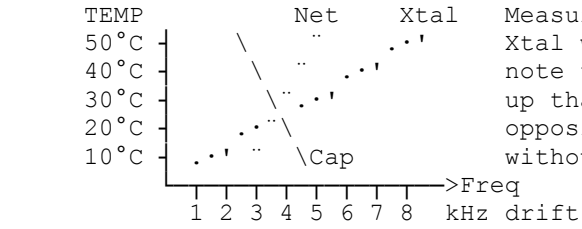
Simple Crystal Oven

By G8MNY (Updated Nov 08)
(8 Bit ASCII Graphics use code page 437 or 850)

Here is a design revamped from an old Radcom, I have used it with some success on a commercial MW Tx to stabilise the frequency. Other uses are for frequency counters & UHF/SHF Transceivers & Transverters where good frequency accuracy & stability are important.

THERMAL COMPENSATION

Before making an oven try to compensate the Xtal osc with negative temperature coefficient capacitors instead of existing caps in the osc circuit.



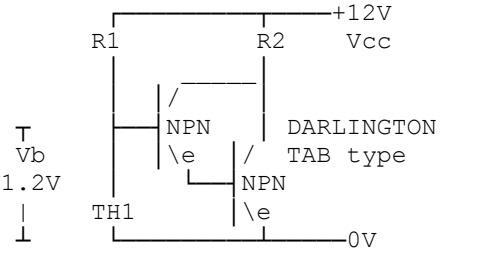
Measure the frequency e.g. on a SSB Rx. Heat the Xtal with the tip of a soldering iron near by & note the tone change. Substitute a capacitor & heat up that (not melt it) to see if you can get the opposite effect. This can easily half the drift without an oven, & if your lucky by far more.

When you have the best compensation you can get, make an oven around both the Xtal & the compensation cap.

The aim of the oven is not to cook the Xtal osc & its components, but to maintain a temperature slightly higher than the hottest running conditions, & by doing this eliminate frequency drift due to slow warm up & ambient temperature changes.

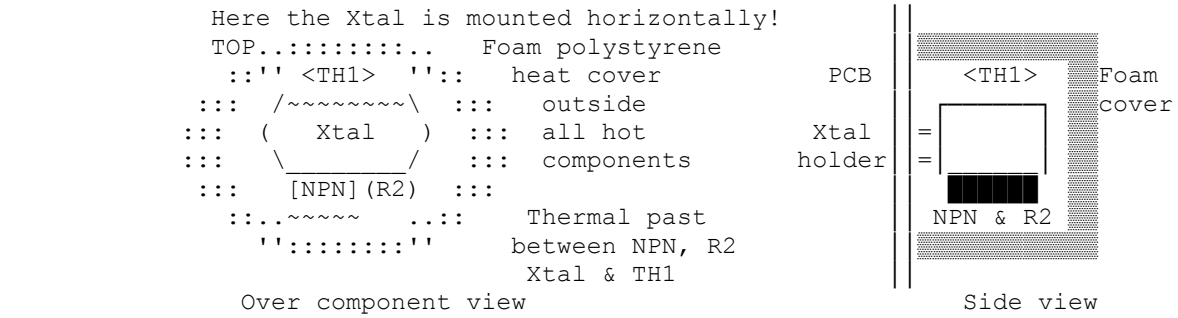
OVEN CIRCUIT

This is quite simple. But mechanically quite important to get a few things in the right place.



The negative temperature coefficient thermistor TH1 must be mounted above the Xtal so that it is the last thing to get hot. The NPN darlington & R2 are placed below the Xtal, mount the NPN so its tab does not touch the Xtal & fill the gaps with heatsink thermal compound.

MOUNTING



R2 is the main heating component & limits the current & power the heater takes, it therefore determines the warm up time. Typical value 100Û 2W for a 12V rail.

After a short time as everything has started to warm up the NPN darlington then becomes the main source of heat as the base drive is reduced.

Resistances of R1 & TH1 determine the operate temperature, R1 turning on the NPN darlington & TH1 turning it off. To find a suitable value for R1, heat up your thermistor TH1 until it is uncomfortable to hold (50°C) & measure its resistance.

$$\frac{(Vcc - Vb)}{Vb}$$

Then some simple maths for 12V & a darlington gives x9 a starting value for R1

Do a test without the cover to check it is all functioning & that the current goes down (NPN collector voltage goes up) when the lot is hot. Make sure it is not too hot (increase R1 if it is) that it could melt the foam cover material. Then make a foam polystyrene heat cover for it all, to dramatically cut down the power consumption & maintain a steadier temperature. Higher temperature foam can be made in a mould from expanded foam (cavity sealing/thermal insulation etc.).

See also my related tech buls, "Crystal Drift Compensation", "198kHz Off Air Standard", "Off Air Lock for Ref Osc", "Comparing Off Air Freq Standards", & "Calibrating Frequency".

Why don't U send an interesting bul?

73 de John G8MNY @ GB7CIP