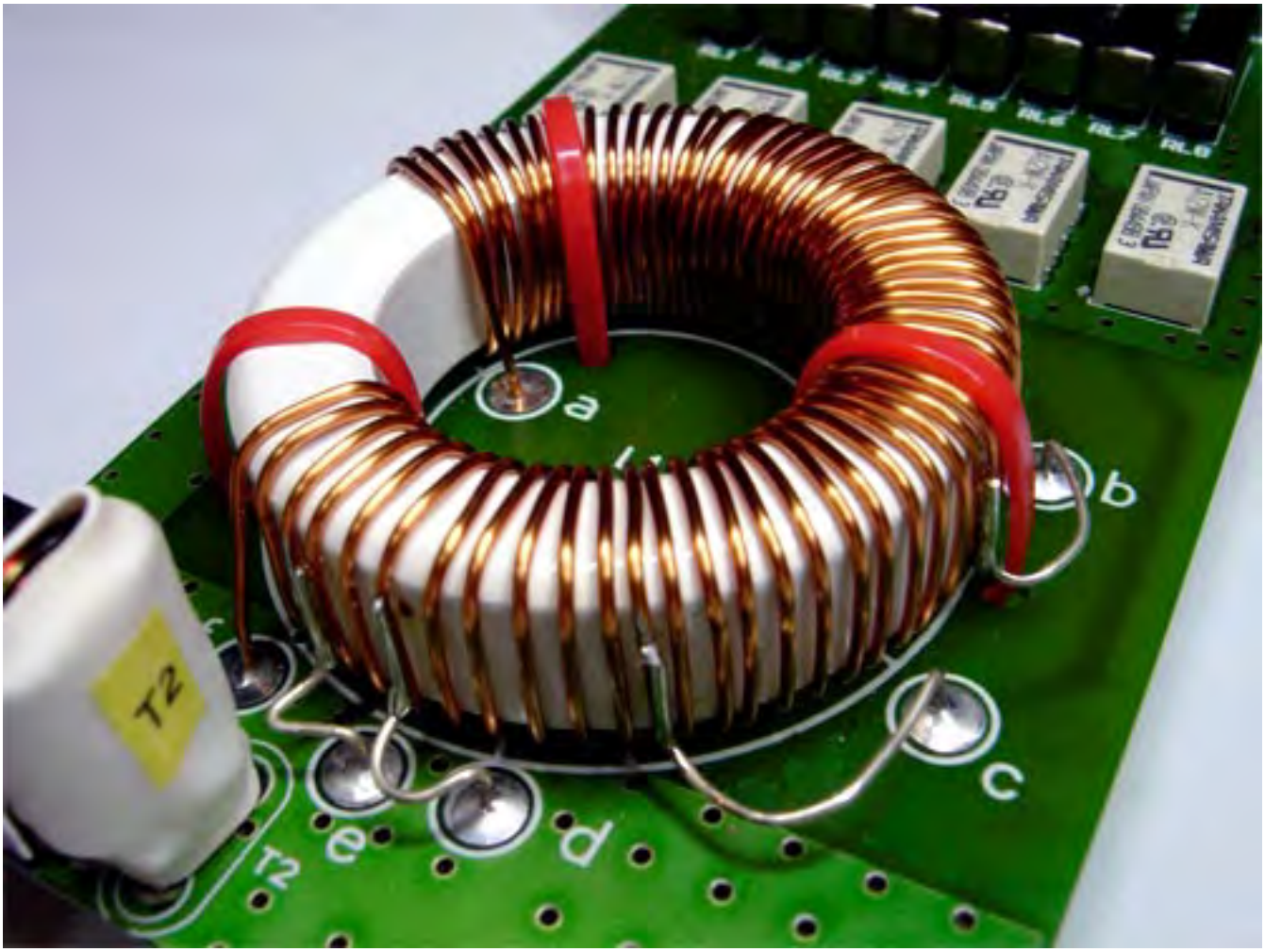
HEROS
technology Ltd
general electronics



tiny SCR Preselector Kit version. Assembly manual.

Modular 1.8MHz to 30MHz Tunable Band Pass Filter.

Software Controlled Radio Preselector via USB or I2C bus

Revision B. October 2009

Preventing Electrostatic Discharge Damage

There is no climate or work location where the components of your tiny SCR Preselector are safe from Electrostatic Discharge (ESD) unless you take specific steps to prevent such damage.
Many of the components in your tiny SCR Preselector can be damaged by static discharges of only a few volts far too little for you to notice. It is those low-voltage but destructive discharges that easily happen anywhere and under virtually any environmental conditions.
ESD damage may not be apparent at first. The damaged components may not fail completely. Instead, the damage may result in below-normal performance for an extended period of time before you experience a total failure.

How ESD Damage Occurs

Whenever an object containing a static charge touches a circuit in your tiny SCR Preselector, current will rush into the circuit until the components reach the same voltage as the source of the static charge.
If the voltage or current that passes through a component in your tiny SCR Preselector during that brief period exceeds its normal operating specifications, it may be damaged or destroyed.

Preventing ESD Damage

ESD damage cannot occur if there is no voltage difference between the components in your tiny SCR Preselector and any object that touches them.
That is how anti-static packaging works. Anti-static bags allow the static charge to flow over their surface, so that any part of the bag that touches the components inside are all at the same potential at all times.
Anti-static foam keeps the leads of sensitive components at the same potential.
At your work bench, avoiding a dangerous voltage is achieved most easily by tying everything together and connecting them to a common mains safety ground. This includes your tiny SCR Preselector, individual boards or other sensitive components as well as everything they may touch at the work table.
Inexpensive static dissipating work mats are readily-available that will steadily and safely drain off any charges built up on parts or circuit boards placed on them.
They are supplied with a lead that connects the mat to the common workbench ground.
Also, metal cabinets on test equipment used on the bench should be tied togetherand connected to the common ground.
Most importantly, you must have a way of continuously draining off any static charges that occur on your body. Such charges are easy to create, even while sitting quietly at the work bench. Moving your feet on the floor, shifting position in your chair or even moving your arms so that clothing rubs against itself can all produce destructive static charges. You can discharge yourself by touching an unpainted metal ground, but that will last only until you move in a way that produces a new static charge. The safest technique is to wear a grounded wrist strap with a series 1-megohm resistor that continuously drains off any charges. Such wrist straps are readily available and inexpensive.

WARNING

DO NOT attach a ground directly to yourself without a current-limiting resistor as this poses a serious shock hazard.
A wrist strap must include a 1-megohm resistor to limit the current flow.
If you choose to touch an unpainted, metal ground to discharge yourself, do it only when you are not touching any live circuits with your other hand or any part of your body.
We strongly recommend you take the following anti-static precautions to avoid trouble:
- Leave ESD-sensitive parts in their anti-static packaging until you install them. The packaging may be a special plastic bag or the component's leads may be inserted in conductive foam. Parts which are especially ESD-sensitive are identified in the parts list and in the assembly procedures.
- Wear a conductive wrist strap with a series 1-megohm resistor. If you do not have a wrist strap, touch a ground briefly before touching any sensitive parts to discharge your body. Do this frequently while you are working. You can collect a destructive static charge on your body just sitting at the work bench. DO NOT attach a ground directly to yourself as this poses a serious shock hazard.
- Use a grounded anti-static mat on your work bench.
- Be sure the iron is ESD-safe with a grounded tip tied to the same common ground used by your mat or wrist strap.

Unpacking and Inventory

Preventing Electro-Static Discharge Damage

The PIC microcontroller used in the tiny SCR Prelelector is sensitive to Electro-Static Discharge (ESD) damage. ESD damage may not make the preselector fail completely. Sometimes the unit may continue to operate somewhat, creating a very difficult-to-find problem. We strongly recommend that you take the following precautions whenever handling the PC boards when the microcontroller is installed.

The precautions are listed in their order of importance:

1. Leave the PIC microcontroller in its anti-static packaging until you install it.
2. Wear a conductive wrist strap with a 1-megohm series resistor when handling the PIC microcontroller or the boards with the PIC installed. If you do not have a wrist strap, frequently touch an unpainted ground while working. You can collect a destructive charge on your body just sitting at the work bench.
Do not attach a ground directly to yourself as this poses a serious shock hazard.
3. Use an ESD-safe soldering iron with a grounded tip.
4. Use a grounded anti-static mat on your work bench.

