Variable Supply | Basic Electronics

LM317 voltage regulator: Pinout, CALCULATOR, and circuits

By Apichet Garaipoom October 4, 2019 10 Comments

Do you need to build a variable DC power supply? It has a lot of choices for you. However, many people choose LM317 as the first, me too! Why?

Because It has high efficiency, is easy, and is cheaper.

It can replace 1.5 V or 9 V battery and others *as we want to do*.

Is it really? You find out below.

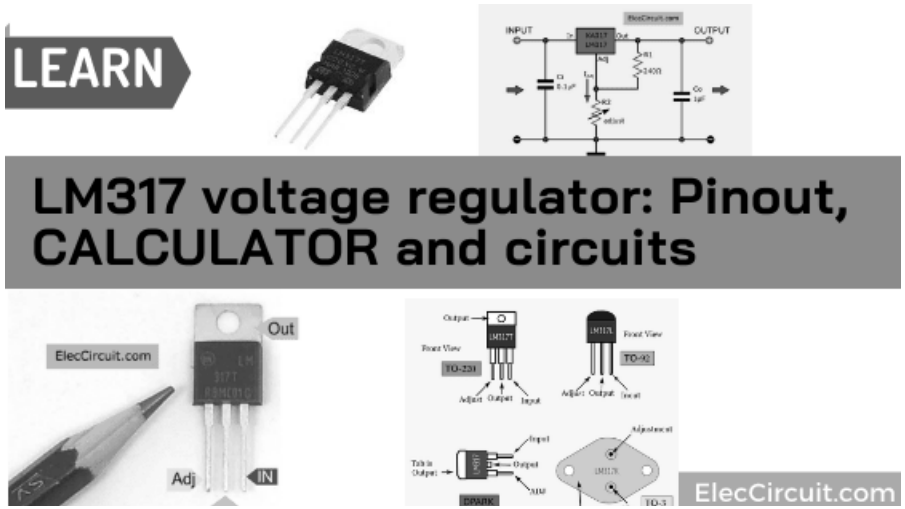


Table of Contents [hide]

LM317 Datasheet

It is an adjustable 3-terminal positive voltage regulator, to supply more than 1.5 A of load current, and an output adjustable voltage: 1.2 V to 37 V range.

Also, LM317 has an internal current limiting, temperature detects shutdown and safe area compensation.

