The Pixie 2 transmitter

(Presented to the Vange ARC April 2016 – by Steve G0KVZ)

Introduction.

Back in 1992, the GQRP Club magazine featured a very simple transceiver circuit called a Micro-80. There have been many variants of this concept, with further refinements and improvements. And one of the more recent, and effective circuits is called the Pixie-2.

Browsing eBay one evening I stumbled upon a seller called tomtop-digital who was selling kits to make the Pixie for around £2.30. At this price, I just couldn't resist it. (Coincidentally, a week or two after I ordered this kit, the Pixie was featured in Radcom.)

Three or four weeks later, the kit landed on my mat. But I missed the diminutive package and trod on it!
When I carefully unwrapped the package I was pleasantly surprised, as there was no serious damage apart from a few bent legs on the chip, and chip socket.

Each of the components were identified (see parts list below) and fastened to a sheet of paper alongside printed component values to aid correct placement when I started construction.

After identifying and checking the components, my attention was drawn to the circuit board – this was a top quality glass fibre board, with silk screened legend on the component side, and lacquer covered track side, with clear regions over the solder pads. (Although I refer to track side of the board, it is actually a two sided board with through hole plating to ensure ease of construction and reliable connections between the two sides of the board.)

I set out my tools on the kitchen table, and placed the sheet of components on a tray, and all of the remaining components (buzzer, IC socket, connectors etc.) in a plastic box also on the tray.

I selected a very fine PTK-6 (310ºC) tip for the Weller soldering station, and commenced construction. It's been a while since I wielded a soldering iron, and it was soon apparent that an eye glass would be necessary for inspecting my joints – this was not due to me losing my touch, but due to the small size of the components and solder pads.
Fortunately, a combination of the correct soldering iron bit, the top quality board, and my residual soldering skills, the joints were really neat, and my confidence of sound joints was high. (The usual procedure was followed where low profile components were assembled and soldered first.)

To finish the kit off, I decided to make use of one of the ubiquitous "Altoids" tins. This was found to be the perfect size, and would enable me to include a PP3 battery, and Phono type aerial socket too (although these are not supplied with the kit.) As no power switch was included, I decided to rely on simply disconnecting the battery when the transceiver is not in use.

Cutting the holes was a concern as if one tries to drill such a thin metal enclosure, the twist drill would snag, and rip the metal. Fortunately, each of the holes just happened to be the same size as the holes punched in paper. So a single hole – hole-punch was employed, and this made short work of the three holes needed.

