# ICARC DTOA Fox Receiver

This presentation describes the latest
FOX Project

A low cost dedicated directional receiver for VHF
and UHF fox hunts

http://www.icarc.org/icarc_foxhunt.htm

# ICARC DTOA Fox Receiver

## History:
## 102-73170 DTOA switch

Successful unit that exploits
***Differential Time Of Arrival technique***

Uses handy-talkie (cheap Baofeng or more expensive
Kenwood, Yaesu, ICOM)

# ICARC DTOA Fox Receiver

## DTOA

FM Receiver will demodulate a phase shift producing an audio *squeal*

Switch receiver input between two antennas at 500Hz to 1KHz

Orient the antenna array normal to the source to minimize audio *squeal*
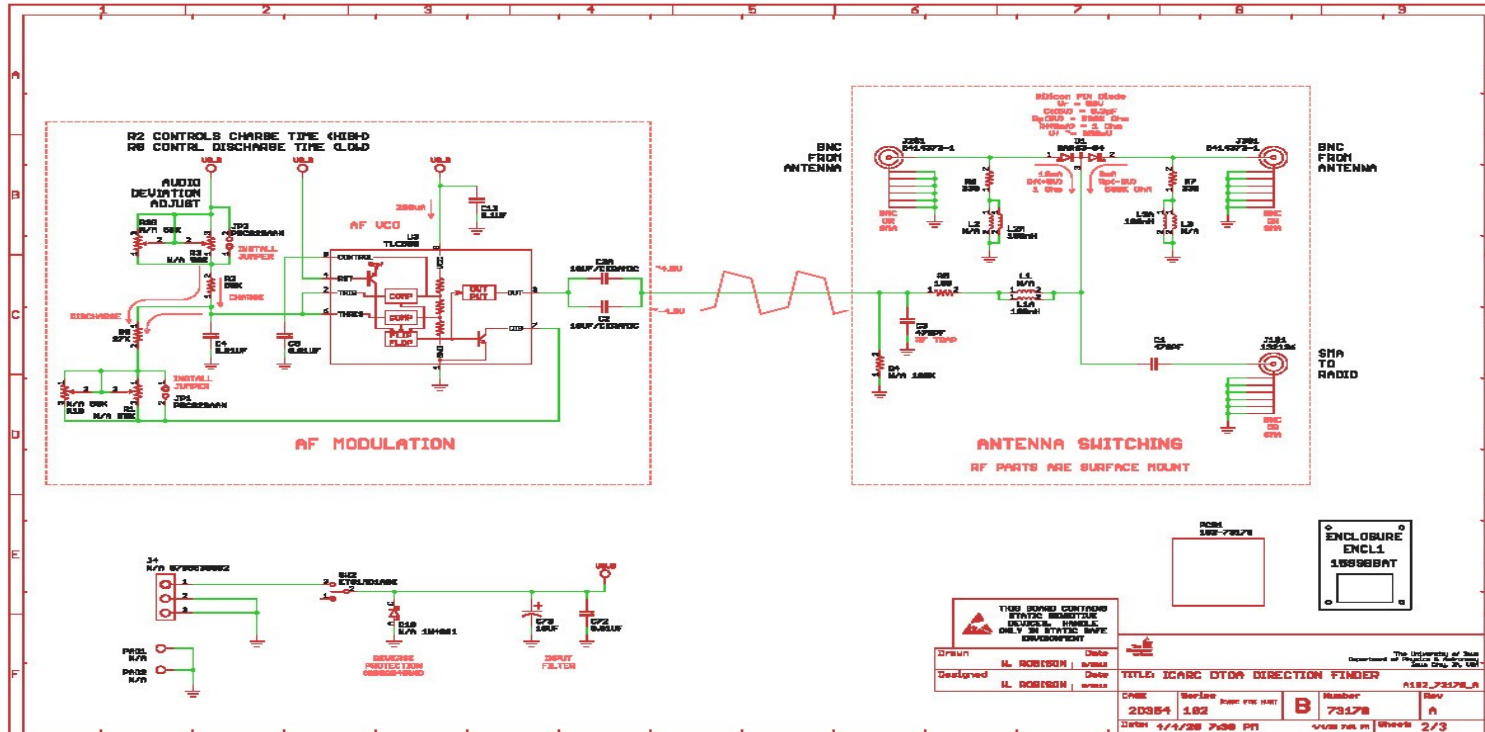
# ICARC DTOA Fox Receiver

## 102-73170 DTOA switch internals

555 timer to generate switching signal.  A square wave of around 1KHz.