Before starting construction, do a complete inventory, comparing the parts in your kit with the parts list to familiarize yourself with all of the parts and to ensure the kit is complete.
If you find anything missing, please contact with us.

tiny SCR Preselector Band Pass Filter module. Bill of materials

Description	Designator	Description	Quantity
Chip Cap	C1	1PF NPO 0805	1
Chip Cap	C2	2p2/50V 0805 NPO	1
Chip Cap	C3	3p9/50V 0805 NPO	1
Chip Cap	C4-C4a	4p7 +2p2 /50V 0805 NPO	2
Chip Cap	C5	12pF/50V 0805 NPO	1
Chip Cap	C6	22PF 0805 50V NPO	1
Chip Cap	C7-C7a	39pF + 5p6 pF/50V 0805 NPO	2
Chip Cap	C8-C8a	82pF + 2p2 /50V 0805 NPO	2
Chip Cap	C9	220PF 0805 50V NPO	1
Chip cap	C10 and C100	100NF 50V 0805 X7R	40
Chip cap	C11	10UF 1206 10% 16V X5R	1
Ceramic Disc	C12	1nF ceramic disk	1
Relay	RL1-RL8	12 VOLT SIL REED RELAY-SIL12-1A72-71Q MEDER	8
Relay	RL9-RL13	A12-WK 12V DPDT MICRO RELAY	5
Diode	D	LS4148 FAST SWITCHING DIODE SOD-80	5
Toroid	L1	T200-7 Micrometals (white)	1
Enam. Wire		3mts./0.91mm diameter/20SWG/ ENAM. WIRE	1
Cable Tie		Coloured Cable Ties 98mm x 2.5mm	3
tinned wire		0.3mt/1mm 20SWG/ TINNED WIRE	1
Transformers	T1-T2	Assembled	2
Gas discharge	GDT	BT11A TYPE GDT SL1011A230A	1
SMD inductor	In	SMD 1812 AF INDUCTOR 100 UH	26
BNC Socket	J1-J2	L/P SCREENED BNC ELBOW SOCKET	2
IDC	J3	16 WAY IDC STRAIGHT BOXED HEADER	1
Spacer		10MM M3 HEX THREADED F-F SPACERS	4
screws		M3 x 8mm.	4
Washer		M3	4
PCB		Band Pass Filter module	1

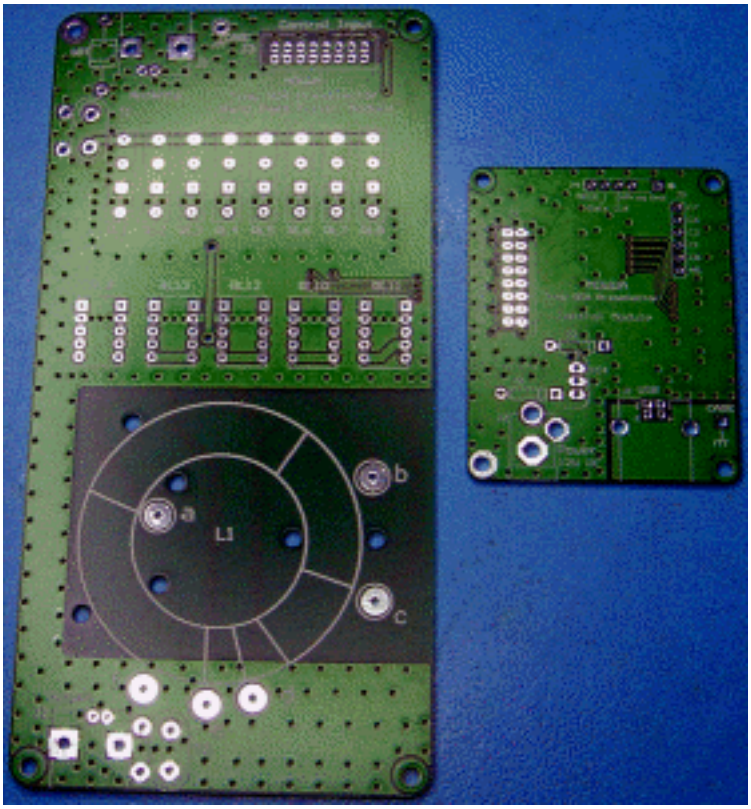
tiny SCR Preselector PIC Control module. Bill of materials

Description	Designator	Description	Quantity
SMD resistor	R1	27 Ohms 0805	1
SMD Resistor	R2	27 Ohms 1206	1
Chip Cap	C1-C2	27PF 0805 50V NPO	2
Chip Cap	C3	470NF 16V 0805 X7R	1
Chip Cap	C5-C6	330PF 0805 50V NPO	2
Chip Cap	C4,C7,C8,C27,C28, C10- C24	100n/50V 0805	20
Chip Cap	C9-C25	10UF 1206 10% 16V X5R	2
Tantallum cap	C26	22uF 16V CHIP TANT.	1
PIC	IC1	Preprogrammed PIC 18F 2455 / package PDIP SOIC 28 pins	1
IC	IC2-IC3	ULN2803ADWG4 DARLINGTON DRIVER	2
IC4	IC4	7805CV REGULATOR TO-220	1
Diode Array	DARY	Littlefuse SP0503BAHTG Diode Array	1
Diode	D1-D2	1N5817 SCHOTTKY DIODE 20V 1A	2
Crystal	XT	4MHz ACT HC49/US-SMX	1
Cable Tag		USB Earth connection	1
Connector	J1	SINGLE B SERIES USB CONNECTOR	1
Connector	J2	2.5mm PCB DC POWER SOCKET	1
Connector	J3	16 WAY IDC STRAIGHT BOXED HEADER -Red dot	1
Ribbon cable	J3 to J3	0.25m RIBBON CABLE GREY 16 WAY with two IDC sockets	1
Connectors	J4	4 + 1 WAY SINGLE ROW HEADER	1
Connectors	J5	6 WAY SINGLE ROW HEADER	1
Spacers	Hexagonal	10MM M3 HEX THREADED F-F SPACERS	4
Screw	M3	M3 x 8mm.	4
Washer	M3		4
PCB	PCB	Control Module	1
USB Cable		Type A-B USB cable	1
CDROM		Software and manuals	

Preparing for Assembly

Overview

The tiny SCR Preselector kit version comprises two PCB assemblies: the main tunable Band Pass Filter module and the Control module. The figure shows the two high-quality double-sided plated through hole bare PC boards.



Tools Required

You will need the following tools to build this kit:

- Fine-tip temperature-controlled ESD-safe soldering station with grounded tip 370-430°C (700 to 800°F) lonf life type no greater than 1 mm.
- High wattage (approx. 100 watt) iron to solder the BNC connectors and tin coil leads. Use the temperature-controlled station for all other soldering.
- IC-grade, small-diameter solder wire no more that 0.7mm in diameter. Small diameter solder is important to avoid filling adjacent solder pads and creating solder bridges.
- DO NOT use acid-core solder wire or water-soluble flux solder.
- High quality Flux pen solder such as Electrolube.
- Flux residue remover.
- Fine tips Tweezers
- Small diagonal cutters. Flush-cutting type required.
- Magnifying visor or magnifying glass with a hands-free stand.
- Desoldering tools and supplies are invaluable. Narrow solder wick or a good vacuum desoldering are recommended.
- Razor blade. Single cutting edge with rigid stiffner. To scratch enameled wire.
- A 12V 1 Amp. Power Supply with Voltimeter and Ammeter.

The following tools are strongly recommended:

- ESD wrist strap.
- Static dissipating work mat.
- Eventually a Digital Multimeter (DMM)

Soldering and Desoldering

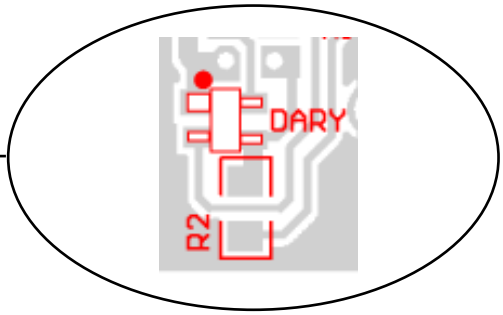
Use adequate ventilation when soldering; avoid inhaling smoke or fumes. Always wash your hands after handling solder, as lead residue is highly toxic.
When applying solder, use the minimum amount required to surround the component lead and make good contact with its printed-circuit pad. You don't need a "fillet" (build-up) of solder. This will avoid unwanted solder bridges and any need to clean the PC boards.
The solder must flow onto both the component lead and its PC board pad. To ensure that both will be heated at the same time, the tip of the iron should contact both the component lead and the PC board pad before solder is applied.
Solder joints should be clean and shiny. If a joint appears dull or has fine cracks, it is probably cold. Cold solder joints should be cleaned and re-soldered. First, use solder wick (desoldering braid) to remove the old solder. Then apply fresh solder. If you have many cold solder joints, it probably indicates that your soldering iron temperature is too low, or that the tip or solder itself is defective.
The SCR Preselector kit version uses ROHS compliance high-quality double-sided PC boards. Removing components can be difficult, since you must get all of the solder back out of the hole before a lead can be removed. To do this, you'll need solder wick (desoldering braid) and/or a vacuum desoldering tool. It also takes some practice. A number of suggestions are provided below.
The best strategy for avoiding de-soldering is to place all components properly the first time. Double-check values and orientations, and avoid damaging parts via ESD.

When removing components:

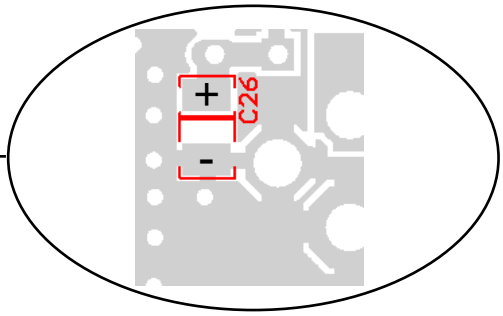
- Don't pull a lead or pin out of a hole unless the solder has been removed or you are applying heat. Otherwise you can literally pull the plating out of the plated-through hole.
- Limit soldering iron contact to a few seconds at a time.
- Use small-size solder-wick, about 2.5 mm wide (0.1"). Use the wick on both the top and bottom pads when possible. This helps get all of the solder out of the hole.
- If you use a vacuum desoldering tool (solder sucker), use a large unit. Small solder suckers are not very effective.
- The safest way to remove ICs and other components with more than 3 leads is to clip all of the pins at the body of the device first, then remove all of the pins individually. You may damage pads and traces by trying to remove such components intact.
- Invest in a PC board vice with a heavy base if possible. This makes parts removal easier because it frees up both hands.

