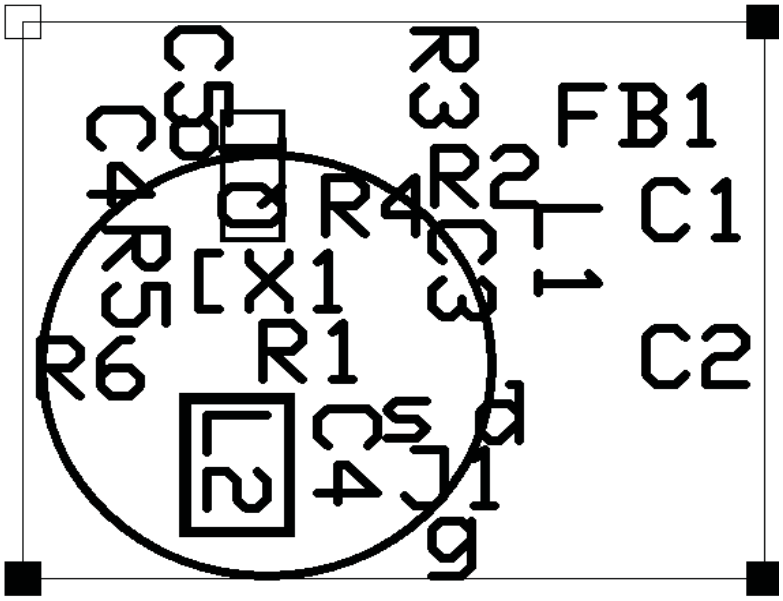
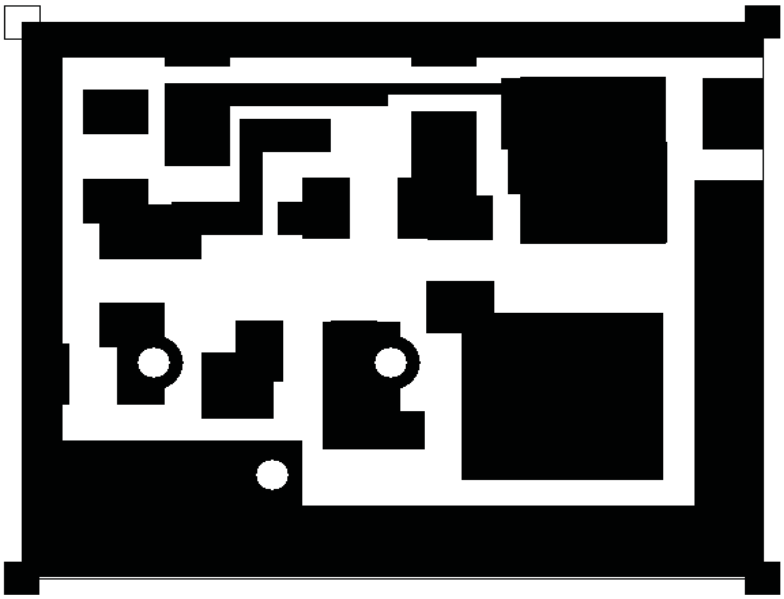
VNA Master Oscillator
- Vertical Board
- used on Mk 1 and Mk 2 versions

(all layers viewed from top)

