A

Seminar report

On

Regulated Power Supply

Submitted in partial fulfillment of the requirement for the award of degree
Of ECE

SUBMITTED TO: **SUBMITTED BY:**

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Acknowledgement

I would like to thank respected Mr…….. and Mr. ……..for giving me such a wonderful opportunity to expand my knowledge for my own branch and giving me guidelines to present a seminar report. It helped me a lot to realize of what we study for.

Secondly, I would like to thank my parents who patiently helped me as i went through my work and helped to modify and eliminate some of the irrelevant or un-necessary stuffs.

Thirdly, I would like to thank my friends who helped me to make my work more organized and well-stacked till the end.

Next, I would thank Microsoft for developing such a wonderful tool like MS Word. It helped my work a lot to remain error-free.

Last but clearly not the least, I would thank The Almighty for giving me strength to complete my report on time.

Preface

I have made this report file on the topic **Regulated Power Supply**; I have tried my best to elucidate all the relevant detail to the topic to be included in the report. While in the beginning I have tried to give a general view about this topic.

My efforts and wholehearted co-corporation of each and everyone has ended on a successful note. I express my sincere gratitude to …………..who assisting me throughout the preparation of this topic. I thank him for providing me the reinforcement, confidence and most importantly the track for the topic whenever I needed it.

CONTENT

INTRODUCTION

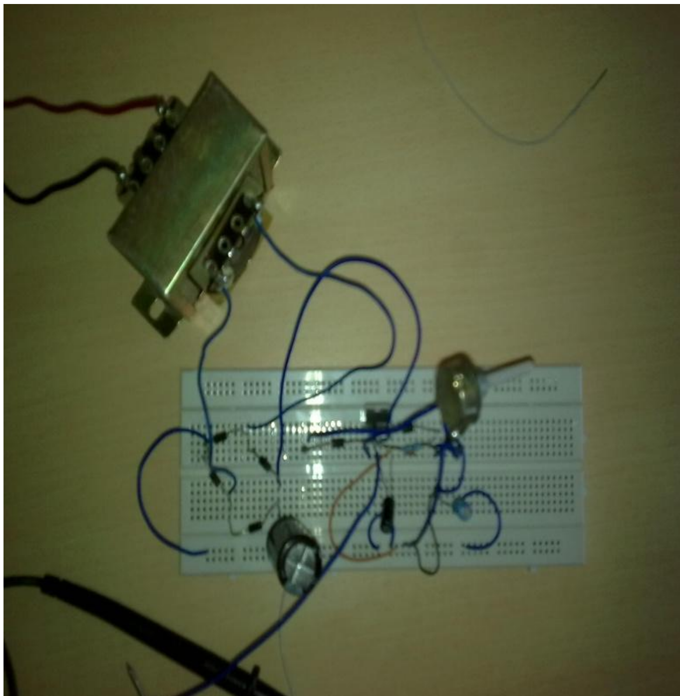
The LM 317 series is adjustable to three terminal positive voltage regulators. The different grades of regulators in the series are available with output voltage of 1.2 to 57 volts and output current from 0.1 to 1.5 ampere.

The LM 317 series regulators are available in standard transmitter packages that are easily mounted and handled. The three terminals V_{in}, V_{out}, adjustable.

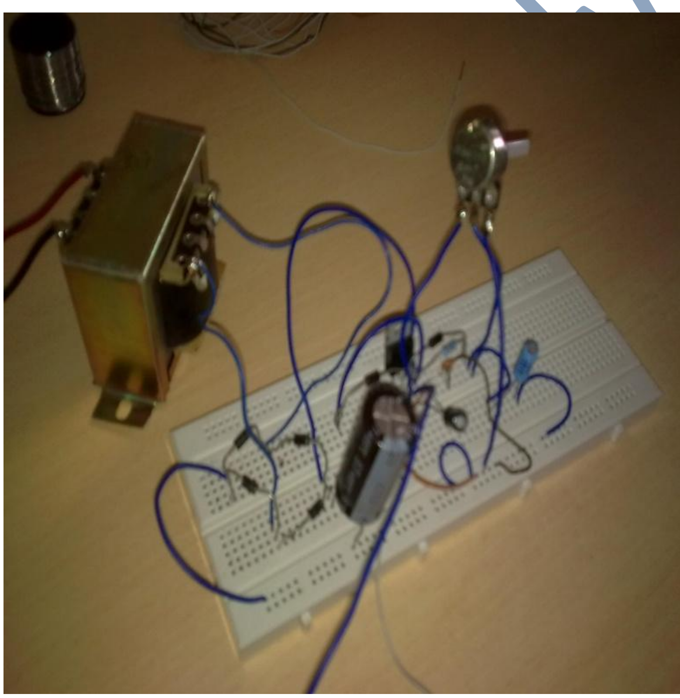
The LM 317 develops a nominal 1.25 volt referred to as reference voltage between the output and the adjustment terminal. The maximum value of adjustable pin current is 100µA.

