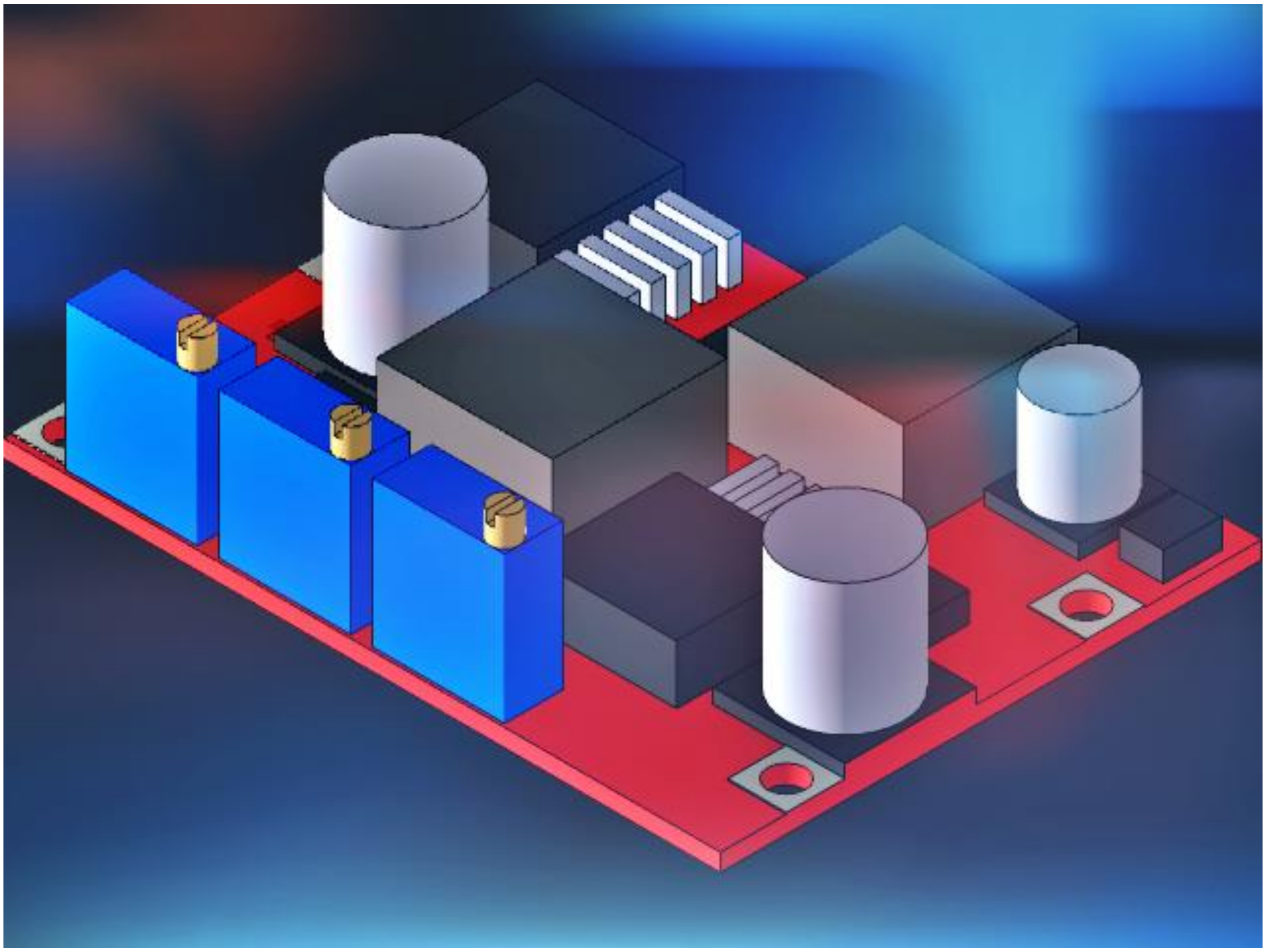
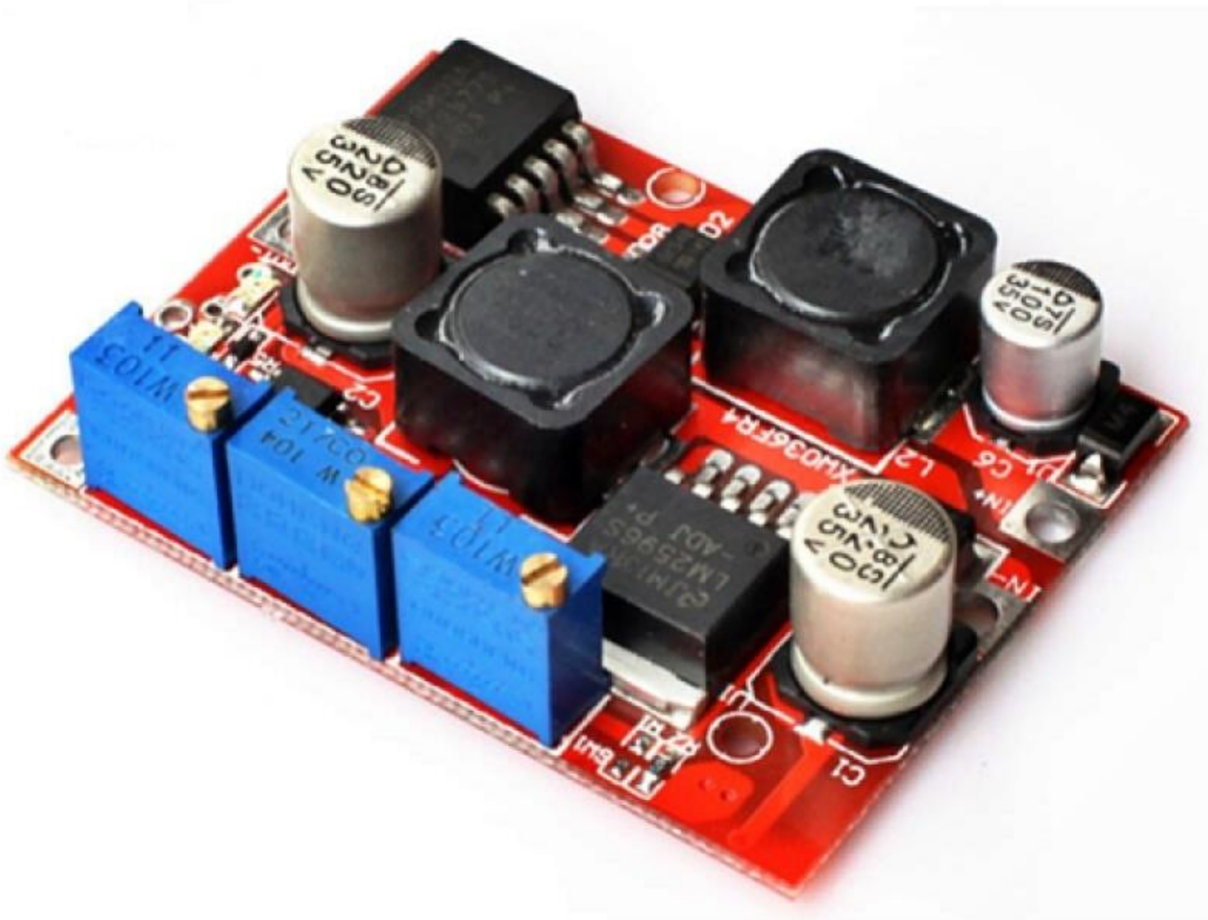


