

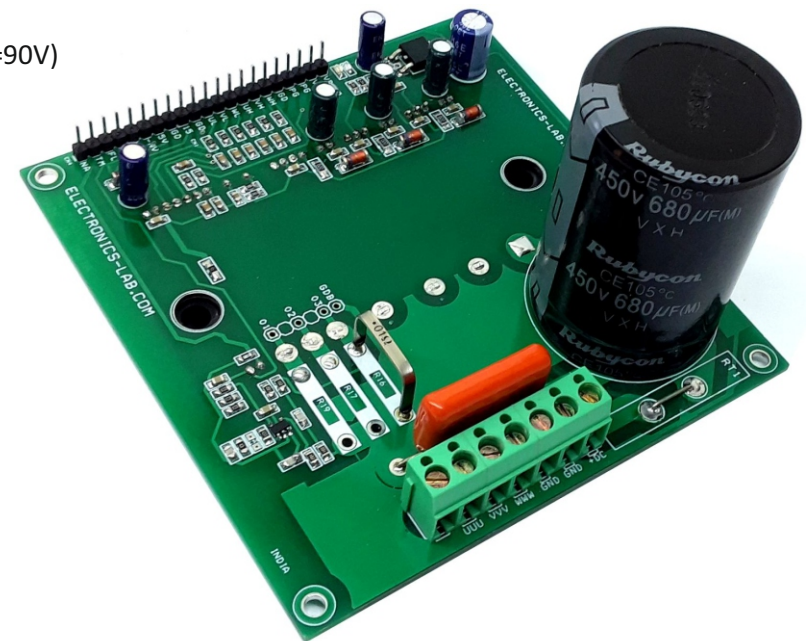
600V - 30A IPM Module Carrier Board for Variable Frequency Drive (VFD)

This compact IPM module circuit provides a fully-featured, high-performance inverter output stage for AC Induction, BLDC, and PMSM motors. The circuit is based on FNA23060 chip which integrates the optimized gate drive of the built-in IGBTs to minimize EMI and losses, while also providing multiple on-module protection features: under-voltage lockouts, over-current shutdown, temperature sensing, and fault reporting. The built-in, high-speed HVIC requires only a single supply of 15V and translates the incoming logic-level gate inputs to high-voltage, high-current drive signals to properly drive the module's internal IGBTs. On-Board optional current sense circuit can be used to monitor the current. LM317 regulator provides 5V DC output to drive op-amp current sense circuit. LED D4 and D5 indicate 5V power and 15V power. Board has an option for 3 current sense resistors. An external 3 phase current circuit is required for 3 phase current sense circuit, if a single current sense circuit is required, solder all 3 phase NU+, NV+, NW+ together and use U4 op-amp circuit, in this case, solder R16. The current sense circuit is built using op-amp based, the gain of the circuit can be set as per user requirement. The board works with lethal high voltage DC and requires extra care while testing. PFC-based DC power supply is recommended to power the board.

Note: It is advisable to read the datasheet of FNA23060 to configure and control this board, current trip, Fault output, input PWM sequence, Over temperature output.

Features

- Operating Supply Motor 90V to 390V DC
- IPM Load Current Maximum 30Amps (Approx. 2.2KW Motor Rating)
- Logic Supply 15V DC
- Motor Supply (Bus-Voltage Feed-Back Output 3.2V when Bus 390V, 0.75 when Bus V=90V)
- On Board Current Sense Circuit
- Current Sense Output 1.7V at 0 Amp 100mV/Amp Approx.
- 2X Power LEDs for 15V and 5V
- Fault Output Normally High Goes Low When Fault Condition Occurs
- Over Current Circuit
- Under-Voltage Protection Circuit Detection Level 10.8-12.8V
- Short Circuit Current Level 60A
- Inbuilt Thermistor for over Temperature
- 47K Ohms @ 25 Degree Centigrade, 2.9K @ 100 Degree Centigrade
- Over Temperature Protection Output
- Operating Frequency up to 20Khz





Current Sense: Board has provision to mount 3 shunt resistors if 3 phase current monitor required, in this case use R16, R17, R19 resistors. This will be required 3 phase current to voltage op-amp circuit, board has provision to measure the single current sense, in this case solder all 3 emitters of IGBTs (Pin 5,6,7) and use U4 op-amp circuit to monitor the current of motor.