LM317 pinout

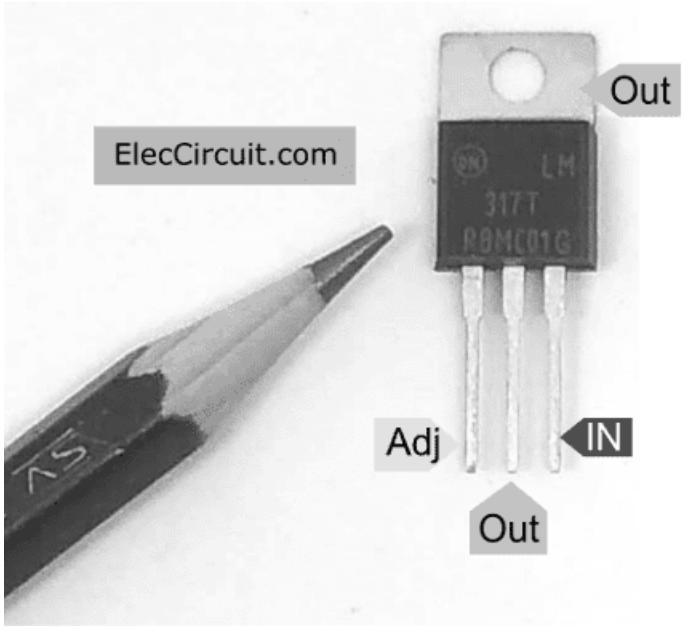
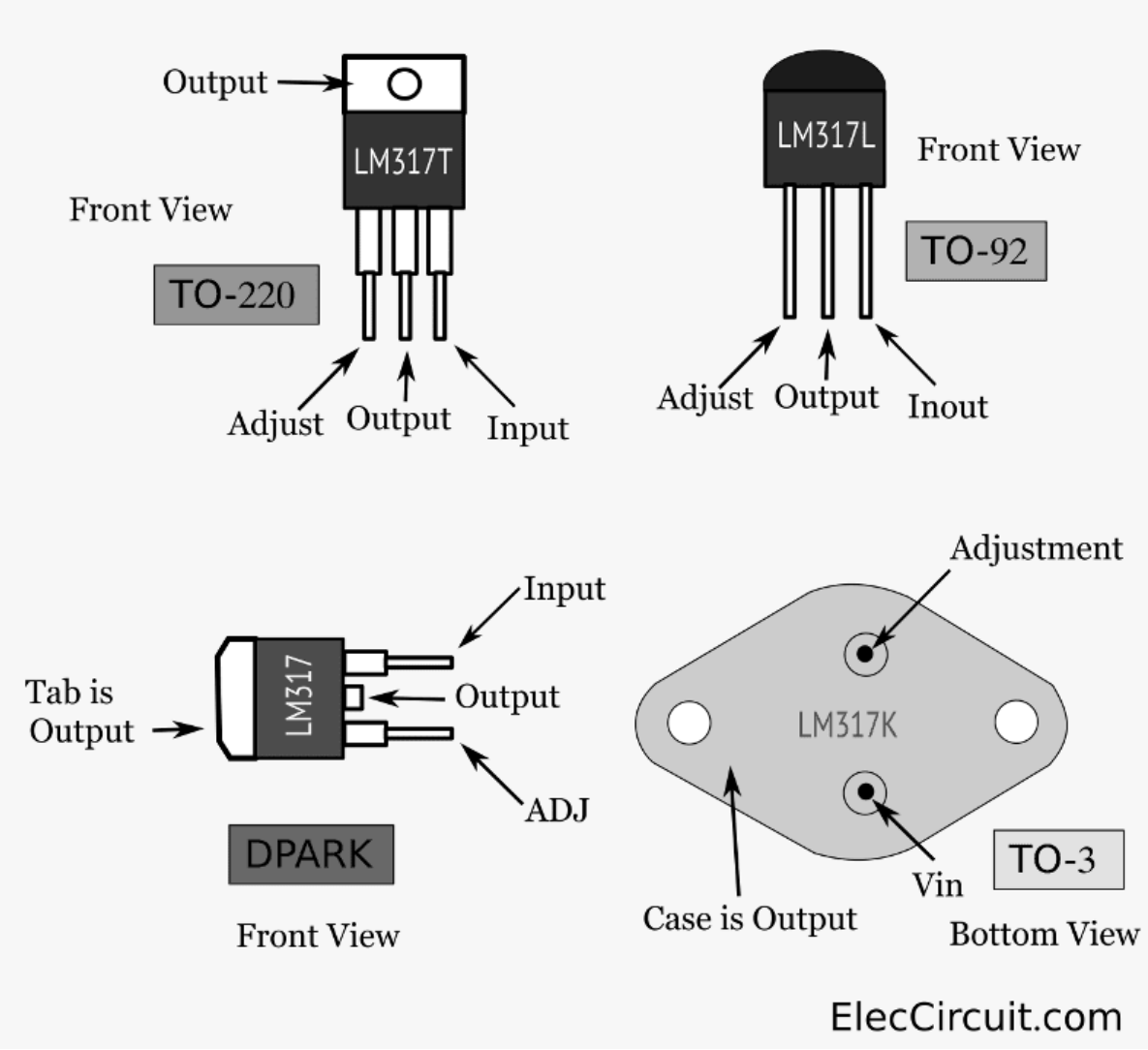


Figure 1: LM317 pinout on TO-220

Look:



