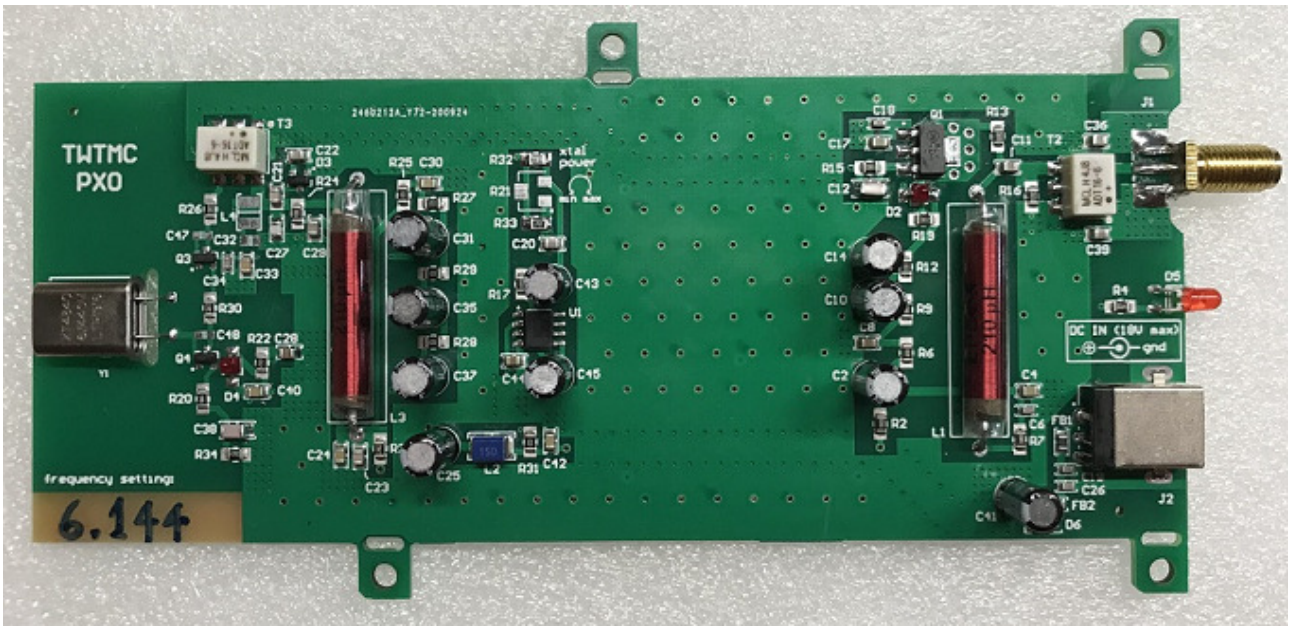
TWTMC-PXO Pierce oscillator



It's a intermediate level oscillator to be used as the master clock for digital to analog conversion. It performs worse than the state of the art oscillators (TWTMC-DRIXO and TWTMC-EXO) although it is also a low phase noise device, especially the 5.6448 MHz and the 6.144 MHz.

The output of this oscillator is sine wave therefore it needs a sine to square converter to be connected to digital devices such as FIFO or DAC (for example the TWTMC-STS).

Features:

Oscillator type: Pierce

Frequencies: 5.6448 MHz, 6.144 MHz, 11.2896 MHz, 12.288 MHz, 22.5792 MHz, 24.576 MHz, 45.1584 MHz, 49.152 MHz

Output: 50 Ohm sine wave (+11 dBm to +12 dBm)

Crystals: AT-Cut fundamental and overtone only

Board size: 151mm x 75mm (excluding SMA connector)

