DRV8412EVM Motor Drive Evaluation Board

The DRV8412 customer evaluation module demonstrates the operation and performance of the DRV8412 device from Texas Instruments. The EVM can be used with a MCU controller module or can be wired into an existing system.

Contents

List of Figures

List of Tables

1 Introduction

1.1 Description

The DRV8412 is a dual full bridge PWM motor driver. It has a maximum recommended supply voltage of 50V with an absolute maximum of 70V. The DRV8412 is capable of delivering 2x3A continuous output current and 2x6A peak current per device. The DRV8412 has an advanced protection system consisting of short-circuit protection, overcurrent protection, undervoltage protection, and two-stage thermal protection.

The DRV8412EVM can be operated with either two full bridge outputs or 4 half bridge outputs. It can also be used in parallel mode to double the current capability. The unit can be operated with external PWM inputs using a MCU controller module or signal generator, etc. The outputs and power supplies can be connected using stripped wires by connecting them to the on-board terminal blocks. The EVM module also has hardware switches to control the modes and to allow a manual reset.

1.2 DRV8412EVM Features

- PWM input motor driver module
- Self-contained protection system (short-circuit and thermal)
- Double-side, plated-through PCB layout

1.3 DRV8412EVM Specifications

Table 1. Key Parameters

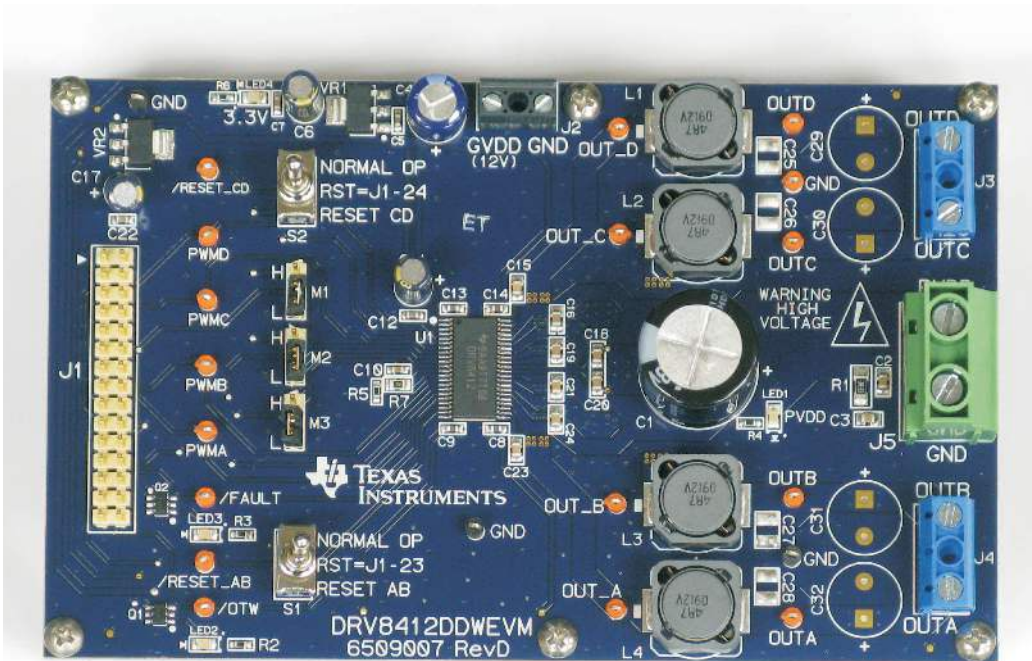|	
Output Stage Voltage	0 to 50 Vollts
System Supply Voltage	12 Volts
Number of Output	4 × Half Bridge, 2 × Full Bridge
Output Current per Output Pin	Up to 6A peak, 3 A continuous

Figure 1. The TI DRV8412EVM Motor Drive Evaluation Board – Top View

Figure 2. The TI DRV8412EVM Motor Drive Evaluation Board – Bottom View

2 Operation

2.1 Quick Start List for Stand-Alone Operation

Follow these steps to use the DRV8412EVM stand-alone or when connecting it into existing circuits or equipment. Connections to the EVM module can be made by inserting stripped wire for the power supplies and output connections.

