

# ETUM

ELECTRONIC TOILET USAGE MONITORING

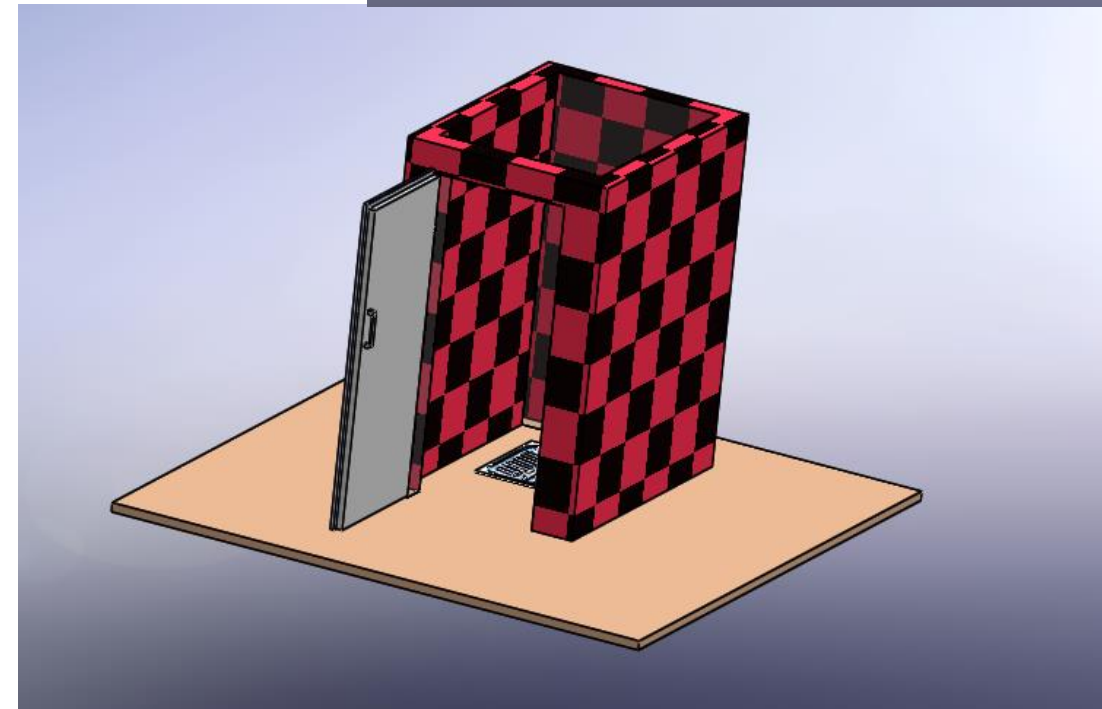
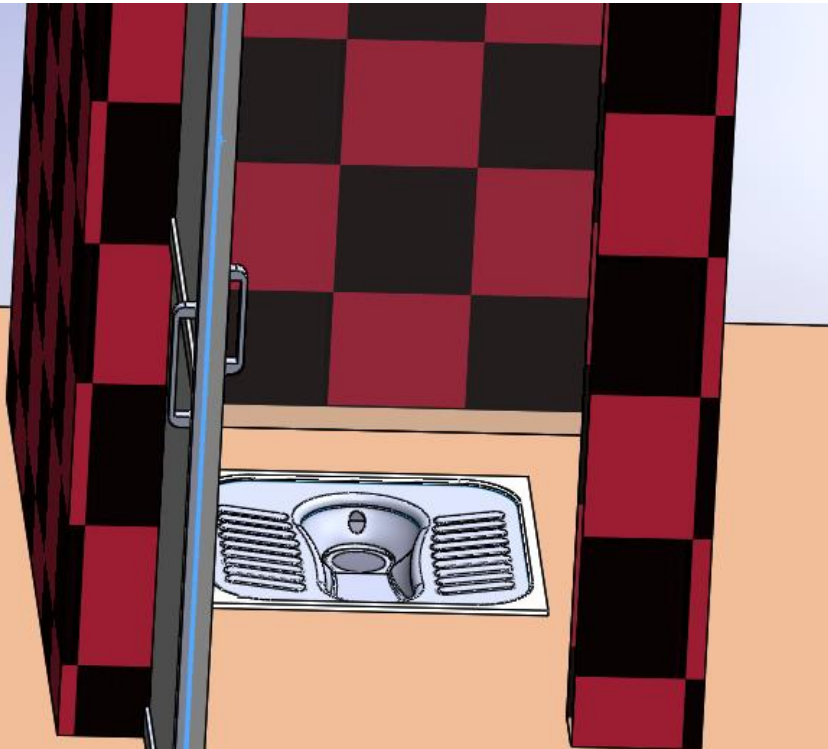
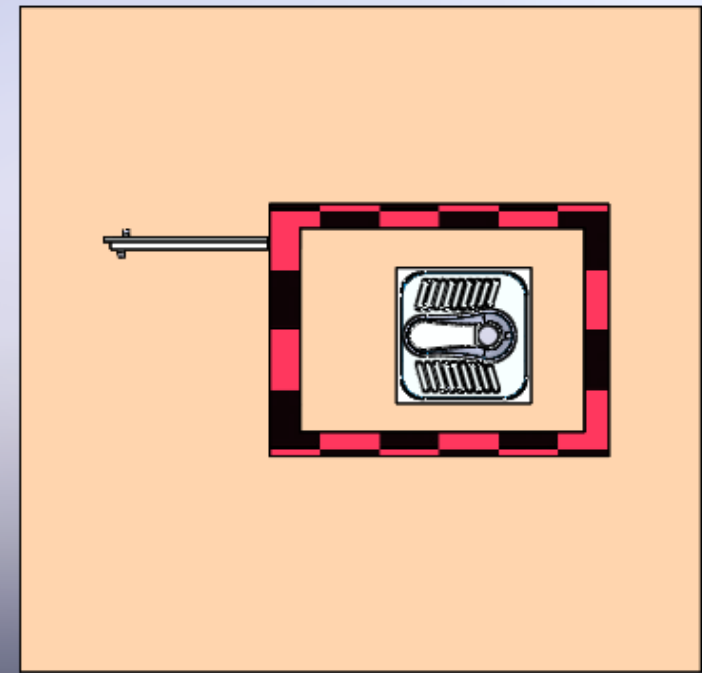
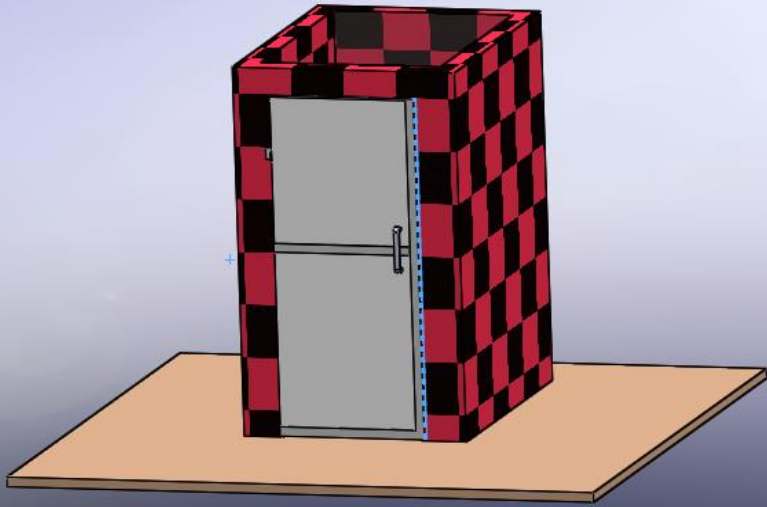




