

Upgrade/ retrofitting a Linear DC Power Supply

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I Circuit Diagram

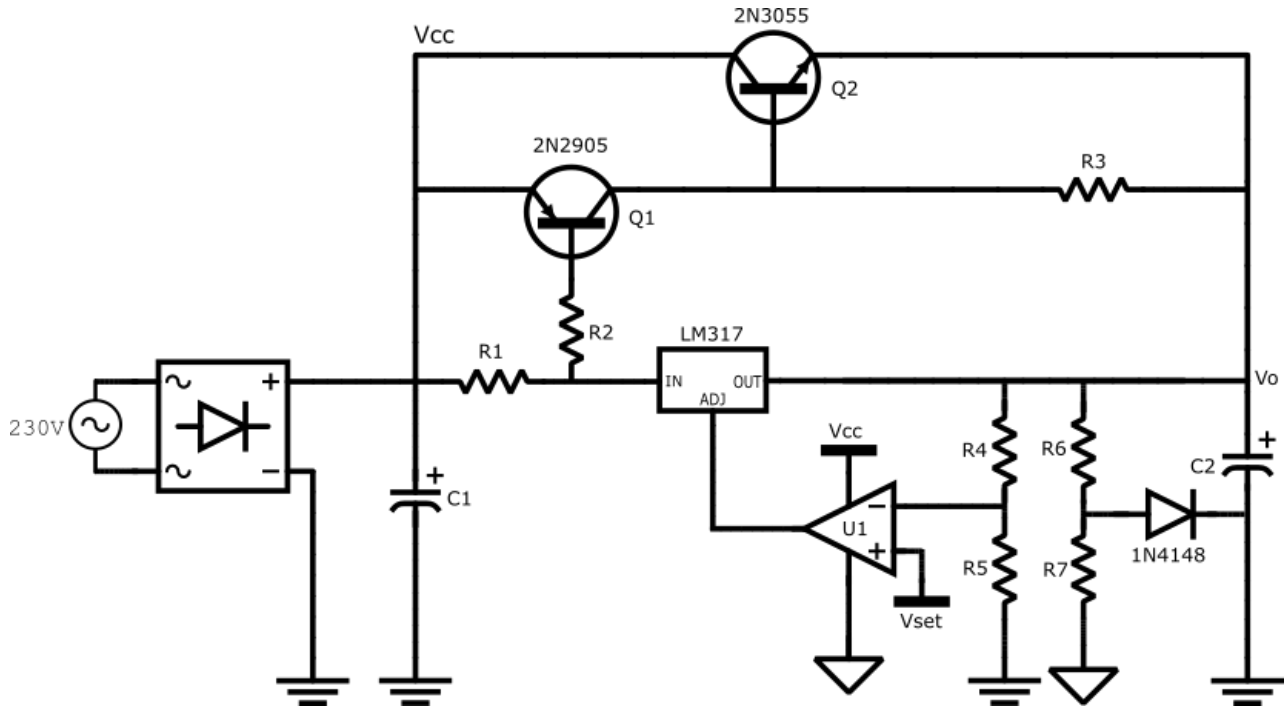


Figure 1: LM317 Based Linear Regulated Power Supply

Here, $R_1 = 22\Omega$, $R_2 = 5K\Omega$, $R_1 = 22\Omega$, $R_3 = 500\Omega$, $R_4 = 10K\Omega$, $R_5 = 5.6K\Omega$, $R_6 = 2.2K\Omega$, $R_7 = 150\Omega$, $C_1 = 0.1\mu F$, $C_2 = 1000\mu F$, $U1 = LM358N$,

II Working Principle

The LM317 device is an adjustable three-terminal positive-voltage regulator capable of supplying more than 1.5A over an output-voltage range of 1.25V to 37V. The voltage difference across the output terminal and adjust pin is always 1.25V. The OpAmp drives the adjust pin and maintains the output voltage constant at a set value incorporating negative feedback. Resistors R_6 , R_7 , and diode, along with negative feedback, pull the output voltage to 0 V, which is possible because of the dual rail supply given to the OpAmp. OpAmp's output is pulled down to -1.25 to maintain the output as 0V. Voltage divider with division factor 3 is used to feed the output voltage so that we can get output voltage up to 15V with input reference voltage set to 5V. It can later be driven by the micro-controller.

The LM317 can handle 1.5A of current, with maximum load regulation of 1.5%. To improve the load regulation and increase the current carrying capacity, NPN transistor Q_2 in voltage follower mode is used along with Q_1 , which drives it. This way, the transistor Q_2 supplies the maximum of the output load current, and the current rating of the power supply is set by the current rating of transistor Q_2 (2N3055), i.e. 15A

III Test Results

Parameter	Test Conditions	Load Current (I_L) (A)	$V_{O_{FL}}$ (V)	
Load Regulation	$V_{O_{NL}} = 5V$	0.5	4.98	0.4 %
		1.0	4.97	0.6 %
		1.5	4.97	0.6 %
		2	4.95	0.8 %
	$V_{O_{NL}} = 10V$	0.5	9.98	0.2 %
		1.0	9.98	0.2 %
		1.5	9.97	0.3 %
		2	9.97	0.3 %

Table 1: Load Regulation

Parameter	Test Conditions	ΔV_{in} (V)	ΔV_O (V)	
Line Regulation	$V_O = 5V$	10	0.04	0.4 %
	$V_O = 10V$	10	0.15	1.5 %

Table 2: Line Regulation

IV PCB

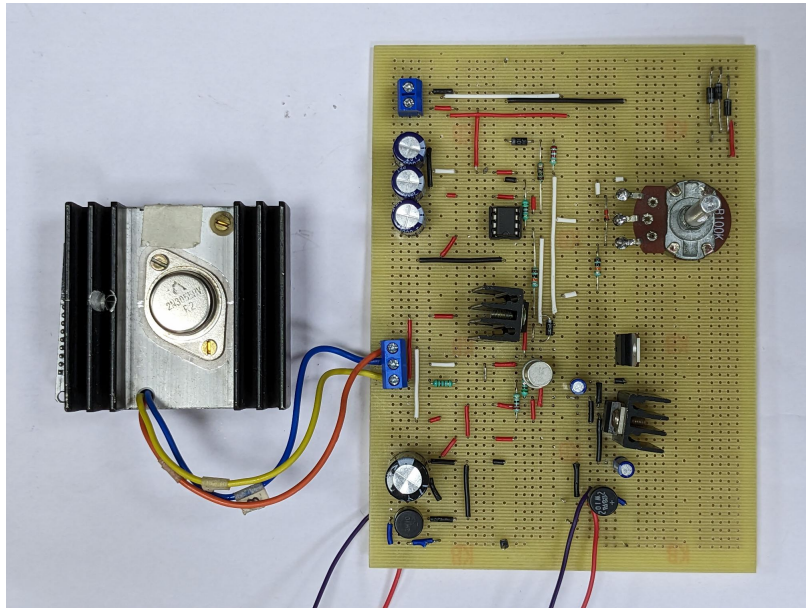


Figure 2: PCB of Linear Regulated Power Supply

V Conclusion

With the help of current booster circuit the output current capacity is increased to 2.5 A without degrading the load regulation significantly. The load regulation is also improved at the higher load currents limiting it to 0.8 % .