

# EVM User's Guide: DRV8351EVM

## DRV8351 Evaluation Module



### Description

The DRV8351 is a gate driver IC for three-phase motor drive applications and provides three high-accuracy trimmed and temperature compensated half-bridge drivers, each capable of driving high-side and low-side Ntype MOSFETs.

Along with the hardware of the DRV8351, the [TMS320F280049C](#) microcontroller-based board has reference software that sends necessary signals to the DRV8351 to spin a 3-phase Brushless-DC motor. GuiComposer software allows the user to program settings, enable the motor to spin, and monitor the system from fault conditions.

### Get Started

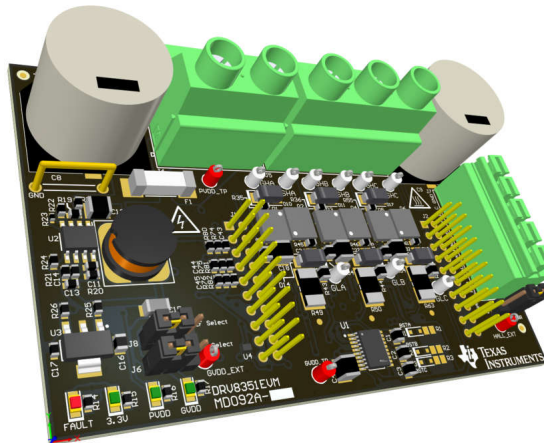
1. Order the DRV8351EVM and [TMS320F280049C](#)
2. Read the DRV8351EVM user's guide.
3. Download the comprehensive reference design files.
4. Refer to the data sheet or E2E for questions and support.

### Features

- 6 - 100V operation, 30A peak H-bridge output current
- Onboard CSAs for three-phase low-side current measurement
- Onboard buck for GVDD generation and device internal bootstrap diodes
- Supply LEDs, fault LEDs, and temperature sensor for user feedback
- C2000 (LAUNCHXL-F280049C) sensed trapezoidal firmware available

### Applications

- [E-bikes, e-scooters, e-mobility](#)
- [Fans, pumps, and servo drives](#)
- [Brushless-DC \(BLDC\) Motor Modules and PMSM](#)
- [Cordless garden, power tools, lawnmowers](#)
- [Cordless vacuum cleaners](#)
- [Drones, robotics, and RC toys](#)
- [Industrial and logistics robots](#)



# 1 Evaluation Module Overview

## 1.1 Introduction

This document is designed to be used as a startup guide to the DRV8351EVM and LAUNCHXL-F280049C designs. This document is intended for the engineers involved in the design, implementation, and validation of DRV8351 and TMS320F280049C reference software.

The scope of this document is to provide the user with a guide to evaluate the DRV8351 device with a TMS320F280049C isolated board. This document covers the hardware connections required between boards and external motor and supplies. When the hardware connections are complete, the user is required to download the necessary tools and software to spin a motor.

The reference software is composed of GuiComposer software with sensed trapezoidal algorithm for BLDC motor control.

This document is provided with the DRV8351EVM customer evaluation module (EVM) as a supplement to the DRV8351 data sheet. This user's guide details the hardware implementation of the EVM.

## 1.2 Kit Contents

- DRV8351EVM
- EVM Disclaimer Read Me

## 1.3 Specification

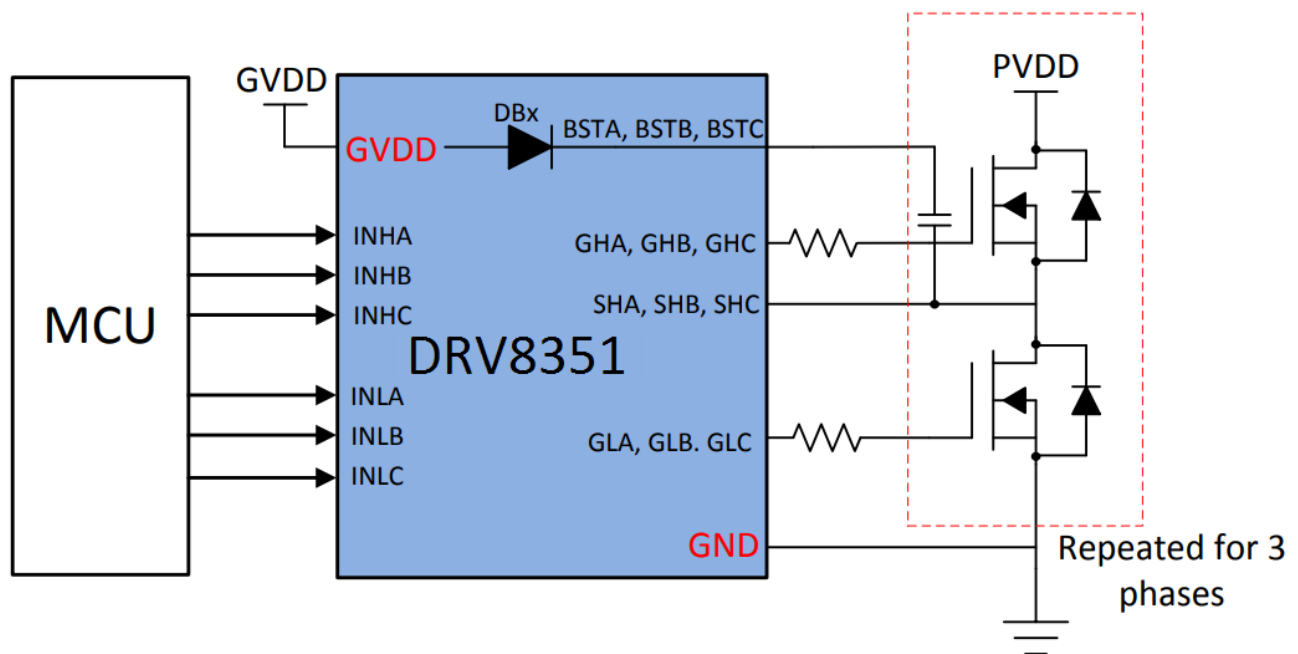


Figure 1-1. DRV8351 Device Block Diagram

## 1.4 Device Information

The DRV8351EVMs are designed to be evaluated only with the LAUNCHXL-F280049C MCU PCB which must be ordered separately. The  $3.3V_{DC}$  power to the LAUNCHXL-F280049C is provided from the DRV8351EVM. To verify high voltage isolation between the DRV8351EVM and the LAUNCHXL-F280049C board, the three isolation jumpers must be removed as shown below.

Although the MCU PCB provides isolation of up to  $3000V_{RMS}$  to the USB, the DRV8351EVM is considered an electrically live EVM and is not intended nor designed for isolation voltage testing. Voltages exceeding the standard EVM ratings as specified on the data sheet can cause personal injury, electrical shock hazard, damage the EVM, or a combination.

**WARNING**

Additionally, do not leave power connections to the EVM connected while not in operation.

