

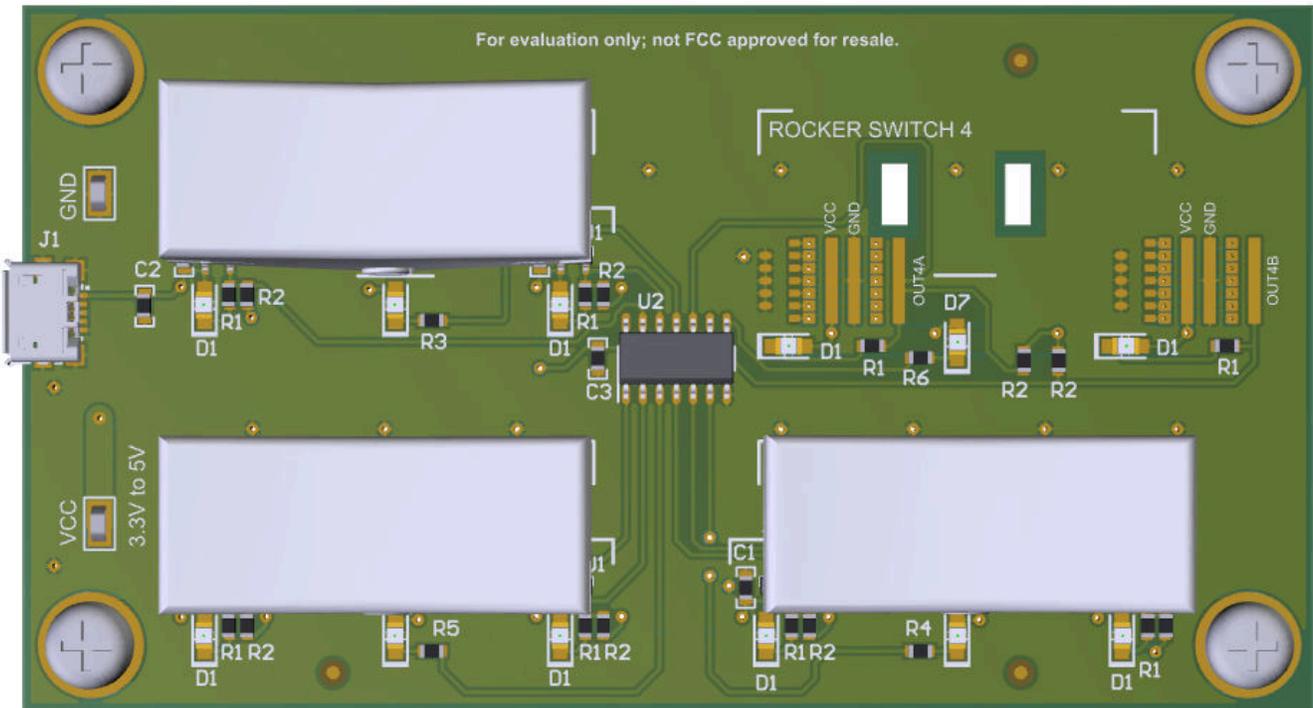
# User's Guide

## HALLROCKER-EVM



### ABSTRACT

This user's guide describes the characteristics, operation, and use of the Hall-effect human machine interface (HMI) HALLROCKER evaluation module (EVM). This EVM is designed to evaluate the performance of Hall-effect switches in the SOT-23 package. Throughout this document, the terms evaluation board, evaluation module, and EVM are synonymous with the HALROCKER-EVM. This document includes a schematic, reference printed circuit board (PCB) layouts, and a complete bill of materials (BOM).



### Table of Contents

<b>1 Overview</b> .....	<b>2</b>
<b>2 Hardware</b> .....	<b>3</b>
<b>3 Operation</b> .....	<b>4</b>
<b>4 Schematics, PCB Layout, and Bill of Materials</b> .....	<b>7</b>
4.1 Schematics.....	7
4.2 PCB Layout.....	8
4.3 Bill of Materials.....	10

### Trademarks

All trademarks are the property of their respective owners.

