# MONITORING DEVICE FOR ELECTRONICS COMPONENTS INVENTORY MANAGEMENT SYSTEM OF FKP

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## SUPERVISOR'S DECLARATION

I hereby declare that I have check this thesis/project and in my opinion, the thesis/project is adequate in term of scope and quality for the award of Bachelor of Mechatronics Engineering.

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## STUDENT'S DECLARATION

I hereby declare that the work in this thesis/project is my own except for quotations and summaries which have been duly acknowledged. The thesis/project has not been accepted for any degree and is not concurently submitted for award of others degree.

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*First of all, all the praises and thanks to Allah S.W.T for give me the time,healthy and all of things*

*This thesis I dedicated*

*To my family and especially to my beloved parent, Yusni Binti Saad and Zakaria Bin Endut.*

*To my supervisor En.Ismail Bin Mohd.Khairuddin and all my friend whose give their support and encouragement.*

*May Allah bless all who help me from the first until last finished the thesis.*

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## ABSTRACT

This project aim to facilitate inventory management system in term of reservation, borrowing and returning electronics component in electronics laboratory. Generally, the focus of this project to overcome the problem in detecting the quantity of component in laboratory.This project usually monitoring and managing the inventory system in laboratory. This final year project carry out by the author to fulfillment the requirement for award the degree of Bachelor Mechatronics Engineering. This project give the student easy to take the electronics component and the duty staff can manage electronics laboratory in systematics way and flexible on time. This project only need the student to keep in the data of component in online form then print it. After that, scan the code with barcode scanner and receive the component when indicator show pass and unlock the system. The result will show when output 1 (drawer 1), output 3 (drawer 2) and output 5 (drawer 3) were on and the plunger will unlock.The remaining time will delay 25 second to lock back the system. The inventory management system is important to all staff and student especially in Faculty of Manufacturing department as the guided and easier way to keep in track of record.

# ABSTRAK

Tujuan projek ini adalah untuk memudahkan sistem pengurusan inventori dalam aspek tempahan, peminjaman dan pemulangan komponen elektronik di dalam makmal elektronik. Matlamat projek ini adalah untuk mengatasi masalah dalam mengesan kuantiti komponen di makmal elektronik.Projek ini direka untuk memantau dan mewujudkan cara yang sistematik dalam menguruskan sistem inventori di makmal.Projek tahun akhir yang dilaksanakan oleh penulis ini adalah bertujuan memenuhi keperluan untuk mendapat Ijazah Sarjana Muda dalam bidang Kejuruteraan Mekatronik. Projek ini merujuk kepada penggunaan infrastruktur di makmal elektronik disamping teknologi internet dijadikan sebagai medium untuk berkomunikasi. Projek ini dapat memberikan kemudahan kepada pelajar untuk mengambil komponen elektronik dan kakitangan yang bertugas boleh menguruskan makmal elektronik dengan cara sistematik dan fleksibel. Projek ini hanya memerlukan pelajar untuk mengisi borang secara online dan mencetaknya.Selepas itu pengimbas akan mengimbas kod bar dan isyarat lampu akan menyala.Pelajar hanya dapat mengambil komponen apabila isyarat lampu menyala dan pelocok terbuka.Isyarat lampu akan menunjukkan lampu 1 (laci 1), lampu 3 (laci 2) dan lampu 5 (laci 3)dan pelocok dibuka.Masa untuk mengambil komponen elektronik telah ditetapkan dalam masa 25 saat dan selepas itu sistem akan terkunci secara automatik. Sistem pengurusan inventori adalah penting untuk semua kakitangan dan pelajar terutama di Fakulti Kejuruteraan Pembuatan sebagai cara yang lebih mudah untuk menyimpan dan merekod data.