**WARNING**



**Hot surface.** Contact can cause burns. Do not touch.

**WARNING**



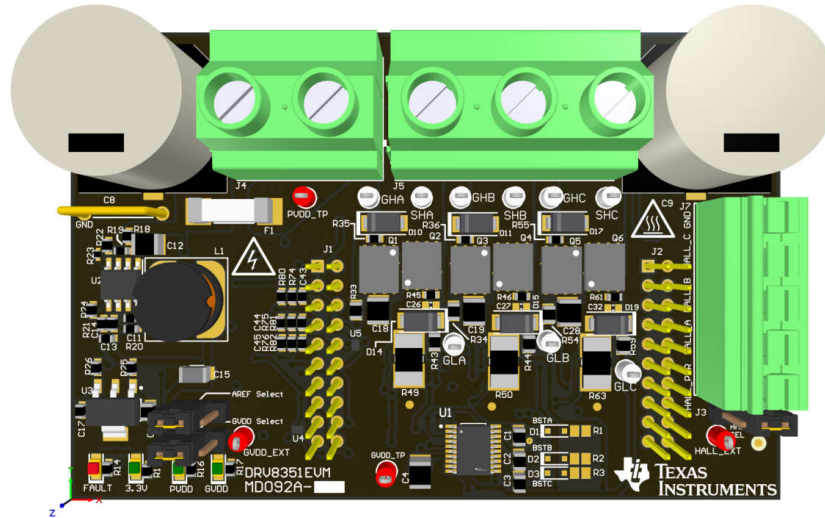
**High Voltage.** Electric shock is possible when connecting board to live wire. The board must be handled with care by a professional.

For safety, use of isolated test equipment with overvoltage and overcurrent protection is highly recommended.

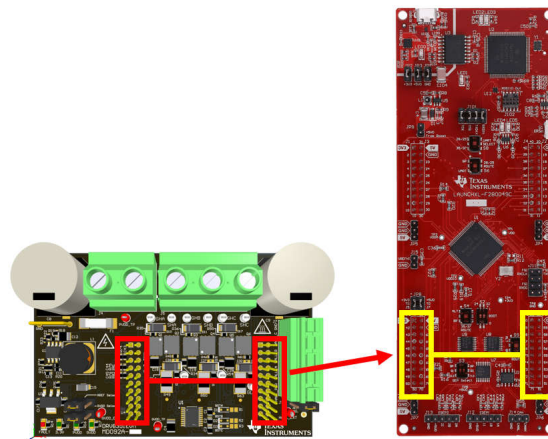
## 2 Hardware

### 2.1 Hardware Connections Overview

The following section describes the EVM hardware and connections to the external supply, hall sensors, PC via USB, and motor.

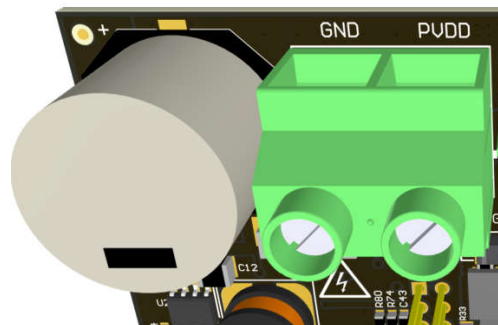


**Figure 2-1. EVM Board Overview**



**Figure 2-2. DRV8351EVM Connecting to LAUNCHXL-F280049C**

The DRV8351EVM must plug into the lower LAUNCHXL-F280049C LaunchPad headers as shown below.

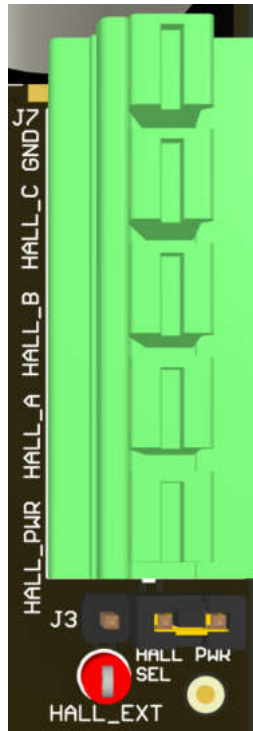


**Figure 2-3. PVDD Input (J4)**

**WARNING**

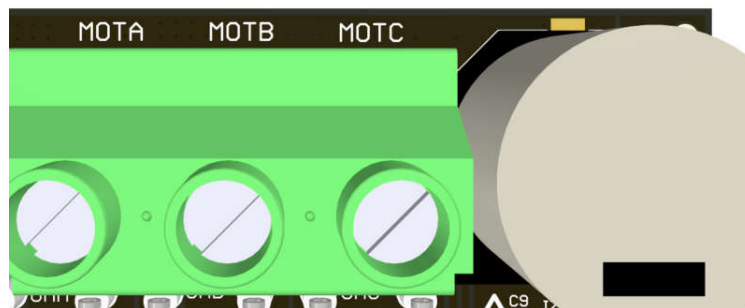
To minimize the risk of potential shock hazard and personal injury, remove all power connections and interfaces to the DRV8351EVM when not in use.

The DRV8351EVM is designed for an input supply from 6V<sub>DC</sub> to 100V<sub>DC</sub> and up to 25A continuous drive current (software limited). The input connects to J4 with the noted polarity. PVDD\_TP connects to the same node but must not be used for high current input. PVDD input is fused with a 30A fuse and the input connector is rated for 32A.



**Figure 2-4. Hall Sensor Input and Power Connections (J7)**

Hall sensors are connected to J7 including hall power and GND. The 3.3V<sub>DC</sub> supply to the Hall sensors is supplied from the 3.3V LDO on the EVM. External hall power can be input through the HALL\_EXT test point if a different supply or voltage level is desired. To use the included 3.3V LDO to power the halls, connect J3 on the right side to pins 1:2 as shown. To use HALL\_EXT, connect J3 on the left side to pins 2:3. To insert or remove wires/terminals on J7, use a flat blade screwdriver to push down the respective tab on top of the J7 connector.



**Figure 2-5. Motor Phase Connector (J5)**

**WARNING**

Motor Phase connections must match the hall sensor connection sequence. For example, MOT A must match HALL\_A, MOT B must match HALL\_B, MOT C must match HALL\_C. The phases must also be in sequential order; A, then B, then C.

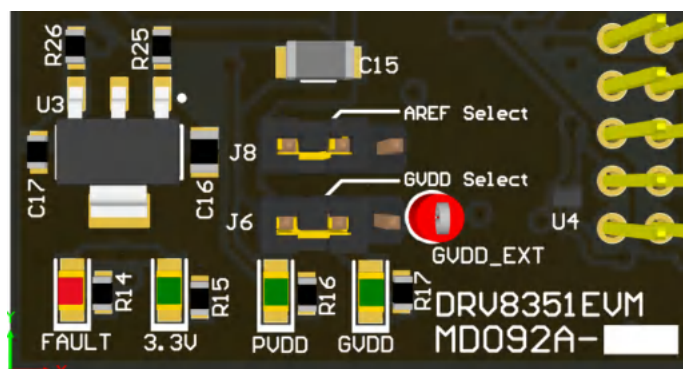
If the motor phases do not match the hall sensors or the connections are made out of order, then the motor does not spin smoothly and current consumption increases.

The three phase inputs of the motor connect to MOT A/MOT B/MOT C through connector J5.

**2.2 Faults, Indicators, and Jumper Settings**

The DRV8351 implements bootstrap undervoltage, GVDD undervoltage, and thermal shutdown in case of overtemperature. See the DRV8351 data sheet for more information on DRV8351 fault support.

