CRK-10 CW Transceiver Kit Manual

Rev. B
CRKITS.COM
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RockMite was introduced to China years ago by BD6CR/4. BD4RG, the designer of HB-1A and HB-1B, improved the design by rewriting the firmware, increasing RF power output, and smoothing the keying. The improved version is called Octopus in China, and already received good reputation and popularity among Chinese QRPers. Now CRKITS.COM proudly introduces this kit to the worldwide, and names it as CRK-10 CW Transceiver kit.

The RF output power is about 3 watt at 12V. Power supply range is 9-15V. TX current is about 500 mA, and RX current is about 15 mA (measured at 12V). The built-in MCU can generate side tone of about 700 Hz, switch RX/TX, and act as a keyer for not only paddle (normal paddle or bug key simulation mode), but also straight key.

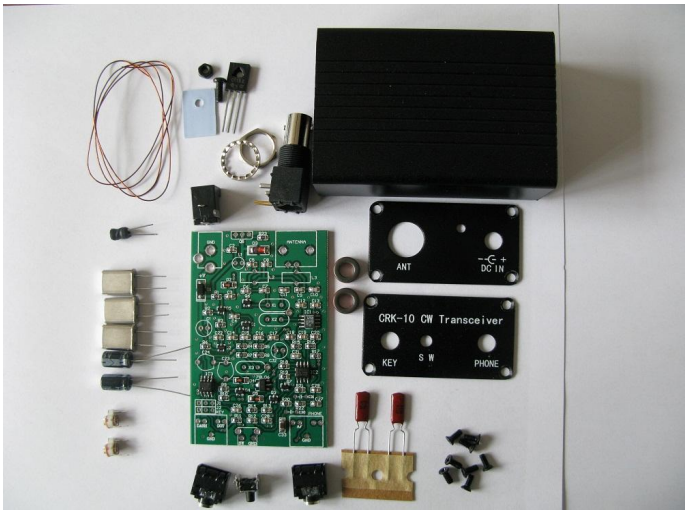
The receiver is a direct conversion receiver, but the sensitivity is very high because of a two-pole crystal filter in the receiver front-end and an audio filter, which block interference and filter out background noise. The MCU automatically shifts TX frequency, generates side tone and acts as the keyer, which makes the whole radio quite practical. The power supply polarity protection and the high SWR protection make the radio durable.

Parts Inventory

Most of the components of this kit are SMD parts and already pre-mounted by factory on PCB, so you will only need to solder about 20 through-hole parts including all the connectors and buttons. Part list is shown below.

Item	Quantity	Value	Comments
Custom case	1	CRK-10, black	With front and rear panels
PCB assembly	1	CW-DC-1N	All SMD parts pre-mounted
Inductor, fixed	1	10uH, black	L1
Inductor, toroid	2	T37-2, red	L2 (10 turns), L3 (12 turns)
Enamel wire	0.4m	0.38mm diameter	For L2 and L3 winding
Capacitor, trimmer	2	9-50pF	C23 (for TX), C24 (for RX)
Capacitor, electrolytic	2	100uF 25V	C1, C32
Capacitor, polyester film	2	0.01uF, 103J	C30, C31
Push button	1	PCB mount	SW
3.5mm jack	2	3.5mm stereo type	PHONE, KEY
DC IN connector	1	2.1mm type	+V, 12-13.8V power supply connector
Crystal	3	7.010, 7.020, 7.025 or 7.030 MHz	X1, X2, X3
Power Amp. transistor	1	2SC1162	Q6
Thermal pad / insulator	1	TO-220 type	With back paste, stick to inner side of the rear panel
M3x8 screw	1	M3x8, black, pan head	For fixing the transistor
M3 nut	1	M3, black	For fixing the transistor
Antenna connector	1	BNC, PCB mount	Black, with washer and nut
Panel screw	8	Black, flat head	For front and rear panels

The whole kit will look like this:

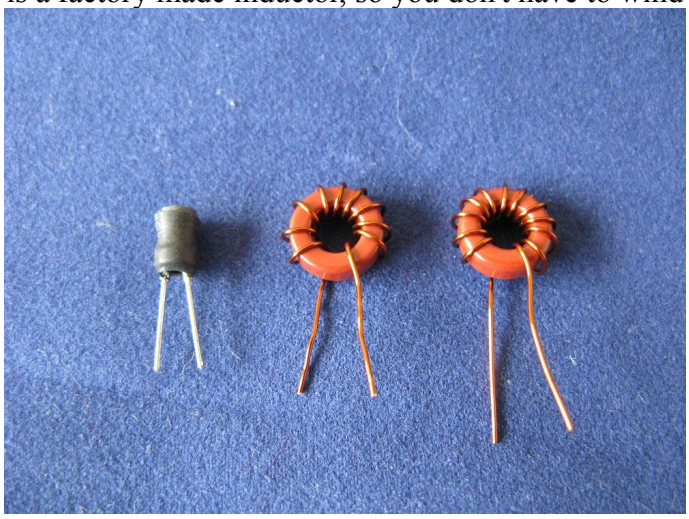


Step by Step Building

It takes about an hour to build and align the kit, so it is an ideal one-evening kit to give you some pure fun of kit building and QRP operation.