BAR63-04 PIN diode used as RF switch.  Two diodes, series connected.

Pass RF when forward biased.  Only one biased at a time.

# ICARC DTOA Fox Receiver

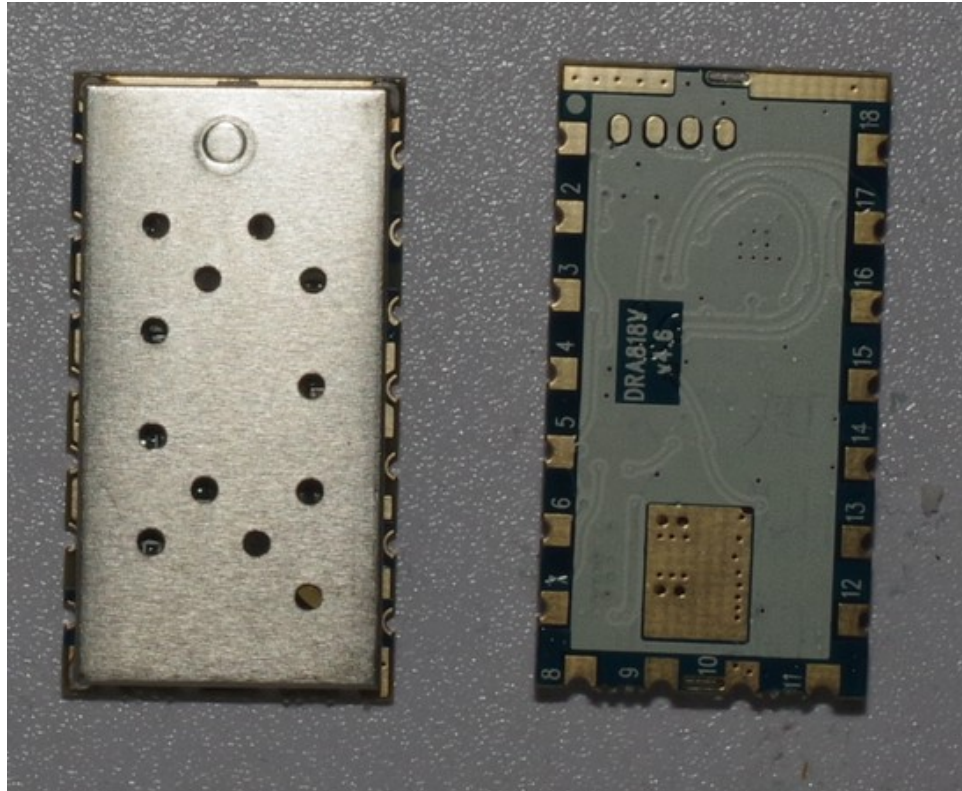# ICARC DTOA Fox Receiver

## 102-73185 DTOA receiver

zNEO generates switching signal.  Square wave at 500Hz.

BAR64-05 PIN diode used as RF switch.  Two diodes, common cathode.

Pass RF when forward biased.  Nominally only one diode biased at a time.

# ICARC DTOA Fox Receiver

## 102-73185 RF Section, DRA818

# ICARC DTOA Fox Receiver

## 102-73185 RF Section

DRA818/SA818 RF tranceiver

Less than $15 on ebay !!!

36mm by 19mm (1.5" by 0.750")

500mW or 1000mW output power

4V power supply

# ICARC DTOA Fox Receiver

## 102-73185 Processor

ZiLOG zNEO

128KB program FLASH    4KB data SRAM

Lots of useful peripherals

Free development tools (software)

# ICARC DTOA Fox Receiver
## 102-73185 PIN Driver

MAX3188, an RS232 driver, supplies +5V or -5V on output pin

MAX870 is switch capacitor inverter.

