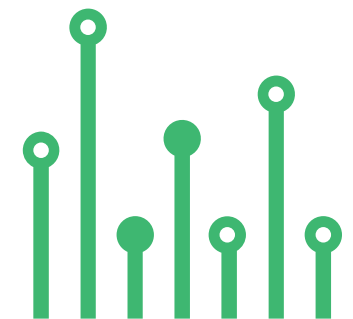


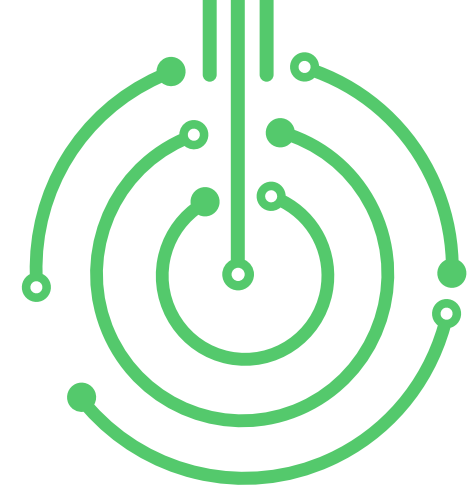
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3-Phase Advance Motion Module 400VDC-4A



SKU: EL148527

MOTOR CONTROL

3 Phase Advance Motion Control Module, 400V DC , 4Amp



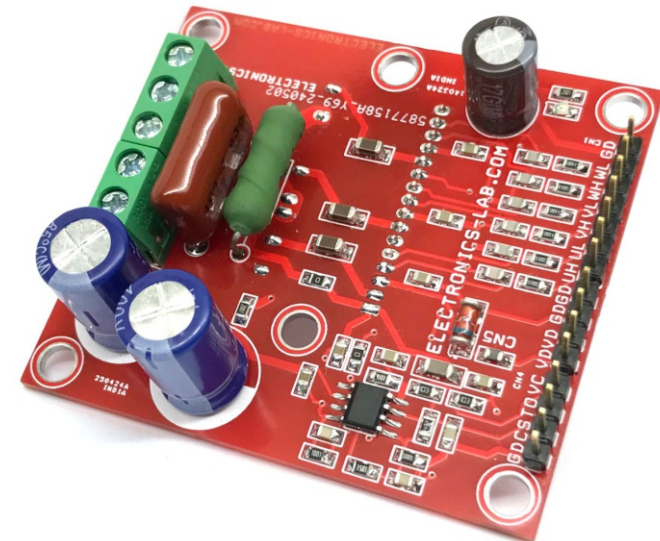
This is an advanced Motion module providing a fully featured, high-performance inverter output stage for AC induction, BLDC and PMSM motors such as refrigerators, fans, and pumps. This module is based on NFA50460 chip which integrates the optimized gate drive of the built-in IGBTs (FS4 RC IGBT technology) to minimize EMI and losses, while also providing multiple on-module protection features including under-voltage lockouts and thermal monitoring. The built-in high-speed Driver IC requires only a single supply voltage and translates the incoming logic-level gate inputs to the high voltage, high current drive signals required to properly drive the module's internal IGBTs. Separate open emitter IGBT terminals are available for each phase to support the widest variety of control algorithms. Heatsink is a must for the IC before conducting any test.



Note-1: The project operates with lethal voltage and the user must take care of safety and all necessary precautions before testing the project.

FEATURES

- Load Power Supply Up to 400V DC (Maximum 450V DC)
- Load Current Continues 4A
- Logic Supply 15V DC, Current 100mA
- Power Supply for Over Current/Temperature Circuit (Comparator U2) 5V DC
- One Board Power LED for Logic Supply
- Shunt and Comparator Based Over Current Output
- Over temperature threshold is 80 degrees centigrade.
- HVIC for gate driving and under-voltage protection
- Active-High interface, can work with 3.3V/5V logic (PWM Signals)
- On Threshold Voltage 2.9V, Off Threshold Voltage 0.8V
- Optimized for low electromagnetic interference
- Isolation voltage rating of 1500Vrms for 1min
- 4X4MM Mounting Holes
- PCB Dimensions 60.64X54.29MM



