



### ELECTRONIC TOILET USAGE MONITORING



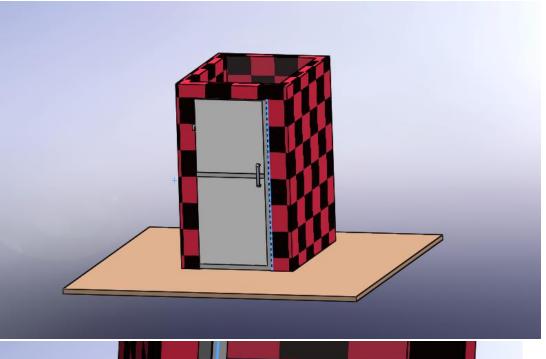
## **ETUM**





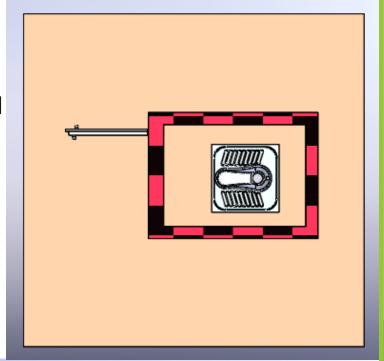


The government has made Millions of toilet for a clean India under the Swachh Bbharat Ahiyaan. To have a effective usage of these toilets, we have developed ETUM.

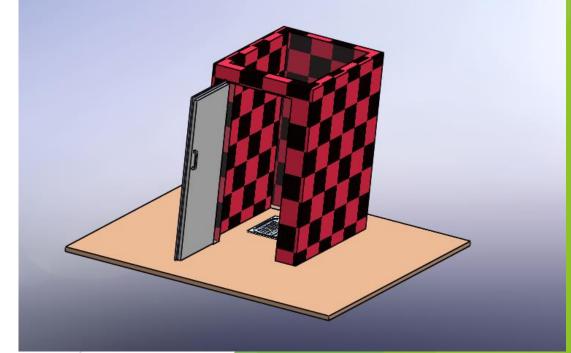


## **ETUM**

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











### PIR SENSOR



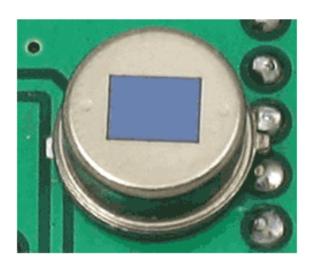
PIR sensors allow you to sense motion, almost always used to detect whether a human has moved in or out of the sensors range. They are small, inexpensive, low-power, easy to use and don't wear out. For that reason they are commonly found in appliances and gadgets used in homes or businesses. They are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





### PIR SENSOR



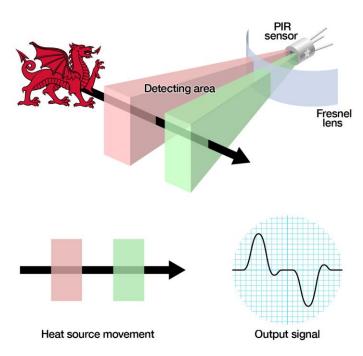


PIRs are basically made of a pyroelectric sensor (which you can see above as the round metal can with a rectangular crystal in the center), which can detect levels of infrared radiation. Everything emits some low level radiation, and the hotter something is, the more radiation is emitted. The sensor 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.





