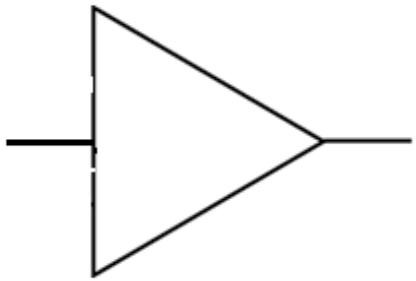
How The Pixie Transceiver Works

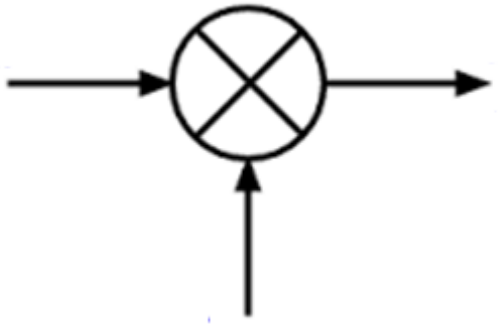
… in 18 minutes or less.

Radio Building Blocks



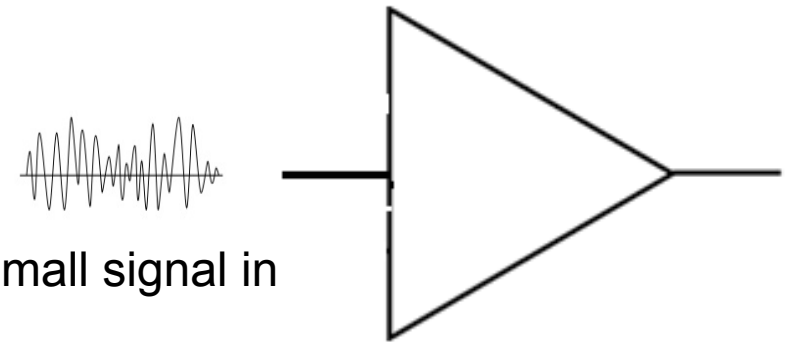
Amplifier

Oscillator

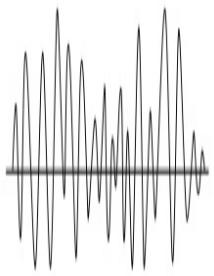


Mixer

Amplifiers



Small signal in



Larger signal out

Gain = Ratio of output / input

Types

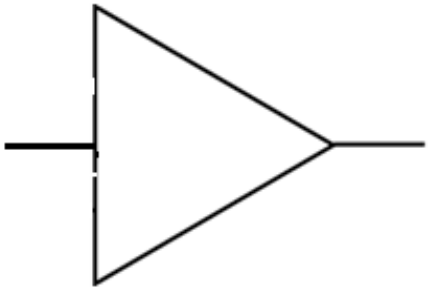
- Audio, RF

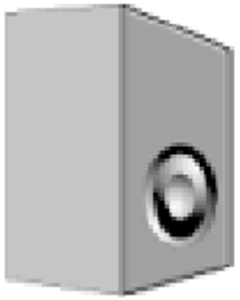
Function

- Power, Signal (voltage)

An Audio Power Amplifier

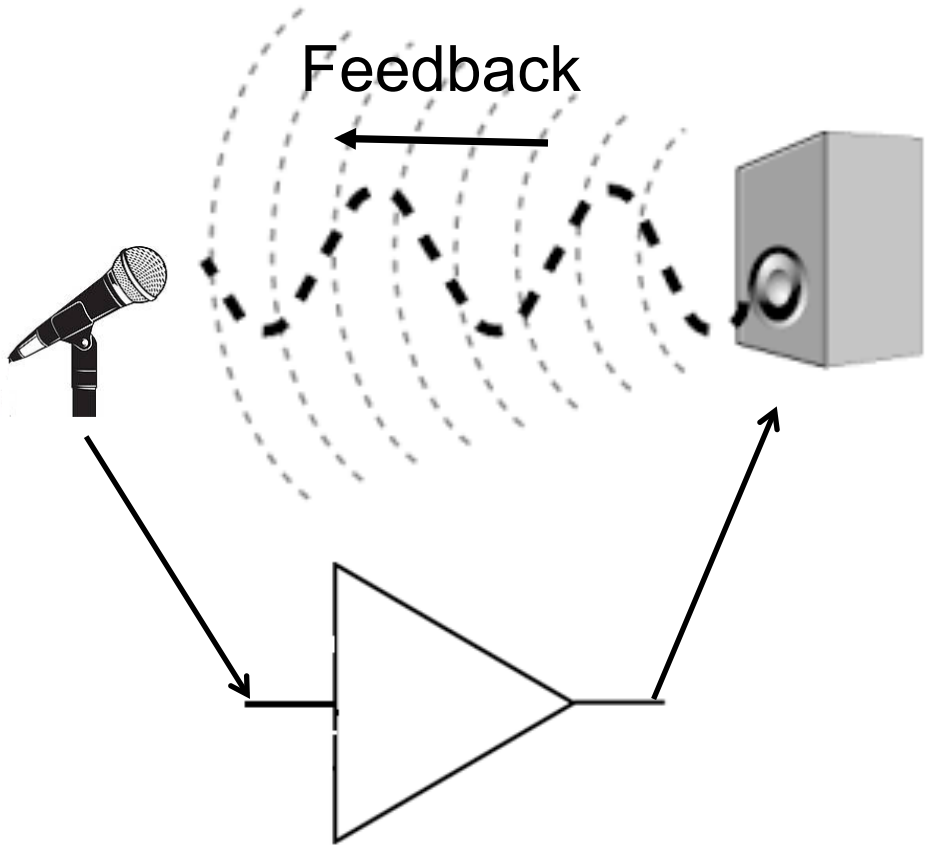
Hello…



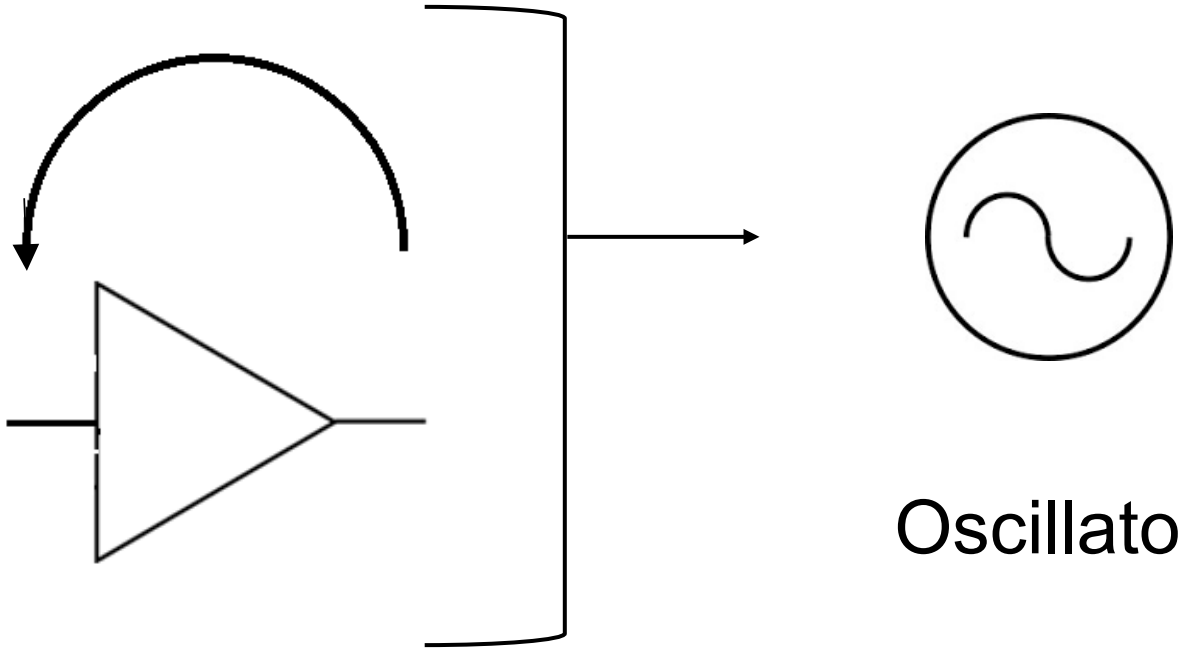


Hello…

An Audio Power Amplifier

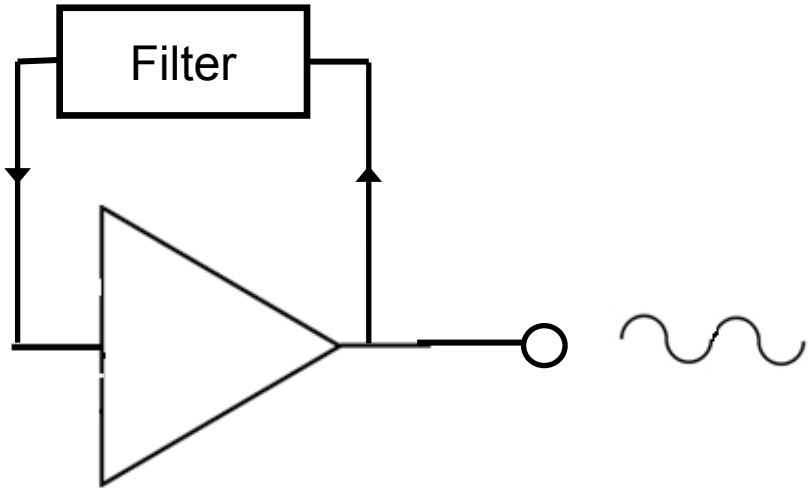


How to Make an Oscillator



An amplifier with sufficient gain and positive feedback becomes an oscillator.

