

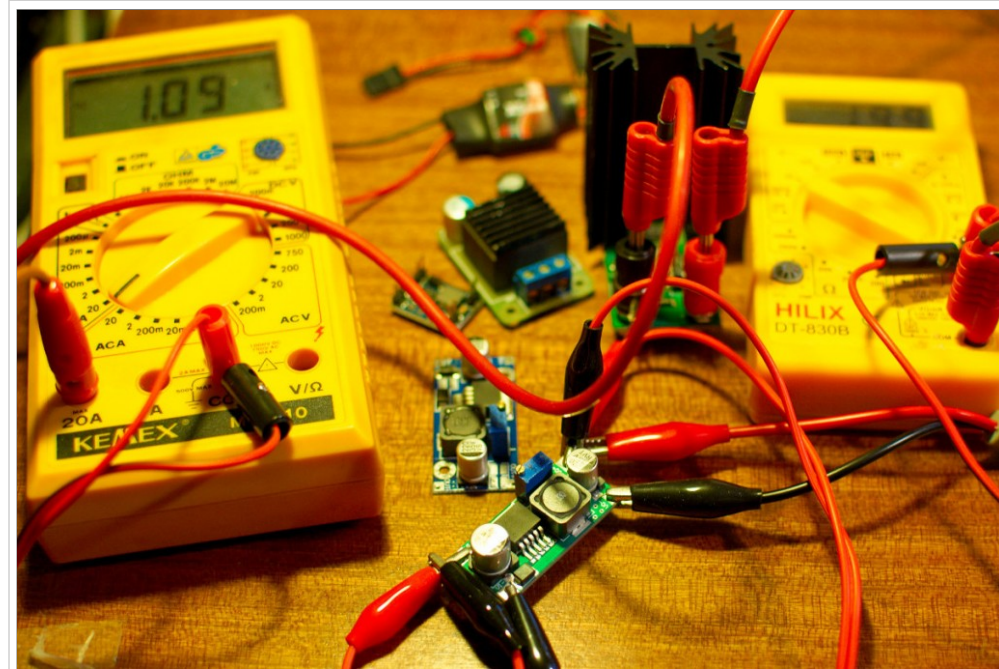
Bajdi.com

Arduino electronics and robotics

Browse: [Home](#) / [Testing switch mode voltage regulators](#)

Testing switch mode voltage regulators

By [admin](#) on 02/02/2014



Testing switch mode regulators

There are different types of [DC-DC regulators](#). The most common are linear and switch mode regulators. Everyone that has tinkered with electronics has probably used a 78xx series linear regulator. They are easy to use since they don't need any special components. With most linear regulators you just put a capacitor on the input and one on the output and they will work. Always check the datasheet to see which type and capacity is recommended. Unfortunately linear regulators are very inefficient, because of that they can produce lots of heat. For example if you feed a 7805 (5V linear regulator) 12V and you draw 1A from it, the regulator will need to dissipate 7W of heat. So that 7W goes to waste, not ideal for a battery powered or energy efficient device.

About 2 years ago I started playing with electronics and was browsing Tayda electronics voltage regulator section for a regulator that could output more then 1A. I found the LM2576 5V 3A regulator and ordered some. I didn't know what I had bought until I read the datasheet.

The LM2576 is a switch mode regulator. It's a pretty old design, that's why it's so cheap (\$0,76 @ Tayda). I'm not going to explain how they work, there is [wikipedia](#) for that.

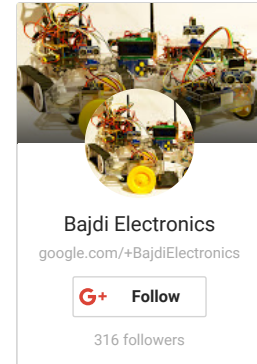
Switch mode regulators are more efficient then linear regulators. They can not only lower the voltage (buck converter) some of them can also up the voltage (boost converter) or they can do both (buck-boost converter). Most switch mode regulators need some more components then linear regulators to make them work.

For the LM2576/LM2596 you need 2 capacitors (input/output), a big inductor and a schottky diode. You also need to take into account that you can't just place the different components like you want on a PCB. The datasheets of these regulators will have a reference design to show you how to place them to get the best results. Not following these guidelines or using components with not the right specifications and you are risking that they just don't work or produce lots of noise. I have designed a couple of PCB's using the LM2576 and LM2596 and got them to work, so it's not that hard 😊

If you don't want to design your own PCB's you can buy small boards with a switch mode regulator on Ebay or from Chinese webshops. So today I decided to test some of the boards I have bought from China.