Over Current: IPM module has in built separate over current shutdown circuit, over current is set using R23, R24, and C27, refer data sheet of IC to calculate the Over Current shutdown threshold as per requirement.

Signal Input Pins: Pins IN(UL), IN(VL), IN(WL), IN(UH), IN(VH), IN(WH), These pins control the operation of the built-in IGBTs. They are activated by voltage input signals. The terminals are internally connected to a Schmitt-trigger circuit composed of 5 V-class CMOS. The signal logic of these pins is active HIGH. The IGBT associated with each of these pins is turned ON when a sufficient logic voltage is applied to these pins. The wiring of each input should be as short as possible to protect the Motion against noise influences. To prevent signal oscillations, RC (Resistors and capacitors) R1, R5, R6, R11, R12, R13, C3, C4, C5, C11, C12, C13) provided at all 6 inputs signals.

Power Supply: 15V DC supply required to drive the Logic gate driver circuit Use Pin 1 and 2 of connector CN1 to apply logic supply. U2 LM317 regulator provides 5V DC to op-amp circuit for current sense. CN2 screw terminals provided to power the load.

Power LED: D4 5V LED, D5 15V LED

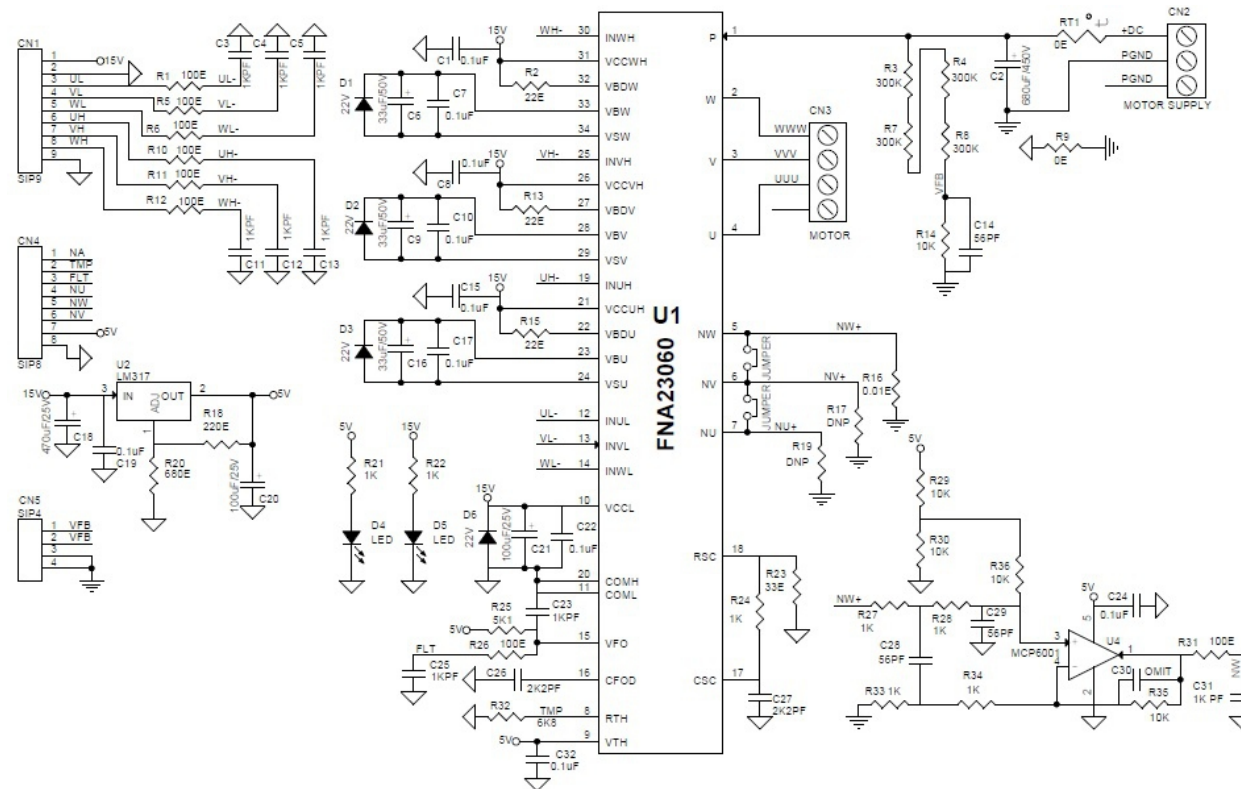
Motor Supply Voltage Feedback: CN5 Connector provides Bus voltage (Motor Supply) feedback (Output 3.2V when 390V, 0.75V when Bus V=90V)