Oscillator Frequency Control

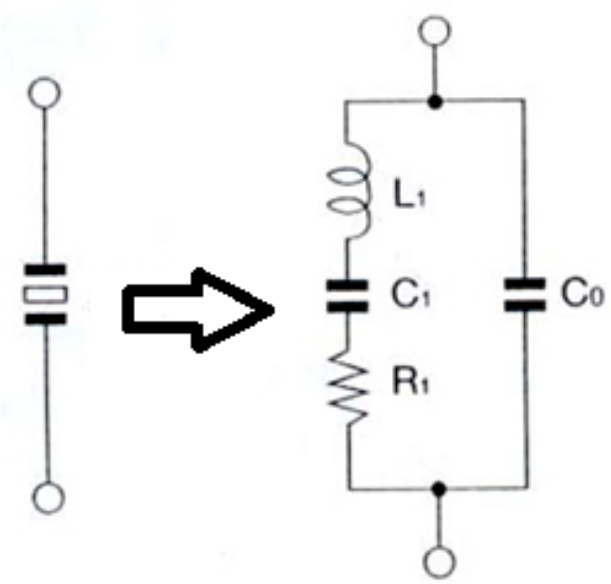


The filter elements can be fixed or adjustable.

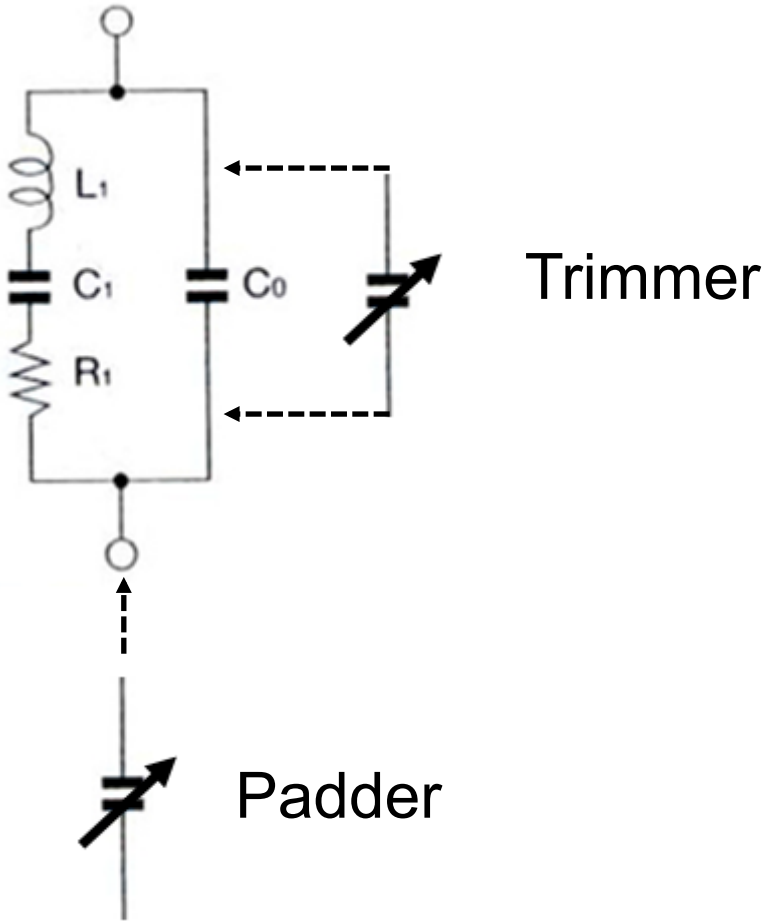
A quartz crystal is ideal as a fixed element.

- Good frequency stability
- Low component count
- Relatively inexpensive

Quartz Crystal Equivalent Circuit

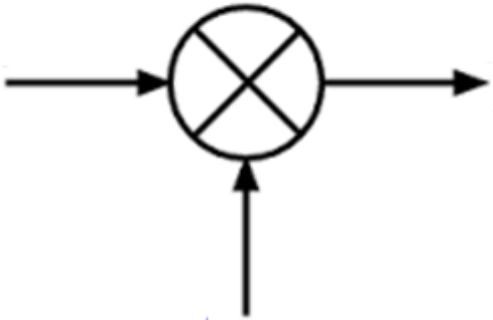


“Rubbering” a Crystal



Mixers

This



"Frequency Mixer"

"Heterodyne Mixer"

Very non-linear

(Extreme distortion)

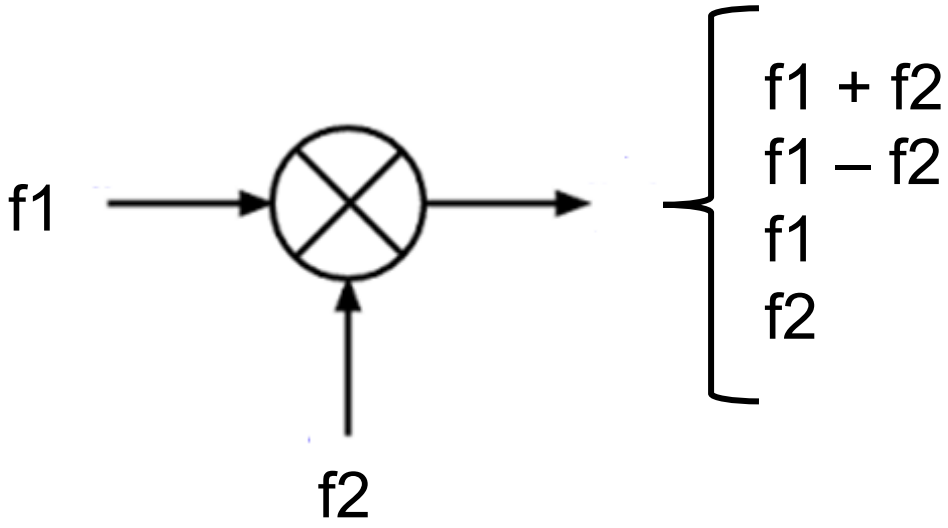
Not This

Audio Mixer

Very linear

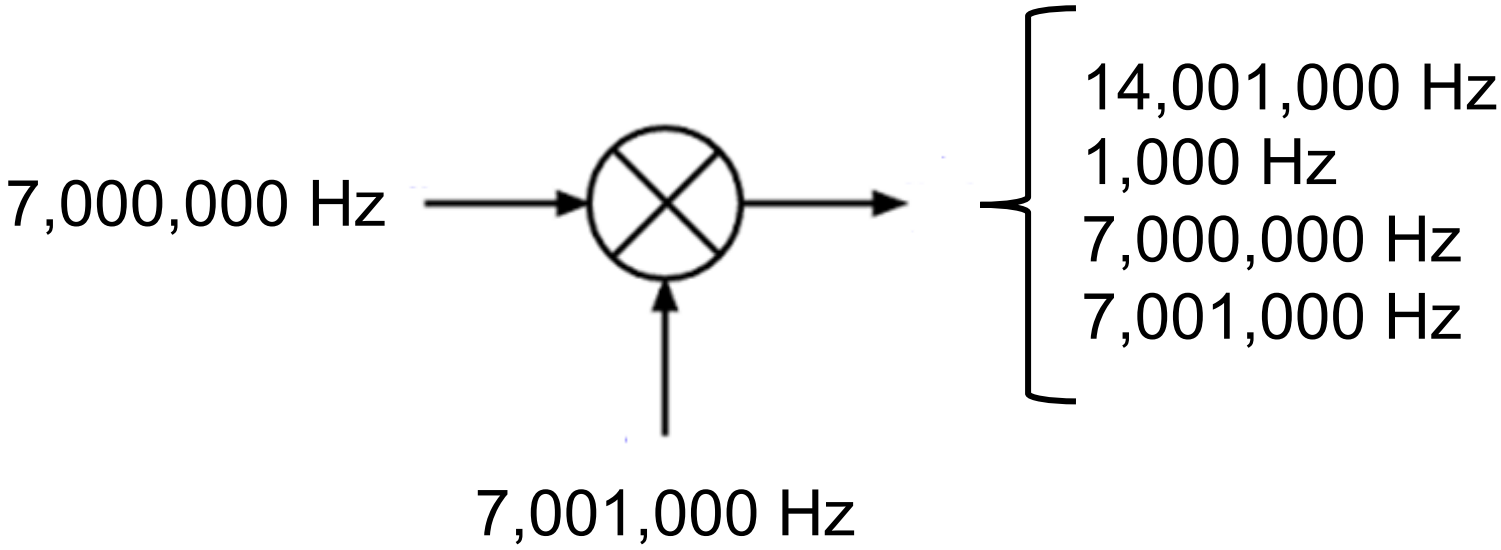
(Very low distortion)