The government has made Millions of toilet for a clean India under the Swachh Bbharat Ahiyaan. To have a effective usage of these toilets, we have developed ETUM.

# ETUM

We have considered a standard  
0.8 x1x1.9 m toilet room.



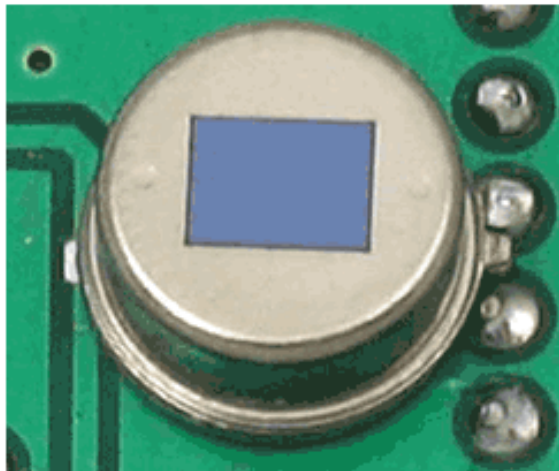
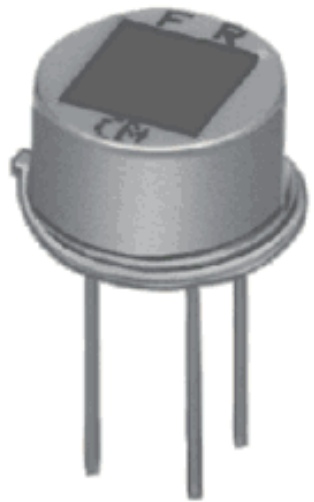


# PIR SENSOR



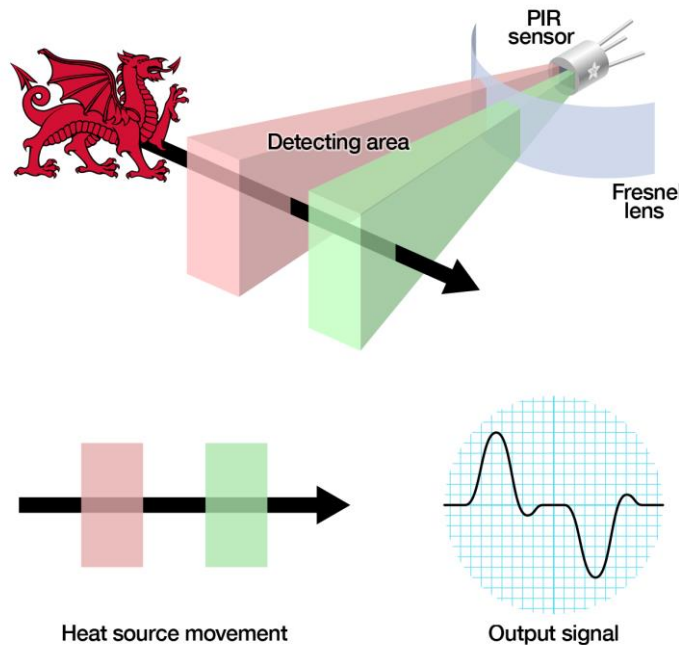
PIR sensors allow you to sense motion, almost always used to detect whether a human has moved in or out of the sensors range. They are small, inexpensive, low-power, easy to use and don't wear out. For that reason they are commonly found in appliances and gadgets used in homes or businesses. They are often referred to as PIR, "Passive Infrared", "Pyroelectric", or "IR motion" sensors.

# PIR SENSOR



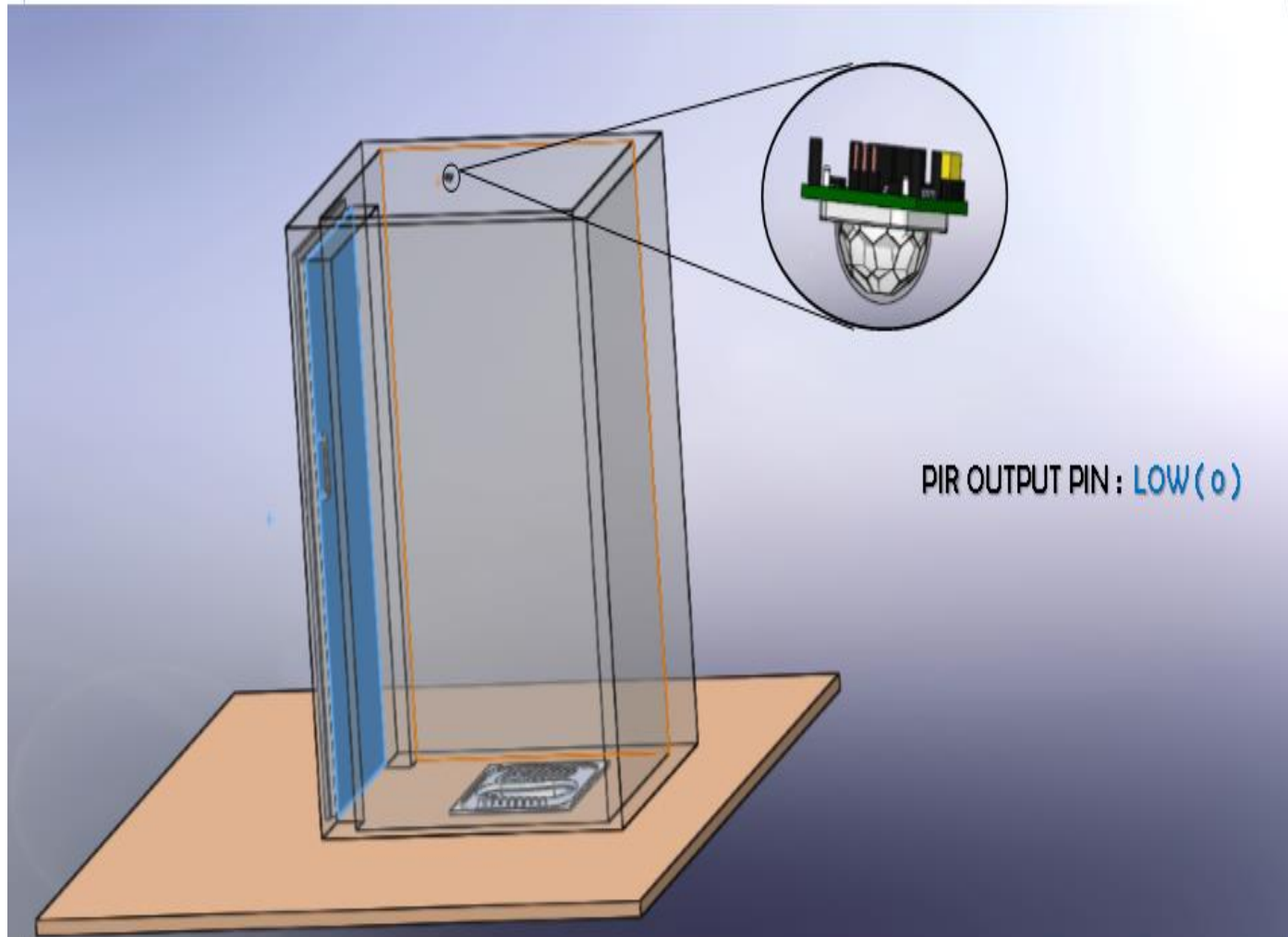
PIRs are basically made of a pyroelectric sensor (which you can see above as the round metal can with a rectangular crystal in the center), which can detect levels of infrared radiation. Everything emits some low level radiation, and the hotter something is, the more radiation is emitted. The sensor in a motion detector is actually split in two halves. The reason for that is that we are looking to detect motion (change) not average IR levels. The two halves are wired up so that they cancel each other out. If one half sees more or less IR radiation than the other, the output will swing high or low.

