

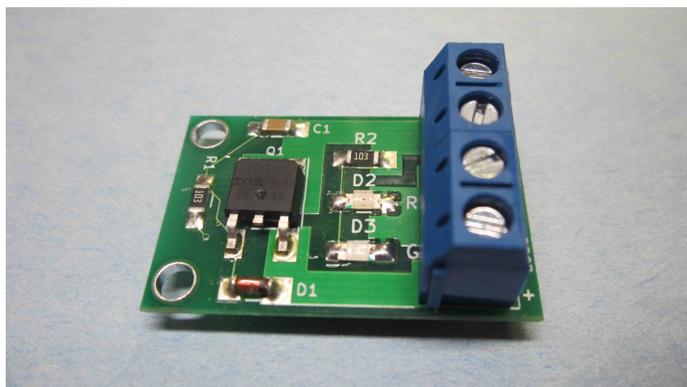
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SMT REVERSE POLARITY PROTECTION



RPP-SMT – Reverse Polarity Protection V2

Assembly Instructions

We have all done it, or will one day, hook the power cables to the radio backwards. Hopefully little to nothing will happen. Sometimes it's a minor repair like replacing a fuse or regulator. But on others you watch the equipment lose all its magic smoke. Adding reverse polarity protection inside your QRP radio can prevent that accidental cross wiring smoke from happening.

Parts List included with this kit:

Qty	Ref	Description	Markings
1	PCB	Printed Circuit Board RPP-SMD	
2	C1	Capacitor 1206 .1uF	Tan Body
4	R1, R2	Resistor 1206 10K	103 Black Body
2	D1	Diode Zener ZMM5V1 5.1V	Round Glass
2	D2	LED 1206 RED	
2	D3	LED 1206 GREEN	
1	Q1	Transistor MOSFET IRFR5305 DPAK	FR5305
2	P1 P2	Terminal Block 2-pin_5mm	

Construction notes:

This kit was designed using larger sized SMT components as an introduction to soldering with SMT devices.

- The following tools are recommended:
 - Pencil type soldering iron with a fine point tip and solder.
 - Tweezers
 - Magnifier
 - Solder Wick and/or solder sucker
 - Small slotted screwdriver
 - Small vice or PCB holder
 - Hookup wire and optional #4 mounting screws and spacers
- Familiarize yourself with components using the included parts list.
 - TIP: Not sure what part is what? The following sources have great articles on component identification and building techniques.
 - A copy of the ARRL Handbook
 - The GQRP web site: <http://www.gqrp.com/databook.htm>
- Never soldered SMT devices before? Highly recommended is the YouTube video by Adafruit Industries called Collin's Lab – Surface Mount Soldering. In a nutshell when hand soldering I use these 4 steps: 1) Tin one of the pads 2) Grab your part, while heating the tinned pad slide the part into place. 3) Solder down the other pads.. 4) If needed go back and freshen up the first pad.

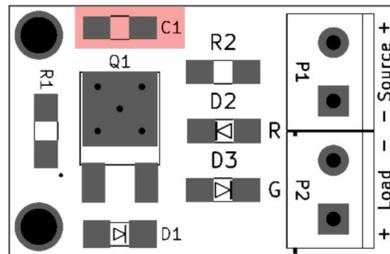
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Board Assembly

All components are installed on the top side of the board which also shows the silkscreen placement of the components.

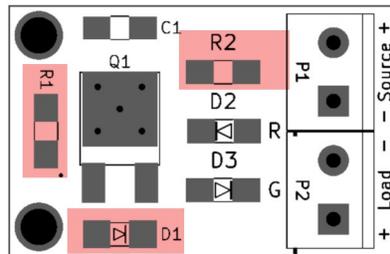
1. Locate C1 on the board. Tin (wet) ones of the pads. While heating the wetted pad, slide one end of the .1uF capacitor (tan body) into the pad, align the part with the other pads, and allow the solder to melt into it. Solder the remaining pads in place. Check the first pad and touch up if needed.



2. Using the same technique as above, solder the following:

R1 10K Resistor
 R2 10K Resistor
 D1 Zener Diode

Marked as 103
 Marked as 103
 Observe the polarity (band) on the PCB with the blue band on the diode.



3. Using the same technique as above, solder the following LED's

D2 RED LED See notes below for polarity
 D3 GREEN LED See notes below for polarity

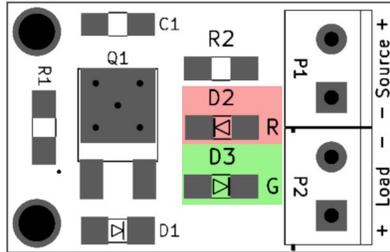
Note the BOTTOM of the LED will have a "T" printed on it. The T aligns with the anode and cathode symbols as shown below:



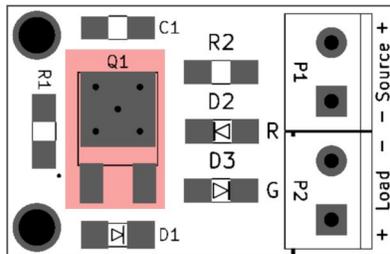
LED upside down showing markings

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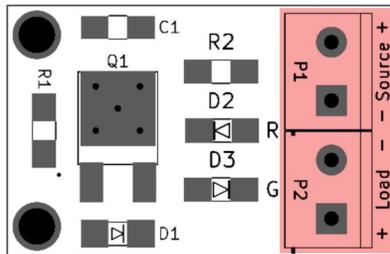
Assembly Instructions



4. Tin (wet) the one of the smaller pads on Q1. Using the same technique as above, slide Q1 into place while aligning the other leg and heatsink. Solder the other leg and heatsink into place. On the bottom side of the board optionally fill the 5 via pads under Q1 with solder.