Assembling the Control board module

Either wear a grounded anti-static wrist strap or touch an unpainted, grounded object before handling IC1, IC2 and IC3 in the next step.
Using Fig. 1 as reference, bottom side:

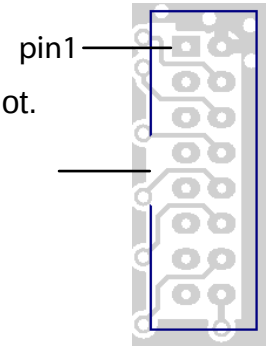


- ☐ IC1, IC2 and IC3, Check the position
- ☐ Diode array DARY, Check the position
- ☐ R1 27Ω/0805
- ☐ R2 27Ω/1206
- ☐ C1,C2 27pF/0805
- ☐ C3 470n/0805
- ☐ C5,C6 330pF/0805
- ☐ C4,C7,C8,C27,C28, C10 to C24 100n/0805
- ☐ C9,C25 10uF/1206
- ☐ C26 22uF Tantallum, Check the position
- ☐ XT, Crystal
- ☐ Mount the spacers



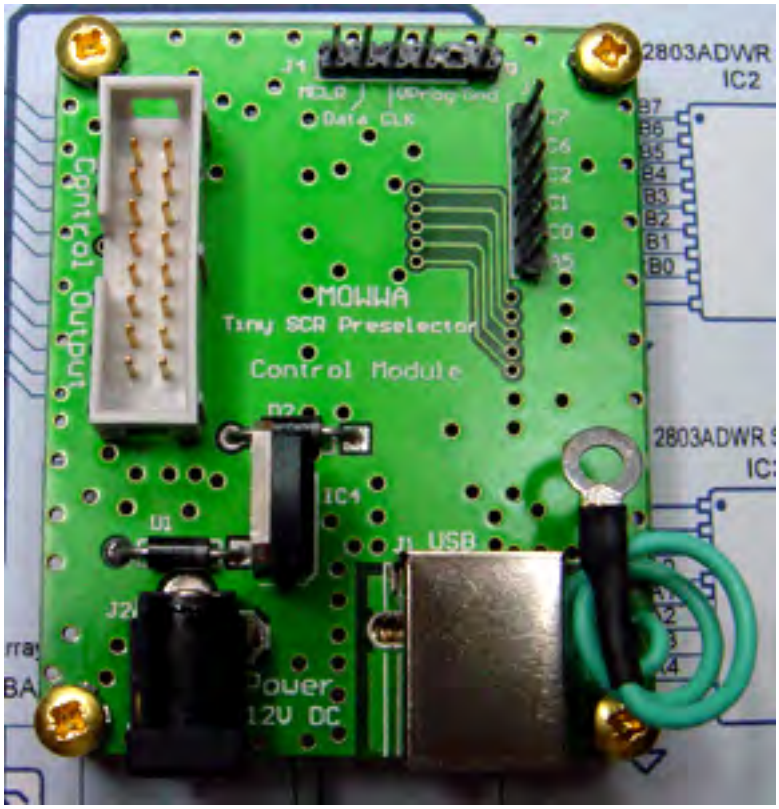
Using Fig. 2 as reference, top side:

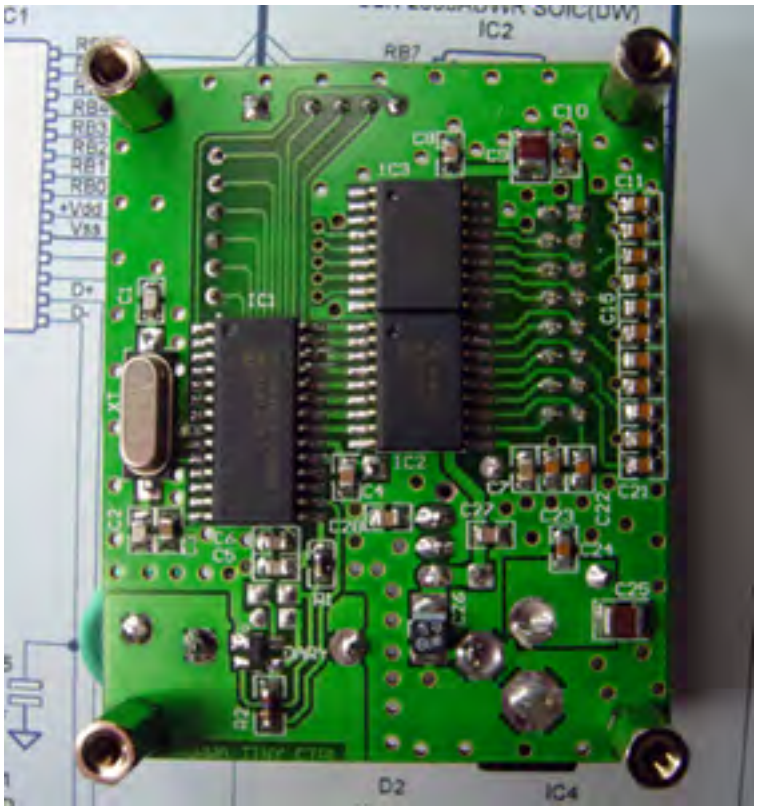
- ☐ Connector J4 4+1 pins (one pin blank)
- ☐ Connector J5 6 pins
- ☐ D1, D2 1N5817 axial, Check the position
- ☐ J1 USB connector
- ☐ J2 Power connector
- ■ J3, IDC connector red spot, Check the position of center polarizing slot.
- ☐ IC4 7805 CV, Check the position
- ☐ Cable tag on pad labelled “CASE”



Visual Inspection

Use a magnifier and carefully check the board for any missed solder connections or solder bridges.
Verify that there are no leads or solder fillets too high on the bottom side of the board.
Clean the PCB.





