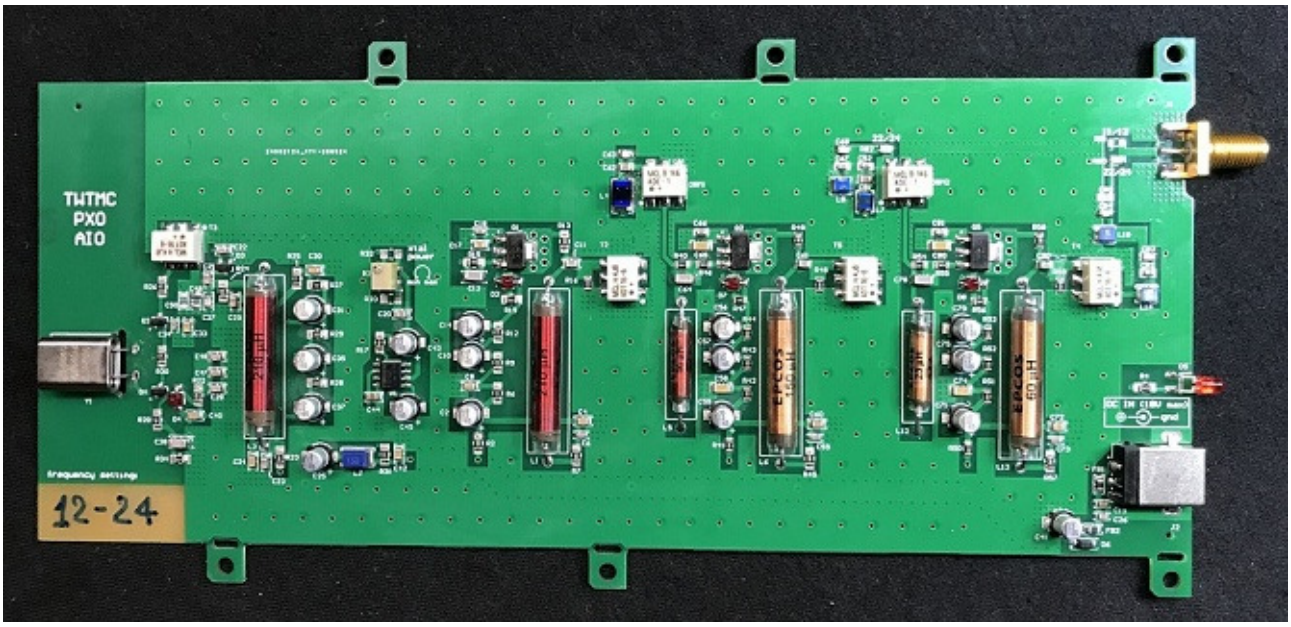
TWTMC-PXO-AIO Combo Pierce oscillator & Frequency doublers



It includes the same oscillator of the TWTMC-PXO and a pair of frequency doublers on the same board and it's designed to be used as the master clock for digital to analog conversion. It performs very well because the AT-Cut 5.6448 MHz, the 6.144 MHz and the 6.25 MHz crystals used in the oscillator section are very good parts, therefore the phase noise of the multiplied outputs is very low, not much far from the state of the art oscillators. The output frequency is configurable to 2X or 4X the base frequency (11.2896/12.288/12.5 MHz and 22.5792/24576/25 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: 11.2896 MHz, 12.288 MHz, 12.5 MHz, 22.5792 MHz, 24.576 MHz, 25 MHz

Output: 50 Ohm sine wave (+10 dBm to +11 dBm)

Crystals: AT-Cut fundamental only (5.6448 MHz, 6.144 MHz and 6.25 MHz)

Board size: 211mm x 100mm (excluding SMA connector)

