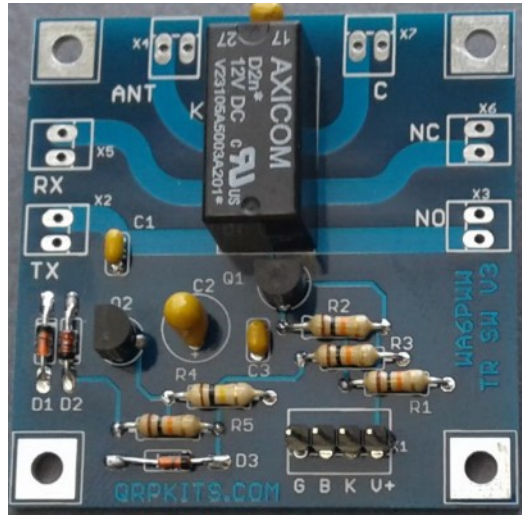


Pacific Antenna Easy TR Switch Kit



Kit Description

The Easy TR Switch is an RF sensing circuit with a double pole double throw relay that can be used to automatically switch an antenna between a separate receiver and transmitter.

It also has a second switched pair of inputs and outputs that can be used for other switching applications such as muting or switching an audio channel or even to switch a remote amplifier or pre-amplifier.

Manual operation is achieved through use of control inputs to disable RF switching and to key the relay.

Features and Specifications

- Provides automated or manual switching
- Two independent sets of inputs and outputs
- Automatic Rf sensing requiring as little as 50mW of RF for switching
- Frequency range of 160-6M
- Power handling of up to 125 Watts
- All on a 2 by 2 inch circuit board.

Support

PACIFIC ANTENNA
QRP KITS.COM
qrpkits.com@gmail.com

Recommended Tools

- Temperature Controlled Soldering Station with small tip or a 15-35 watt soldering iron with small tip.
- Solder 60/40 or 63/37 Tin-Lead
- Small Diagonal Cutters
- Small Needle Nose Pliers
- Pencil, Pen, and/or Highlighter
- BRIGHT work light

Optional

- Magnifying headpiece or lighted magnifying glass.
- Multi-meter
- Solder Sucker or Solder Wick
- Knife or Wire Stripper
- Cookie Sheet to build in and keep parts from jumping onto the floor.