The DRV8351EVM implements overvoltage and undervoltage on the PVDD and GVDD supplies as well as gross over-current protection. Status LEDs for the 3.3V, PVDD, GVDD, and FAULT are included and shown below.



**Figure 2-6. Status LEDs, AREF Select, and GVDD Select**

The FAULT LED lights up if the EVM senses a fault due to the following conditions:

FAULT	Lower Limit	Upper Limit	Action Taken
PVDD	6V	100V	PWM Input forced to 0%.
GVDD	6V	20V	PWM Input forced to 0%.
Over-Current	-25A	25A	PWM Input forced to 0%.

The Faults can be reset in the GUI software using the CLEAR FAULTS button. More details on the GUI can be found in the Software section below.

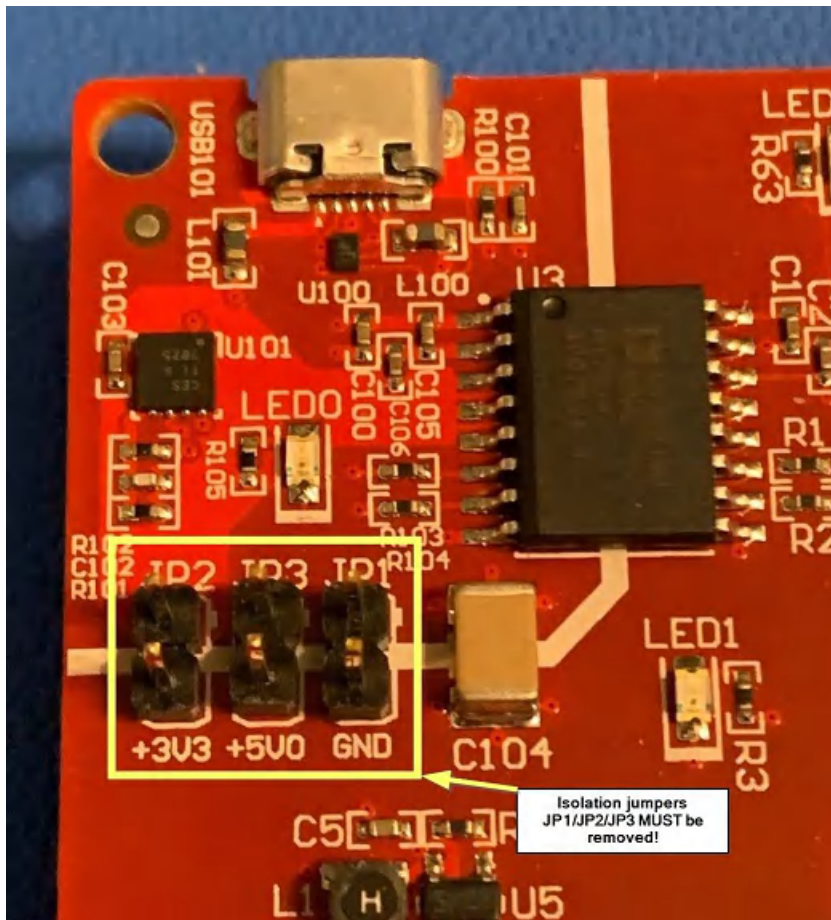
The AREF Select jumper selects the offset for the Current Shunt Amplifiers on the EVM. The default position is to the left on pins 1:2 which configures the CSA for Bi-directional mode (offset 1.65V) allowing the CSA input to sense positive or negative current. Placing the jumper to the right on pins 2:3 configures the CSA for Unidirectional mode (offset 0V) which allows only positive currents to be measured. This does increase the measurement range of the CSA.

The GVDD Select jumper allows the user to use the built-in 12V Buck Regulator to generate GVDD or input externally through GVDD\_EXT. The default position is to the left on pins 1:2, which configures the EVM for internal mode (GVDD from the buck regulator). Placing the jumper to the right on pins 2:3 configures the board for external GVDD mode (GVDD supplied into GVDD\_EXT test point).



## 2.3 EVM Hardware Quick-Start

This section describes the steps to prepare the DRV8351EVM for first motor spin-up. This section assumes the default jumper positions mentioned above are used.



**Figure 2-7. JP1/JP2/JP3 Removed**

1. Make sure that the isolation jumpers JP1/JP2/JP3 on the LAUNCHXL-F280049C have been removed.
2. Plug the DRV8351EVM onto the lower position of the LAUNCHXL-F280049C board.
3. Connect motor phase connections to the respective MOTA/MOTB/MOTC inputs on J5, making sure to match A, B, and C.
4. Connect the hall sensor connections, hall power, and ground to J7. Make sure that Hall A, B, and C are in the correct order.
5. Connect the provided micro-USB cable to the LAUNCHXL-F280049C.
6. Connect PVDD and GND to connector J4. A low current limit of 300mA on the PVDD supply is recommended for first power-up to make sure the EVM is connected correctly. If there is no issue upon power-up, then the current limit can be raised to allow for current based on your motor specifications.
7. Start the GUI per the instructions below in the software section.

### 3 Software

#### 3.1 DRV8351 EVM GUI Software

This section details the features of the EVM GUI Software. The GUI is written in GUI Composer and is available on the development software gallery at [dev.ti.com/gallery](http://dev.ti.com/gallery). Once logged into the TI system, if users cannot find the GUI, then users need to request access from a TI representative.