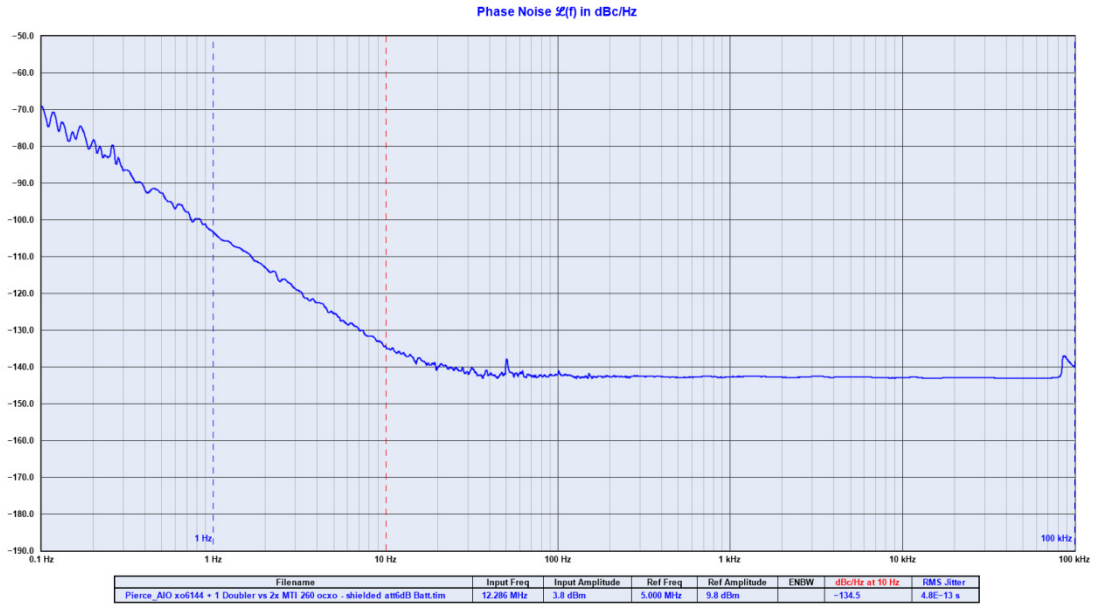
Power supply: 12-18 Vdc 60 mA (15-16.5 Vdc suggested)

Suitable box: Hammond 1455L2201 (Mouser part 546-1455L2201)

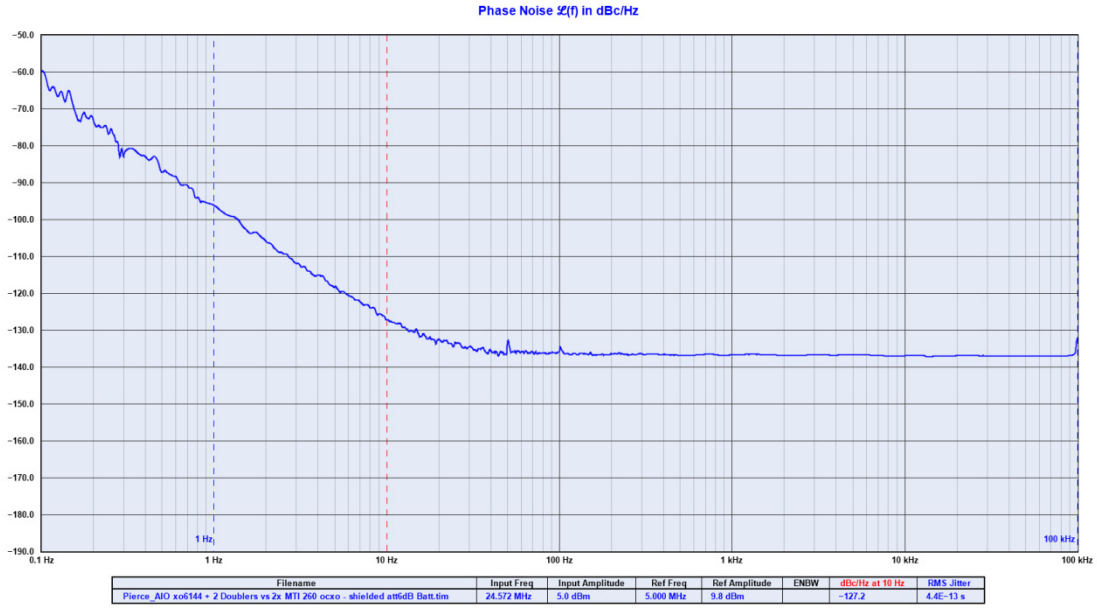
Board options: finished and semi-finished

Note: supplied without crystal and box

Measured phase noise of the Pierce All in One oscillator at different output frequencies: 12.288 MHz, 24.576 MHz.