# PIR SENSOR WORKING



The PIR sensor itself has two slots in it, each slot is made of a special material that is sensitive to IR. When the sensor is idle, both slots detect the same amount of IR, the ambient amount radiated from the room or walls or outdoors. When a warm body like a human or animal passes by, it first intercepts one half of the PIR sensor, which causes a *positive differential* change between the two halves. When the warm body leaves the sensing area, the reverse happens, whereby the sensor generates a negative differential change. These change pulses are what is detected.

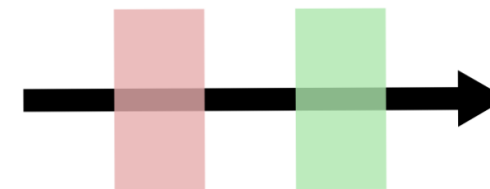
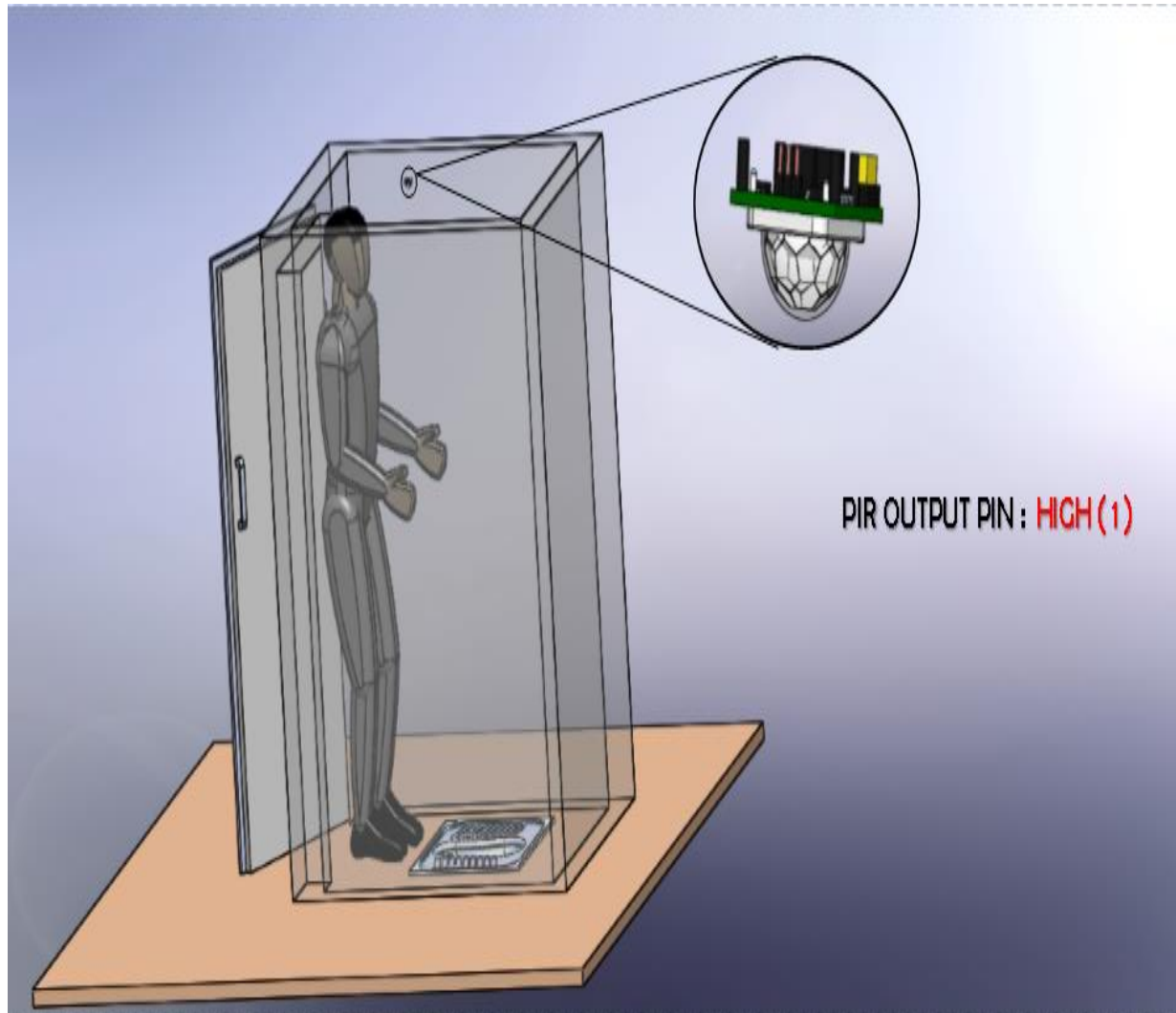
# ETUM WORKING



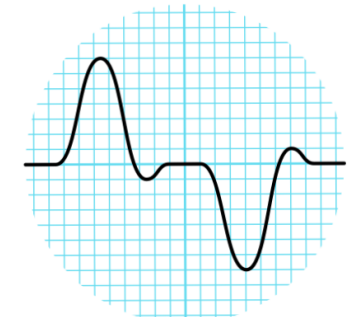
When the toilet is not being used,  
the sensor reads low.