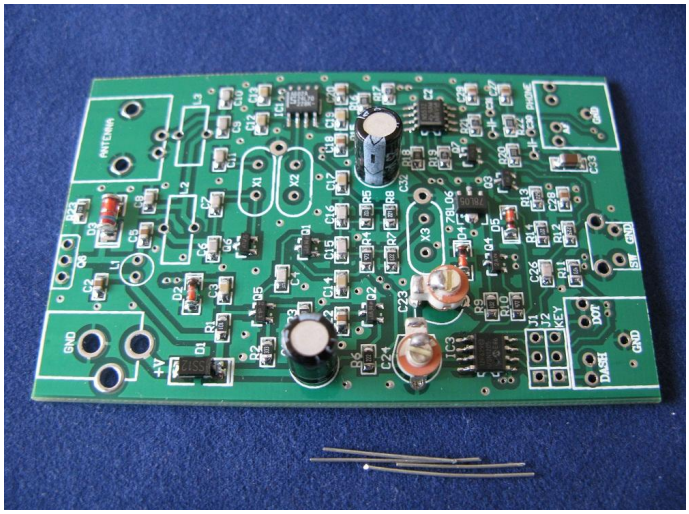
Step 1: Toroids Winding

Follow the picture to wind 10 turns for L2 and 12 turns for L3. They are parts of the low-pass filter to purify the transmitter output. Scratch the enamel of wire endings and tin them well. L1 is also shown in the picture. It is a factory made inductor, so you don't have to wind it here.



