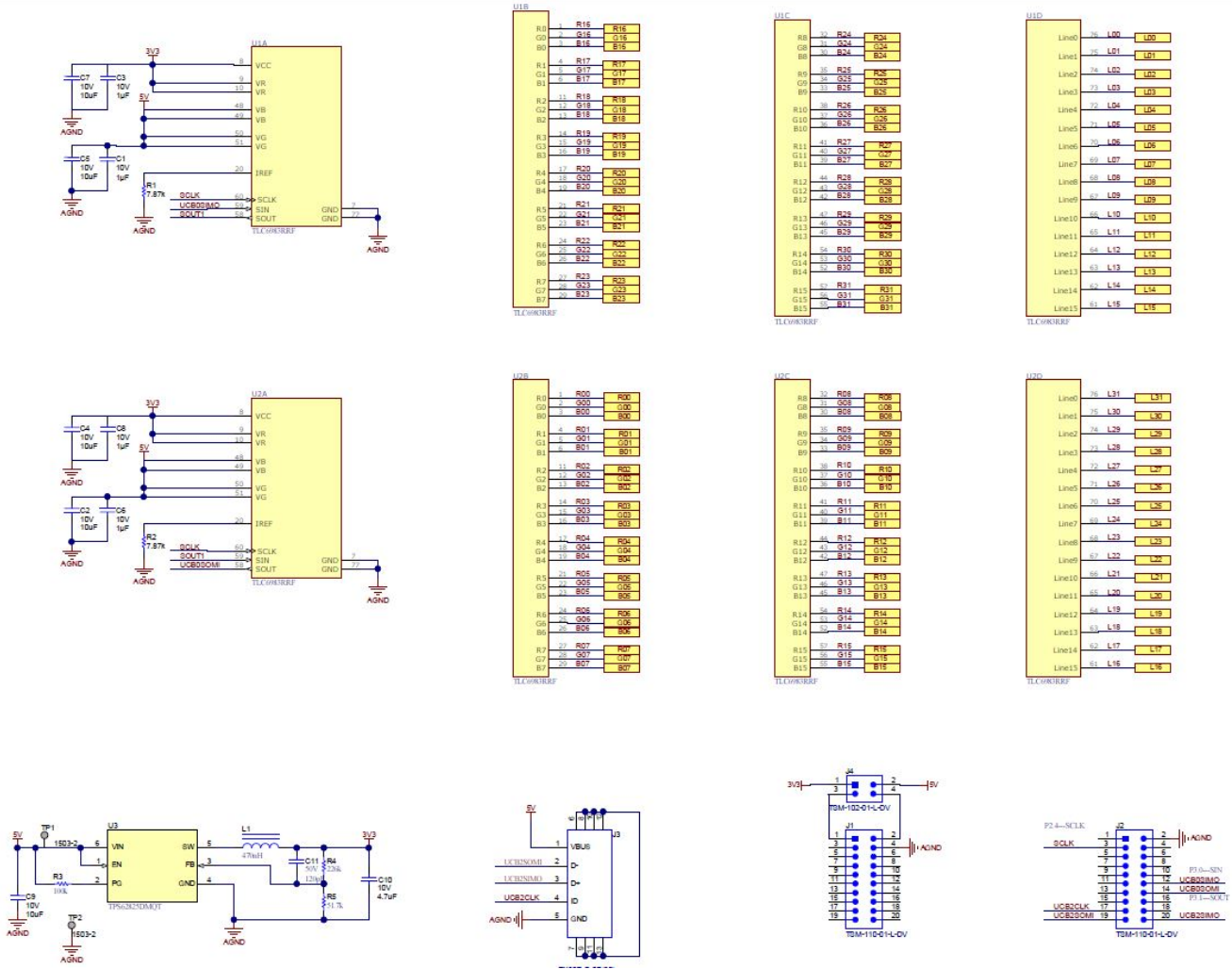


Figure 5-1. TLC6983 EVM Schematic

5.2 Bill of Materials

Table 5-1 lists the TLC6983 EVM BOM.

Table 5-1. TLC6983 EVM Bill of Materials

Item No.	Designator	QTY	Value	Part Number	Manufacturer	Description	Package Reference
1	C1, C3, C6, C8	4	1uF	CL05A105MP5NNNC	Walsin	CAP, CERM, 1 μ F, 10 V, +/- 20%, X5R, 0402	0402
2	C2, C4, C5, C7, C9	5	10uF	ZRB18AD71A106KE01L	MuRata	CAP, CERM, 10 uF, 10 V, +/- 10%, X7T, 0603	0603
3	C10	1	4.7uF	CGB3B1X5R1A475K055A C	TDK	CAP, CERM, 4.7 uF, 10 V, +/- 10%, X5R, 0603	0603
4	C11	1	120pF	VJ0603A121FXACW1BC	Vishay-Sprague	CAP, CERM, 120 pF, 50 V, +/- 1%, C0G/NP0, 0603	0603
5	D1_M0... D128_M7	102 4	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, 2.54mm, 2x2, Gold, SMT	Header, 2.54mm, 2x2, SMT
9	L1	1	470nH	DFE201610E-R47M=P2	MuRata	Inductor, Shielded, Metal Composite, 470 nH, 3.6 A, 0.032 ohm, SMD	1.6x2mm
10	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
11	R1, R2	2	7.87k	CRCW04027K87FKED	Vishay-Dale	RES, 7.87 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	0402
12	R3	1	100k	CRCW0603100KFKEA	Vishay-Dale	RES, 100 k, 1%, 0.1 W, 0603	0603
13	R4	1	226k	CRCW0603226KFKEA	Vishay-Dale	RES, 226 k, 1%, 0.1 W, 0603	0603
14	R5	1	51.7k	RT0603BRD0751K7L	Yageo America	RES, 51.7 k, 0.1%, 0.1 W, 0603	0603
15	TP1, TP2	2		1503-2	Keystone	Terminal, Turret, TH, Double	Keystone1503-2
16	U1, U2	2		TLC6983RRF	Texas Instruments	48x16 Common Cathode Matrix LED Display Driver with Ultra Low Power	VQFN76
17	U3	1		TPS62825DMQT	Texas Instruments	2-A High Efficiency Synchronous Buck Converter, DMQ0006A (VSON-HR-6)	DMQ0006A

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