## 1 Overview

Rocker switches are one of the possible forms of control in a HMI. These electromechanical switches are tri-state. Two states require active mechanical force from the user, while the third state is the default resting state when no force from the user is applied. A rocker switch can be constructed with magnets and Hall-effect switches. This document presents an example of such a rocker switch. In particular, the rocker switches presented here are the same switches that were covered in [HMI Rocker Switch with Hall-Effect Switches application report](#).

**Table 1-1. EVM Device Summary**

Product	Max Operate Point (B <sub>OP</sub> Max)	Min Release Point (B <sub>RP</sub> Min)
<a href="#">DRV5033FADBZ</a>	±6.8 mT	±0.5 mT
<a href="#">DRV5033AJDBZ</a>	±12 mT	±1 mT
<a href="#">DRV5032ZEDBZ</a>	±63 mT	±30 mT

### Kit Contents

[Table 1-2](#) lists the contents of the EVM kit. Contact the nearest Texas Instruments Product Information Center if any component is missing.

**Table 1-2. Kit Contents**

ITEM	QUANTITY
HALLROCKER-EVM	1
<a href="#">DRV5033FA</a> Rocker Assembly	1
<a href="#">DRV5033AJ</a> Rocker Assembly	1
<a href="#">DRV5032ZE</a> Rocker Assembly	1
USB A male to USB micro B male	1

### Related Documentation From Texas Instruments

This user's guide is available from the TI website under literature number SLIU024. Any letter appended to the literature number corresponds to the document revision that is current at the time of the writing of this document. Newer revisions are available from [www.ti.com](http://www.ti.com) or the Texas Instruments' Literature Response Center at (800) 477-8924 or the Product Information Center at (972) 644-5580. When ordering, identify the document by both title and literature number. [Table 1-3](#) lists documentation related to the EVM. Click the links in [Table 1-3](#) for further information. The device name links to the product web folder on [www.ti.com](http://www.ti.com). The literature number links to the document PDF.

**Table 1-3. Related Documentation**

DOCUMENT TITLE	DOCUMENT LITERATURE NUMBER
<a href="#">DRV5033</a> data sheet	<a href="#">SLIS152</a>
<a href="#">DRV5032</a> data sheet	<a href="#">SLVSDC7</a>

## 2 Hardware

This EVM allows the user to evaluate Hall-effect switches in a rocker switch application. The EVM includes three rocker switches designed with either the DRV5033FAQDBZ, DRV5033AJQDBZ, or DRV5032ZEDBZ according to the steps described in the [HMI Rocker Switch with Hall-Effect Switches application report](#). In addition to these switches, there is space for incorporating another switch of the user's own design in the quadrant designated as Rocker Switch 4. This rocker switch location provides the user with the flexibility to offset the device from the default location used for the other switches. The EVM is intended to provide basic functional evaluation of the devices. The layout is not intended to be a model for the target circuit, nor is it laid out for electromagnetic compatibility (EMC) testing.

### Features

- 3D printed Rocker switch assemblies.
- Conveniently powered from a common micro-USB connector.
- Slots for inserting custom switch.
- 3D CAD files available for printing more switches or tailoring the design.

