*User's Guide*
# TLC6983 48x16 Common Cathode Matrix LED Display Driver Evaluation Module

**TEXAS INSTRUMENTS**

## 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).

## Table of Contents

## List of Figures

## List of Tables

## Trademarks

All trademarks are the property of their respective owners.

# 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 (Vcc down to 2.5V) and ultra-low operation current (Icc 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 fist 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

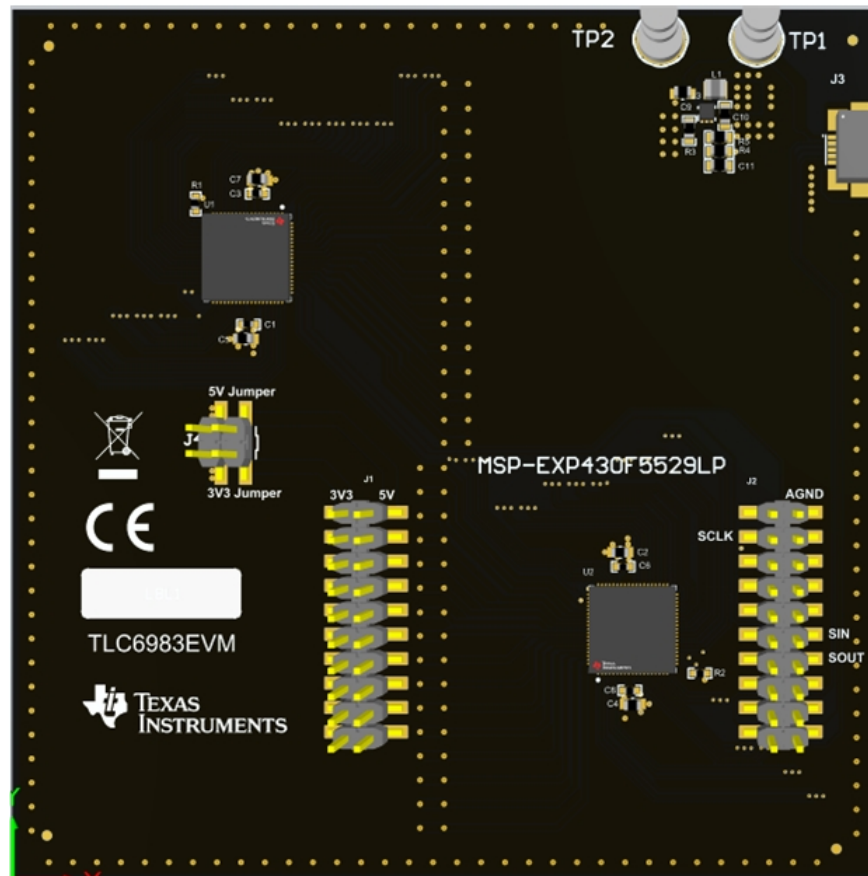Figure 2-1 shows the image of driver IC side of TLC6983EVM board.