It is highly efficient in protecting circuits that are complex and complicated. That is why LM 317 circuit is highly useful.

DETAILED DESIGN AND CALCULATIONS



LM317 protecting circuit (top view)



LM317 protecting circuit (front view)

Calculations:

V_0= 0 to 30 V
I_0 = 1.0 A
I_{adj} = 100µA max
If we use R_1=240 ohm, then for V_0 of 1.2 volt, the value of R_2 from equation
$V_0=1.25(1+R_2/R_1)+(I_{adj})(R_2)$
$1.2=1.25(1+R_2/240)+(10^{-4})R_2$
R_2=2.02 KΩ

If V_0=30V
$30=1.25(1+R_2/240)+(10^{-4})R_2$
R_2 =5.4 KΩ

Component Names & Specifications

The main parts required for the construction of the variable regulated power supply are listed below along with their specifications:-

BR1 = Bridge Rectifier, 100V - 3A

C1 = 1000 µF, 63V

IC1 = LM317, adjustable regulator

C2 = 0.1 µF

V = Meter, 30V, RI = 85 ohm

C3 = 1µF

Plug = 3-wire plug & cord

C4 = 10µF

TR1 = Transformer, 30V, 2A

R1 = 240 ohm, 5%

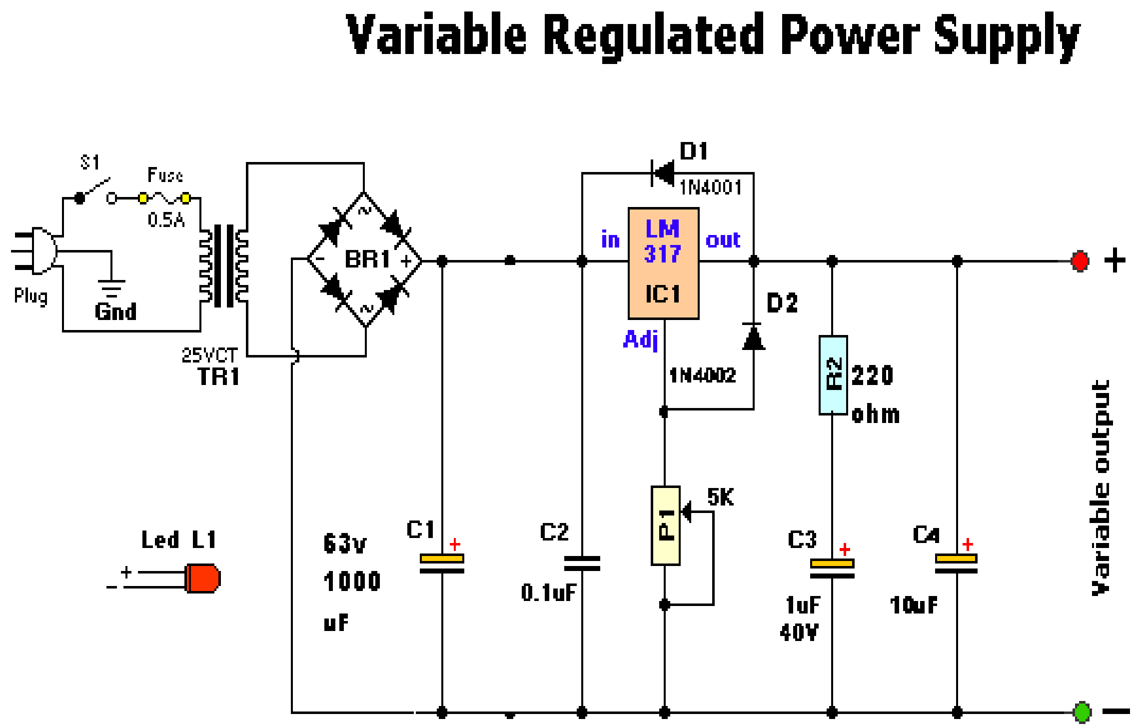
D1 = 1N4002

D2 = 1N4002

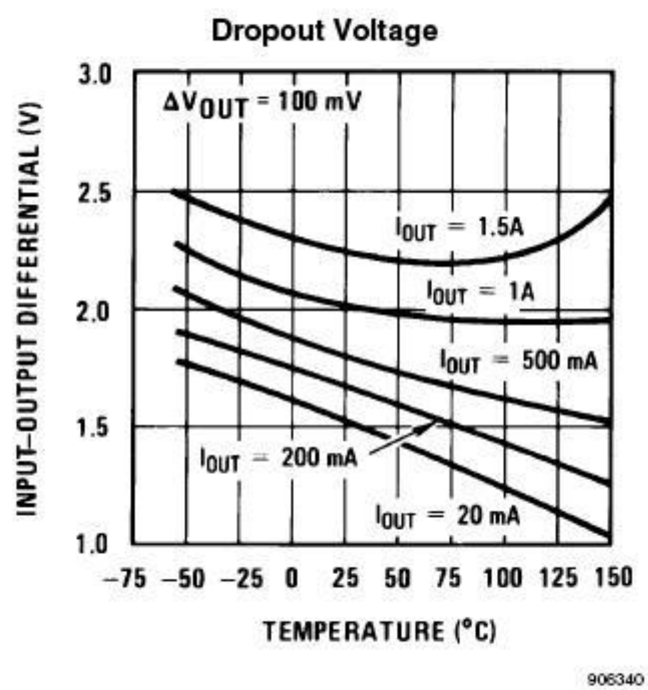
P1 = 5K, potentiometer

Fuse = 110V, 500mA, slow-blow, Fuse Holder, wire, solder, case, knob for P1 Red & Black Banana Jacks

CIRCUIT DIAGRAM & GRAPH



LM317 WITH CAPACITORS AND PROTECTIVE DIODES



WORKING PRINCIPLE

This is a simple, but low-ripple power supply and an excellent project if you're starting out in electronics. It will suit your needs for most of your bench testing and prototype applications.

The output is adjustable from 1.2 volts to about 30 volts. Maximum current is about 1.5 amps which is also sufficient for most of your tinkering. It is relatively easy to build and can be pretty cheap if you have some or all the required parts. A printed circuit board is not included and I'm not planning on adding one since the whole thing can easily be build on perforated or Vero board. Or buy one of Radio Shack/Tandy's experimenters' boards (#276-150). Suit yourself. The meter and the transformer are the money suckers, but if you can scrounge them up from somewhere it will reduce the cost significantly. BR1 is a full-wave bridge rectifier. The two '~' denotes 'AC' and are connected to the 25vac output coming from the transformer.

