Rocket Electronics

ESS472: Rockets and Instrumentation
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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: \( C = \frac{Q}{V} \)
- 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

3rd bar (multiplier)
• black - x1
• brown - x10
• red - x10²
• orange - x10³
• yellow - x10⁴
• green - x10⁵
• blue - x10⁶

4th 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

3rd bar (multiplier)
- black - x1
- brown - x10
- red - x10^2
- orange - x10^3
- yellow - x10^4
- green - x10^5
- blue - x10^6

4th 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

3rd bar (multiplier)
- black - x1
- brown - x10
- red - x10²
- orange - x10³
- yellow - x10⁴
- green - x10⁵
- blue - x10⁶

4th bar (tolerance)
- 5% - gold
- 10% - silver

10*10² = 1000 Ω = 1 kΩ ± 5%
Capacitors

The 3rd digit is the multiplier
0 – x1
1 – x10
2 – x100
3 – x10³
4 – x10⁴
etc...

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

Ex: A capacitor marked 104 is $10 \times 10^4 = 100,000 \text{ pF} = 0.1 \text{ μF}$
- pico is $10^{-12}$
- micro is $10^{-6}$
- $(100,000) \times 10^{-12} = (10^5) \times 10^{-12} = 10^{-7} = 0.1 \times 10^{-6} = 0.1 \text{ μF}$

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

- Transmitter
- Input Power
- Antenna
- 555 Timer
- Polarized Cap. (+ to the inside)
Coax

Folded back braid

SMA connector

6 1/4"

6"

1"
Antenna Images
Antenna Images
Using the CricketSAT

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