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# LIST OF ABBREVIATIONS

| | |
|---|---|
| PC | Personal Computer |
| RFID | Radio Frequency Identification |
| CCTV | Closed-Circuit Television |
| FKP | Fakulti Kejuruteraan Pembuatan |
| LED | Light Emitting Diode |
| IC | Integrated Circuit |
| AC | Alternate Current |
| DC | Direct Current |
| V | Voltage |
| SEC | Seconds |
| K1 | Relay 1 |
| K2 | Relay 2 |
| K3 | Relay 3 |
| K4 | Relay 4 |
| K5 | Relay 5 |
| K6 | Relay 6 |

# CHAPTER 1

# INTRODUCTION

## 1.0 INTRODUCTION

In this chapter, were state background of study, problem statement, objective of research, scope of project, organizing of thesis, definition of term, significant of study and expected result.

## 1.1 BACKGROUND OF STUDY

Monitoring device is the tool or equipment to monitor the place while inventory management system is a process for managing and locating objects or materials. Monitoring device is usually like security purpose for company or private equipment like the laptop and PC at office, vehicle at parking area and others. In Malaysia, Monitoring device are not complimentary at all places and area rather than Europe and Asian. Otherwise, monitoring device is the best solution to keep the place more secure and systematic. Inventory management system has been recognized as one of the most important functions of industrial and commercial enterprises, which often has a great impact on their overall performance. Monitoring device usually like CCTV camera, smart tag and fingerprint identification at room or laboratory. Anybody can't enter the room or laboratory without any permission and all behavioral of human can be monitor by CCTV camera and smart tag identification. The barcode system also one of device monitoring and normally used in supermarket or all outlet store.

In University Malaysia Pahang (UMP), especially at electronic laboratory in Manufacturing Engineering Faculty doesn't have monitoring device to control in and out data of electronic component. The student are easily grab the component over than they need and sometime it not necessary use. Impact of this, the electronics component is empty and laboratory staff need to reorder again thus the previous order already enough to Manufacturing student purpose. The student was doing the final project also having the problem not enough components to complete their project. The problem can cause Manufacturing Engineering Faculty to invest a lot of money to buy electronics component again. To avoid this problem happen again, we need put the device security system like the barcode system for monitoring the electronic component in and out data from electronic component store. This probably can give inventory management system of electronic component in FKP more systematic and reliable.

## 1.2 PROBLEM STATEMENT

The Faculty of Manufacturing (FKP) Laboratory currently have a problem to control and diserve the quantity of electronic component was taken by student. Therefore laboratory staff also difficult to manage the electronic component available or not in store. The aim of this project is to make the FKP laboratory have the systematic inventory management system and save the money and time constraint.

## 1.3 RESEARCH OBJECTIVE

1. To design the device for monitoring electronics component in laboratory
2. To design the device can satisfied and fulfill the staff and student requirement.
3. To developed the systematic way in electronic component laboratory

## 1.4 SCOPE OF PROJECT

The project is developed to Faculty of Manufacturing (FKP) electronics laboratory and used by staff and student of University Malaysia Pahang (UMP). The project is usually use indicator light at the rack and give the signal to student receive the electronic component and barcode system to scan the product code of the electronics component as well.

## 1.5 ORGANIZATION OF THESIS

This project consists of three chapters. Chapter 1 describe an introduction. While Chapter 2 highlights of the literature review on article and journal and Chapter 3 explained the methodology for the project. Chapter 4 were show about result and discussion and chapter 5 were state the conclusion and recommendations.

## 1.6 DEFINITION OF TERM

Inventory Management System is process of develope and manage the inventory such as material or object in systematic arrangement. The inventory management system commonly use in supermarket, warehouse and others. Monitoring device is one of the device were give the signals and display to monitor or screen such as barcode scanner, CCTV or radio-frequency identification (RFID). Monitoring device also used for security purpose like monitoring the customer in and out from shop or outlet. That means the tool or equipment to record the inventory transaction in and out from the place also called monitoring device.

## 1.7 SIGNIFICANT OF STUDY

After project have been done, it will contribute to Faculty of Manufacturing (FKP) especially staff and student can used this system much easier and save the time. This project also consist of CATIA software to design the rack system and visual basic to coding the program into PC. By the way it also use Electrical and Electronics technology to elaborate the skill to design and create the circuit.