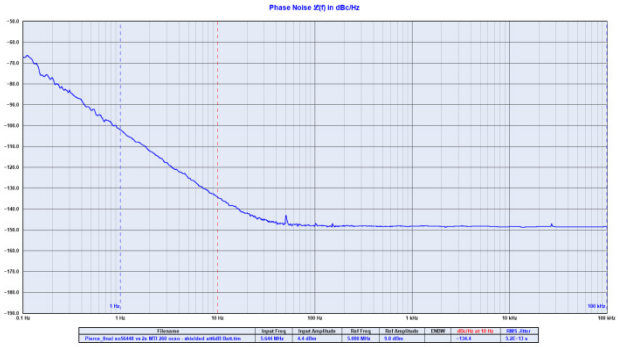
Power supply: 12-18 Vdc 60 mA (15-16.5 Vdc suggested)

Suitable box: Hammond 1455J1601 (Mouser part 546-1455J1601)

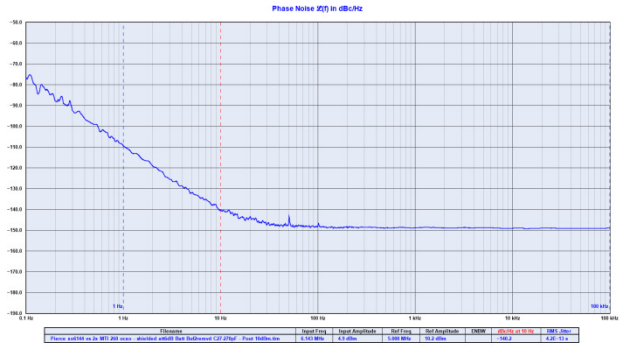
Board options: finished and semi-finished

Note: supplied without crystal and box

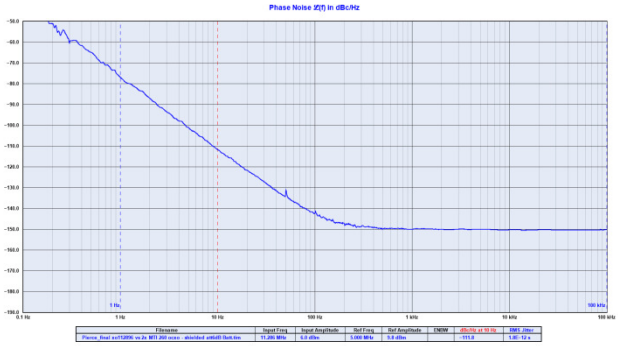
Measured phase noise of the Pierce oscillator at different crystal frequencies: 5.6448 MHz, 6.144 MHz, 11.2896 MHz, 12.288 MHz, 22.5792 MHz, 24.576 MHz.