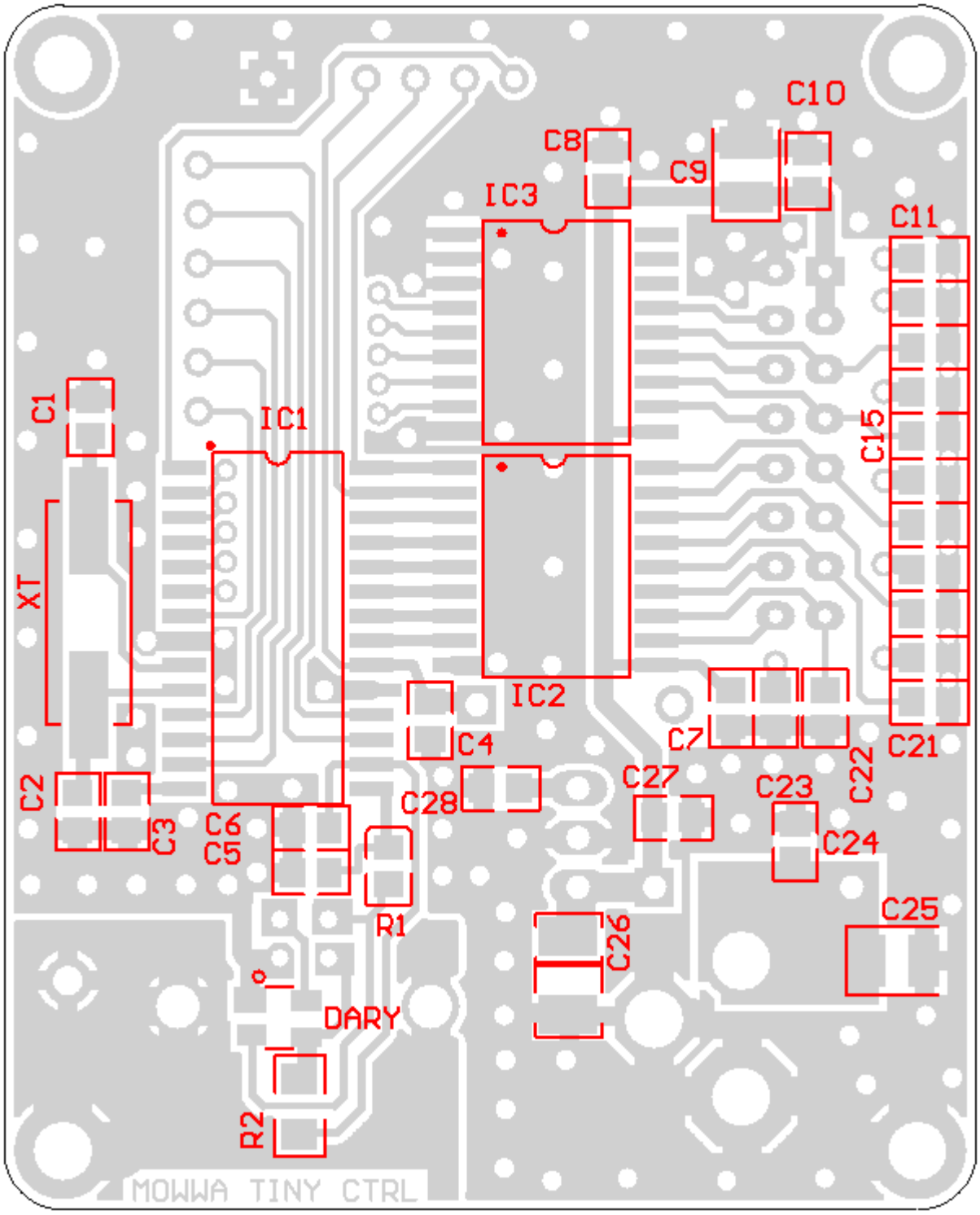


Fig. 2 Control module board. Top view

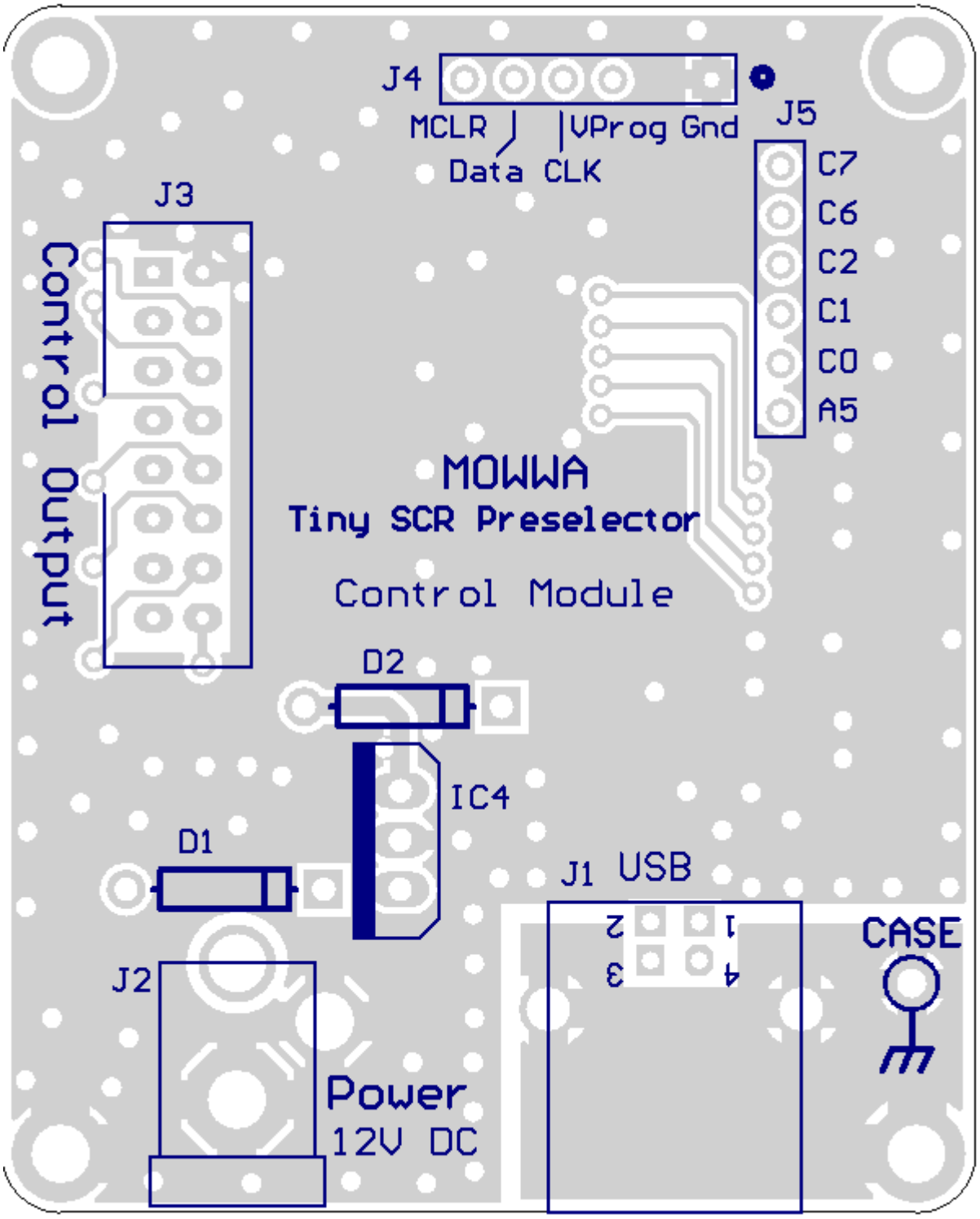
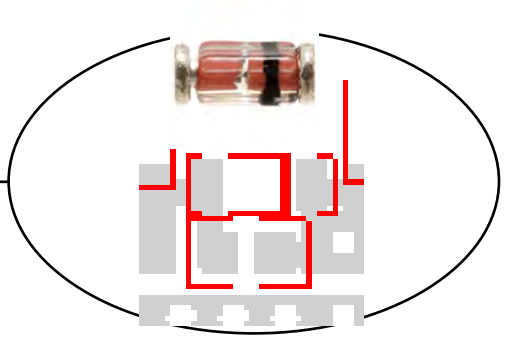


Fig. 1 Control module board. Bottom view

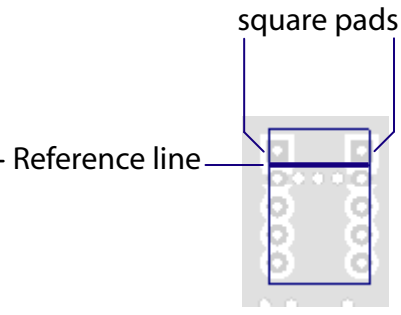
Assembling the Band Pass Filter module

Using Fig. 3 as reference, bottom side:

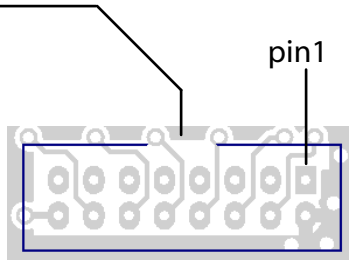


- ☐ Five diodes labelled "D" LS 4148, Check the position
- ☐ Twenty seven 100n chip caps labelled "C10"
- ☐ Thirteen 100n chip caps labelled "C100"
- ☐ C11, 10uF, 1206, chip cap.
- ☐ Twenty six SMD inductors labelled "In"
- ☐ C9, 470pF chip cap.
- ☐ C1, 1pF chip cap
- ☐ C2, 2p2 chip cap
- ☐ C3, 3p9 chip cap
- ☐ C4,C4a, 4p7 + 2p2 chip cap
- ☐ C5, 12pF chip cap
- ☐ C6, 22pF chip cap
- ☐ C7, C7a, 39pF + 5p6 chip cap
- ☐ C8, C8a, 82pF + 2p2 chip cap
- ☐ Mount the spacers.

Using Fig. 4 as reference, top side:



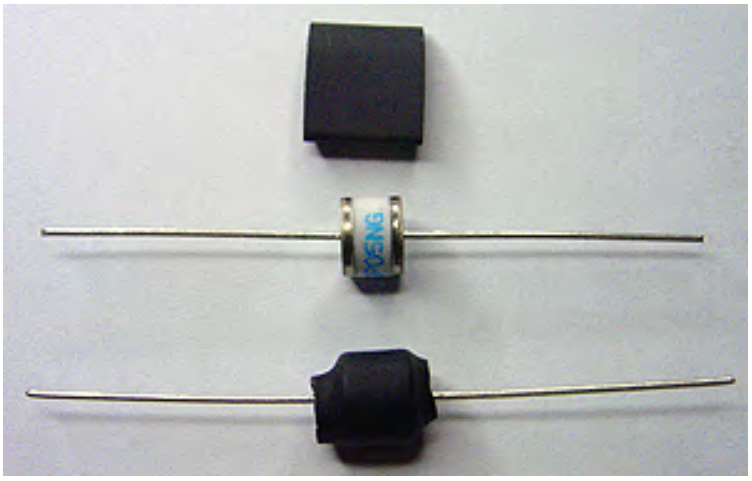
- ☐ Relays RL9 to RL13. Check the position.
- ☐ Connector J3. Check the position of center polarizing slot.

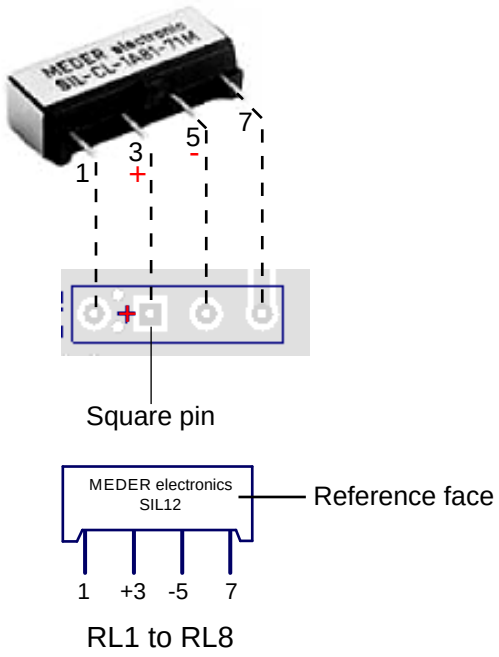


☐ Relays RL1 to RL8. Check the position
(diode in parallel with the coil incorporated in relay)

☐ J1-J2 BNC connectors

☐ Gas Discharge tube labelled “GDT”
(isolated with thermal shrinkable sleev)





A hairdryer can be used to shrink the tube onto the GDT.

Toroidal coil L1. T200-7 white core.

60 turns on toroid core T200-7, 0.9mm, #19AWG, ennamelled copper wire.
The wind starts from outside, pad “f”, towards inside, winding counterclockwise finishing at pad “a”.
Gap among turns 2.5mm (100mil) roughly. Turns uniformly distributed along winding.