2.1.1 Power Supply

Two power supplies are required to power up the EVM. One is needed for system power, logic and gate drive, while the second is for the output stage power supply. Please use enough wire gauge such that the impedance is relatively low. The output stage supply should use at least AWG 22 wire.

Table 2. Power Supply Requirements

Description	Voltage Range	Current Requirements	Wire Size
System Power Supply	12 V	1 A	26 AWG
Output Stage Power Supply	0 – 50 V	6 A	22 AWG

2.1.2 Evaluation Module Preparation

Inputs and Outputs

1. Ensure that all external power sources are set to OFF.
2. Connect load(s) across the outputs (OUTX) or between the outputs and ground depending on the configuration requirement.
3. Connect an external 12V power supply to the terminal block marked GVDD and GND (J2). Make sure the wires are connected with correct polarities.
4. Connect an external regulated power supply adjustable from 0V - 50V to the terminal block marked PVDD and GND (J5). Make sure the wires are connected with correct polarities.

Control Signals

1. Install the mode jumpers on M3, M2, and M1 depending on the mode desired. See "Mode Pin Configurations" table for detail.
2. Set RESET_AB (S1) and RESET_CD (S2) switches to low (RESET) position.
3. Prepare the PWM signals needed to control the power stage and make sure that PWM logic is 3.3V not 5V.

2.1.3 Power Up

The DRV8412 device doesn't require a special power up sequence, but the following sequence is recommended for the EVM.

1. Turn on GVDD (12V) power supply.
2. Enable PWM signals.
3. Set RESET_AB (S1) and RESET_CD (S2) switches to high (NORMAL OPERATION) position.
4. Turn on the external PVDD power supply to the desired voltage gradually.
5. Adjust the duty cycle of PWM input signals to the desired value. The EVM should begin to operate normally.

2.1.4 Fault Conditions

When device shuts down due to any fault conditions, flip RESET_AB and/or RESET_CD switches back and forth to clear the fault and reset the device. If this doesn't work for any reason, turn 12V GVDD power supply off and on again to clear the latch. Please inspect the board and test condition carefully to understand the problem before next operation.

Table 3. Mode Pin Configurations

MODE PINS			OUTPUT CONFIGURATION	DESCRIPTION
M3	M2	M1		
0	0	0	2 FB or 4 HB	Dual Full Bridges (two PWM inputs each full bridge) or four half bridges with cycle-by-cycle current limit
0	0	1	2 FB or 4 HB	Dual full bridges (two PWM inputs each full bridge) or four half bridges with OC latching shutdown (no cycle-by-cycle current limit)
0	1	0	1 PFB	Parallel full bridge with cycle-by-cycle current limit
0	1	1	1 FB	Dual Full Bridges (one PWM input each full bridge with complementary PWM on second half bridge) with cycle-by-cycle current limit
1	x	x		Reserved