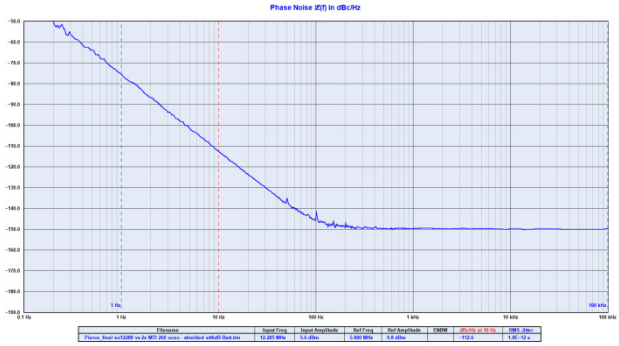
TWTMC-PXO 5.6448 MHz phase noise



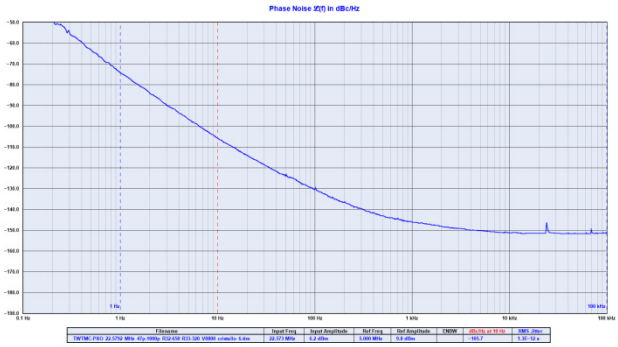
TWTMC-PXO 6.144 MHz phase noise



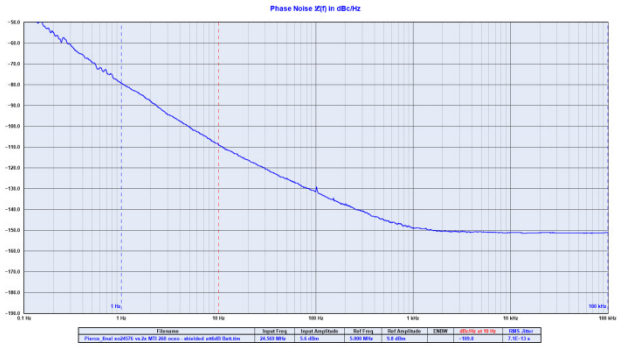
TWTMC-PXO 11.2896 MHz phase noise



TWTMC-PXO 12.288 MHz phase noise



TWTMC-PXO 22.5792 MHz phase noise



TWTMC-PXO 24.576 MHz phase noise

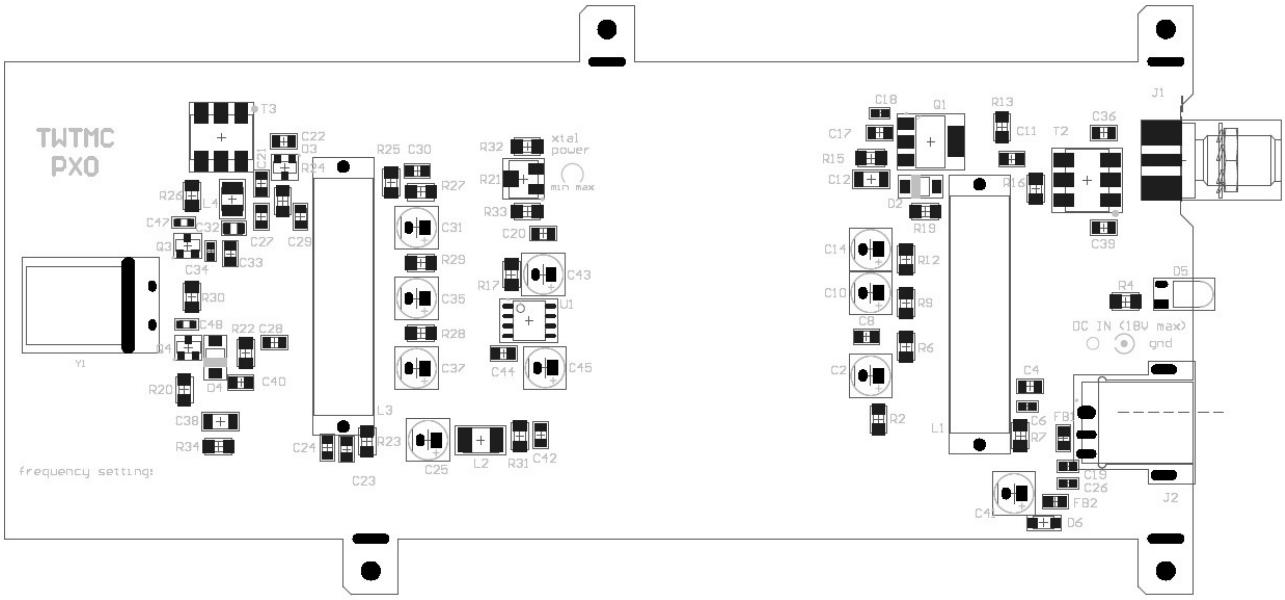
There are 2 available options for this oscillator:

- finished boards (fully assembled and tested)

- semi-finished boards (users have to solder a few parts, mostly TH)

The BOM for semi-finished board is available at post #3010 on the diyaudio.com thread: The Well Tempered Master Clock - Building a low phase noise/jitter crystal oscillator.