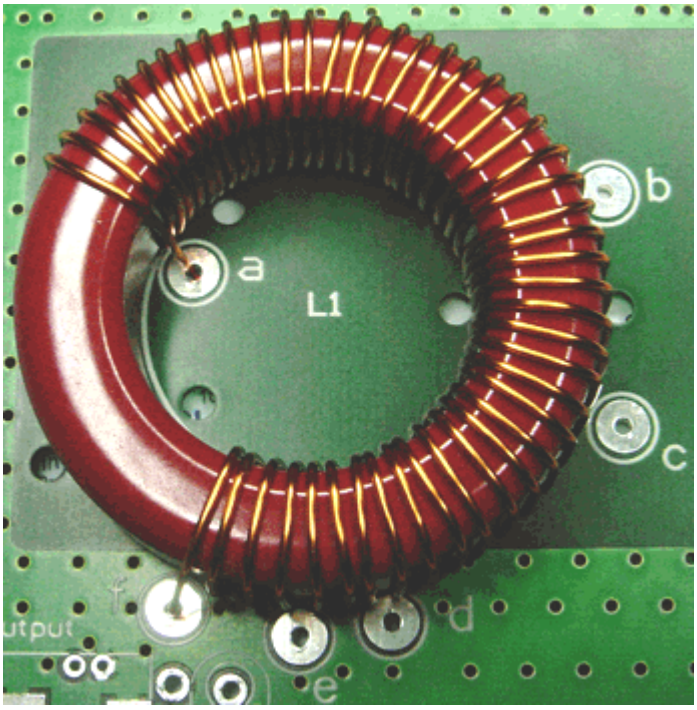
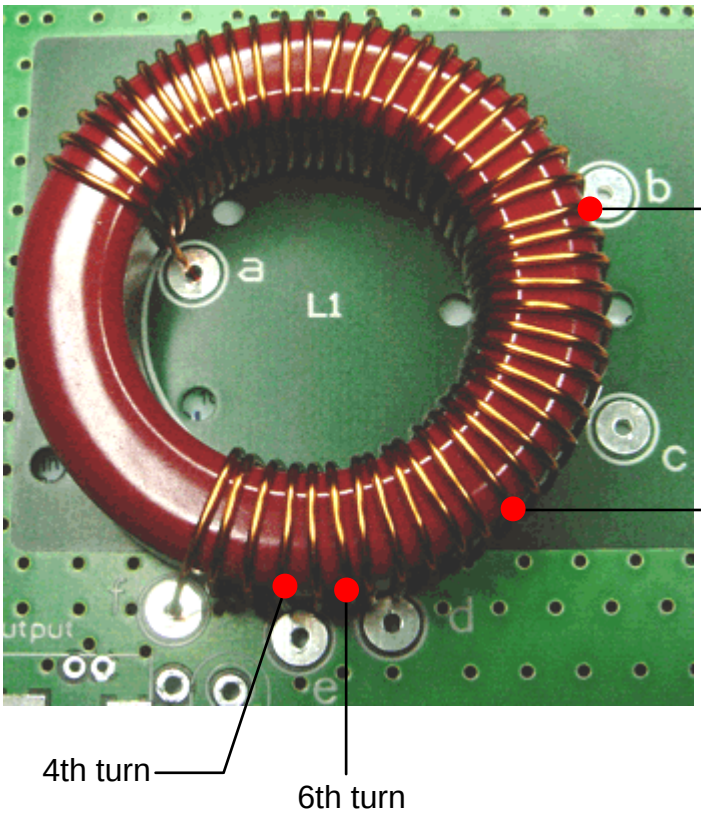


Image is for illustrative purposes only.

Coil taps.

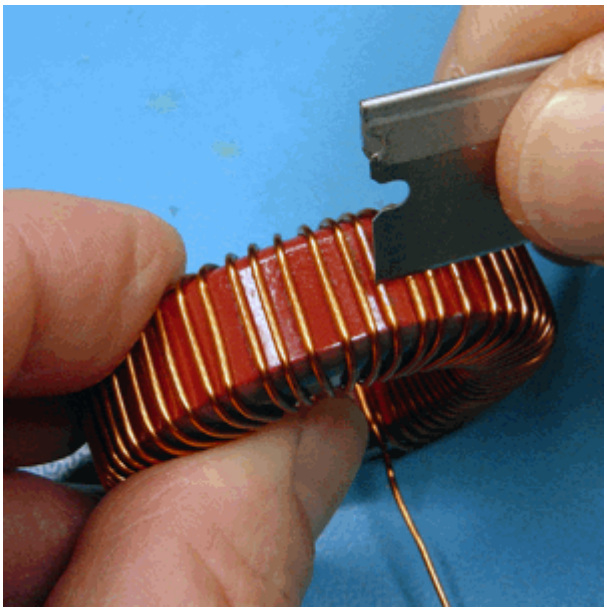
They are four side taps starting counting from “f”
“b” on 23rd turn.
“c” on 12th turn.
“d” on 6th turn.
“e” on 4th turn.

Image is for illustrative purposes only.

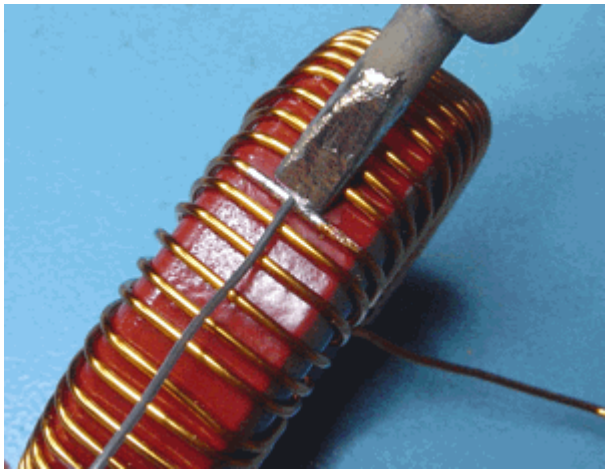


Scratch the enamel carefully at each tap and the wires at start and the end.

(Images are for illustrative purposes only.)

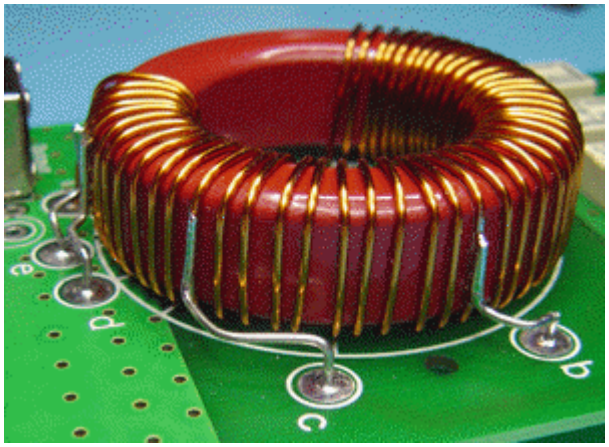


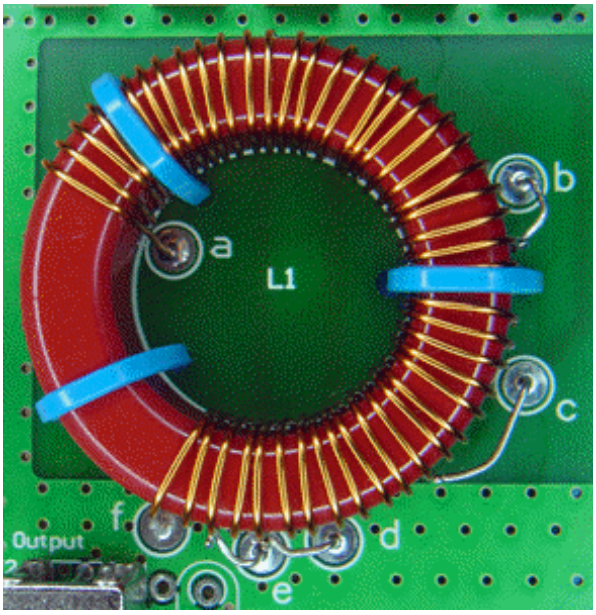
Tin the wires



☐ Solder each tap with its respective pad using the tin wire supplied with the kit

(Images are for illustrative purposes only.)