## 1.8 EXPECTED RESULTS

The expected result for the project is well work and able to use by Faculty of Manufacturing (FKP) electronics laboratory in UMP especially for staff and student. The system able to give the staff more easily to define who take the component and order the component by follow the system as well. The student also do not waiting the component for longer time to receive it by using this system. This system is integrated with software and hardware through networking system. The system is friendlier user and can be use both staff and student as well. The system is more efficiently and can reduce the cost to buy the electronics component

# CHAPTER 2

# LITERATURE REVIEW

## 2.1 INTRODUCTION

In this chapter, the findings and previous studies regarding this project title will be presented. Most of the finding materials are based on the book and published journals. From the findings, the general information about the project can be gathered more easily when do the experiment . In the section 2.2 have introduced about Inventory Management System. In section 2.3, were describe about Device Monitoring System. In section 2.4 has conclude about this chapter in conclusion. Section 2.5 is summary.

## 2.2 INVENTORY MANAGEMENT SYSTEM

Inventory management system is a process for managing and locating objects or materials like idle stock of physical goods that contain economics value, and held in various forms by company. Inventory management is part of business management concerned with planning and controlling inventories (APICS, 1995). Inventory management system cannot be considered as isolated systems but are linked to many different management areas within companies (Bonney, 1994). Inventory management system is an efficiency way of handling the constant flow of material into and out of an existing inventory, whereby it will bring benefit outcome especially for industries purpose. This process usually involve controlling the transfer of material in order to avoid inventory becoming too high and costly to company. An analysis of issues involve in assessing inventory management system reveals that inventory management often hold

process, planning, information and organization dimension (Corbey and Jansen,1993). Balancing the various tasks of inventory management and calculating known as buffer stock is the key of success in manage the inventory. Inventory management system is not limited to document of delivery raw material but the movement of those material also important. Normally known as work in progress or goods, tracking materials are used to identify and adjust the amount of ordering the material before inventory get low and become dangerous to company as well.

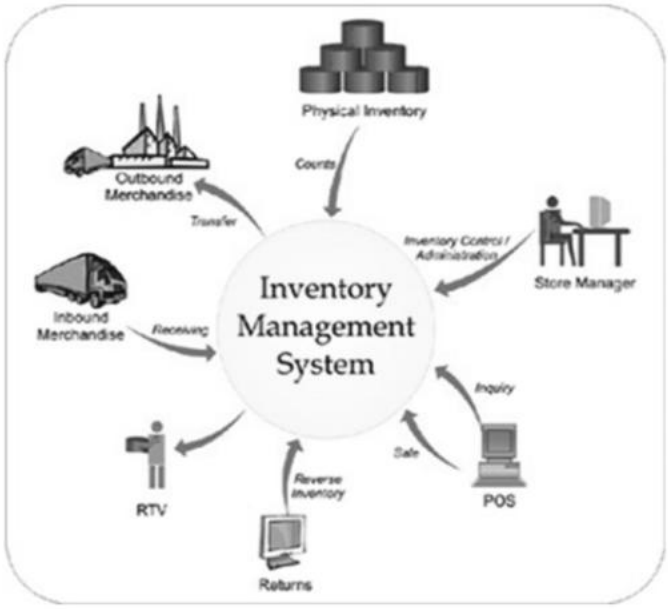


**Figure 2.1** Inventory management system flow (Mega Ventory, 2012)

Inventory management system has been recognized as one of the most important functions of industrial and commercial enterprises, which often has a great impact on overall performance. Inventory is probably the most thoroughly researched area of production and operations management. However, almost large companies and many small and medium-sized enterprises increasingly try to apply scientific methods for better managing their inventory, the use of these methods is often limited to some basic tools like the computation of economic order quantities and rough approximations of reorder points or base stocks for achieving target service levels. The way inventory management

system generally considered as important key factor for success of companies (Bonney, 1994). The maintaining control of volume and movement of various inventories also can give the inventory management be success as well. Inventory management system is very important function that determines the health of the supply chain as well as the impacts the financial health of the balance sheet.