TWTMC-PXO-AIO 12.288 MHz phase noise



TWTMC-PXO-AIO 24.576 MHz phase noise

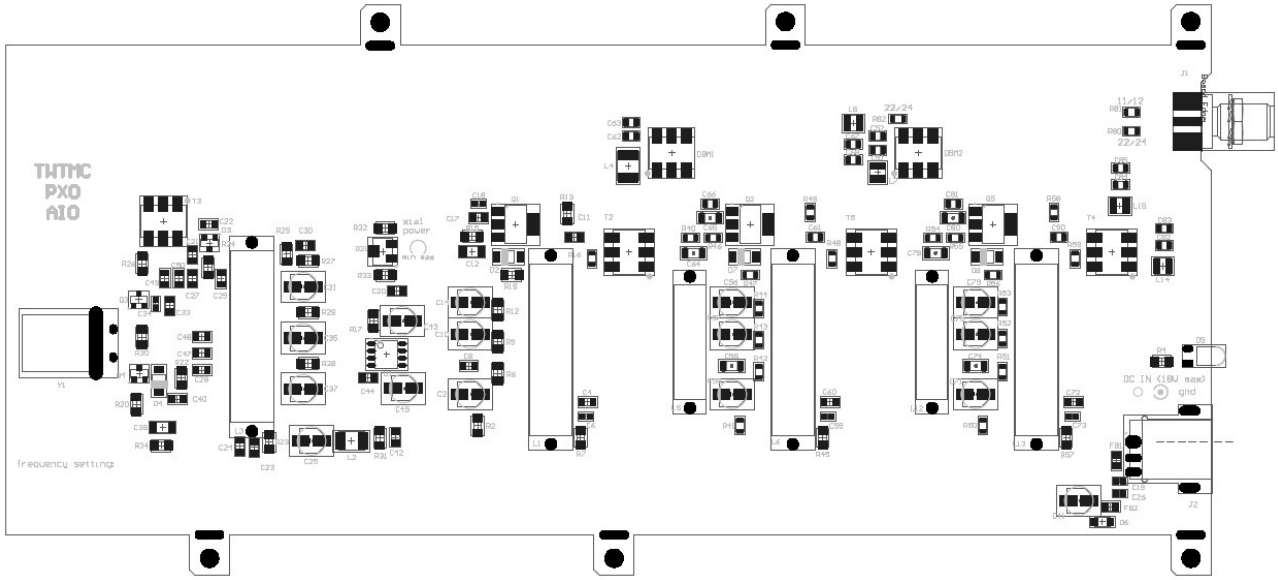
There are 2 available options for this oscillator:

- 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 #3011 on the diyaudio.com thread: The Well Tempered Master Clock - Building a low phase noise/jitter crystal oscillator.