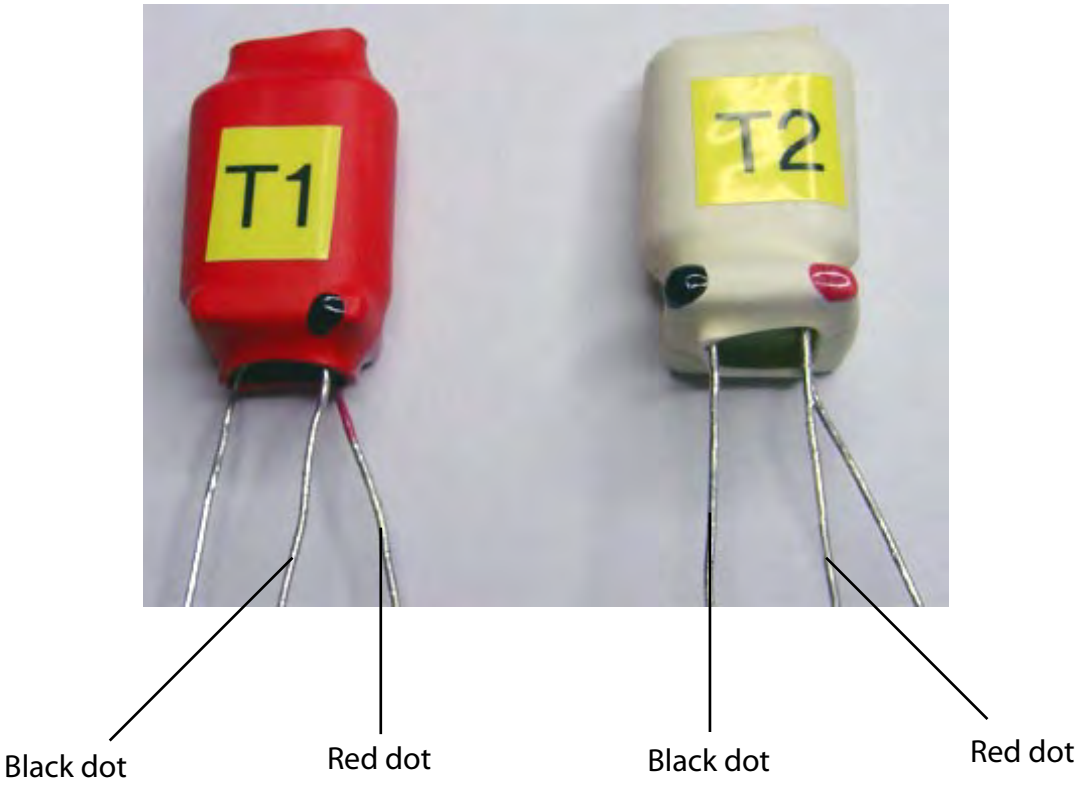




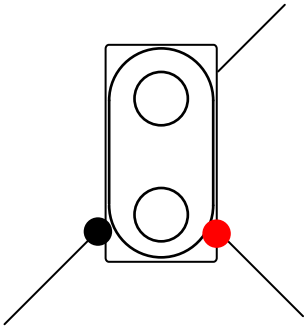
☐ Mount the coloured nylon cable ties, tighten gently.

Transformers T1 and T2

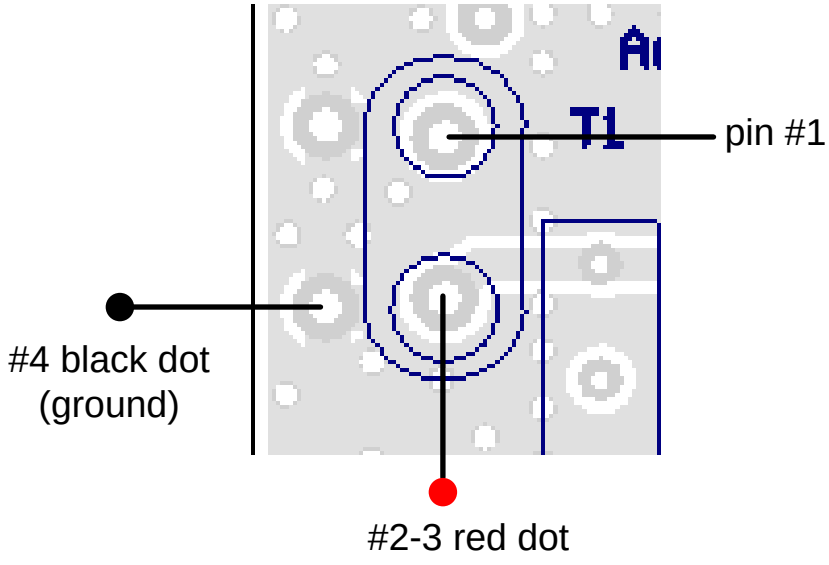
A set of two assembled impedance match transformers come with the kit.



☐ Mount T1 on PCB

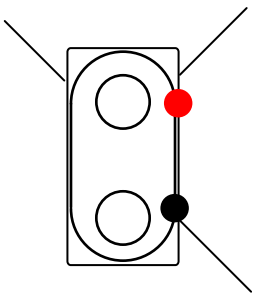


T1 top view

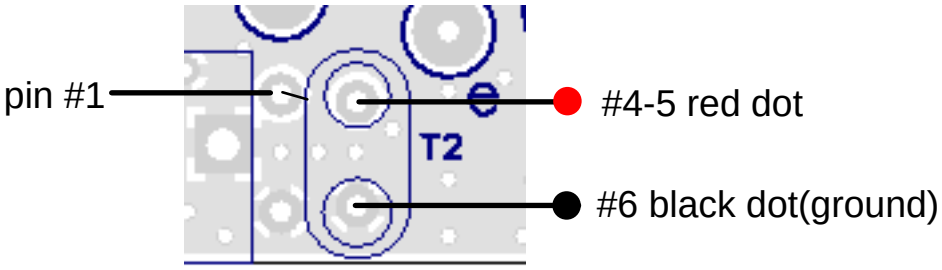


(Refer to schematic)

☐ Mount T2 on PCB

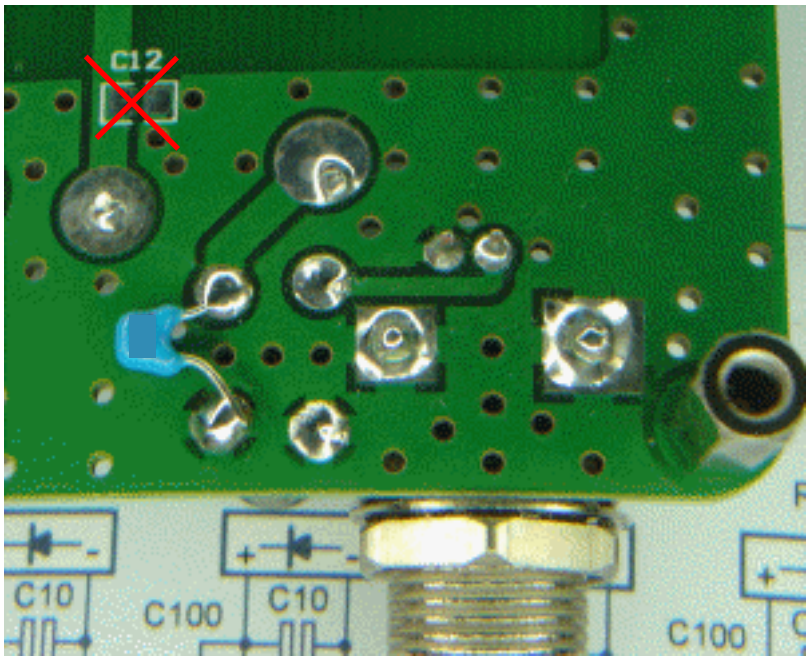


T2 top view



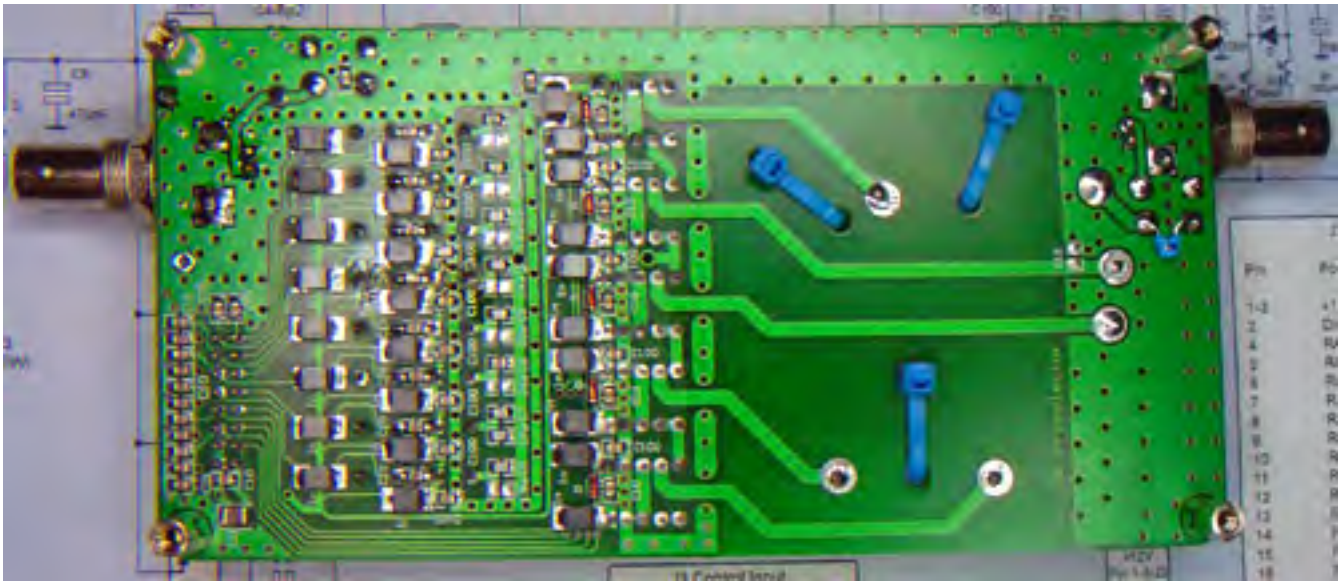
(Refer to schematic)