## 2.3 DEVICE MONITORING INVENTORY SYSTEM

Device monitoring inventory system is like device to monitor the object or data in management system. That include CCTV camera, Radio-frequency Identification (RFID) and barcode system. Inventory management system in earlier days using the system known as cardex system. The cardex system like the printed bin card an attach with every location. Whenever inventory was put into the bin or removed the card had been updated. Apart from bin card, the logbook or register book were maintain to state the transaction manually. After the barcode system was implement, the cardex system is not being used as well. The barcode is one of the most important development in library, retail automation and factory.

### 2.3.1 BARCODE SYSTEM

The barcode is a machine readable representing visual format in the surface which can be transfer to the computer (Sutton, 2002). The barcode are extensively used for control the inventory product, supply and stocking purpose and retail management in application of industry. The barcode scanner is providing to be an effective tool toward achieving inventory control (J.Jesitus, 1995). The main advantage of barcode system is safe and rapid availability of information a product. Automatic data collection by barcode scanning is also more effective front end to an inventory control system (D.Navas, 1996). Barcode can read by optical scanner called barcode reader. The barcode is dominant technology at point of sale for identification (R.P.Vlosky, 1994). The benefit of using barcode is collecting data are very simple, speed and accuracy than traditional manual

keyboard entry (S.M.Youssef and R.M.Salem, 2007). The usage jumped more than 30% after Wal-Mart endorsed use the barcode in 1984 (Bear, Stream Co.Inc, 2003).

**Figure 2.2** Barcode Scanner (BarcodesInc, 2013)

### 2.3.2 RADIO-FREQUENCY IDENTIFICATION (RFID) SYSTEM

In 2003, Wall-Mart notified the top supplier start to using radio-frequency identification (RFID) for managing the supplies (RFID Journal, 2003). The supplier is believe RFID can bring more benefit when they change the monitoring device system. It can give their more efficiency in supply chain management, increased product availability and improved asset management for the company (Angeles, 2005). RFID could also increase the accuracy of shipment data, improve forecast and production planning (Lapide, 2004). Radio-frequency Identification (RFID) is use radio frequency wave to transfer data between a reader and a tag on item to be identified, tracked or located. Kourouthanassis and Roussos in 2003 were designed and implemented a prototype system catering to consumers on the move by using a wireless connect cart with display device (RFID) system that detect object in the cart.

However radio-frequency identification (RFID) system basically outperformed to barcode system because the barcode system is higher reliability on read state (C.C. Chen et al., 2005). For example, a pilot study were examines the reliability of RFID for tracking the location of nurse, patients and medical equipment in a hospital (K.Ohashi et al., 2008).

The RFID antenna were placed at ceiling over the patient room entrance and bedside while the tag is belong to person with different position of body like chest, neck and wrist. The result show the radio-frequency identification (RFID) system not stable and reading of tag take about an hours. From this know that RFID still have the drawback compare with barcode system. The barcode system is cheaper than radio-frequency identification (RFID) system. The switching from barcode system to RFID system is more efficiency but the cost is higher from usual. The change the system to RFID only benefit to customer but supplier will suffer.

**Figure 2.3** RFID Reader (Rebecca Ring, 2012)

## 2.4 CONCLUSION

Inventory management system is important for the place like industries and company as well. It can generate the systematic rule to manage the inventory like electronic component in laboratory. Device monitoring like the equipment to support the system. The barcode scanner is the best device and cheap in Inventory management system as well.