Connection Diagram various LM317 Pinout

- LM317T on TO-220: output 1.5 A

- LM317K on TO-3: output 1.5 A
- LM317 on DPARK: output 1.5 A

Basic Features

- Output current in excess of 1.5 A
- Output-Adjustable between 1.2 V to 37 V
- Internal Short-Circuit Current Limiting or Output is short-circuit protected
- Internal Thermal Overload Protection or Current limit constant with temperature
- Output-Transistor Safe Operating Area Compensation
- TO-220 Package like 2SC1061 transistors.
- There are 1% output voltage Durability
- There are max. 0.01% / V line regulation(LM317), and 0.3% load regulation (LM117)
- There are 80 dB ripple rejection

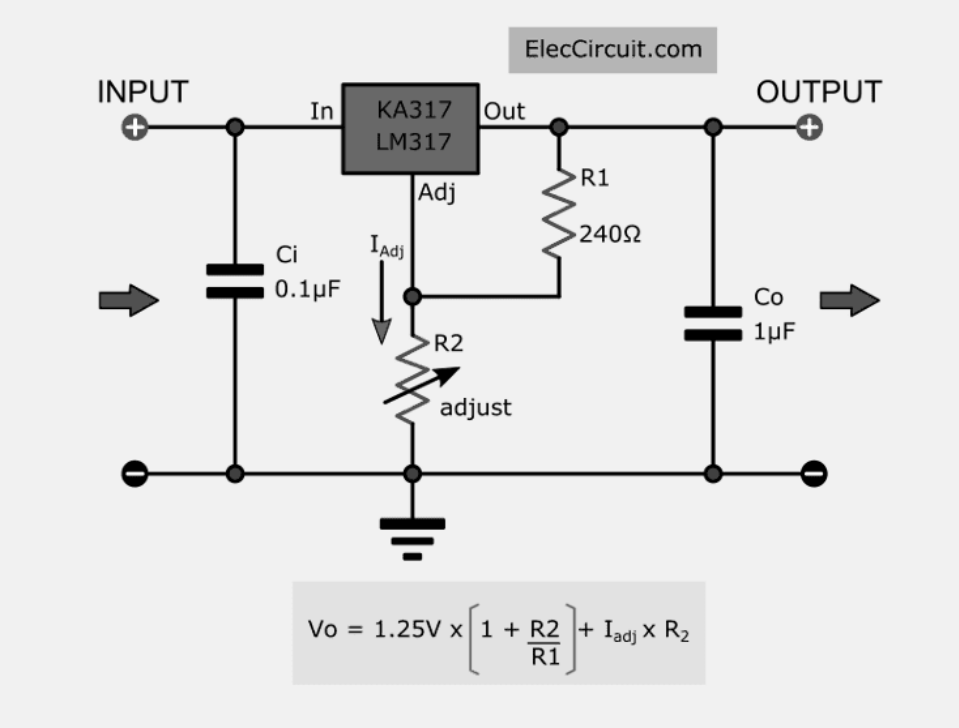


Figure 2 the basic circuit diagram

Basic circuit diagram

If the distance from the IC regulator and input voltage is too much. We should put Ci to reduce any noise.

Next, see the figure circuit. You not need to put Co. But You want a high-efficiency output. You should add It to keep lower an ripple.

As I_{Adj} is controlled to less than 100 uA, the little error is unimportant in most uses.

Learn more: IC Voltage Regulators Information

LM317 calculator

This **calculator** will work for most DC Voltage Regulators with a reference voltage (V_{REF}) of 1.25. Typically, the program resistor (R1) is 240 ohms for the LM117, LM317, LM138, and LM150.

Some said Iadj is very low current.

So, we may reduce it down. To be shorter and easy.

> **Vout = 1.25 V x {1 + R2/ R1}**

Which is better?