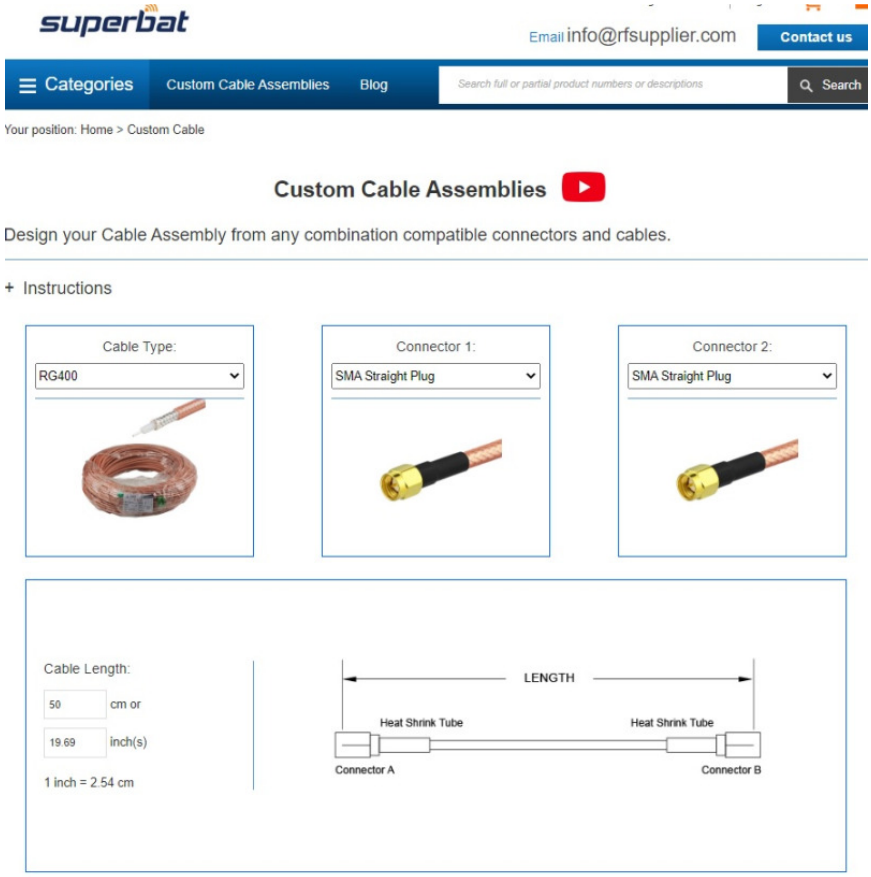
PCB layout



Connectors

J2: DC power supply (12 to 18 Vdc). Suitable plug connector CUI PP3-002B Mouser part 490-PP3-002B (internal is +V, external is ground). The circuit is protected against power supply polarity inversion.

J1: RF output. SMA plug connector and RG400 semi-rigid cable should be used to connect the board to other devices.



Crystal: the crystal is supplied separately so it has to be soldered to the oscillator board. It's a good practice to install the crystal with thermal and vibration decoupling in order to achieve the best phase noise performance.