Mixer Operation



“The Sum, the Difference, and the Two Originals”

Mixing Example

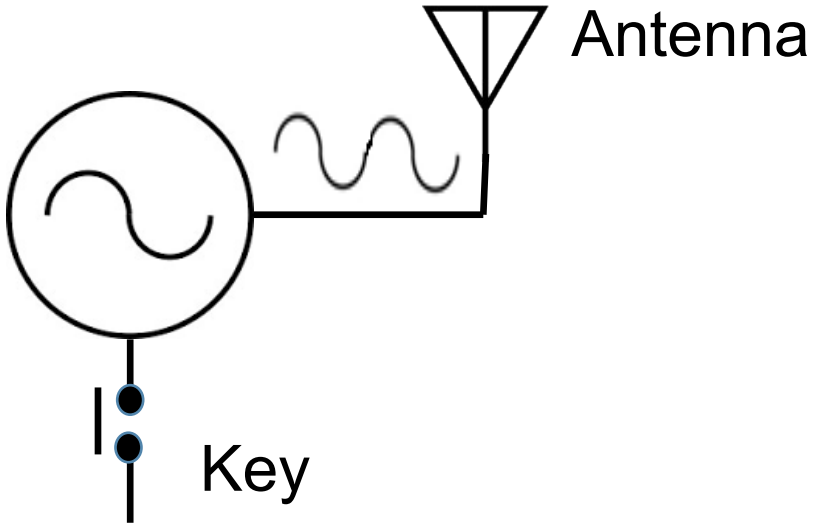


“The Sum, the Difference, and the Two Originals”

With those building blocks…

Let’s make radios.

A Simple CW Transmitter

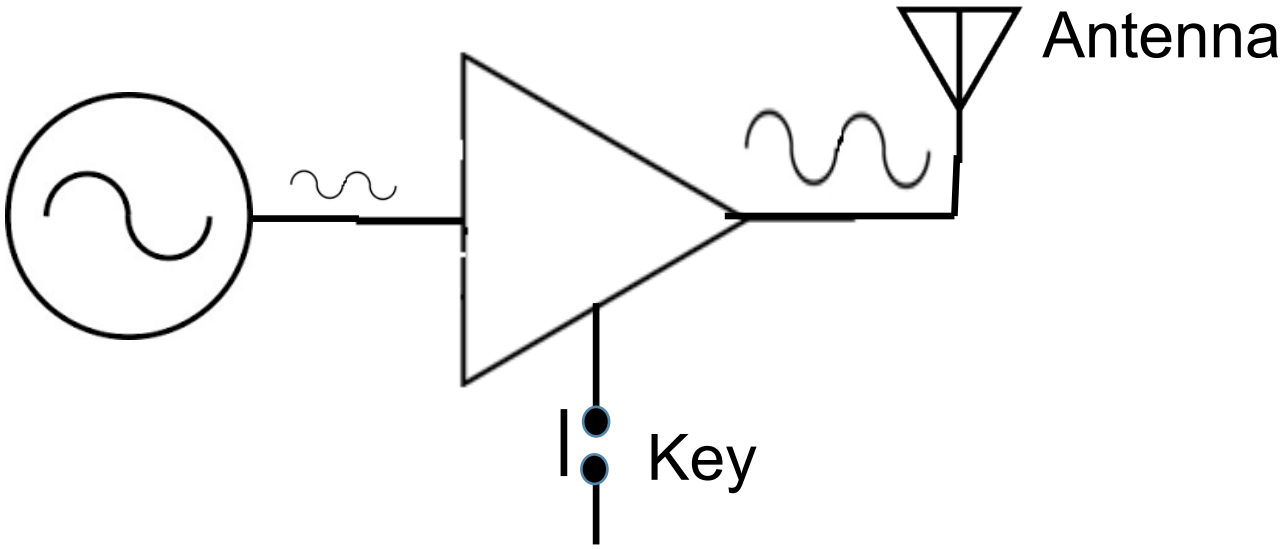


Drawbacks:

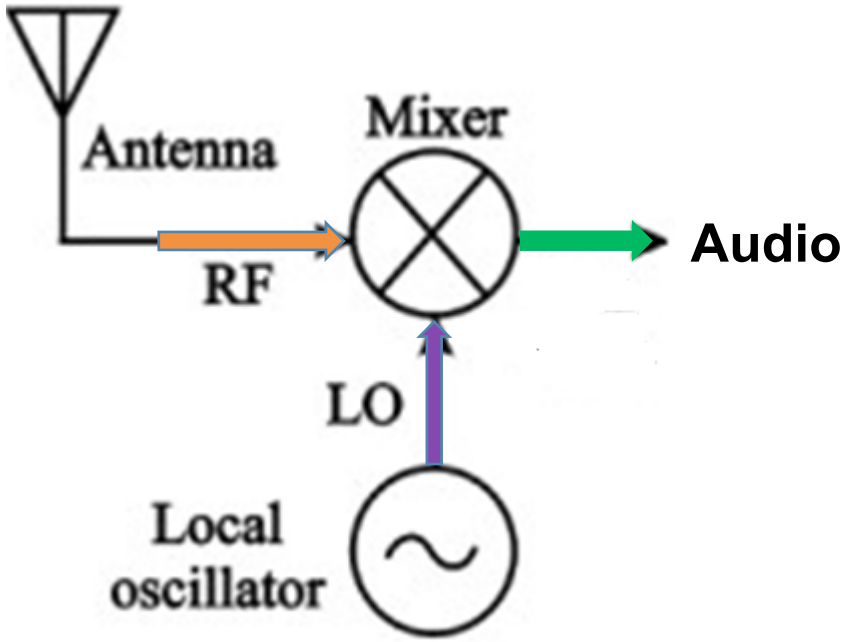
- Component heating can cause drift
- Antenna changes can pull frequency
- Prone to Chirp