Search

Google Plus



Contact me

info [aT] bajdi {dot} com

Categories

- [3D printing](#)
- [Arduino](#)
- [Arduino sketches](#)
- [Bajdupod 996R](#)
- [Bajdupod 9G](#)
- [Bob the biped](#)
- [Buying parts](#)
- [Dagu Rover 5](#)
- [Dagu service droid](#)
- [Gentoo](#)
- [Insectbot](#)
- [Line following robot](#)
- [Raspberry Pi](#)
- [Self balancing bot](#)

Tags

[28BYJ-48](#) [74HC595](#) [ADXL345](#)
[ATmega328P-PU](#) [ATmega1284](#)
[Bajduino](#) [DHT22](#) [DS1307](#) [DS3231](#)
[electronics](#) [EL shield](#) [encoder](#) [Gentoo](#) [gripper](#)
[HC05](#) [heartbeat](#) [hexapod](#) [HMC5883L](#) [I2C](#) [IR](#)
[L293D](#) [L298](#) [L0110](#) [LED](#) [LGT8F88A](#) [MPU6050](#) [Nano](#)
[nRF24Lo1](#) [Pololu](#) [power led](#) [pwm](#) [python](#)
[Raspberry Pi](#) [RGB LED](#) [robot](#) [Serial](#) [servo](#)
[SG90](#) [SR04](#) [TCRT5000](#) [TFT](#) [ultrasonic](#) [VS1053](#)
[webserver](#) [WiiCamera](#)

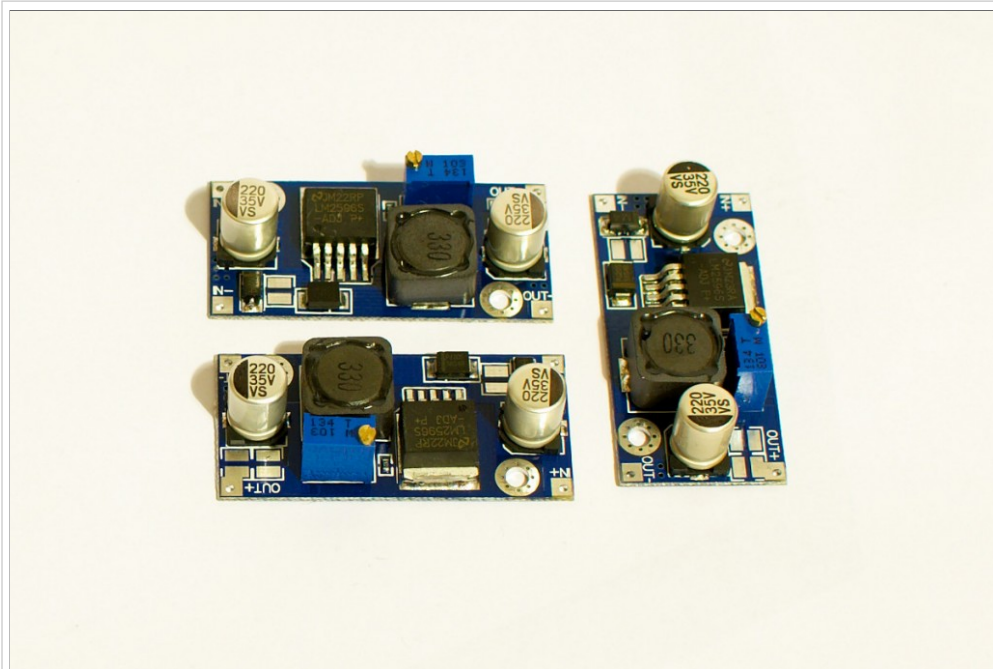
Pages

- [Bajduino](#)
- [Bajduino 1284](#)

LM2596

The most popular board is one with an LM2596 adjustable regulator. The LM2596 is a 3A 150kHz stepdown regulator, it's a pretty old design. More modern switch mode regulators switch at +1MHz.

- [Bajduino 328](#)
- [Media gallery](#)
- [Stepper robot arm](#)



LM2596 boards

You can buy these boards for 1,1€ from Chinese sellers on Ebay. I have a dozen of these boards, some have blue PCB's, some green others red. They are not exactly the same, some have different capacitors. The ones I have with the blue PCB have capacitors rated at 35V, the ones with the green PCB have a 50V capacitor on the input. The boards have a small potentiometer to set the output voltage.

I tested the boards with an input voltage of 8V, 10V and 12V and with a 2A load. I used a [Re:load V2](#) as a constant current dummy load.