The project is built using NFA50460R4B IPM chip. This compact and reliable inverter project is ideal for small power motors such as fans and pumps. H-bridge configuration can also be created for low current high-voltage brushed DC motors. The Inverter project supports loads up to 4A. DC power supply voltage is up to 400VDC. The project operates with 6 PWM signals. Parameters for bootstrap circuit elements are dependent on PWM algorithm. For 15 kHz of switching frequency Bootstrap capacitors C3, C4, and C5 values is 1uF. Resistor R4, R6, R7, R11, R15, R16 and capacitor C9, C10, C11, C12, C16, C17 prevent improper signal due to surge-noise. The logic supply is protected with a 20V Zener diode, which prevents surge destruction under severe conditions. Comparator U2A provides low output when an over condition occurs, it measures the current across shunt resistor R13, and normally output is high. Comparator U2B is provided for over temperature, the output of U2B is high when IPM temperature is below 80 degrees C and goes low when the temperature reaches the threshold. A heatsink is a must for full load current, 2 mounting holes are provided throughout the PCB to mount the heatsink as shown in Figure below. Silicone thermal compound, also called thermal grease, should be applied between the heat sink and the flat surface of the IPM to fill microscopic air gaps due to imperfect flatness that ultimately reduces the contact thermal resistance. The IPM module should be soldered first. Excessive torque may bend the PCB.



Note-2: The board has dual option current sense resistor R13. The resistor must be 1% THT or SMD size 2512.

Temperature Sensing Output (VTS) – CN4 Pin 2-TO

Pin: VTS This indicates the temperature of the V-phase HVIC with analog voltage. HVIC itself creates some power loss, but mainly heat generated from the MOSFETs increases the temperature of the HVIC. Comparator U2B is used for over temperature. Output is high in normal condition when temperature is below 80 degrees, goes low when over temperature condition occurs. Over temperature threshold is 80 degrees centigrade.

Current Sense

Current sense resistor R13, Comparator U2A provided to sense the current, this circuit activates when over current condition occurs, output of U2A is normally high, goes low when over condition occurs. Threshold of over current can be alter using divider resistor R2 and R5.

Signal Input Pins

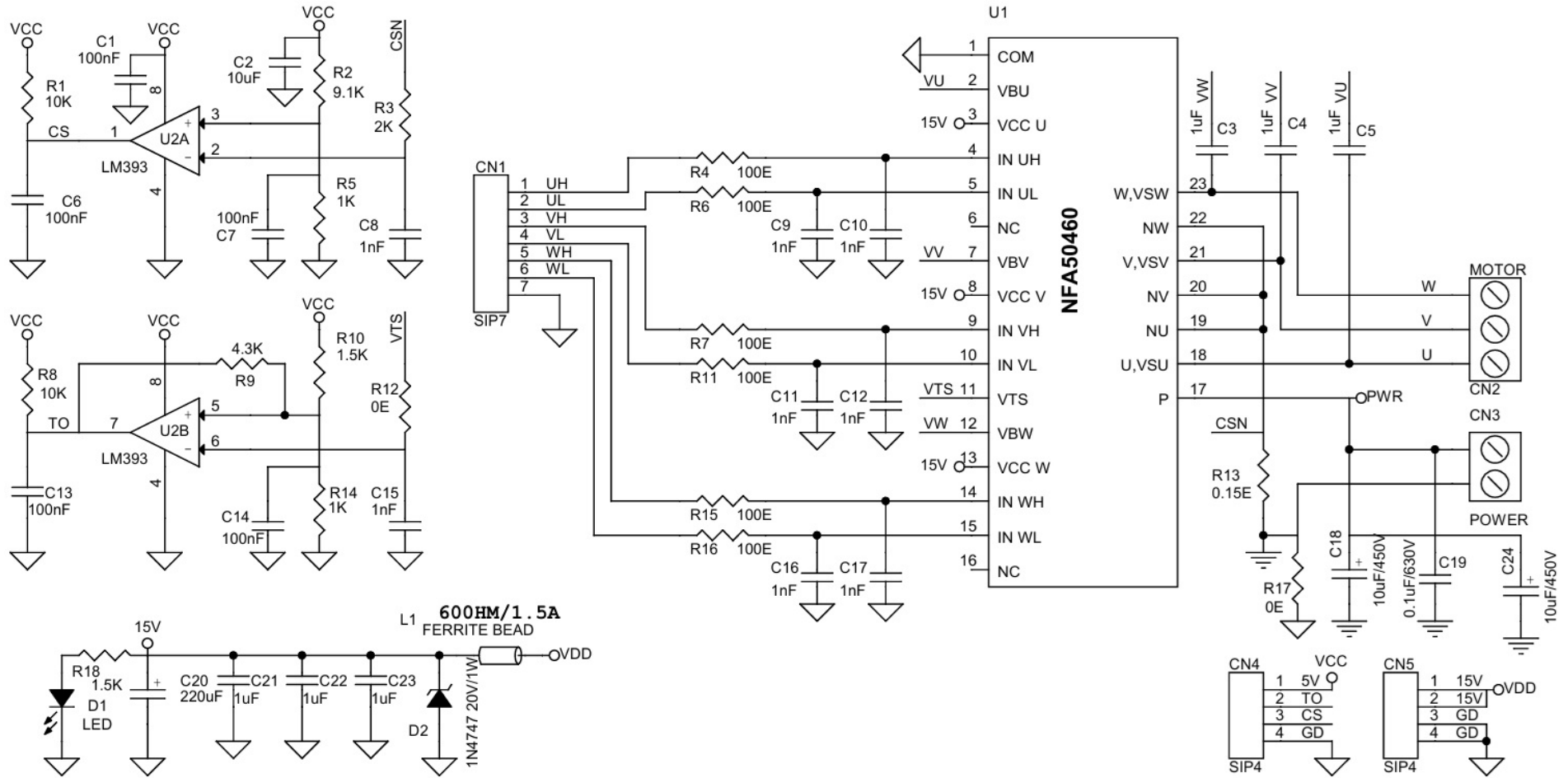
- Pins: IN(UL), IN(VL), IN(WL), IN(UH), IN(VH), IN(WH)
- These pins control the operation of the MOSFETs.
- These pins are activated by voltage input signals. The terminals are internally connected to the Schmitt trigger circuit.
- The signal logic of these pins is active HIGH; the MOSFET turns ON when sufficient logic voltage is applied to the associated input pin.
- The wiring of each input needs to be short to protect the module against noise influences.
- An RC filter is used to mitigate signal oscillations or any noise that traces of input signals may pick up.