3 Schematics, PCB Layers, and Bill of Materials

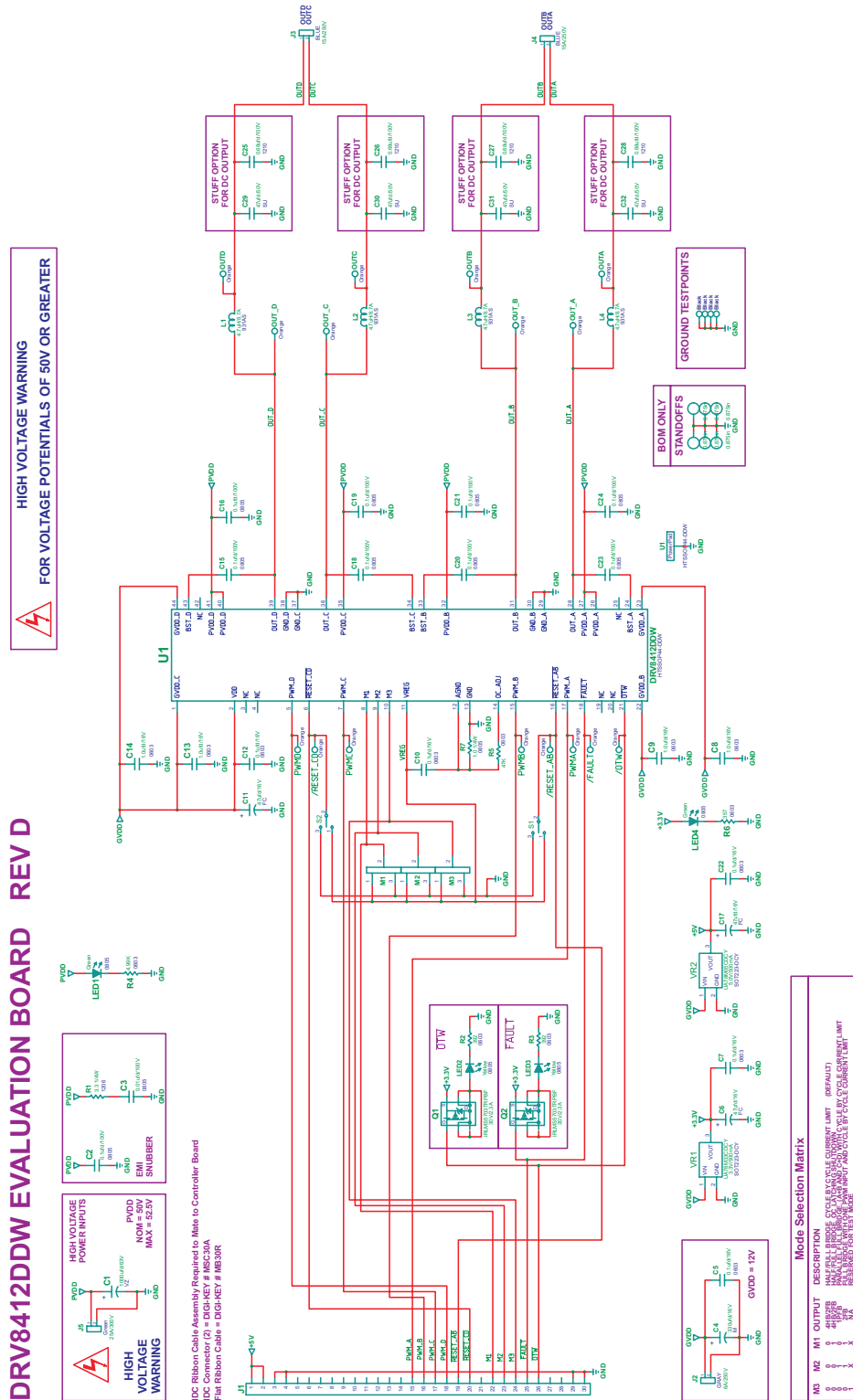## 3.1 DRV8412EVM Schematic

Figure 3. DRV8412EVM Schematic

