

QPA-1

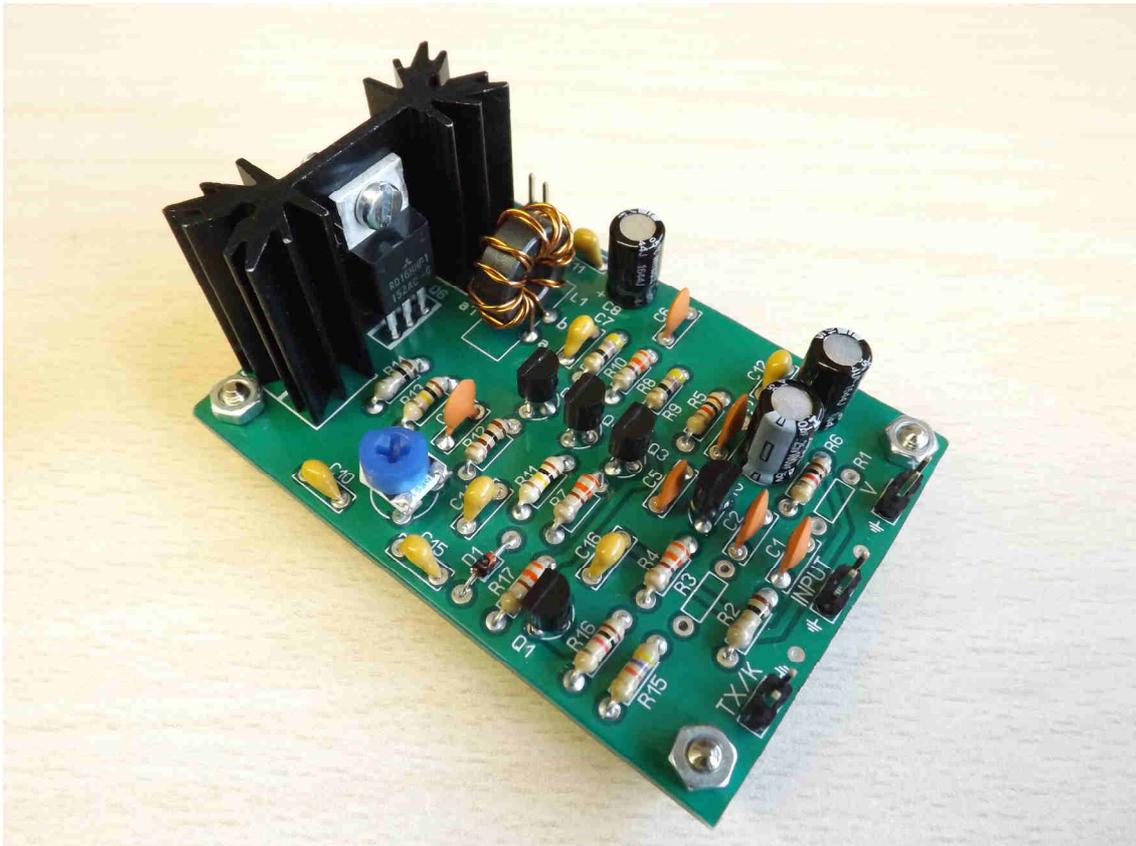
QPA-1 Low level input QRP HF Amplifier and CW TX (3 a 30MHz)

Assembly manual

Last update: May 1, 2018

ea3gcy@gmail.com

Most recent updates and news at: www.ea3gcy.com



Thanks for constructing the **QPA-1** Amplifier kit

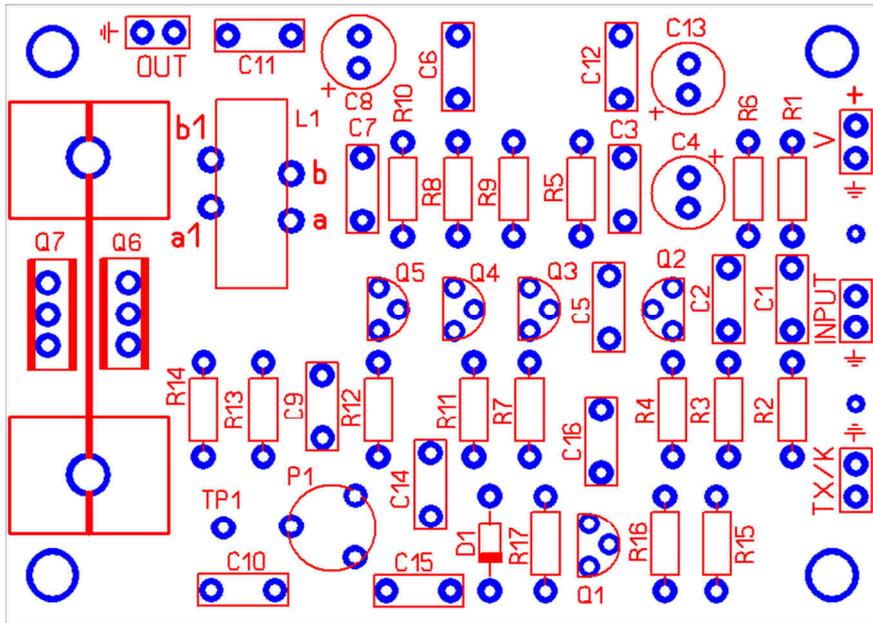
Have fun assembling it and enjoy QRP! 73 Javier Solans, ea3gcy

