User's Guide
SLAU753–December 2017

TLC6C5724-Q1 Evaluation Module

This document is a guide for using the TLC6C5724-Q1 EVM and GUI. The TLC6C5724EVM is designed to be controlled with the TLC65724EVM GUI via a USB2ANY communication tool. The TLC6C5724EVM can be powered by a micro-USB supply with a PC USB port. The TLC6C5724EVM GUI is designed demonstrate the TLC6C5724-Q1 features.

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1 Introduction

The TLC6C5724-Q1 device is a 24-channel, constant-current LED driver designed to support automotive LED applications.

1.1 Features

The EVM has the following features:

- 24 constant-current-sink output channels
- Excellent constant-current accuracy
- 7-bit individual dot correction
- 8-bit global brightness control
- 12-bit PWM dimming
- LED protection and diagnostics

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1.2 Applications

This EVM can be used in the following applications:

- Automotive cluster indicator
- Automotive HVAC panel
- Automotive E-shifter indicator
- Automotive local dimming display
- Automotive ambient lighting

1.3 Description

1.3.1 Kit Contents

TLC6C5724EVM kit contains a USB2ANY, TLC6C5724EVM, and two connection cables, as Figure 1 shows.

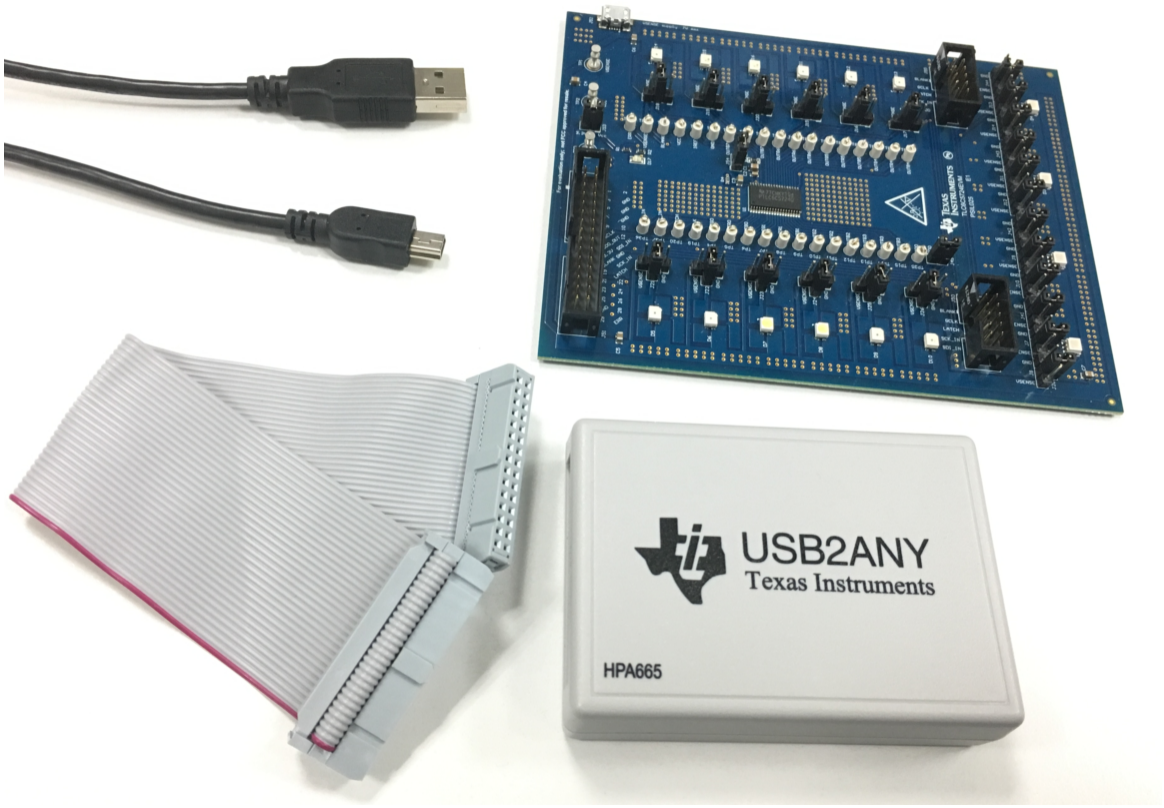


Figure 1. TLC6C5724EVM Kit

1.3.2 Additional Items Required

The following additional items are required to run the TLCC65724EVM:

- PC with the TLC6C5724EVM GUI installed
- 5-V DC supply or USB port for LED supply

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2 Test Setup and Results

2.1 Hardware Setup

Figure 2 shows the hardware setup of the TLC6C5724-Q1 EVM.

- Connect the 5-V power supply to the LED board between TP1 (SENSE) and TP3 (GND), use the 5-V micro-USB supply connected to J52 to supply the LED.
- Put a shunt on J53 to connect the USB2ANY 3.3-V supply to VCC. In this case, extra DC supply is not needed to supply the VCC.
- Connect the host computer to the USB2ANY board via a USB cable.
- Connect the ribbon cable between the USB2ANY board and the TLC6C5724-Q1 EVM board.