Parts List

Diodes
- D1 - 1N4001
- D2 - 1N4001
- D3 - 1N4148

Transistors
- Q1 - 9018
- Q2 - 8050

I.C.
- U1 - LM386

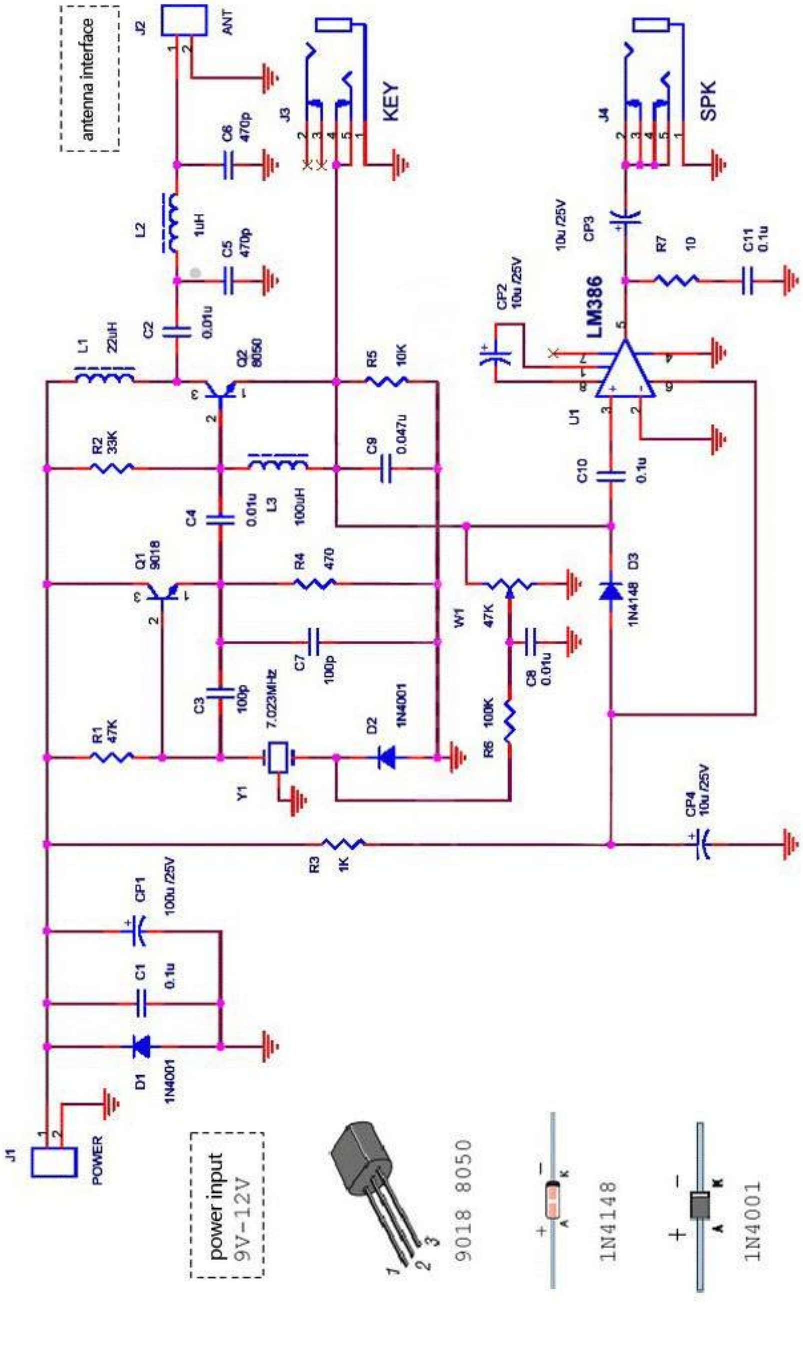
Crystal
- Y1 - 7.023MHz

Capacitors (Ceramic & Electrolytic)
- C1 - 0.1uF (104)
- C2 - 0.01uF (103)
- C3 - 100pF (101)
- C4 - 0.01uF (103)
- C5 - 470pF (471)
- C6 - 470pF (471)
- C7 - 100pF (101)
- C8 - 0.01uF (103)
- C9 - 0.047uF (473)
- C10 - 0.1uF (104)
- C11 - 0.1uF (104)
- CP1 - 100uF 25v
- CP2 - 10uF 25v
- CP3 - 10uF 25v
- CP4 - 10uF 25v

Resistors (0.25W)
- R1 - 47KΩ
- R2 - 33KΩ
- R3 - 1KΩ
- R4 - 470Ω
- R5 - 10KΩ
- R6 - 100KΩ
- R7 - 10Ω
- W1 - 47KΩ

Inductors
- L1 - (Red,Red,Black,Silver) 22uH
- L2 - (Brown,Black,Gold,Silver) 1uH
- L3 - (Brown,Black,Brown,Silver) 100uH

Circuit Diagram



Photographs of finished item.