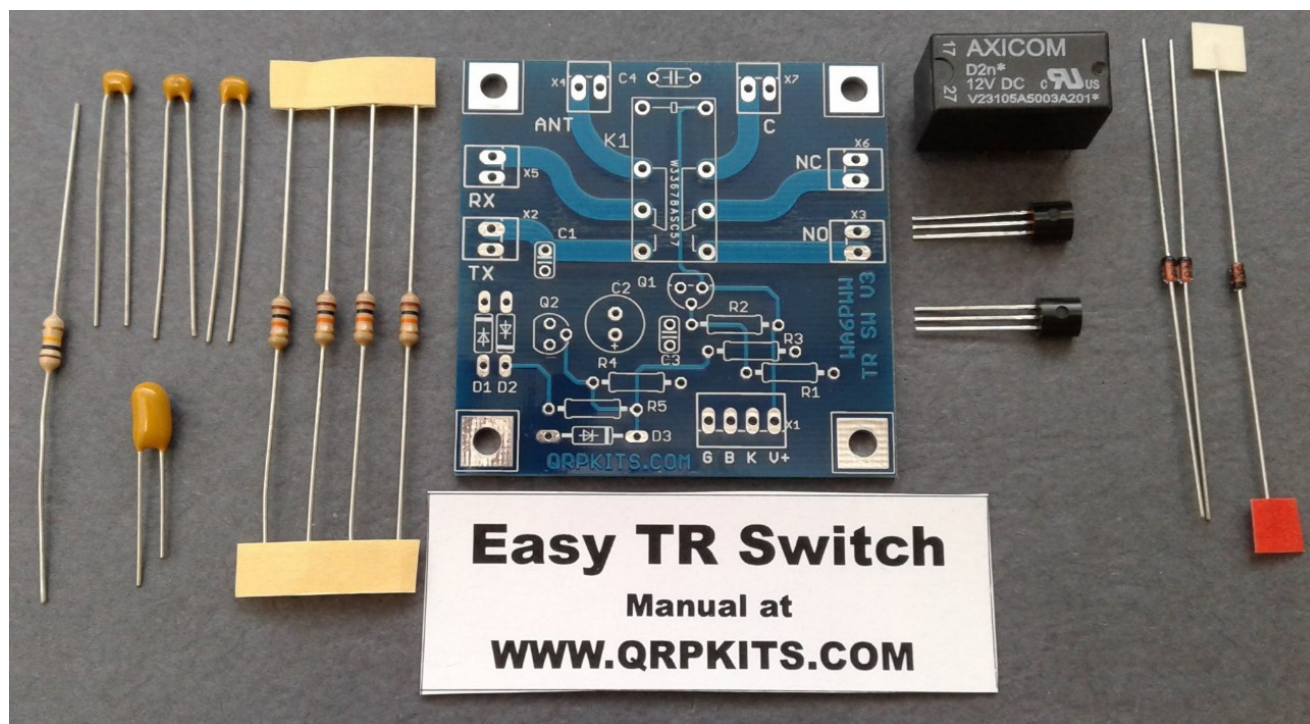
Construction Techniques

- Please take time to inventory the parts before starting. Report any shortages to QRPKITS.com (In many cases it may be faster and cheaper to pull a replacement from your parts supply, but please let us know if we missed something.)
- Pre-sorting the resistors and capacitors can speed up the assembly and reduce mistakes.
- There is no need to print out the whole assembly manual unless you want a copy. Print the Parts List and Schematic (last two pages) then view the rest of the manual on a computer, laptop, or tablet. The Parts List has columns for inventory and construction.
- You can insert several parts at a time onto the board. When you insert a part bend the leads over slightly to hold the part in place, then solder all at the same time. Clip the leads flush.
- Most parts should be mounted as close to the board as possible. Transistors should be mounted about 1/8" above the board. Solder one lead on ICs or IC sockets and then check to make sure the component is flush before soldering the remaining leads.
- Use a Temperature Controlled Soldering Station with small tip or 15-35 watt soldering iron with small tip. Conical or very small screw driver tips are best.
- DO NOT use a large soldering iron or soldering gun.
- If you are a beginner, new to soldering, there are a number of resources on the web to help you get on the right track soldering like a pro. Google Soldering Techniques.

TR Switch V3 Parts List

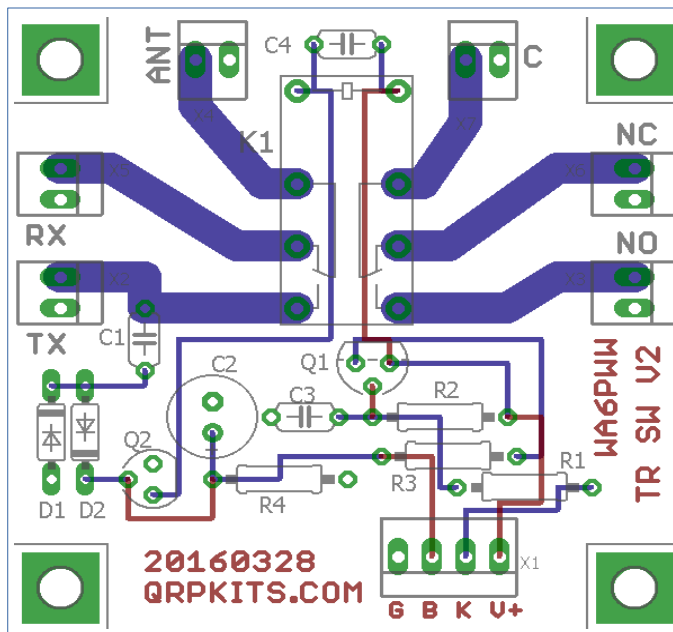
Qty	Value	Component	Description
4	10K	R1, R2, R3, R5	Resistor, 1/4W, Brown-Black-Orange-Gold
1	100K	R4	Resistor, 1/4W, Brown-Black-Yellow-Gold
2	1N4148	D1, D2	Diode, glass body (Check labels with magnifier)
1	1N5240	D3	Zener diode, 10V, glass body, (Check label with magnifier)
1	47pF	C1	Monolythic Capacitor, marked 47 or 470. (0.1" lead spacing)
1	22pF	C1 alternate	Monolythic Capacitor, marked 22 or 220. (0.1" lead spacing)
2	0.1uF	C3, C4	Monolythic Capacitor, marked 104. (0.1" lead spacing)
1	4.7uF	C2	Tantalum polarized capacitor, marked 4u7 or 475
1	2N3906	Q1	PNP Transistor
1	BS170	Q2	N-Channel MosFet
1	Relay	K1	Axicom V23105 12V relay
1	PCB	PCB	Circuit Board labeled TR SW V3