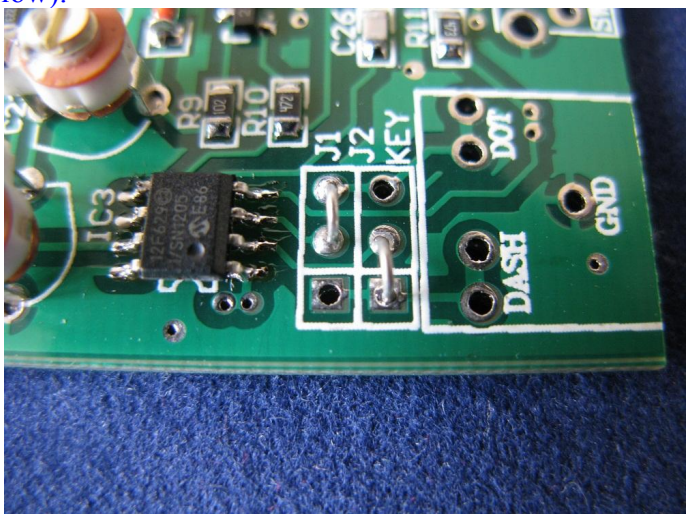
Step 2: Capacitors C23, C24, C1 and C32

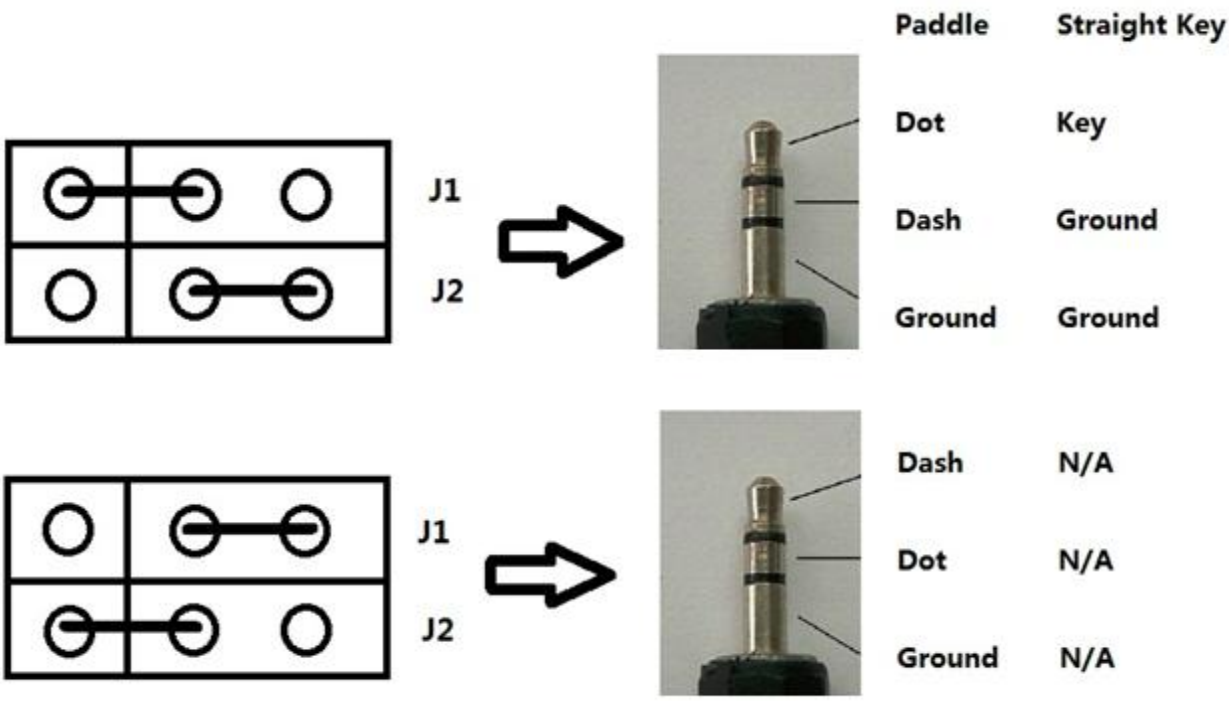
Follow the picture to put C23 in place and solder. Do the same for C24. C24 controls the receiver frequency and C23 in parallel of C24 control the transmit frequency. Proceed to C1 and C32. Check the polarity when you solder. Trim the leads of C1 and C32 and reserve for use in the following steps.



Step 3: J1 and J2 Jumpers

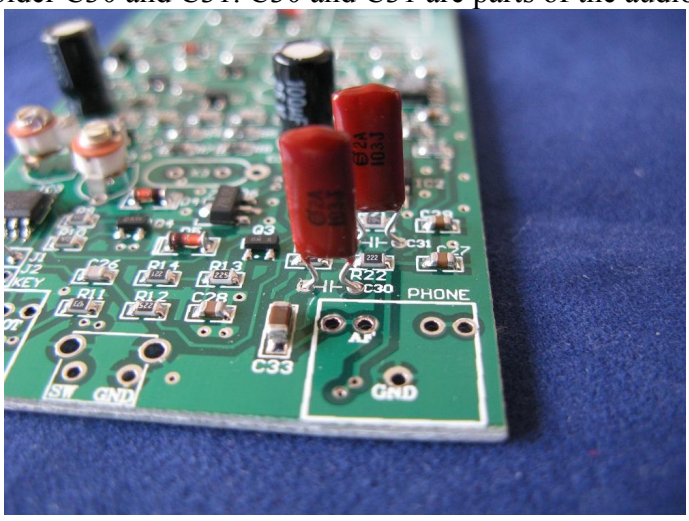
The J1 and J2 jumpers are used to swap dash and dot wiring. Here, we can refer to the diagram to solder two jumper wires. Note that straight key is only supported in one setting (but not the one shown in the picture below).





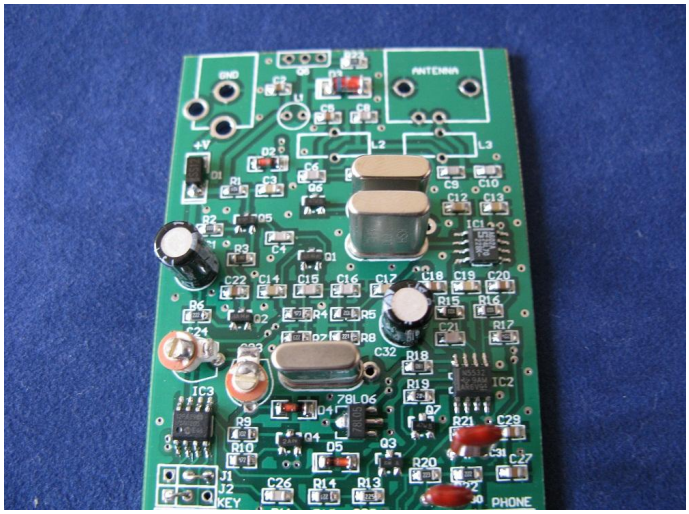
Step 4: Capacitors C30, C31

Follow the picture to solder C30 and C31. C30 and C31 are parts of the audio filter.