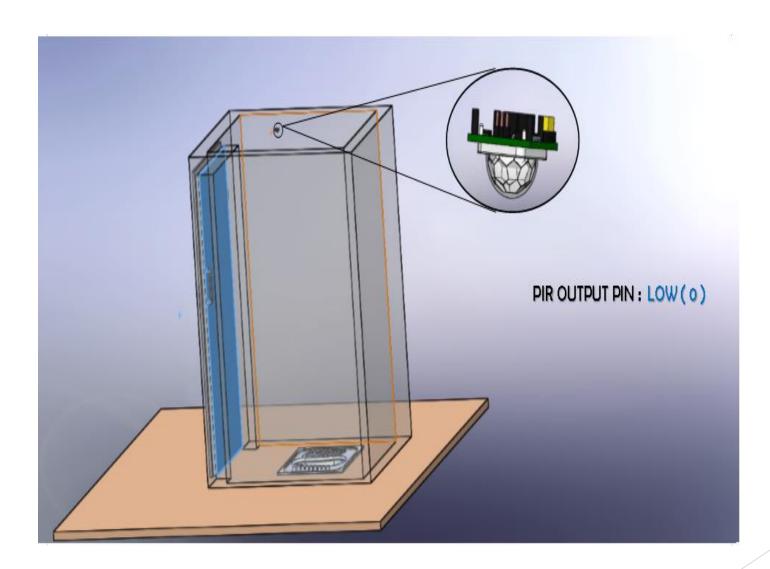
### PIR SENSOR WORKING



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**

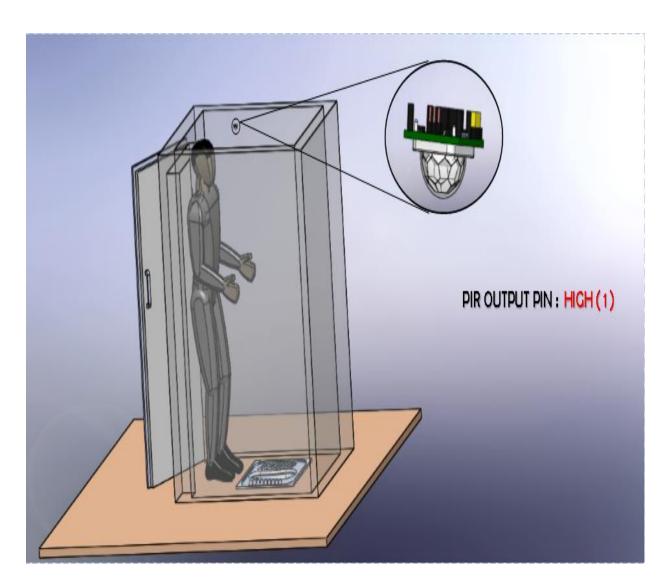




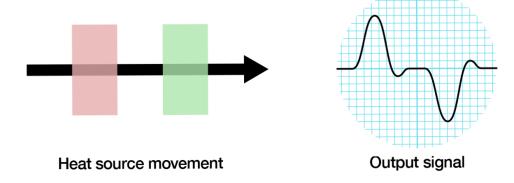
When the toilet is not being used, the sensor reads low.

### **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.



### 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 voltal 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 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:

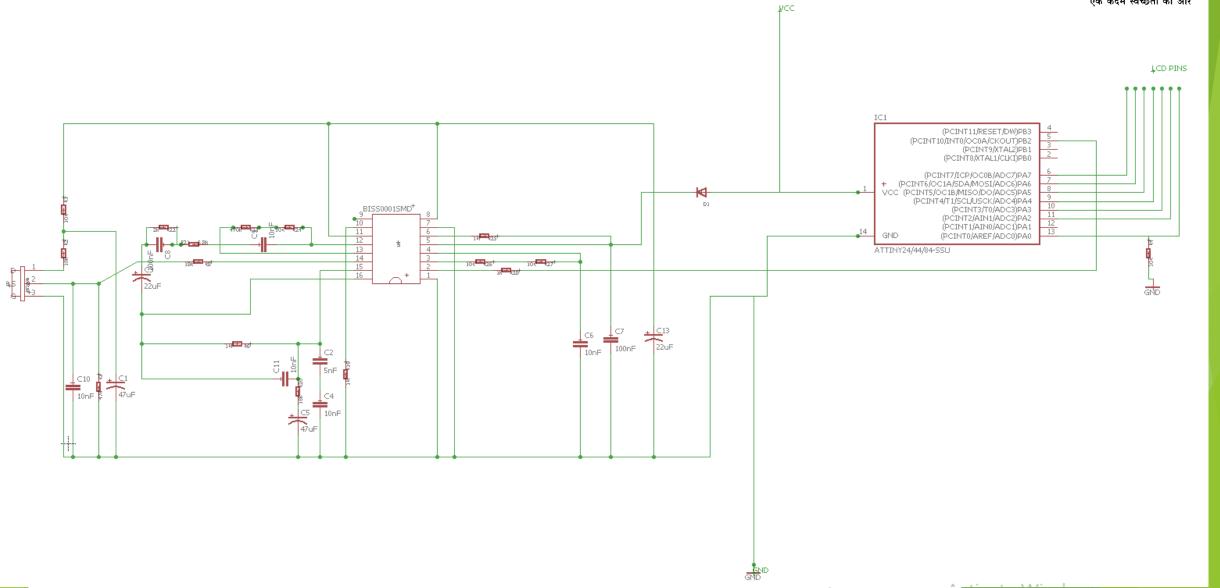
Resistor(ohms)
47k -1
6.8k -1
2k -1
10k -5
18k -3
470k -1
1M -3
1k -1

3000mAh Rechargeable battery 1	Capacitor 5nF -1 47uF -1
	22uF -2 100nF -2
	10nF -5