# ETUM WORKING

As soon as a person enters into the toilet,  
The sensor reads high for a small duration of  
About 2 to 3 seconds and comes back to low.



Heat source movement



Output signal



# ETUM IDEA



A Standard 16x2 LCD screen.

The device works on the principle of infrared rays detection by a PIR sensor. The device is designed to work continuously for about 5 months without any maintenance in between. After duration of these 5 months, a person will have to record the data that is stored in these 5 months by plugging in an LCD screen into the LCD pins provided in ETUM.

# ETUM IDEA



We instead of using a standard HC-SR501, have designed our own PCB module removing the unnecessary voltage Regulator and potentiometer for minimum power dissipation. We in the PCB we have added a microcontroller(ATTINY 24A) for the processing of the data along with separate pins in which the LCD has to be Plugged-in to read the data. A battery of 3000mAh is used in the device.

Here is a list of the components used in the device:-

## Resistor(ohms)

47k -1  
6.8k -1  
2k -1  
10k -5  
18k -3  
470k -1  
1M -3  
1k -1

## 3000mAh

Rechargeable battery 1

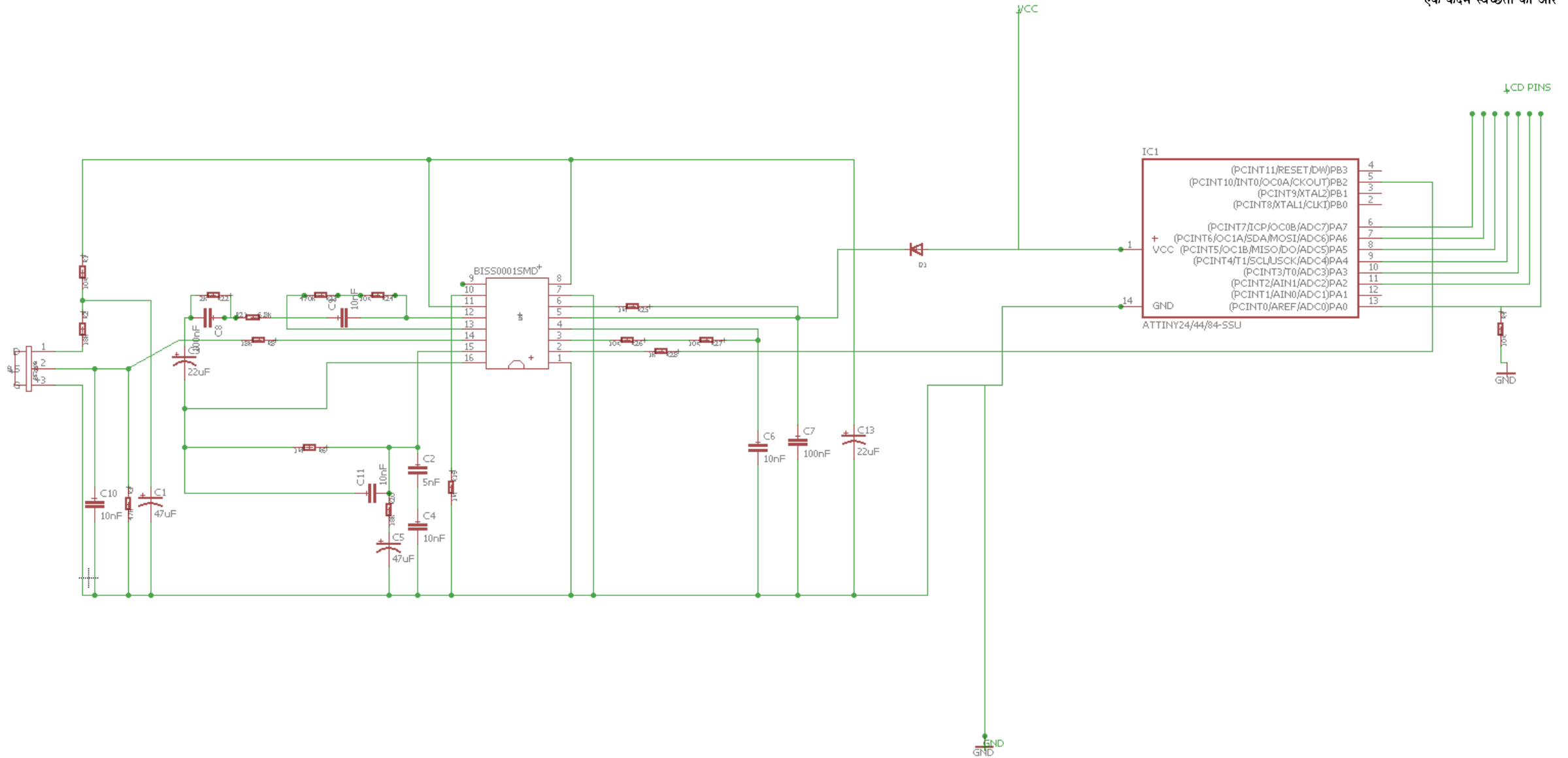
## Capacitor

5nF -1  
47uF -1  
22uF -2  
100nF -2  
10nF -5

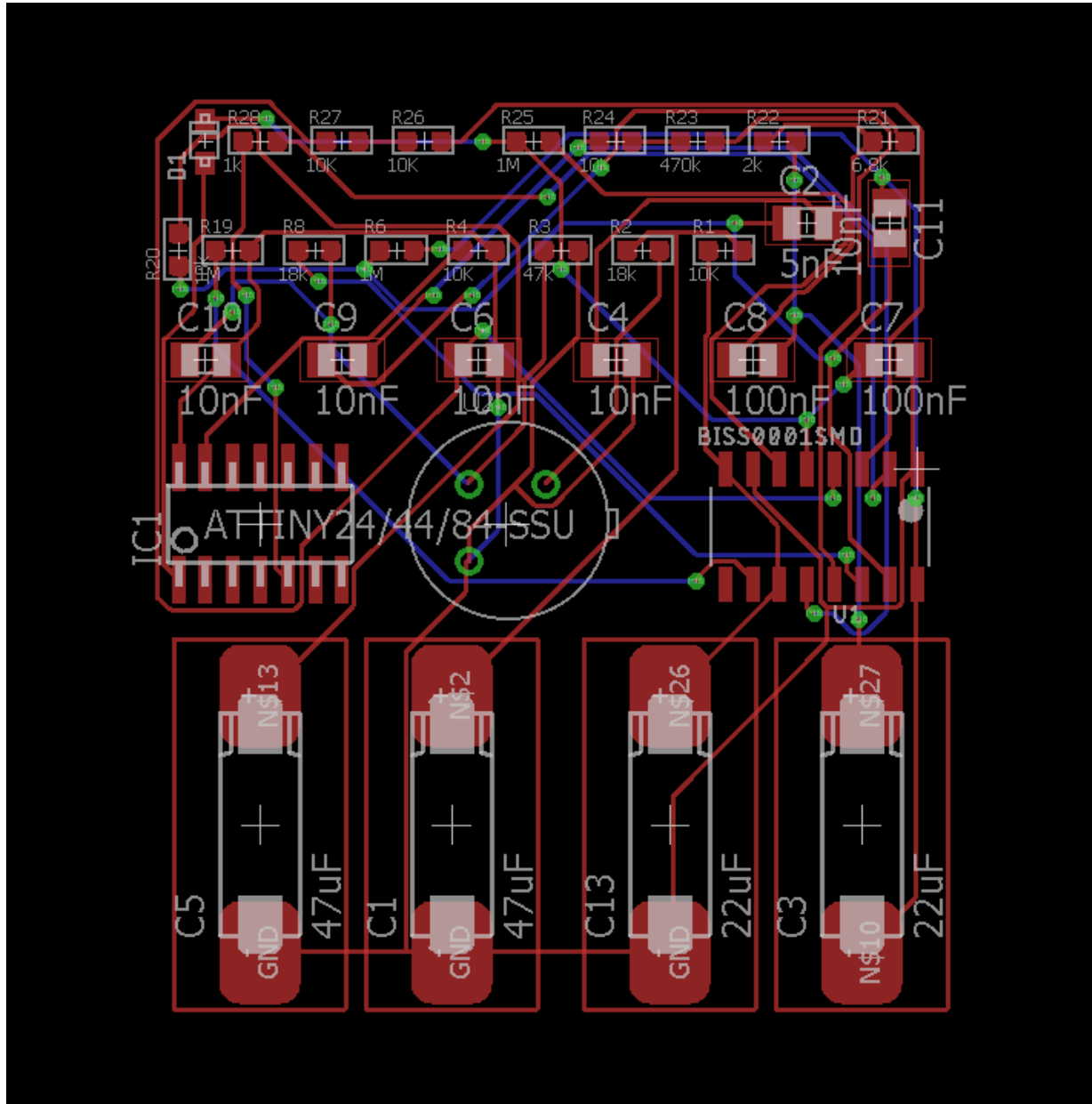