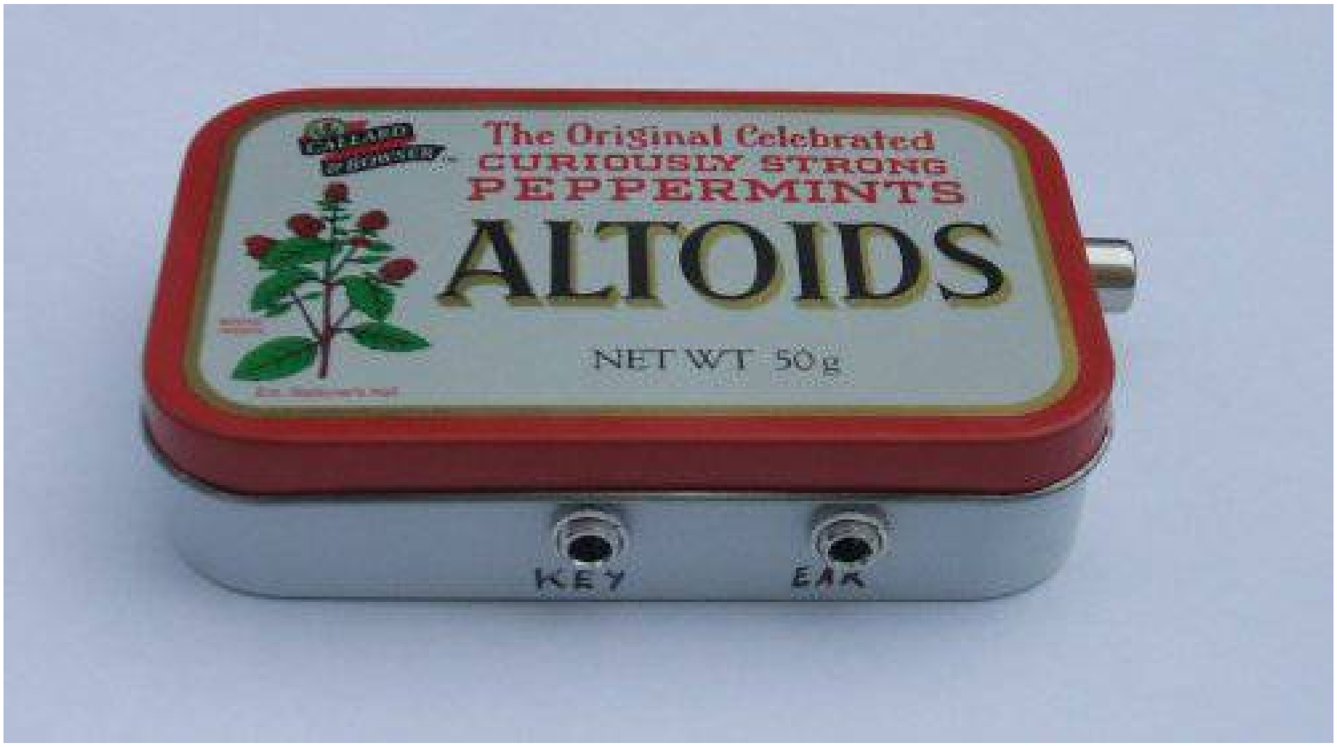


Illustration 1: Top/Front of finished project

Illustration 2: Internals of finished project

Magazine article from Radcom (Jan 2016)

Review

'Pixie'

7MHz QRP

CW transceiver kit

The 'Pixie' is a well-established low power CW transceiver that has been around for many years in various guises. Here we examine a typical inexpensive kit.

Introduction

Pixies are available in kit form from a number of sources. The one described here was obtained from a Chinese eBay supplier for just £2.89 including delivery. And this wasn't even the cheapest one I found!

There are several different versions [1], with the kits generally hovering around the £3 mark. Some have a BNC antenna socket and a power socket; others have two-pin flying lead connections for both the antenna and power. All the kits I've seen have 3.5mm sockets for the key and for headphones. Some are 3-transistor designs but most I saw, like this one, use two transistors and one IC.

Circuit

The Pixie reviewed here is a two transistor transceiver consisting of a 7.023MHz crystal oscillator and an RF output stage / receive mixer. The oscillator runs continuously and constantly feeds the output / mixer transistor. For transmit, the output / mixer transistor's emitter is grounded via the key and it acts as a (QRP) power amplifier. On key up (receive) a 10k resistor in the emitter circuit limits the transistor current and makes it act as a mixer for a direct conversion receiver. Cleverly, the crystal oscillator frequency is 'pulled' slightly on recieve by a 1N4001 acting as a varicap so that you can hear replies on your transmit frequency. A variable resistor on the board lets you set the magnitude of the change and thus the received tone frequency. Audio amplification is provided by a LM386 IC, which provides ample power for headphones or a small loudspeaker.