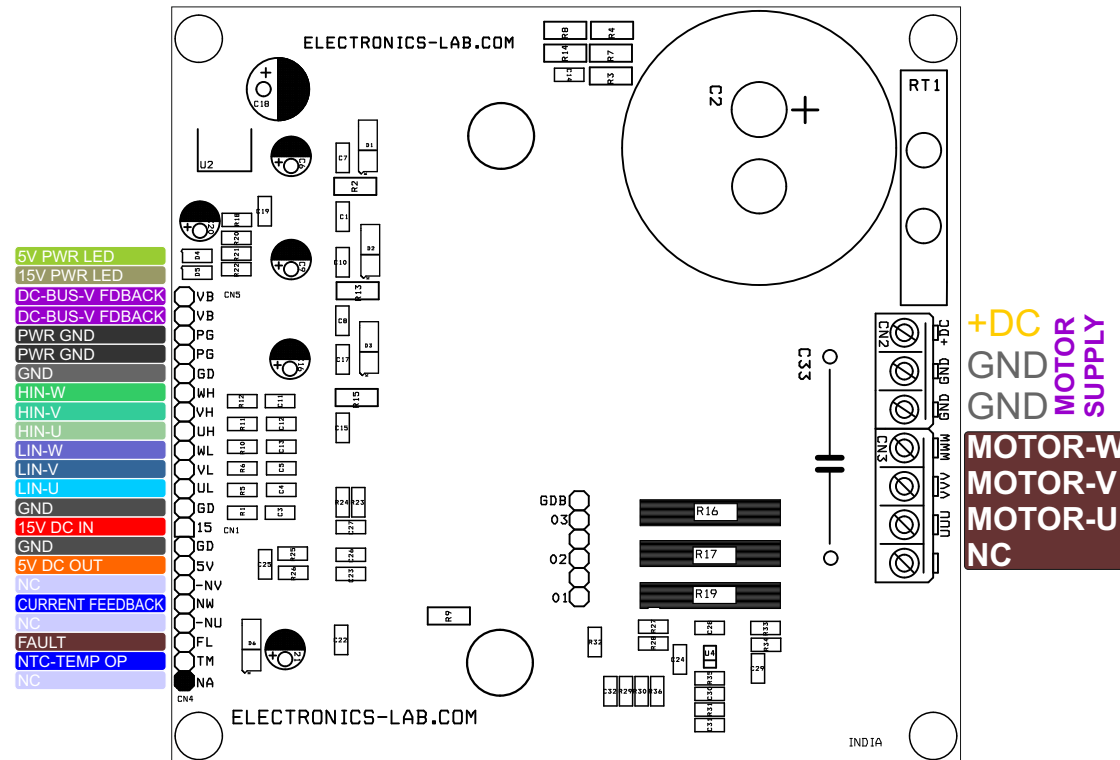
Motor Connections: 4 Pin screw terminal CN3 for motor connections, pin 1 motor phase W, pin 2 motor phase V, pin 3 motor phase U