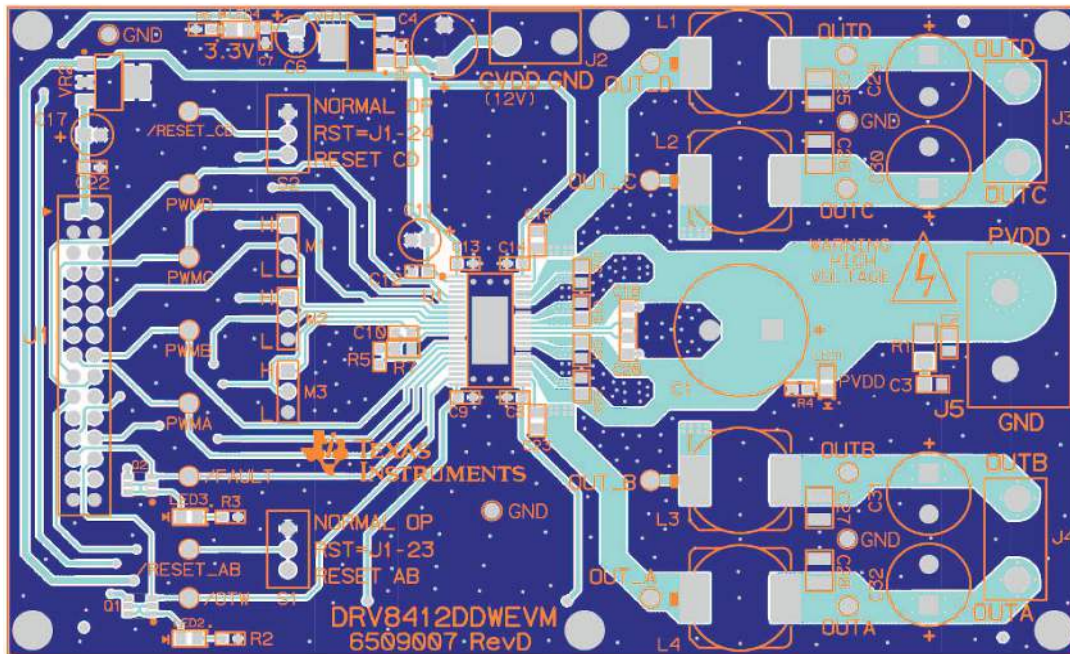## 3.2   DRV8412EVM PCB Layers
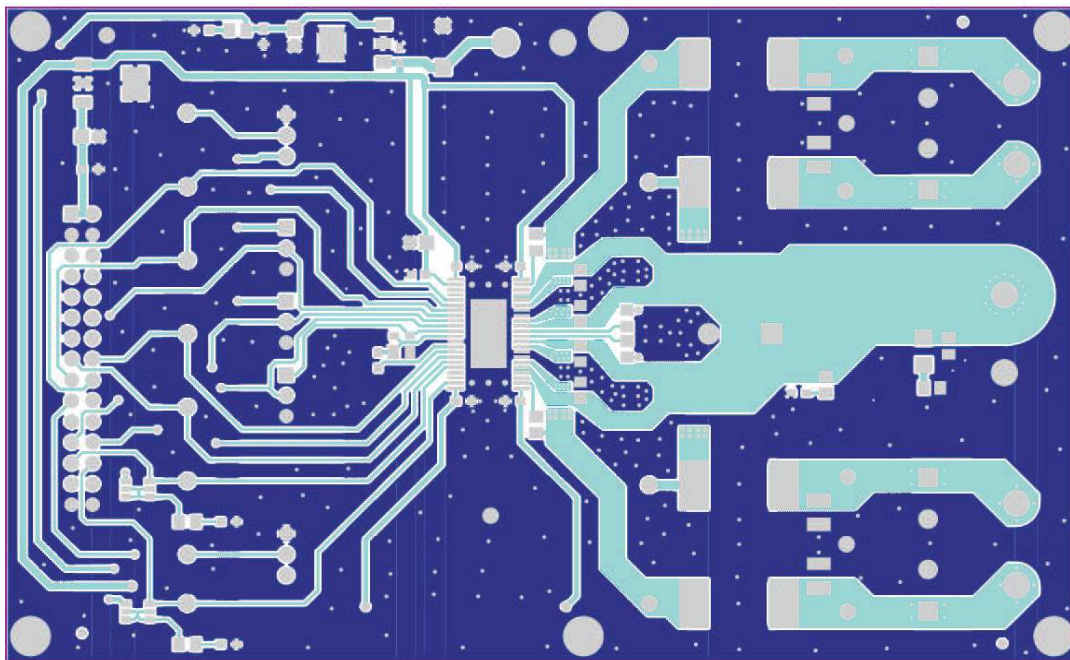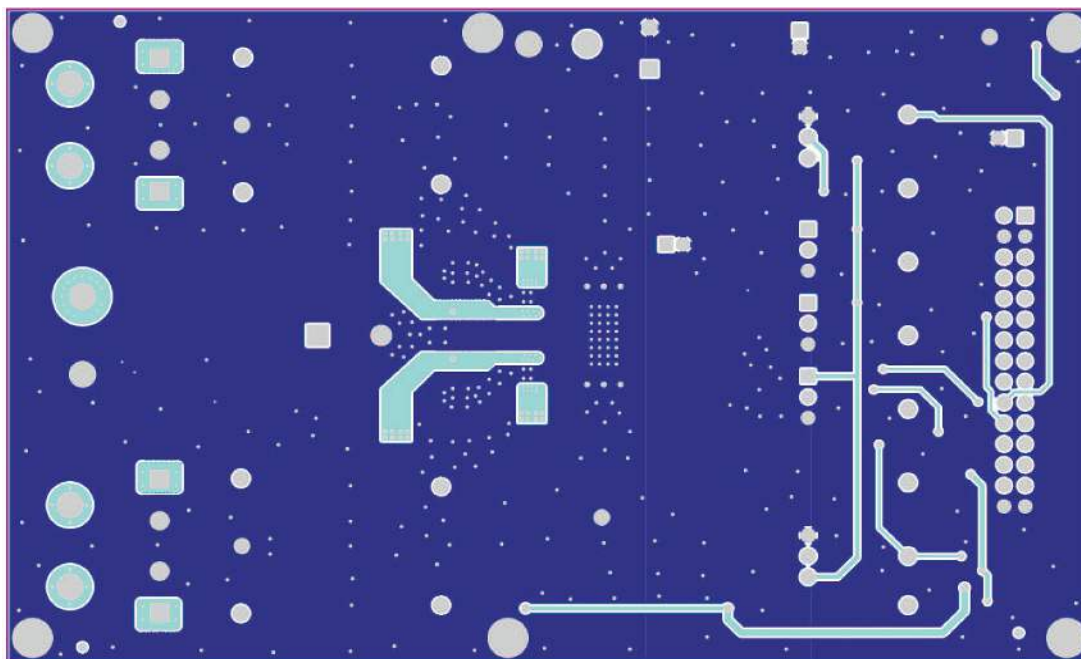