## ICs and PIR

ATTINY 24A  
BISS0001 SMD  
RE200B

# ETUM PCB SCHEMATIC



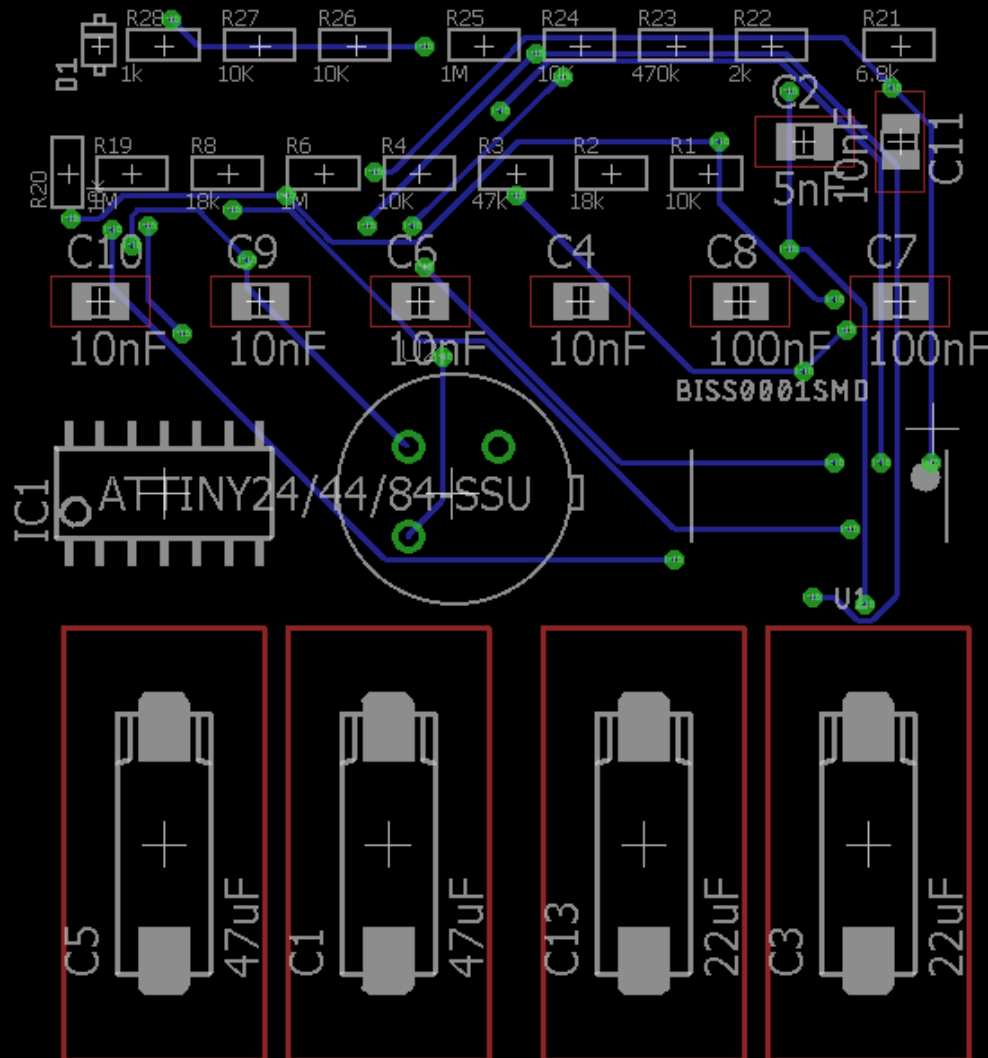
# ETUM PCB BOARD



PCB design of ETUM

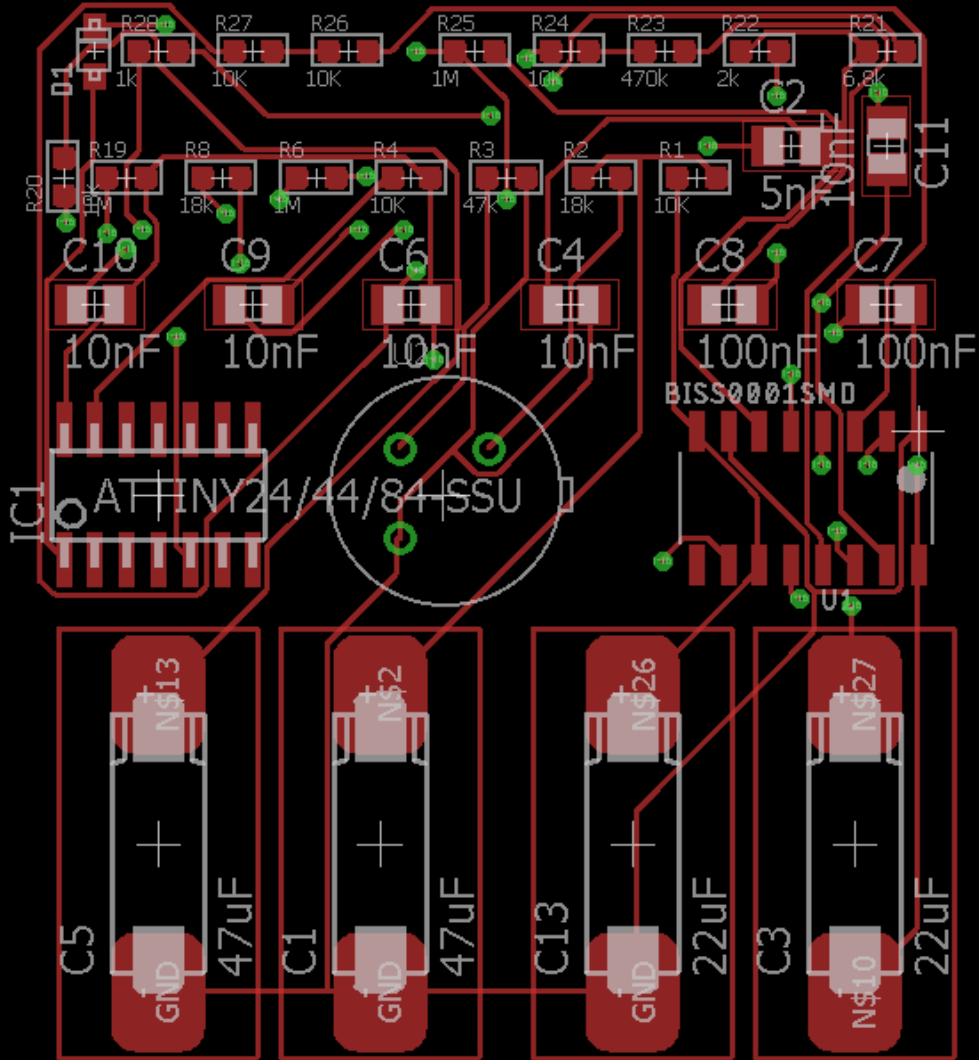


# ETUM PCB BOARD



Bottom layer of PCB.

# ETUM PCB BOARD




Top layer of PCB

# COST in ETUM manufacturing.



Eagle: Newark DesignLink part search for TEST.sch



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[Technical Data Sheet](#)

**MULTICOMP - MCRE000140 - RES, THICK FILM, 1K, 1%, 0.05W, 0201**

Manufacturer:  
Order Code:  
94W5149  
Manufacturer Part No:  
MCRE000140

RoHS: **YES**

Description

- MULTICOMP - MCRE000140 - RES, THICK FILM, 1K, 1%, 0.05W, 0201

**Availability**  
Availability: 2110

**Price For:** 1 TC

**Minimum Order Quantity:** 1

**Order Multiple:** 1

Price (USD)	
Qty	List Price
1 - 9	0.0010
10 - 99	0.0010
100 - 999	0.0010
1000+	0.0010

1K resistor cost= 0.001

Eagle: Newark DesignLink part search for TEST.sch



[Technical Data Sheet](#)

**MULTICOMP - MCRE000212 - RES, THICK FILM, 1M, 1%, 0.05W, 0201**

Manufacturer:  
Order Code:  
94W5205  
Manufacturer Part No:  
MCRE000212

RoHS: **YES**

Description

- MULTICOMP - MCRE000212 - RES, THICK FILM, 1M, 1%, 0.05W, 0201
- Resistance: 1Mohm
- Voltage Rating: 25V
- Resistor Case Style: 0201 [0603 Metric]