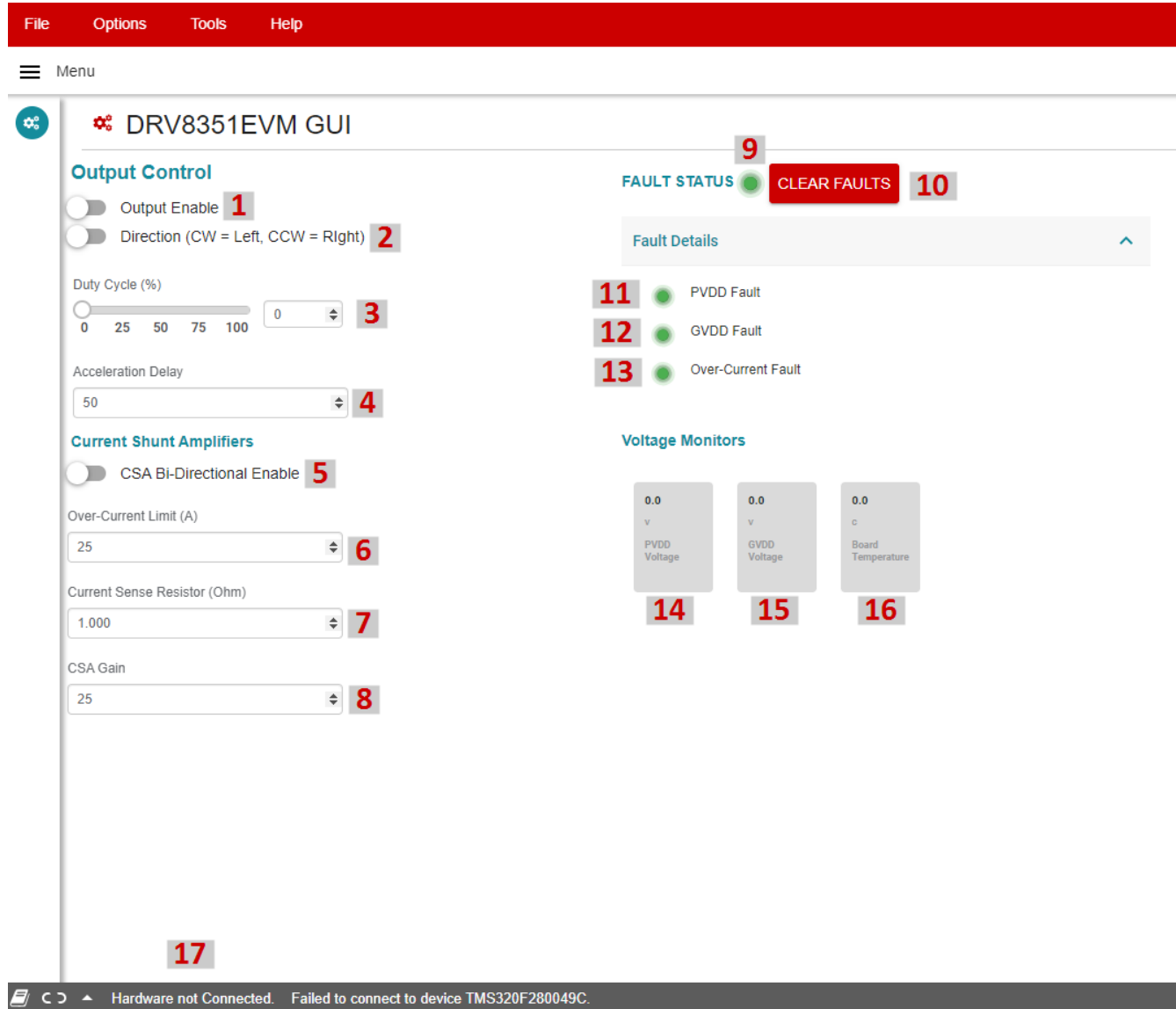


Figure 3-1. DRV8351EVM GUI Software



The GUI connect to and program the C2000 MCU on the LAUNCHXL-F280049C board when launched, assuming the board is connected and powered.

The GUI includes the following indicators and controls.

Item #	Item Name	Item Description
1	Output enable	This enables or disables the Duty Cycle slider. When disabled, the Duty Cycle is automatically set to 0%.
2	Direction	This changes the direction the motor is spinning
3	Duty cycle %	This controls the Duty Cycle % input sent to the DRV8351. Note that the PWM frequency is fixed at 20kHz.
4	Acceleration delay	Number of processing cycles to skip in each update of the PWM and GUI controls. Increase this for slower PWM update rate or decrease for faster PWM update rate.
5	CSA bi-directional enable	Enabled by default, this controls the software offset for the CSA. This must match the selection of jumper J8.
6	Over-current limit	Software Over-Current limit for gross overcurrent detection and Fault.
7	Current sense resistor	Current sense resistor value populated on board, default is 0.003 ohms.
8	CSA gain	CSA gain resistor setting, hardware resistor, default 10V/V.
9	Fault status LED	Indicator for overall Fault status. Logical OR of all faults.
10	CLEAR FAULTS	Click this button to clear the Fault warning. If the fault persists, then this control does not disable or clear the faults.
11	PVDD fault LED	Indicates a PVDD fault has occurred, either overvoltage or undervoltage.
12	GVDD fault LED	Indicates a GVDD fault has occurred, either overvoltage or undervoltage.
13	Over-current fault LED	Indicates a gross Over-Current fault has occurred. Limit is set by control (5).
14	PVDD voltage indicator	PVDD voltage sensed by the MCU.
15	GVDD voltage indicator	GVDD voltage sensed by the MCU.
16	Board temperature	Temperature sensor on the bottom of the PCB located under the FETs.
17	Connection status and control	Displays if the GUI is connected to the hardware.

Once the hardware is connected, the FAULT Status and Voltage Monitors must match the EVM. If these do not match, then remove EVM power and recheck the setup.

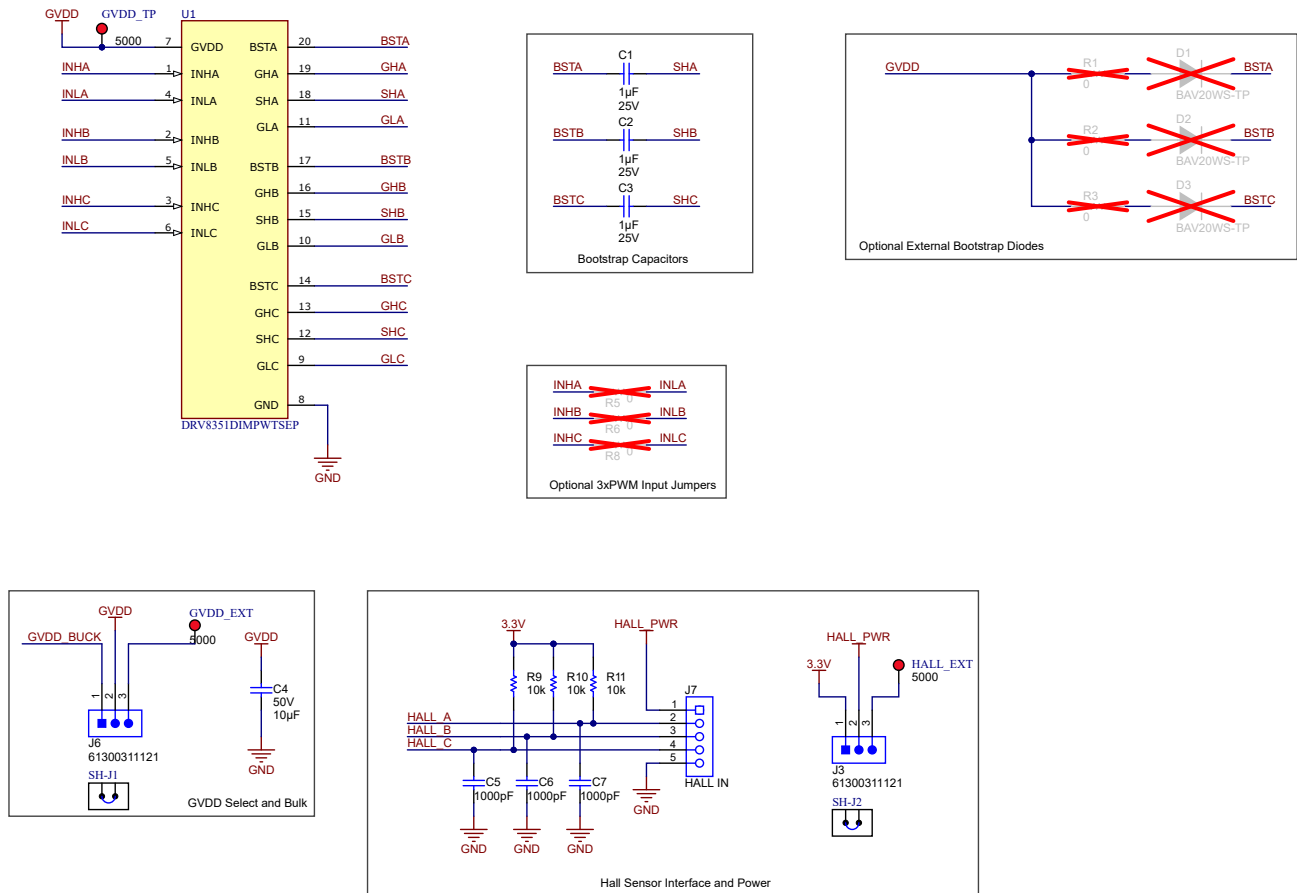
To spin the motor:

