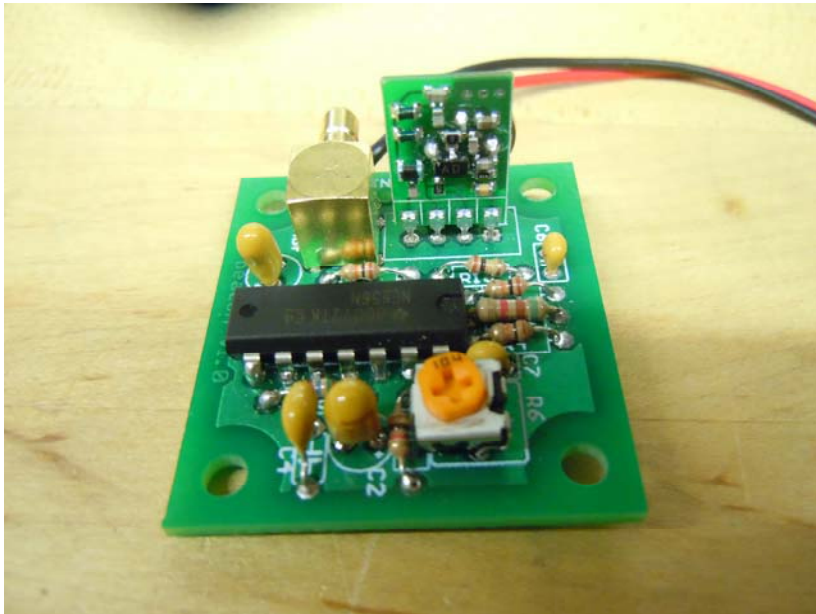


# Rocket Electronics



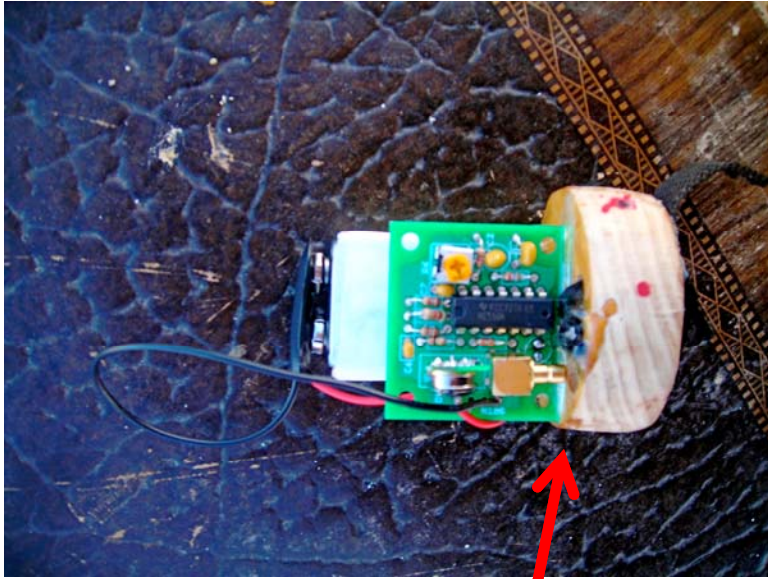
ESS472: Rockets and Instrumentation

Ian Johnson

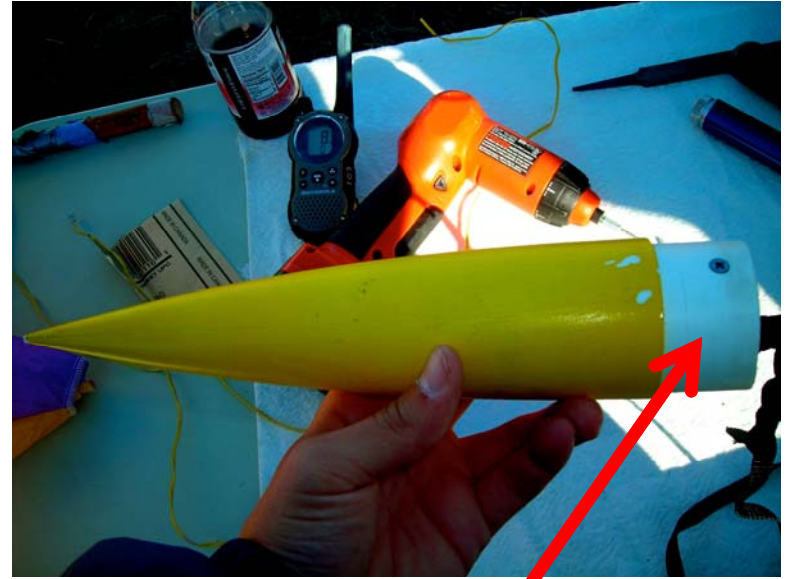
[ikj@uw.edu](mailto:ikj@uw.edu)