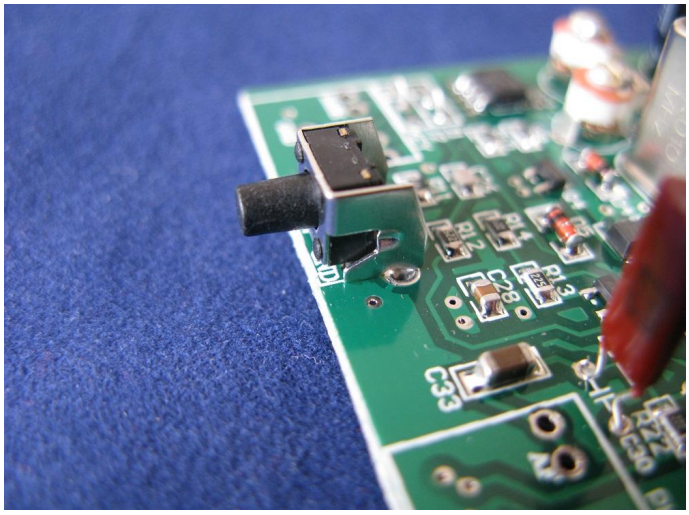
Step 5: Crystals X1, X2 and X3

Follow the picture to solder X1, X2 and X3. X1 and X2 form a 2-pole crystal filter in the front-end of the direct conversion receiver, while X3 is working as the oscillator for both the receiver and transmitter.



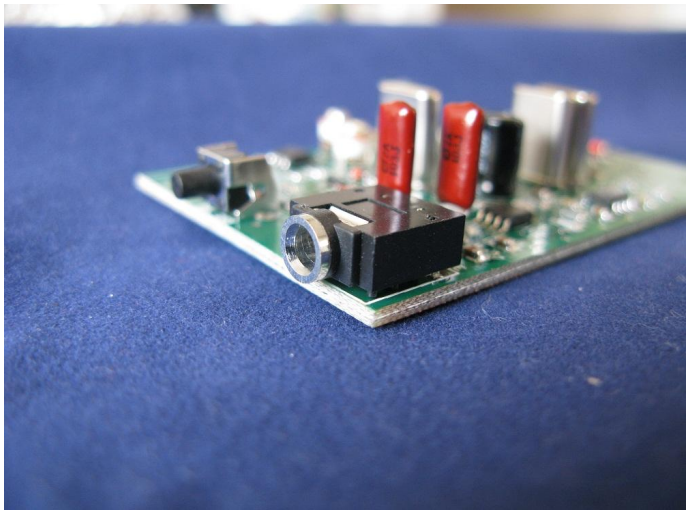
Step 6: Push Button SW

Follow the picture to install and solder SW. SW is an important part of human-machine interface.



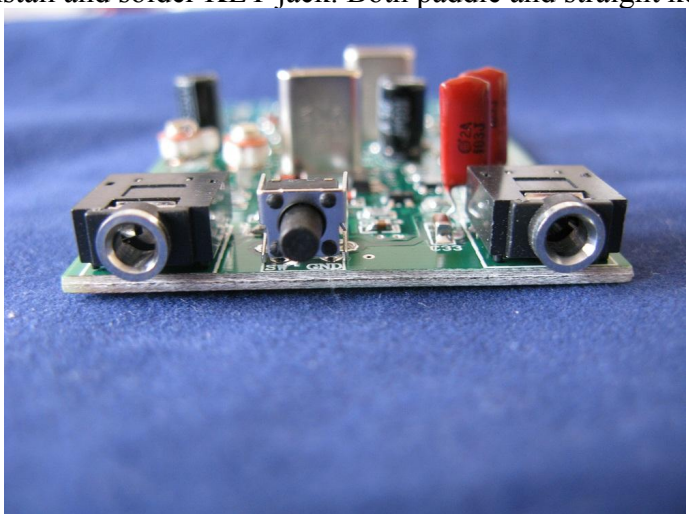
Step 7: 3.5 mm Jack PHONE

Follow the picture to install and solder PHONE jack. Low impedance (around 32 ohm) and high sensitivity stereo headphones are recommended here.



