High Voltage DC Motor Speed Controller, Heater Controller, High Voltage Lamp/LED Dimmer, AC230V Input, 600W Load

This is a very powerful DC Motor speed controller for DC motors up to 330V DC and current up to 2A. Basically, the project is a high voltage PWM source with adjustable frequency and adjustable PWM duty cycle range 0 to 99%. The board has been designed considering many applications and the circuit can be used as a heater controller, DC Motor speed controller, LED dimmer, Lamp dimmer, and High voltage PWM driver. The circuit can handle load up to 600W (330V DC @ 2A). The operating input supply is 100V AC to 250V AC or 100V to 330V DC. It is important to provide the input supply as per the operating power supply of the load. Trimmer pot PR1 is provided to adjust the frequency, and P1 to adjust the PWM duty cycle.

Connector CN2 is used for AC or DC load voltage supply, F1 Fuse for protection, R1 NTC to control inrush-current, C2 and C6 for EMI noise, C7 and C8 DC Bus filter capacitor for load supply, R12 Current sense resistor for overcurrent protection feedback circuit (CSC), R3 Temperature monitor (NTC) divide resistor for temperature feedback output, C3, C4 logic supply filter capacitors, CN1, R2 pull up resistor for Fault (VFO), SG3525 PWM Generator, Q1 BC847 to inverse the PWM, D1 power LED, U1 5V regulator.

Precautions for High Voltage

The project is built using the FBA42060 IPM chip. This IPM chip is made for power factor correction, and consists of an inbuilt bridge rectifier, diode for back-EMF protection for inductive loads, IGBT to drive the loads, and IGBT gate driver and on chip NTC temperature monitor.

The project can be used in a standalone mode or with a microcontroller interface.

Standalone Mode:

Solder all components from PWM block, driver chip block, and regulator LM7805. The circuit requires 15V DC to driver logic supply, and Load supply as per operating supply of load.

- Logic Supply 15V DC (Connector CN1 Pin1 and Pin 2)
- Load Supply CN2, 100V – 250V AC or 100V to 330V DC (load Supply will depend on Operating Voltage of Load)
- Fault Output is available at PIN 4 of CN1, normally this pin is high 5V TTL, goes low when fault condition arrives
- Frequency Approx. 20 Khz When Trimmer Pot is in Middle (Range 3Khz to 60Khz)
- Duty Cycle 0 to 99% (Speed Control/Dimmer), P1 Trimmer Potentiometer provided to adjust the duty cycle
- CN3 to connect the Load
- LED D1, Power LED
- PCB Jumper J1 Closed
- PCB Jumper J2 Open
- Soft Start Feature active
- Inbuilt Over current circuit is active