@ 8V

output 2A @ 5V

input current 1.65A = efficiency of 75,8%

@ 10V

output 2A @ 5V

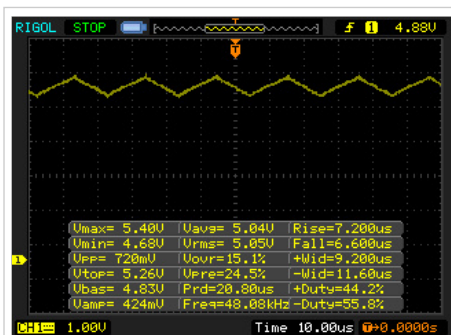
input current 1,32A = efficiency of 75,6%

@ 12V

output 2A @ 5V

input current 1,09A = efficiency of 76,5%

These results don't say everything... With a constant load of 2A the board became to hot to touch. The small PCB can not dissipate enough heat. After about 15 minutes the regulator started to oscillate and the input current started to rise. I would not recommend using these boards with a constant load of more then 1A. I even destroyed one board when trying to draw 3A from it.



LM2596 oscillating

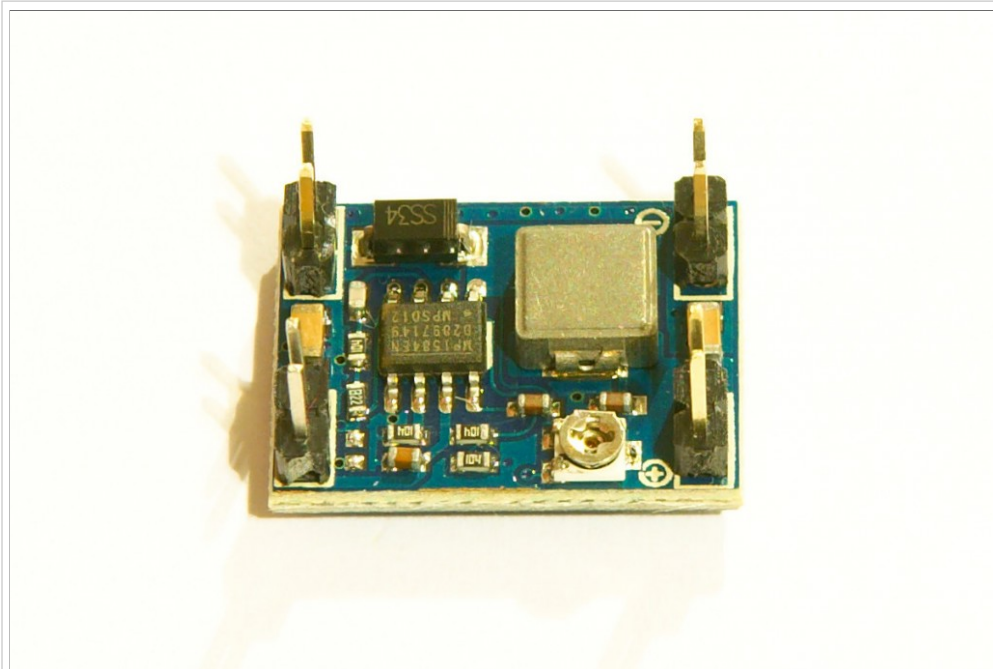
I have used LM2596 regulators on my self designed boards, the 5V version in a TO220-5 package. Using a good heatsink and Nichicon capacitors I get an efficiency of 80% and have no trouble with heat.

**Bookmarks**

- [Arduino](#)
- [Atmel](#)
- [Gentoo](#)
- [Linux](#)
- [My videos on Vimeo](#)
- [My Youtube channel](#)
- [Robot rebels](#)

MP1584

Another 3A adjustable switch mode regulator that I have bought is the MP1584. The MP1584 is a 1.5MHz step down regulator. I bought the regulator on a small board from [Electrodragon](#).



MP1584 3A switchmode voltage regulator

@ 8V

output 2A @ 5V

input current 1.48A = efficiency of 84,5%

@ 10V

output 2A @ 5V

input current 1,08A = efficiency of 92,6%

@ 12V

output 2A @ 5V

input current 0,9A = efficiency of 92,6%

After drawing a constant load of 2A for more then 10 minutes the board became very hot. But the output voltage stayed stable with a peak to peak voltage of only 160mV. Pretty good regulator / board.

KIM-055L

Next regulator I tested is the KIM-055L board I bought on Ebay. This is a 5V 5A switch mode regulator. The board I have has a big heatsink.



KIM-055L

With an input voltage of 8V the board can not output 5V. So I only tested it at 10 and 12V.