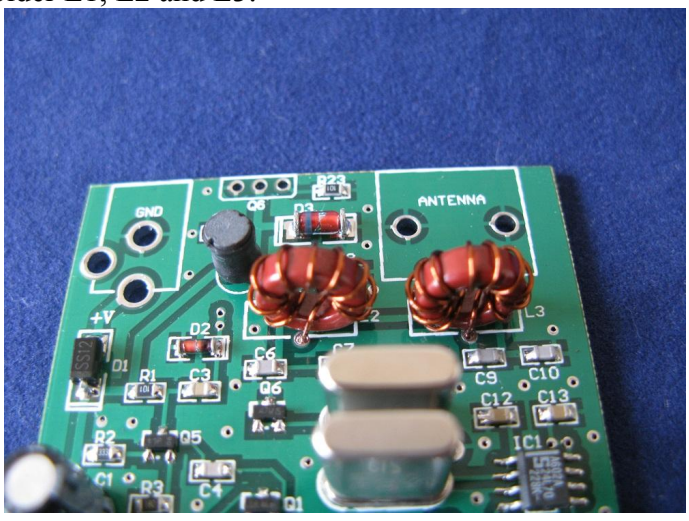
Step 8: 3.5 mm Jack KEY

Follow the picture to install and solder KEY jack. Both paddle and straight key are supported.



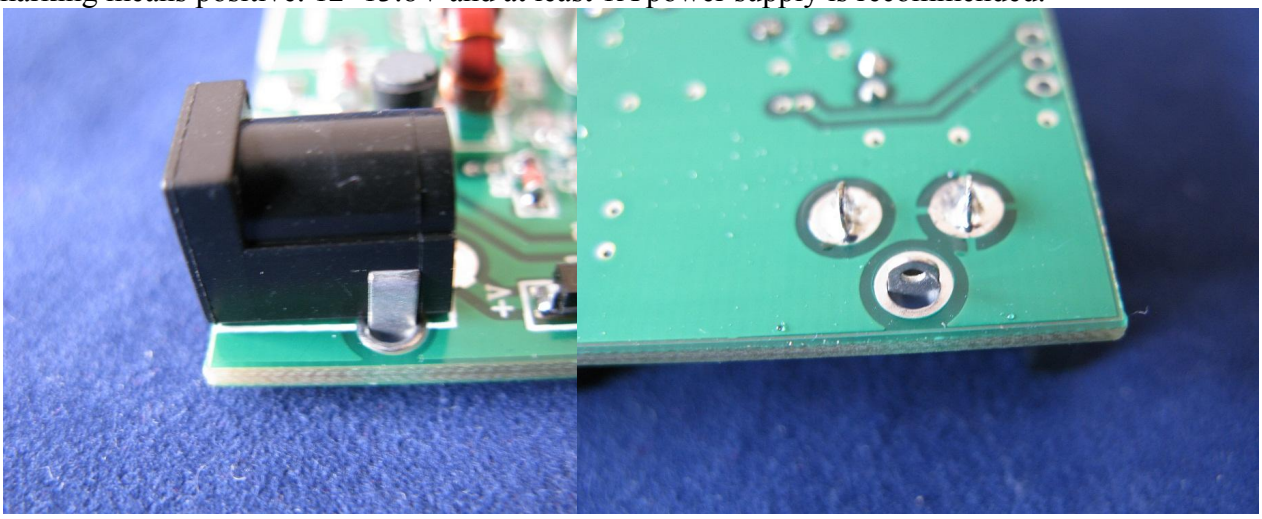
Step 9: Inductor L1, L2 and L3

Follow the picture to solder L1, L2 and L3.