(206) 914 - 0211

# The CricketSAT



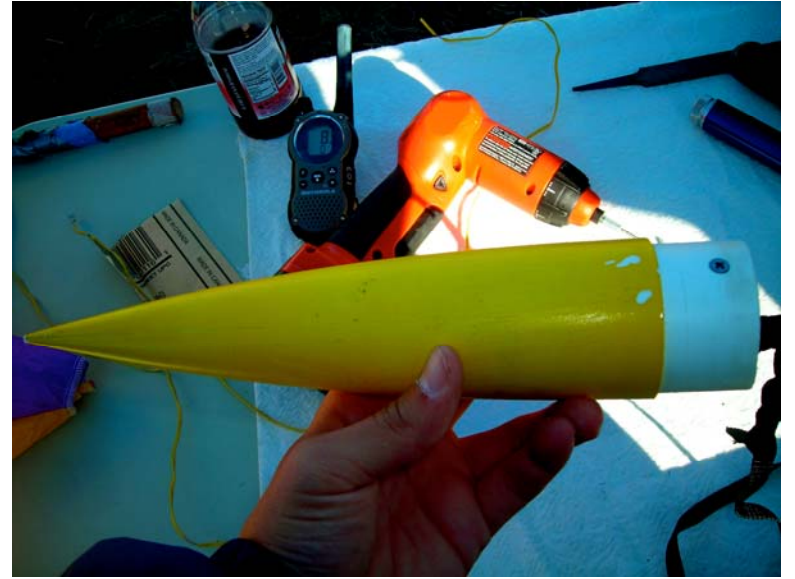
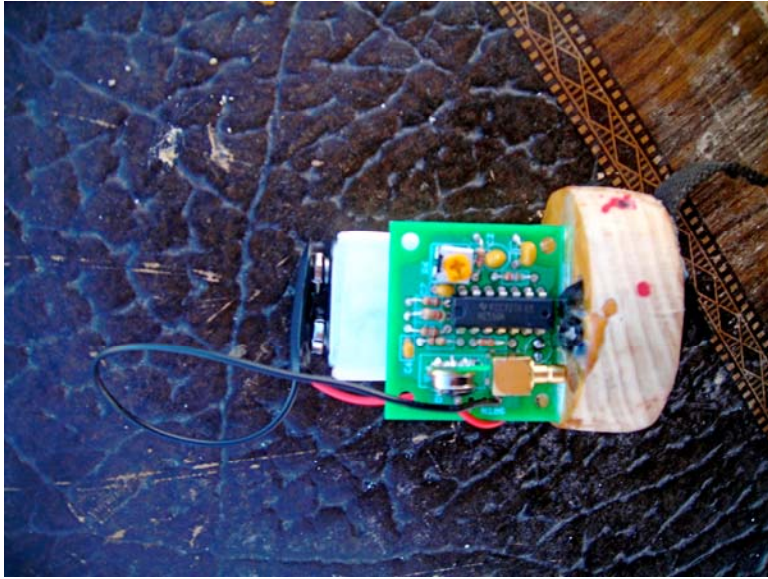
Epoxy



Screw



# The CricketSAT

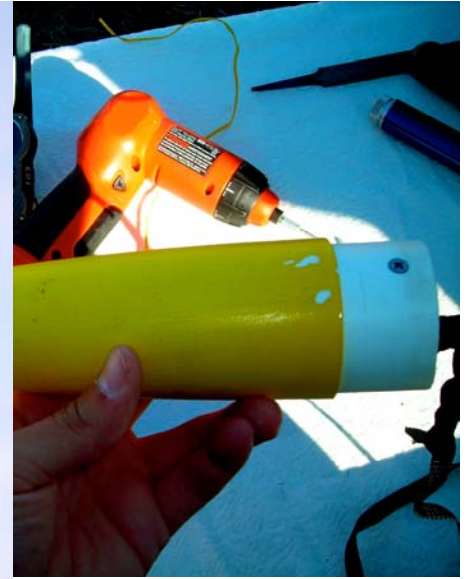
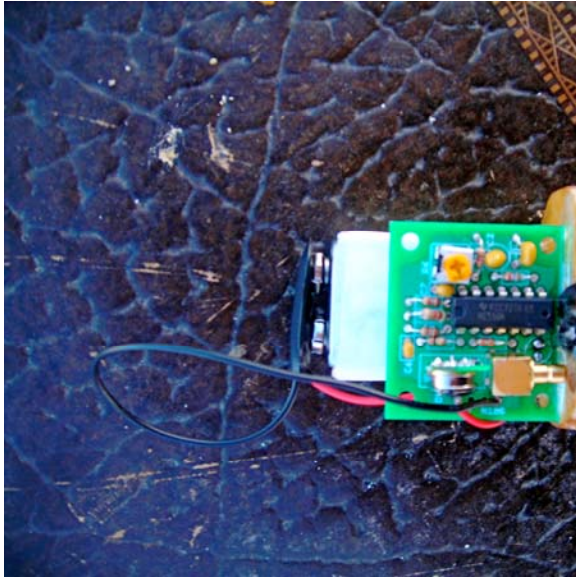


Good looking guy





# The CricketSAT



# The CricketSAT





... sometimes not needed

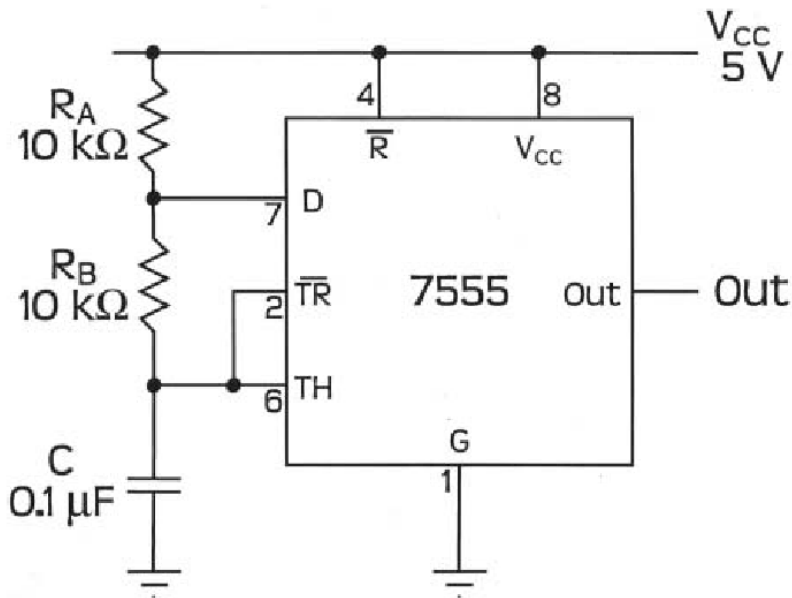
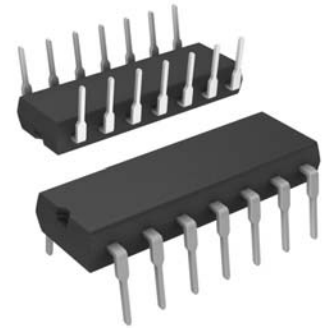