A Better CW Transmitter - MOPA

Master Oscillator Power Amplifier



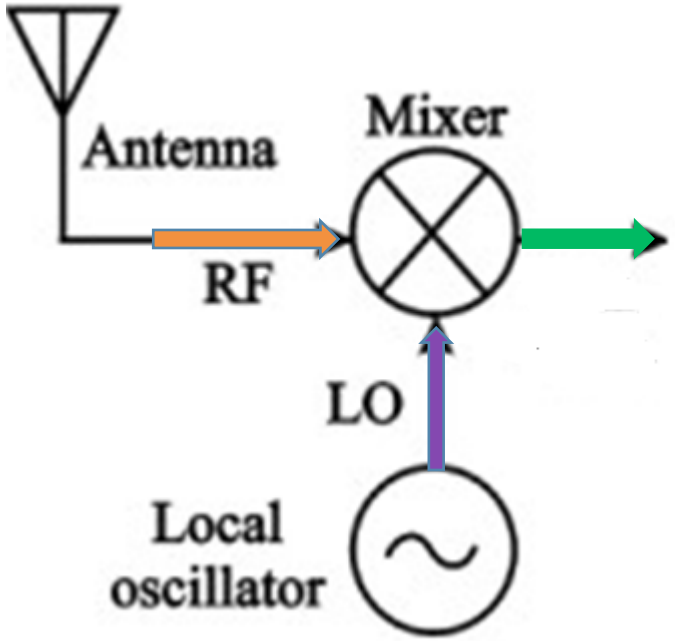
A Simple Radio Receiver



This is known as a **Direct Conversion** Receiver

Direct Conversion Receiver Operation

7,000,000 Hz
Radio Signal

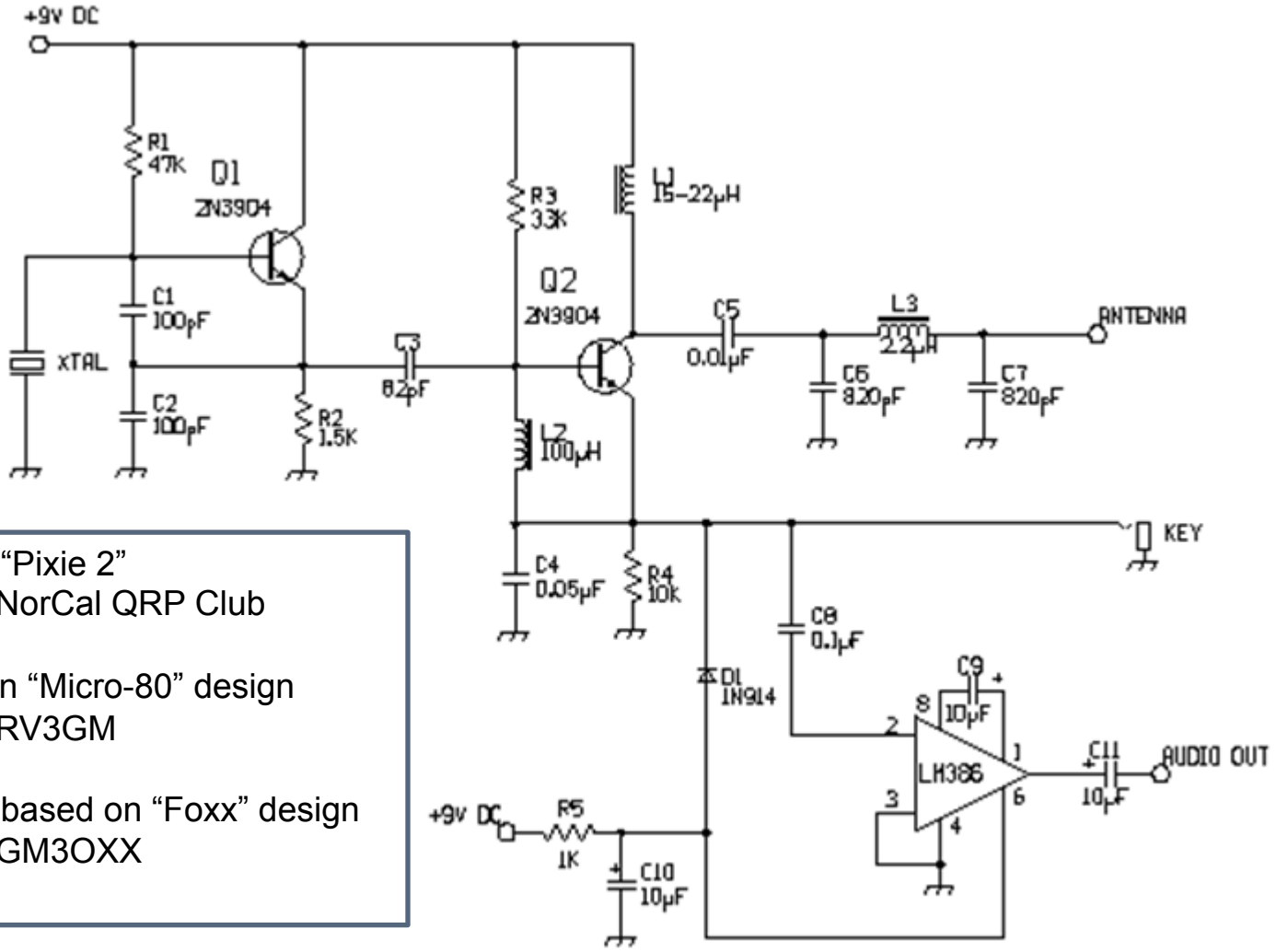


1,000 Hz
Audio Note
(The difference)