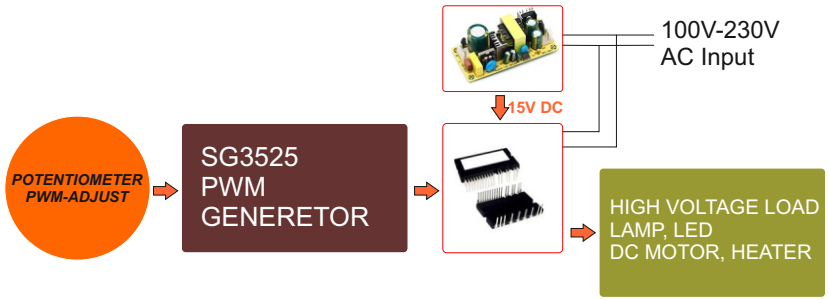
Microcontroller Interface

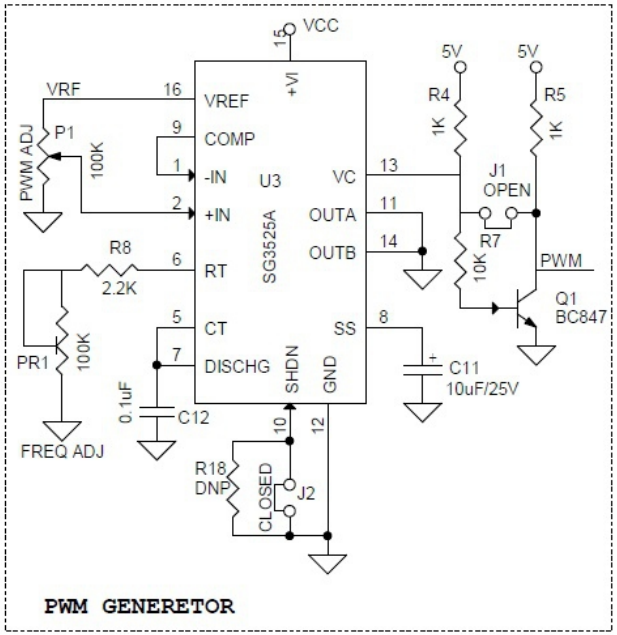
Do not solder components from PWM blocks, use only drive chip block, use current feedback circuit, if current output required.

- Logic Supply 15V DC (Connector CN1 Pin 1 and Pin2)
- CN1 Pin 3 PWM Input Duty Cycle 0 to 100%
- CN1 Pin 3 VFO, Fault Output, normally this pin is High-5V TTL, goes low when fault condition occurs
- CN1 Pin 4 VT – Over temperature feedback, refer data sheet of chip for more information
- CN1 Pin 5 CO – Current Feedback Optional
- CN1 Pin 6 – GND
- CN1 Pin 7- 5V DC Output

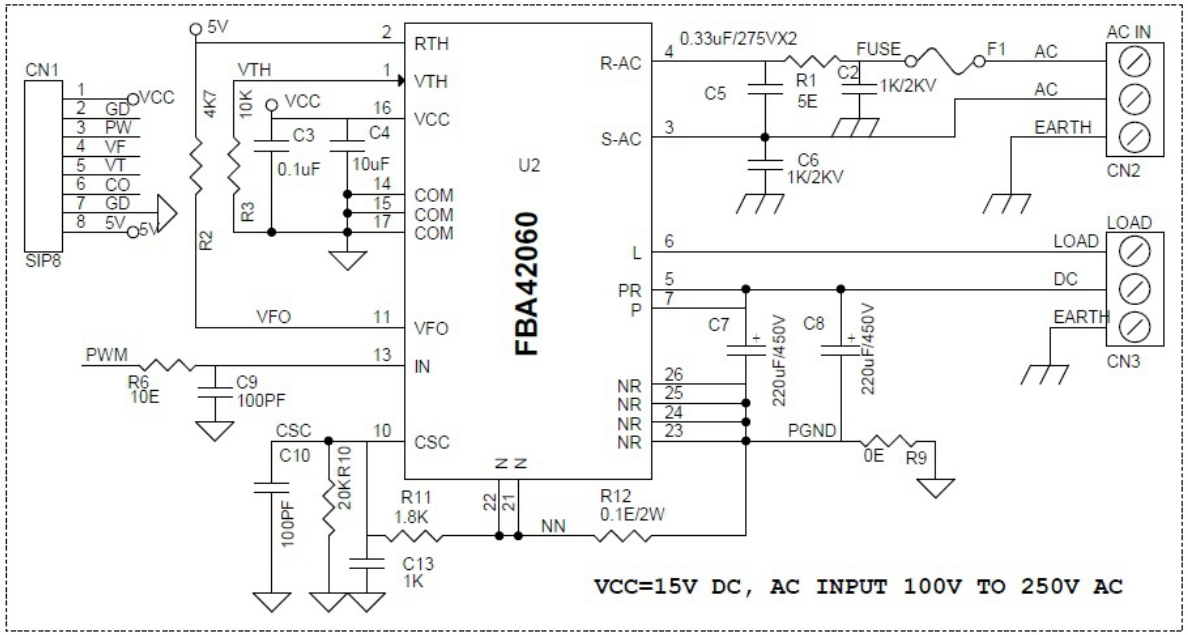
T***esting and using this project - PRECAUTIONS***

It is important to use an isolated logic supply of 15V. It is important to take proper precautions to handle and use this project, especially while adjusting the PWM and frequency since lethal high voltage DC is used. Don't touch the PCB tracks and pads until and unless the DC bus capacitors are fully discharged, high voltage is present for some time even when power is in an OFF state.