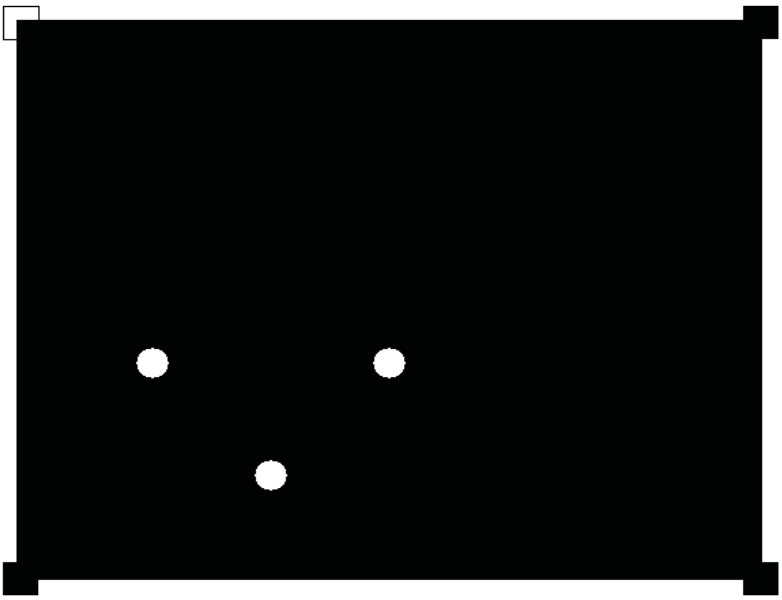


Virtual Silkscreen Layer



Board is 0.625" W x 0.500" H
0.031" thick

Top Layer



Solder copper foil around entire board perimeter to join top and bottom layers.

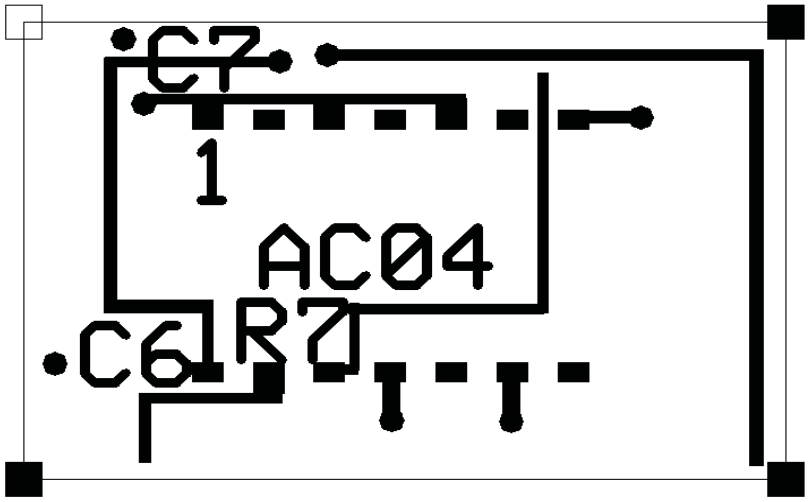
Make sure the two 'hot' crystal lead holes are cleared on the bottom layer to prevent shorts to ground.

Bottom Layer

VNA Master Oscillator
- Mk 1 only
- Horizontal Board

(all layers viewed from top)

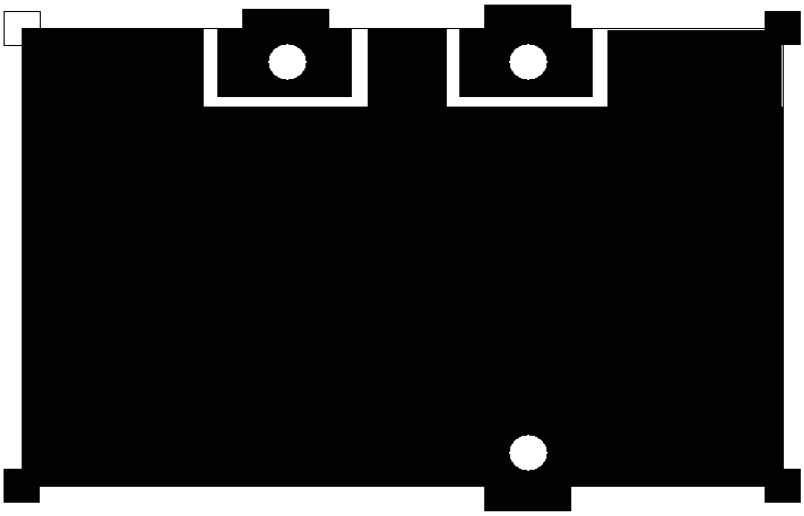
Virtual Silkscreen Layer



Components are mounted dead-bug on the top layer of the horizontal board.