7,001,000 Hz
Oscillator Frequency

Now… On to the Pixie

The Pixie Transceiver

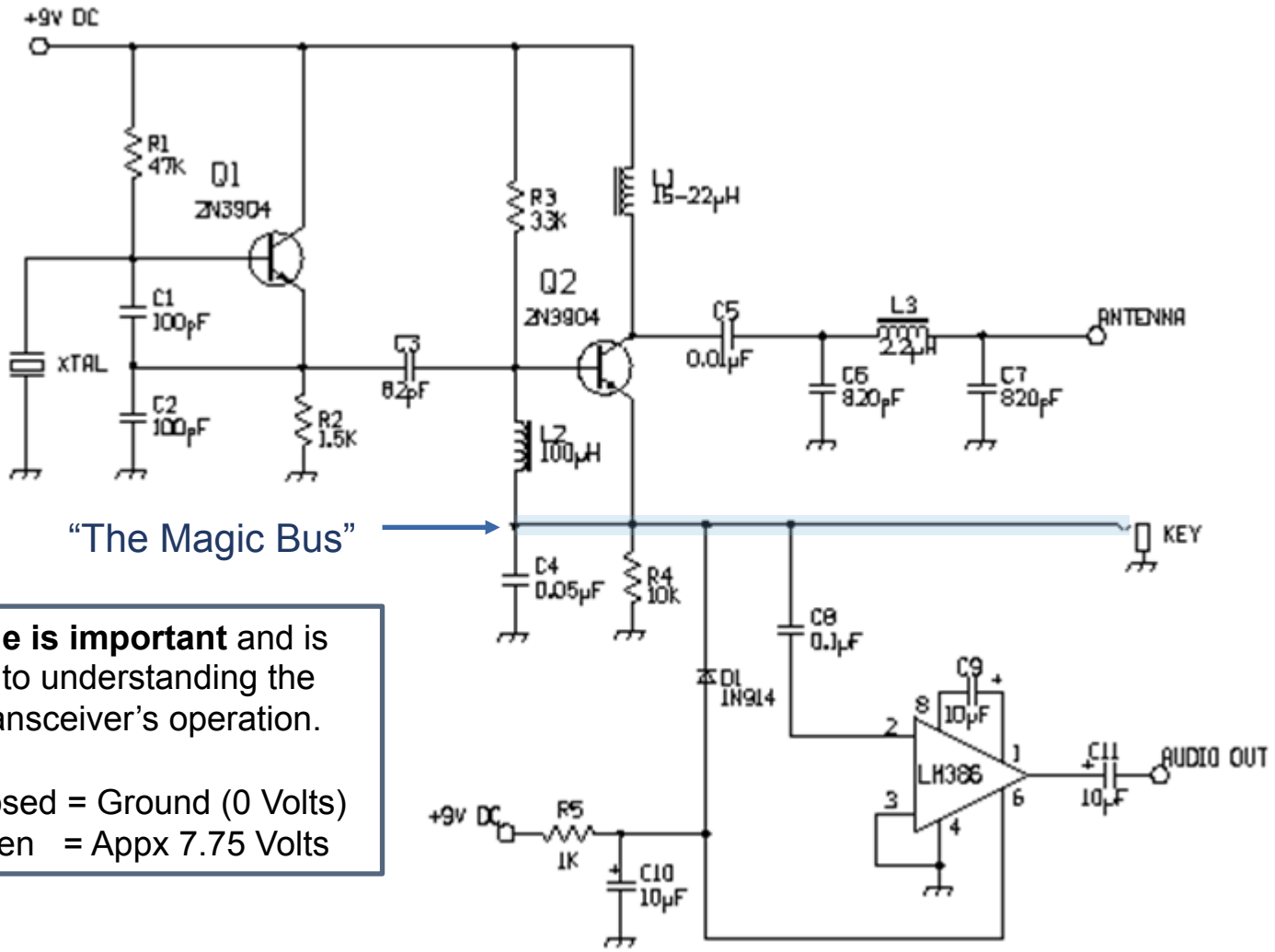


Original “Pixie 2”
c. 1995 NorCal QRP Club

Based on “Micro-80” design
c. 1992 RV3GM

Loosely based on “Foxx” design
c. 1982 GM3OXX

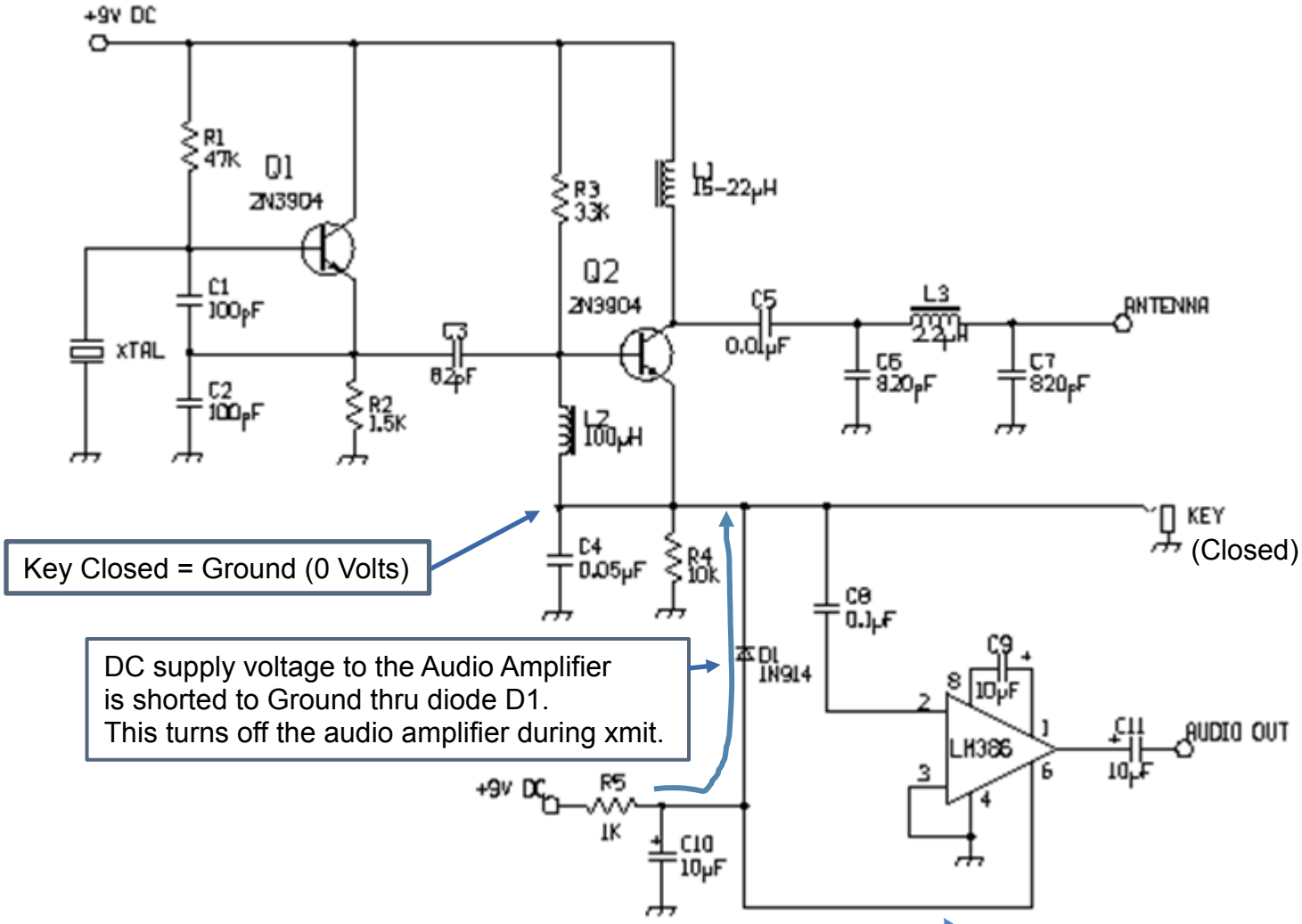
The Pixie Transceiver



This line is important and is the key to understanding the Pixie transceiver's operation.

Key Closed = Ground (0 Volts)
Key Open = Appx 7.75 Volts

The Magic Bus – Key Closed

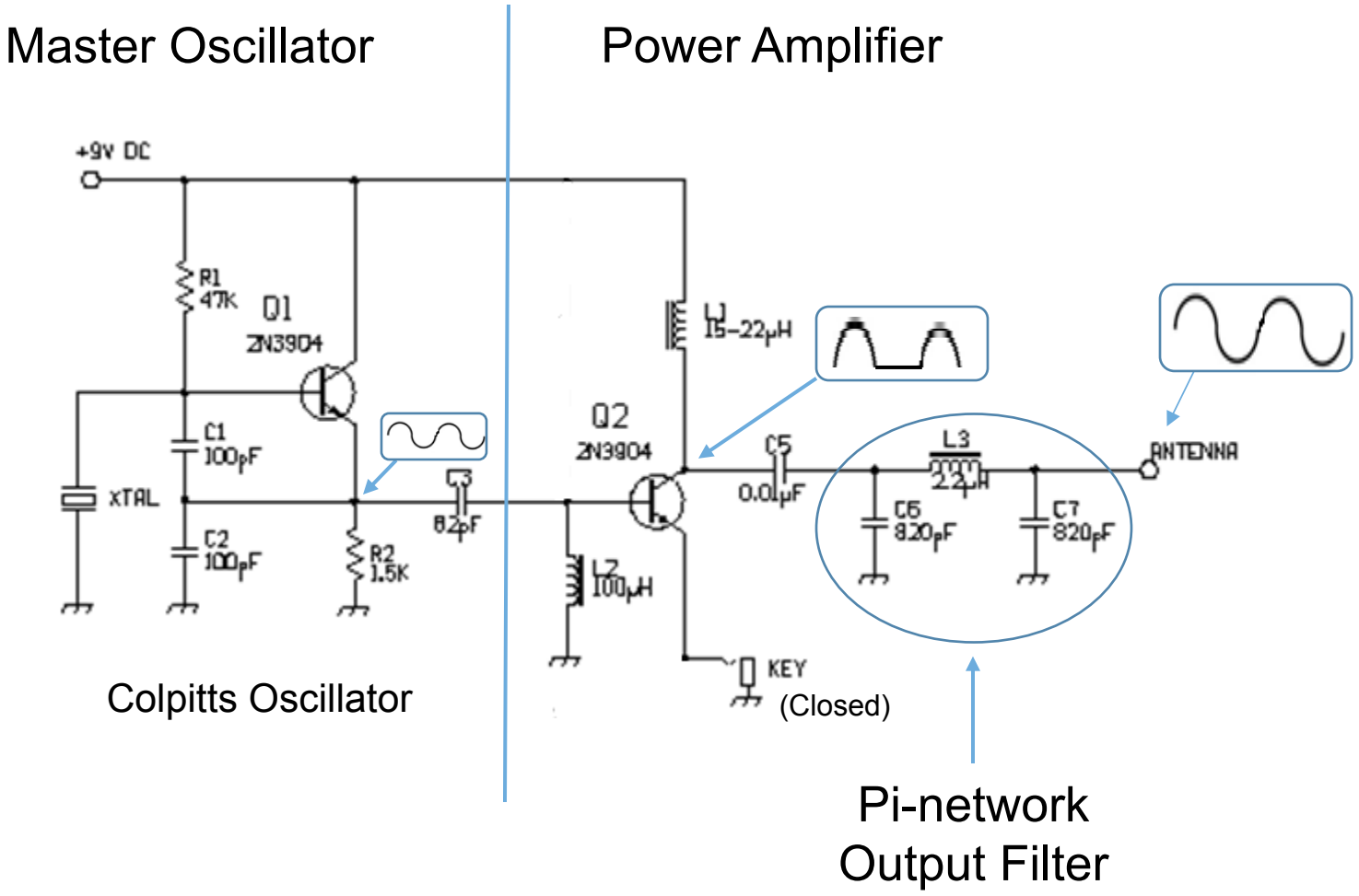


Key Closed = Ground (0 Volts)