# CricketSAT Overview

- Radio Beacon
  - 555 Timer Chip
    - Resistors / Capacitors
  - Radio (433 MHz Transmitter)
  - Cricket Sat Design



# 555 Timer Chip



- Timer chip utilizes built in oscillator
- Frequency given by:

$$f = \frac{1.44}{C(R_1 + R_2)}$$

- $f = 720 \text{ Hz}$





# Resistors and Capacitors

## Resistors impede current flow

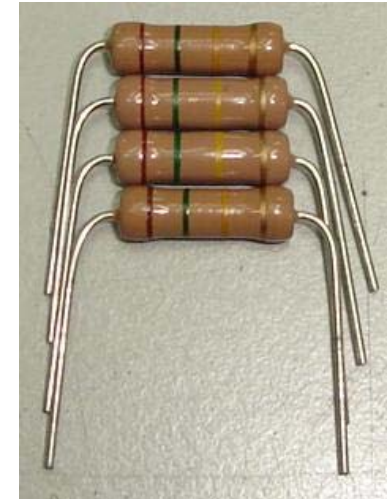
Ohm's Law:  $V = IR$  (Voltage = Current \* Resistance)

- As the resistance goes up, the current goes down.
- Rock in river

## Capacitors store energy

Ratio of electric charge to potential:  $C = Q/V$

- As the charge gets larger, the voltage gets larger
- Dam in river.



# Resistors

## First 2 bars

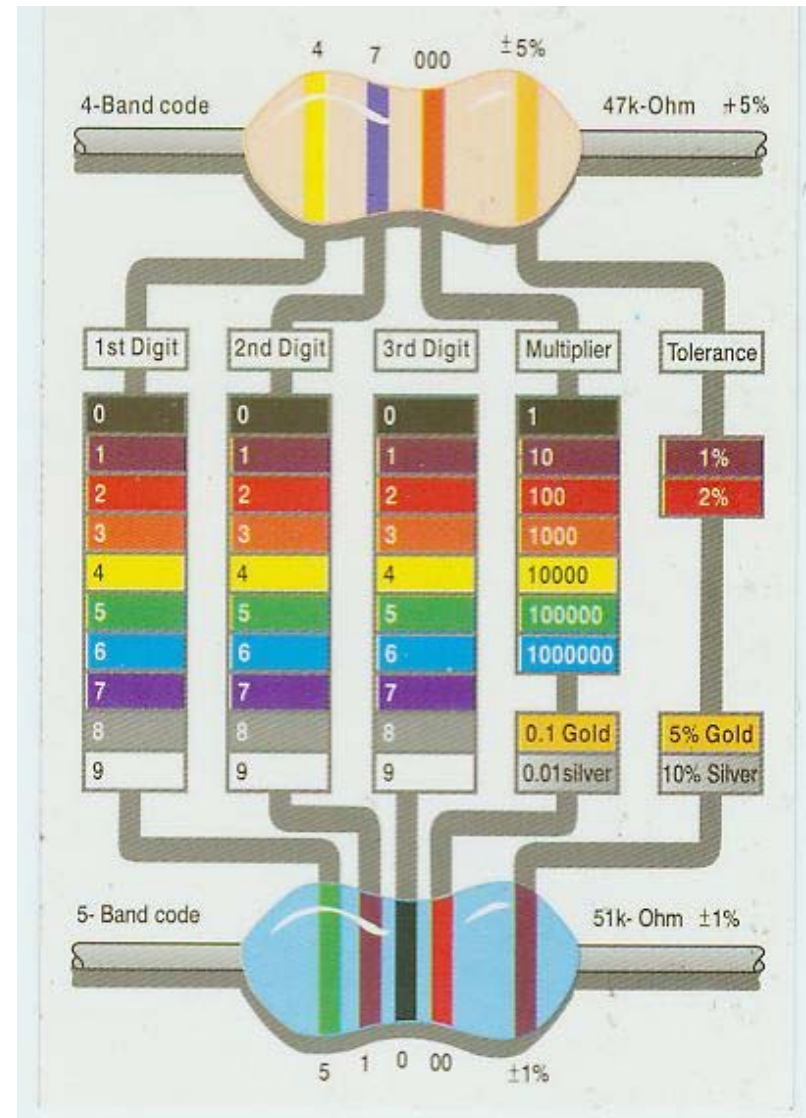
- black - 0
- brown - 1
- red - 2
- orange - 3
- yellow - 4
- green - 5
- blue - 6
- violet - 7
- gray - 8
- white - 9

## 3<sup>rd</sup> bar (multiplier)

- black -  $\times 1$
- brown -  $\times 10$
- red -  $\times 10^2$
- orange -  $\times 10^3$
- yellow -  $\times 10^4$
- green -  $\times 10^5$
- blue -  $\times 10^6$

## 4<sup>th</sup> bar (tolerance)

- 5% - gold
- 10% - silver





# Resistors

First 2 bars

- black - 0
- brown - 1
- red - 2
- orange - 3
- yellow - 4
- green - 5
- blue - 6
- violet - 7
- gray - 8
- white - 9