Typical Parts Appearance



Note: Some parts may vary in appearance from those shown here due to source changes.

Board Layout



Note: Pin 1 of X1 is the pad closest to the X1 Label (on the right above) and is the connection point for 12V power. The leftmost pin (4) is ground connection.

Install the following components on the PC board.

Resistors

R1	10K Ohm, 1/4W, Brown-Black-Orange-Gold
R2	10K Ohm, 1/4W, Brown-Black-Orange-Gold
R3	10K Ohm, 1/4W, Brown-Black-Orange-Gold
R5	10K Ohm, 1/4W, Brown-Black-Orange-Gold
R4	100K Ohm, 1/4W, Brown-Black-Yellow-Gold

Capacitors

C1	47pF Note: a 22pF is also included and is recommended for high power (>50W) use.
C2	4.7uF Tantalum Note: align + side lead with + pad on board outline
C3	0.1uF monolythic ceramic, marked 104
C4	0.1uF monolythic ceramic, marked 104

Transistors and diodes

Q1	2N3906 (align flat to board outline with center pin away from flat)
Q2	BS170 (align flat to board outline with center pin away from flat)
D1	1N4148 (align band to board outline) Note: confirm labels on diodes with magnifier
D2	1N4148 (align band to board outline) Note: confirm labels on diodes with magnifier
D3	1N5240 (align band to board outline), Note: confirm labels on diodes with magnifier

Misc parts

K1	Axicom V23105 Relay, (only fits one way due to pin configuration)
Header	Pin header that can be used for connection if wires are not to be directly soldered

Operation

The TR switch provides switching between two separate sets of contacts to two separate output/input pairs.

It will sense RF input on the TX inputs and switch at approximately 50mW of RF and above and can be used over a frequency range of 160-6M and up to 125 Watts of RF under matched conditions.

The switch can be bypassed by grounding pin 3 (Bypass) of the control inputs (X1). This will prevent the switch from engaging either in manual or automatic, RF sensed mode.

For testing, or for manual switching from an external control, operation of the relay can be accomplished by grounding pin 2 (Key).

12V DC power should be connected at connector SV1 with V+ to pin 1 (marked "V+") and ground to pin 4 (marked "G")

Choice of C1:

