

## 15V to 60V, Three-Phase Brushless DC Motor Pre-Driver

The project presented here is a three-phase BLDC motor pre-driver. The project consists of 3x half-bridge IR2101 driver IC and 6 channel high current N-MOSFETS. The project can be configured as 3 independent half-bridges H-bridge for a brushed DC motor, or a single high current brushless motor driver. The rotor position can be detected using 3 hall sensors assembled in the motor. Hall-effect shaft position sensors are used to control the switching sequence of the three 1/2 bridge outputs. The bridge voltage can vary between 15V and 60V and the maximum summed bridge current is 10A with a large size heat-sink and sufficient airflow using a fan. This motor driver can be used for multiple applications including e-bikes, battery-powered tools, electric power steering, wheelchairs, or any other application, where a BLDC motor is utilized. Motor start/stop, forward/reverse rotation, braking with closed-loop speed control. The project also includes 3 phase current sense circuit which can be used to detect 3 independent phase currents. An LM317 regulator provides 5V DC to op-amp circuitry. All inputs and feedback outputs provided for an easy micro-controller or DSP interface.

**Current Sense Circuit:** Current sense circuit measures the current across all 3 half-bridges and provides 3 independent current feedback outputs, this can be used for overcurrent sense or senseless FOC configuration, the default output at 0A is 1.45V, and provides approx. 100mV/Amp. User may change the Gain of an op-amp, current shunt resistors as per requirement, LM317 power 5V to op-amp circuit.

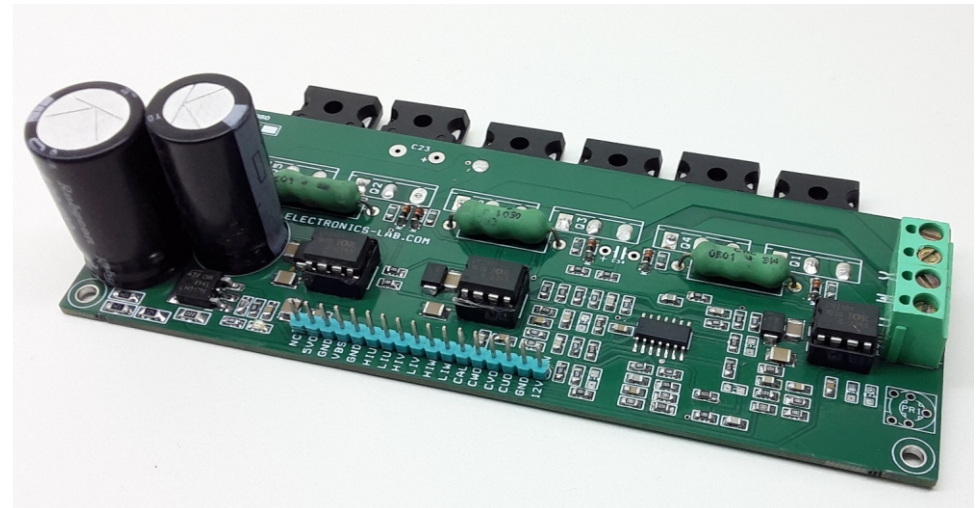
User need to generate 6 PWM pulse sequence to control the motor, the board accepts TTL input, more information about brushless motor driver available here:

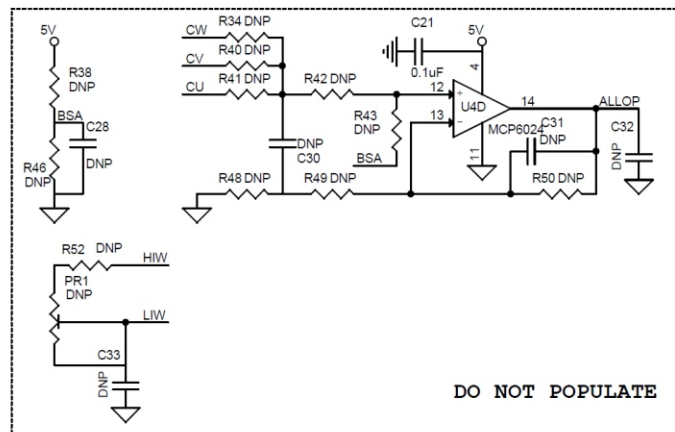
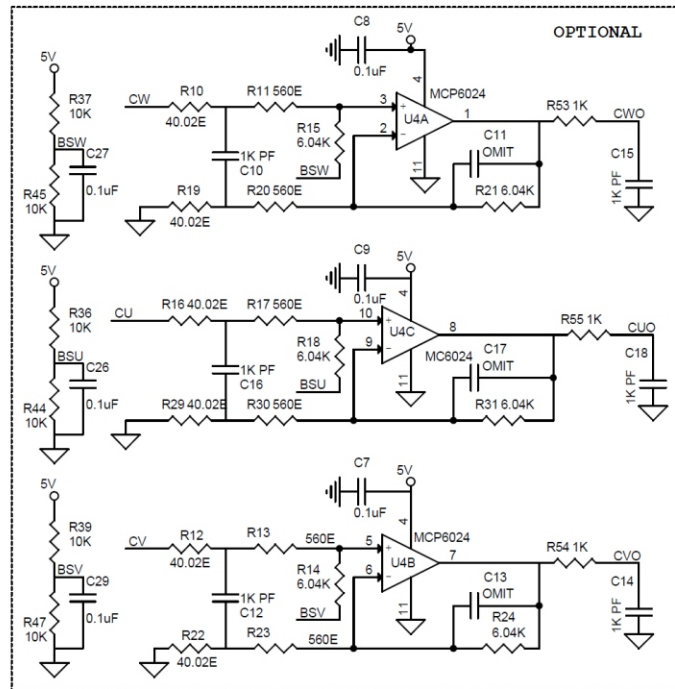
<https://www.digikey.com/en/articles/why-and-how-to-sinusoidally-control-three-phase-brushless-dc-motors>