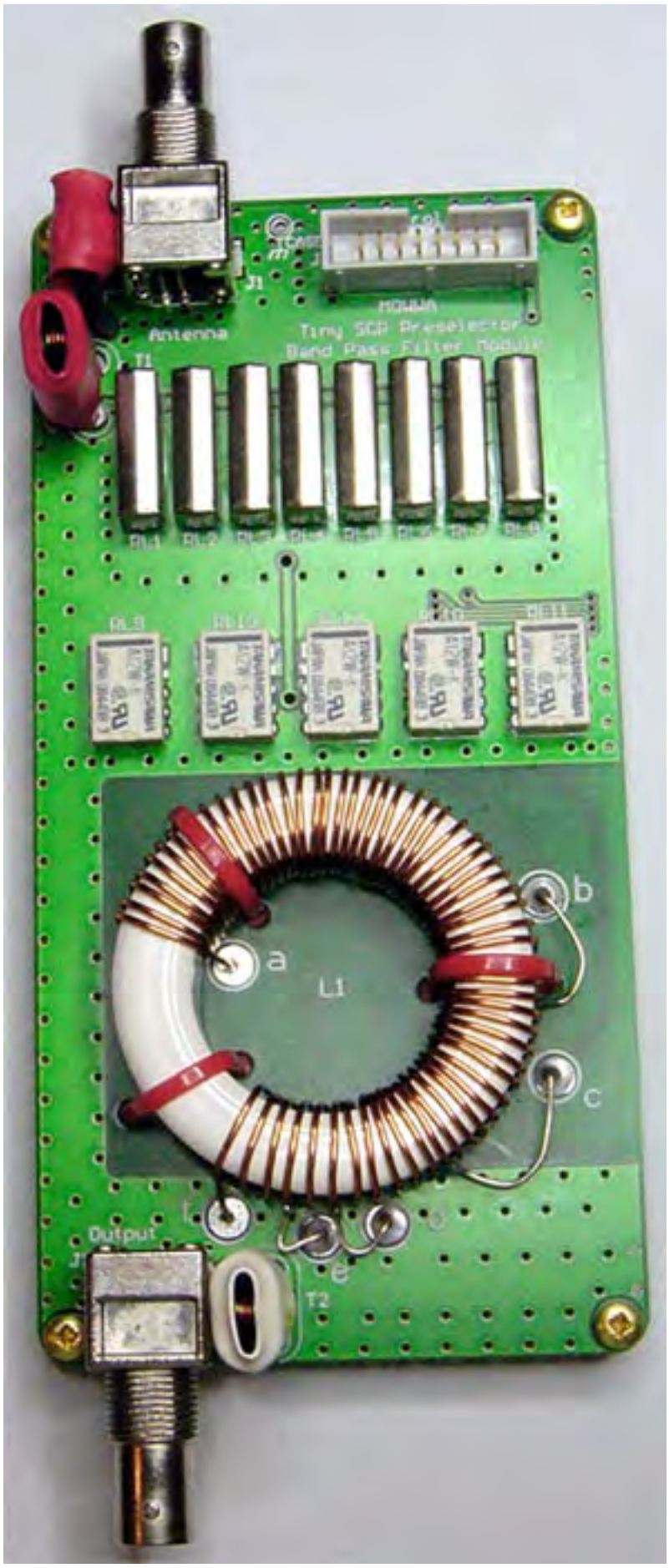
☐ Mount C12 capacitor as the figure indicates.



Visual Inspection

Use a magnifier and carefully check the board for any missed solder connections or solder bridges.
Verify that there are no leads or solder fillets too high on the bottom side of the board.
Clean the PCB and the coil around solder taps..