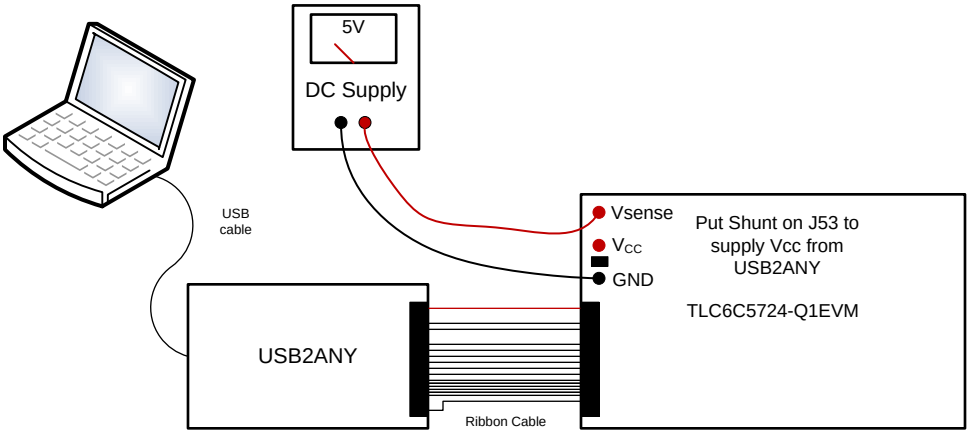


Figure 2. TLC6C5712-Q1EVM Hardware Setup

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2.2 Software Installation

Download the GUI software from the TLC6C5724-Q1 EVM tool folder and install on the PC. Once installed, a shortcut to the GUI is found on the desktop and also in the start-up menu under the Texas Instruments folder. shows the landing page of the TLC6C5724EVM GUI. A support document link is on bottom of the landing page.

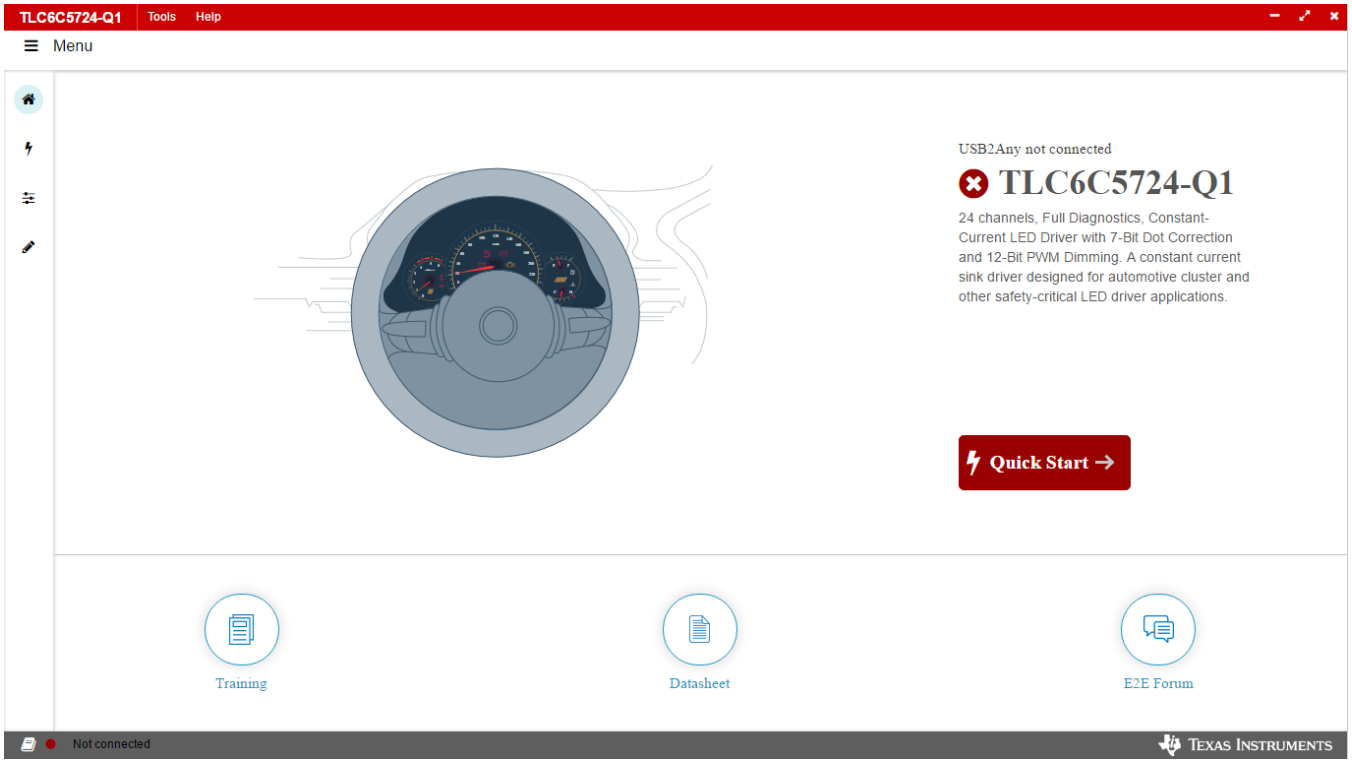


Figure 3. TLC6C5724EVM GUI Landing Page

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2.3 GUI Function

This section provides instructions to run the TLC6C5724EVM using the TLC6C5724EVM GUI.