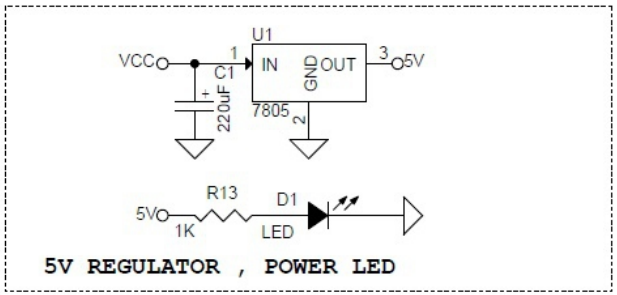

100V-230V
AC Input
15V DC
POTENTIOMETER
PWM-ADJUST
SG3525
PWM
GENERETOR
HIGH VOLTAGE LOAD
LAMP, LED
DC MOTOR, HEATER



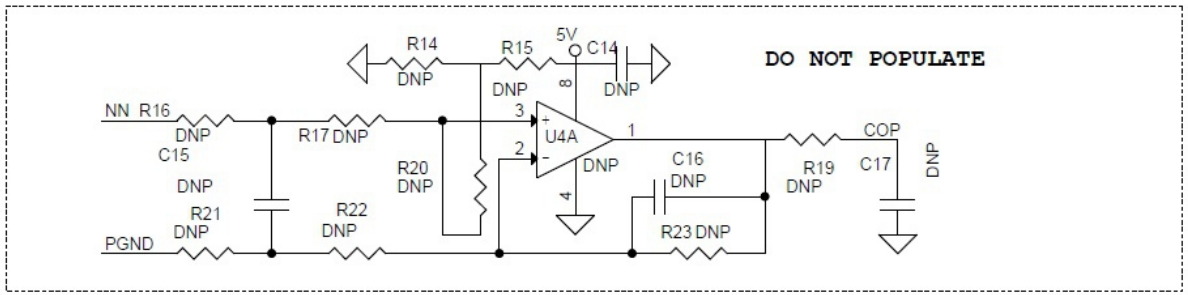
PWM GENERETOR



VCC=15V DC, AC INPUT 100V TO 250V AC

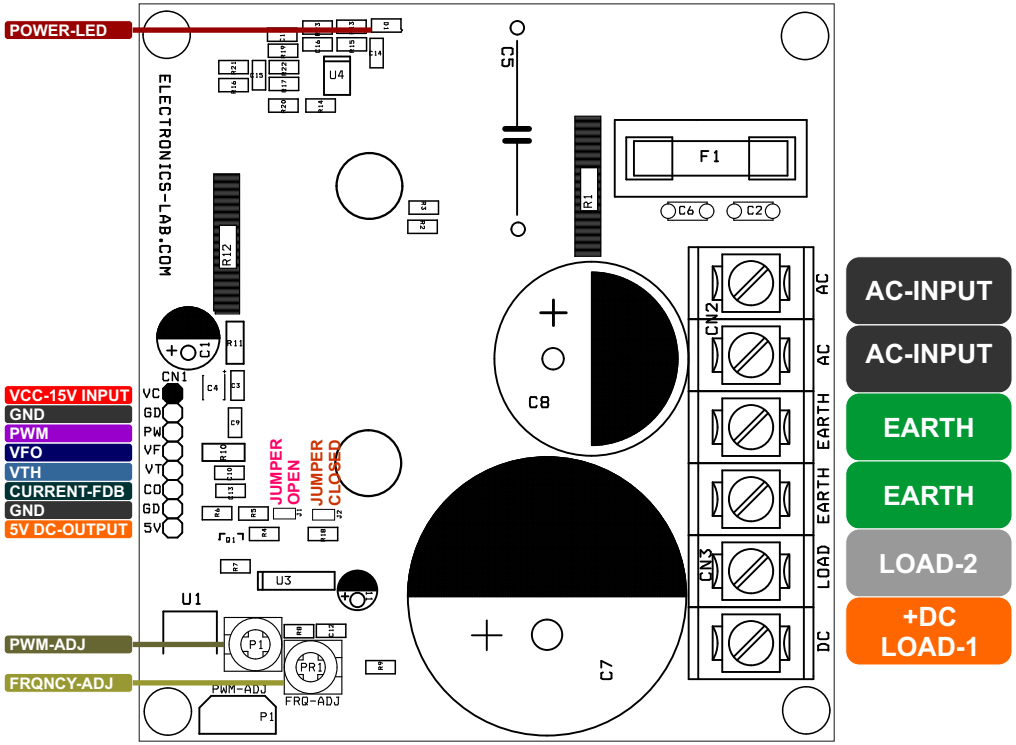


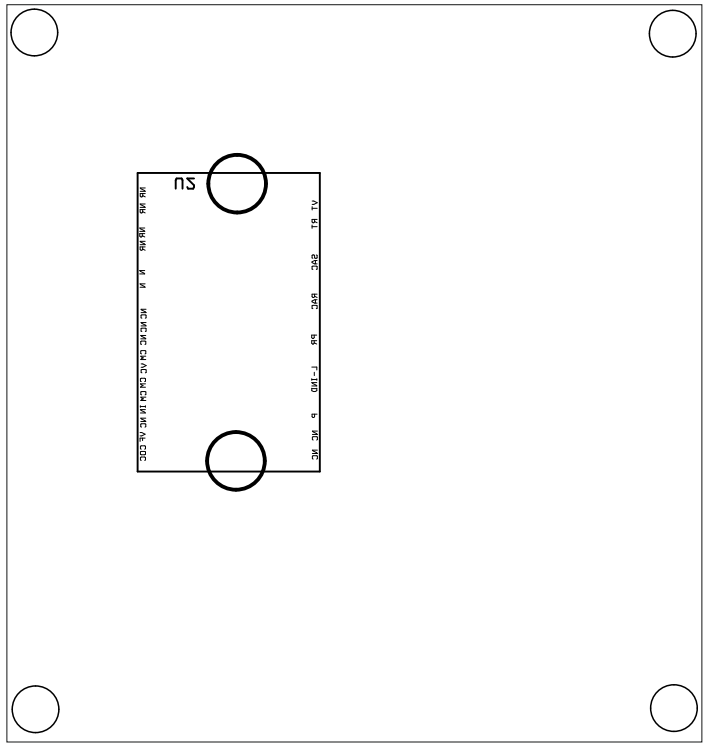
5V REGULATOR , POWER LED



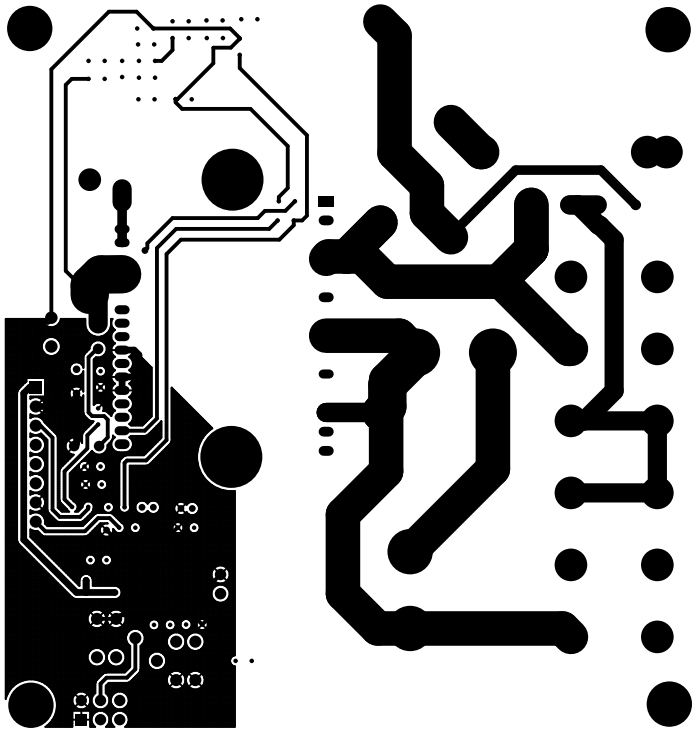
DO NOT POPULATE

BOM						
NO.	QNTY.	REF.	DESC.	MANUFACTURER	SUPPLIER	SUPPLIER PART NO
1	1	CN1	8 PIN MALE HEADER PITCH 2.54MM	WURTH	DIGIKEY	732-5321-ND
2	1	CN2	3 PIN BARRIER BLOCKS PITCH 9.53MM	TE	DIGIKEY	A98482-ND
3	1	CN3	3 PIN BARRIER BLOCKS PITCH 9.53MM	TE	DIGIKEY	A98482-ND
4	1	C1	220uF/25V	NICHICON	DIGIKEY	493-15236-3-ND