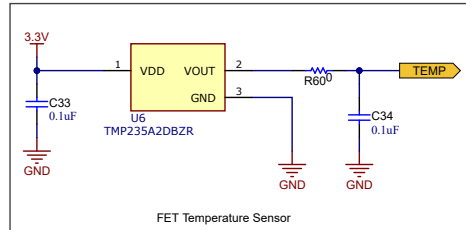
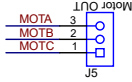
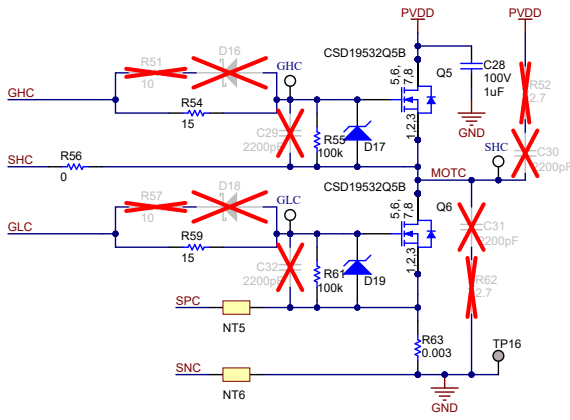
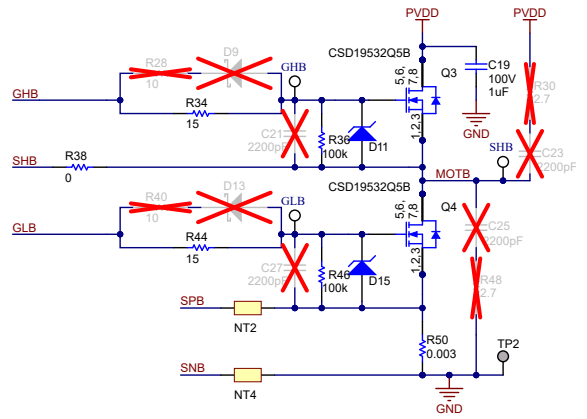
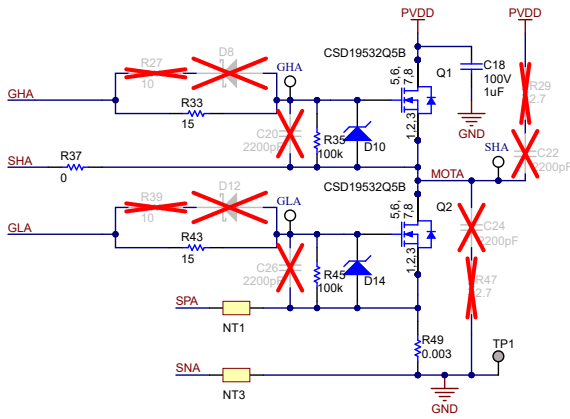
1. Enable the PWM using the Output Enable toggle switch.
2. Use direction to toggle the direction the motor spins.
3. Use the Duty Cycle slider or input field to change the PWM Input Duty Cycle.
4. The motor now spins.

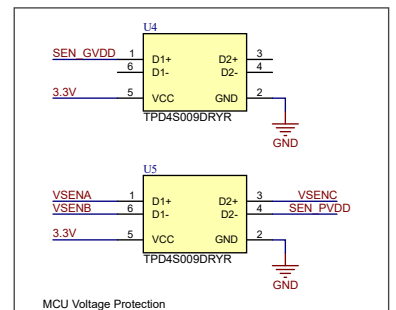
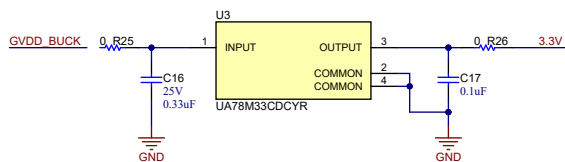
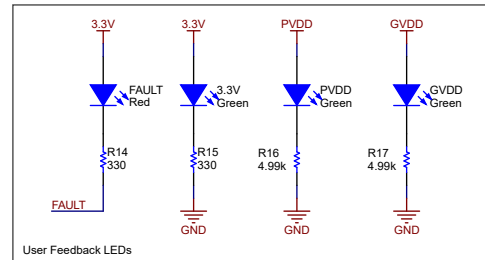
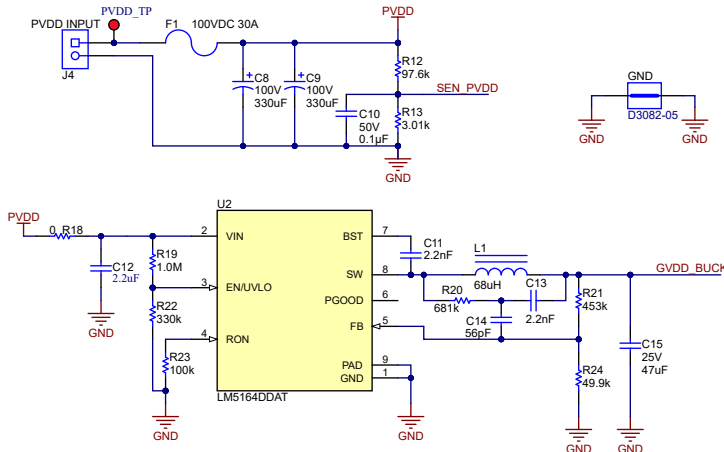
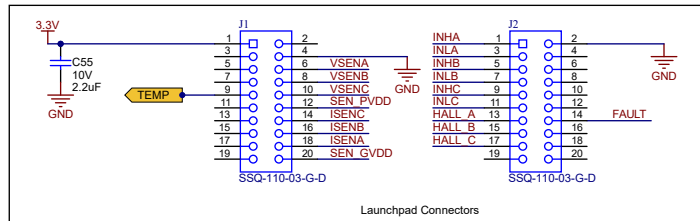
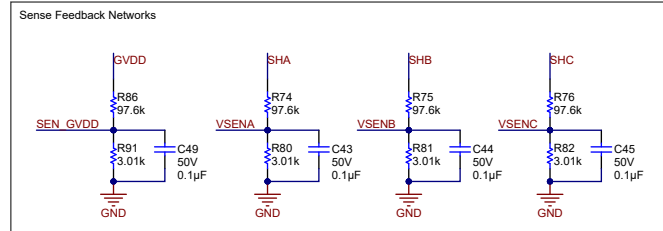
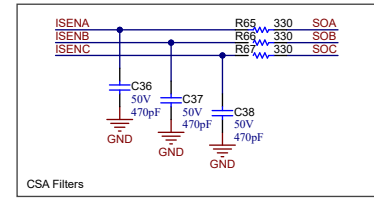
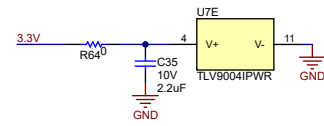
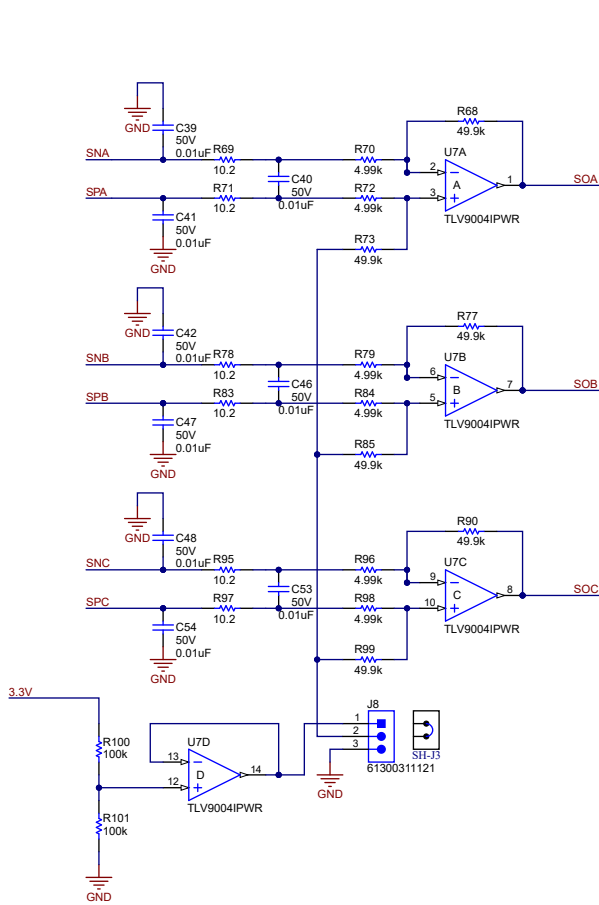
## 4 Hardware Design Files