2.3.1 Connection Status

The TLC6C5724EVM connection status appears on the GUI landing page. A Red status indicator means *Device Not connected*, a Green status indicator means *Device connected*. Click the *Quick Start* button and a quick configuration page opens for control of the TLC6C5724EVM.

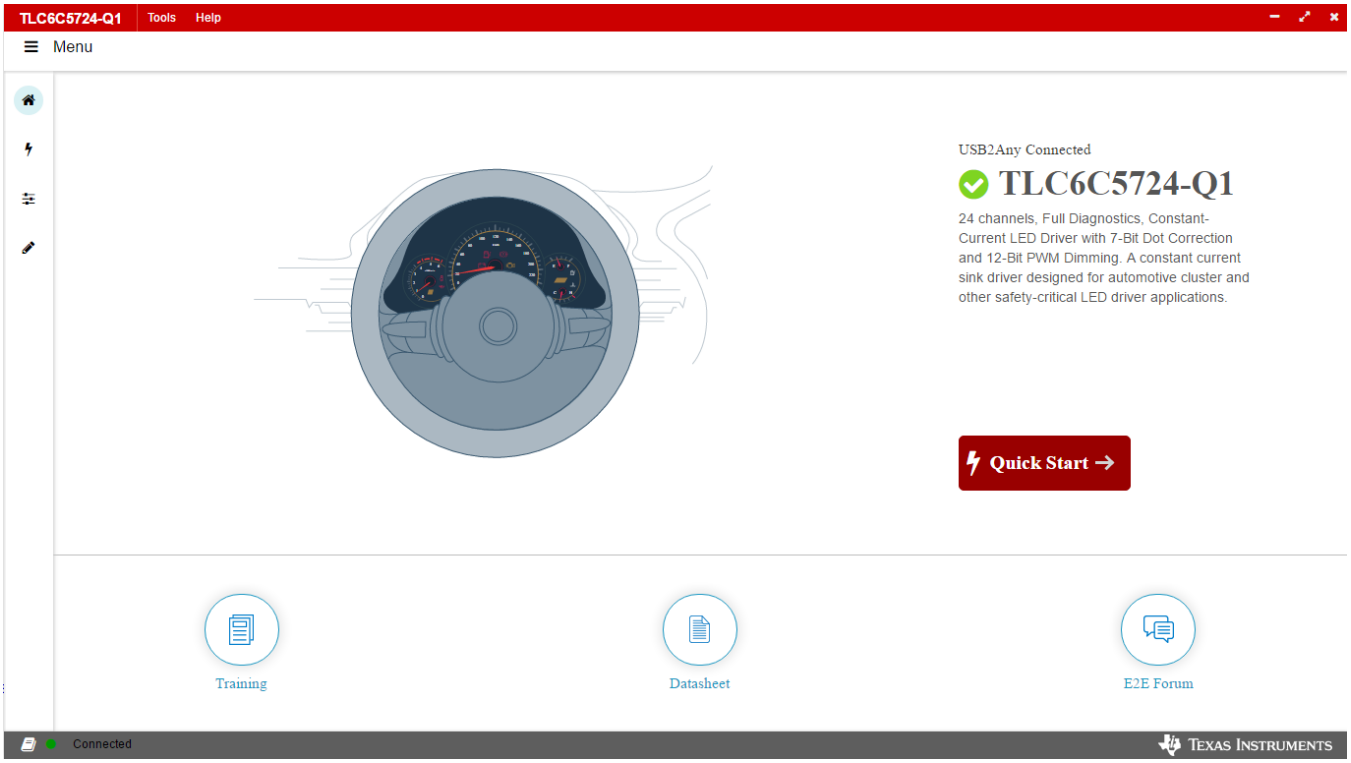


Figure 4. Connection Status

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2.3.2 Quick Start Page

The LED brightness is adjustable and the channel status is easily read on the *Quick Start* page. There are two kinds of LEDs on the EVM, monochrome LEDs and RGB LEDs. The LED groups can be controlled individually or globally. For monochrome LEDs, if the *Apply this brightness to all monochrome LEDs* option is selected, all monochrome LEDs are dimmed at the same brightness, if not, the LEDs are controlled individually. For RGB LEDs, if the *Apply this color to all color LEDs* option is selected, all the four RGB LEDs color are changed simultaneously with the same color, if not, each RGB LED is changed individually.

At the right side of the GUI, the LED status is read out every 2 seconds. A Green color of the status stands for no error, Red color status stands for fault status. By clicking the button next to *APS OK*, the detailed LOD and LSD information will show up.