## 3 Operation

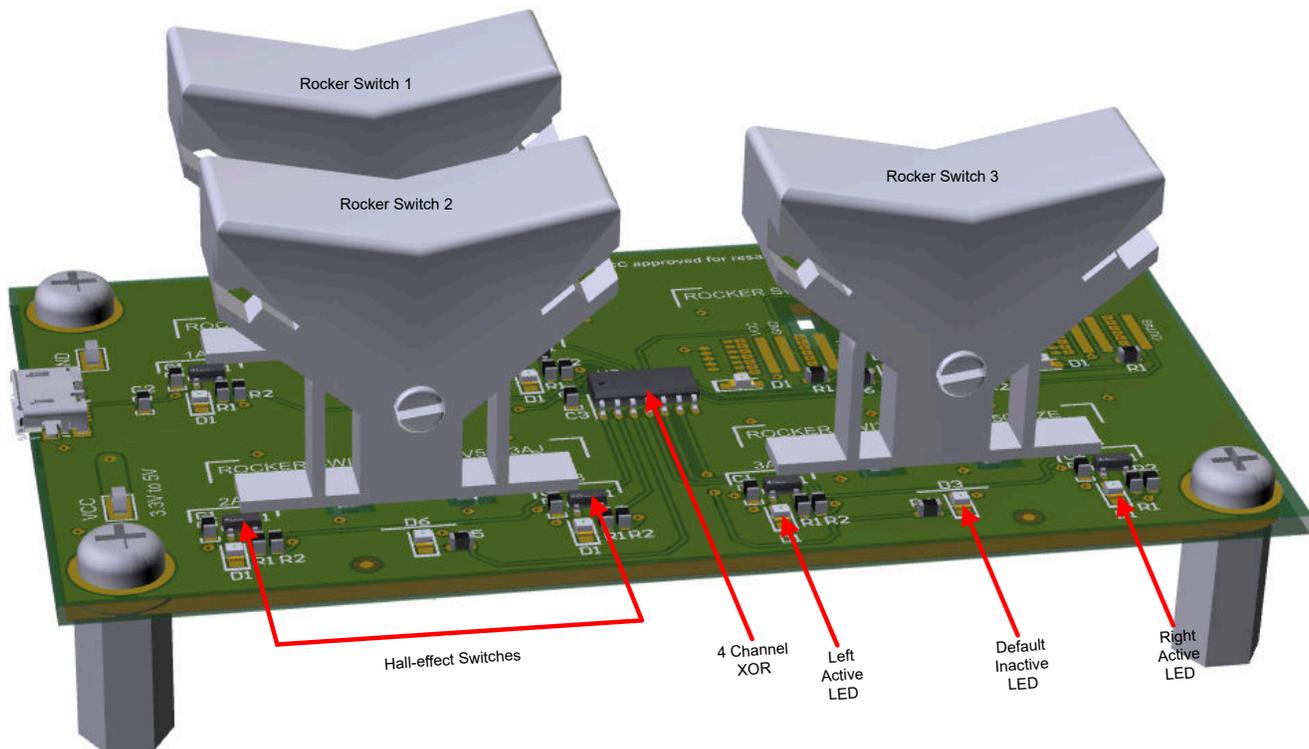
### Quick Start Setup

The following instructions describe how to set up and use the EVM.

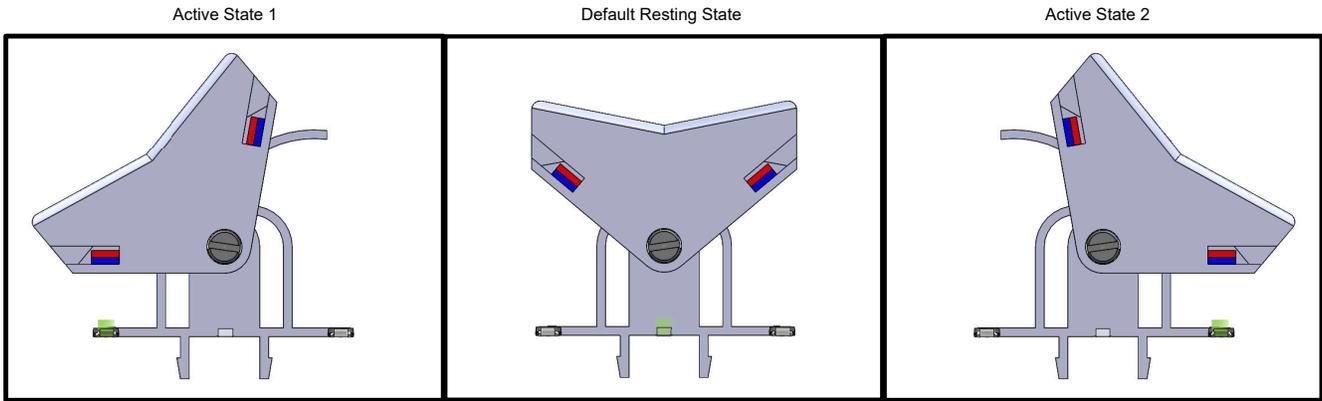
1. Connect the EVM to a PC using a USB cable.
  - a. Insert the micro USB cable into the EVM micro-USB receptacle.
  - b. Plug the other end of the USB A terminal into a PC.