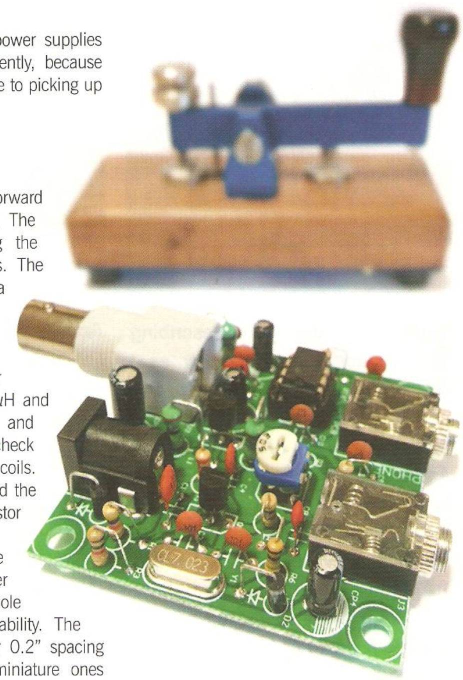
The output stage includes a very simple low pass filter but for anything other than novelty use you'd probably want to add better harmonic suppression via an outboard filter. Although the circuit diagram suggests that the circuit will work from 9-12V it's probably better to err on the higher side, perhaps with eight AA batteries. I measured the receive current at about 15mA so a PP3 battery wouldn't supply 9V for long anyway. Mains power supplies are not recommended, apparently, because the simple circuit is quite prone to picking up hum.

Construction

Building the circuit was straightforward and took me about an hour. The hardest part was identifying the capacitor and inductor values. The (limited) instructions included a decode of the tiny printing on the side of the capacitors – eg 0.1μF capacitors are marked 104 – but you're left to your own devices for the 1μh, 22μH and 100μH inductors. I cheated and used a cheap L/C meter to check that I'd correctly identified the coils. A magnifying glass helped read the capacitors and tell which transistor was which.

Component pads on the double sided PCB were rather small, although the through-hole plating greatly helped solderability. The PCB layout was designed for 0.2" spacing capacitors rather than the miniature ones supplied, which meant it was impossible to mount them snugly to the board without risking cracking their cases. Likewise, pads for the electrolytic capacitors were a tad far apart. I had no problem with the other components. The four sockets fitted perfectly and the board even included slot-shaped holes for the power socket's oblong pins.

Although not mentioned in the sparse documentation, the kit included a 56Ω resistor that could be used as a dummy load when testing – a nice touch. Oddly, there were several ceramic capacitors left over when I'd finished construction. They just went in my junkbox.



The Pixie 40m QRP CW transciever, which took me about an hour to contstuct.

In use

I was impressed that my transceiver worked first time. I was pleasantly surprised by the sensitivity and amount of activity I heard when I connected it to my vertical antenna. The Rx is easily tunable over its small range using the preset pot in the middle of the board. This is basically a single-frequency transceiver and once you've set the Rx frequency you're unlikely to need to alter it again. The tuning range is very small – a few hundred Hz – so you really don't need to make the pot a front panel control.

Transmit tone quality is largely set by the 'snappiness' of your Morse key's contacts. Dirty contacts give a very 'scratchy' transmit sound. The front end is as wide as a barn door, of course, and as it's a direct conversion receiver you hear signals either side of your wanted frequency. But hey, what do you expect for £3? It's a fun little one-evening kit that actually works quite well and would make a great Intermediate practical project.

WEBSEARCH

[1] History of the Pixie design – www.gqrp.com/The_Sprat_Pixie_File.pdf

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