NFA50460R4B is an advanced Motion SPM 5 Series based on FS4 RC-IGBT technology as a compact inverter solution for small power motor drive applications such as fans and pumps. Embedded six FS4 RC-IGBTs, three half-bridge gate drive HVICs with temperature sensing, and three bootstrap diodes in a compact package fully isolated and optimized for thermal performance. Major features are low Electro-magnetic Interference (EMI) characteristics through optimizing switching speed and reducing parasitic inductance. Since IGBTs are employed as power switches, it provides much more ruggedness and larger Safe Operating Area (SOA) than IGBT based power modules. Right solution for compact and reliable inverter designs where the assembly space is constrained.

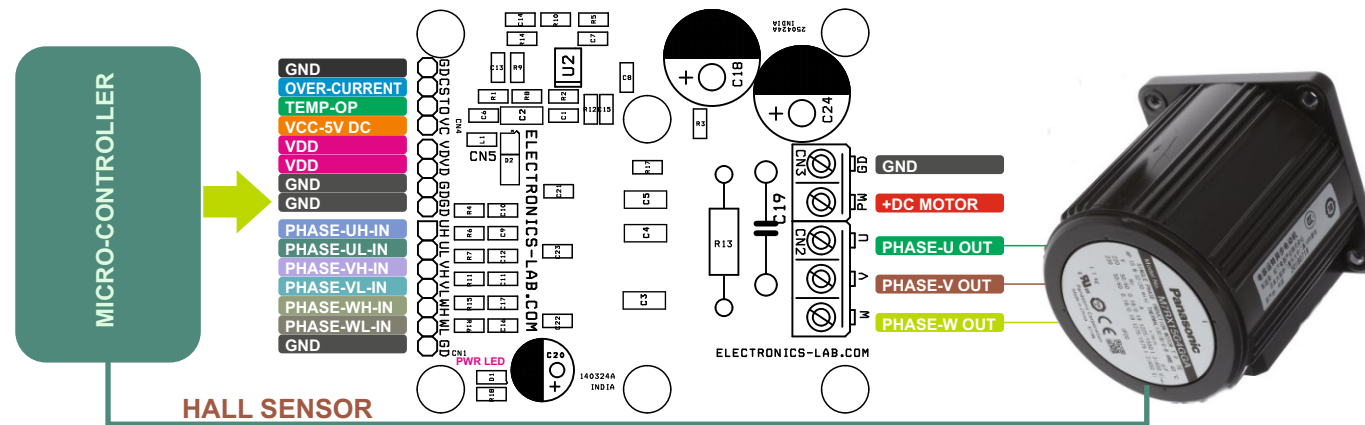
Operation Tooth Table

- HIN 0, LIN 0 = Output Z Both MOSFET Off
- HIN 0, LIN 1 = Output 0 Low Side MOSFET On
- HIN 1, LIN 0 = Output VDC High Side MOSFET On
- HIN 1, LIN 1 = Forbidden Shoot Through