### EVM Operation

The board is populated with three rocker switches as indicated in [Figure 3-1](#). With each switch there are two Hall-effect switches and three LED indicators. When a rocker is in the default resting state, the magnets in the rocker top are sufficiently far from either Hall-effect switch such that neither operate point ( $B_{OP}$ ) is triggered, resulting into high outputs feeding into an XOR that drives the middle LED to turn on. When the rocker top is moved sufficiently far in one direction, the  $B_{OP}$  of Hall-effect device in that direction will trigger, resulting in the corresponding LED to light up. [Figure 3-2](#) shows how the LEDs for a given rocker switch light up based upon the rocker top position.



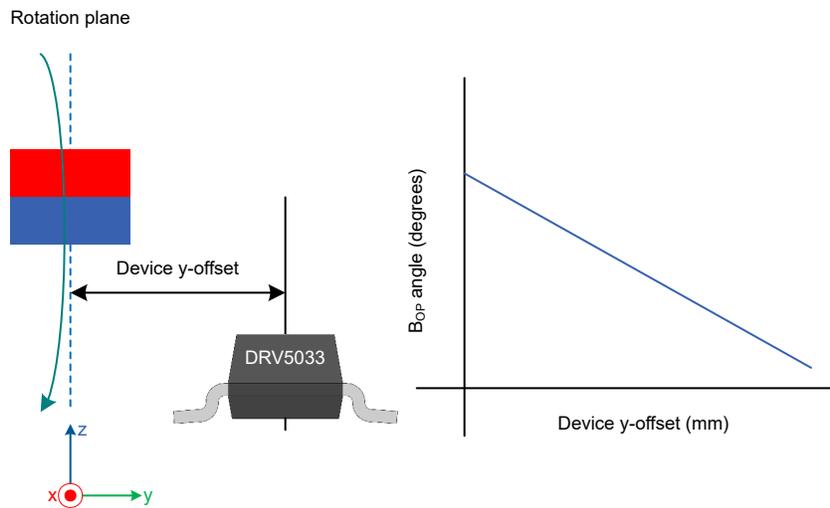
**Figure 3-1. Rocker Switch Board**



**Figure 3-2. Rocker Switch Operation**

**Rocker Switch 4 Quadrant**

The unpopulated rocker space allows the user to place a rocker switch of interest to them. This space has multiple locations at which a Hall-effect sensor can be placed. This allows the user to observe the impact of increasing sensor offset, which decreases the field observed by the sensor and thereby lowers the  $B_{OP}$  threshold angle as shown in Figure 3-3. Alternatively, these alternate sensor placement locations provide the user with the option to evaluate the performance of in-plane devices like the TMAG5123 in a rocker switch design by making some minor modifications to the 3d print files and reorienting the magnet as seen in Figure 3-4.



**Figure 3-3. Y-Offset With DRV5033**

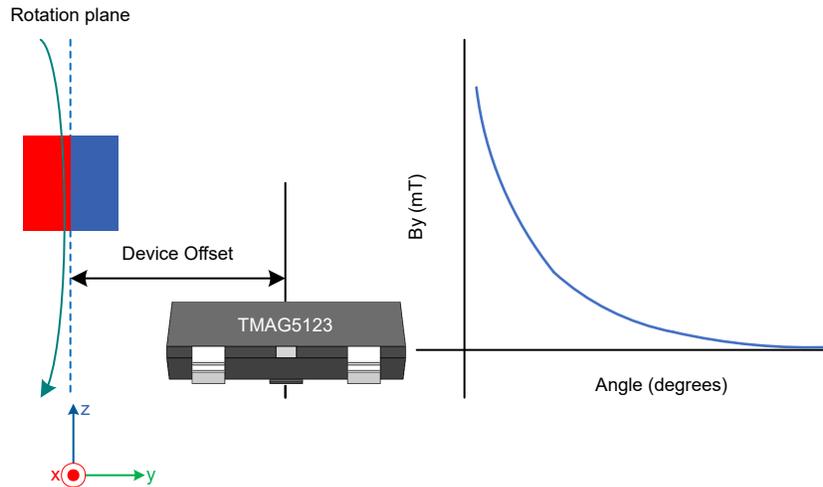


Figure 3-4. Y-Offset With TMAG5123

CAD files are available for the user to reuse and manipulate for their evaluation.