Board is 0.625" W x 0.400" H

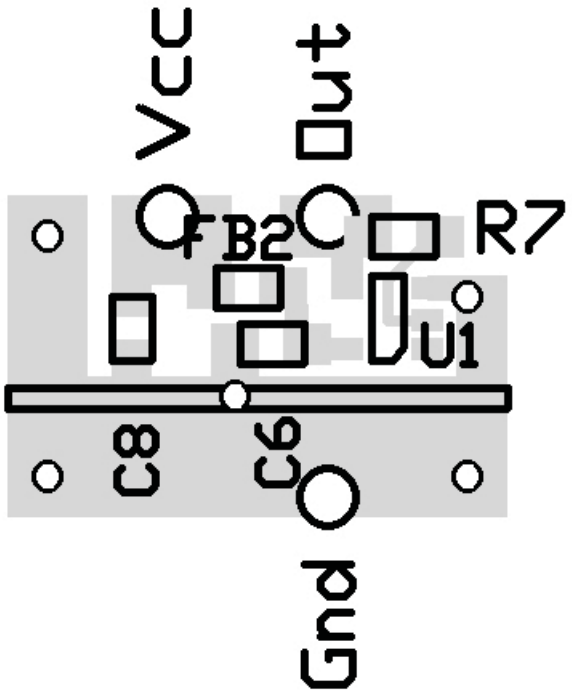
Top Layer



There is no bottom layer on this board.

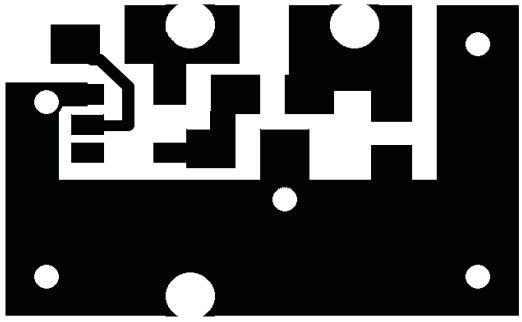
Instead wire pads can be formed around the board edge from the top layer and through the holes to permit soldering the master oscillator to the VNA PCB.

VNA Master Oscillator
- Mk 2 only (G3SEK)
- Horizontal Board



Virtual Silkscreen Layer

Board is 0.625" W x 0.400" H



Top Layer

0.8mm DS BOARD
THIS SIDE TO COPPER

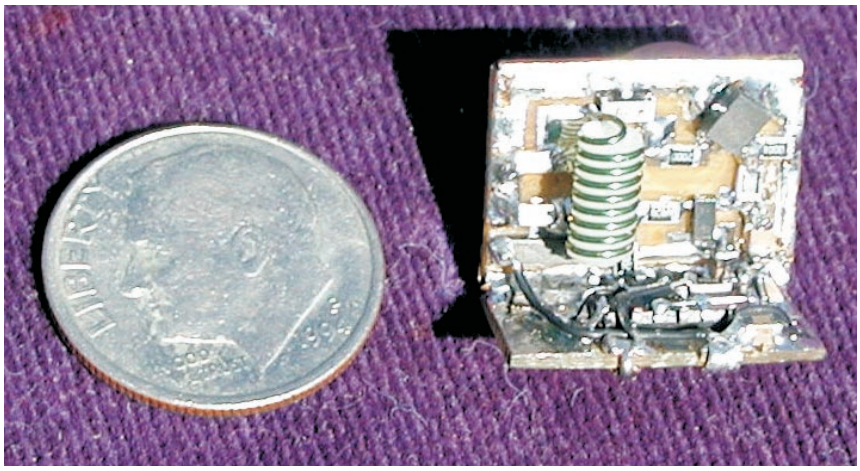
The bottom layer on the Mk 2 horz. board is solid copper, except for:

a) clearances around the two half-circular cut-outs for the 'module' RF output and DC connections on the top side, and
b) the five drilled holes for wire shorts between top and bottom layer ground conductors.