SPECIFICATIONS

- Bandwidth: 1 to 35MHz.
- Input power max. (no attenuator): 0dBm 50ohms.
- Minimum gain: 37dB@30MHz 13.8V
- Output Power Max: 15W (with extra heatsink)
- Supply: 12 to 14V
- PCB Size: 55 x 40mm

PARTS LIST

	Qty	Reference	Value	Component type	Identification
	1	R14	1	1 Ω resistor	brown-black-gold
	1	R2 (input attenuator)	1 (see text)	1 Ω resistor	brown-black-gold
	2	R9, R10	47	47 Ω resistors	yellow-violet-black
	1	R12	100	100 Ω resistors	brown-black-brown
	4	R4, R7, R8, R17	330	330 Ω resistors	orange-orange-brown
	3	R5, R6, R16	1K	1K resistors	brown-black-red
	2	R1, R3 (input attenuator)	See text		
	1	R15	4K7	4K4 resistor	yellow-violet-red
	2	R11, R13	100K	100K resistor	brown-black-yellow
	1	P1	5K	5K Adjustable resistor	503 - 53
	6	C1, C2, C3, C5, C6, C9	10n	10n capacitors	103 or 0.01
	7	C7, C10, C11, C12, C14, C15, C16	100n	100n capacitors	104 or 0.1
	3	C4, C8, C13	100uF	100uF electrolytic capacitors	100uF
	1	Q1	BC557/558	BC557 or BC558 PNP transistor	BC557/558
	1	Q2	2N3819	2N3819 Fet transistor	2N3819
	3	Q3, Q4, Q5	BS170	BS170 Fet transistors	BS170
	1	Q6	RD16HHF1	RD16HHF1 Power amp transistor	RD16HHF1
	1	Q7 (see text)	--	(see text)	--
	1	D1	6V2	Zener diode 6V2	6V2
	1	L1	FT50-61	FT50-61 toroid 10 x 2 turns (see text)	FT50-61
	43cms	Enamelled wire	--	43cms enamelled wire for L1 toroid	--
	8	Terminal-pins	--	Terminal-pins 2 + 2 + 2 + 2	--
	4	Spacers+screws+nuts	--	Hex spacers + M3x4 screws + M3 nuts	--
	1	M3x10 screw+nut+washer	--	M3x10 screw+nut+washer	--
	1	Heatsink	--	RD756 Heatsink for Q6 (Power Amp)	--
	1	QPA-1 PCB	--	QPA-1 board	--



PLEASE READ ALL OF THE ASSEMBLY INSTRUCTIONS COMPLETELY AT LEAST ONCE BEFORE BEGINNING.

TIPS FOR FIRST TIME BUILDERS

Tools required:

- A 30W soldering iron with fine tip, small wire cutters for cutting component leads, wire strippers, long-nose pliers, needle-nose pliers, X-Acto knife, screwdriver for M3 screws, alignment tool for adjusting IF transformers.

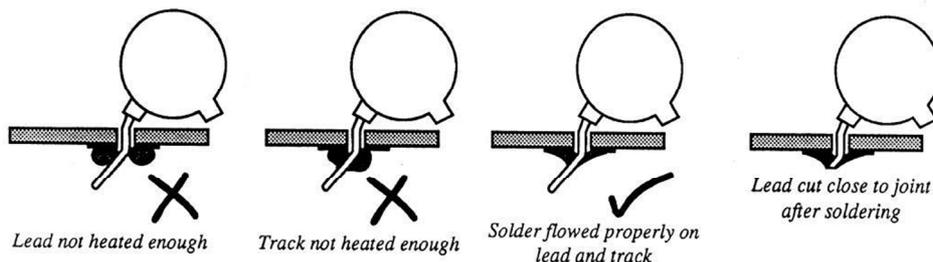
- You will need a good light and a magnifying glass to see the fine print on the components and other assembly details.