-5V current flows only to charge node capacitance during switching.

Schematic Sheet 2:7B  PIN Driver

Schematic Sheet 2:7E  -5V Supply

# ICARC DTOA Fox Receiver
## 102-73185 Audio Subsystem

DRA818 provides enable when carrier present

ZNEO provides enable when it want to *talk*

ZNEO uses PWM controller to implement DAC

DAC bandwidth somewhat limited

Schematic Sheet 2:2F  PWM Filter

Schematic Sheet 3:6D  Audio Amplifier

Schematic Sheet 3:3B  Audio Summer

# ICARC DTOA Fox Receiver

## 102-73185 TOY and FRAM

Same DS1672 and MB85RS4MT as used on the 102-73161 and 102-73181 Fox Transmitters

FRAM is 4Mb to make room for audio clips.

Schematic Sheet 4:5C  FRAM

Schematic Sheet 2:3E  TOY Clock

# ICARC DTOA Fox Receiver

## 102-73185 Network Port

ICOM CI-V compatible

Full Duplex / Half Duplex

Schematic Sheet 5:4B  CI-V Interface

# ICARC DTOA Fox Receiver
## 102-73185 Display and Controls

LCD   8 characters   2 lines

Rotary Encoder w/button

Volume Control

Schematic Sheet 4:6D  LCD

Schematic Sheet 5:8D Encoder

Schematic Sheet 3:4D  Volume Control

# ICARC DTOA Fox Receiver

## 102-73185 Power Management

Much the same as 102-73161-25 and 102-73181

Switchmode on battery to get to 5V

Linear device for 3.3VB rail.