DC-DC Boost & Buck Voltage Converter LM2577 & LM2596 Module

Following my online seller’s description, let me call it as “DC-DC Boost and Buck Voltage Converter LM٢٥٧٧-LM٢٥٩٦ Module”. But before committing to use the seemingly well-made power supply module, I want to take a quick look.



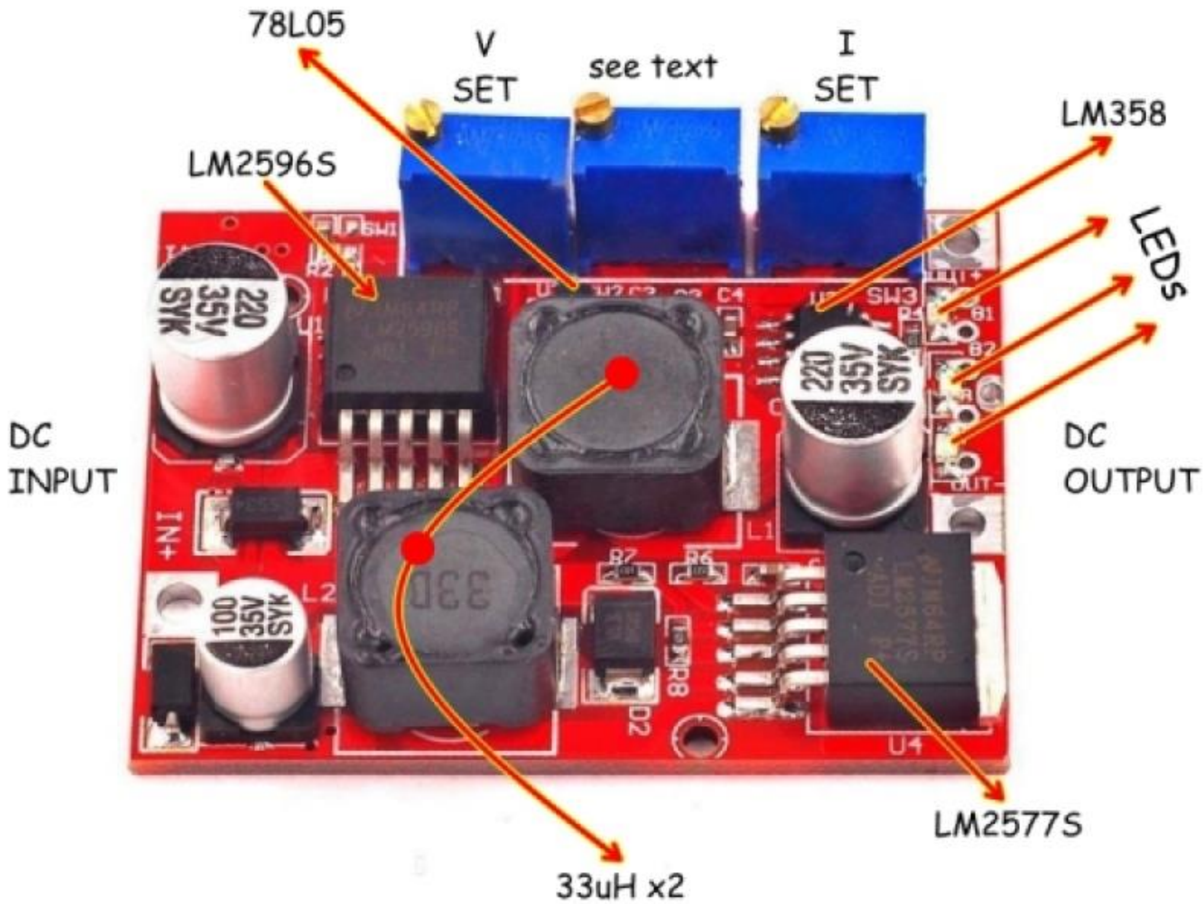
As it seems, the module is a DC step up (boost) and step down (buck) converter module. The module uses an LM۲٥٧٧S for stepping the voltage up and an LM۲٥٩٦S for stepping the voltage down. It has an input range of ٤ to ٣٥V and an output range of ١,٢٥ to ٢٥V. Both the input and output are rated at ١A nominal and ٣A maximum.

Here are its key specifications (borrowed from the seller's page):

- Input voltage: 4-35V DC
- Output Voltage: 1.25-25V DC
- Output Current: 3A (max)
- Constant Current Output: 0-3A (Adjustable)
- Output Power: 15W (For more than 15W, it should be equipped with a heatsink)

This module is designed primarily for lithium-ion battery charging and high-power LED driving applications as it can maintain a steady output even with a fairly fluctuating input. As you can see, the module holds two independent series-wired voltage converters (LM۲٥٧٧S and LM۲٥٩٦S). The idea is simple to implement, but due to double conversion, the module will have a deliberately low efficiency. The module also has a linear fixed voltage regulator chip (٧٨L٠٥) onboard, and a dual op-amp (LM٣٥٨).

