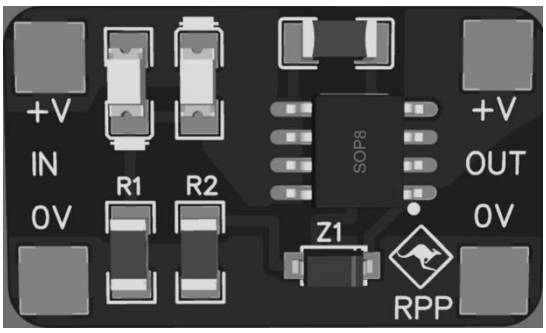
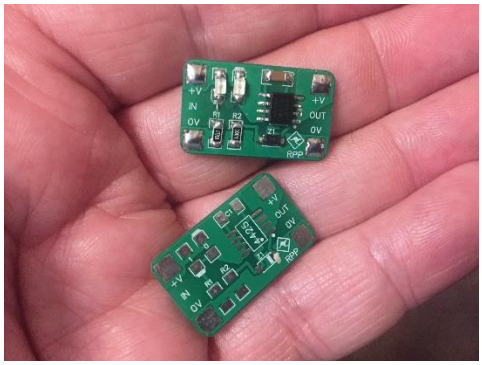
KANGA PRODUCTS
Electronic Kits For The Radio Amateur

Kanga ‘Smoke Stopper’ SMD-RPP



This is a low cost item that can stop your precious QRP or Homebrew rig from letting all the smoke out that manufacturers carefully pack into the chips of your radio !

The ‘Smoke Stopper’ is a Reverse Polarity Protection module that is small enough to be fitted in just about any of your projects, not just radios! (25x15mm PCB)



Traditionally we have used a number of methods to do this, the most common way would be a diode in series with the positive feed, that will work for sure, but it brings its own problem. A diode has a considerable volt drop, typical 0.7 to 1v when passing a couple of amps, You can use a Schottky diode which will help reduce the loss but the diode itself is going to get very hot as it will be dissipating a couple of watts of wasted power at that current.

The other problem is that now you have reduced the voltage to your radio and many QRP rigs will lose precious RF power with such a drop of supply voltage.

The other common method is to put a diode backwards after an in-line fuse so it normally doesn’t do anything and no volt drop if the supply is connected correctly but as soon as you make a bad connection the diode conducts and blows the fuse. That protects the radio but if you’re in the middle of field or it’s a Sunday afternoon contest you now need to get a replacement fuse!

The Kanga Smoke Stopper works differently. We are using a power MOSFET that constantly keeps an eye on the input polarity, if it’s reversed the output instantly turns off protecting the rig.

Unlike the diode methods it will not pop any fuse and also it doesn’t introduce any significant volt drop between its input and output (typically less than 0.05v with a few Amps current)

The Module is a SMD project that can be tackled by SMD beginners with a minimum of equipment, I use a standard 70 watt Weller iron with its standard tip and a set of ‘helping hands magnifiers’

The MOSFET is rated at 18 Amps but I have only used and tested this module up to 5A, I do not recommend you using it at higher current levels for risks of damage to the PCB itself.

The module has two LED’s, a green one, and a red.

The green LED indicates that the supply is connected correctly and that the output will be live, if the red LED is on then the polarity is reversed and the modules output is turned off.

Warning! You MUST take great care that you install parts the right way round. Please read ALL the instructions BEFORE you start work on the module. SMD work is not hard but you do need to be careful as the parts are very small and it can sometimes be hard to identify which way round they go. Using a magnifying glass and good light will make the task much easier.

So let’s build it!