Figure 4. DRV8412EVM – Top Layer Composite

Figure 5. DRV8412EVM – Top Layer Copper

Figure 6. DRV8412EVM – Bottom Copper

3.3 Bill of Materials for DRV8402DKD_EVM

Table 4. Bill of Materials

QTY	REF DES	Description	Vendor	Vendor Part No.	MANU	MANU Part No.
1	U1	MOTOR DRIVE POWER AMP HTSSOP44-DDW ROHS	Texas Instruments	DRV8412DDW	Texas Instruments	DRV8412DDW
1	VR1	VOLT REG 3.3V 500mA SOT223-DCY ROHS	Digi-Key	296-13424-1	Texas Instruments	UA78M33CDCYR
2	VR2	VOLT REG 5.0V 500mA SOT223-DCY ROHS	Digi-Key	296-12290-1	Texas Instruments	UA78M05CDCYR
2	Q1, Q2	MOSFET, P-Chan 30V 2.3A, SOT23-DBV6 ROHS	Digi-Key	IRLMS5703PBFCT	International Rectifier	IRLMS5703TRPBF
2	LED1, LED4	LED, GREEN 2.0V SMD0805 ROHS	Digi-Key	67-1553-1	Lumex Opto	SML-LXT0805GW-TR
2	LED2, LED3	LED, YELLOW 2.0V SMD0805 ROHS	Digi-Key	67-1554-1	Lumex Opto	SML-LXT0805YW-TR
1	C3	CAP SMD0805 CERM 0.01UFD 100V 10% X7R ROHS	Digi-Key	PCC1991CT	Panasonic	ECJ-2VB2A103K
5	C5, C7, C10, C12, C22	CAP SMD0603 CERM 0.1UFD 16V 10% X7R ROHS	Digi-Key	PCC1762CT	Panasonic	ECJ-1VB1C104K
9	C2, C15, C16, C18, C19, C20, C21, C23, C24	CAP SMD0805 CERM 0.1UFD 100V 10% X7R ROHS	Digi-Key	445-1418-1	TDK	C2012X7R2A104K
4	C8, C9, C13, C14	CAP SMD0603 CERM 1.0UFD 16V 10% X5R ROHS	Digi-Key	PCC2224CT	Panasonic	ECJ-1VB1C105K
3	C6, C11, C17	CAP 47UFD 16V RAD ALUM ELEC FC ROHS	Digi-Key	P11196	Panasonic	EEU-FC1C470
1	C4	CAP 330UFD 16V RAD ALUM ELEC M 20% ROHS	Digi-Key	P10371TB	Panasonic	ECA-1CM331B
1	C1	CAP 1000UFD 63V RAD ALUM ELEC VZ ROHS	Digi-Key	493-1359	Nichicon	UVZ1J102MHD
1	R7	RESISTOR SMD0805 1.0 OHM 1/4W 1% ROHS	Digi-Key	RHM1KCT	ROHM	ESR10EZPJ1R0
1	R1	RESISTOR SMD1206 3.3 OHM 1/8W 5% ROHS	Digi-Key	P3.3PCT	Panasonic	ERJ-8RQJ3R3V