## 2.5 SUMMARY

**Table 2.1** Barcode vs RFID System

| Barcode System | RFID System |
|---|---|
| The barcode is a machine readable representing visual format in the surface which can be transfer to the computer (Sutton,2002) | Radio-frequency Identification (RFID) is use radio frequency wave to transfer data between a reader and a tag on item to be identified, tracked or located |
| The benefit of using barcode is collecting data are very simple, speed and accuracy than traditional manual keyboard entry (S.M.Youssef and R.M.Salem, 2007). | RFID could also increase the accuracy of shipment data, improve forecast and production planning ( Lapide,2004) |
| The barcode system is higher reliability on read state ( C.C. Chen et al.,2005) | It can give their more efficiency in supply chain management, increased product availability and improved asset management for the company (Angeles, 2005). |

# CHAPTER 3

# METHODOLOGY

## 3.1 INTRODUCTION

The main objective of this project is to developed easier way to manage electronics laboratory in FKP. The focus parameter is to design the device that can monitor electronics component in laboratory. This chapter will presents about the methodology that been applied in order to achieved objectives of the project.

Methodology is a guideline for developer to structure, plan and control the process of development the system. This chapter will be discuss the method and process for the project development of inventory management system at FKP. For this project, the device system will be connected with web-based system through networking.

This project consist of software development such as visual basic like the programming platform to control the circuit, barcode scanner as hardware to access device and plunger as locking system. It also have LED light for the indicator as well**.** The data of barcode will sent by server through the web form filling by user. The user can receive the component when the barcode is valid for access.