### Rocker Switch 4 Setup

1. Only DBZ 3-pin SOT-23 package devices are intended to be used.
2. GND pin must be on the left-most column of solder pads.
3. As indicated in Figure 3-5, 0- $\Omega$  resistors, wire, or solder bridges should be used to connect the device VCC pad to the board VCC as well as the device output to the board OUT4x pad.
4. As indicated in Figure 3-5, a decoupling cap of at least 0.1  $\mu\text{F}$  should be used between the VCC pads and GND pads.

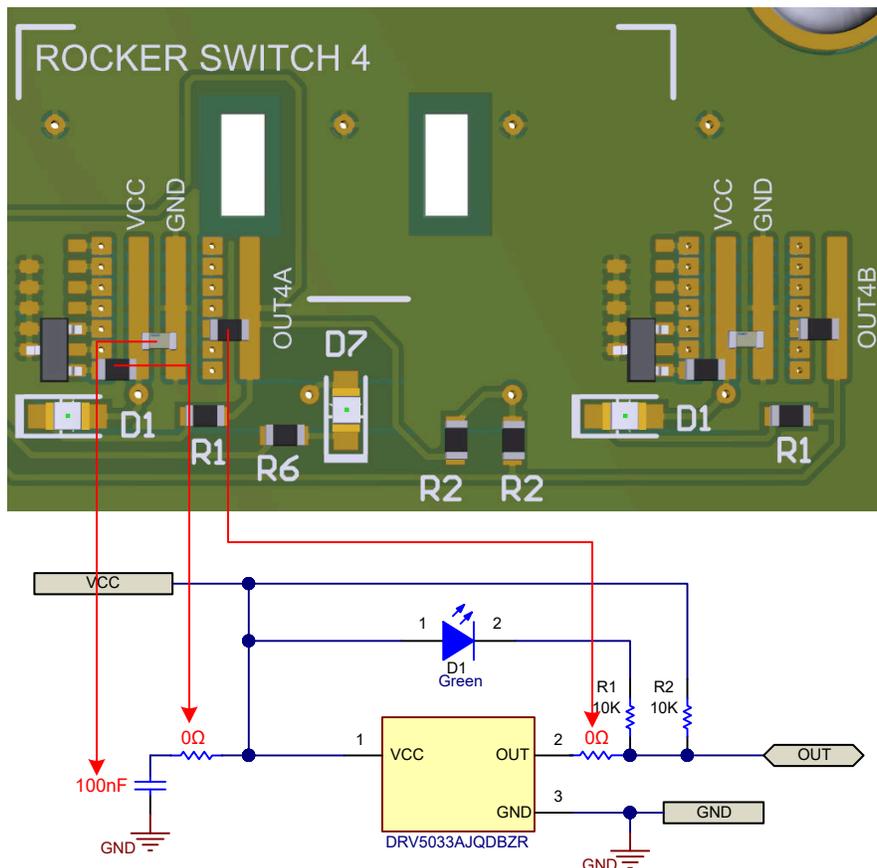


Figure 3-5. Rocker 4 VCC and GND Connections

## 4 Schematics, PCB Layout, and Bill of Materials

### 4.1 Schematics

Figure 4-1 and Figure 4-2 show the schematic of the EVM. Figure 4-1 corresponds to the Hall-effect sensor circuit represented by the sheet symbols (green boxes), found in Figure 4-2.