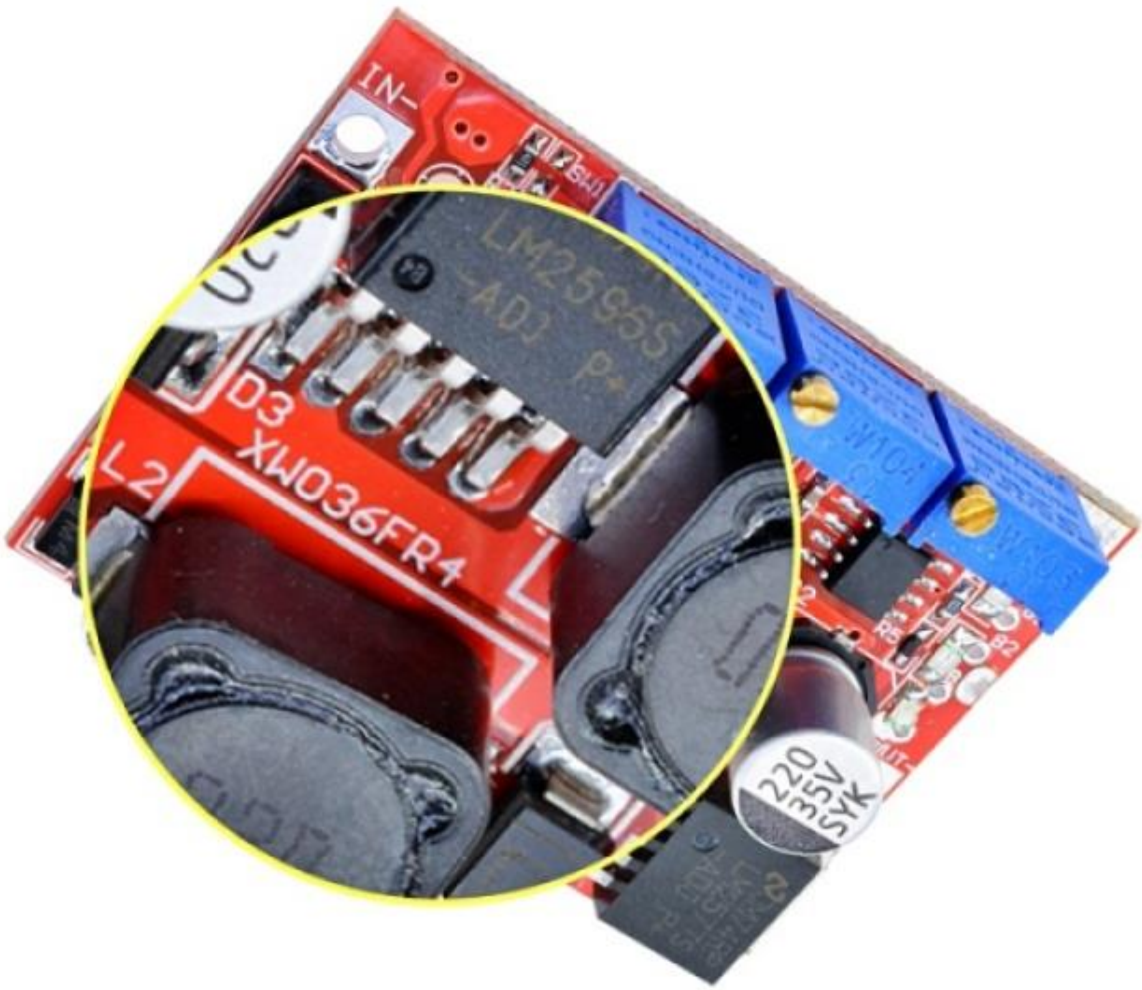
Below is an annotated picture of the module.