## 3.2 RESEARCH METHODOLOGY FLOWCHART

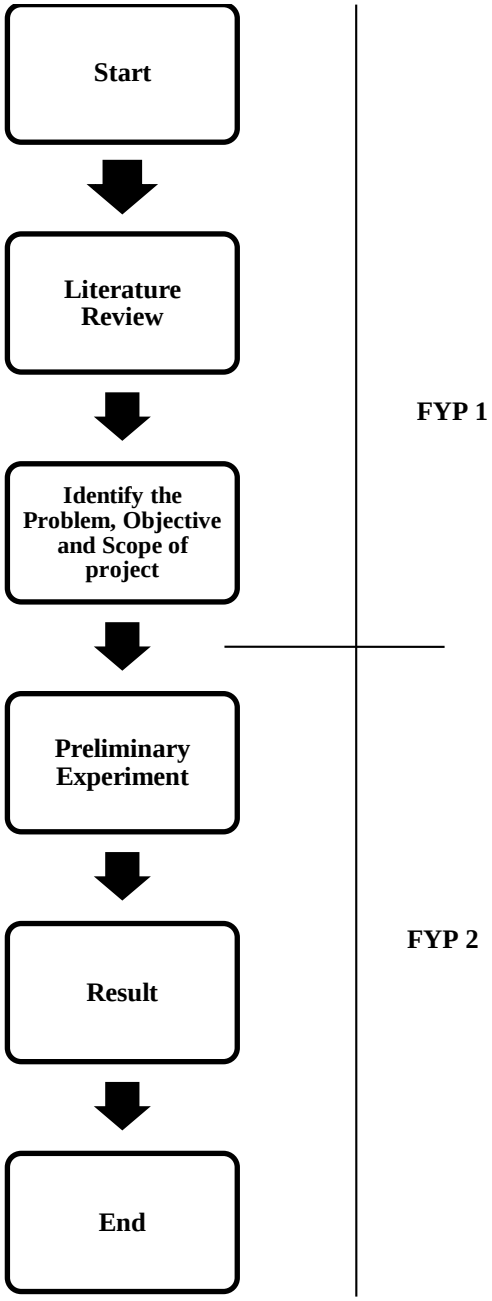


**Figure 3.1** Research Methodology Flowchart

## 3.3 PROCESS METHODOLOGY FLOWCHART

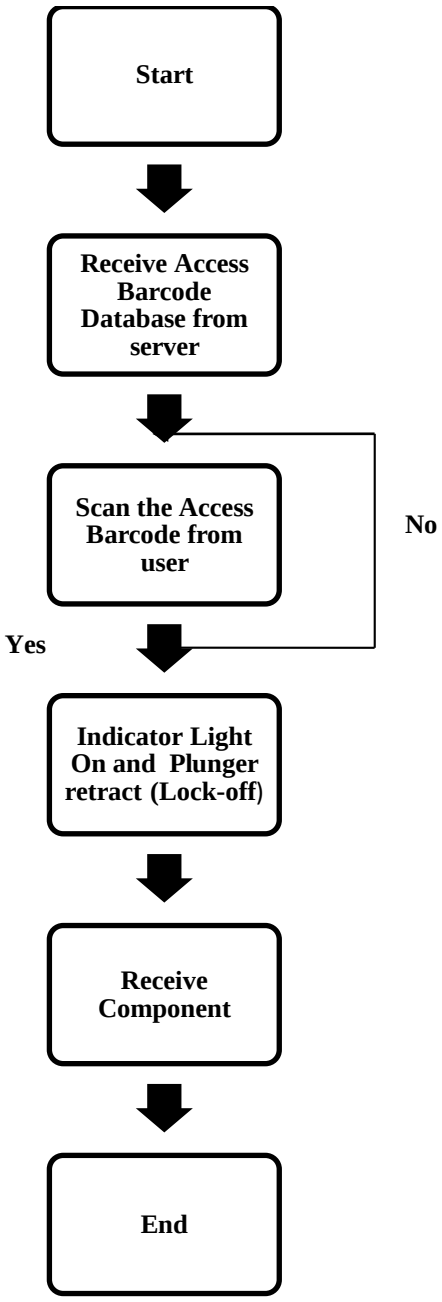


**Figure 3.2** Process Methodology Flowchart

## 3.4 DESIGN METHODOLOGY OF DEVICE MONITORING SYSTEM

For this project, the users will using the printed barcode from the website of electronics laboratory component to access the system in the laboratory. Barcode scanner is main device that been used to check the validity of the barcode. Whereby a user successfully access the system, the machine will provide electronic components for users as well.

## 3.5 HARDWARE DEVELOPMENT

Hardware development was contain of design consideration and equipment were used in this project. With all of this will bring the project become working as well.

### 3.5.1 DESIGN CONSIDERATION

For this project, the design also important to make the project become establish and develop. The rack was design in cubic shape like the normal rack in market sale. The rack size is 400mm height x 200mm width x 300mm length. The rack display the 2 type color of LED light as indicator for each drawer , there is the green LED light shown when receive pass signal for barcode system and red LED light were show the system is lock as usual.