IC1 is a 3-pin, TO-220 model. Be sure to put a cooling rib on IC1, at its max 1.5 a current it quickly becomes very hot. All the parts can be obtained from your local Radio Shack or Tandy store. The physical size of the power supply case depends largely on the size of the meter & transformer. But almost anything will do. Go wild.

CIRCUIT DESCRIPTION:

For any circuit to study or construct, first of all we need to have a translucent picture of our required circuit. We must have all the details of the inputs and outputs of the circuit so that there must be no error while constructing the given circuit. So in the following paragraph there is a detailed description of the circuit to be done.

The 110V-AC coming from the power cord is fed to the transformer TR1 via the on-off switch and the 500mA fuse. The 30vac output (approximately) from the transformer is presented to the BR1, the bridge-rectifier, and here rectified from AC (Alternating Current) to DC (Direct Current). If you don't want to spend the money for a Bridge Rectifier, you can easily use four general purpose 1N4004 diodes. The pulsating DC output is filtered via the 2200µF capacitor (to make it more manageable for the regulator) and fed to 'IN'-put of the adjustable LM317 regulator (IC1). The output of this regulator is your adjustable voltage of 1.2 to 30volts varied via the 'Adj' pin and the 5K pot meter P1. The large value of C1 makes for a good, low ripple output voltage.

Why exactly 1.2V and not 0-volt? Very basic, the job of the regulator is two-fold; first, it compares the output voltage to an internal reference and controls the output voltage so that it remains constant, and second, it provides a method for adjusting the output voltage to the level you want by using a potentiometer. Internally the regulator uses a zener diode to provide a fixed reference voltage of 1.2 volt across the external resistor R2. (This resistor is usually around 240 ohms, but 220 ohms will work fine without any problems). Because of this the voltage at the output can never decrease below 1.2 volts, but as the potentiometer (P1) increases in resistance the voltage across it, due to current from the regulator plus current from R2, its voltage increases. This increases the output voltage.