5	2	C2,C6	1K/2KV	TDK	DIGIKEY	445-175512-ND
6	2	C3,C12	0.1uF/50V SMD SIZE 0805	MURATA/YAGEO	DIGIKEY	
7	1	C4	10uF/25V SMD SIZE 1206 OR 1210	MURATA/YAGEO	DIGIKEY	
8	1	C5	0.33uF/275VX2	KEMET	DIGIKEY	399-11486-ND
9	1	C7	680uF/450V	NICHICON	DIGIKEY	493-7535-ND
10	1	C8	330uF/450V	NICHICON	DIGIKEY	493-6112-ND
11	2	C9,C10	100PF/50V SMD SIZE 0805	MURATA/YAGEO	DIGIKEY	
12	1	C11	10uF/25V ELECTROLYTIC	NICHICON	DIGIKEY	493-17428-3-ND
13	4	R4,R5,R13,C13	1K 5% SMD SIZE 0805	MURATA/YAGEO	DIGIKEY	
14	15	U4,R14,C14,R15,C15,R16,C16,R17,C17,R18,R19,R20,R21,R22,R23	DNP	PCB JUMPER		DON'T USE
15	1	J1	OPEN-SOLDER JUMPER	PCB JUMPER		PCB JUMPER
16	1	J2	CLOSED-PCB JUMPER			PCB JUMPER
17	2	PR1,P1	100K TRIMMER POTENTIOMETER	NIDEC	DIGIKEY	CT6EW104-ND