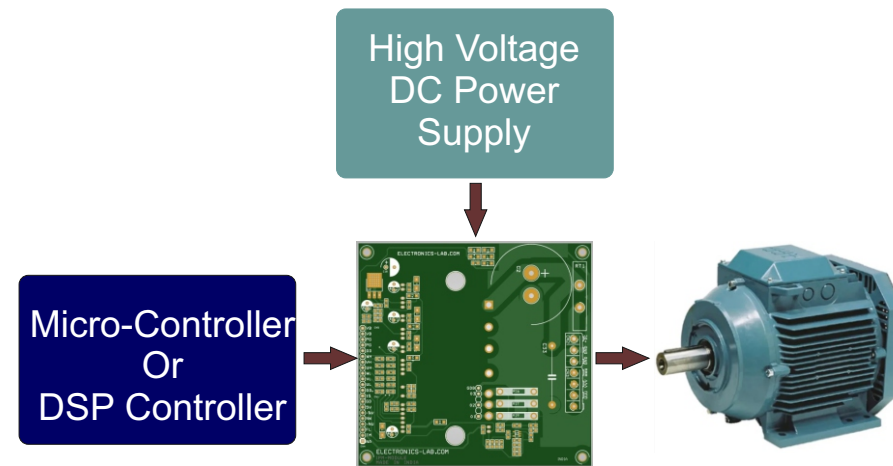
Heatsink: Large size heatsink and fan is very important to cool down the IPM module.

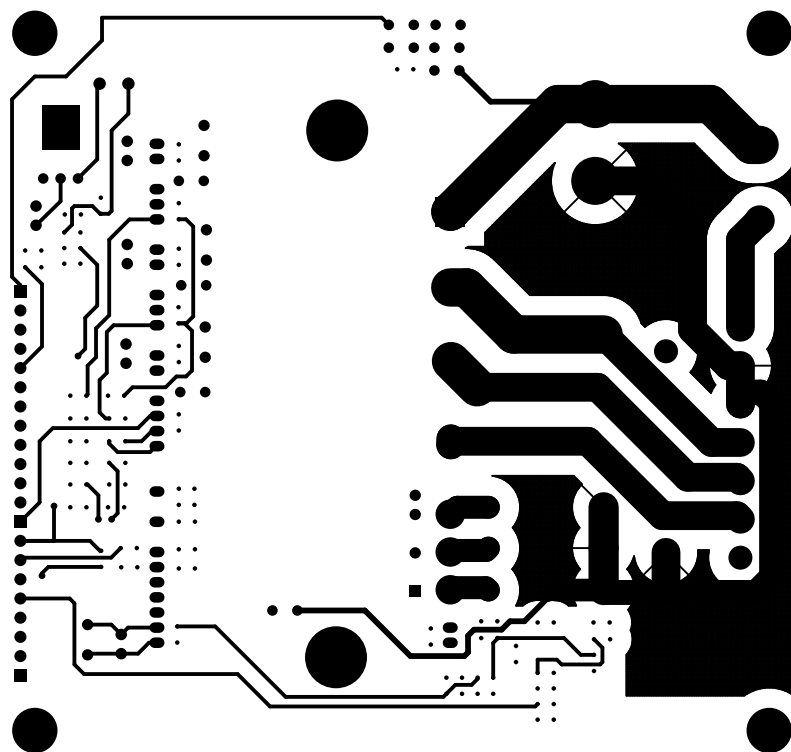
BOM						
NO	QNTY.	REF.	DESC.	MANUFACTURER	SUPPLIER	SUPPLIERS PART NO
1	1	CN1	9 PIN HEADER MALE 2.54MM PITCH	WURTH	DIGIKEY	732-5322-ND
2	1	CN2	3 PIN SCREW TERMINAL 5.08MM PITCH	PHOENIX	DIGIKEY	277-1248-ND
3	2	CN3	2 PIN SCREW TERMINAL 5.08MM PITCH	PHOENIX	DIGIKEY	277-1247-ND
4	1	CN4	8 PIN MALE HEADER 2.54MM PITCH	WURTH	DIGIKEY	732-5321-ND
5	1	CN5	4 PIN MALE HEADER 2.54MM PITCH	WURTH	DIGIKEY	732-5317-ND
6	10	C1,C7,C8,C10,C15,C17,C19,C22,C24,C32	0.1uF/50V SMD SIZE 0805	MURATA/YAGEO	DIGIKEY	
7	1	C2	680uF/450V ELECTROLYTIC	NICHICON	DIGIKEY	493-7535-ND
8	8	C3,C4,C5,C11,C12,C13,C23,C25,C31	1KPF/50V SMD SIZE 0805	MURATA/YAGEO		
9	3	C6,C9,C16	33uF/50V ELECTROLYTIC	NICHICON	DIGIKEY	493-16213-3-ND
10	3	C14,C28,C29	56PF/50V SMD SIZE 0805	MURATA/YAGEO		
11	1	C18	470uF/25V ELECTROLYTIC	NICHICON	DIGIKEY	493-4907-3-ND
12	2	C20,C21	100uF/25V ELECTROLYTIC	NICHICON	DIGIKEY	493-12902-1-ND