At the bottom right of the page, the configuration can be saved locally. On subsequent uses of the GUI, the existing configuration data can be loaded directly. For detailed features configuration, can click the *GO ADVANCED!* button.

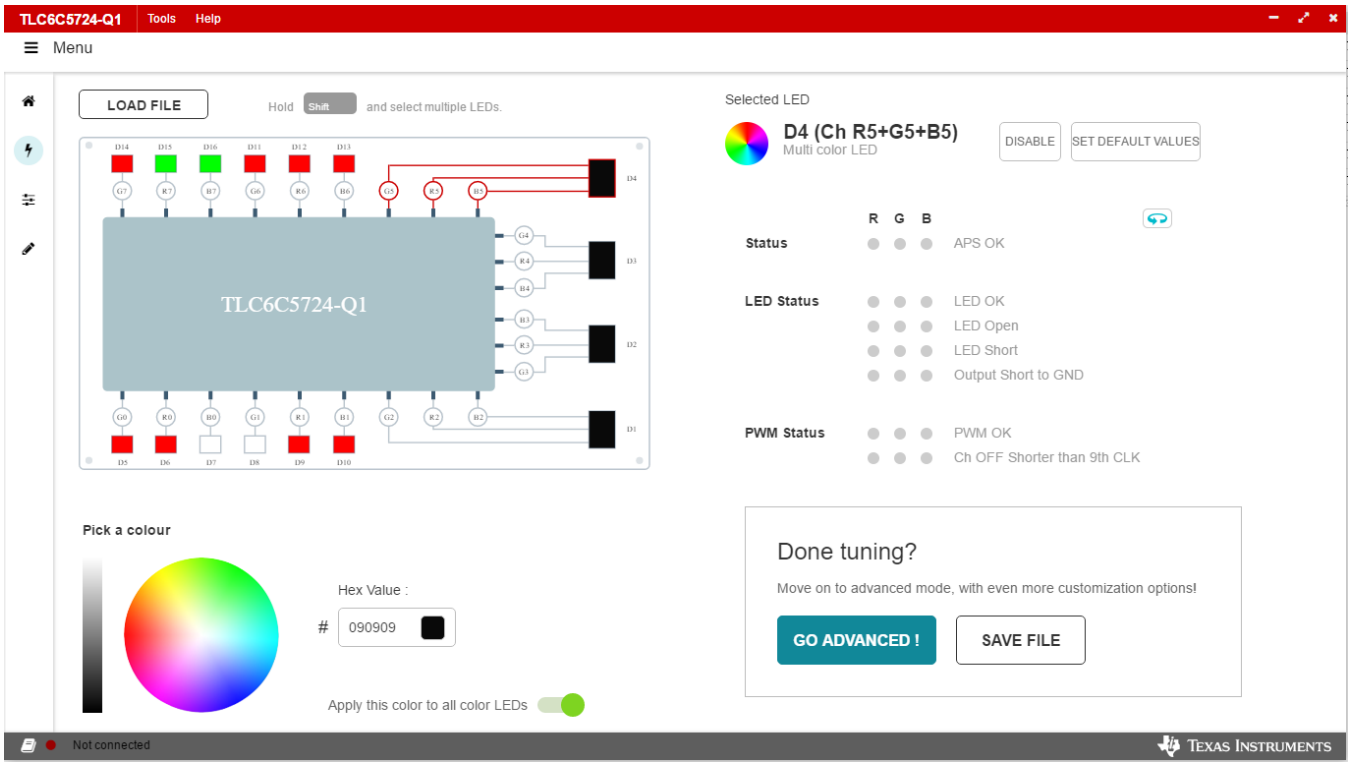


Figure 5. Quick Start Page

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2.3.3 Advanced Settings Page

The *Advanced Settings* page (Figure 6) provides more register configuration features. GLOBAL RESET resets the TLCC65724-Q1 internal registers, meaning all registers values are set to 0 except the *Mask LED Error* bit is set to 1. INITIALIZE ALL CH VALUES turns on all channels with 50% greyscale (GS), dot correction, and brightness control values. GS and dot correction channels can be adjusted separately.

For APS test and LOD test, turn off all output channels. For other configurations, refer to *TLC6C5724-Q1 24-Channel, Full Diagnostics, Constant-Current LED Driver With 7-Bit Dot Correction and 12-Bit PWM Dimming* for details.