18	1	Q1	BC847	NEXPERIA	DIGIKEY	1727-2924-2-ND
19	1	R1	5-OHMS 20MM DIAMETER NTC	SEMITEC	MOUSER	954-5D2-18LCS
20	1	R2	4K7 5% SMD SIZE 0805	MURATA/YAGEO		
21	2	R3,R7	10K 5% SMD SIZE 0805	MURATA/YAGEO		
22	1	R6	10E 5% SMD SIZE 0805	MURATA/YAGEO		
23	1	R8	2.2K 5% SMD SIZE 0805	MURATA/YAGEO		
24	1	R9	0E SMD SIZE 0805	MURATA/YAGEO		
25	1	R10	20K 1% SMD SIZE 0805	MURATA/YAGEO		
26	1	R11	1.8K 5% SMD SIZE 0805	MURATA/YAGEO		
27	1	R12	0.1E/2W	OHMITE	DIGIKEY	12FR100E-ND
28	1	U1	LM7805	ON SEMI	DIGIKEY	MC78M05CDTGOS-ND
29	1	U2	FBA42060-D	ON SEMI	DIGIKEY	1990-FBA42060-ND
30	1	U3	SG3525A	ON SEMI	DIGIKEY	497-6479-1-ND
31	1	F1	FUSE HOLDER	WURTH	DIGIKEY	732-11376-ND
32	1	F1	FUSE HOLDER CLIP COVER	WURTH	DIGIKEY	732-11379-ND
33	1	F1	GLASS-FUSE	WURTH	DIGIKEY	507-1270-ND