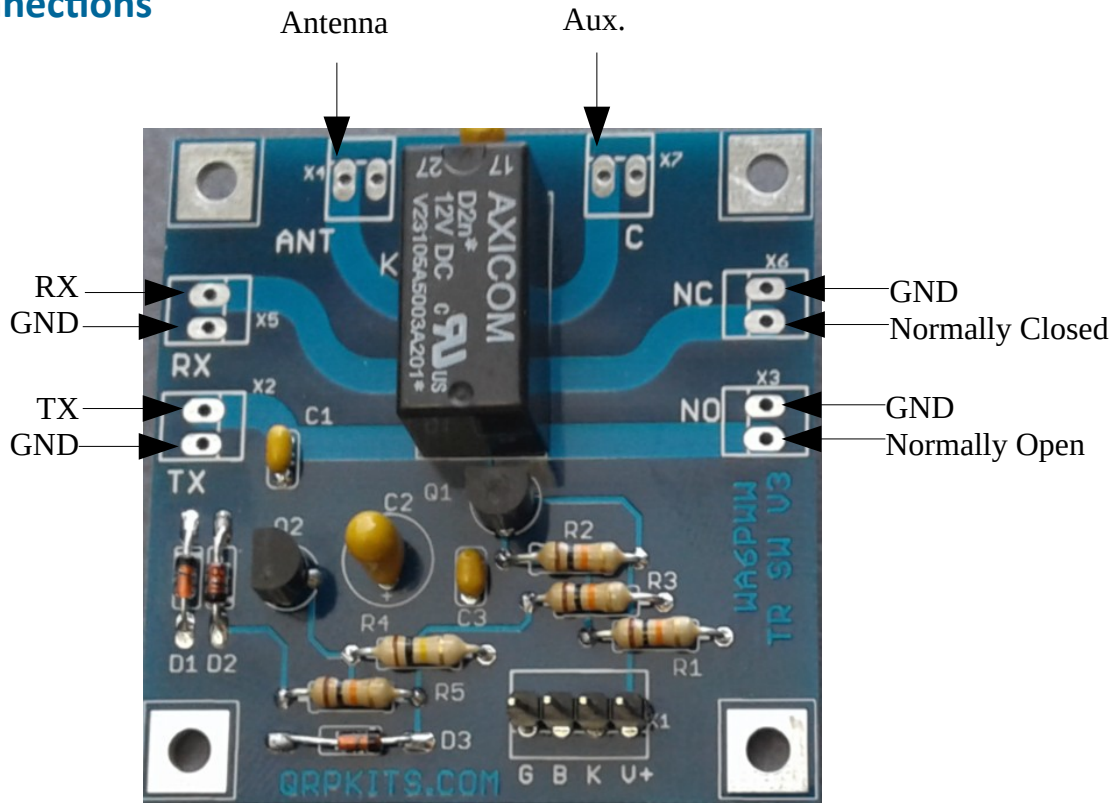
Capacitor C1 senses the RF signal and feeds the signal to Q2 to control switching.

The 47pF capacitor supplied for C1 should work over most conditions and is recommended for most applications. An extra 22pF capacitor is also included and is recommended if power levels used will always be above 50W.

If automated switching is not reliable on certain frequencies, or at certain power levels, the value of C1 may need to be adjusted.

In general, increase C1 for lower frequency and/or lower power operation and decrease it for high frequency and or high power use.

Board Connections



The Antenna, RX and TX as well as the second switched pair (C, NC and NO) are as shown above.

For the pads marked RX, TX, NC and NO, the connection is to the upper pad and the lower pads are connected to ground on the board as shown above.

For antenna switching between a receiver and Transmitter, you will only need to use the ANT, RX and TX connections.

The Auxiliary contact set can be utilized to mute audio of a receiver by switching its output to a resistor during transmit instead of the speaker or headphones.