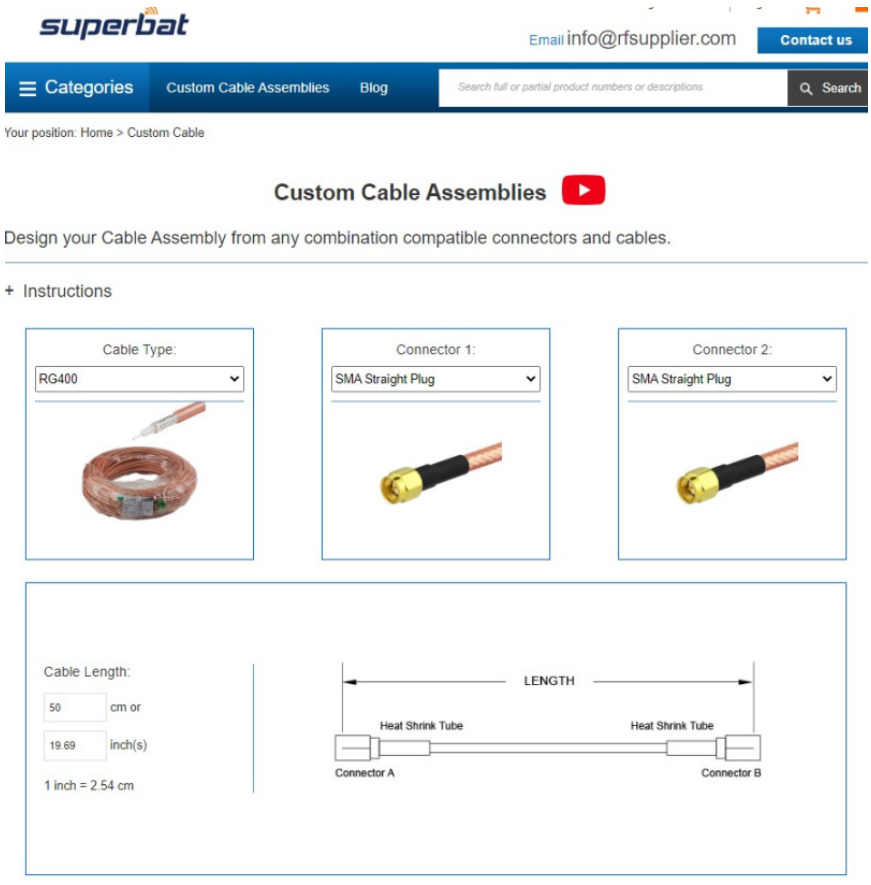
PCB layout



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.



Selecting the output frequency (2X or 4X the frequency of the base oscillator)

The resistors R80, R81 and R82 (zero Ohm, jumper) allow to select the output frequency between the two available options: base oscillator multiplied by 2 or base oscillator multiplied by 4:

- with R81 installed, R80 and R82 not installed the output frequency is 2 X the base oscillator (for example the output frequency will be 12.5 MHz in case of the base oscillator has the crystal at 6.25 MHz)

- with R80 and R82 installed and R81 not installed the output frequency is 4 X the base oscillator (for example the output frequency will be 25 MHz in case of the base oscillator has the crystal at 6.25 MHz)

The default configuration of the finished board is 4 X the frequency of the base oscillator.

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.

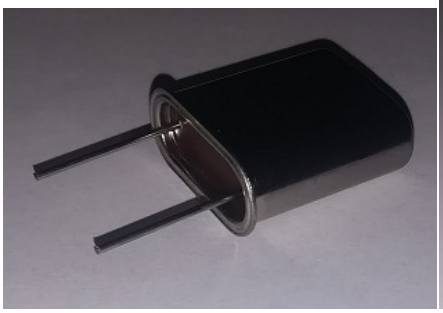
Soldering the crystal

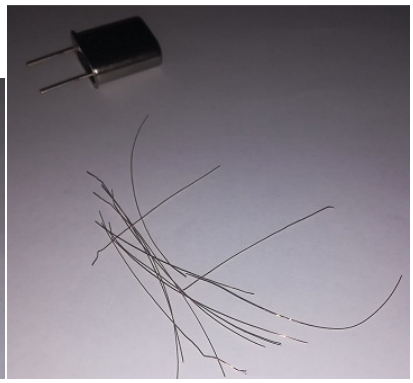
The following figures show how to proper install the crystal on the oscillator board.

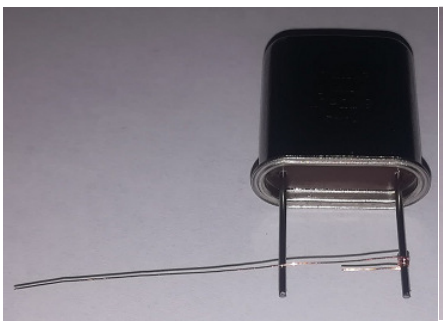
This way helps to reduce the effect of vibrations that can affect the phase noise performance of the oscillator.

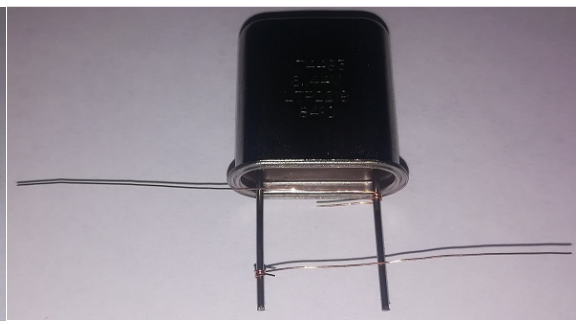
Moreover this way also provides a little thermal stability to the oscillator circuit.