For example:
You use R1 = 270 ohms and R2 = 390 ohms. It causes output is 3.06 V

Is it easy? If you have voltages choice with most resistors. In local stores near you.

look at the list:

Output Voltage with R1 and R2 List

1.43V : R1 = 470Ω, R2 = 68Ω
1.47V : R1 = 470Ω, R2 = 82Ω
1.47V : R1 = 390Ω, R2 = 68Ω

1.51V : R1 = 390Ω, R2 = 82Ω

1.52V : R1 = 470Ω, R2 = 100Ω

1.53V : R1 = 390Ω, R2 = 82Ω

1.56V : R1 = 330Ω, R2 = 82Ω

1.57V : R1 = 270Ω, R2 = 68Ω

1.57V : R1 = 470Ω, R2 = 120Ω

1.57V : R1 = 390Ω, R2 = 100Ω

1.59V : R1 = 390Ω, R2 = 100Ω

1.60V : R1 = 240Ω, R2 = 68Ω

1.63V : R1 = 330Ω, R2 = 100Ω

1.63V : R1 = 270Ω, R2 = 82Ω

1.64V : R1 = 390Ω, R2 = 120Ω

1.64V : R1 = 220Ω, R2 = 68Ω

1.65V : R1 = 470Ω, R2 = 150Ω

1.66V : R1 = 390Ω, R2 = 120Ω

1.68V : R1 = 240Ω, R2 = 82Ω

1.71V : R1 = 330Ω, R2 = 120Ω

1.71V : R1 = 270Ω, R2 = 100Ω

1.72V : R1 = 220Ω, R2 = 82Ω

1.72V : R1 = 180Ω, R2 = 68Ω

1.73V : R1 = 470Ω, R2 = 180Ω

1.73V : R1 = 390Ω, R2 = 150Ω

1.76V : R1 = 390Ω, R2 = 150Ω

1.77V : R1 = 240Ω, R2 = 100Ω

1.81V : R1 = 270Ω, R2 = 120Ω

1.82V : R1 = 150Ω, R2 = 68Ω

1.82V : R1 = 330Ω, R2 = 150Ω

1.82V : R1 = 180Ω, R2 = 82Ω

1.83V : R1 = 390Ω, R2 = 180Ω

1.86V : R1 = 390Ω, R2 = 180Ω

1.88V : R1 = 240Ω, R2 = 120Ω
1.89V : R1 = 470Ω, R2 = 240Ω
1.93V : R1 = 330Ω, R2 = 180Ω
1.93V : R1 = 150Ω, R2 = 82Ω
1.94V : R1 = 270Ω, R2 = 150Ω
1.96V : R1 = 390Ω, R2 = 220Ω
1.97V : R1 = 470Ω, R2 = 270Ω
1.99V : R1 = 390Ω, R2 = 220Ω
2.02V : R1 = 390Ω, R2 = 240Ω
2.03V : R1 = 240Ω, R2 = 150Ω
2.06V : R1 = 390Ω, R2 = 240Ω
2.08V : R1 = 330Ω, R2 = 220Ω
2.10V : R1 = 220Ω, R2 = 150Ω
2.12V : R1 = 390Ω, R2 = 270Ω
2.13V : R1 = 470Ω, R2 = 330Ω
2.16V : R1 = 330Ω, R2 = 240Ω
2.16V : R1 = 390Ω, R2 = 270Ω
2.19V : R1 = 240Ω, R2 = 180Ω
2.23V : R1 = 470Ω, R2 = 390Ω
2.25V : R1 = 150Ω, R2 = 120Ω
2.27V : R1 = 270Ω, R2 = 220Ω
2.27V : R1 = 330Ω, R2 = 270Ω
2.29V : R1 = 470Ω, R2 = 390Ω
2.29V : R1 = 180Ω, R2 = 150Ω
2.31V : R1 = 390Ω, R2 = 330Ω
2.36V : R1 = 270Ω, R2 = 240Ω
2.37V : R1 = 390Ω, R2 = 330Ω