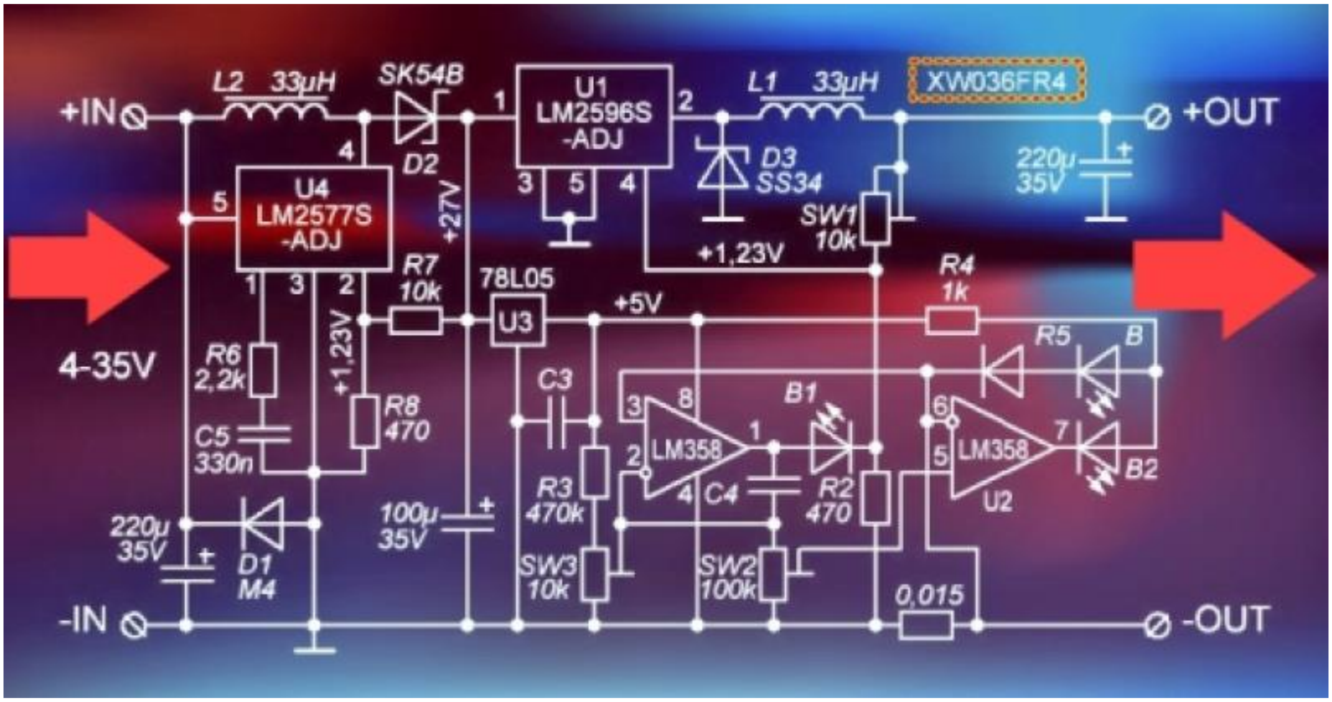
By default, the module output is set to ١A@٤,٢V, for charging lithium-ion type batteries. Trimpot SW١ sets the output voltage, SW٢ sets the indicator threshold for battery charging process, and SW٣ sets the output current limits.

Moreover, there are three LED indicators – constant current indicator and charging indicator LEDs are red (B١-B٢), and the charged indicator is blue (B). It’s however noticed that a green LED is used in some modules for charged (end of charge) indication, and it doesn’t work correctly. This is due to the relatively low forward voltage (V_F) of the green LED, I think!

The module that I gathered came with a set of mounting hardware i.e., four female threaded standoffs and four screws. The PCB is marked as XW٠٣٦FR٤.