**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.
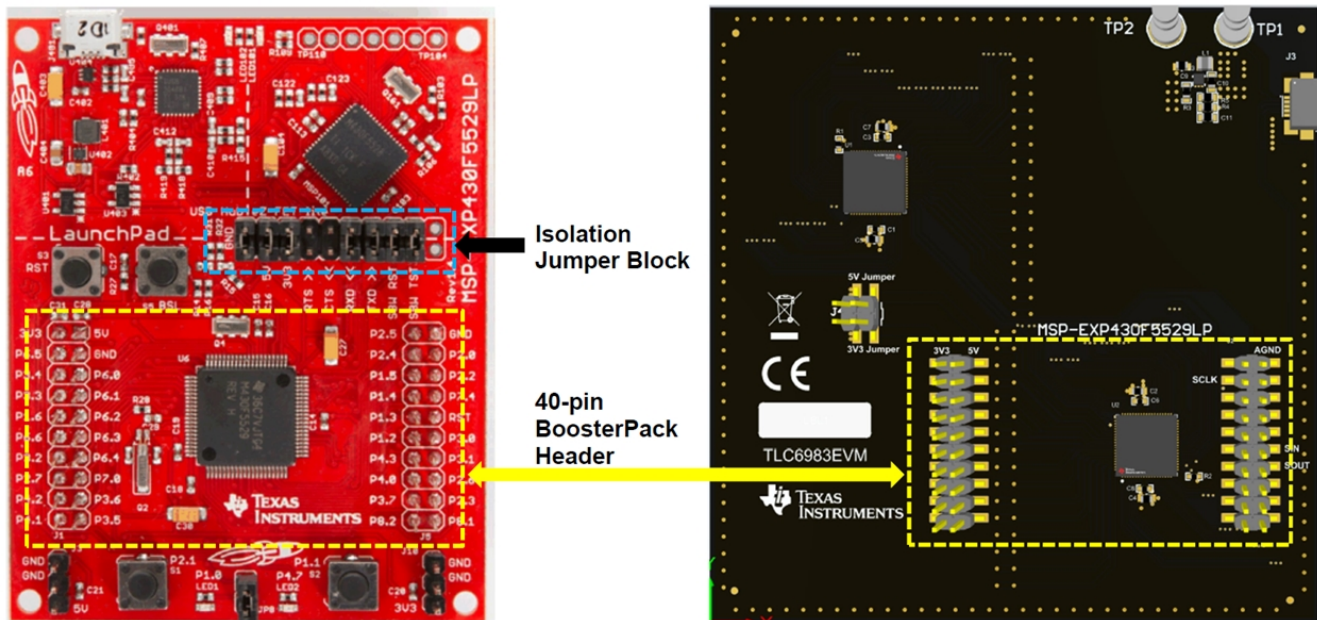


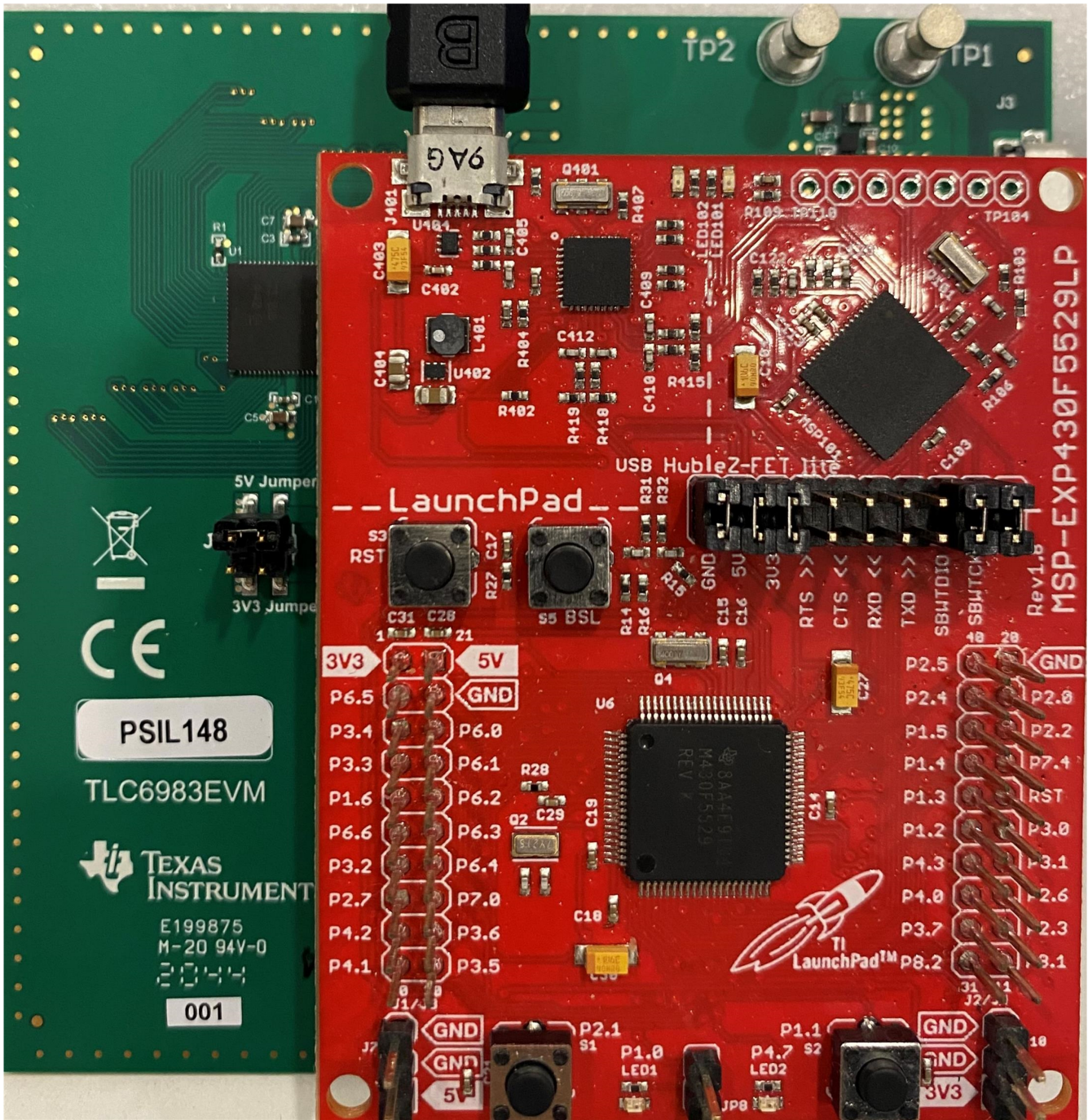**Figure 3-1. TLC6983EVM and MSP430F5529 LaunchPad™ connector pinout**