- Power Rating: 50mW
- Resistance Tolerance: 1%
- Product Range: MCRE Series
- Packaging: Cut Tape

**Availability**  
Availability: 9027

**Price For:** 1 TC

**Minimum Order Quantity:** 1

**Order Multiple:** 1

Price (USD)	
Qty	List Price
1 - 9	0.0010
10 - 99	0.0010
100 - 999	0.0010
1000+	0.0010

1M resistor cost= 0.001

# COST in ETUM manufacturing.



Eagle: Newark DesignLink part search for TEST.sch

**VISHAY - CRCW04022K00FKED - RES, THICK FILM, 2K, 1%, 0.063W, 0402**



Manufacturer: VISHAY/DALE  
Order Code: 52K6788  
Manufacturer Part No: CRCW04022K00FKED  
RoHS: **YESX**

Description

- VISHAY - CRCW04022K00FKED - RES, THICK FILM, 2K, 1%, 0.063W, 0402
- Resistance: 2kohm
- Voltage Rating: 50V
- Resistor Case Style: 0402 [1005 Metric]
- Power Rating: 63mW
- Resistance Tolerance: 1%
- Product Range: CRCW Series
- Packaging: Cut Tape
- Filter Terminals: SMD

[Packaging / Drawing / Footprint](#)

Price (USD)	
Qty	List Price
1 - 24	0.1
25 - 99	0.045
100 - 249	0.026
250 - 499	0.023
500 - 999	0.021
1000+	0.018

2K resistor cost=  
0.018

Eagle: Newark DesignLink part search for TEST.sch

## VISHAY - CRCW12106K80JNEA - THICK FILM CHIP RESISTORS, CRCW1210 6.8K 5% 200 RT1

Manufacturer: VISHAY/DALE  
Order Code: 43C5250  
Manufacturer Part No: CRCW12106K80JNEA