2.44V : R1 = 390Ω, R2 = 390Ω

2.50V : R1 = 470Ω, R2 = 470Ω
2.57V : R1 = 390Ω, R2 = 390Ω
2.61V : R1 = 220Ω, R2 = 240Ω
2.65V : R1 = 330Ω, R2 = 390Ω
2.66V : R1 = 240Ω, R2 = 270Ω
2.73V : R1 = 330Ω, R2 = 390Ω
2.74V : R1 = 470Ω, R2 = 560Ω
2.75V : R1 = 150Ω, R2 = 180Ω
2.76V : R1 = 390Ω, R2 = 470Ω
2.78V : R1 = 270Ω, R2 = 330Ω
2.78V : R1 = 220Ω, R2 = 270Ω
2.84V : R1 = 390Ω, R2 = 470Ω
2.92V : R1 = 180Ω, R2 = 240Ω
2.96V : R1 = 270Ω, R2 = 390Ω
2.97V : R1 = 240Ω, R2 = 330Ω
3.03V : R1 = 330Ω, R2 = 470Ω
3.05V : R1 = 390Ω, R2 = 560Ω
3.06V : R1 = 270Ω, R2 = 390Ω
3.06V : R1 = 470Ω, R2 = 680Ω
3.08V : R1 = 150Ω, R2 = 220Ω
3.13V : R1 = 220Ω, R2 = 330Ω
3.14V : R1 = 390Ω, R2 = 560Ω
3.18V : R1 = 240Ω, R2 = 390Ω
3.25V : R1 = 150Ω, R2 = 240Ω
3.28V : R1 = 240Ω, R2 = 390Ω
3.35V : R1 = 220Ω, R2 = 390Ω
3.37V : R1 = 330Ω, R2 = 560Ω

3.43V : R1 = 390Ω, R2 = 680Ω

3.43V : R1 = 470Ω, R2 = 820Ω
3.47V : R1 = 220Ω, R2 = 390Ω
3.50V : R1 = 150Ω, R2 = 270Ω
3.54V : R1 = 180Ω, R2 = 330Ω
3.55V : R1 = 390Ω, R2 = 680Ω
3.70V : R1 = 240Ω, R2 = 470Ω
3.82V : R1 = 180Ω, R2 = 390Ω
3.83V : R1 = 330Ω, R2 = 680Ω
3.84V : R1 = 270Ω, R2 = 560Ω
3.88V : R1 = 390Ω, R2 = 820Ω
3.91V : R1 = 470Ω, R2 = 1K
3.92V : R1 = 220Ω, R2 = 470Ω
3.96V : R1 = 180Ω, R2 = 390Ω
4.00V : R1 = 150Ω, R2 = 330Ω
4.02V : R1 = 390Ω, R2 = 820Ω
4.17V : R1 = 240Ω, R2 = 560Ω
4.33V : R1 = 150Ω, R2 = 390Ω
4.36V : R1 = 330Ω, R2 = 820Ω
4.40V : R1 = 270Ω, R2 = 680Ω
4.43V : R1 = 220Ω, R2 = 560Ω
4.44V : R1 = 470Ω, R2 = 1.2K
4.46V : R1 = 390Ω, R2 = 1K
4.50V : R1 = 150Ω, R2 = 390Ω
4.51V : R1 = 180Ω, R2 = 470Ω
4.63V : R1 = 390Ω, R2 = 1K
4.79V : R1 = 240Ω, R2 = 680Ω
5.04V : R1 = 330Ω, R2 = 1K