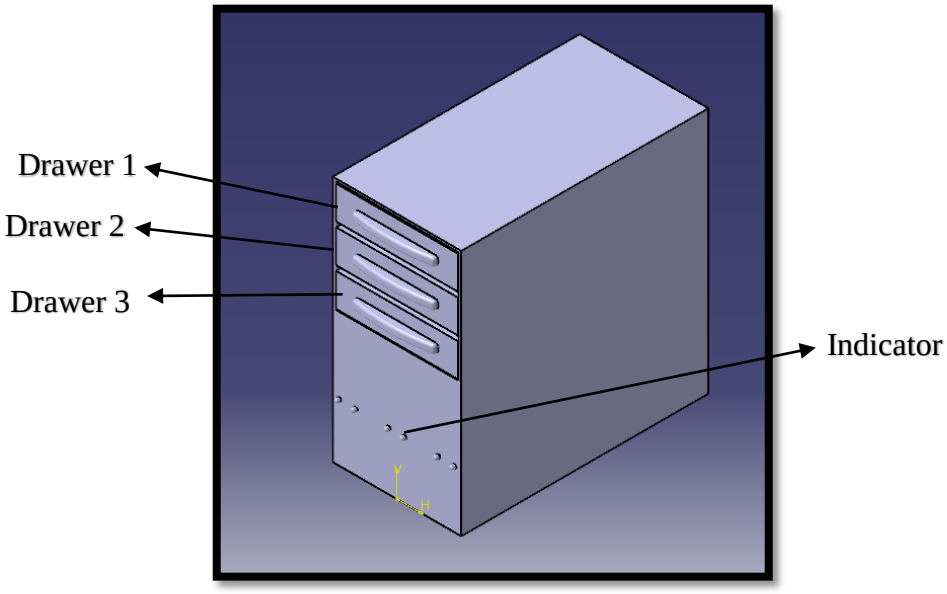


**Figure 3.3** Electronics component rack

The control box will be located near the electronics component rack and give the easier for technician to troubleshoot or program the board if system was failed and not function as well.

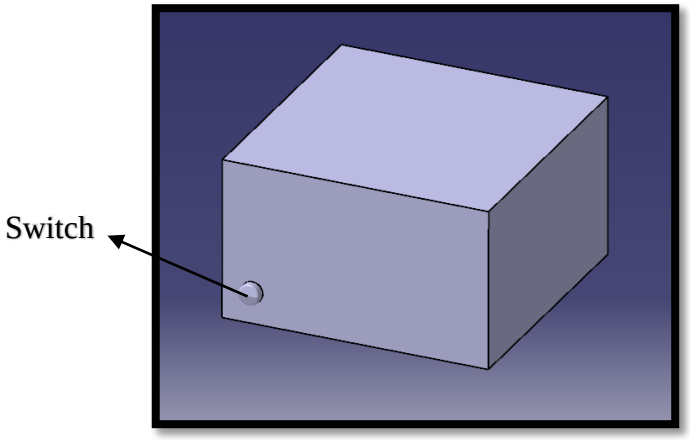


**Figure 3.4** Control box

Design for this project also have to considered electrical part as well. All of this electrical peripheral must connected to circuit board as function to deliver the task for input and output signal. Personal computer or laptop were link to barcode scanner and parralel port cable. Then the parralel port cable must link to circuit board and connected to 2 peripheral device as plunger (central lock car) and LED light (indicator).