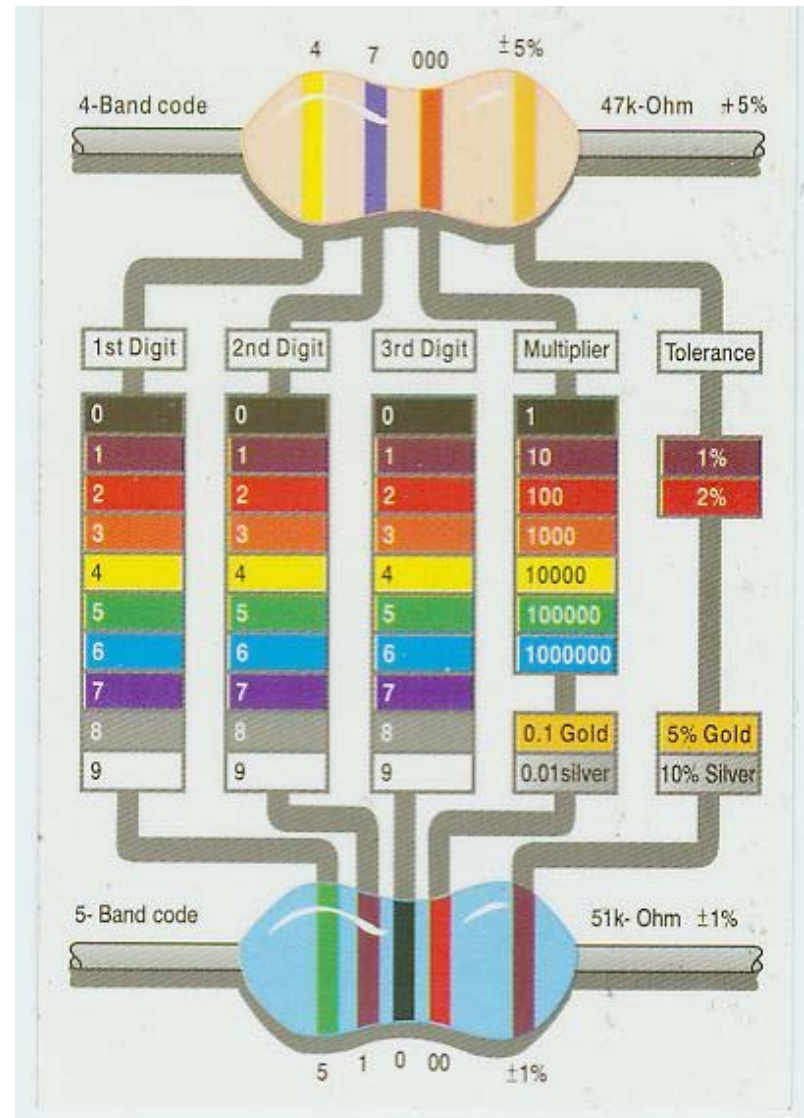
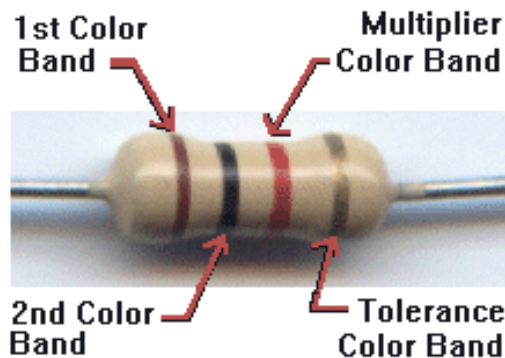
3<sup>rd</sup> bar (multiplier)

- black - x1
- brown - x10
- red - x10<sup>2</sup>
- orange - x10<sup>3</sup>
- yellow - x10<sup>4</sup>
- green - x10<sup>5</sup>
- blue - x10<sup>6</sup>

4<sup>th</sup> bar (tolerance)

- 5% - gold
- 10% - silver

What is this resistance value?



# Resistors

First 2 bars

- black - 0
- brown - 1
- red - 2
- orange - 3
- yellow - 4
- green - 5
- blue - 6
- violet - 7
- gray - 8
- white - 9

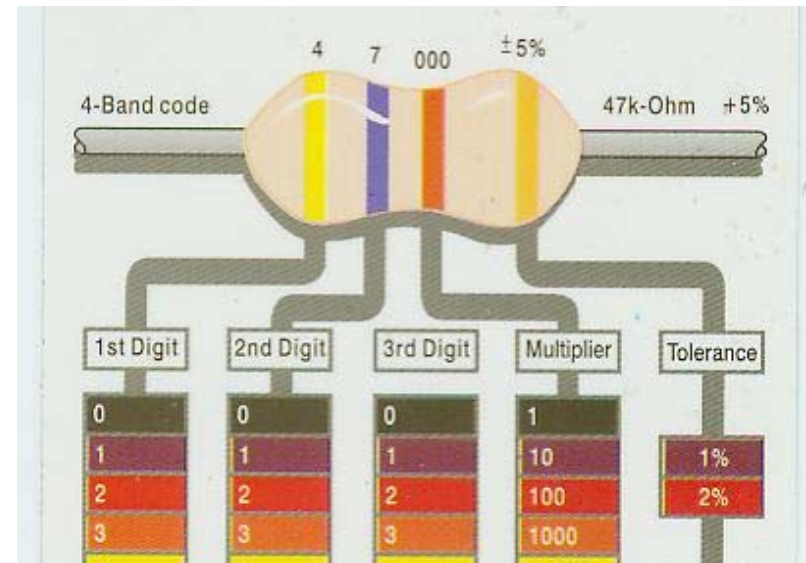
3<sup>rd</sup> bar (multiplier)

- black - x1
- brown - x10
- red - x10<sup>2</sup>
- orange - x10<sup>3</sup>
- yellow - x10<sup>4</sup>
- green - x10<sup>5</sup>
- blue - x10<sup>6</sup>

4<sup>th</sup> bar (tolerance)