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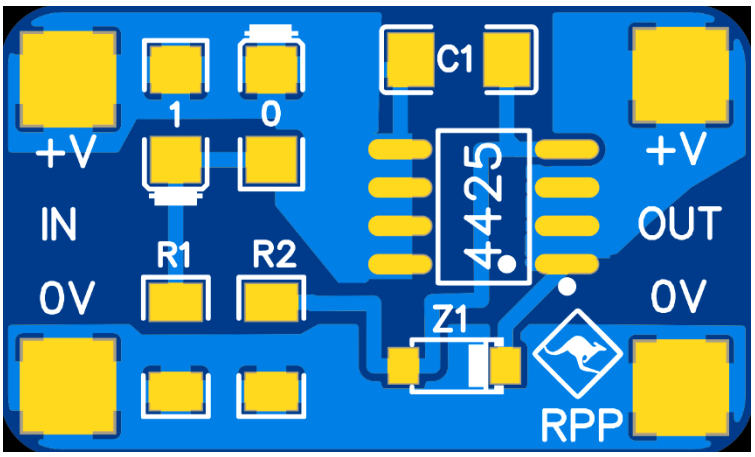
Kanga RPP Module Parts List

1 x Bag 1 SMD RPP PCB & Sticky Foam Mounting Pad
1 x Bag 2 SMD Green LED
1 x Bag 3 SMD Red LED
1 x Bag 3 SMD 6V2 Zener Diode (Black plastic and slightly smaller than the two resistors)
1 x Bag 3 SMD 10K ¼ watt Resistor Marked 103
1 x Bag 3 SMD 1K ¼ watt Resistor Marked 102 (See Notes below)
1 x Bag 3 SMD 0.1uF Capacitor Light Tan Colour un-marked
1 x Bag 4 SMD SI4425DY MOSFET

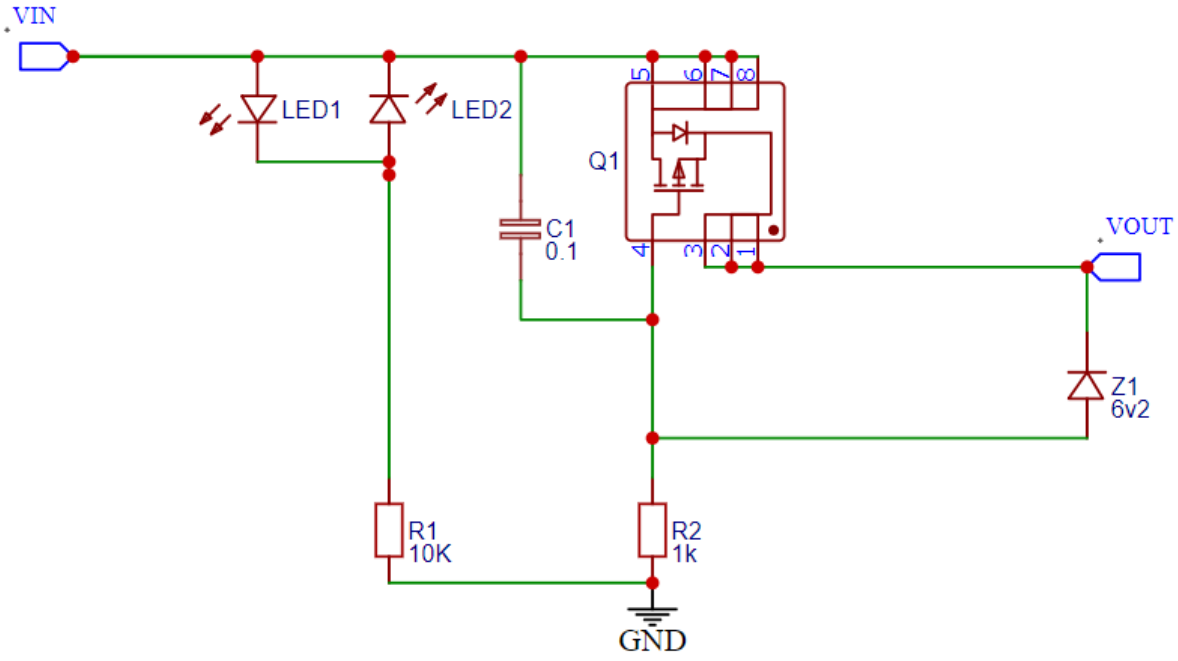
PCB Layout



The board is 25 x 15mm in size.

The SMD parts used in this project are small by through the hole standards but are considered Large for SMD boards.