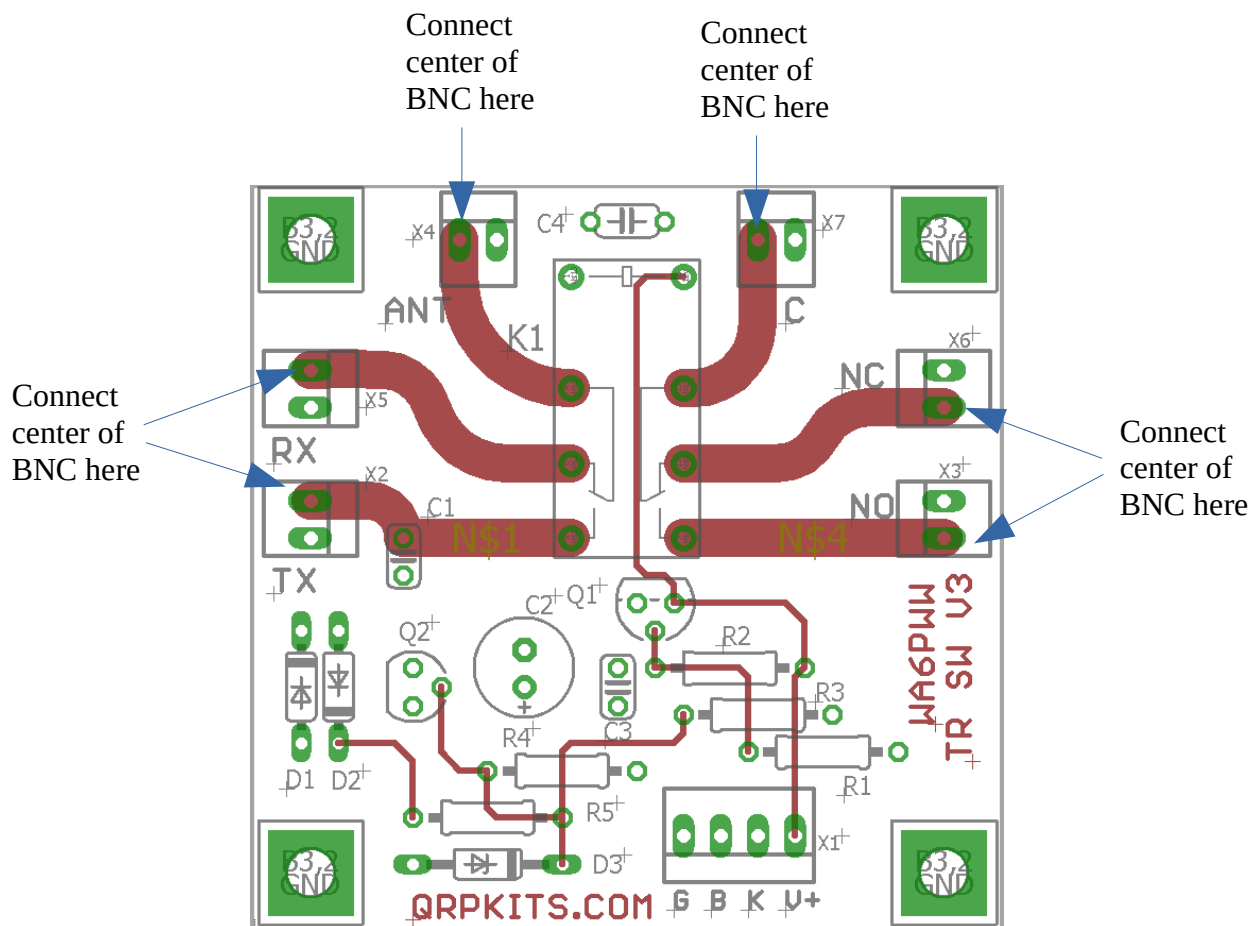
This would be accomplished by connecting the audio to the Aux input and connecting a speaker to the normally closed (NC) output and a 10 ohm or so resistor from the normally open output to ground.

If the TR switch is embedded into another system, jumper wires can be used to the appropriate pads for signals, power and control lines (if needed).

To connect to a BNC or other external RF type connectors, the center will go to the pads as shown below and the ground is the adjacent pad.

You can see the pads with traces and connected to ground by looking at the back of the board. As a guide, the trace locations are shown in the drawing below.

The additional switched contacts (if used), are connected in the same manner.



X1: Control and Power input

Pin 1: V+; Pin next to X1 label on board, connects to a 12 Volt supply to power the TR switch.

Pin 2: K; External keying control line. Ground this pin to key the TR switch manually.

Pin 3: B: Bypass control line. Ground to disable switching.

Pin 4: Ground for power, control and key signals

4	3	2	1	X1
G	B	K	V+	

Troubleshooting

The Easy TR switch is intended to be easy to assemble and should operate without any problems. However, if it fails to operate, there are a few things to check:

Check the board for cold solder joints, these will appear rough rather than shiny. If in doubt, reheat connections to ensure a good connection.

Check for any solder bridges or solder whiskers that may short between adjacent pads

Verify correct location and orientation of the diodes D1 and D2 as well as the transistors Q1 and Q2. They should be oriented as shown on the PC board outlines.

Verify that power and ground are connected to Pads 1 and 4 of X1.

Test by connecting Pad 2 of X1 to ground with 12 power applied to Pin 1. You should be able to hear the relay click. If not, recheck components and solder connections as indicated above.

When applying RF to the TX input, with an antenna or dummy load connected to the output you should hear the relay click.

Capacitor C1 is part of the RF sensing circuit that controls the automatic TR switching.

The kit is supplied with a 22pF capacitor for C1 and for most applications, this will work well. In general, a larger value capacitor (47 or 100pF) may improve switching at low power and low frequencies (<1Mhz).

If you still experience problems, or have any questions, please contact us at grpkits.com@gmail.com and we will be happy to assist you.

Schematic