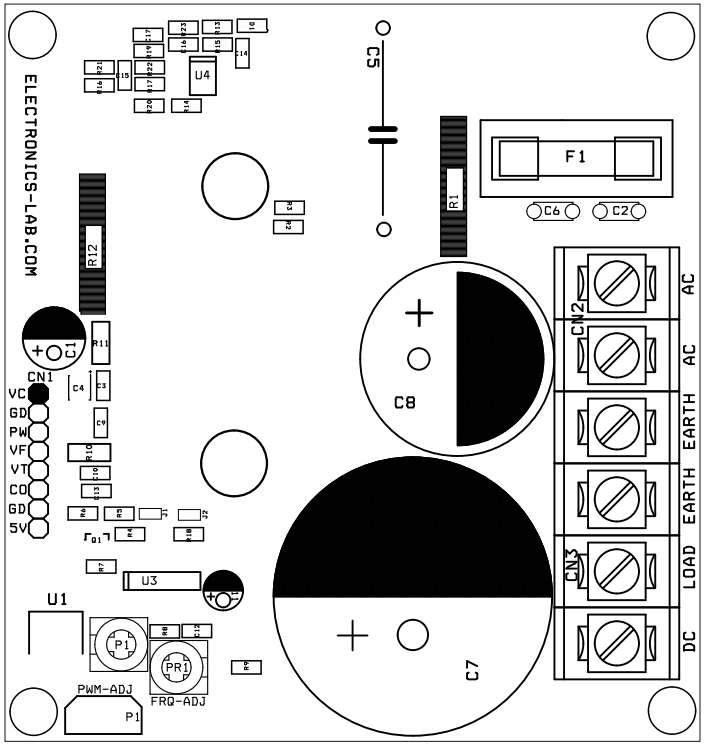

POWER-LED
VCC-15V INPUT
GND
PWM
VFO
VTH
CURRENT-FDB
GND
5V DC-OUTPUT
PWM-ADJ
FRQNCY-ADJ
ELECTRONICS-LAB.COM
JUMPER OPEN
JUMPER CLOSED
AC-INPUT
AC-INPUT
EARTH
EARTH
LOAD-2
+DC LOAD-1



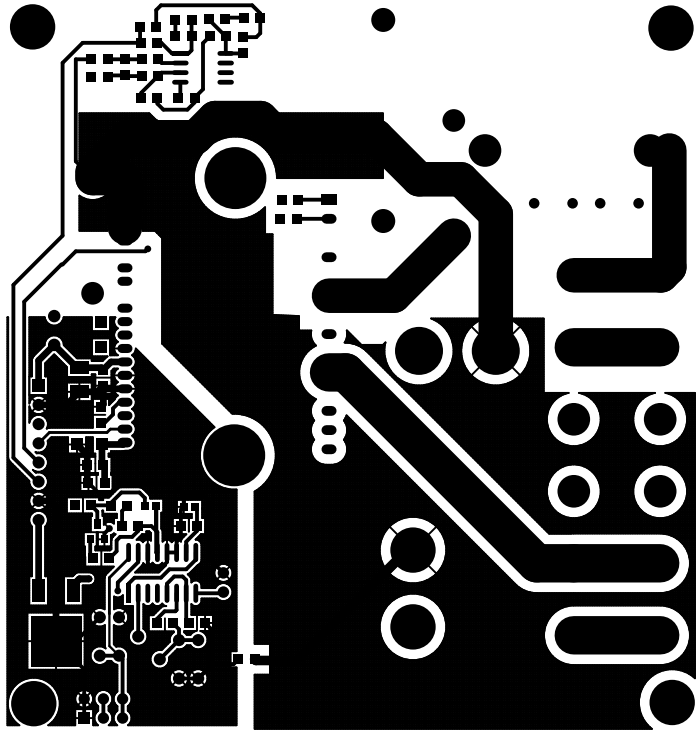
SILK SCREEN BOTTOM



BOTTOM LAYER



SILK SCREEN TOP



TOP LAYER