Table 4. Bill of Materials   (continued)

QTY	REF DES	Description	Vendor	Vendor Part No.	MANU	MANU Part No.
1	R6	RESISTOR SMD0603 357 OHM 1% THICK FILM 1/10W ROHS	Digi-Key	P357HCT	Panasonic	ERJ-3EKF3570V
2	R2, R3	RESISTOR SMD0603 392 OHM 1% THICK FILM 1/10W ROHS	Digi-Key	P392HCT	Panasonic	ERJ-3EKF3920V
1	R4	RESISTOR SMD0603 4.99K OHM 1% THICK FILM 1/10W ROHS	Digi-Key	P4.99KHCT	Panasonic	ERJ-3EKF4991V
1	R5	RESISTOR SMD0603 47K OHMS 5% 1/10W ROHS	Digi-Key	P47KGCT	Panasonic	ERJ-3GEYJ473V
4	L1, L2, L3, L4	INDUCTOR SMD 4.7UH 8.7A TYPE D128C ROHS	TOKO	931AS-4R7M	TOKO	931AS-4R7M
3	M1, M2, M3	HEADER THRU MALE 3 PIN 100LS GOLD ROHS	Digi-Key	S1011E-03-ND	Sullins	PBC03SAAN
1	J1	HEADER THRU MALE 2X15 100LS GOLD ROHS	Digi-Key	S2011E-15	Sullins	PBC15DAAN
1	J5	TERMINAL BLOCK 2PIN 25A/300V GREEN 9.52mm PITCH 12-24AWG ROHS	Digi-Key	ED2677	On Shore Technology	OSTT7022150
1	J2	TERMINAL BLOCK 2PIN 6A/250V GRAY 7mm PITCH 16-28AWG ROHS	Digi-Key	ED1534	On Shore Technology	ED655/2DS ED600/2DS
2	J3, J4	TERMINAL BLOCK 2PIN 15A/250V BLUE 10mm PITCH 14-22AWG ROHS	Digi-Key	ED1627	On Shore Technology	
2	S1,S2	Switch,SPST Vert-PCB on-off-on miniature toggle ROHS	Digi-Key	563-1159	Copal Electronics	ATE1E-2M3-10-Z
16	OTW, FAULT PWMA, PWMB, PWMC, PWMD, OUTA, OUT_A, OUTB, OUT_B, OUTC, OUT_C, OUTD, OUT_D, RESET_AB, RESET_CD	PC testpoint, orange, ROHS	Digi-Key	5003K	Keystone Electronics	5003
4	GNDx4	PC TESTPOINT, BLACK, ROHS	Digi-Key	5001	Keystone Electronics	5001K
2	S1, S2	SWITCH,SPST VERT-PCB ON-OFF-ON MINIATURE TOGGLE ROHS	Digi-Key	ATE1E-2M3-10-Z	Copal Electronics	563-1159
3	M1(2-3), M2(2-3), M3(2-3)	SHUNT, BLACK AU FLASH 0.100LS	Digi-Key	S9001	Sullins	SPC02SYAN
6	N/A	4-40 SCREW, STEEL 0.250 IN	Digi-Key	H342	Building Fasteners	PMS 440 0025 PH
6	N/A	STANDOFF,4-40,1.0INx1/4IN,ALUM RND F-F	Digi-Key	2031K	Keystone Electronics	2031

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