### 4.1 Schematics

This section illustrates the DRV8351EVM schematics.







## 4.2 PCB Layouts

This sections illustrates the PCB layers of the DRV8351EVM.

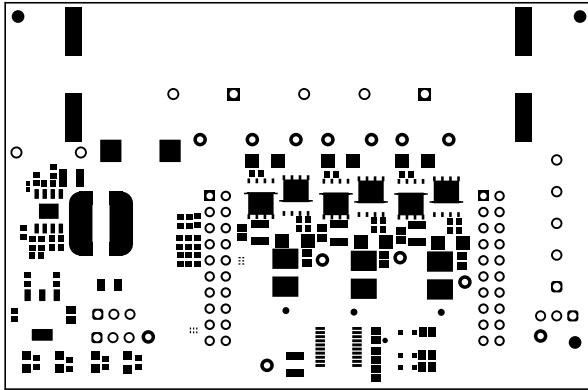


Figure 4-1. Top Solder

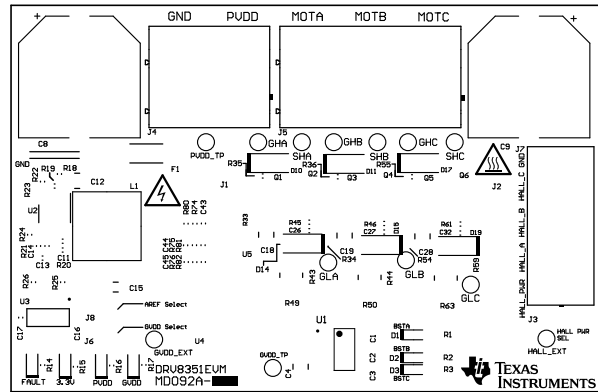


Figure 4-2. Top Overlay

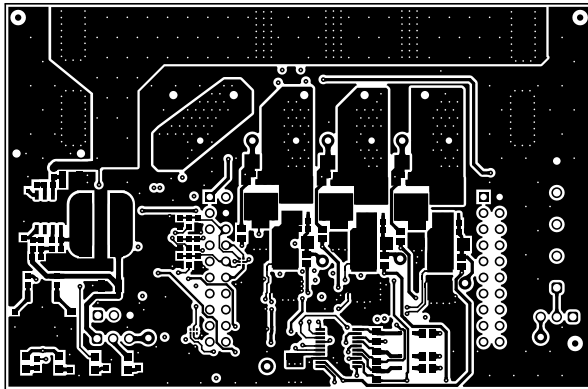


Figure 4-3. Top Layer

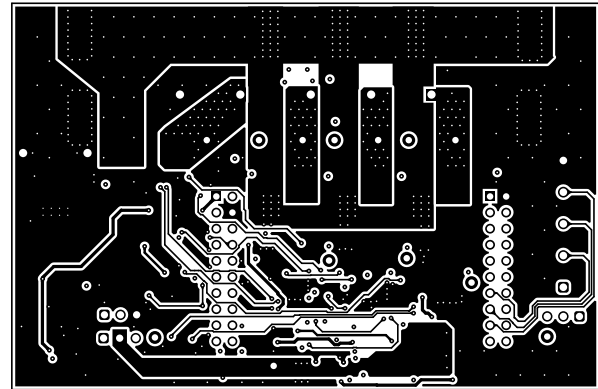


Figure 4-4. Layer 2

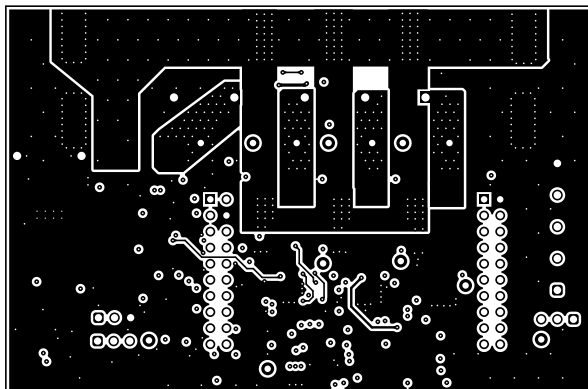


Figure 4-5. Layer 1

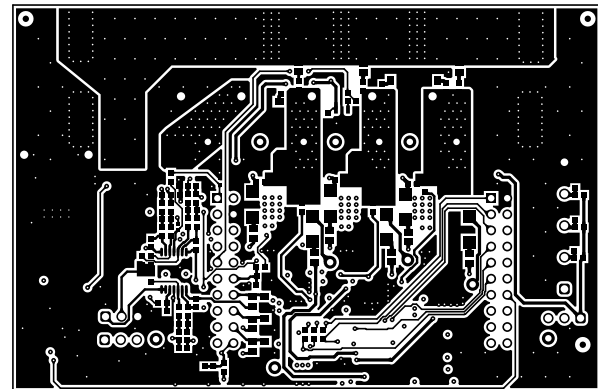


Figure 4-6. Bottom Layer

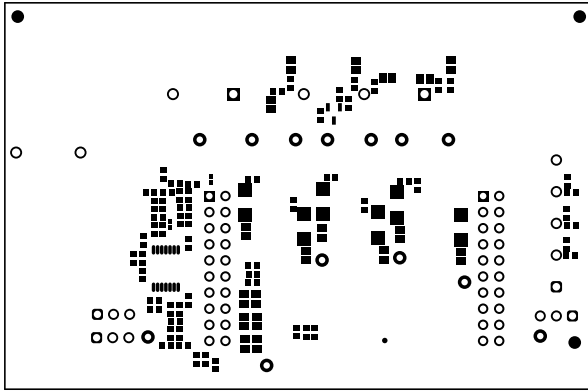


Figure 4-7. Bottom Solder

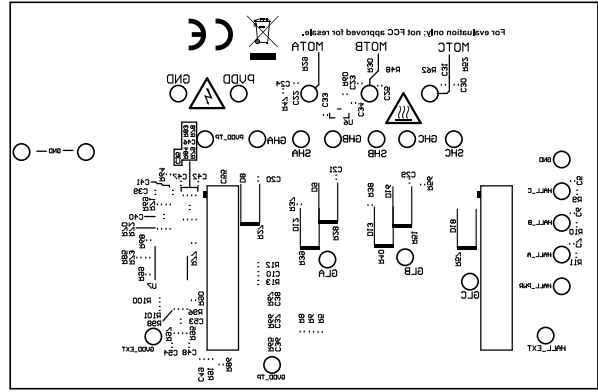


Figure 4-8. Bottom Overlay

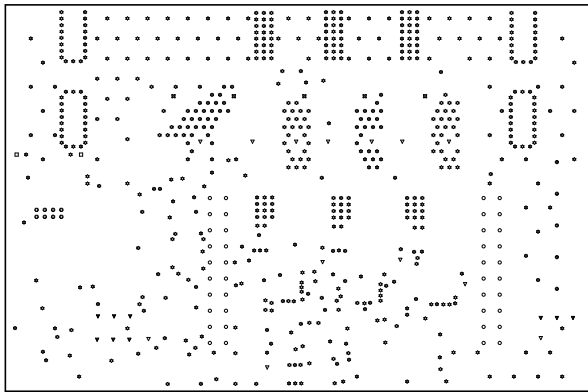


Figure 4-9. Drill Drawing



Figure 4-10. Board Dimensions

### 4.3 Bill of Materials (BOM)

Table 4-1 lists the bill of materials for DRV8351EVM.

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

Designator	Quantity	Value	Description	Part Number	Manufacturer	Package Reference	Alternate Manufacturer	Alternate Part Number
!PCB1	1		Printed Circuit Board	MD092	Any			
3.3V, GVDD, PVDD	3	Green	LED, Green, SMD	LTST-C171GKT	Lite-On	0805 LED		
C1, C2, C3	3	1uF	CAP, CERM, 1µF, 25V, +/- 10%, X7R, 0805	CL21B105KAFNNNE	Samsung Electro-Mechanics	0805		
C4	1	10uF	CAP, CERM, 10µF, 50V, +/- 10%, X7R, 1210	CL32B106KBJNNWE	Samsung Electro-Mechanics	1210		
C5, C6, C7	3	1000pF	CAP, CERM, 1000pF, 16V, +/- 10%, X7R, 0603	885012206034	Würth Elektronik	0603		
C8, C9	2	330uF	CAP, AL, 330uF, 100V, +/- 20%, 0.153 ohm, AEC-Q200 Grade 2, SMD	EEV-FK2A331M	Panasonic	SMT Radial K16		
C10, C43, C44, C45, C49	5	0.1uF	CAP, CERM, 0.1µF, 50V, +/- 10%, X7R, AEC-Q200 Grade 1, 0603	C0603C104K5RACAUTO	Kemet	0603		
C11, C13	2	2200pF	CAP, CERM, 2200pF, 100V, +/- 10%, X7R, AEC-Q200 Grade 1, 0603	CGA3E2X7R2A222K080A A	TDK	0603		
C12	1	2.2uF	CAP, CERM, 2.2uF, 100V, +/- 10%, X7R, 1210	C1210C225K1RAC7800	Kemet	1210		
C14	1	56pF	CAP, CERM, 56pF, 100V, +/- 5%, C0G/NP0, 0603	GRM1885C2A560JA01D	MuRata	0603		
C15	1	47uF	CAP, CERM, 47uF, 25V, +/- 20%, X5R, 1206_190	C3216X5R1E476M160AC	TDK	1206_190		
C16	1	0.33uF	CAP, CERM, 0.33uF, 25V, +/- 10%, X5R, 0805	KGM21AR51E334KU	AVX	0805		
C17, C33, C34	3	0.1uF	CAP, CERM, 0.1uF, 16V, +/- 5%, X7R, 0603	C0603C104J4RAC7867	Kemet	0603		
C18, C19, C28	3	1uF	CAP, CERM, 1uF, 100V, +/- 10%, X7R, AEC-Q200 Grade 1, 1210	CGA6M2X7R2A105K200 AA	TDK	1210		