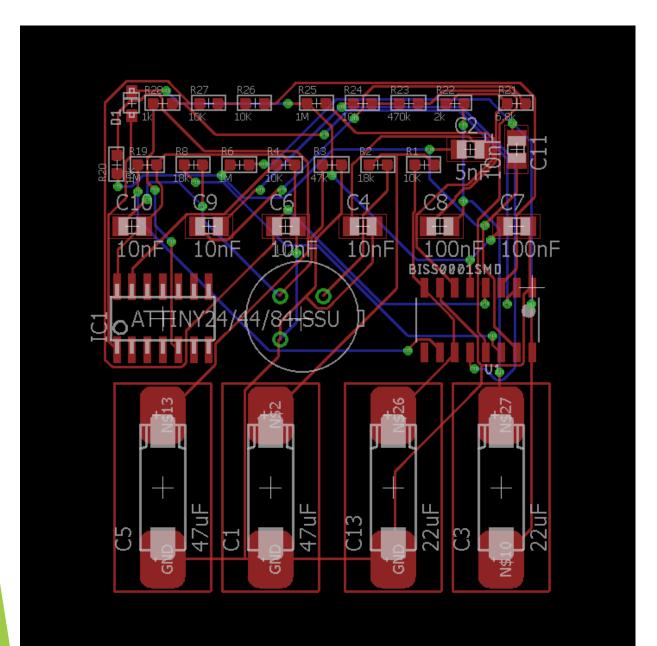
ICs and PIR ATTINY 24A BISS0001 SMD RE200B

### ETUM PCB SCHEMATIC





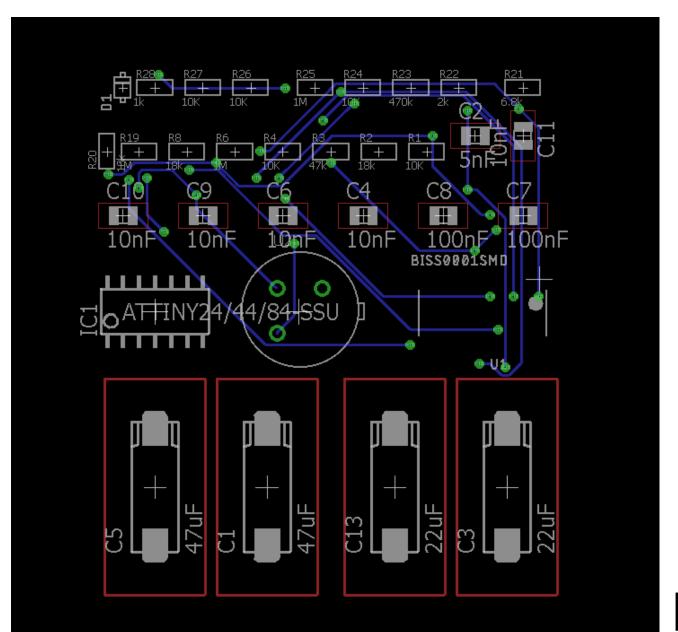
## ETUM PCB BOARD





PCB design of ETUM

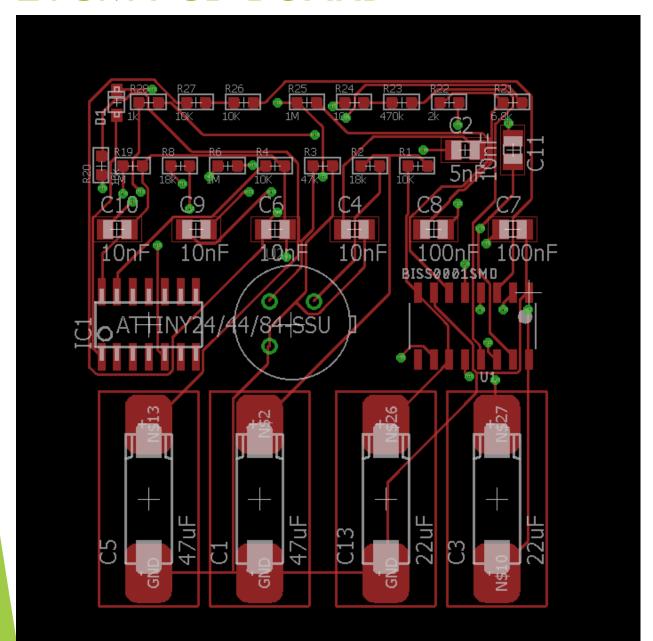
### ETUM PCB BOARD





Bottom layer of PCB.