**Figure 3-2. TLC6983EVM hardware setup**
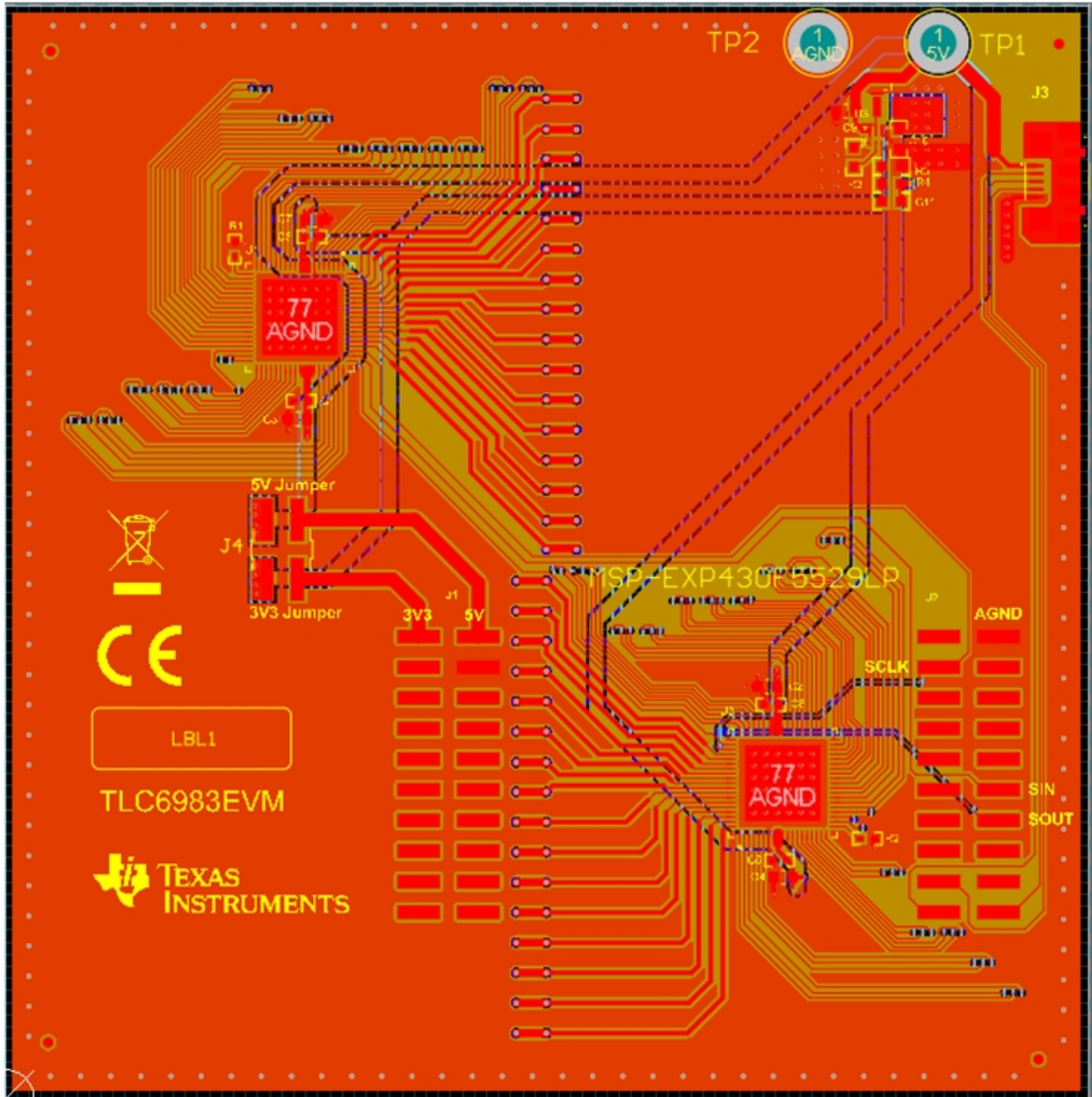
# 4 Board Layout

illustrates the EVM Board Layout.