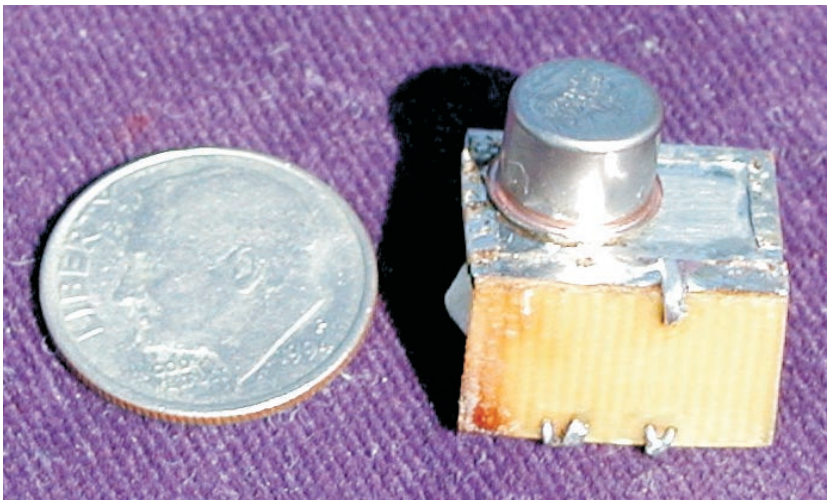
Bottom Layer

VNA Master Oscillator Photos

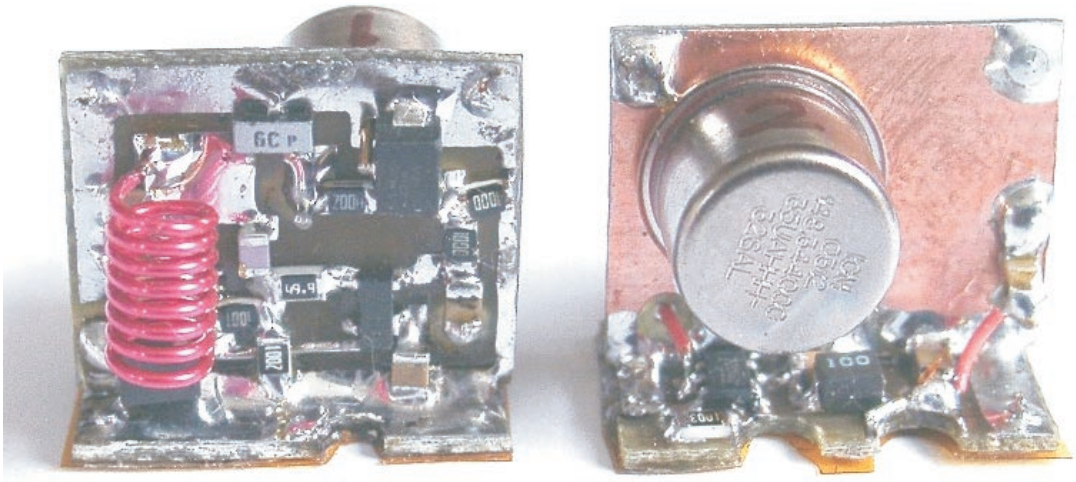
Mk 1 side view



Mk 1 bottom view



Mk 2 MO
(G3SEK)



G3SEK Mk 2 Master Oscillator Build Notes

The 'Mk 2' horizontal board uses a single Fairchild Tiny Logic gate in a smaller SOT-23 package. This simplifies the construction and allows a smaller overall footprint for the MO module. The 'Mk 2' horizontal board includes U1, R7 and C6 as shown in the schematic of Figure 8. It also includes additional bypassing of the Vcc line (FB2 and C8 are identical to FB1 and C7, but are not shown in Figure 8).