### ETUM PCB BOARD





Top layer of PCB



X

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



RoHS: YES Description

Manufacturer: Order Code: 94W5149

Manufacturer Part No: MCRE000140

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

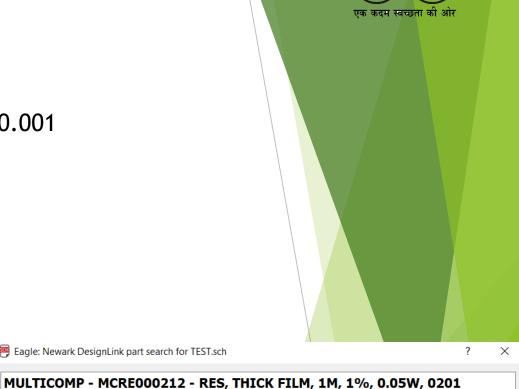
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Technical Data Sheet

Availability Availability: 2110	
Price For: 1 TC	
Minimum Order Quantity: 1	
Order Multiple: 1	
Price (USD)	

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

#### Manufacturer: Order Code: 94W5205 Manufacturer Part No: MCRE000212 RoHS: YES

Technical Data Sheet

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) List Price 1 - 9 0.0010 10 - 99 0.0010 100 - 999 0.0010 0.0010

1M resistor cost = 0.001

Eagle: Newark DesignLink part search for TEST.sch



Packaging / Drawing / Footprint

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

o, 0.063W, 0402		
Availability		
Availability: 44913		
Price For: 1 TC		
Minimum Order Quantity: 1		
Order Multiple: 1		
Price (USD)		
Qty	List Price	
1 - 24	0.1	
25 - 99	0.045	
100 - 249	0.026	

0.023

0.021

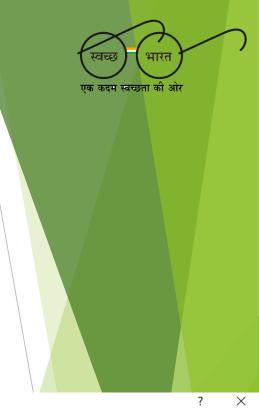
0.018

250 - 499

500 - 999

1000+

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

 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 -0.029 20000 25000 -0.027 45000 50000+ 0.023

6.8K resistor cost = 0.023

Eagle: Newark DesignLink part search for TEST.sch

Manufacturer: Order Code:

Technical Data Sheet

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

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

0.0010

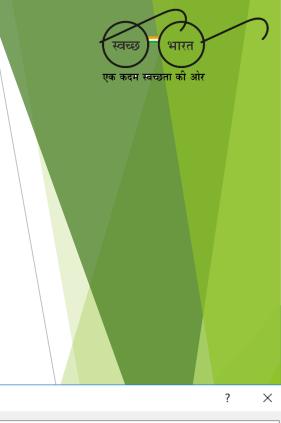
0.0010

100 - 999

1000+

 $\times$ 

10K resistor cost = 0.001



Eagle: Newark DesignLink part search for TEST.sch

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: 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

0.12

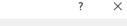
1000+

Availability

0.01uF capacitor cost= 0.12



Datasheet



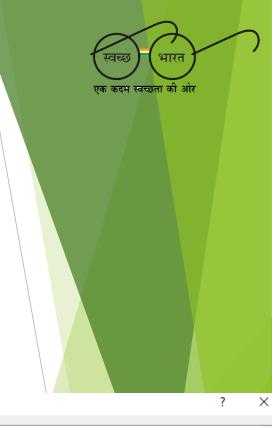


Description

- 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) 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 Manufacturer: Availability

Technical Data Sheet

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: 297 Price For: 1 EA

Minimum Order Quantity:

Order Multiple: 1

Price (USD)

24999

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

22uF capacitor cost = 0.022

Eagle: Newark DesignLink part search for TEST.sch

 $\times$ 



YAGEO - RC0603FR-1047KL - RES, THICK FILM, Price (USD)

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 Availability: 2289 Price For: 1 TC Minimum Order Quantity: 1 Order Multiple: 1 Qty List Price 1 - 9 0.08 10 - 24 0.015 25 - 99 0.01 100 - 249 0.0060 250 - 999 0.0040

0.0030

1000+

47K resistor cost= 0.003



Eagle: Newark DesignLink part search for TEST.sch

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



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

Availability Availability: 4383 Price For: 1 TC Minimum Order Quantity: 1 Order Multiple: 1 Price (USD) List Price 1 - 9 0.24 10 - 24 0.109 25 - 49 0.097

0.086

0.074

0.07

0.065

0.057

50 - 99

100 - 249

250 - 499

500 - 999

1000+

47uF capacitor cost = 0.057

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 Order Multiple: 1 Price (USD)

Minimum Order Quantity: 1 List Price 0.078 1 - 9 10 - 49 0.052 50 - 99 0.034 100 - 249 0.024 250 - 499 0.02 500 - 999 0.017

0.011

1000+

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: Availability VISHAY/DALE Availability: 5318

Packaging / Drawing / Footprint

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

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

470K resistor cost= 0.004



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

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#### 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.

## **ETUM**



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

https://drive.google.com/drive/folders/0B7fBHyx3akR\_MkswR0VGWkpjUFk?usp=sharing







Utkarsh Deepak utkarsh230897@gmail.com Electronics, ATtiny24A code



Nitin Yadav yadav.nitin558@gmail.com Electronics,PCB





# THANK YOU!