**Figure 4-1. TLC6983EVM Layout**

Copyright © 2020 Texas Instruments Incorporated

# Schematic and Bill of Materials

## 5.1 Schematic
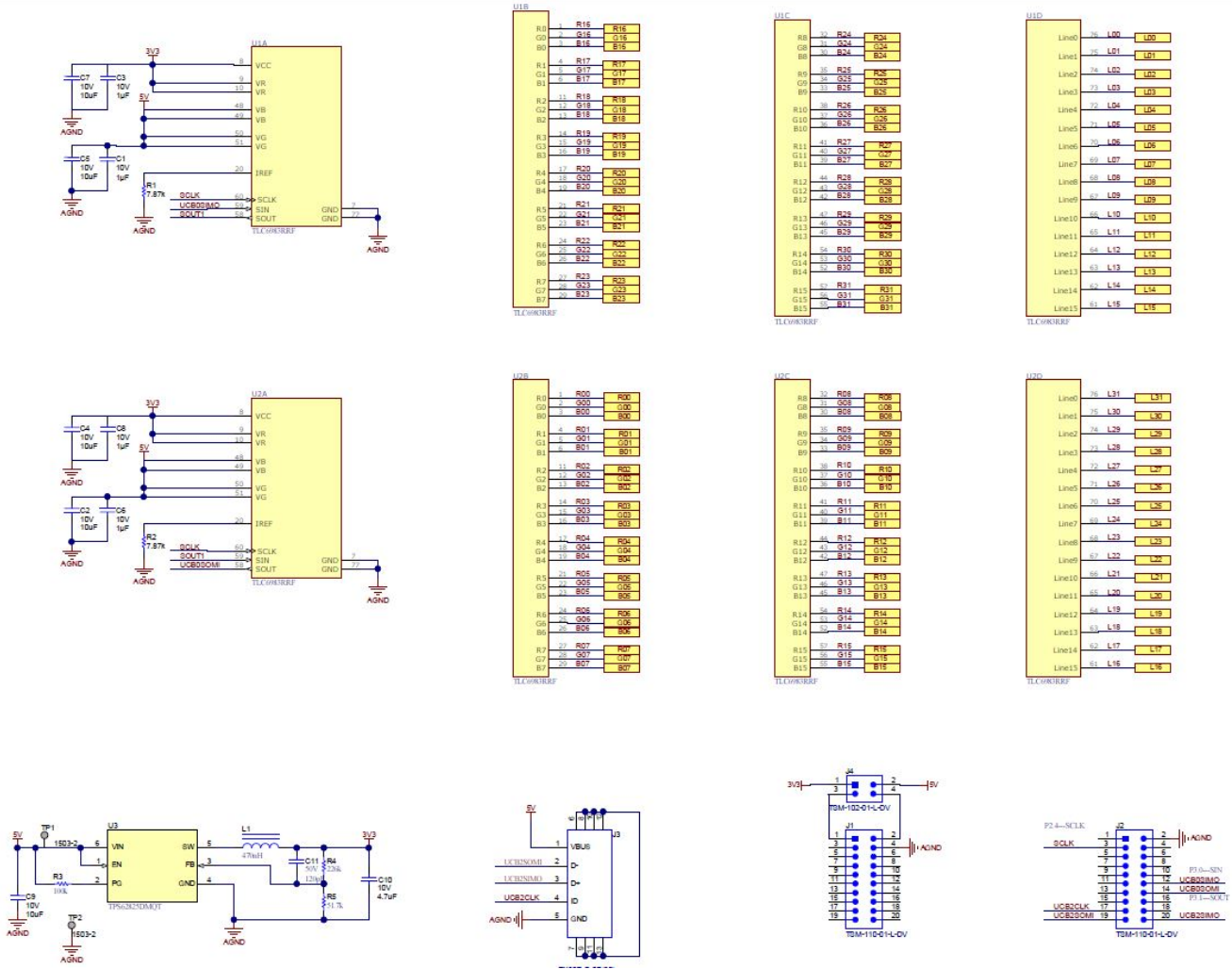
TLC6983 EVM Schematic shows the EVM schematic.



**Figure 5-1. TLC6983 EVM Schematic**

## 5.2 Bill of Materials

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 µF, 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 | CGB3B1X5R1A475K055AC | 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 | 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, 2.54mm, 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 |

# IMPORTANT NOTICE AND DISCLAIMER