<https://www.microchip.com/wwwappnotes/appnotes.aspx?appnote=en1001927>

### Features

- Operating Supply-Motor 15V to 60V
- Load 5 Amps (10Amps Maximum)
- Gate Driver Supply 12-15V DC
- 3 Independ Half-Bridge
- H-Bridge (DC Brushed Motor Driver)
- 3 Phase Brushed DC Motor Driver
- DC Bus Voltage Feed Back (Load Supply)
- LED for Gate driver supply
- 3 Phase Current sense output 100mV/Amp
- PWM Frequency up to 20Khz.
- Required 6 PWM Signals
- PCB Dimensions 143.69 x 52.40 mm







BOM						
NO.	QNTY.	REF.	DESC.	MANUFACTURER	SUPPLIER	SUPPLIER PART NO
1	1	CN1	14 PIN MALE HEADER 2.54MM PITCH	WURTH	DIGIKEY	732-5325-ND
2	2	CN2	2 Pin Screw Terminal 5.08MM PITCH	PHOENIX	DIGIKEY	277-1247-ND
3	1	CN3	3 PIN SCREW TERMINAL 5.08MM PITCH	PHOENIX	DIGIKEY	277-1264-ND
4	1	CN4	3 PIN MALE HEADER 2.54MM PITCH	WURTH	DIGIKEY	732-5316-ND
5	3	C1,C3,C5	10uF/25V SMD SIZE 1210	MURATA/YAGEO		
6	3	C2,C4,C6	4.7uF/25V SMD SIZE 1210	MURATA/YAGEO		
7	8	C7,C8,C9,C21,C26,C27,C29,C34	0.1uF/50V SMD SIZE 0805	MURATA/YAGEO		
8	6	C10,C12,C14,C15,C16,C18	1K PF/50V SMD SIZE 0805	MURATA/YAGEO		
9	3	C11,C13,C17	OMIT			
10	1	C19	100PF/50V SMD SIZE 0805	MURATA/YAGEO		
11	1	C20	100uF/16V SMD SIZE 1210	MURATA/YAGEO		
12	2	C22,C24	470uF/100V	RUBYCON	DIGIKEY	1189-1712-ND
13	18	PR1,C23,C28,C30,C31,C32,C33,R34,R38,R40,R41,R42,R43,R46,R48,R49,R50,R52	DNP			
14	3	D1,D2,D3	SS34 OR MBRS240	ON SEMI	DIGIKEY	MBRS240LT3GOSTR-ND
15	6	D4,D5,D6,D7,D8,D9	1N4148	MICROCHIP	DIGIKEY	1N4148UR-1-ND
16	1	D10	LED SMD SIZE 0805	OSRAM	DIGIKEY	475-1415-1-ND
17	6	Q1,Q2,Q3,Q4,Q5,Q6	FDH3632	ON SEMI	DIGIKEY	FDH3632FS-ND
18	6	R1,R2,R3,R4,R5,R6	10E 5% SMD SIZE 0805	MURATA/YAGEO		
19	3	R7,R8,R9	0.01E/3W THT	VISHAY	DIGIKEY	LVRB-.01RCT-ND
20	6	R10,R12,R16,R19,R22,R28	40.02E 1% SMD SIZE 0805	MURATA/YAGEO		
21	6	R11,R13,R17,R20,R23,R30	560E 1% SMD SIZE 0805	MURATA/YAGEO		
22	6	R14,R15,R18,R21,R24,R31	6.04K 1% SMD SIZE 0805	MURATA/YAGEO		
23	1	R25	10K 5% SMD SIZE 1206	MURATA/YAGEO		
24	2	R26,R27	39K 5% SMD SIZE 1206	MURATA/YAGEO		
25	1	R28	100K 5% SMD SIZE 1206	MURATA/YAGEO		
26	3	8 PIN DIP	8 PIN DIP IC SOCKET	TE	DIGIKEY	A120347-ND
27	4	R32,R53,R54,R55	1K 5% SMD SIZE 0805	MURATA/YAGEO	DIGIKEY	
28	1	R33	220E 1% SMD SIZE 0805	MURATA/YAGEO	DIGIKEY	
29	1	R35	680E 1% SMD SIZE 0805	MURATA/YAGEO	DIGIKEY	
30	6	R36,R37,R39,R44,R45,R47	10K 5% SMD SIZE 0805	MURATA/YAGEO	DIGIKEY	
31	1	R51	0E SMD SIZE 0805	MURATA/YAGEO	DIGIKEY	
32	3	U1,U2,U3	IR2101 DIP8	INFINION	DIGIKEY	IR2101PBF-ND
33	1	U4	MCP6024-I/SL	MICROCHIP	DIGIKEY	MCP6024-I/SL-ND
34	1	U5	LM317M DPAK	ST	DIGIKEY	497-1574-1-ND
35	1	C25	1uF/100V	LLNINIOS	DIGIKEY	1572-1641-ND



