PWM Temperature Controlled FAN using TC648 and NTC sensor

The project described here is a switch mode fan speed controller for use with brushed or brushless DC motors. Temperature proportional speed control is accomplished using pulse width modulation (PWM). 10K Ohms NTC is used to sense the temperature. The project is built using TC648 chip and configured with auto-shutdown mode. In Auto-Shutdown mode, fan operation is automatically suspended when measured temperature is lower than 25 degrees centigrade. The fan is automatically restarted and proportional speed control restored when temperature exceeds 25 degrees centigrade. An integrated Start-Up Timer ensures reliable motor start-up at turn-on, or when coming out of Shutdown mode. MOSFET Q1 provided to drive the Fan up to 3A of load. A few fans require a PWM signal to work. Use gate of MOSFET to take out the direct PWM signal.

Auto-Shutdown Setting (Resistor Divider R3 and R5)

An external resistors R3 and R5 divider connected to the VAS input sets the auto-shutdown threshold. Auto-shutdown occurs when VIN ≤ VAS. During shutdown, supply current falls to 25 µA (typical). The fan is automatically restarted when VIN ≥ (VAS +VHAS).

Auto shut-Down Mode Calculation

- Calculation R1 and R2 based on using an NTC having a resistance of 10 k at TMIN (25°C) and 4.65 k at TMAX (45°C) R1 = 20 k R2 = 3K6 k
- Set auto-shutdown level. VAS = 1.8V Limit the divider current to 100 µA R3 = 33 k R5 = 18 k

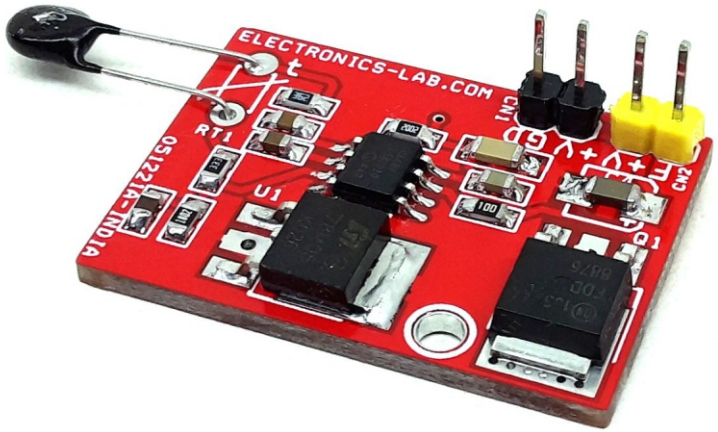
Note: This board operates in auto-shutdown mode, but it can also be configured as minimum speed mode, refer to datasheet for configuration. Various speed (Duty Cycle) VS Temp range can be achieved by changing resistor value, refer to the datasheet of the chip for equations..

Features

- Operating Supply 12V to 18V
- Fan 12V – 18V DC
- Load up to 3Amps (12V to 18V)
- PWM Duty Cycle 42% to 100%
- Fan Shut-down when Temperature Falls approx. 25 Degree Centigrade
- Fan Low Speed (42% Duty Cycle) When Temperature 25 Degree Centigrade
- Fan Full Speed (100% Duty Cycle) When

Temperature goes Above approx. 45 Degree Centigrade

- PWM Frequency 30 Hz
- Temperature Proportional Fan Speed for Acoustic Control and Longer Fan Life