13	2	C26,C27	2K2PF/50V SMD SIZE 0805	MURATA/YAGEO		
14	1	C30	OMIT			
15	1	RT1	JUMPER WIRE 2MM DIAMETER	GLOBAL SPECIALITEAS	DIGIKEY	8KWK-3-ND
16	4	D1,D2,D3,D6	22V/1W ZENER DIODE	VISHAY	DIGIKEY	ZM4748A-GS08TR-ND
17	2	D4,D5	LED SMD SIZE 0805	OSRAM	DIGIKEY	475-1410-2-ND
18	1	R9	0E SMD SIZE 0805	MURATA/YAGEO	DIGIKEY	
19	8	R1,R5,R6,R10,R11,R12,R26,R31	100E 5% SMD SIZE 0805	MURATA/YAGEO		
20	3	R2,R13,R15	22E 5% SMD SIZE 1206	MURATA/YAGEO		
21	4	R3,R4,R7,R8	300K 1% SMD SIZE 1206	MURATA/YAGEO		
22	5	R14,R29,R30,R35,R36	10K 5% SMD SIZE 0805	MURATA/YAGEO		
23	1	R16	0.01E	RIEDON	DIGIKEY	696-1630-ND
24	2	R17,R19	DNP	OMIT		OMIT
25	1	R18	220E 1% SMD SIZE 0805	MURATA/YAGEO		
26	1	R20	680E 1% SMD SIZE 0805	MURATA/YAGEO		
27	7	R21,R22,R24,R27,R28,R33,R34	1K 5% SMD SIZE 0805	MURATA/YAGEO		
28	1	R23	33E 5% SMD SIZE 0805	MURATA/YAGEO		
29	1	R25	5K1 1% SMD SIZE 0805	MURATA/YAGEO		
30	1	R32	6K8 5% SMD SIZE 0805	MURATA/YAGEO		
31	1	U1	FNA23060	ON SEMI	DIGIKEY	FNA23060-ND
32	1	U2	LM317	ON SEMI	DIGIKEY	LM317MDTRKGOSCT-ND
33	1	U4	MCP6001	MICROCHIP	DIGIKEY	MCP6001RT-E/OTCT-ND