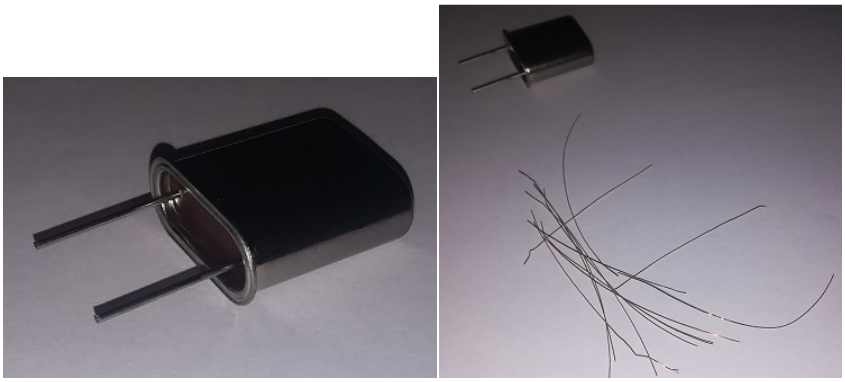
Soldering the crystal

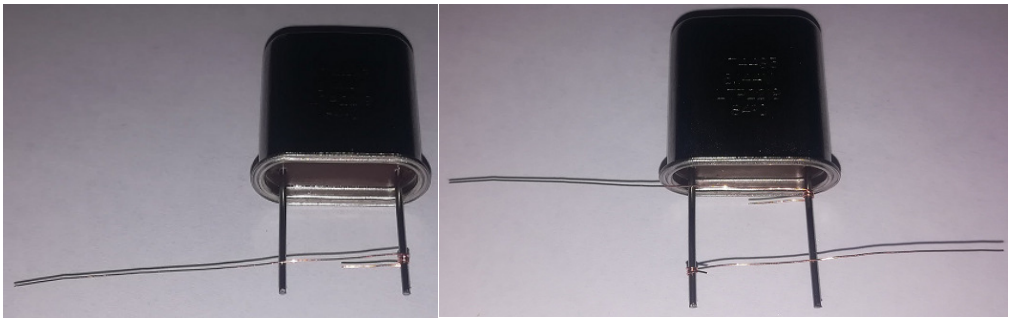
The following figures show how to proper install the crystal on the oscillator board.

This way helps to reduce the effect of vibrations that can affect the phase noise performance of the oscillator.

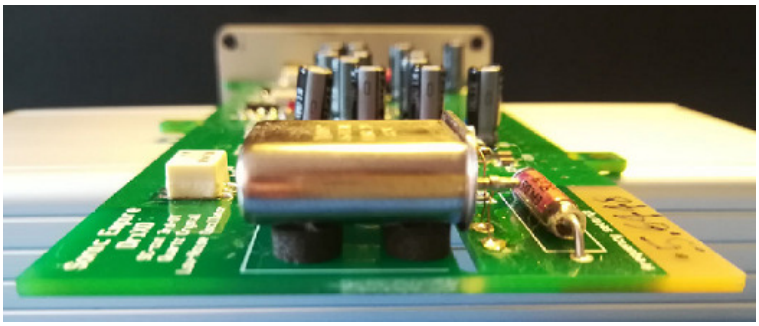
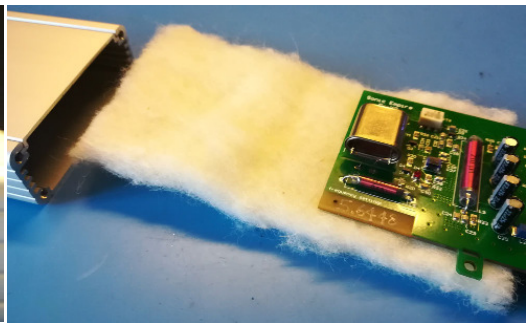
Moreover this way also provides a little thermal stability to the oscillator circuit.

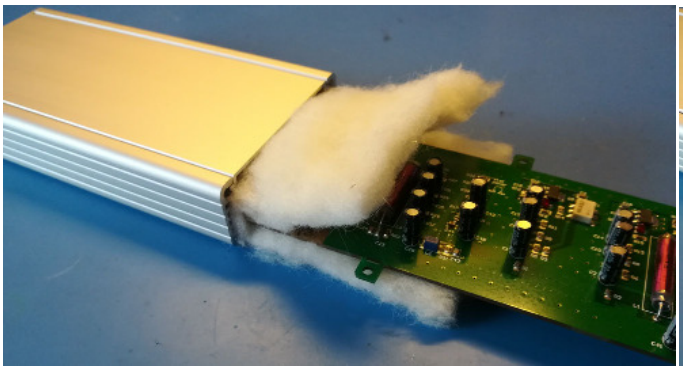
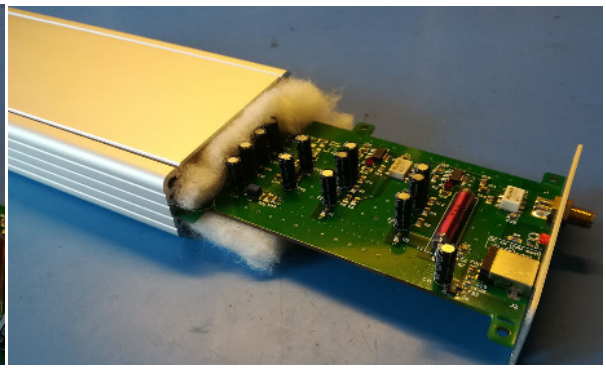
You can use a pair of neoprene cylinders to decouple the crystal from the board, then you can wrap the oscillator section with a polyester fiber or wool foil.