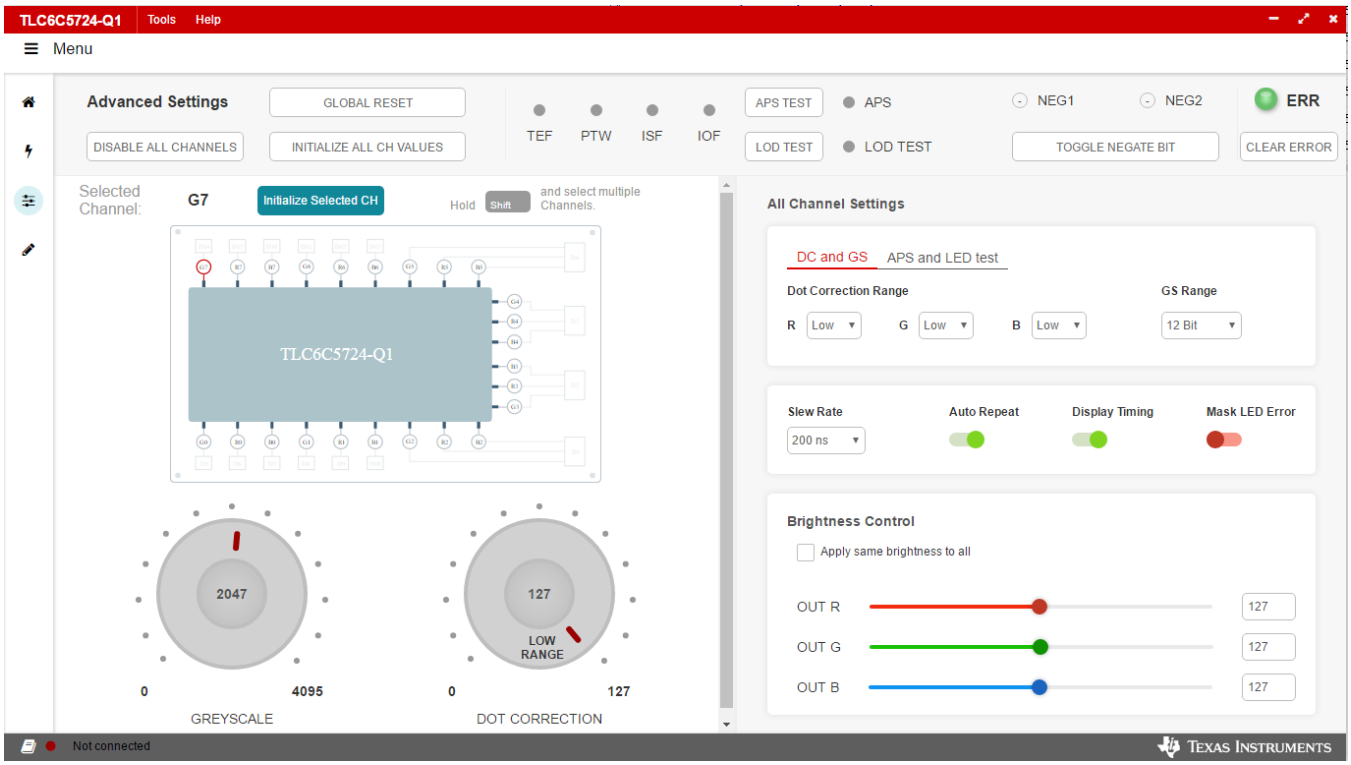


Figure 6. Advanced Settings Page

2.3.4 Device Cascading

Use J50 and J55 to connect two TLC6C5724-Q1 EVMs in cascading mode.

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3 Board Layout

Figure 7 illustrates the PCB layout of TLC6C5724EVM.