@ 10V

output 2A @ 5V

input current 1,02A = efficiency of 98%

@ 12V

output 2A @ 5V

input current 0,85A = efficiency of 98%

Even after drawing more then 2A from a longer period of time the heatsink became barely warm. The output voltage stayed stable, peak to peak voltage was 120mV.

Posted in [Buying parts](#) | Tagged [electronics](#) | [13 Responses](#)

13 responses to “Testing switch mode voltage regulators”



[Chemary](#) 04/02/2014 at 12:40 | [Permalink](#) | [Reply](#)

Hi, thanks for this interesting benchmark. I will take into account the results when I buy next regulators.

I was thinking on buying some cheap LM2596 to get 5V@1A but after reading your article they seem to have a poor efficiency.



[Testarea surselor in comutatie](#) | [arduino.ro](#) 05/02/2014 at 07:51 | [Permalink](#)

[...] prezinta un test facut asupra surselor reglabile in comutatie. Sursele sunt alimentate la tensiuni diferite si pentru un rezultat mentine aceasi tensiune si [...]



[Joe Price](#) 18/02/2015 at 16:20 | [Permalink](#) | [Reply](#)

Good data, thanks for sharing. I may need to affix heat sinks to the regulators on order.



[Gil Elgez](#) 08/05/2015 at 14:57 | [Permalink](#) | [Reply](#)

Thanks for sharing this valuable data. You saved me significant testing time. The MP1584 seems to be the efficiency and size winner as a BEC regulator in RC planes and Multirotors.

Two of them could be paralleled for twice the current output with “OR-ing” diodes and the output voltage can be trimmed to compensate for the output diodes voltage drop.



Berwyn 25/09/2015 at 08:42 | [Permalink](#) | [Reply](#)

If anybody wants to know how to make those LM2596 boards stable, you can do it simply by replacing the output cap with the low ESR ones recommended in the datasheet. (Different caps are recommended for different output voltages):

http://www.onsemi.com/pub_link/Collateral/LM2596-D.PDF



Peter 26/09/2015 at 06:41 | [Permalink](#) | [Reply](#)

Is there a way to control the output current on the MP1584. So that it will act as a CC-CV regulator?



admin 26/09/2015 at 13:24 | [Permalink](#) | [Reply](#)

Not sure if that is possible with the MP1584, the datasheet doesn't show an example circuit for such a setup.



Pekka 21/04/2016 at 15:12 | [Permalink](#) | [Reply](#)

I see that your “LM2596” board is running at ~50khz which suggests it's actually a LM2576 or something similar.



Cheap eBay Stuff! | [MCNB Electronics](#) 10/05/2016 at 03:56 | [Permalink](#)

[...] slight spike occurring at 51kHz. I didn't think anything about it at first, but I came across this comment, which leads me to believe that I have a LM2576 (which has an internal oscillator at ~52kHz) as [...]



Werner 30/05/2016 at 07:09 | [Permalink](#) | [Reply](#)

Hi,

I used the Kim055 and with 2A load the output voltage dropped to 4,4V, which is too low to charge eg a smartphone. Did anybody else have this problem too? And what to do about it?



admin 30/05/2016 at 09:20 | [Permalink](#) | [Reply](#)

That's strange, I've tested mine with a constant load of 3A and the voltage stayed stable.



Mike 04/11/2016 at 07:18 | [Permalink](#) | [Reply](#)

Great writeup, thank you! Some additional testing I've done on the MP1584 module to see load regulation and temperature. My goal is to regulate from old laptop power supplies 16 to 19VDC down to 5VDC. Adjusted the board potentiometer to 5V out @ 1A load, ran at each load for 15 minutes.

Load Vout Temp

0A 5.28V 23C

1A 5.05V 63C

2A 4.84V 110C

My conclusion: with that much voltage drop (19v to 5v), much above 1A will cook the components. Could try adding a heat sink, but that kind of ruins the purpose of the small form factor. Did not repeat the temp tests with a 12V supply, but a quick check showed nearly the same output voltage at 12Vin in as 19Vin with no adjustment to the board. This makes it nice to set once an use with different power bricks.



João Paulo Nogueira 04/08/2017 at 20:37 | [Permalink](#) | [Reply](#)

Thank you for being informative and helpful!!

Leave a Reply

Comment

Name *

Email *

Website



CAPTCHA Code *

Post Comment

[« Previous](#)

[Next »](#)

Copyright © 2017 [Bajdi.com](#). Powered by [WordPress](#) and [Hybrid by Bajdi](#).