Instruments required:

- Multimeter, oscilloscope (desirable but not essential), frequency counter or HF receiver, RF power meter, dummy load: 5W - 50 Ohms.

Soldering:

There are two important things which need to be done to insure successful operation of a kit. The first is to put the component into the proper place on the circuit board; the second is good soldering.



To solder properly, you must use a high-quality solder for electronics use and the correct type of iron. Use a small soldering iron with a fine, pointed tip. The soldering iron should be about 30 watts (if it is not thermostatically controlled). Use only high-quality electronic type solder. NEVER use any extra flux. You should hold the hot soldering iron in contact with both the circuit board and the component lead for about two seconds to heat them up. Then, keeping the soldering iron in place, touch the solder at the junction of the lead and trace and wait about two seconds or so until the solder flows between the terminal and the trace to form a good joint. Now remove the soldering iron. The soldering iron should have been in contact with the work piece for a total time of about 4-5 seconds. After soldering each joint, you should clean the soldering tip, removing any excess solder. This prevents mixing in old solder and residues from previous soldering operations.

Finding the correct component:

Diodes

Be careful to observe the correct polarity of the diodes. There is a black band towards one end of the diode. This band should be oriented towards the line printed on the component outline of the circuit board.

Electrolytic capacitors:

These must be placed with the correct polarity. The positive lead (+) is always the long lead. The negative terminal (-) is the short lead and is marked by a stripe on the body of the capacitor. Make sure that the positive lead of the capacitor goes through the hole marked with a "+" on the circuit board.

Coils and transformers:

You may find it convenient to wind and prepare all the coils and transformers before beginning to mount the components. That way you won't have to stop and possibly lose concentration while winding them.

This is the part of the construction that some consider to be the most difficult. I personally find it to be one of the easiest stages, and it can even be relaxing. Look for the most appropriate moment to do it, and most importantly, take your time. The drawings and instructions in the manual will illustrate and accompany you in the process.

RECOMMENDED ASSEMBLY SEQUENCE

1.- The resistors are installed first. Mount all the resistors R1 to R13.

Install and solder P1

2.- Next mount the D1 diode, being careful to place them with the correct orientation. This is a band on one end that corresponds to the component outline on the circuit board.

3.- There are ceramic and electrolytic capacitors. They all have their value printed on the body. Refer to the "identified" column in the parts list. Install and solder all the capacitors C1 to C16

When you mount them, make sure to leave the leads as short as possible.

The electrolytic capacitors must be placed with the correct orientation: the LONG LEAD goes in the hole labeled "+" and the SHORT LEAD is "-", indicated by a band containing "-" signs on the side of the capacitor.

4.- Place and solder Q1 to Q5 transistors in place printed on the board. Your printed silhouette should match the body of the transistor. Q6-Q7 will be installed later.

5.- Install the pins-terminals. Turn the board over and insert and hold the header in place, using a “jumper” placed on the header while you solder the pins to avoid burning your fingers. Use your other hand to hold the soldering iron and move the board towards the solder to solder the headers in place. If you have someone available to help you, it will be much easier!

6.- The L1 Toroid will be wound as shown below.

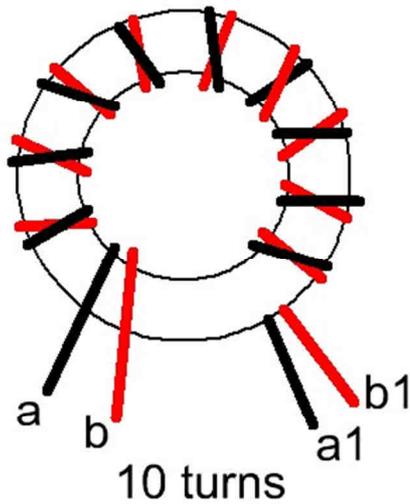
L1 TOROID WINDING

L1 is an impedance matching transformer with a bifilar winding. An FT50-61 is used (black toroid with 12mm/0.5in OD). It has 10+10 turns.

- Cut a 42cm (17in) long piece of 0.5mm diameter enameled wire.
- Bend the wire in half.
- Twist it so that there are about two twists per cm.



- Before beginning to wind, leave 15-20mm of wire, measured from the end of the wires to the outer edge of the toroid. Now wind ten (10) turns on the toroid. Remember: Count one turn for every time the wire passes through the center of the toroid.
- Spread the turns evenly around the toroid.
- Cut the ends and separate the two windings.
- Use a sharp X-Acto knife to scrape the enamel off the ends that will be soldered. The ends of the coils that we have made need to be prepared in this manner before soldering them into the board.
- Using a multimeter in its ohm or continuity function, locate and mark the ends, identifying them as “a” - “a1” and “b” - “b1”.
- Mount the toroid into the appropriate holes as marked on the circuit board.