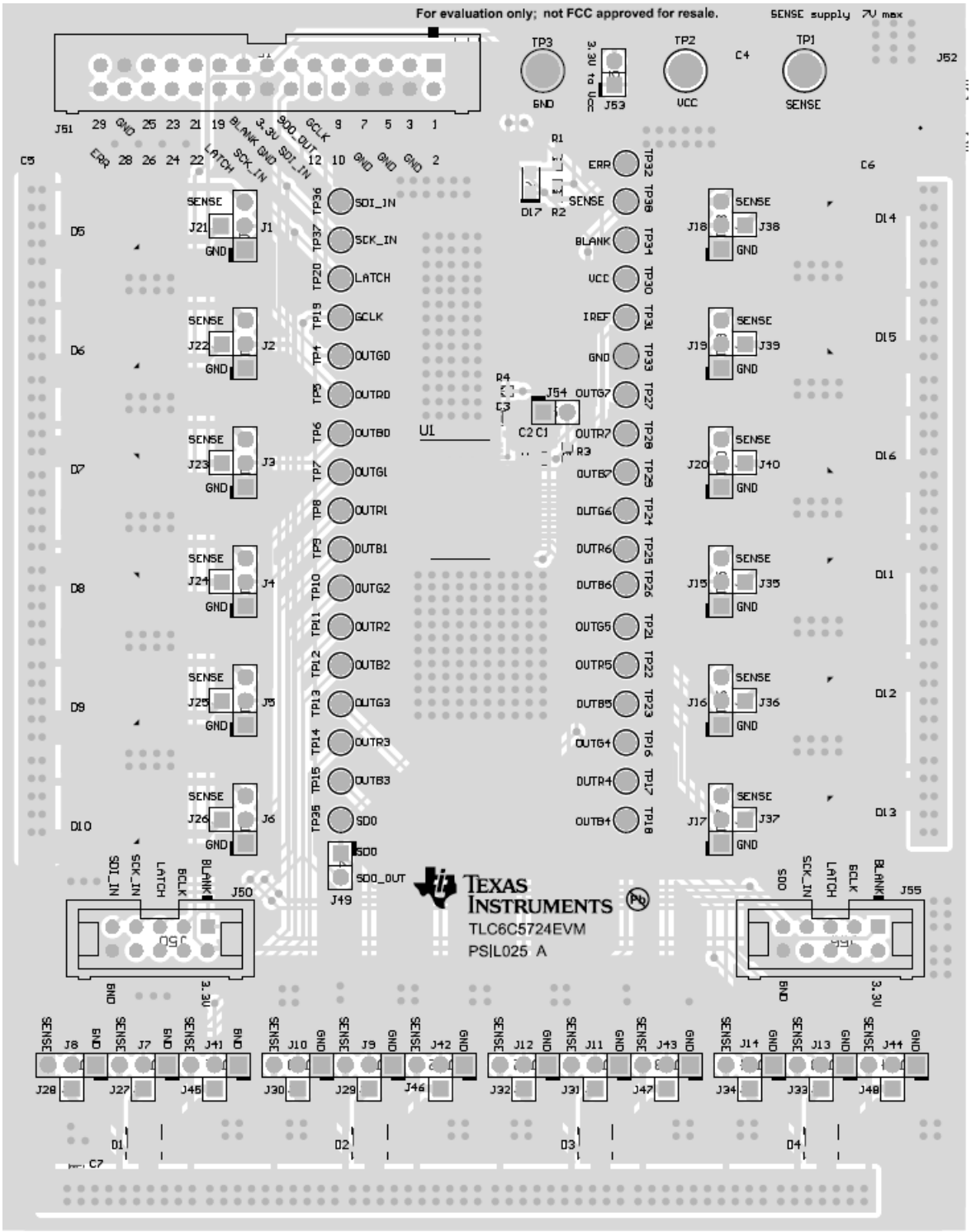


Figure 7. PCB Layout

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4 Schematic and Bill of Materials

4.1 Schematic

Figure 8 illustrates the TLC6C5724EVM schematic.