Schematic Sheet 1:3D  Switchmode power convertor

Schematic Sheet 1:6D  Linear Regulator

Schematic Sheet 1:6D  DRA818/SA818 Regulator

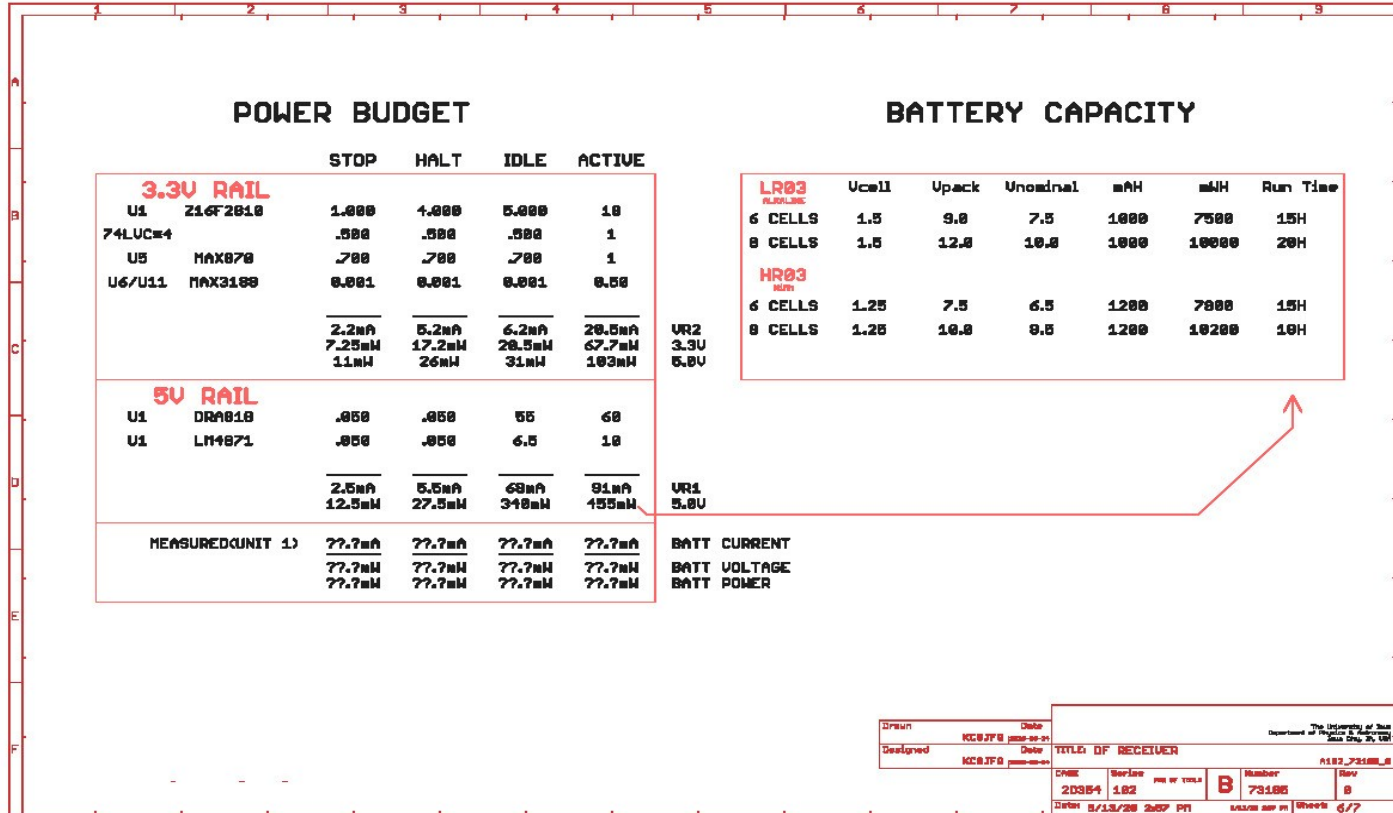# ICARC DTOA Fox Receiver

## 102-73185 Power Estimates

DRA818/SA818 are power hogs

Software Power Management?

Schematic Sheet 6  Power Estimates (next page)

# ICARC DTOA Fox Receiver

## POWER BUDGET

### 3.3V RAIL

|  |  | STOP | HALT | IDLE | ACTIVE |  |
|---|---|---|---|---|---|---|
| U1 | Z16F2810 | 1.000 | 4.000 | 5.000 | 10 |  |
| 74LVCx4 |  | .500 | .500 | .500 | 1 |  |
| U5 | MAX870 | .700 | .700 | .700 | 1 |  |
| U6/U11 | MAX3188 | 0.001 | 0.001 | 0.001 | 0.50 |  |
|  |  | 2.2mA | 5.2mA | 6.2mA | 20.5mA | VR2 |
|  |  | 7.25mW | 17.2mW | 20.5mW | 67.7mW | 3.3V |
|  |  | 11mW | 26mW | 31mW | 103mW | 5.0V |

### 5V RAIL

|  |  | STOP | HALT | IDLE | ACTIVE |  |
|---|---|---|---|---|---|---|
| U1 | DRA818 | .050 | .050 | 55 | 60 |  |
| U1 | LM4871 | .050 | .050 | 6.5 | 10 |  |
|  |  | 2.5mA | 5.5mA | 60mA | 91mA | VR1 |
|  |  | 12.5mW | 27.5mW | 340mW | 455mW | 5.0V |

| MEASURED(UNIT 1) | ??.?mA | ??.?mA | ??.?mA | ??.?mA | BATT CURRENT |
|---|---|---|---|---|---|
|  | ??.?mW | ??.?mW | ??.?mW | ??.?mW | BATT VOLTAGE |
|  | ??.?mW | ??.?mW | ??.?mW | ??.?mW | BATT POWER |

## BATTERY CAPACITY

### LR03 ALKALINE

|  | Vcell | Vpack | Vnominal | mAH | mWH | Run Time |
|---|---|---|---|---|---|---|
| 6 CELLS | 1.5 | 9.0 | 7.5 | 1000 | 7500 | 15H |
| 8 CELLS | 1.5 | 12.0 | 10.0 | 1000 | 10000 | 20H |

### HR03 NiMH

|  | Vcell | Vpack | Vnominal | mAH | mWH | Run Time |
|---|---|---|---|---|---|---|
| 6 CELLS | 1.25 | 7.5 | 6.5 | 1200 | 7800 | 15H |
| 8 CELLS | 1.25 | 10.0 | 9.5 | 1200 | 10200 | 19H |

# ICARC DTOA Fox Receiver

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