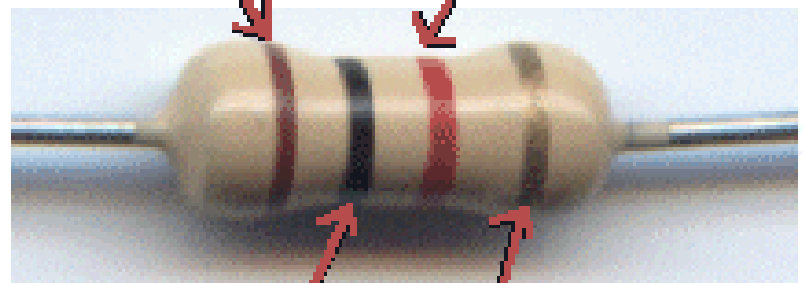
- 5% - gold
- 10% - silver

$$10 * 10^2 = 1000 \Omega = 1 \text{ k}\Omega \pm 5\%$$



1st Color Band

Multiplier Color Band



2nd Color Band

Tolerance Color Band



# Capacitors

The 3<sup>rd</sup> digit is the multiplier

0 – x1

1 – x10

2 – x100

3 – x10<sup>3</sup>

4 – x10<sup>4</sup>

etc...



This times the first two digits gives you the value in Pico-Farads

**Ex: A capacitor marked 104 is  $10 \times 10^4 = 100,000$  pF =  $0.1 \mu\text{F}$**

- pico is  $10^{-12}$

- micro is  $10^{-6}$

-  $(100,000) \times 10^{-12} = (10^5) \times 10^{-12} = 10^{-7} = 0.1 \times 10^{-6} = 0.1 \mu\text{F}$

Tolerance

J – 5%

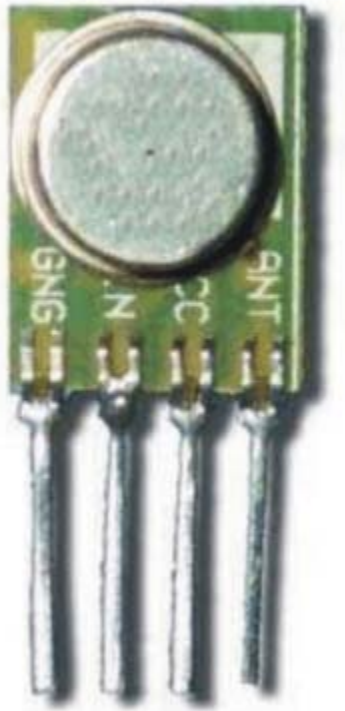
K – 10%

Some caps are polarized

-- the + and - directions matter

-- the CricketSAT has 1 such cap

# TX433 Transmitter

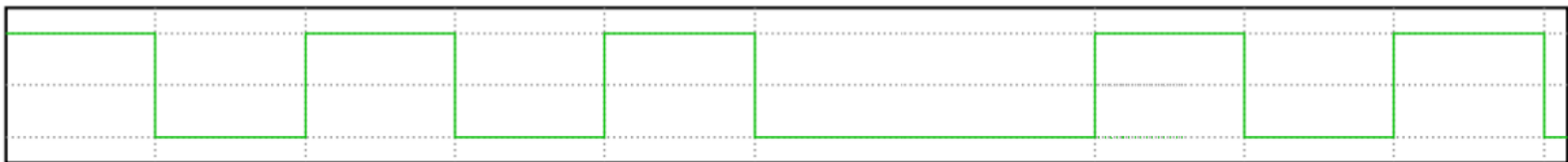
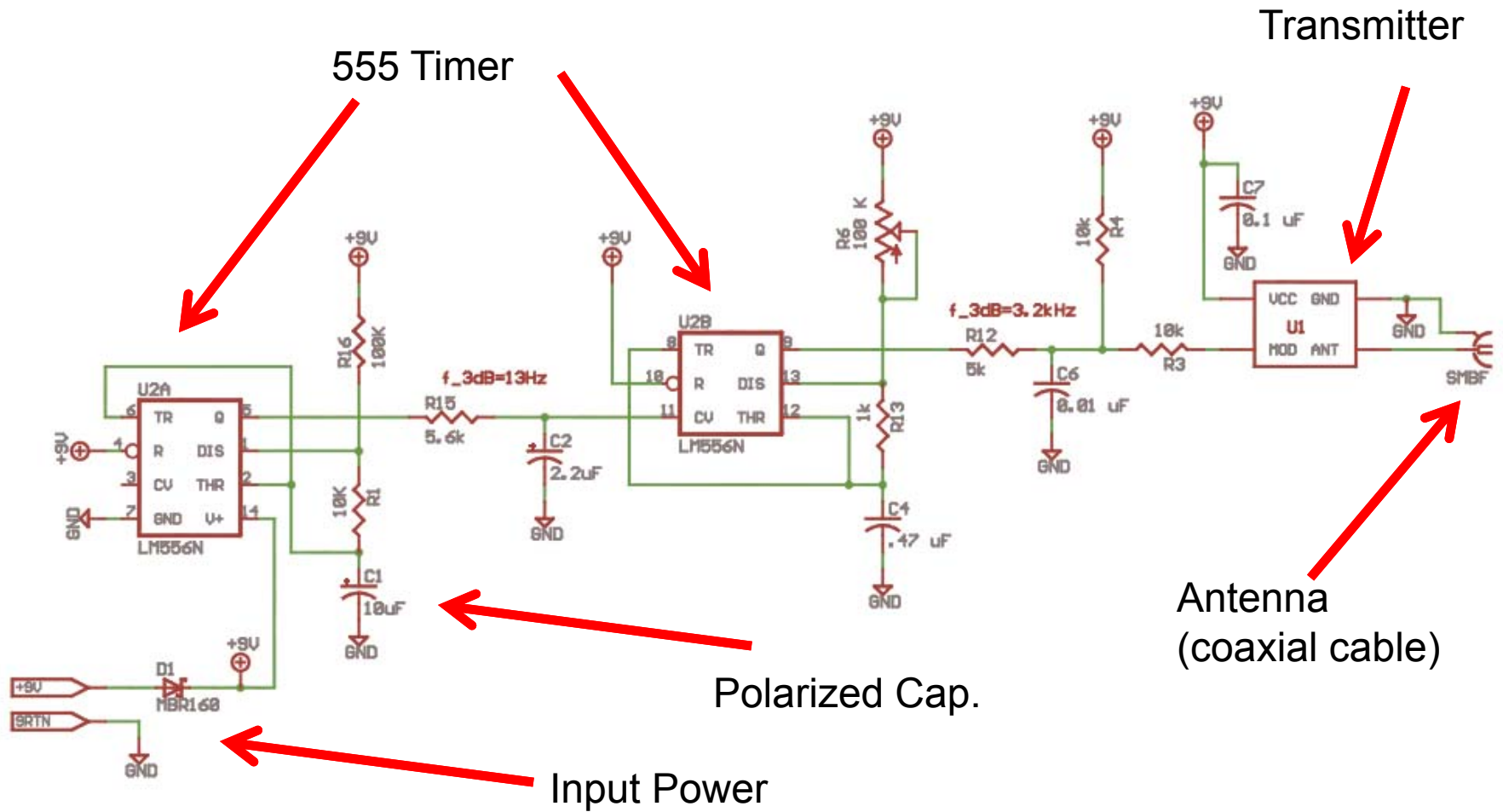