I would recommend that you get yourself a good magnifying device if you are going to start with SMD projects. I have now bought an electronic microscope, (look on Amazon or the like and you will find them) this makes building such projects much easier. Also consider a fine needle tip soldering iron too (not like me and my big tipped 70 watt Weller)

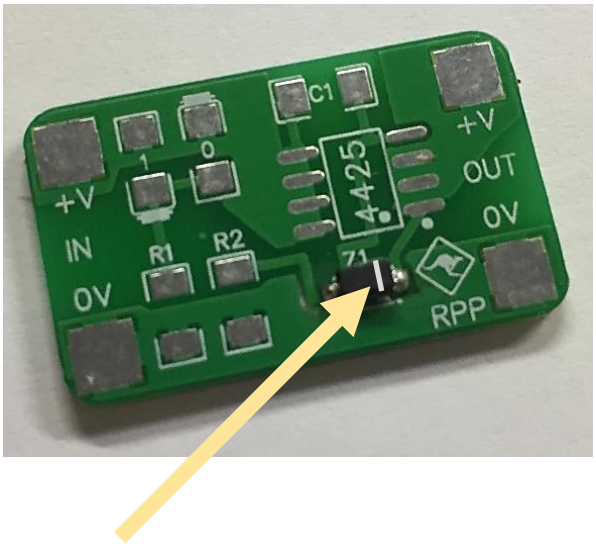


Circuit of the 'Smoke Stopper'

First fit the hard to fit parts, the Diode and the Chip

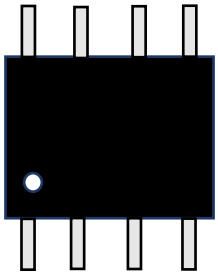
The diode **MUST** Be fitted the correct way round, with SMD parts it can be hard to see the markings on the parts, that's where a good magnifier can help.

Look carefully and you will see that the diode has a horizontal line at one end. Now this is the difficult part of SMD work I find, the markings can be very difficult to see. You need a good strong light to see the markings. The diode is a Zener diode (Z1) 6v2.



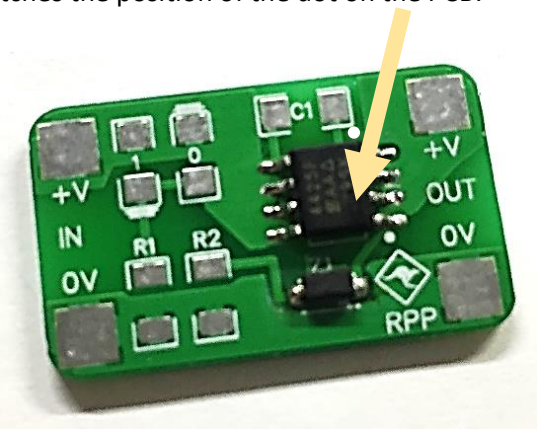
The diode will have a line on one end, this needs to be nearest to the Kanga Symbol on the PCB

Next, I recommend fitting the MOSFET chip, most MOSFET's have 3 legs, this chip has 8, the chip uses pins 1, 2 & 3 as the Source connection, pins 5 to 8 as the Drain, and that leaves pin 4 as the Gate. The Gate does not have a high current passing through it so one pin is fine but the chip can handle up to 18 Amps so the manufacture uses a number of pins to carry such current. In our design I do not recommend currents over 5 Amps. (May damage the PCB itself)



The SI4425 chip must be fitted the correct way round. If you look CAREFULLY you will see a small dot on the top of the chip. This shows where pin 1 is. The PCB shows a small dot near the location of pin1, make sure that the chip is fitted so the dot on the chip matches the position of the dot on the PCB.

I use a small pair of tweezers to hold the parts in place while soldering. Just solder 1 pin first. Now you have done that check again that the chip IS the correct way. It is easy to get this wrong so triple check that you have it correct. When you're sure it's right soldering the rest of the pins. Make sure ALL 8 pins are soldered.



That's the two most difficult parts to fit now done. Double check that the diode and chip are the right way round.