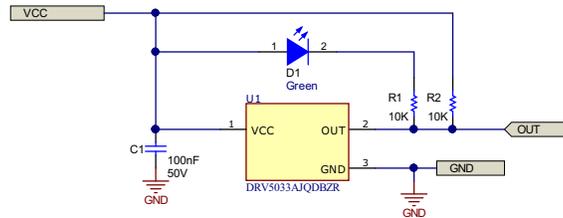


Figure 4-1. Hall-Effect Switch Circuit Block

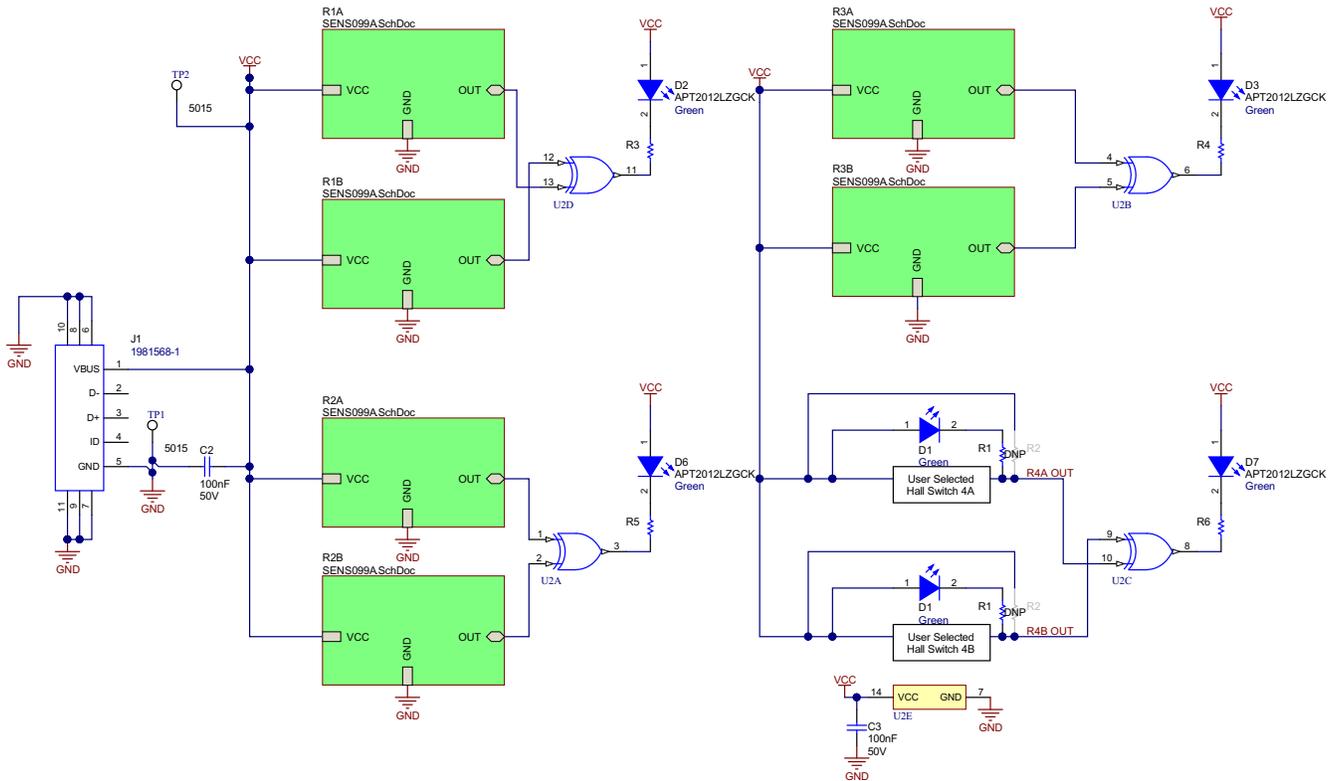


Figure 4-2. EVM Schematic

## 4.2 PCB Layout

Figure 4-3 through Figure 4-6 show the PCB layers of the EVM.