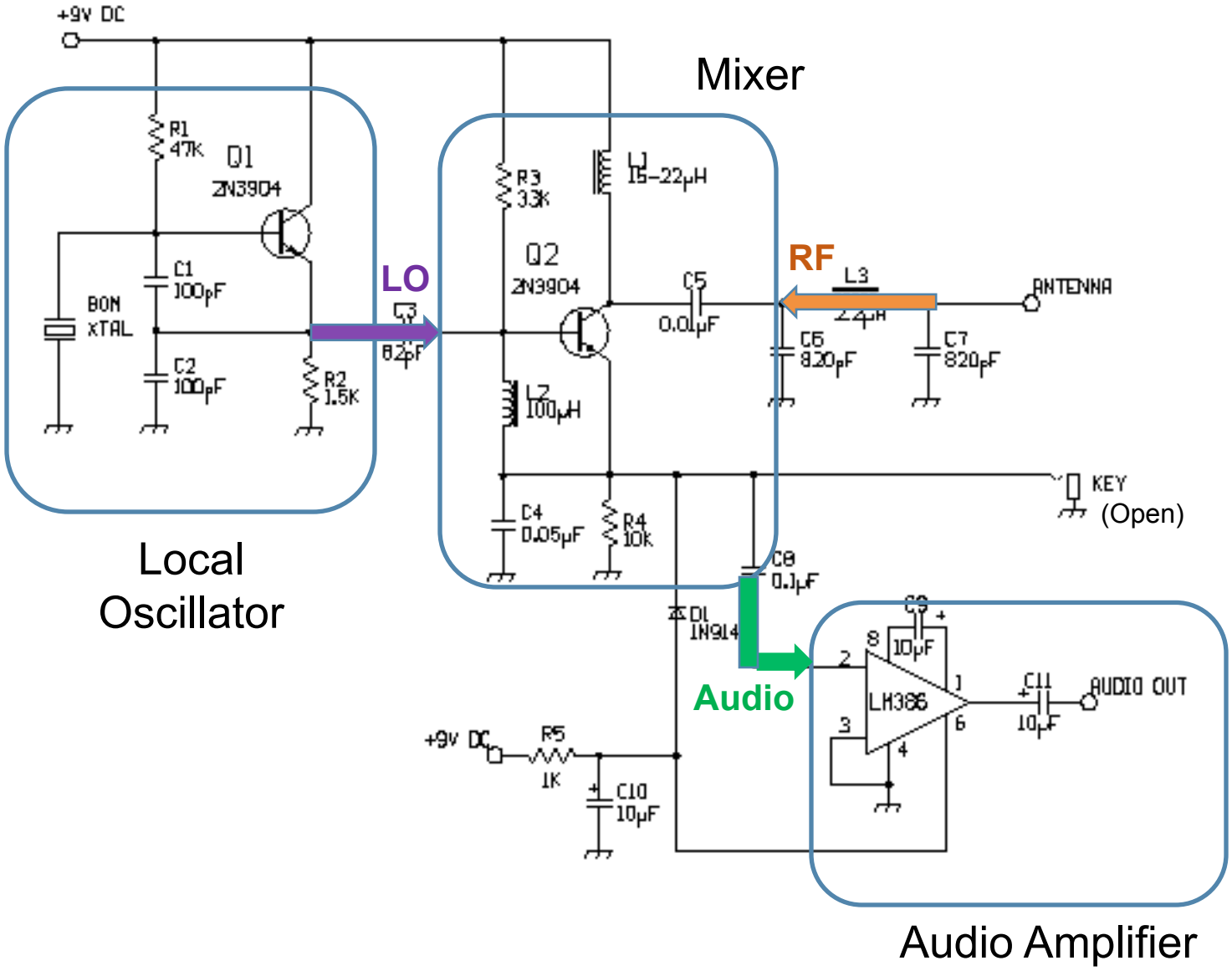
DC supply voltage to the Audio Amplifier
is shorted to Ground thru diode D1.
This turns off the audio amplifier during xmit.