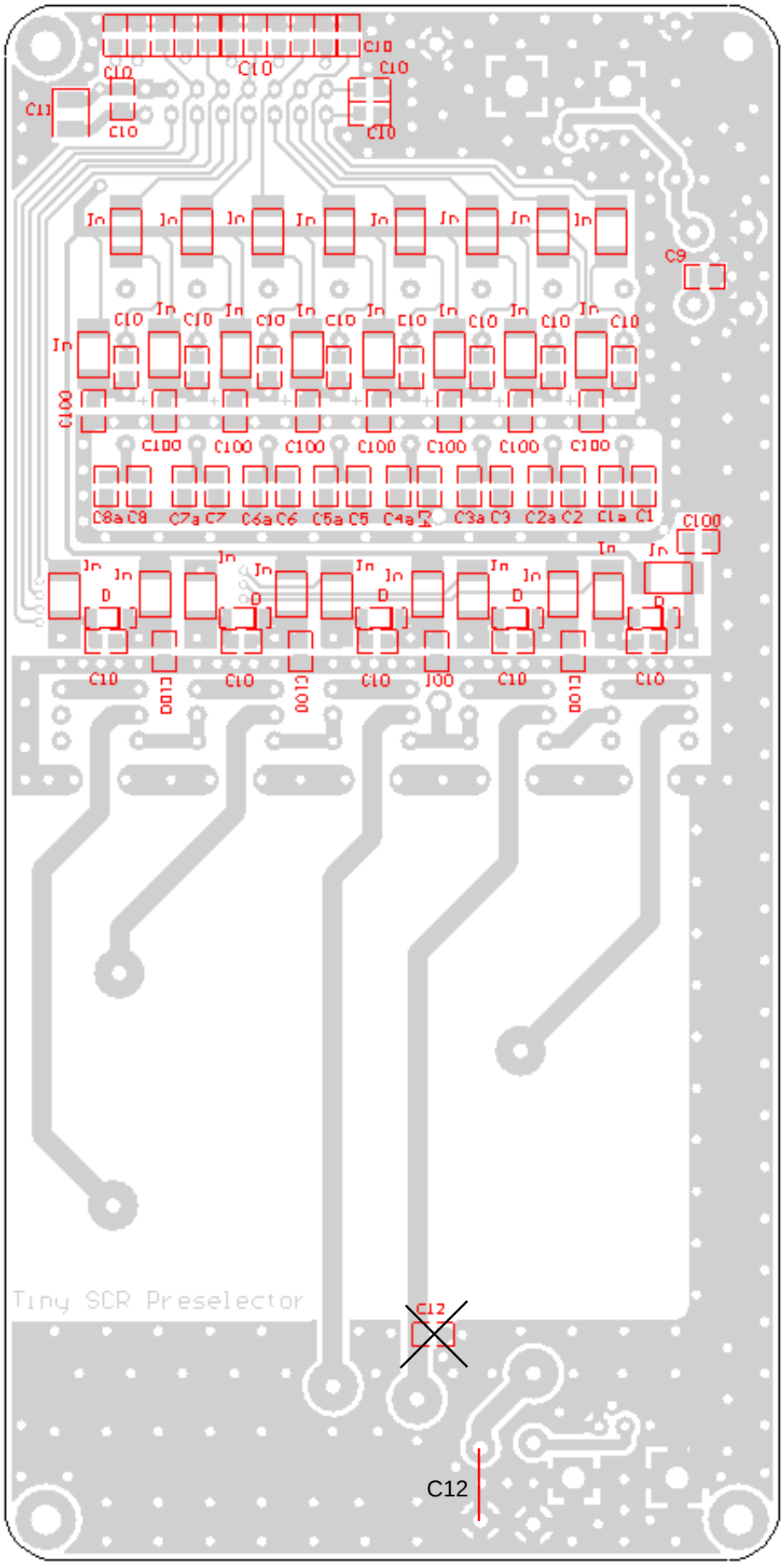


Fig. 3 Band Pass Filter module board. Bottom view

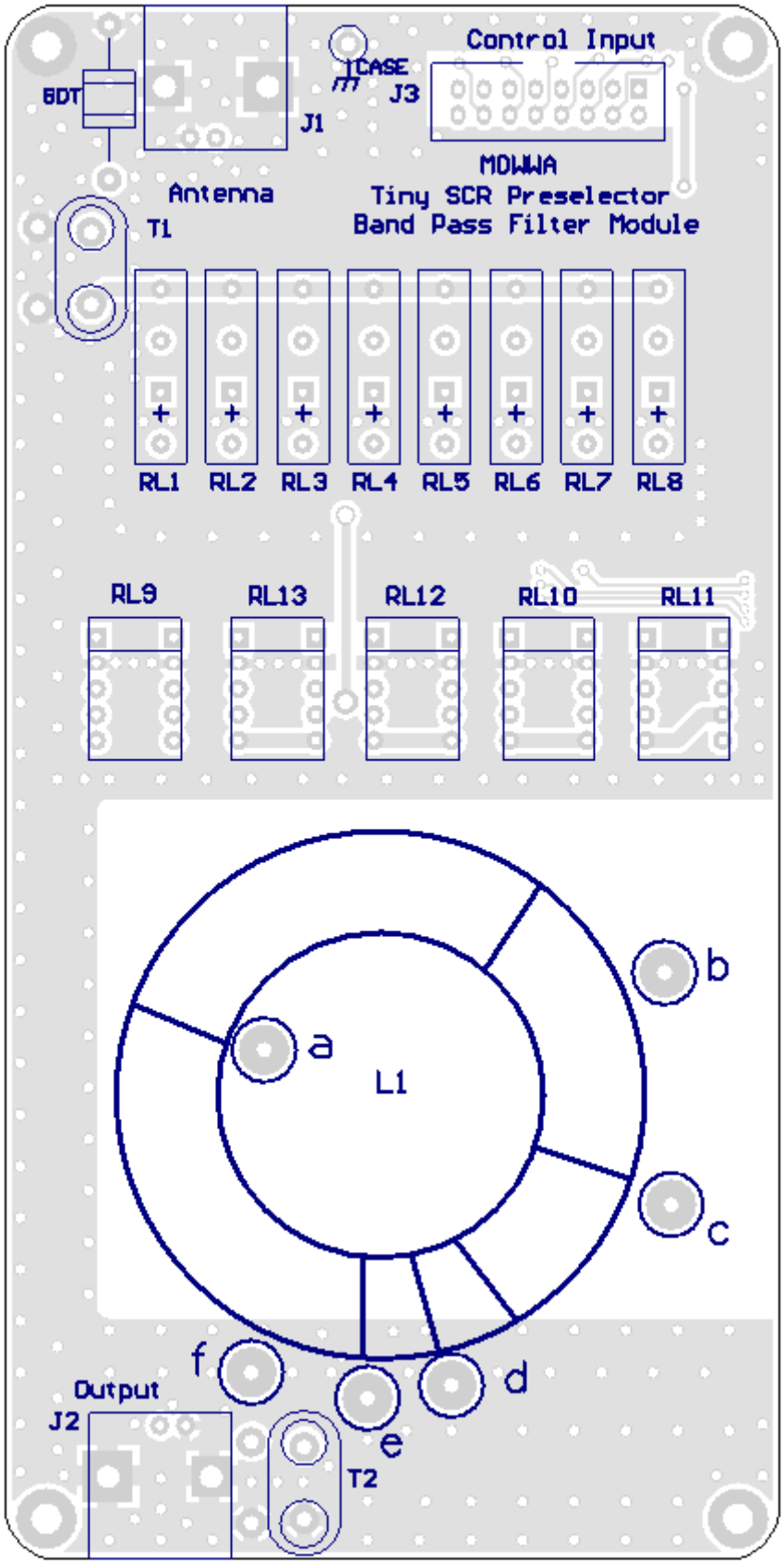


Fig.4 Band Pass Filter module board. Top view

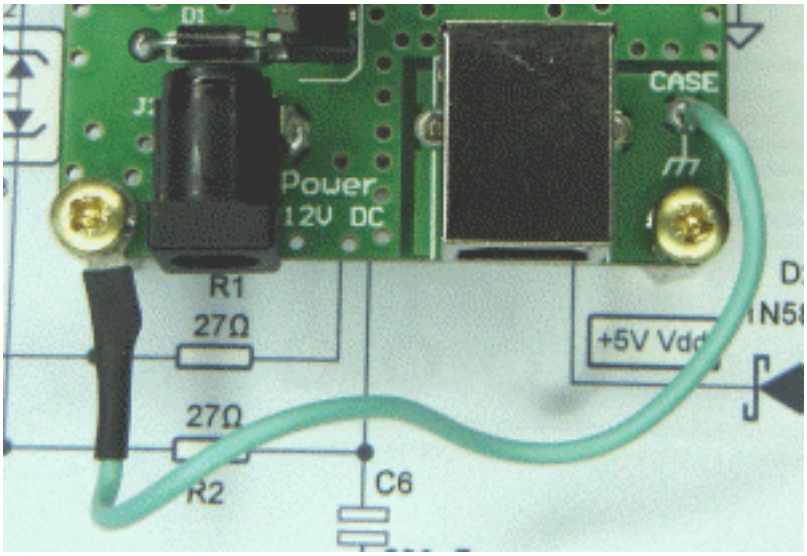
Start up

It's time to apply power! In the following start up you will check out your tiny SCR Preselector. Have your user manual handy.
If you encounter any difficulties with the procedure:
- Carefully check your setup to ensure all cables are properly connected.
- Inspect again your parts placement and soldering on the PCBs.

Most initial difficulties are eventually traced to an incorrectly placed component or a bad solder connection.
The circuit description and schematic diagrams in your manual can help you decide which circuits to check, based on where in the start up procedure you experience difficulty.

☐ Fix the USB shield tag to the screw located at the left side of the power connector in order to avoid noise from the USB cable.
Futhermore the tag must be fix to the enclosure (earth) where you will mount the kit.

Don't connect anything else until instructed to do so.



☐ Connect your 12 VDC power supply to the Power connector.

☐ The ammeter on your power supply must indicate around 33mA.

☐ Connect the USB cable from your PC to the USB socket. Now the ammeter will show an increment of current around 45mA. When plug the USB cable a sound event on your PC will indicate that an USB device has been connected.

☐ Follow the USB driver instalation procedure explained on the User Manual according with your Windows operate system.

☐ Unplug the power supply and the USB plug from the board. Plug one side connector of the ribbon cable on J3 box header and the other on the band pass filter board, J3 box header. Check the position of center polarizing slot on both sides.

☐ Reconnect the 12 VDC power supply and the USB plug. Open the tiny SCR Preselector program software. By default it opens with Band A selected and showing 128 value on the Tune window; with this configuration the ammeter on your power supply must indicate around 68mA. Changing bands selector you must listen clicking relays RL9 to RL13. Varing the tune knob you will listen relays RL1 to RL8 clicking according.

☐ Connect the tiny SCR Preselector to your receiver as indicates the user manual. Tune to a specific frequency an adjust to maximum signal or background noise. Sliding right or left increases or decreases the centre frequency of the band-pass filter. Notice due to the response of typical series tuned circuits, the attenuation of the pass band filter increases with less capacity. A good practice is to avoid values smaller than 50 picofarads.

☐ The band coverage can vary lightly due the tolerance of the coil. Varing the gap among turns or the taps you can adjust the coverage as you wish.

Congratulations!

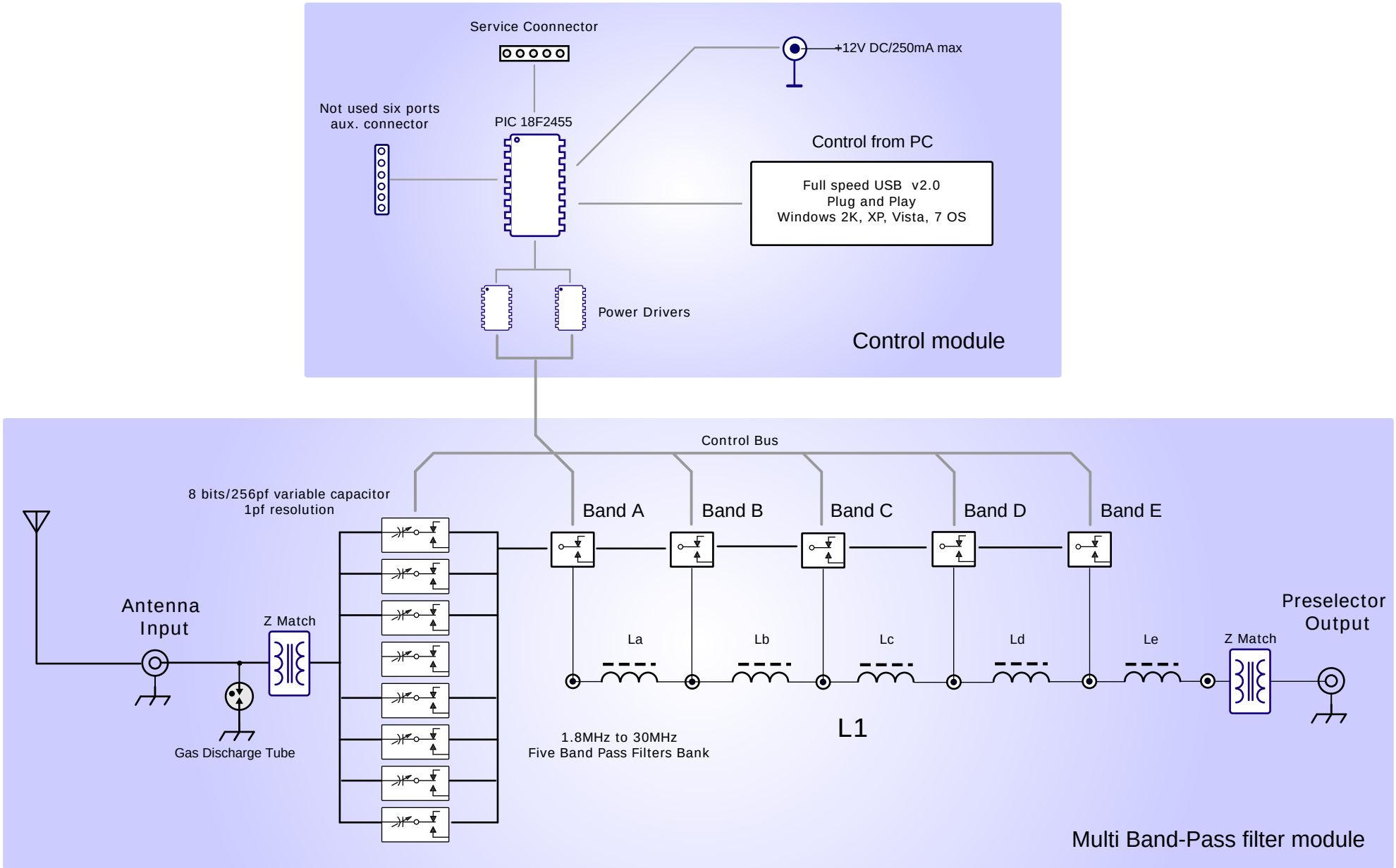
You have completed the assembly of your tiny SCR Preselector. Enjoy it!

Troubleshooting

If any doubt arises do not hesitate to consult us.

Yours Sincerelly.

Heros Technology Limited.



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general electronics

Drawing tiny SCR Preselector_Rev_B Diagram			
Approvals	Size	DWG No	
Issued	A4	REV B	Sheet 1/1
Checked	Scale	FCSM No	
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