- Frequency: 433.92 MHz
- Data Rate: 8 kbps
- Modulation: Amplitude Shift-Key (ASK)
- \$6 a piece. Do Not Break!
  - -20 to +85 ° C
    - Soldering (10 sec max per pin)
  - feel free to break the other components

- 1) GND
- 2) Data in
- 3) Vcc
- 4) ANT



# Cricket Sat Schematic

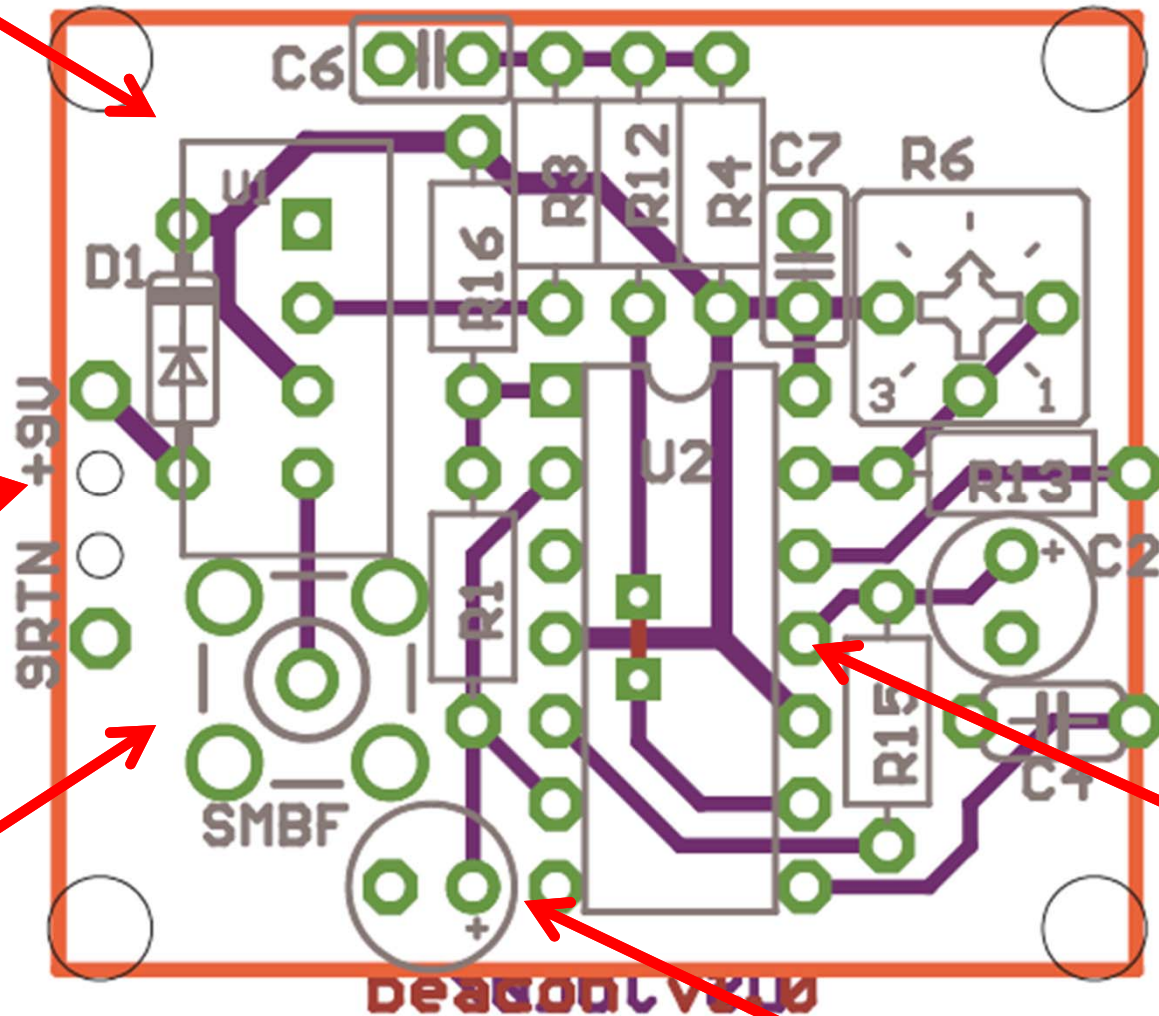


# Cricket Sat Schematic

Transmitter

Input Power

Antenna



555 Timer

Polarized Cap. (+ to the inside)