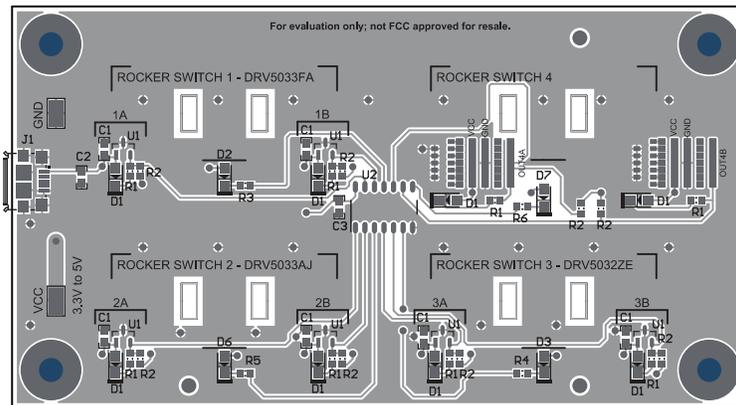


Figure 4-3. Top View

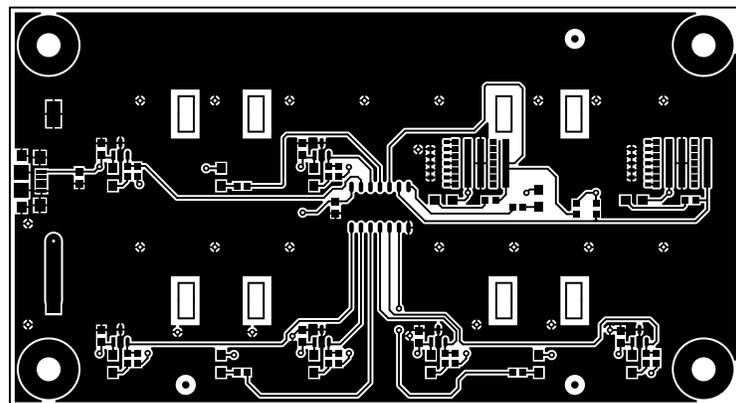


Figure 4-4. Top Layer

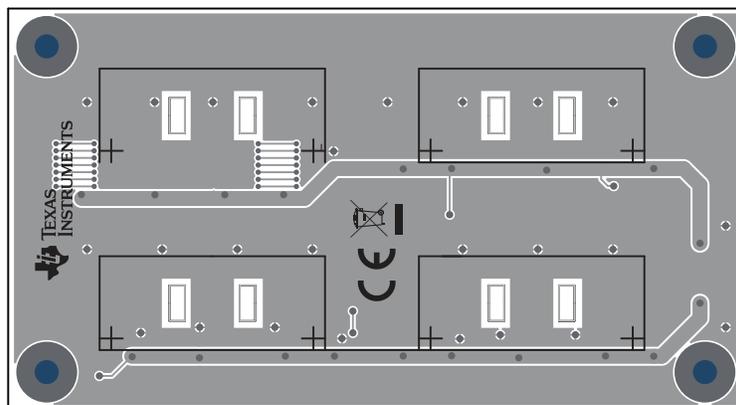
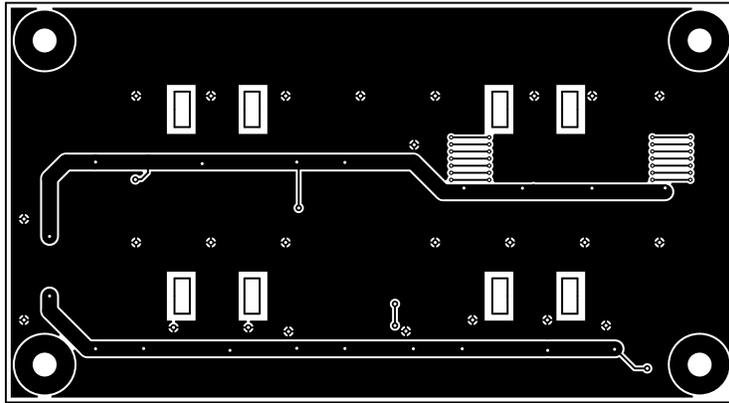