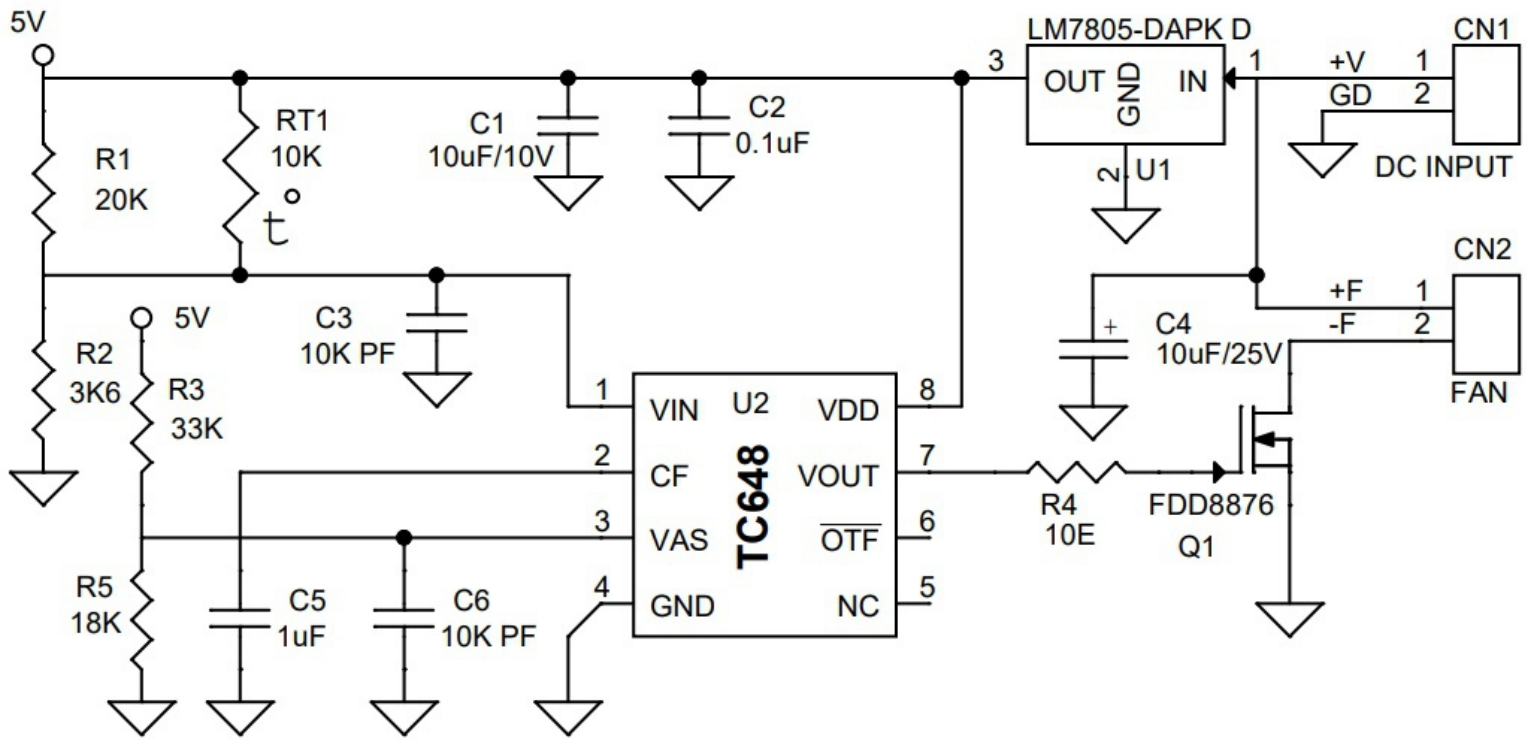


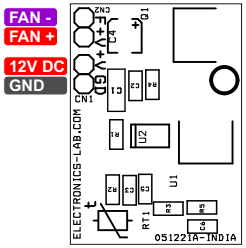
PWM (Duty Cycle 42% to 100%, 42% is setpoint for minimum speed beyond this shutdown event occurs)

The PWM circuit consists of a ramp generator and threshold detector. The frequency of the PWM is determined by the value of the capacitor connected to the CF pin. A frequency of 30 Hz is selected using CF capacitor C5, PWM is also the time base for the Start-up Timer. The PWM voltage control range is 1.25V to 2.65V (typical) for 0% to 100% output duty cycle.

Start-Up Timer

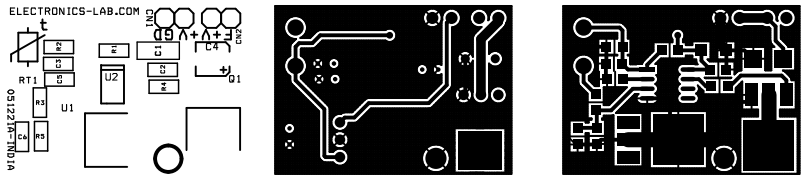
To ensure reliable fan start-up, the Start-up Timer turns the VOUT output on for 32 cycles of the PWM whenever the fan is started from the off state. This occurs at power-up and when coming out of shutdown or auto-shutdown mode. Start-up time is approximately one second with PWM frequency 30Hz)





NTC
T-SENSOR

BOM						
NO	QNTY.	REF.	DESC.	MANUFACTURER	SUPPLIER	SUPPLIER PART NO
1	1	CN1	2 PIN MALE HEADER PITCH 2.54MM	WURTH	DIGIKEY	732-5315-ND
2	1	CN2	2 PIN MALE HEADER PITCH 2.54MM	WURTH	DIGIKEY	732-5315-ND
3	1	C1	10uF/10V SMD SIZE 1206	MURATA/YAGEO	DIGIKEY	
4	1	C2	0.1uF/50V SMD SIZE 0805	MURATA/YAGEO	DIGIKEY	
5	2	C3,C6	10K PF SMD SIZE 0805	MURATA/YAGEO	DIGIKEY	
6	1	C4	10uF/25V SMD SIZE 1210 OR 1206	MURATA/YAGEO	DIGIKEY	
7	1	Q1	FDD8876	ON SEMI	DIGIKEY	FDD8876CT-ND
8	1	RT1	10K 5% SMD SIZE 0805	MURATA/YAGEO	DIGIKEY	
9	1	R1	20K 1% SMD SIZE 0805	MURATA/YAGEO	DIGIKEY	
10	1	R2	3K6 1% SMD SIZE 0805	MURATA/YAGEO	DIGIKEY	
11	1	R3	33K 1% SMD SIZE 0805	MURATA/YAGEO	DIGIKEY	
12	1	R4	10E 5% SMD SIZE 0805	MURATA/YAGEO	DIGIKEY	
13	1	R5	18K 1% SMD SIZE 0805	MURATA/YAGEO	DIGIKEY	
14	1	U1	LM7805-DAPK D	ON SEMI	DIGIKEY	MC78M05CDTGOS-ND
15	1	U2	TC648 SOIC8	MICROCHIP	DIGIKEY	TC648VOA713CT-ND
16	1	C5	1uF/10V SMD SIZE 0805	MURATA/YAGEO	DIGIKEY	



SILK SCREEN TOP BOTTOM LAYER TOP LAYER

PCB DIMENSIONS 31.91MM X 22.86MM