# CricketSAT Images

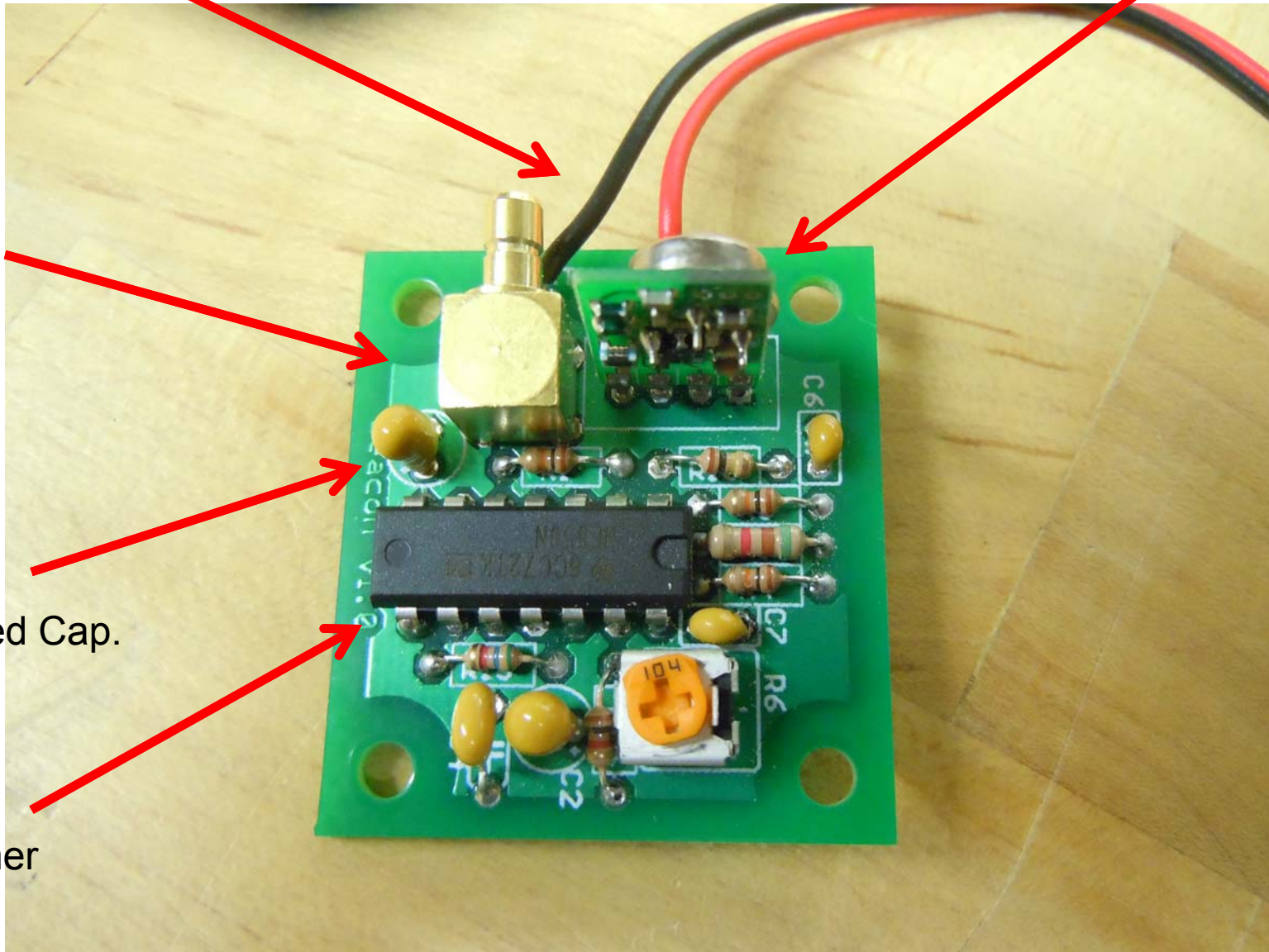
Input Power

Transmitter

Antenna

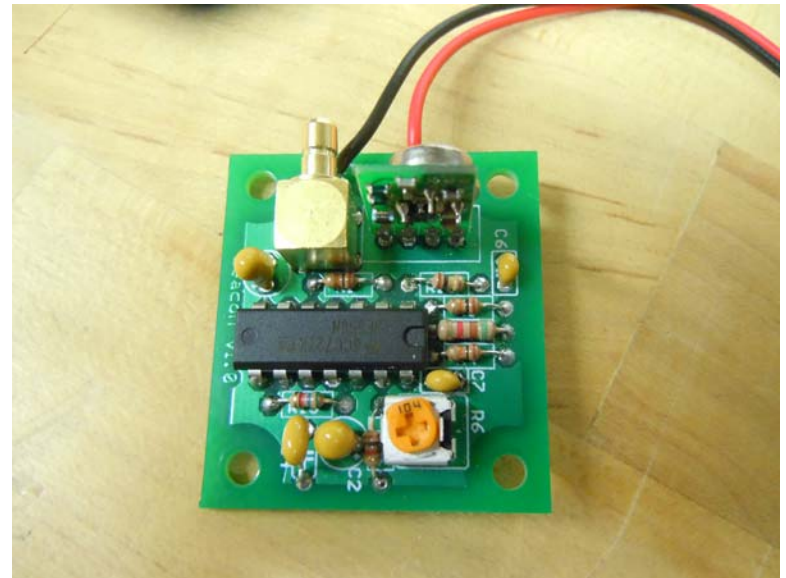
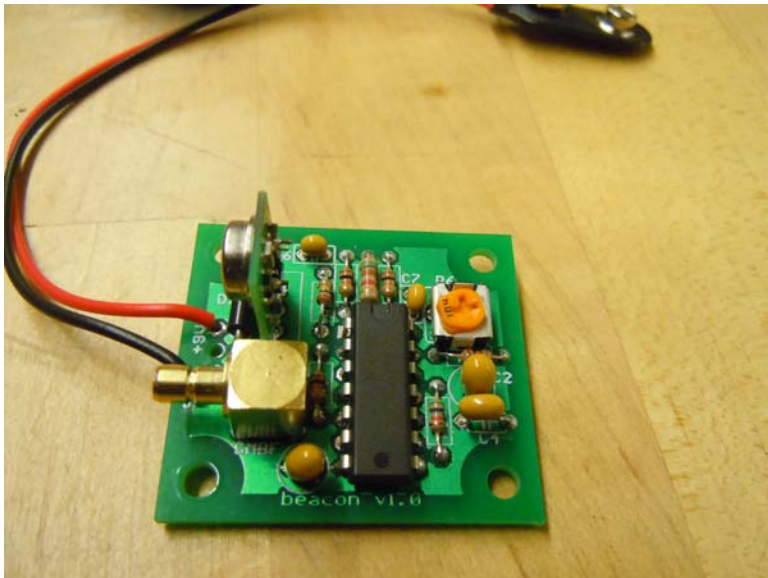
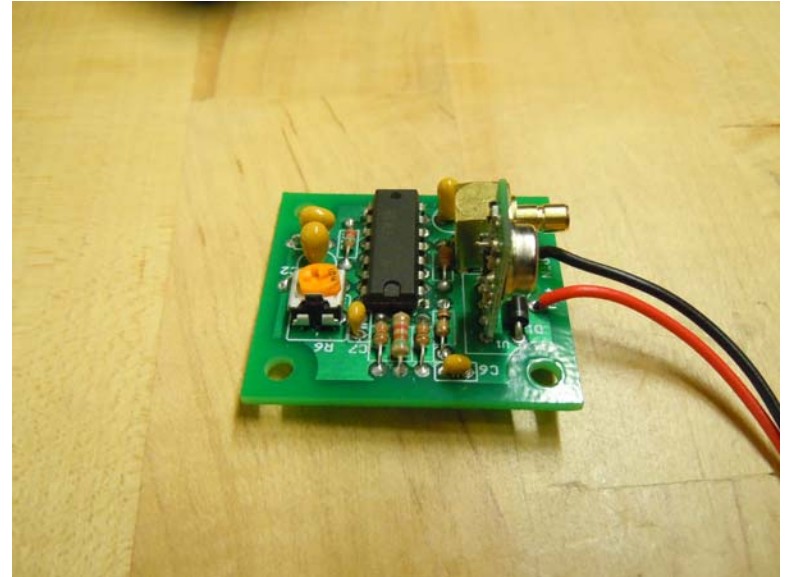
Polarized Cap.