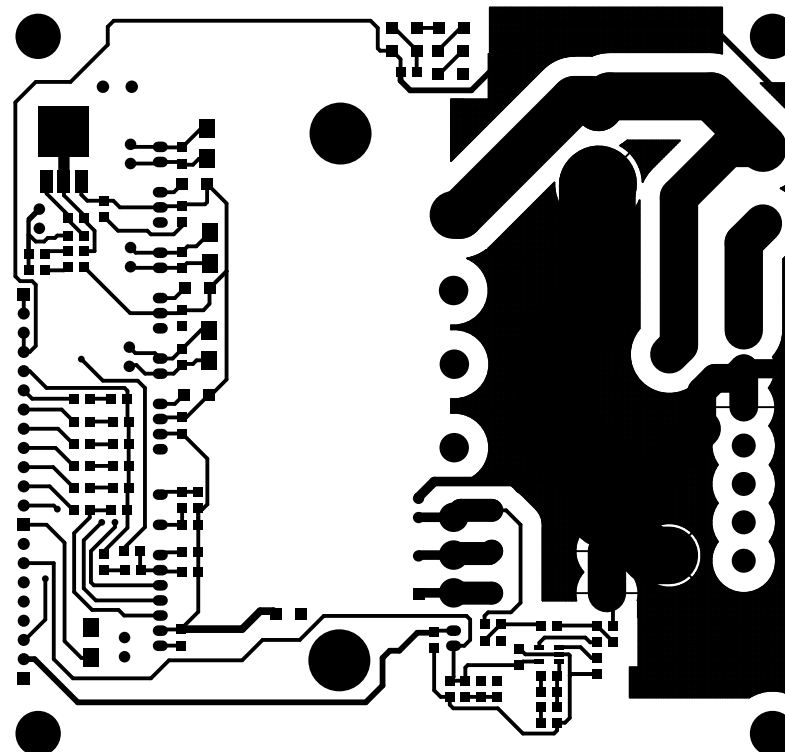






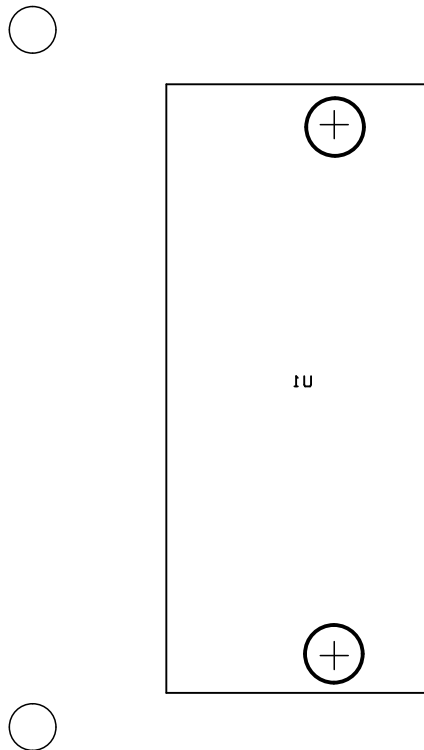


BOTTOM LAYER

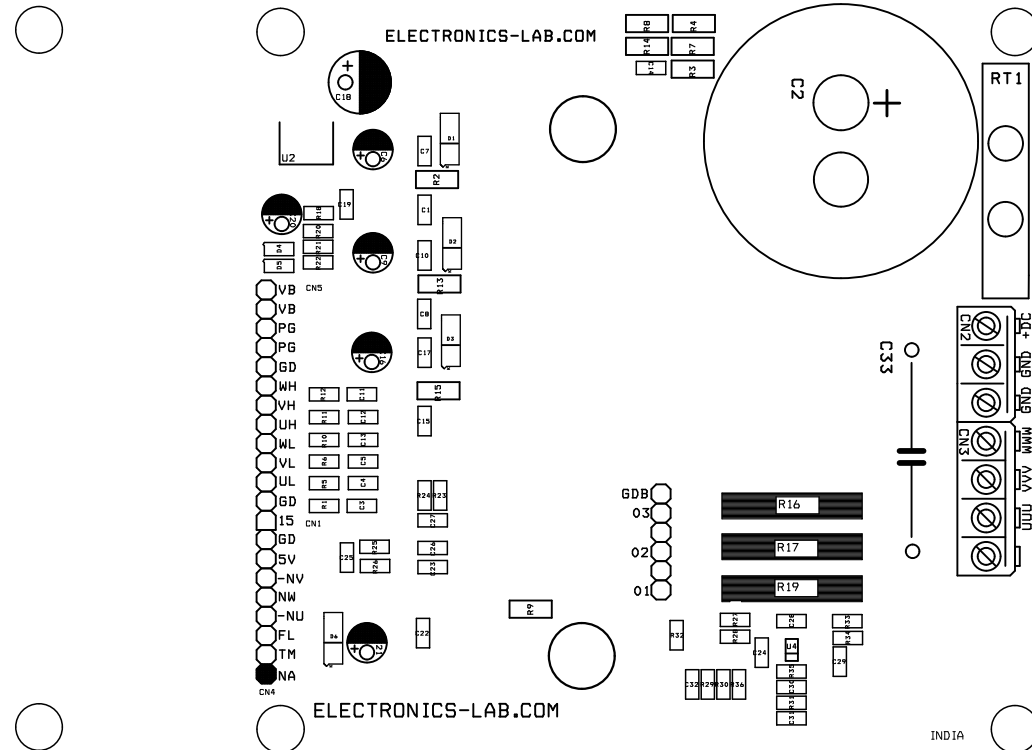


TOP LAYER





SILK SCREEN BOTTOM



SILK SCREEN TOP

PCB DIMENSIONS 100.17MM X 104.93MM