5. Slide the 2 terminal blocks together to lock in place. Insert and solder terminal blocks P1 and P2. Make sure the wire entrances are pointing away from the PCB.



This completes the board assembly procedure.

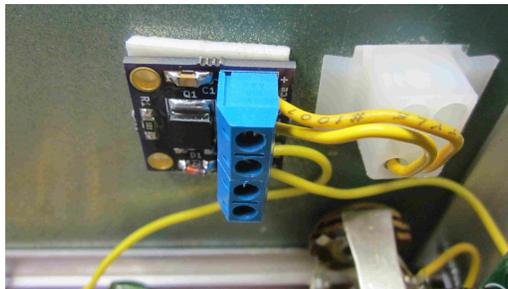
RPP-SMT – Reverse Polarity Protection V2 Assembly Instructions

Board Installation

A typical installation is made by interrupting the connection directly after the power connector inside a radio. The following procedure shows a typical installation inside an HW-8.

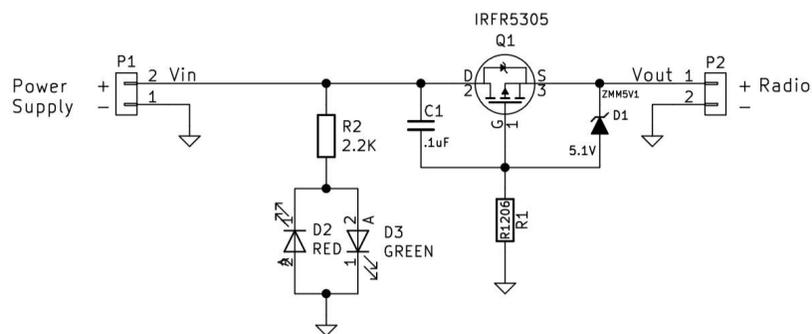
1. Cut the power leads directly after the power connector.
2. Connect the positive lead from the power connector to the positive (+) SOURCE terminal on the RPP board.
3. Connect the negative lead from the power connector to the negative (-) SOURCE terminal on the RPP board.
4. Connect the positive lead going to the radio to the positive (+) LOAD terminal on the RPP board.
5. Connect the negative lead going to the radio to the negative (-) LOAD terminal on the RPP board.

Alternative connection: The negative leads do not necessarily need to be connected through the RPP board. Only a single negative (-) lead can be connected to the RPP board as long as a single common (AKA ground) connection within the radio exists for the power supply negative, radio negative, and RPP board. Additionally this alternative connection only works when a single device is connected to a power supply. Note the mounting holes have no electrical connection.



RPP-SMT installed in an HW-8

RPP Schematic



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SPECIFICATIONS:

Supply voltage input:

Minimum: 4V (Vgsth) Maximum: 50V (Vdss)
(See IRF4905 spec sheet for details)

Current Load:

4.25A Continuous
7A Peak

Typical Voltage Drop across RPP (loss @ 13.4VDC):

1mV@60mA 130mV@820mA 340mV@1.3A 900mV@5.4A for 60seconds

FAQs:

What do the components do?

- Q1 is configured to act as a switch, allowing current to pass when properly polarized and the circuit to appear open when reversed.
- C1 just helps prevent static discharge protection between the gate and drain.
- R1 and D1 help clamp the voltage between gate and source. In the case of the IRF4905 these 2 parts they are really not needed as long as the power supply remains below 20V (The Vgs max of the transistor). In this case the diode can be omitted and the resistor can be jumpered. When used the resistor is not critical, anything between 10K and 100K will work. The zener diode, however, must be a value between the MOSFETs Vgsth and Vgss maximum.

Hey! This MOSFET is rated for 31A, why the above current limits??

First off it's 31A with a maximum power dissipation of 110W at room temperature. Push a bunch of current through it, which causes heat, and that 31A derates to 22A at 212F (100C). Secondly the terminal blocks are rated for 15A maximum. But the PCB itself is the biggest limitation. PCB traces of 1.4mils thick and conductors of 1/2" long by 80 mils wide calculates to about 4.25A of maximum current. Although the traces are duplicated on both sides of the PCB, it might handle up to 7A but we decided to keep the safety margin of 4.25A in place. Adding a heat sink to Q1 along with duplicating the power traces with thick wires could increase the current ratings. The MOSFET was chosen for its low RdsOn, not its maximum amperage.