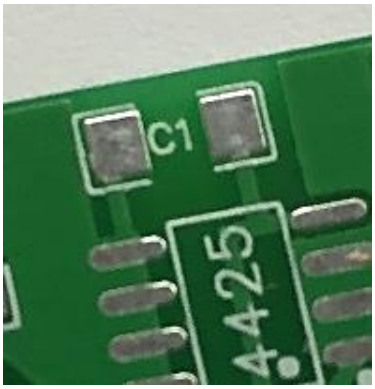
Next, we will fit the LED's Take care its easy to fit these the wrong way.

There are two LED's on the board, the board is marked '1' and '0', the '1' is the green LED which will be on when the output is active, the '0' is the red LED which will be on if the output is off (polarity connected backwards). Let's start with the Green LED that will be fitted in position marked '1'

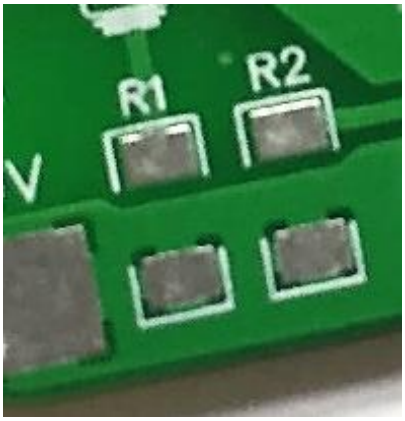
The LED's **must** be fitted the right way round. Read the notes below before fitting them. If you look at the LED you will see a small green mark at one end, on the PCB you will see a thicker white band on one end of the LED silk screen printing on the board (for this LED its nearest to the position for R1). The green mark MUST be located nearest to this thick white band. If you can't see the green mark but you can see a green arrow then you have the LED upside down! Turn it over!! I doubt if you will see the green mark while the LED is in its little bag.

The markings may vary depending on the source of the LED but it will be there, use you magnifying glass to make sure you fit it correctly, some LED's will have two marks as in this photo and others may have only one small green mark.

Once the Green LED is fitted fit the second LED the Red one, but this time the small green mark must be nearest to the edge of the board (position '0')



The next few parts are easier to fit, we first need to fit the capacitor C1, this is located at the bottom of the chip. C1 can be fitted either way round.



Now we have just two more parts to fit, the resistors R1 and R2.

R1 is a 10K ¼ watt 1206 resistor it will be marked 1002 (or 103) on the top, resistors can be fitted either way round, just don't mix it up with the other resistor, R2 which is marked 1001(or 102).

Note ** if using this module on 24v or higher then you may want to change this resistor (R2) for a 2k2 resistor, that will reduce the current (and hence heat) into the Zener diode, (DO NOT EXCEED 30V or damage to the MOSFET will occur)

Now we are ready to test our work but first double check the board, make sure you haven't missed any parts and that they are all the right way round.

Testing

Now, if you have such a thing as a current limited PSU that's good. I always like to test things with such a bench supply and turn the current limit down too, in this case to about 20mA. If you don't have such a supply then we will just have to carry on.

There are solder pads for the inputs and outputs on the board solder two wires to the input side and connect them to a DC power source of 12v or so. As soon as you do the green LED should be on and a few mA of current will flow. Use your volt meter and check the voltage on the input to the board, then check the output voltage on the outside of the board, you should see the same voltage.

Now disconnect the input wires and connect them the wrong way round, the negative pad to the PSU positive and the positive pad to the negative PSU terminal. Now the red LED should be on, check the input voltage on the module and then check the output pads, you will find that there is no output voltage. I like to test such devices as this with a load such as an old car headlight bulb, a high beam bulb is about 55 watts which is nearly 5 amps at 12v. Now if you do this be careful. 55 watts of light is bright, very bright so protect your eyes and don't look into the light. Also, a 55 watt bulb will get red hot! Do not burn yourself!!

Do the same tests as before but the bulb should be off when the supply is reversed. The voltage drop across the module will be very low, typically around 0.05 volts. That's it all done! Now you can put this module into your equipment and not worry about mishaps.

The module is supplied with a small double sided foam pad, use this to attach the finished board to a suitable location inside the equipment it is to be fitted into.

Please note, this module is a designed to protect against REVERSE POLARITY, it will not protect from short circuits.

Enjoy the safety and protection this module will give you. 73 Paul M0BMN