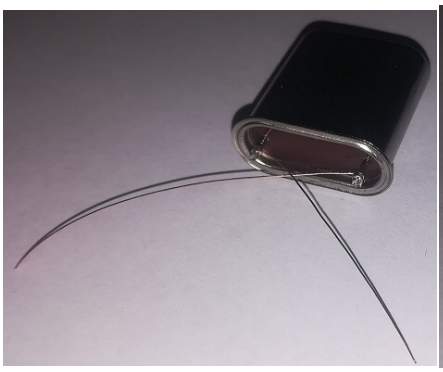
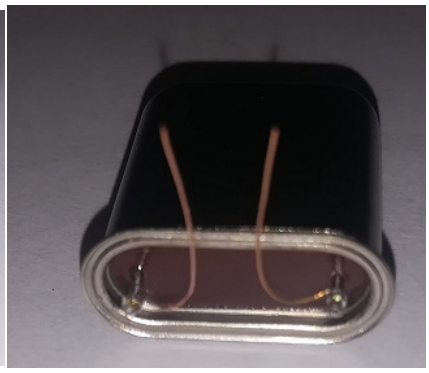
You can use a pair of neoprene cylinders to decouple the crystal from the board, then you can wrap the oscillator section with a polyester fiber or wool foil.



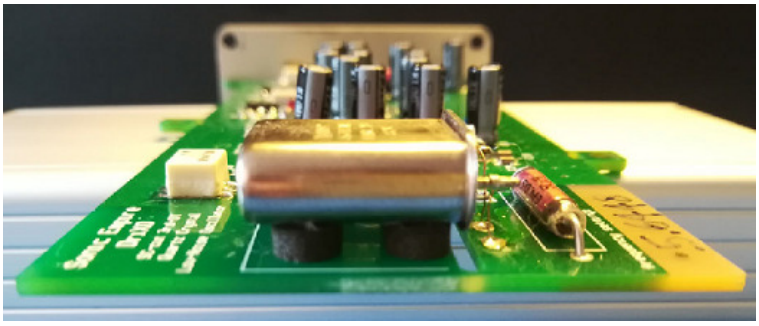
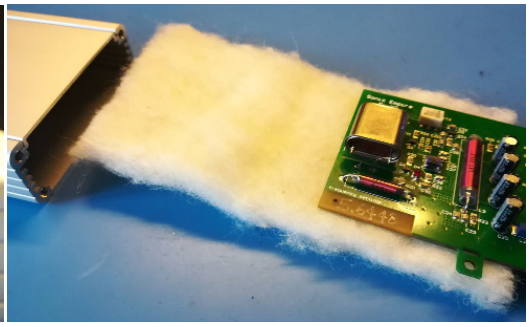


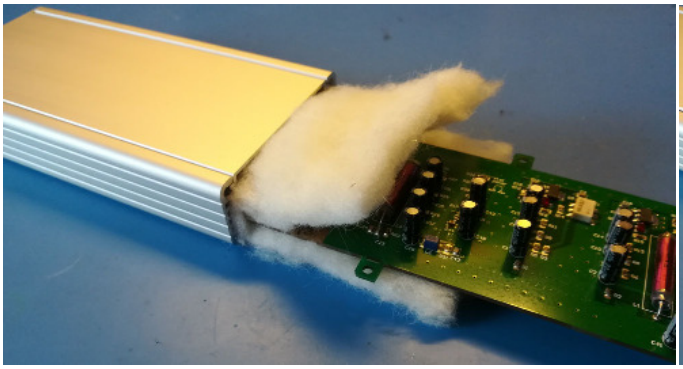
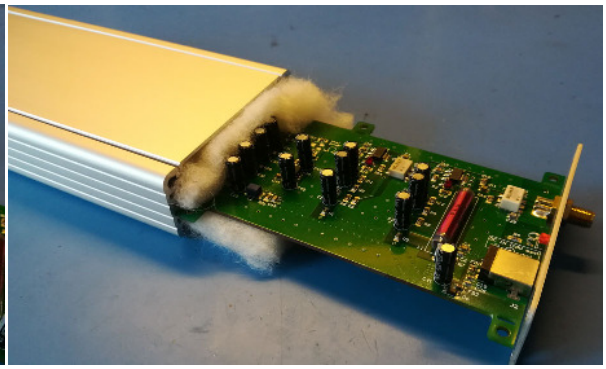




Soldering copper wires to the crystal legs.

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

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