Power Rail for Audio Amplifier

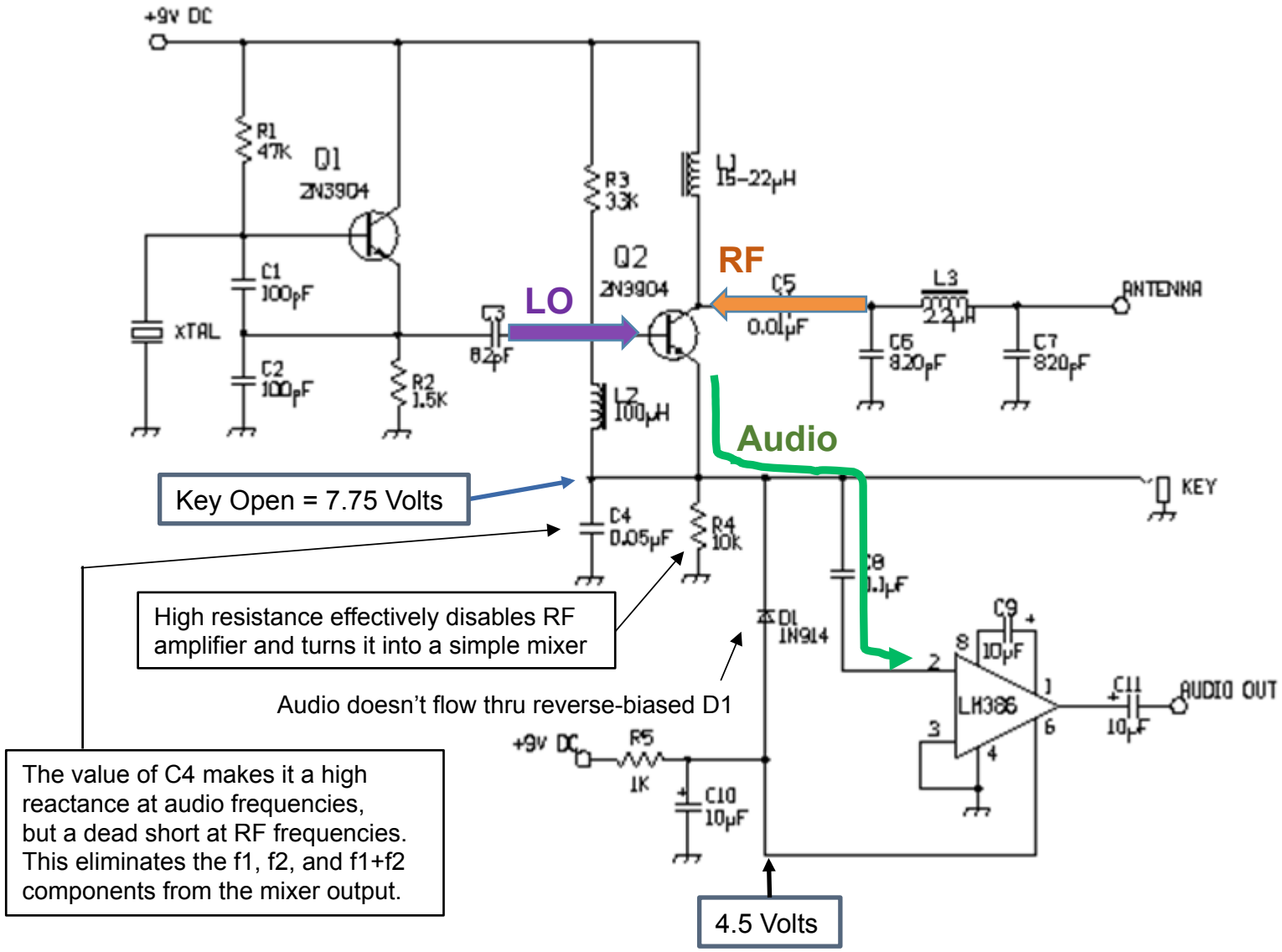
Pixie Key Closed - Transmitter



Pixie Key Open - Receiver

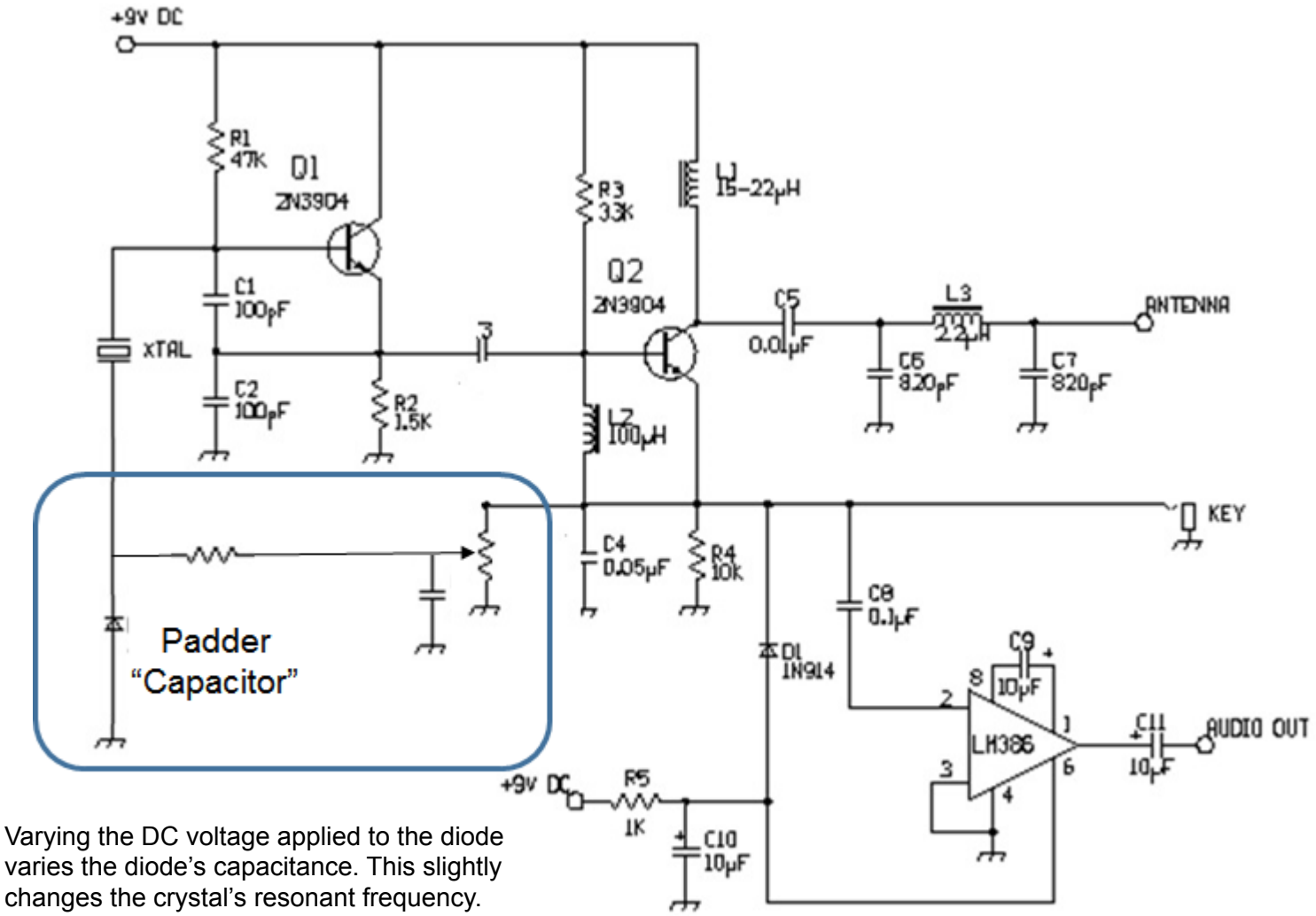


The Magic Bus – Key Open



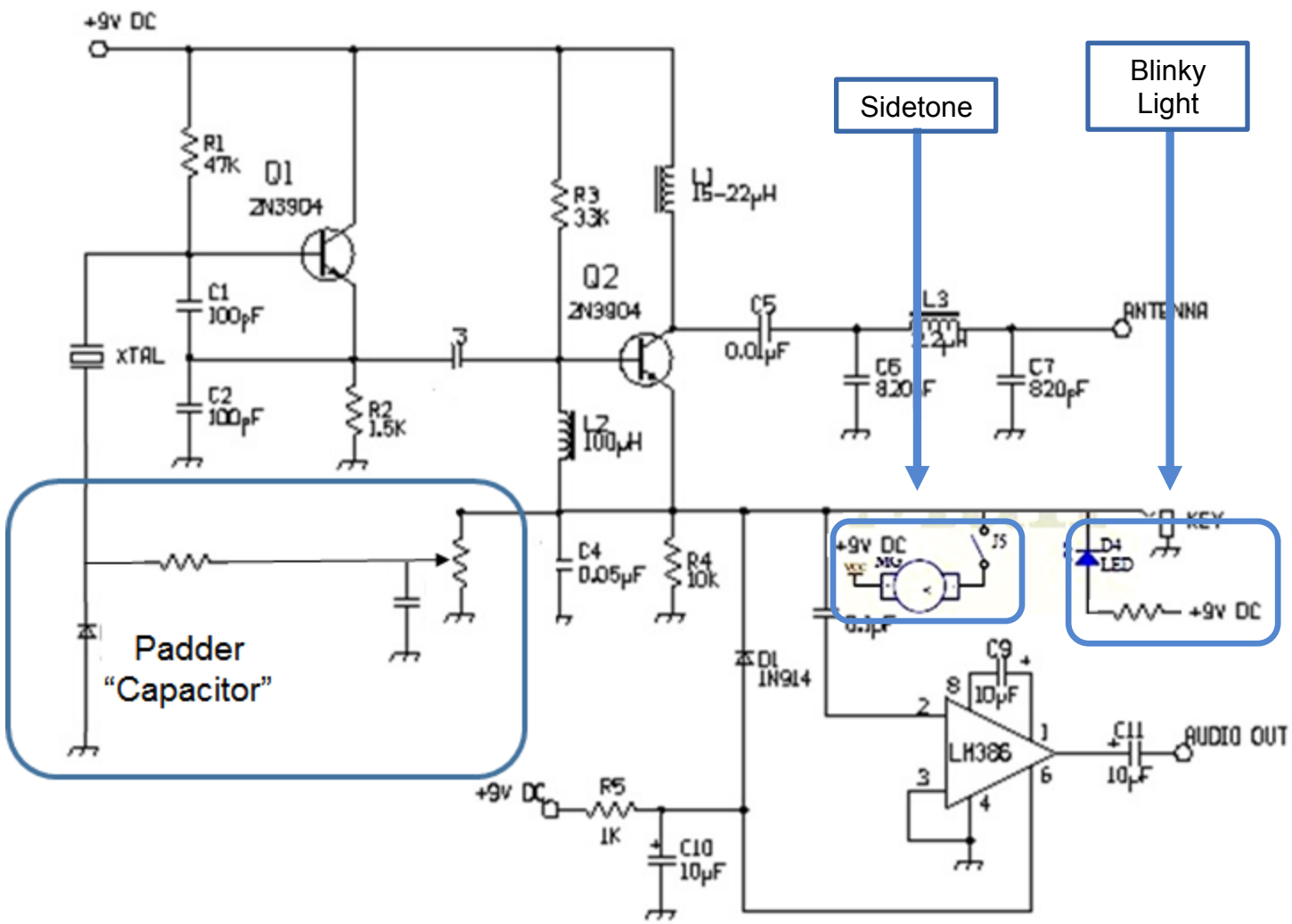
Super Pixie Additions

Adding a Bit of Frequency Mobility

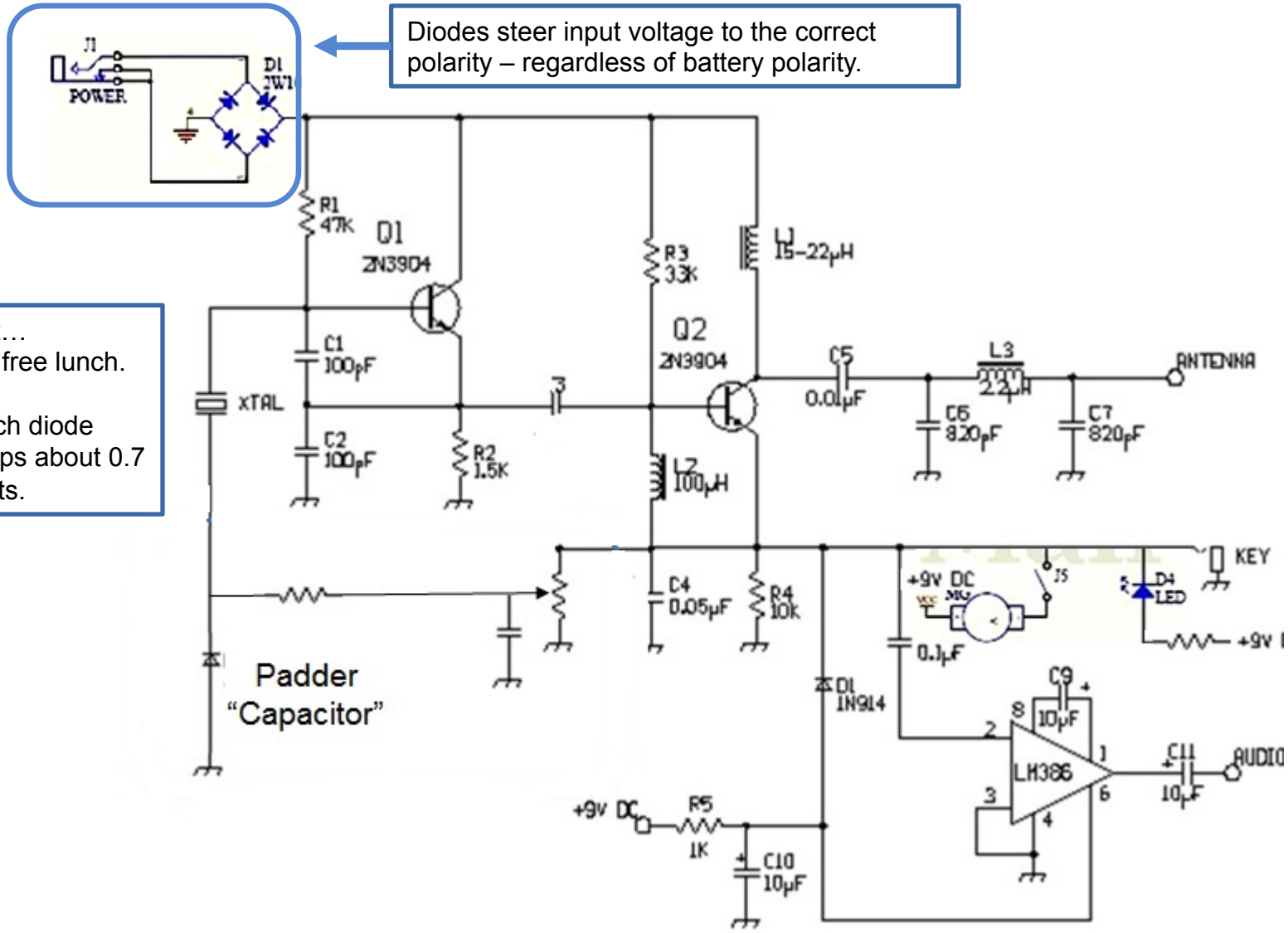


Varying the DC voltage applied to the diode varies the diode's capacitance. This slightly changes the crystal's resonant frequency.