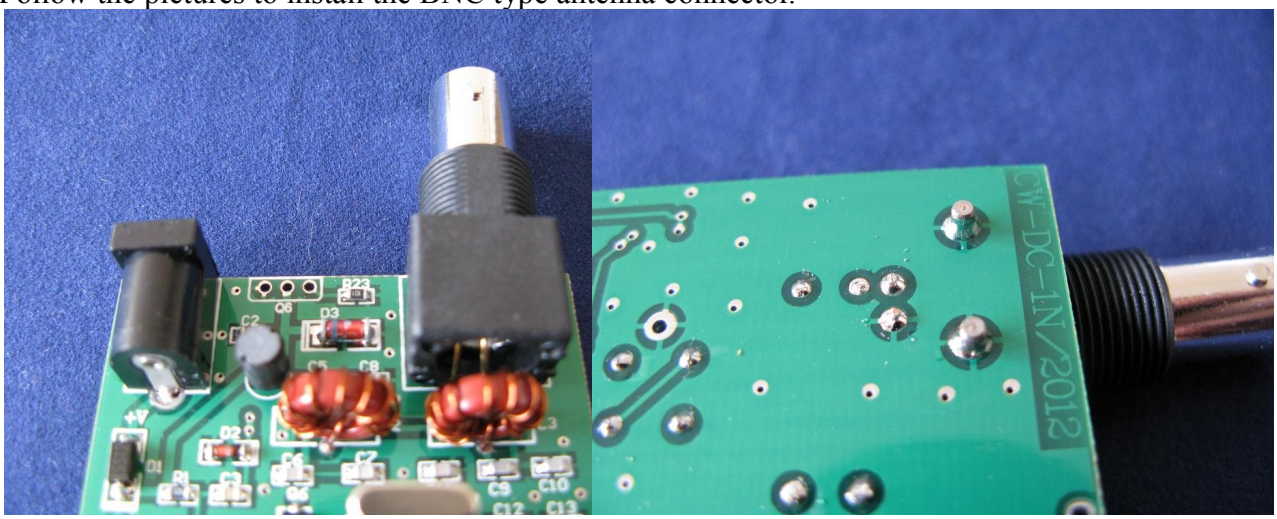
Step 10: DC IN Connector

Follow the pictures to install DC IN connector. Leave one side pin NOT soldered. The center or V+ marking means positive. 12~13.8V and at least 1A power supply is recommended.



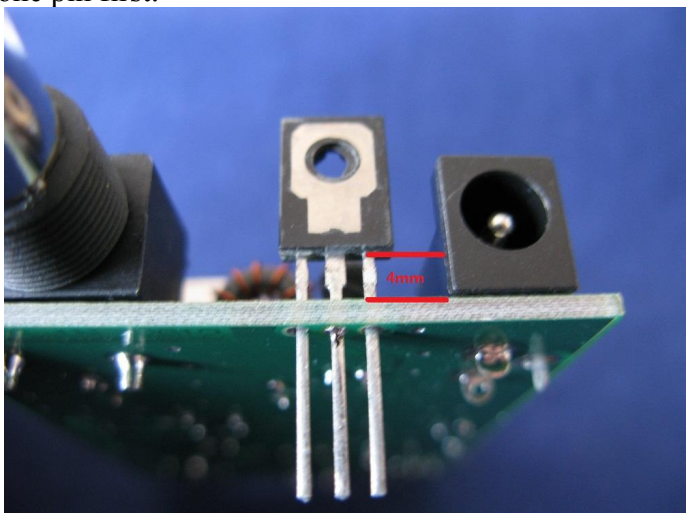
Step 11: Antenna Connector

Follow the pictures to install the BNC type antenna connector.



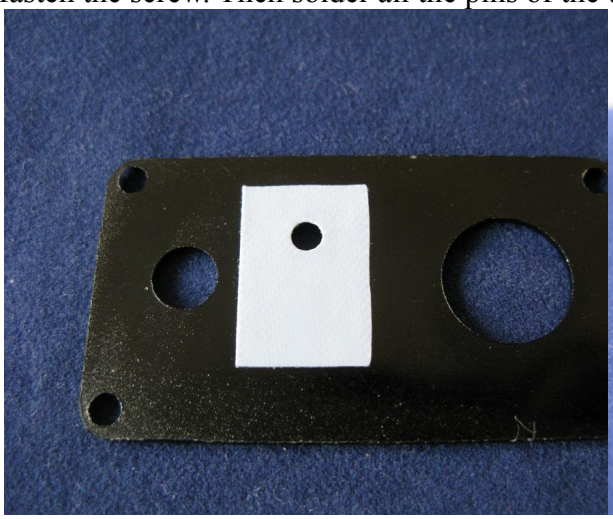
Step 12: Power Amplifier Transistor

Follow the pictures to install the power amplifier transistor. Keep the pin about 4 mm above the board, and only solder one pin first.



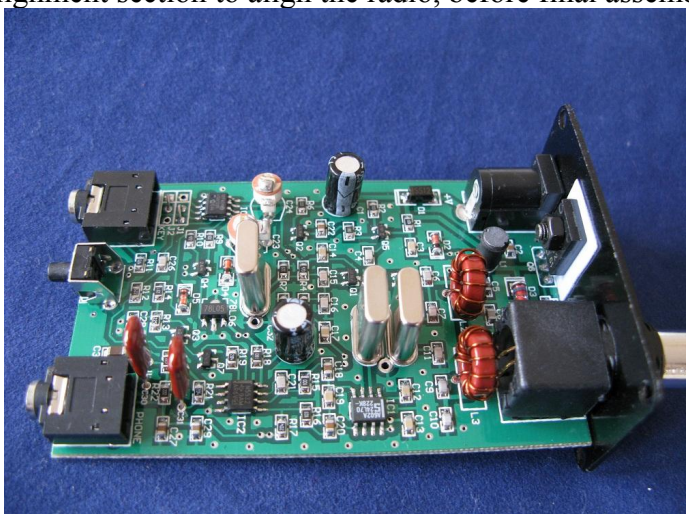
Step 13: Thermal Pad / Insulator

Follow the pictures to stick the thermal pad to the inner side of the rear panel, and fix the transistor to the rear panel by M3 screw and nut. Make sure the DC IN connector can be plugged in when you fasten the screw. Then solder all the pins of the transistor and trim the leads.