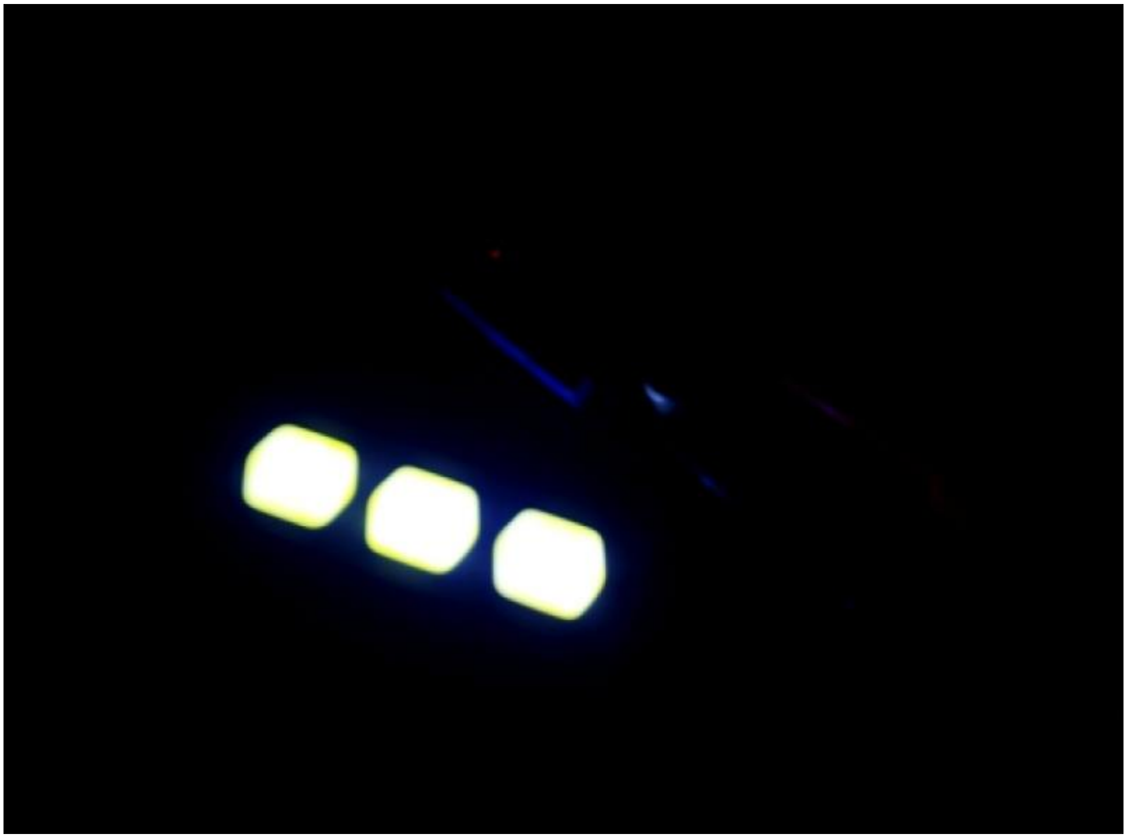


This is the schematic from the internet. It appears correct.