Schematic



Connections

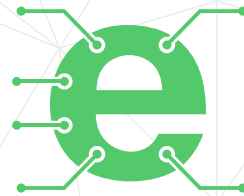


Connections

- CN1: Pin1 = PWM U-High, Pin 2 = PWM U-Low, Pin 3 = PWM V-High, Pin 4 = PWM V-Low, Pin 5 = PWM W-High, Pin 6 = PWM W-Low, Pin 7 = GND
- Cn2: 3 Phase Motor, Pin 1 = Phase=W, Pin 2 = Phase-V, Pin 3 = Phase-U
- CN3: Pin 1 = Motor Supply 400V DC, Pin 2 = GND
- CN4: Pin 1 = VCC 5V, Pin 2 = TO-NTC OUT, Pin 3 = Over Current/Fault, Pin 4 = GND
- CN5: Pin 1,2 = VDD 15V, Pin 3,4 = GND
- D1: Power LED for Logic Supply

Parts List

BOM						
NO.	QNTY.	REF.	DESC.	MANUFACTURER	SUPPLIER	SUPPLIER PART NO
1	1	CN1	7 PIN MALE HEADER PITCH 2.54MM	WURTH	DIGIKEY	732-5320-ND
2	1	CN2	3 PIN SCREW TERMINAL PITCH 5.08MM	PHOENIX	DIGIKEY	277-1248-ND
3	1	CN3	2 PIN SCREW TERMINAL PITCH 5.08MM	PHOENIX	DIGIKEY	277-1247-ND
4	2	CN4,CN5	4 PIN MALE HEADER PITCH 2.54MM	WURTH	DIGIKEY	732-5317-ND
5	5	C1,C6,C7,C13,C14	100nF/50V CERAMIC SMD SIZE 0805	MURATA/YAGEO	DIGIKEY	
6	1	C2	10uF/25V CERAMIC SMD SIZE 0805	MURATA/YAGEO	DIGIKEY	
7	8	C8,C9,C10,C11,C12,C15,C16,C17	1nF/50V CERAMIC SMD SIZE 0805	MURATA/YAGEO	DIGIKEY	
8	2	C18,C24	10uF/450V ELECTROLYTIC THT	PANASONIC	DIGIKEY	P13558-ND
9	1	C19	0.1uF/630V THT 18X5MM LEAD PITCH 15MM	KEMET	DIGIKEY	399-19284-1-ND
10	1	C20	220uF/25V ELECTROLYTIC 8MM DIA.	PANASONIC	DIGIKEY	P10271-ND
11	1	D1	LED SMD SIZE 0805	OSRAM	DIGIKEY	
12	1	D2	20V 1W ZENER DIODE SMD	MICROCHIP	DIGIKEY	150-1N4747UR-1/TRCT-ND
13	1	L1	FERRITE BEAD 600OHM SMD SIZE 0805	LAIRD	DIGIKEY	240-2390-1-ND
14	2	R1,R8	10K 5% SMD SIZE 0805	MURATA/YAGEO	DIGIKEY	
15	1	R2	9.1K 1% SMD SIZE 0805	MURATA/YAGEO	DIGIKEY	
16	1	R3	2K 1% SMD SIZE 0805	MURATA/YAGEO	DIGIKEY	
17	6	R4,R6,R7,R11,R15,R16	100E 5% SMD SIZE 0805	MURATA/YAGEO	DIGIKEY	
18	2	R5,R14	1K 5% SMD SIZE 0805	MURATA/YAGEO	DIGIKEY	
19	1	R9	4.3K 1% SMD SIZE 0805	MURATA/YAGEO	DIGIKEY	
20	2	R10,R18	1.5K 1% SMD SIZE 0805	MURATA/YAGEO	DIGIKEY	
21	2	R12,R17	0E SMD SIZE 0805	MURATA/YAGEO	DIGIKEY	
22	1	R13	0.1E/3W 1% THT or SMD 2512 OPTIONAL	YAGEO	DIGIKEY	ALSR03R1000FE12
23	1	U1	NFA50460R4B	ON SEMI	DIGIKEY	488-NFA50460R4B-ND
24	1	U2	LM393 SOIC8	TI	DIGIKEY	296-1015-1-ND
25	3	C3,C4,C5	1uF/35V CERAMIC SMD SIZE 1206	MURATA/YAGEO	DIGIKEY	
26	3	C21,C22,C23	2.2uF/35V CERAMIC SMD SIZE 0805	MURATA/YAGEO	DIGIKEY	



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