RoHS: **YESX**

Description

- VISHAY - CRCW12106K80JNEA - THICK FILM CHIP RESISTORS, CRCW1210 6.8K 5% 200 RT1

Availability	
Availability: 0	
Price For: 1 TR	
Minimum Order Quantity: 5000	
Order Multiple: 5000	
Price (USD)	
Qty	List Price
5000 - 5000	0.033
10000 - 20000	0.029
25000 - 45000	0.027
50000+	0.023

6.8K resistor cost= 0.023



# COST in ETUM manufacturing.



Eagle: Newark DesignLink part search for TEST.sch

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## MULTICOMP - MCRE000164 - RES, THICK FILM, 10K, 1%, 0.05W, 0201



Manufacturer:  
Order Code:  
94W4638  
Manufacturer Part No:  
MCRE000164

RoHS: **YES**

Description

- MULTICOMP - MCRE000164 - RES, THICK FILM, 10K, 1%, 0.05W, 0201
- Resistance: 10kohm
- Voltage Rating: 25V
- Resistor Case Style: 0201 [0603 Metric]
- Power Rating: 50mW
- Resistance Tolerance: 1%
- Product Range: MCRE Series
- Packaging: Cut Tape

Availability  
Availability: 10169

Price For: 1 TC

Minimum Order Quantity: 1

Order Multiple: 1

Price (USD)	
Qty	List Price
1 - 9	0.0010
10 - 99	0.0010
100 - 999	0.0010
1000+	0.0010

10K resistor cost= 0.001

[Technical Data Sheet](#)

Eagle: Newark DesignLink part search for TEST.sch

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## VISHAY - D103K69Y5PL63L0R - CERAMIC CAPACITOR 0.01UF, 500V, Y5P, 10%, RADIAL



Manufacturer:  
Order Code:  
91K7212  
Manufacturer Part No:  
D103K69Y5PL63L0R

RoHS: **YES**

Description

- VISHAY - D103K69Y5PL63L0R - CERAMIC CAPACITOR 0.01UF, 500V, Y5P, 10%, RADIAL
- Capacitance: 0.01 F
- Voltage Rating: 500V
- Product Range: D Series
- Capacitance Tolerance: 10%
- Capacitor Terminals: Radial Leaded
- Dielectric Characteristic: Y5P
- Packaging: Each

Availability  
Availability: 5504

Price For: 1 EA

Minimum Order Quantity: 1

Order Multiple: 1

Price (USD)	
Qty	List Price
1 - 9	0.141
10 - 24	0.141
25 - 49	0.141
50 - 99	0.141
100 - 499	0.12
500 - 999	0.12
1000+	0.12

[Datasheet](#)

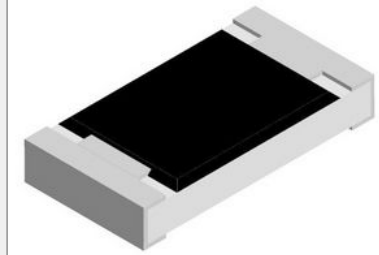
0.01uF capacitor cost= 0.12

# COST in ETUM manufacturing.



Eagle: Newark DesignLink part search for TEST.sch

## MULTICOMP - MC0063W0603118K - RES, THICK FILM, 18K, 1%, 0.063W, 0603



Manufacturer:  
Multicomp Passives  
Order Code:  
58K4510  
Manufacturer Part No:  
MC0063W0603118K

RoHS: **YESX**

Description

- MULTICOMP - MC0063W0603118K - RES, THICK FILM, 18K, 1%, 0.063W, 0603
- Resistance: 18kohm
- Voltage Rating: 50V
- Resistor Case Style: 0603 [1608 Metric]
- Power Rating: 63mW
- Resistance Tolerance: 1%
- Product Range: MC Series
- Packaging: Cut Tape
- Filter Terminals: SMD

### Availability

Availability: 48549

Price For: 1 TC

Minimum Order Quantity: 1

Order Multiple: 1

### Price (USD)

Qty	List Price
1 - 9	0.0010
10 - 99	0.0010
100 - 999	0.0010
1000+	0.0010

18K resistor cost= 0.001

Eagle: Newark DesignLink part search for TEST.sch

## MULTICOMP - MCNP35V226M6.3X11 - ALUMINUM ELECTROLYTIC CAPACITOR, 22UF, 35V, 20%, RADIAL



[Technical Data Sheet](#)

Manufacturer:  
Order Code:  
13M5159  
Manufacturer Part No:  
MCNP35V226M6.3X11

RoHS: **YES**

Description

- MULTICOMP - MCNP35V226M6.3X11 - ALUMINUM ELECTROLYTIC CAPACITOR, 22UF, 35V, 20%, RADIAL
- Capacitance: 22 F
- Voltage Rating: 35V
- Product Range: MCNP Series
- Capacitance Tolerance: 20%
- Capacitor Terminals: Radial Leaded
- Diameter: 6.3mm
- Packaging: Each
- Height: 11mm

### Availability

Availability: 297

Price For: 1 EA

Minimum Order Quantity: 1

Order Multiple: 1

### Price (USD)

Qty	List Price
1 - 9	0.022
10 - 99	0.022
100 - 499	0.022
500 - 999	0.022
1000 - 4999	0.022
5000 - 9999	0.022
10000 -	0.022
24999	

22uF capacitor cost= 0.022

# COST in ETUM manufacturing.



Eagle: Newark DesignLink part search for TEST.sch

**YAGEO - RC0603FR-1047KL - RES, THICK FILM, 47K, 1%, 0.1W, 0603**



Manufacturer:  
Order Code:  
68R0126  
Manufacturer Part No:  
RC0603FR-1047KL  
RoHS: **YESX**

Description

- YAGEO - RC0603FR-1047KL - RES, THICK FILM, 47K, 1%, 0.1W, 0603
- Resistance: 47kohm
- Voltage Rating: 50V
- Resistor Case Style: 0603 [1608 Metric]
- Power Rating: 100mW
- Resistance Tolerance: 1%
- Product Range: RC Series
- Packaging: Cut Tape
- Body Height: 0.45mm

[Datasheet](#)

Price (USD)	
Qty	List Price
1 - 9	0.08
10 - 24	0.015
25 - 99	0.01
100 - 249	0.0060
250 - 999	0.0040
1000+	0.0030

Availability  
Availability: 2289

Price For: 1 TC


Minimum Order Quantity: 1

Order Multiple: 1

47K resistor cost= 0.003

Eagle: Newark DesignLink part search for TEST.sch

**NICHICON - UVZ1C470MDD1TD - ALUMINUM ELECTROLYTIC CAPACITOR, 47UF, 16V, 20%, RADIAL**



Manufacturer:  
Order Code:  
65R3135  
Manufacturer Part No:  
UVZ1C470MDD1TD  
RoHS: **YES**