D1 is a general purpose 1N4001 diode, used as a feedback blocker. It steers any current that might be coming from the device under power around the regulator to prevent the regulator from being damaged. Such reverse currents usually occur when devices are powered down.
The 'ON' Led will be lit via the 18K resistor R1. The current through the led will be between 12 - 20mA @ 2V depending on the type and color Led you are using. C2 is a 0.1µF (100nF) de-coupler capacitor to filter out the transient noise which can be induced into the supply by stray magnetic fields. Under normal conditions this capacitor is only required if the regulator is far away from the filter cap, but I added it anyway. C3 improves transient response. This means that while the regulator may perform perfectly at DC and at low frequencies, (regulating the voltage regardless of the load current), at higher frequencies it may be less effective. Adding this 1 µF

capacitor should improve the response at those frequencies.
R3 and the trimmer pot (P2) allows you to 'zero' your meter to a set voltage. The meter is a 30Volt type with an internal resistance of 85 ohms. I you have or obtained a meter with a different Ri (internal resistance) you will have to adjust R3 to keep the current of meter to 1mA.

Just another note in regards this meter, use the reading as a guideline. The reading may or may not be off by about 0.75volts at full scale, meaning if your meter indicates 30 volts it may be in reality almost 31 volts or 29 volts. If you need a more precise voltage, then use your multi meter.

CONSTRUCTION

Construction has always been the most essential segment for any circuit to be done. All the theoretical knowledge that we possess are implemented in the construction of the circuit. Like, I said earlier we have to be very clear about all the nuances of the circuit, and then only we will be successful in making a flawless circuit. So in following paragraph there is a detailed description of the construction of our circuit.

Because of the few components we can use a small case but use whatever we have available. We used a power cord from a computer and cut the computer end off. All computer power cords are three-prong. The ground wire, which is connected to the middle pin of the power plug is connected to the chassis. The color of the ground-wire is either green or green/yellow. It is there for your protection if the 110vac accidentally comes in contact with the supply housing (case). BE CAREFUL always to disconnect the power plug when you working inside the chassis. If we choose to use an in-line, or clip-type fuse holder be sure to isolate it with heat shrink or something to minimize accidental touching.

I use perf-board (or Vero board) as a circuit board. This stuff is widely available and comes relatively cheap. It is either made of some sort of fiber material or Phenolic or Bakelite pcb. They all work great. Some Phenolic boards come with copper tracks already on them which will make soldering the project together easier.

I mounted the LM 317(T) regulator on a heat sink. If you use a metal/aluminum case you can mount it right to the metal case, insulated with the mica insulator and the nylon washer around the mounting screw. Note that the metal tab of the LM317 is connected internally to the 'Output' pin. So it has to be insulated when mounting directly to the case. Use heat sink compound (comes in transparent or white color) on the metal tab and mica insulator to maximize proper heat transfer between LM317 and case/ or heat sink.

Drill the holes for the banana jacks, on/off switch, and LED and make the cut-out for the meter. It is best to mount everything in such a way that you are able to trouble-shoot your circuit board with ease if needed. One more note about the on-off switch S1, this switch has 110VAC power to it. After soldering, insulate the bare spots with a bit of silicon gel. Works great and prevents electrical shock through accidental touching.

If all is well, and we are finished assembling and soldering everything, then we must check all the connections. After checking the connections, checking of the capacitors C1 & C3 for proper polarity (especially for C1, polarity reversal may cause explosion) should be done. Hookup a multi meter to the power supply output jacks.

Set the meter for DC volts. Switch on S1 (led will light, no smoke or sparks?) and watch the meter movement. Adjust the potentiometer until it reads on your multi meter 15Volts. Adjust trim pot P2 until the meter also reads 15volts. When done, note any discrepancies between your multi meter and the power supply meter at full scale (max output). Maybe there is none, maybe there is a little, but you will be aware of it.

FUTURE SCOPE OF THE PROJECT

LM 317 has many future prospects. By using LM 317 we can easily overcome the noise effect of the circuit and by changing the load resistance and voltage the noise effect can further be diminished. So that we get an error free output voltage. In other words LM 317 is highly proficient in making a circuit error free and flawless.

REFERENCES

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