5.10V : R1 = 390Ω, R2 = 1.2K

5.11V : R1 = 220Ω, R2 = 680Ω
5.14V : R1 = 180Ω, R2 = 560Ω
5.17V : R1 = 150Ω, R2 = 470Ω
5.24V : R1 = 470Ω, R2 = 1.5K
5.30V : R1 = 390Ω, R2 = 1.2K
5.52V : R1 = 240Ω, R2 = 820Ω
5.80V : R1 = 330Ω, R2 = 1.2K
5.88V : R1 = 270Ω, R2 = 1K
5.91V : R1 = 220Ω, R2 = 820Ω
5.92V : R1 = 150Ω, R2 = 560Ω
5.97V : R1 = 180Ω, R2 = 680Ω
6.04V : R1 = 470Ω, R2 = 1.8K
6.06V : R1 = 390Ω, R2 = 1.5K
6.32V : R1 = 390Ω, R2 = 1.5K
6.46V : R1 = 240Ω, R2 = 1K
6.81V : R1 = 270Ω, R2 = 1.2K
6.92V : R1 = 150Ω, R2 = 680Ω
6.93V : R1 = 330Ω, R2 = 1.5K
6.94V : R1 = 180Ω, R2 = 820Ω
7.02V : R1 = 390Ω, R2 = 1.8K
7.10V : R1 = 470Ω, R2 = 2.2K
7.33V : R1 = 390Ω, R2 = 1.8K
7.50V : R1 = 240Ω, R2 = 1.2K
8.07V : R1 = 330Ω, R2 = 1.8K
8.08V : R1 = 150Ω, R2 = 820Ω
8.19V : R1 = 270Ω, R2 = 1.5K
8.30V : R1 = 390Ω, R2 = 2.2K

8.68V : R1 = 390Ω, R2 = 2.2K

9.06V : R1 = 240Ω, R2 = 1.5K
9.58V : R1 = 330Ω, R2 = 2.2K
9.77V : R1 = 220Ω, R2 = 1.5K
9.90V : R1 = 390Ω, R2 = 2.7K
10.03V : R1 = 470Ω, R2 = 3.3K
10.37V : R1 = 390Ω, R2 = 2.7K
10.63V : R1 = 240Ω, R2 = 1.8K
11.25V : R1 = 150Ω, R2 = 1.2K
11.44V : R1 = 270Ω, R2 = 2.2K
11.48V : R1 = 330Ω, R2 = 2.7K
11.67V : R1 = 180Ω, R2 = 1.5K
11.83V : R1 = 390Ω, R2 = 3.3K
12.40V : R1 = 390Ω, R2 = 3.3K
12.71V : R1 = 240Ω, R2 = 2.2K
13.75V : R1 = 330Ω, R2 = 3.3K
15.31V : R1 = 240Ω, R2 = 2.7K
16.25V : R1 = 150Ω, R2 = 1.8K
16.53V : R1 = 270Ω, R2 = 3.3K
16.59V : R1 = 220Ω, R2 = 2.7K
18.44V : R1 = 240Ω, R2 = 3.3K
19.58V : R1 = 150Ω, R2 = 2.2K
20.00V : R1 = 220Ω, R2 = 3.3K
23.75V : R1 = 150Ω, R2 = 2.7K
24.17V : R1 = 180Ω, R2 = 3.3K
28.75V : R1 = 150Ω, R2 = 3.3K

For example:

You need 4.5 volts from a 3 x AA 1.5V battery in a series. But you have no them.

How to do it?

You have only LM317 and a lot of resistors. Yes! you can use them instead.

Look at the list above, in 4.5V voltage. We can use R1 = 150Ω, R2 = 390Ω.

It is easy, right?

LM317 heat sink calculator

What is the size of the heat sink enough?

LM317 is always hot while working. Though it has an over-temperature cut-out mode. But we should not release it too hot. We always install the heat sink.

Someone ask me. What size heat sink should we use? LM317 has a maximum temperature of 50 °C/W without a heat sink.

I found this site, good for using LM317 heat sink calculator.

The LM317 Heat sink, how big?