Step 14: Ready for Alignment

Follow the following alignment section to align the radio, before final assembly.



Step 15: Final Assembly

Follow the pictures to slide the board to the case and finish the final assembly. Fix the rear panel and front panel by the 8 pcs flat head panel screws. Congratulations! You are done with your building and please enjoy some QSO's now.

Operation

If an effective antenna is used, 3 watt RF power is good enough to make others heard. Although it is a QRP radio, you are encouraged to call CQ to be able to make more successful QSO's. Luckily you can use the push button to automatically call CQ.

Everything else is straightforward but the keyer operation, which will be addressed below. The human-machine interface is made by the push button, a paddle and a headphone.

All parameters will be stored in the MCU, and it will not be lost after power down.

Paddle or Straight Key Keyer Mode Switch

The MCU automatically detects paddle or straight key, as long as you plug in the key before power on. The mechanism is that the MCU detects if the ring of the 3.5 mm stereo plug (pin 3 of the MCU) is permanently short with the shield (ground) or floating. For straight key, it is short. For paddle, it is floating. If you hear Morse code A (Automatic) after power on, it means a paddle is detected and it works in normal paddle mode; Morse code B (Bug) means a paddle is detected and it works in bug key simulation mode; and Morse code M (Manual) means a straight key is detected and it works in straight key mode.

Auto CQ

Briefly press SW button and it automatically send CQ CQ CQ DE + your call three times + K. If you want to stop the auto CQ, press and hold SW button for 1 sec and release.

Speed Adjustment

Press SW button for more than 2 sec, you will hear Morse code S (speed). Release it and adjust the keying speed by paddle within 8 sec (or it automatically exits to keep the original speed). Press dot will increase the speed, and press dash will decrease the speed. Briefly press SW button and you can hear Morse code E to confirm exit, or wait about 8 sec to automatically exit.

Call sign Input

Press SW button for about 2 sec, you will hear Morse code S (speed). Keep pressing for another 2 sec, you will hear Morse code I (input). Release it and input your call sign (up to 10 character) just like you make QSO with your paddle within 8 sec (or it automatically exits to keep the original call sign). Briefly press SW button and you can hear Morse code E to confirm exit, or wait about 8 sec to automatically exit.

Paddle Mode Selection (Normal Paddle/ Bug Simulation)

Press SW button for about 2 sec, you will hear Morse code S (speed). Keep pressing for another 2 sec, you will hear Morse code I (input). Keep pressing for another 2 sec, you will hear Morse code M (mode). Release it and send dot by your paddle, you will hear Morse code NOR, and the radio will be chosen to work in normal paddle mode. If you send dash by your paddle, you will hear Morse code BUG, and the radio will be chosen to work in bug simulation mode. In bug simulation mode, dots will be sent automatically by the MCU and dashes will be sent manually. Note that the keyer does not actually support mechanical bug key.

Adding /QRP

You can choose to add /QRP or not in auto CQ. Press SW button and power on the radio, you will hear normal Morse codes (A or M or B) to indicate working mode. Keep pressing SW button for 1

sec or 2, you will hear Morse code QRP. Release it and now auto CQ will add /QRP after the third time of your call sign. Repeat the above operation you will hear Morse code NO, and it means auto CQ will not add /QRP.

Alignment

It is preferred that you have a power supply of 12~13.8V with short circuit protection. Connect the power supply to the CRK-10 to see if it works. The overall receive current should be about 15 mA.

Disconnect the power supply, connect a headphone, a paddle and an antenna or a 50 ohm dummy load, then connect the power supply again, you should hear dot dash. Touch the antenna connector center pin with tweezers, and you should hear some clicks. It means the receiver works.

Now proceed to TX alignment. Enter the straight key mode and press and hold the key to see if the overall current is about 500 mA. If it is, it means the transmitter works.