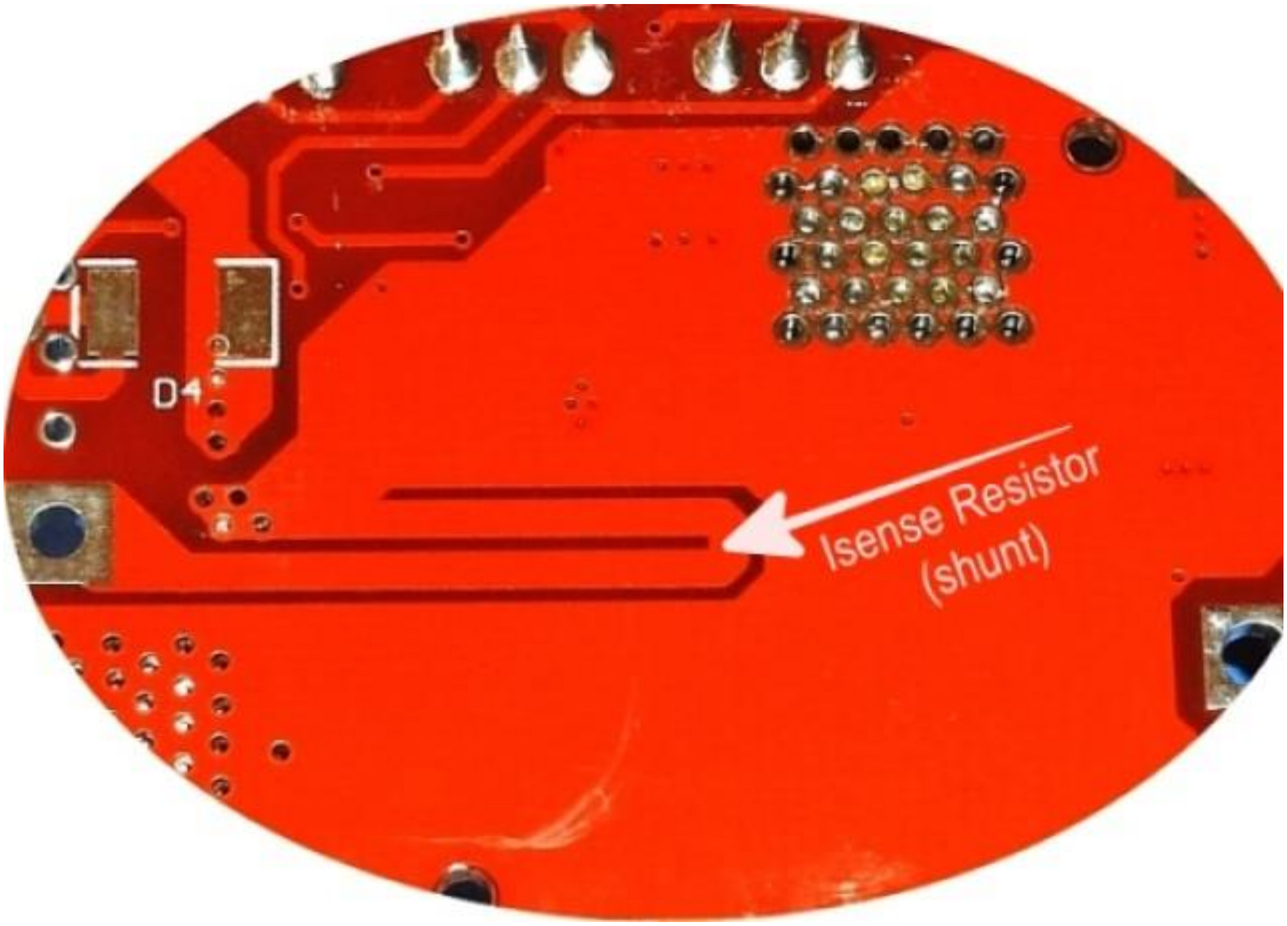


First off, I configured the unit as a constant current high-power LED driver. You can follow these mere steps to use the module as a constant current driver for your high-power LEDs.

- Initially, note down the forward current (I_F) and forward voltage (V_F) of the high-power LED you need to drive.
- Apply suitable DC voltage to the module. The blue LED (B) will illuminate instantly.
- Leave the middle trimpot in its default state, and adjust the "voltage set" trimpot to tune the output voltage aright.
- Use your multimeter in dc current scale to measure output short-circuit current, and adjust the "current set" trimpot to scale the output current as needed.
- Retouch the "voltage set" trimpot if necessary to make sure that the output voltage is still close to the maximum forward voltage of the high-power LED.
- Finally, link the high-power LED to run it as desired. The blue LED will turn off at this time, but the red LEDs (B1-B2) will illuminate instantly.



In the PCB, a hairpin shaped trace acts as the low-value current sense resistor (shunt).

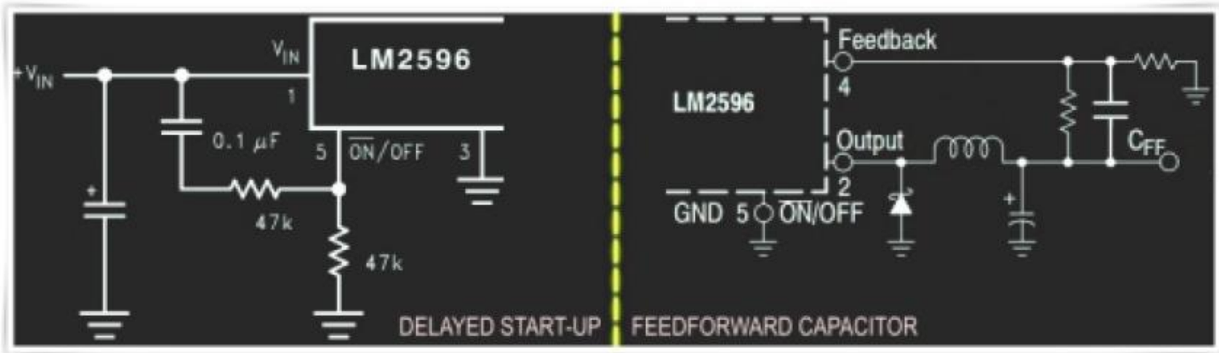


Most commonly found “constant-current constant voltage buck and boost” Chinese modules (including this version) will work fine as promised, but it seems that often they cannot start up entirely if linked with a beefy load at the output when first connected to the input power source. This is because the switching regulators go into current-limiting mode and the linear regulator doesn’t get copious voltage to properly run the op-amp for constant current mode. Once the switching regulators have started up and the linear regulator is in action, the constant current regulation circuitry will work as defined.

To put it simply, the output current (load current) needs to be limited for a few moments when the module’s input is first connected to a power source. Nevertheless, for driving mighty devices in a fixed installation, this issue would appear to make the modules pretty useless (and an easy way to fry some sensitive parts if not careful).

This issue could have been eliminated by delaying the start-up of the buck converter. This would keep it idle for enough time that the boost converter and linear regulator (as well as the op-amp) would start up and be prepared (modifying the existing board isn’t really feasible, though).

In addition, according to the LM٢٥٩٦ datasheet, a feedforward capacitor (C_{FF}) in the voltage feedback circuit is essential to ensure stability mainly at higher voltages. But the recommended capacitor is not present on this module. Even though in my quick testing the module was able to work across its defined range, I would recommend the use of a ٤,٧nF capacitor wired in parallel with the output voltage setting resistor – the ١٠K trimpot SW١.