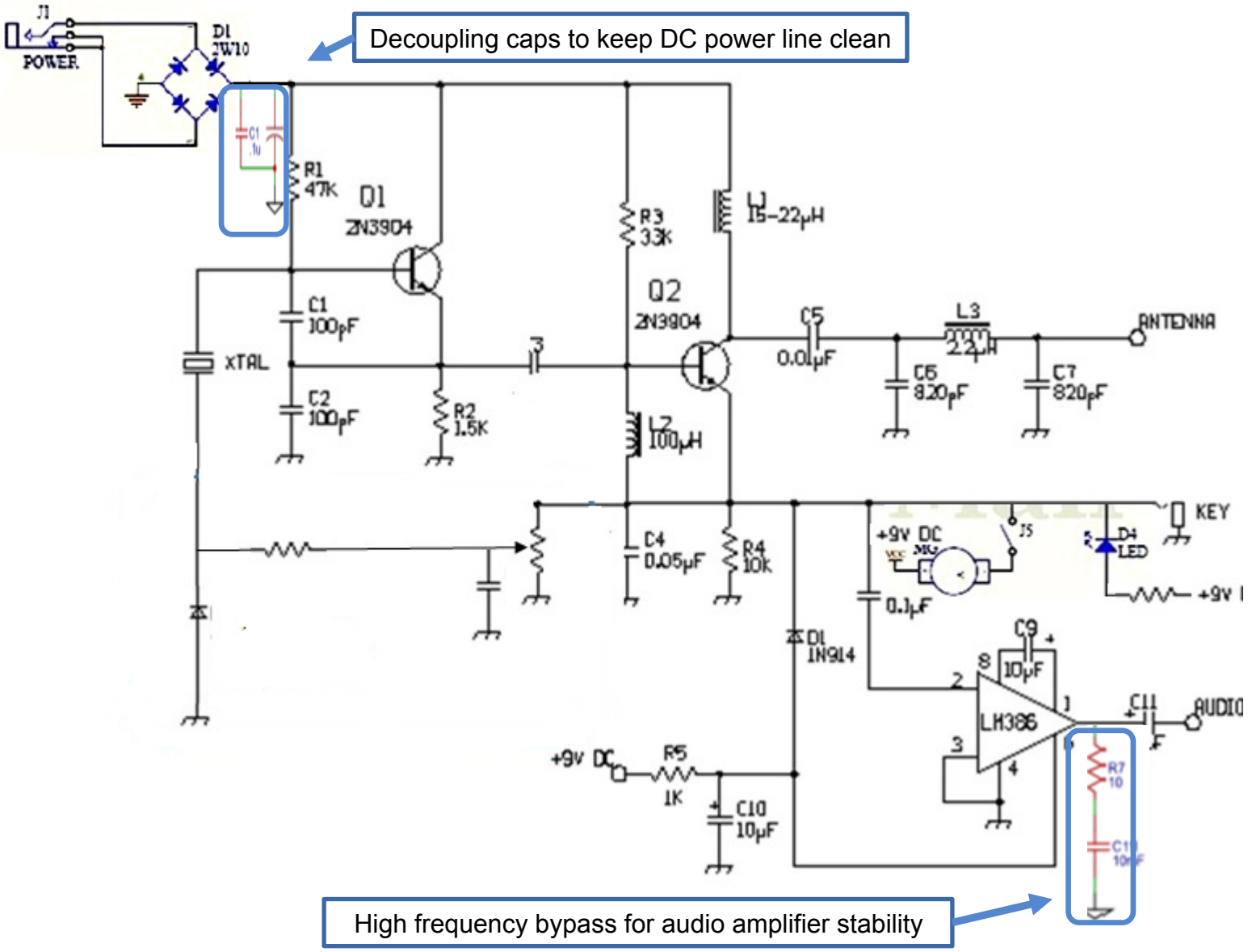
Adding Sidetone and a Blinky Light



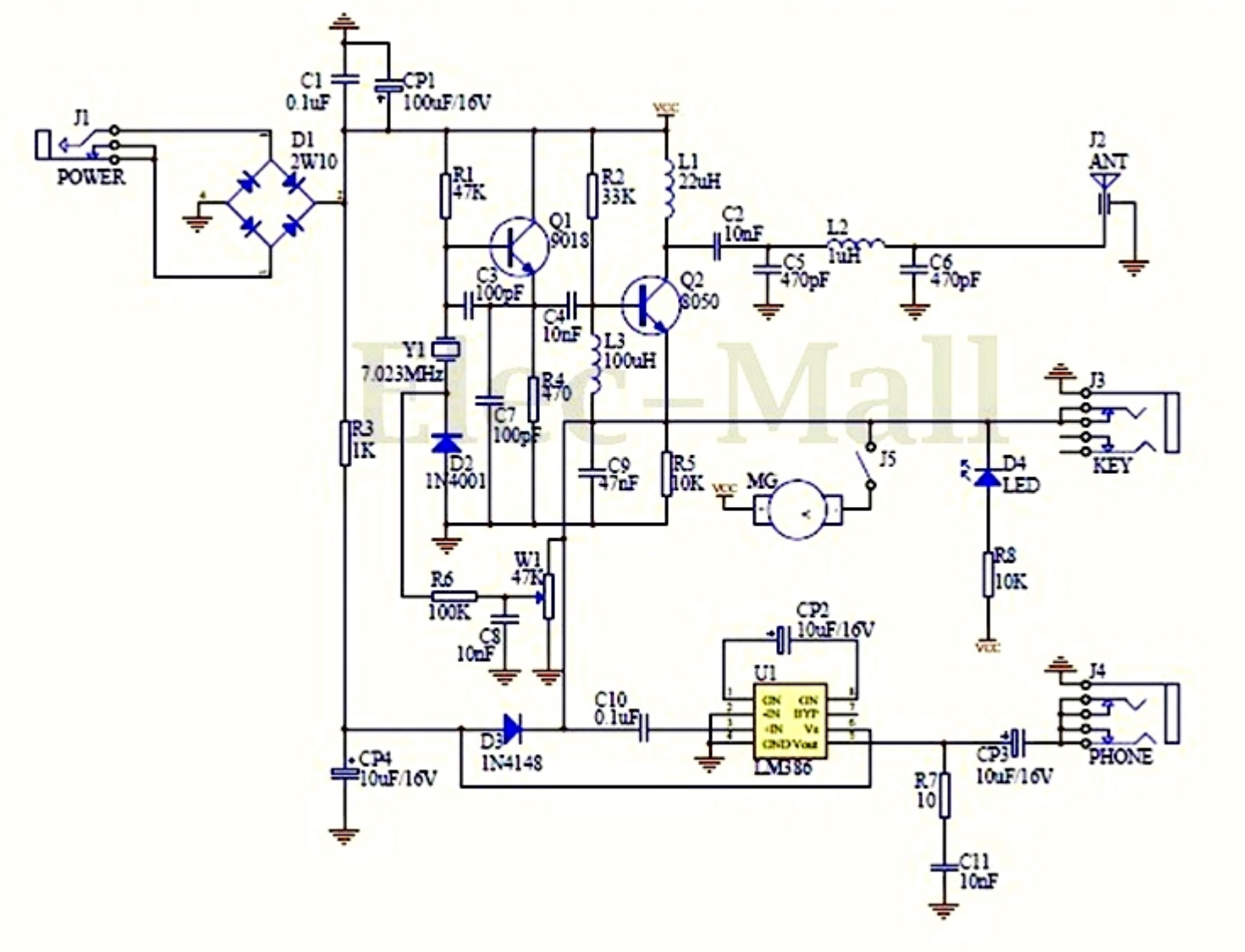
Goof-proofing the Power Input



Complete Super Pixie Schematic



Super Pixie Schematic – Chinese Rendition



That’s the Pixie.

Is it an elegant minimalist design…

Or a clever hack?

Either way, it’s fun to build and a real thrill to make contacts on the air with a rig you built yourself.