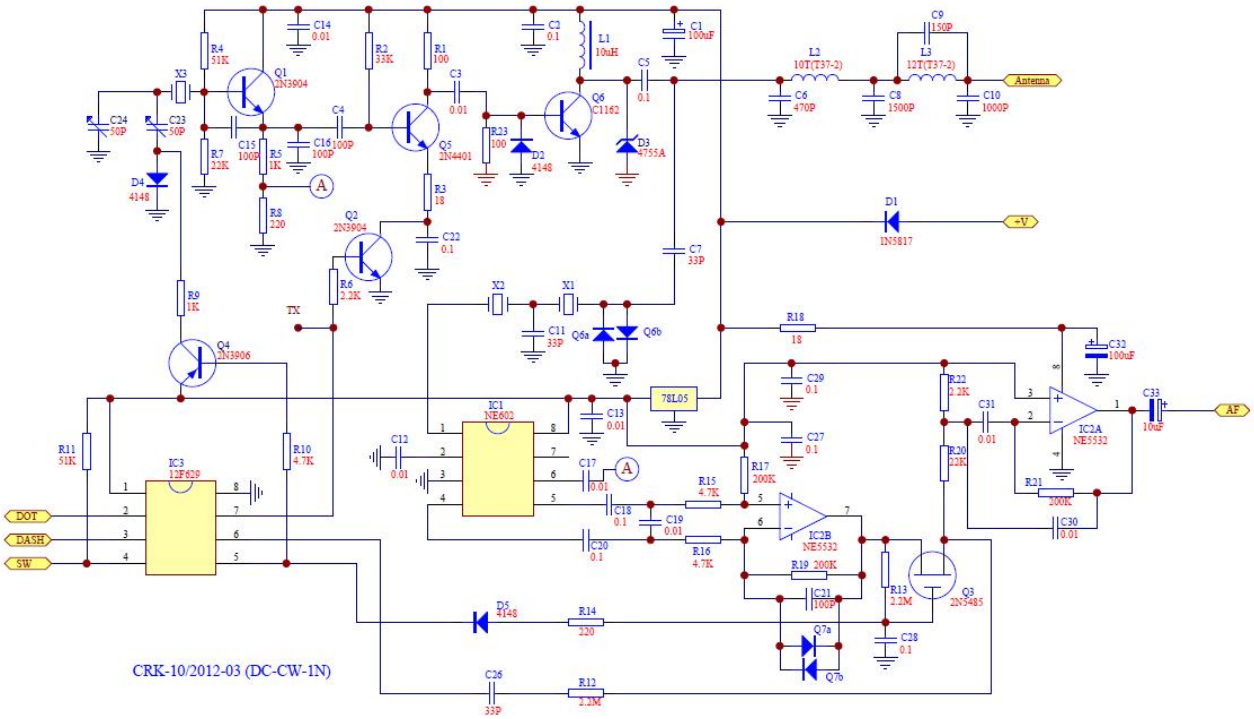
Use a commercial amateur radio to transmit a CW tone at the specified frequency, and adjust the capacitor trimmer C24 to make the receiver frequency exactly on the specified frequency (the tone from the headphone is loud and clear, within 700~800 Hz range). Adjust the capacitor trimmer C23 to make the transmit frequency exactly to the specified frequency.

Theory of Operation

The MCU servers a controller and a keyer. It controls RX/TX switch, including receiver mute and transmit frequency shift. As a keyer, it reads the key input, keys the transmitter to send the signal and generate side tone as well.

The receiver is a typical NE602 direction conversion receiver, with the exception that it only receives one frequency, so a 2-pole crystal filter is added in the front-end to block most of the broadcast interference out. The NE5532 op-amp serves as an audio filter and amplifier to drive a headphone. Q3 2N5485 is controlled by the MCU to mute the receiver in transmit.

The transmitter chain is simple. 2N3904 is the oscillator. C24 controls the receiver frequency and C23 in parallel of C24 control the transmit frequency. 2N4401 is a buffer amplifier and it is also a keying circuit. The power amplifier is 2SC1162. The LPF filters the transmit harmonic signals.



Troubleshooting

If the receive current is much higher than 15 mA, it means the circuit has issue. Inspect all the components to make sure they are installed properly, especially the components with polarity such as electrolytic capacitors, and IC orientation. If all the components are installed properly but the symptom persists, most likely it is because of the PCB short. Please inspect carefully and cut the short circuit trace by a knife.

You can also refer to the following voltage chart to help you find the issue. If the voltages of one IC is abnormal, normally you can check the IC itself or its peripheral components.

Reference voltage on each IC: (Power supply 12V, measured in RX mode)

Pin	1	2	3	4	5	6	7	8
IC1	1.4	1.4	0	3.9	3.9	4.9	4.2	5
IC2	5	5	5	0	4.8	5	5	11.8
IC3	5	5	5	5	5	0	0	0