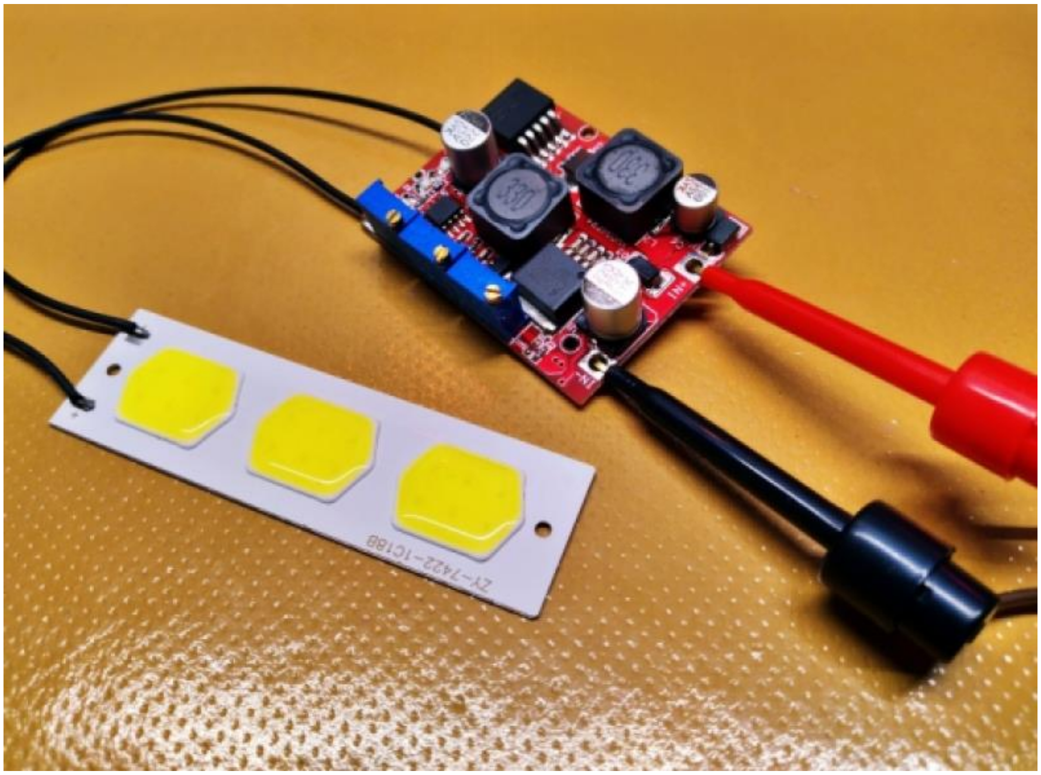


Getting back to my tests, the constant voltage mode of the module also works well to some extent. In my case, with an input of ١٢V DC, I measured the “no-load” output dc voltage range from ١,٢٥V to ٢٧V or so. The specified output voltage range appears to remain reasonably stable under slight loading as well (during the quick examination, it’s noted that some of the components heated up in short order which’s definitely not allowable for long-term operations).

I’ve examined one XW٠٣٦FR٤ module under various operating conditions and measured its performances. In my limited tests, when fed with ١٢V from my lab power supply, I’ve been able to adjust the output all the way up to ٢٧V, and all the way down to ١,٢٥V according to my trusty digital multimeter. Similarly, the current scale up to ١A was checked. The whole point of testing out the module quickly was a matter of experimentation and seeing what works and what doesn’t.

To conclude, this module is well suited for catering low to medium voltage and current output but a heatsink is a must if continuous operation at higher currents is required, and even so I would not recommend running it at the maximum ٣A load especially at higher input and output levels. Once again, note that the output current of the module needs to be limited for a few moments when it’s first connected till the constant current regulation circuitry becomes active. Otherwise, it delivers the maximum current which’s often dangerous!

As said before, initially I configured the module as a constant current source to drive a high-power LED. The high-power LED used in that setup is a ٤V/٤W white COB LED module, and the entire setup (١٢V/٢A input & ٤,٢V/١A output) performed pretty well.



For now, I reshaped my XW۰۳٦FR٤ module as a crude voltage and current-limited adjustable workbench supply. It is handy for powering certain prototypes. I’ve a plan to replace the voltage and current set trimpots with multiturn panel-mountable potentiometers. The output may be wired to a digital volt and ampere meter, as well.

Am I on the right track? Let me know.

I have not mentioned of this before but this is not something I’ve actually examined in-depth, so don’t rely too heavily on my thoughts here!

And, I’ll be interested to see how you get on with this module