C35, C55	2	2.2uF	CAP, CERM, 2.2uF, 10V, +/- 10%, X5R, 0402	C1005X5R1A225K050BC	TDK	0402		
C36, C37, C38	3	470pF	CAP, CERM, 470pF, 50V, +/- 10%, X7R, 0805	C0805C471K5RAC7800	Kemet	0805		
C39, C40, C41, C42, C46, C47, C48, C53, C54	9	0.01uF	CAP, CERM, 0.01uF, 50V, +/- 10%, X7R, AEC-Q200 Grade 1, 0603	GCM188R71H103KA37D	MuRata	0603		



**Table 4-1. Bill of Materials (continued)**

Designator	Quantity	Value	Description	Part Number	Manufacturer	Package Reference	Alternate Manufacturer	Alternate Part Number
D10, D11, D14, D15, D17, D19	6	16V	Diode, Zener, 16V, 1W, SMA	SMAZ16-13-F	Diodes Inc.	SMA		
F1	1		Fuse, 30A, 250 VAC, 100 VDC, SMD	0463030.ER	Littelfuse	10.1x3.12mm		
FAULT	1	Red	LED, Red, SMD	LTST-C170KRKT	Lite-On	Red 0805 LED		
GHA, GHB, GHC, GLA, GLB, GLC, SHA, SHB, SHC	9		Test Point, Miniature, White, TH	5002	Keystone Electronics	White Miniature Test point		
GND	1		1mm Uninsulated Shorting Plug, 10.16mm spacing, TH	D3082-05	Harwin	Shorting Plug, 10.16mm spacing, TH		
GVDD_EXT, GVDD_TP, HALL_EXT, PVDD_TP	4		Test Point, Miniature, Red, TH	5000	Keystone Electronics	Red Miniature Test point		
J1, J2	2		Receptacle, 2.54mm, 10x2, Gold, TH	SSQ-110-03-G-D	Samtec	Receptacle, 2.54mm, 10x2, TH		
J3, J6, J8	3		Header, 2.54mm, 3x1, Gold, TH	61300311121	Wurth Elektronik	Header, 2.54mm, 3x1, TH		
J4	1		Terminal Block, 9.52mm, 2x1, R/A, TH	1902547	Phoenix Contact	Terminal Block, 2x1, Pitch 9.52mm		
J5	1		Terminal Block, 9.52mm, 3x1, R/A, TH	1904150	Phoenix Contact	Terminal Block, 3x1, Pitch 9.52mm		
J7	1		Terminal Block, 5mm, 5x1, R/A, TH	1792892	Phoenix Contact	Terminal Block, 5mm, 5x1, R/A, TH		
L1	1	68uH	Inductor, Drum Core, Ferrite, 68 uH, 1.1A, 0.22 ohm, SMD	SDR1006-680KL	Bourns	SDR1006		
Q1, Q2, Q3, Q4, Q5, Q6	6	100V	MOSFET, N-CH, 100V, 17A, DNK0008A (VSON-CLIP-8)	CSD19532Q5B	Texas Instruments	DNK0008A	None	
R9, R10, R11	3	10k	RES, 10 k, 5%, 0.1 W, AEC-Q200 Grade 0, 0603	CRCW060310K0JNEA	Vishay-Dale	0603		
R12, R74, R75, R76, R86	5	97.6k	RES, 97.6 k, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	CRCW060397K6FKEA	Vishay-Dale	0603		
R13, R80, R81, R82, R91	5	3.01k	RES, 3.01 k, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	CRCW06033K01FKEA	Vishay-Dale	0603		
R14, R15	2	330	RES, 330, 5%, 0.1 W, AEC-Q200 Grade 0, 0603	CRCW0603330RJNEA	Vishay-Dale	0603		