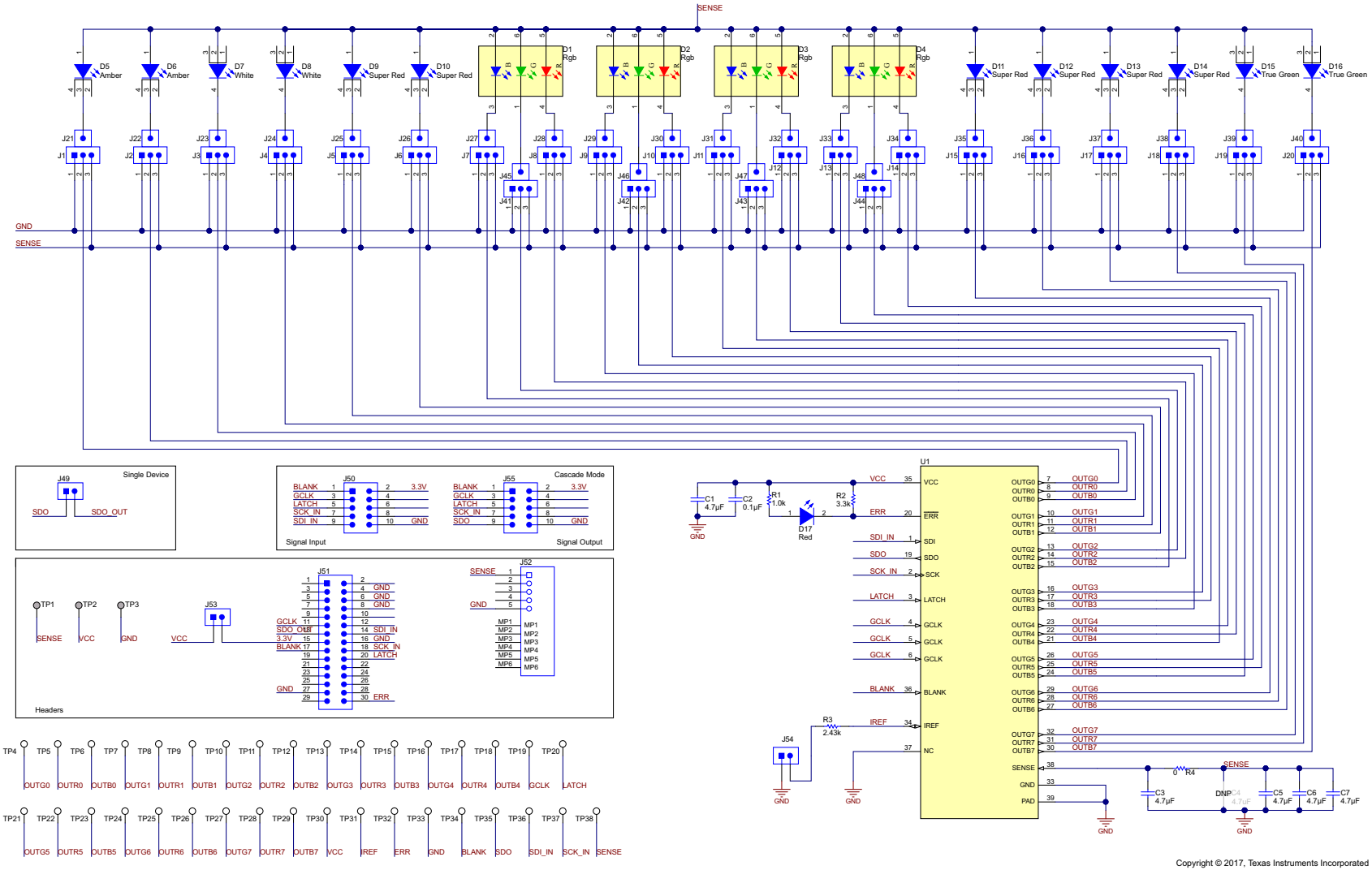


Figure 8. TLC6C5724EVM Schematic

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4.2 Bill of Materials

Table 1 lists the TLC6C5724EVM BOM.

Table 1. Bill of Materials

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer
C1	1	4.7uF	CAP, CERM, 4.7 µF, 16 V, ±10%, X5R, 0805	0805	GRM21BR61C475KA88L	Murata
C2	1	0.1uF	CAP, CERM, 0.1 µF, 16 V, ±5%, X7R, 0603	0603	0603YC104JAT2A	AVX
C3, C5, C6, C7	4	4.7uF	CAP, CERM, 4.7 µF, 16 V, ±10%, X5R, 0805	0805	EMK212BJ475KG-T	Taiyo Yuden
D1, D2, D3, D4	4	Rgb	LED, RGB, SMD	3.3x3mm	LRTB GVSG-UEVE-24+AMAQ-29+SCUC-HR	OSRAM
D5, D6	2	Amber	LED, Amber, SMD	2.8x3.2mm	LA E67B-T2AA-24-1	OSRAM
D7, D8	2	White	LED, White, SMD	2.8x3.2mm	LW E6SG-AABA-JKPL-1	OSRAM
D9, D10, D11, D12, D13, D14	6	Super Red	LED, Super Red, SMD	2.8x3.2mm	LS E67B-S2U1-1-1	OSRAM
D15, D16	2	True Green	LED, True Green, SMD	2.8x3.2mm	LT E6SG-AABB-35-1	OSRAM
D17	1	Red	LED, Red, SMD	Red 0805 LED	LTST-C170KRKT	Lite-On
J1, J2, J3, J4, J5, J6, J7, J8, J9, J10, J11, J12, J13, J14, J15, J16, J17, J18, J19, J20, J41, J42, J43, J44	24		Header, 100mil, 3x1, Gold, TH	3x1 Header	TSW-103-07-G-S	Samtec
J21, J22, J23, J24, J25, J26, J27, J28, J29, J30, J31, J32, J33, J34, J35, J36, J37, J38, J39, J40, J45, J46, J47, J48	24		Header, 100mil, 1pos, Gold, TH	Testpoint	TSW-101-07-G-S	Samtec
J49, J53, J54	3		Header, 100mil, 2x1, Gold, TH	2x1 Header	TSW-102-07-G-S	Samtec
J50, J55	2		Header (shrouded), 100mil, 5x2, Gold, TH	TH, 10-Leads, Body 8.5x20mm, Pitch 2.54mm	XG4C-1031	Omron Electronic Components
J51	1		Connector, 15x2, 3A 300V STRT DIP, TH	Connector, 15x2, Pitch 2.54mm, TH	XG4C-3031	Omron Electronic Components
J52	1		Receptacle, 0.65 mm, 5x1, Gold, R/A, SMT	SMD, 5-Leads, Body 7.9x5.57mm, Pitch 0.65mm	10118192-0001LF	FCI
R1	1	1.0k	RES, 1.0 k, 5%, 0.1 W, 0603	0603	CRCW06031K00JNEA	Vishay-Dale
R2	1	3.3k	RES, 3.3 k, 5%, 0.1 W, 0603	0603	CRCW06033K30JNEA	Vishay-Dale
R3	1	2.43k	RES, 2.43 k, 0.5%, 0.1 W, 0603	0603	RT0603DRE072K43L	Yageo America
R4	1	0	RES, 0, 5%, 0.1 W, 0603	0603	ERJ-3GEY0R00V	Panasonic
SH-J1, SH-J2, SH-J3, SH-J4, SH-J5, SH-J6, SH-J7, SH-J8, SH-J9, SH-J10, SH-J11, SH-J12, SH-J13, SH-J14, SH-J15, SH-J16, SH-J17, SH-J18, SH-J19, SH-J20, SH-J21, SH-J22, SH-J23, SH-J24, SH-J25, SH-J26	26	1x2	Single Operation 2.54mm Pitch Open Top Jumper Socket	Single Operation 2.54mm Pitch Open Top Jumper Socket	M7582-05	Harwin
TP1, TP2, TP3	3		Terminal, Turret, TH, Double	Keystone1502-2	1502-2	Keystone
TP4, TP5, TP6, TP7, TP8, TP9, TP10, TP11, TP12, TP13, TP14, TP15, TP16, TP17, TP18, TP19, TP20, TP21, TP22, TP23, TP24, TP25, TP26, TP27, TP28, TP29, TP30, TP31, TP32, TP33, TP34, TP35, TP36, TP37, TP38	35		Test Point, Miniature, White, TH	White Miniature Testpoint	5002	Keystone
U1	1		24-Channel, Full Diagnostics, Constant-Current LED Driver with 7-Bit Dot Correction and 12-Bit PWM Dimming, DAP0038E (TSSOP-38)	DAP0038E	TLC6C5724QDAPRQ1	Texas Instruments
C4	0	4.7uF	CAP, CERM, 4.7 µF, 16 V,±10%, X5R, 0805	0805	EMK212BJ475KG-T	Taiyo Yuden