Construct the vertical board first - see photograph. This is essentially the same as described above. Note the three through-board wire links to the rear groundplane; alternatively you can wrap the edges with copper foil and solder both sides. Also drill two small holes for the wire links from C4 to U1, and for +5V DC (see photographs); counterbore the rear groundplane around these holes.

L1 in this version is 8.5 turns wound counter-clockwise on a 2.5mm (3/32 in) drill. This allows shorter lead lengths than if wound on a 6-23 screw with a normal right-hand thread. Constructed as shown, both prototype oscillators started first time and required no further adjustment. However, when building the module, do not install the crystal yet. Use flux solvent and a stiff brush to clean-up the vertical board.

When making the horizontal board, leave extra board material around all four sides. Drill the three mounting holes (2.5mm, 3/32in) and use a hand-held drill to counter-bore the groundplane around the holes for Vcc and RF output, to avoid shorts. At this time, also drill small holes for the five wire links to the groundplane underneath. Then cut the board down to size, so that the mounting holes become half-circles in the edges of the finished board.

Install the components on the horizontal board. When that board has been finished and cleaned, install the vertical board as shown in the parts layout and the photographs - right over a groundplane link. Solder along both edges of the vertical board, as much as you can without causing any shorts. Clean-up again with flux solvent and check with an ohm-meter that you haven't caused any unwanted shorts.

Install the two wire links through the vertical board to the horizontal board: C4 to U1, and +5V DC (red insulated wires in the photographs). In the prototypes, C7 was duplicated on both sides of the vertical board, but this is optional. When the vertical board has been installed, wired, cleaned and checked, finally add the crystal.

When the module is completed, rub the underside gently on a flat file to remove any sharp points on the wire links. Then glue a small rectangle of solder-resistant plastic on the underside, to prevent shorts to the main board. Kapton is a good material, teflon is also good but sticks less well, and you can even use two layers of PVC tape if you're very careful when soldering afterwards. Cut small notches in the plastic at the three edge mounting points.

To install the MO module on the MO test board or the main VNA board, solder three wires on the pads where the module will be located (three small resistors with full-length leads are ideal). Lower the module into place between the wires, so that it rests on the main board. Bend each wire down over the pad on the MO module, quickly solder, and cut off the excess wire/resistor.

To remove the MO module, melt the solder at both ends of the link and remove the wire on the tip of the iron. You can then simply lift the MO module off, with no damage to the tracks on either board.

Additional notes:

L1 check:

A tip for checking that the inductance of L1 is correct: when the oscillator is running on the MO test board, try the effect of bringing a dust-iron core or a brass/aluminum core close to L1 (on an insulated wand). The first increases the inductance of L1, and the second decreases the inductance. Look for any sudden shifts in the frequency,

the RF output power or the average DC level. Ideally any changes should be minimal, and about equal for either core. Adjust L1 so that the oscillator is at the most 'comfortable' point for stable long-term performance. The actual oscillator frequency is not important, because the software allows for it.
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Kapton on underside of Mk 2 MO Horz. board:

You can just make out the kapton insulating film underneath the MO boards.

>Does it melt if hit with a soldering iron?

No - it's much like teflon in that respect, only a little easier to stick to the underside of the MO module with something like Duco cement.

You could use teflon, of course, since it doesn't absolutely have to be stuck down. Equally you could use two layers of PVC tape if you're very careful when soldering.
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FB2 on Horz. Board:

The 18Ø6-size ferrite beads are a bit large for the board layout, but ferrites are also available in Ø8Ø5. I normally use my supplier's own-brand, but something like the Tyco/Sigma BMB2AØ3ØØAN1 series should be OK because performance is not at all critical.
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Etching of Mk2 Horz. Board:

Constructors should make a direct download of the (Traxmaker 2ØØØ) PCB mask and print that at 1:1 size on UV-transparent paper.
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(THe Traxmaker 2ØØØ compatible file can be obtained directly from Ian.)