Description

- NICHICON - UVZ1C470MDD1TD - ALUMINUM ELECTROLYTIC CAPACITOR, 47UF, 16V, 20%, RADIAL
- Capacitance: 47 F
- Voltage Rating: 16V
- Product Range: VZ Series
- Capacitance Tolerance: 20%
- Capacitor Terminals: Radial Leaded
- Diameter: 5mm
- Packaging: Cut Tape
- Height: 11mm

[Packaging / Drawing / Footprint](#)

Price (USD)	
Qty	List Price
1 - 9	0.24
10 - 24	0.109
25 - 49	0.097
50 - 99	0.086
100 - 249	0.074
250 - 499	0.07
500 - 999	0.065
1000+	0.057

Availability  
Availability: 4383

Price For: 1 TC

Minimum Order Quantity: 1

Order Multiple: 1

47uF capacitor cost= 0.057

# COST in ETUM manufacturing.



Eagle: Newark DesignLink part search for TEST.sch

## MULTICOMP - MC0805B104M160CT - CERAMIC CAPACITOR, 0.1UF, 16V, X7R, 20%, 0805



Manufacturer:  
Order Code:  
06R3744  
Manufacturer Part No:  
MC0805B104M160CT

RoHS: **YES**

Description

- MULTICOMP - MC0805B104M160CT - CERAMIC CAPACITOR, 0.1UF, 16V, X7R, 20%, 0805
- Ceramic Capacitor Case: 0805 [2012 Metric]
- Capacitance: 100nF
- Voltage Rating: 16V
- Capacitance Tolerance: 20%
- Dielectric Characteristic: X7R
- Product Range: MC Series
- Packaging: Cut Tape

### Availability

Availability: 18145

Price For: 1 TC

Minimum Order Quantity: 1

Order Multiple: 1

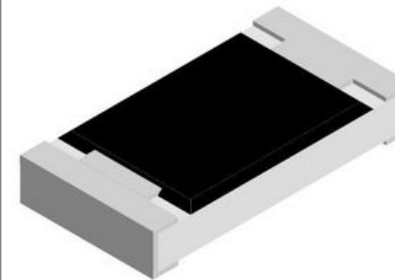
### Price (USD)

Qty	List Price
1 - 9	0.078
10 - 49	0.052
50 - 99	0.034
100 - 249	0.024
250 - 499	0.02
500 - 999	0.017
1000+	0.011

0.1uF capacitor cost= 0.001

Eagle: Newark DesignLink part search for TEST.sch

## VISHAY - CRCW0603470KFKEA - RES, THICK FILM, 470K, 1%, 0.1W, 0603



Manufacturer:  
VISHAY/DALE  
Order Code:  
52K8555  
Manufacturer Part No:  
CRCW0603470KFKEA

RoHS: **YESX**

Description

- VISHAY - CRCW0603470KFKEA - RES, THICK FILM, 470K, 1%, 0.1W, 0603
- Resistance: 470kohm
- Voltage Rating: 75V
- Resistor Case Style: 0603 [1608 Metric]
- Power Rating: 100mW
- Resistance Tolerance: 1%
- Product Range: CRCW Series
- Packaging: Cut Tape
- Filter Terminals: SMD

### Availability

Availability: 5318

Price For: 1 TC

Minimum Order Quantity: 1

Order Multiple: 1

### Price (USD)

Qty	List Price
1 - 24	0.0040
25 - 49	0.0040
50 - 99	0.0040
100 - 249	0.0040
250 - 499	0.0040
500 - 999	0.0040
1000+	0.0040

[Packaging / Drawing / Footprint](#)

470K resistor cost= 0.004



# COST in ETUM manufacturing.



The link to the website we have referred to buy all these products mentioned above is given below:-

[www.newark.com](http://www.newark.com)

## **3000mAh Battery:-**

"https://www.alibaba.com/product-detail/Full-Capacity-original-lg-hg2-3000mah\_60503919326.html?spm=a2700.7724857.main07.207.2bd13975hQXAYq"

## **BISS0001 reference link to buy is:-**

"https://www.aliexpress.com/item/BISS0001-smd-sop16-1000pcs-lot-sensors-infrared-sensor-ic-Infrared-sensor-signal-processor-We-can-offer/32624873306.html?spm=2114.search0301.4.62.xWAtZB"

## **ATTINY 24A(SSU) reference link to buy is:-**

"https://l.facebook.com/l.php?u=http%3A%2F%2Fwww.microchipdirect.com%2FProductDetails.aspx%3FCategory%3DATtiny24A&h=ATM6nKvu\_pvcBGFtBmuNRUAGByPMpY\_M7hWHq2KqCkus7rTcDcn-Xq5z2nCcVwqAmaUceGNCP1VwTRRyCmDyiaobLr\_Lu3gfhr\_9g98PFV\_k\_CxLnTwbSWmDfCHd6nc3a0xv1tuG0jaGUyg"

## **PIR sensor:-**

"https://www.alibaba.com/product-detail/types-of-pir-sensor-pir-sensor\_60528709780.html?spm=a2700.7724857.main07.22.2bd1397500RBvO"

## How far we have reached?

ETUM is designed to detect human presence in a range of about 1m.  
For toilet usage monitoring, it is an optimum amount of distance to be measured.  
The battery life of the device is about 5 months. To minimize the operating cost,  
We have used a 2400mAh battery, but if we want to increase the battery life of the device,  
A higher mAh battery can be used (which will increase the cost).  
For toilet usage monitoring, ETUM is a perfect device as 5 months is enough to determine  
how much the toilet is being used regularly and the future predictions can be made  
easily.

## Future plans

We have a goal to make ETUM more efficient, accurate and cost-efficient. We will work further to increase the battery life and durability of the device and make it optimum for monitoring toilet usage.

Under proper guidance and with the help of the best minds of India, we have a goal to install ETUM in each and every Indian house. Swachh Bharat Abhiyaan, an initiative by Respectful PM Narendra Modi, has to be taken seriously for a clean and beautiful India. And using the best minds of the country in this is the need of the hour.

- ▶ Link to the SolidWorks file, PCB design, ATtiny24A Code and other data is given below:-

[https://drive.google.com/drive/folders/0B7fBHx3akR\\_MkswR0VGWkpjUFk?usp=sharing](https://drive.google.com/drive/folders/0B7fBHx3akR_MkswR0VGWkpjUFk?usp=sharing)



# TEAM MEMBERS



**Utkarsh Deepak**

utkarsh230897@gmail.com

Electronics, ATtiny24A code



**Nitin Yadav**

yadav.nitin558@gmail.com

Electronics, PCB



*THANK YOU!*