*You can find **the LM317** on Amazon here if you're interested.*

For example LM317 circuit

1. **First** **Variable DC Power Supply**
   I built It as a first power supply. Though it is very old, we have still used them for more than 20 years. Why it is great like this?
2. **Linear Selector Power supply Regulator**
   Easy to select the ouput voltage: 1.5V, 3V, 4.5V, 5V, 6V, 9V at 1.5A
3. **30V Dual DC variable power supply**
   High voltage 0V to 60 volts at 1.5A and starts voltage at zero! good job.
4. **Great DC power supply**
   High quality, 3A adjustable voltage regulator. Using LM317 and 2N3055 so easy and cheap. Adjust voltage in steps 3V, 6V, 9V, 12V. And In fine, 1.25V to 20V.
5. **4 Lead Acid Battery charger circuits**
   See 4 LM317 Lead-acid battery charger circuits for 6V, 12V, and 24V battery. With automatic charging and full charged Indicator using TL431. Easy to build.
6. **Dual power supply 3V,5V,6V,9V,12,15V**
   Dual power supply circuit,can select voltage levels 3V,5V,6V,9V,12,15V at 1A and -3V,-5V,-6V,-9V,-12V,-15V at 1A, use LM317 (positive) LM337(negative) […]
7. **USB Battery Replacement**
   This is a USB 5V to 1.5V Step-Down Converter Circuit. When we use a Cheap MP3 Player which uses only one 1.5V AA battery as its power supply.
8. **Low dropout 5v regulator**
   This is 5V low dropout regulator circuit using a transistor and LED only so easy,lowest

9. **Gel cell battery charger circuit**
   It can charge any size of the Gel cell batteries and extend the life of the Gel Cell battery. While the circuit is running, the LED indicates charging.
10. **Nicad Battery Charger using LM317T**
    Here are Universal NiCd and NiMH battery charger circuit. It uses IC LM317T (Hot IC) Control Current less 300mA, Size battery 2.4V,4.8V,9.6V. Low-cost circuit

Last updated on December 2, 2021

Apichet Garaipoom

I love electronic circuits. I will collect a lot of circuit electronics to teach my son and are useful for everyone. Thanks for your support.

10 Comments

worku Reply

January 26, 2016, 6:17 am

Thank’s & GBU this EC member .

vishal Reply

February 2, 2016, 8:22 pm

sir i want 5v,2a power supply circuit with calculation from 230

sunday owen Reply

June 12, 2016, 10:53 pm

pleasr can this idea be used to build solar charge controller?

Sumithra Reply

July 20, 2016, 3:37 am

Pls suggest any simple circuit which supplies output of +12V , -12V dual output with current rating of 1A
I/p supply is +24V DC .

IAM LEANING A LOT I THANK VERY MUCH OUT OF THE MANY THINGS U ARE REVIEWING.

Abiodun Ogundipe Reply

August 4, 2017, 10:26 am

Dear Sir/Ma

We are spare part supplier in Nigeria,
Company name with address
DE- ACCORD SYNERGY CONCEPT NIG LIMiTED. NO6, Oba Amusa Avenue Sumbol Bus Stop, Lagos Nigeria.

Kindly quote us for the bellow items for our customer.

LM78S40 (Universal Switching Regulator) 2nos

LM7805 (Voltage Regulator) 2nos

Your best price and delivery

Best Regards

Abiodun Ogundipe

+23435766398

KUMERASAN Reply

July 1, 2020, 4:45 am

halogen bulb

input voltage is 12v AC and out put 6v dc with variable pot using matal cap transistor like LM317K.

Apichet Garaipoom Reply

August 12, 2020, 8:20 pm

Hello, Kumerasan
Thanks for visiting.

It is a good idea. Let me give you a comment. What is the small halogen rate, current or watts? Here is 5watts https://amzn.to/2XTskJm It uses current about 5W/6V = 0.8A. Yes, you can use LM317. It may very heat. But if you use 10W. It will use current more = 10w/6V = 1.6A.

You cannot use alone LM317. You may use it with a power transistor. Or use LM350. It is easy, too. https://www.eleccircuit.com/lm350-adjustable-voltage-regulator/

I hope this can help you.

Ps. I also had the idea of using hydrogen tubes for my chickens.

Do have chickens?

m0n0 Reply

November 15, 2021, 8:49 am

orthographic sense…

A **Apichet Garaipoom** Reply

December 30, 2021 10:03 am

Hello m0n0,
Thanks for your opinion. I will try to improve my English. I hope you will read this article again.

Thanks a lot again my friends.