Soldering copper wires to the crystal legs.

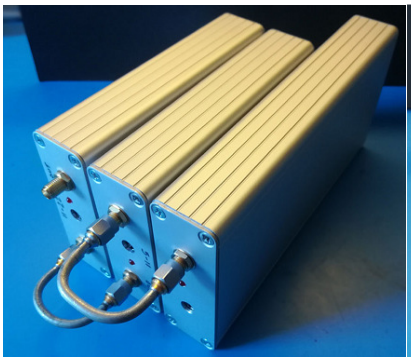
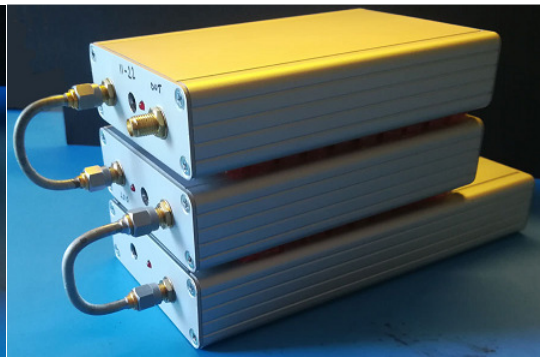



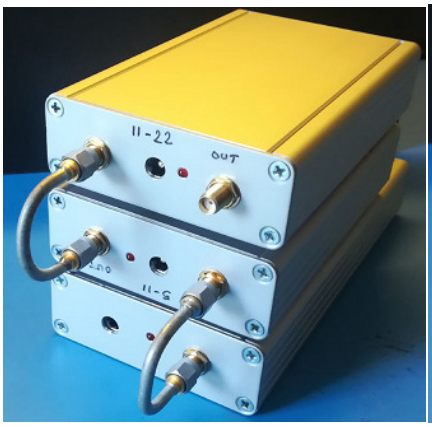
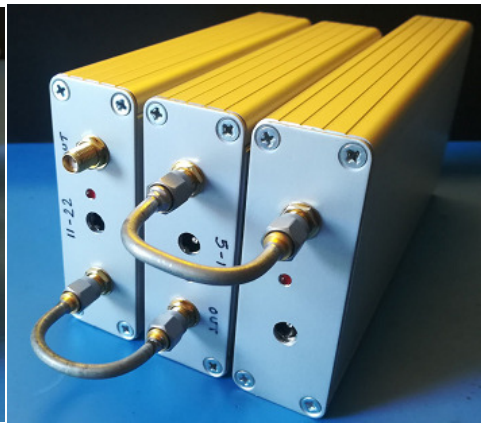



Vibrations and thermal coupling (the pictures show the TWTMC-DRIXO as reference since the proceeding is the same)

Shield and connect oscillators and frequency doublers

The following pictures show the best way to shield and connect oscillator and frequency doublers. The longer box is the oscillator, the shorter boxes are the frequency doublers.

Notes on semi-finished board

The semi-finished board option needs some parts to be soldered (most are through hole, a few are SMD parts).

There are two things to pay the maximum attention:

- be careful selecting the right component value (incorrect component values will get the oscillator not working and it could be tricky finding the error without removing all the installed capacitors and inductors)

- be careful installing polarized components, the component orientation is clearly visible on the PCB overlay