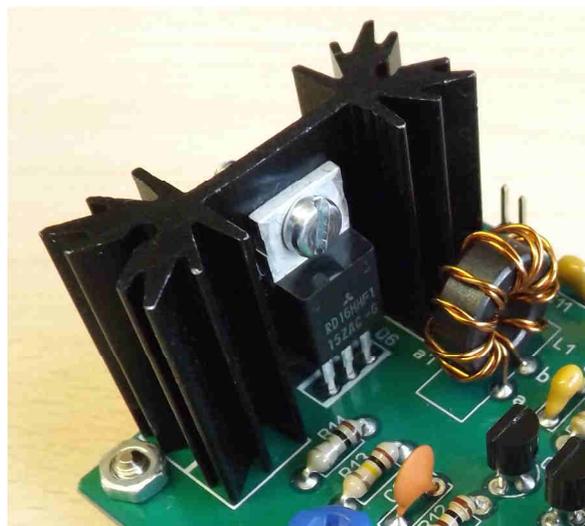
Note: For greater clarity, the drawing shows one black wire and one red wire. In reality, both wires are of the same color.

MOUNTING THE POWER TRANSISTOR Q6

The printed circuit board of the QPA-1 allows the placement of two different MOSFET transistors: Q7 and Q6. The place of Q7 is for an IFR510 or equivalent and the place of Q6 is for an RD16HHF1. In this kit we will use Q6 since the RD16HHF1 is a modern MOSFET transistor special for RF that offers greater gain and efficiency than other transistors.

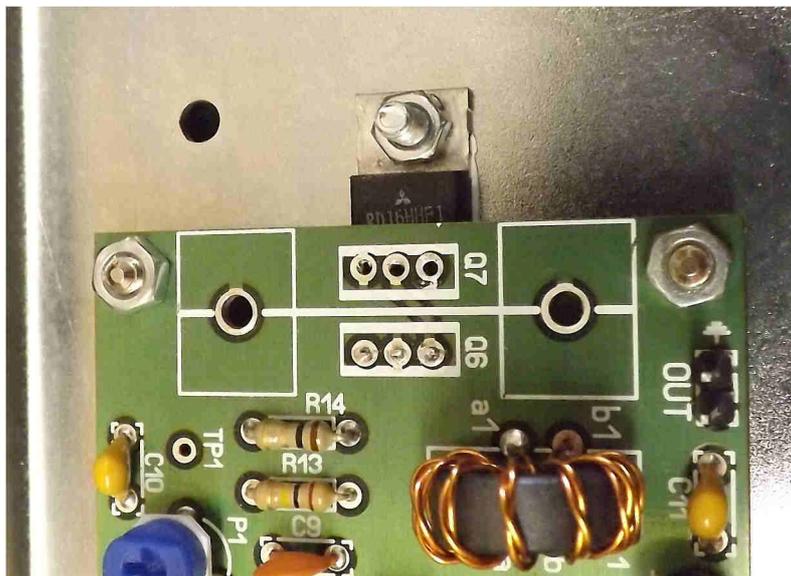
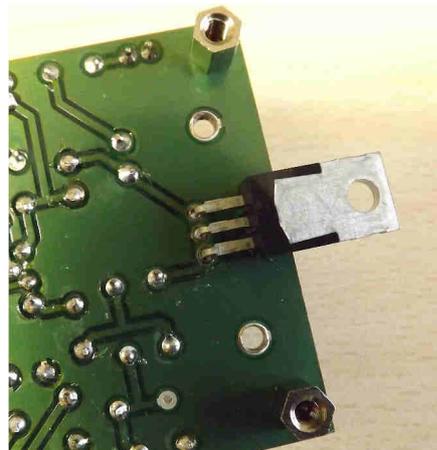
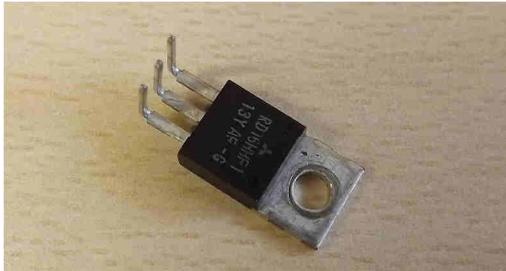
If you are going to use the QPA1 as a CW transmitter and with a moderate output power (about 5W max.), then it will be sufficient to mount the Q6 with the heatsink included in the kit. See the following image.