**Table 4-1. Bill of Materials (continued)**

Designator	Quantity	Value	Description	Part Number	Manufacturer	Package Reference	Alternate Manufacturer	Alternate Part Number
R16, R17, R70, R72, R79, R84, R96, R98	8	4.99k	RES, 4.99 k, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	CRCW06034K99FKEA	Vishay-Dale	0603		
R18, R25, R26, R60, R64	5	0	RES, 0, 5%, 0.1 W, AEC-Q200 Grade 0, 0603	CRCW06030000Z0EA	Vishay-Dale	0603		
R19	1	1.0Meg	RES, 1.0M, 5%, 0.1W, AEC-Q200 Grade 0, 0603	CRCW06031M00JNEA	Vishay-Dale	0603		
R20	1	681k	RES, 681 k, 1%, 0.1 W, 0603	RC0603FR-07681KL	Yageo	0603		
R21	1	453k	RES, 453 k, 1%, 0.1 W, 0603	RC0603FR-07453KL	Yageo	0603		
R22	1	330k	RES, 330 k, 5%, 0.1 W, AEC-Q200 Grade 0, 0603	CRCW0603330KJNEA	Vishay-Dale	0603		
R23	1	100k	RES, 100 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	CRCW0402100KFKEA	Vishay-Dale	0402		
R24	1	49.9k	RES, 49.9 k, 1%, 0.1 W, 0603	RC0603FR-0749K9L	Yageo	0603		
R33, R34, R43, R44, R54, R59	6	15	RES, 15, 5%, 0.125 W, AEC-Q200 Grade 0, 0805	ERJ-6GEYJ150V	Panasonic	0805		
R35, R36, R45, R46, R55, R61, R100, R101	8	100k	RES, 100 k, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	CRCW0603100KFKEA	Vishay-Dale	0603		
R37, R38, R56	3	0	RES, 0, 0%, 0.25 W, AEC-Q200 Grade 0, 0603	RCS06030000Z0EA	Vishay-Dale	0603		
R49, R50, R63	3	0.003	RES, 0.003, 1%, 3 W, AEC-Q200 Grade 0, 2512	CRE2512-FZ-R003E-3	Bourns	2512		
R65, R66, R67	3	330	RES, 330, 1%, 0.125 W, 0805	CRCW0805330RFKEAC	Vishay-Dale	0805		
R68, R73, R77, R85, R90, R99	6	49.9k	RES, 49.9 k, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	CRCW060349K9FKEA	Vishay-Dale	0603		
R69, R71, R78, R83, R95, R97	6	10.2	RES, 10.2, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	CRCW060310R2FKEA	Vishay-Dale	0603		
SH-J1, SH-J2, SH-J3	3	1x2	Shunt, 100mil, Gold plated, Black	SNT-100-BK-G	Samtec	Shunt	3M	969102-0000-DA
U1	1		100V Three-Phase BLDC Gate Driver	DRV8351DIMPWTSEP	Texas Instruments	TSSOP20		
U2	1		100V Low IQ Synchronous Buck Regulator, DDA0008E (SOIC-8)	LM5164DDAT	Texas Instruments	DDA0008E	Texas Instruments	
U3	1		500mA, 25V, Linear Voltage Regulators, DCY0004A (SOT-223-4)	UA78M33CDCYR	Texas Instruments	DCY0004A	Texas Instruments	UA78M33CDCY
U4, U5	2		4-Channel ESD Solution for High-Speed Differential Interface, DRY0006A (USON-6)	TPD4S009DRYR	Texas Instruments	DRY0006A		

**Table 4-1. Bill of Materials (continued)**

Designator	Quantity	Value	Description	Part Number	Manufacturer	Package Reference	Alternate Manufacturer	Alternate Part Number
U6	1		Temperature Sensor Analog, Local approx. -40°C - 150°C 10mV/°C SOT-23-3	TMP235A2DBZR	Texas Instruments	SOT-23		
U7	1		4-Channel, 1MHz, RRIO, 1.8V to 5.5V Operational Amplifier for Cost-Optimized Systems, PW0014A (TSSOP-14)	TLV9004IPWR	Texas Instruments	PW0014A	Texas Instruments	
C20, C21, C26, C27, C29, C32	0	2200pF	CAP, CERM, 2200pF, 100V, +/- 10%, X7R, 0603	06031C222KAT2A	AVX	0603		
C22, C23, C24, C25, C30, C31	0	2200pF	CAP, CERM, 2200pF, 100V, +/- 10%, X7R, 0603	GRM188R72A222KA01D	MuRata	0603		
D1, D2, D3	0	150V	Diode, P-N, 150V, 0.2A, SOD-323	BAV20WS-TP	Micro Commercial Components	SOD-323		
D8, D9, D12, D13, D16, D18	0	40V	Diode, Schottky, 40V, 2A, SMA	SSA24-E3/61T	Vishay-Semiconductor	SMA		
FID1, FID2, FID3, FID4, FID5, FID6	0		Fiducial mark. There is nothing to buy or mount.	N/A	N/A	N/A		
R1, R2, R3	0	0	RES, 0, 5%, 0.333 W, AEC-Q200 Grade 0, 0805	CRCW08050000Z0EAHP	Vishay-Dale	0805		
R5, R6, R8	0	0	RES, 0, 5%, 0.1 W, AEC-Q200 Grade 0, 0603	CRCW06030000Z0EA	Vishay-Dale	0603		
R27, R28, R39, R40, R51, R57	0	10	RES, 10, 5%, 0.125 W, AEC-Q200 Grade 0, 0805	ERJ-6GEYJ100V	Panasonic	0805		
R29, R30, R47, R48, R52, R62	0	2.7	RES, 2.7, 5%, 0.125 W, AEC-Q200 Grade 0, 0805	CRCW08052R70JNEA	Vishay-Dale	0805		

## 5 Additional Information

### 5.1 Trademarks

All trademarks are the property of their respective owners.

## 6 References

See these documents for additional reference:

- [DRV8351 data sheet](#)
- [TMS320F280049C product page](#)
- [LAUNCHXL-F280049C product page](#)

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