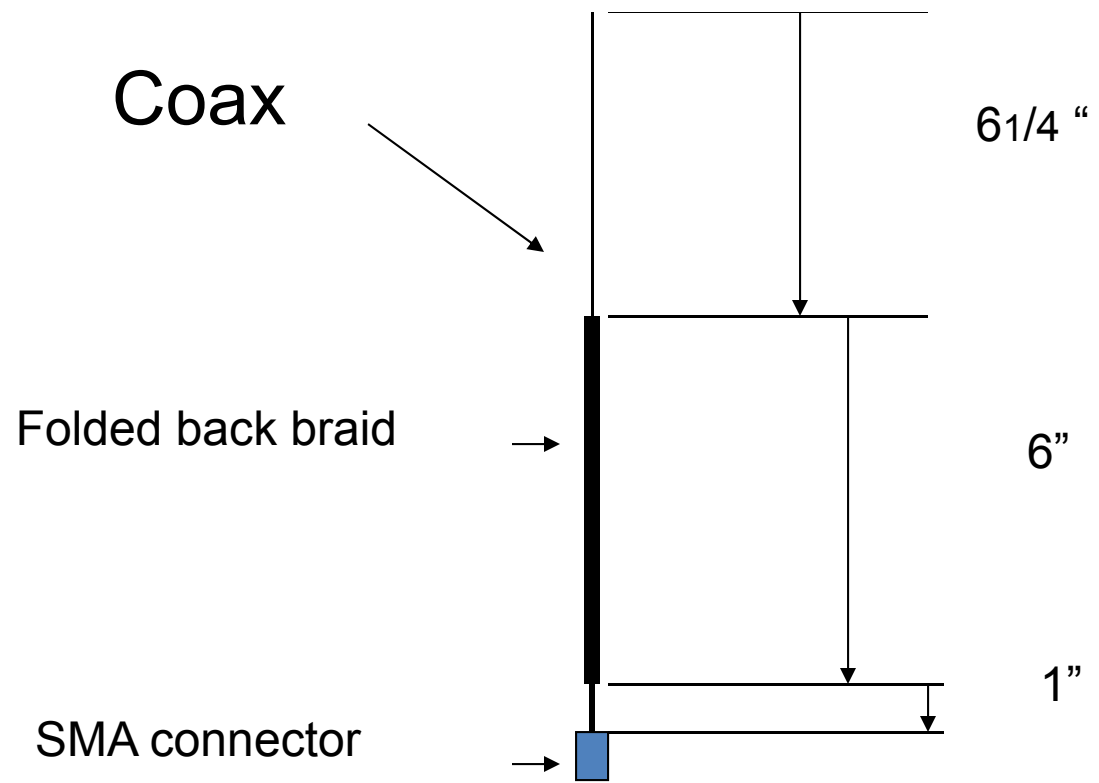
555 Timer





# CricketSAT Images





# Antenna Images





# Antenna Images



# Using the CricketSAT

- Set Receiver to 433 MHz
- Signal gets louder as:
  - You get closer
  - Point antenna at target