Figure 4-5. Bottom View



**Figure 4-6. Bottom Layer**

### 4.3 Bill of Materials

**Table 4-1. Bill of Materials**

Designator	Quantity	Value	Description	PackageReference	PartNumber	Manufacturer
C1_R1A, C1_R1B, C1_R2A, C1_R2B, C1_R3A, C1_R3B	6	0.1uF	CGA3E2X7R1H104K080AA, CAP, CERM, 0.1 uF, 50 V, +/- 10%, X7R, AEC-Q200 Grade 1, 0603	0603	CGA3E2X7R1H104K080AA	TDK
C2, C3	2	0.1uF	CAP, CERM, 0.1 uF, 50 V, +/- 10%, X7R, AEC-Q200 Grade 1, 0603	0603	CGA3E2X7R1H104K080AA	TDK
D1_R1A, D1_R1B, D1_R2A, D1_R2B, D1_R3A, D1_R3B, D4, D5	8	Green	APT2012LZGCK, LED, Green, SMD	LED_0805	APT2012LZGCK	Kingbright
D2, D3, D6, D7	4	Green	LED, Green, SMD	LED_0805	APT2012LZGCK	Kingbright
H1, H3, H5, H7	4			Standoff	1902C	Keystone
H2, H4, H6, H8	4		Machine Screw, Round, #4-40 x 1/4, Nylon, Philips panhead	Screw	NY PMS 440 0025 PH	B&F Fastener Supply
J1	1		Connector, Receptacle, Micro- USB Type B, R/A, Bottom Mount SMT	MICRO USB CONN, R/A	1981568-1	TE Connectivity
R1_R1A, R1_R1B, R1_R2A, R1_R2B, R1_R3A, R1_R3B, R1_R4A, R1_R4B, R3, R4, R5, R6	12	10.0k	RES, 10.0 k, 1%, 0.1 W, 0603	0603	RC0603FR-0710KL	Yageo
TP1, TP2	2		Test Point, Miniature, SMT	Testpoint_Keystone_Miniature	5015	Keystone
U1_R1A, U1_R1B	2		Digital Switch Omnipolar Switch Open Drain Hall Effect SOT-23-3	SOT23-3	DRV5033FAQDBZR	Texas Instruments
U1_R2A, U1_R2B	2		Digital Switch Omnipolar Switch Open Drain Hall Effect SOT-23-3	SOT23-3	DRV5033AJQDBZR	Texas Instruments
U1_R3A, U1_R3B	2		Digital Switch Omnipolar Switch Open Drain Hall Effect SOT-23-3	SOT23-3	DRV5032ZEDBZR	Texas Instruments
U2	1		Quadruple 2-Input Exclusive-OR Gates, D0014A, LARGE T&R	D0014A	SN74HCS86DR	Texas Instruments
R2_R1A, R2_R1B, R2_R2A, R2_R2B, R2_R3A, R2_R3B, R2_R4A, R2_R4B	0	10.0k	RES, 10.0 k, 1%, 0.1 W, 0603	0603	RC0603FR-0710KL	Yageo

## IMPORTANT NOTICE AND DISCLAIMER

TI PROVIDES TECHNICAL AND RELIABILITY DATA (INCLUDING DATA SHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES "AS IS" AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS AND IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for skilled developers designing with TI products. You are solely responsible for (1) selecting the appropriate TI products for your application, (2) designing, validating and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, regulatory or other requirements.

These resources are subject to change without notice. TI grants you permission to use these resources only for development of an application that uses the TI products described in the resource. Other reproduction and display of these resources is prohibited. No license is granted to any other TI intellectual property right or to any third party intellectual property right. TI disclaims responsibility for, and you will fully indemnify TI and its representatives against, any claims, damages, costs, losses, and liabilities arising out of your use of these resources.

TI's products are provided subject to [TI's Terms of Sale](#) or other applicable terms available either on [ti.com](http://ti.com) or provided in conjunction with such TI products. TI's provision of these resources does not expand or otherwise alter TI's applicable warranties or warranty disclaimers for TI products.

TI objects to and rejects any additional or different terms you may have proposed.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265  
Copyright © 2022, Texas Instruments Incorporated