Note: The body of the Q6 is connected to its "SOURCE" terminal. As this terminal goes to GND, the transistor can be fastened with a screw without any insulation. It is advisable to use a little thermal paste to help dissipate the heat.



Q6 mounted on board with heatsink

If you are going to use the QPA-1 every day as an amplifier or as a CW transmitter with output powers of more than 5W, we recommend using a larger heatsink or fasten the transistor directly in the metal box. See the following image.



Q6 fastened in the metal box.

INPUT ATTENUADOR R1-R2-R3

The input of the QP1-A has an attenuating network formed by R1, R2 and R3.

If you use the ILER-DDS Kit based on the AD9850 DDS or another similar circuit that delivers a low level signal (0dBm or less), place a 1Ω resistor in the R2 place and do not place anything in the R1 locations and R3.

If the input signal is going to be higher than 0dBm, then we recommend using an attenuator with the appropriate attenuation factor.

Even with attenuator, we DO NOT recommend the use of QPA-1 with input powers higher than 27dBm (about 500mW). Use 1/2W resistors if necessary.

CONNECTIONS, ADJUSTMENT AND START

- 1.- The power supply 12 to 14V goes to “+” and “GND” terminals printed on board.
- 2.- Connect the signal source at the "INPUT" and the LPF low pass filter/filters at the "OUT" suitable for the bands to be worked and a power meter with a load of 50 ohms on the output filters.
- 3.- The jumper formed by the terminals "TX/K" must be connected while transmitting and must be disconnected when it is not transmitted (it feeds the "Idle" of the Q6 and should not be present while the transistor is not working).
 - If the QPA-1 is used as a *CW transmitter*, then the jumper terminals "TX/K" will be connected to the telegraph key and the input signal can remain connected even if it is not transmitting.
 - If QPA-1 is used as *an amplifier for a SSB transmitter, CW or other signal sources*, then the "TX/K" jumper must be attached while transmitting and disconnecting when it is not transmitted.

Setting of "P1" - Terminal "TP" - Start-up

The only adjustment to be made is the "Idle" (Biasing) of the final transistor Q6 through the adjustable resistor P1.

Note: Make this adjustment with the power transistor cool.

With no signal at the "INPUT", set the amplifier to TX (terminals "TX/K" connected) and set P1 until you get about **3.5-5V** at the "TP" test point.

Now inject the signal source into the "INPUT" and keeping the "TX/K" terminals together, the output power should be within the expected levels in relation to the input.

Note that slightly varying the voltage present in "TP" will increase or decrease the output power. This is because the polarization of the "Gate" of the transistor varies and the type of amplification of the transistor and therefore its gain. It is not recommended to exceed **4.5V**.

Important note: Carry out the adjustments and checks in small time intervals and check that the Q6 radiator does not reach a very high temperature.

LIMITED WARRANTY

Please read carefully BEFORE building your kit

All electronic components and hardware supplied with the kit are under warranty in case of any manufacturing defect for the period of one year after purchase. The warranty does not include the transmitter final amplifier transistor.

The original purchaser has the option of examining the kit and manual for 10 days. If, within this period, the buyer decides not to build the kit, he/she may return the entire unassembled kit at their own expense for the shipping expenses. The shipping expenses and sales commissions (i.e. bank, Ebay, and Paypal commissions) included in the purchase price will not be returned.

Please, BEFORE returning a product, request instructions by email at: ea3gcy@gmail.com

Javier Solans, EA3GCY, warrants this device to function according to the specifications, provided that it is assembled and adjusted as described in this documentation, and used correctly according to all provided instructions.

It is your responsibility to follow all the instructions in the manual, to identify all the components correctly, and to use good workmanship and proper tools and instruments in the construction and adjustment of this kit.

REMEMBER: This kit will not work as a commercially manufactured product; however, it can often give similar results. Do not expect great performance, BUT YOU ARE SURE TO HAVE LOTS OF FUN!

If you believe that there is a missing component for the kit, please do a thorough inventory of all parts using the parts list in the manual. Check all bags, envelopes and boxes carefully. If needed, you may email me and I will replace any component that you are missing. Even if you can find the exact part locally, please let me know so that we are aware of the problem to help other customers.

I can also supply any part that you have lost, damaged or broken accidentally.

If you find any errors in this manual or would like to make a comment, please do not hesitate to contact me at: ea3gcy@gmail.com

THANK YOU for building the **QPA-1** Amplifier kit.

Enjoy QRP!

73 Javier Solans, EA3GCY

SCHEMATIC

QPA-1 3 to 30MHz. Universal QRP PA and CW TX