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      3.1.2 *For EVMs annotated as FCC – FEDERAL COMMUNICATIONS COMMISSION Part 15 Compliant:*

      CAUTION

      This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

      Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

      FCC Interference Statement for Class A EVM devices

      NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

FCC Interference Statement for Class B EVM devices

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- *Reorient or relocate the receiving antenna.*
- *Increase the separation between the equipment and receiver.*
- *Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.*
- *Consult the dealer or an experienced radio/TV technician for help.*

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(1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Concernant les EVMs avec appareils radio:

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Concerning EVMs Including Detachable Antennas:

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication. This radio transmitter has been approved by Industry Canada to operate with the antenna types listed in the user guide with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Concernant les EVMs avec antennes détachables

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante. Le présent émetteur radio a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés dans le manuel d'usage et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur

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If User uses EVMs in Japan, not certified to Technical Regulations of Radio Law of Japan, User is required to follow the instructions set forth by Radio Law of Japan, which includes, but is not limited to, the instructions below with respect to EVMs (which for the avoidance of doubt are stated strictly for convenience and should be verified by User):

1. Use EVMs in a shielded room or any other test facility as defined in the notification #173 issued by Ministry of Internal Affairs and Communications on March 28, 2006, based on Sub-section 1.1 of Article 6 of the Ministry's Rule for Enforcement of Radio Law of Japan,
2. Use EVMs only after User obtains the license of Test Radio Station as provided in Radio Law of Japan with respect to EVMs, or
3. Use of EVMs only after User obtains the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to EVMs. Also, do not transfer EVMs, unless User gives the same notice above to the transferee. Please note that if User does not follow the instructions above, User will be subject to penalties of Radio Law of Japan.

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This is a class A product intended for use in environments other than domestic environments that are connected to a low-voltage power-supply network that supplies buildings used for domestic purposes. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

4 *EVM Use Restrictions and Warnings:*

4.1 EVMS ARE NOT FOR USE IN FUNCTIONAL SAFETY AND/OR SAFETY CRITICAL EVALUATIONS, INCLUDING BUT NOT LIMITED TO EVALUATIONS OF LIFE SUPPORT APPLICATIONS.

4.2 User must read and apply the user guide and other available documentation provided by TI regarding the EVM prior to handling or using the EVM, including without limitation any warning or restriction notices. The notices contain important safety information related to, for example, temperatures and voltages.

4.3 *Safety-Related Warnings and Restrictions:*

4.3.1 User shall operate the EVM within TI's recommended specifications and environmental considerations stated in the user guide, other available documentation provided by TI, and any other applicable requirements and employ reasonable and customary safeguards. Exceeding the specified performance ratings and specifications (including but not limited to input and output voltage, current, power, and environmental ranges) for the EVM may cause personal injury or death, or property damage. If there are questions concerning performance ratings and specifications, User should contact a TI field representative prior to connecting interface electronics including input power and intended loads. Any loads applied outside of the specified output range may also result in unintended and/or inaccurate operation and/or possible permanent damage to the EVM and/or interface electronics. Please consult the EVM user 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, even with the inputs and outputs kept within the specified allowable ranges, some circuit components may have elevated case temperatures. These components include but are not limited to linear regulators, switching transistors, pass transistors, current sense resistors, and heat sinks, which can be identified using the information in the associated documentation. When working with the EVM, please be aware that the EVM may become very warm.

4.3.2 EVMs are intended solely for use by technically qualified, professional electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems, and subsystems. User assumes all responsibility and liability for proper and safe handling and use of the EVM by User or its employees, affiliates, contractors or designees. User assumes all responsibility and liability to ensure that any interfaces (electronic and/or mechanical) between the EVM and any human body are designed with suitable isolation and means to safely limit accessible leakage currents to minimize the risk of electrical shock hazard. User assumes all responsibility and liability for any improper or unsafe handling or use of the EVM by User or its employees, affiliates, contractors or designees.

4.4 User assumes all responsibility and liability to determine whether the EVM is subject to any applicable international, federal, state, or local laws and regulations related to User's handling and use of the EVM and, if applicable, User assumes all responsibility and liability for compliance in all respects with such laws and regulations. User assumes all responsibility and liability for proper disposal and recycling of the EVM consistent with all applicable international, federal, state, and local requirements.

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