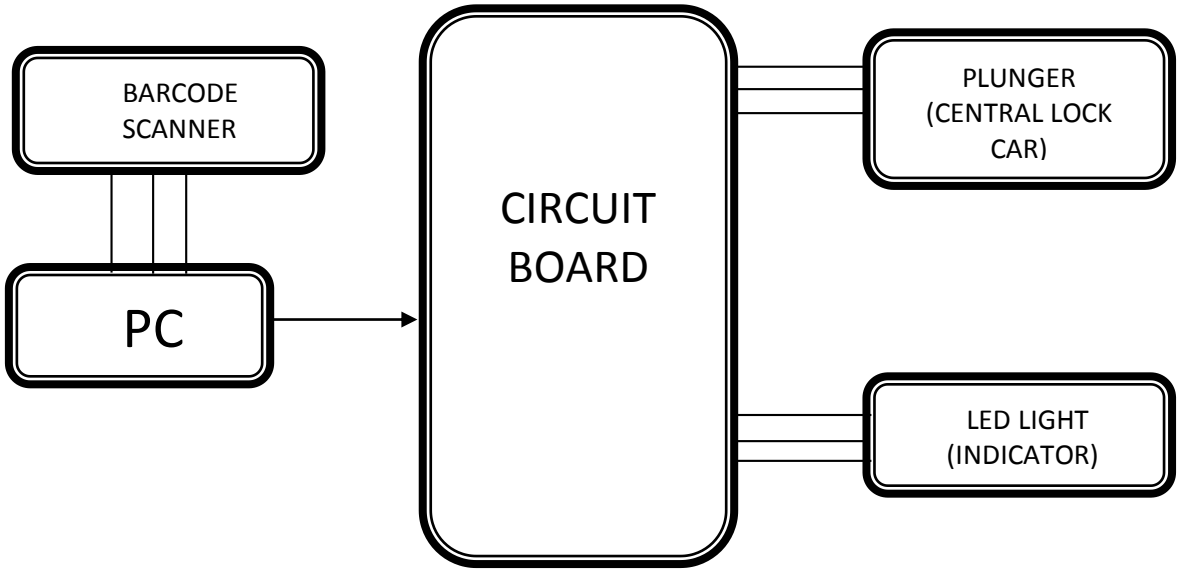


**Figure 3.5** Electrical Block Diagram

### 3.5.2 TOOLS / EQUIPMENT

#### 3.5.2.1 PERSONAL COMPUTER (PC)

Personal computer known as PC is the main peripheral device to generate the program and send data to parralel port as the output. For this project the PC will be connected with barcode scanner to determine the code and display at monitor if status is pass or failed as well.

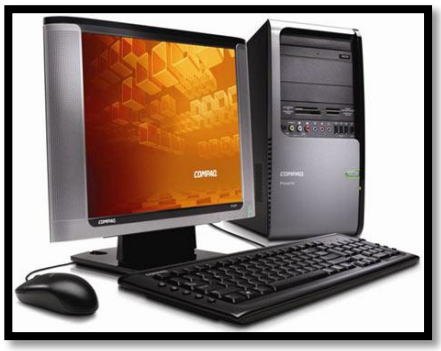

**Figure 3.6** Personal Computer (Unicentrix, 2012)

#### 3.5.2.2 ULN2003 DARLINGTON IC

ULN2003 Darlington IC is used for safety purpose for external device avoid from overcurrent. For this project, ULN2003 Darlington IC used to prevent and protect the PC from damage and short circuit from external voltage like DC power supply. This ULN2003 Darlington IC were install between parralel port and relay.


**Figure 3.7** ULN2003 Darlington IC (Ventor Technologies, 2013)

### 3.5.2.3 RELAY

The relay function as switching the different voltage like high voltage from AC or DC. The coil were build in the relay and active when voltage were applied. For this project, the relay function as switching voltage from 5v to 12v and were connected between ULN2003 Darlington IC and plunger.


**Figure 3.8** Relay (Aztronics, 2011)

### 3.5.2.4 DC POWER SUPPLY

The DC power supply function as supplied DC voltage to main circuit.For this project,the output supply were using is 12V DC voltage.The size of DC power supply is larger when ampere value is high. The DC power supply is important and suitable for this project.

**Figure 3.9** DC Power supply (Apogeekits,2013)

### 3.5.2.5 PARRALEL PORT CABLE

Parralel port cable function as link between the PC to circuit board. Parralel port have 25 pin and 8 pin of it known as output data. For this project were used output parallel port pin 1 until pin 6. The parralel port were send all data in parralel line as well.

**Figure 3.10** Parallel Port Cable (Pete Markiewicz, 2013)

### 3.5.2.6 BARCODE SCANNER

A barcode scanner is an electronic device for reading printed barcode. It consist of light source, a lens and a light sensor translating optical impulse into electrical. Barcode scanner contain decoder circuitry and the sensor and sending barcode content to scanner output port. For this project, barcode scanner function as scan the code from the online form.

**Figure 3.11** Barcode Scanner (BarcodesInc, 2013)

### 3.5.2.7 PLUNGER (CENTRE-LOCK CAR)

Plunger also known as Centre-lock car is device to allow the simultaneously lock and unlock by pressing the button or flipping a switch. The plunger normally used in automobile like car or lorry as locking system for door. The plunger also used to unlock the luggage compartment or fuel filler cap. The device is usually need the supply power at least 12 v DC to activate it. The device is sustainable and efficiency to use for locking system because the price is cheap and easy to use.

**Figure 3.12** Plunger device (Linkdelight, 2013)

### 3.5.2.8 LIGHT EMITTING DIODE (LED)

Light Emitting Diode known as LED is like semiconductor of light source. LED light are used as indicator for many devices such as for personal computer, laptop, mobile phone and many more. The advantages is lower energy consumption, longer lifetime, smaller size and faster switching. The applications of LED light commonly use as aviation lighting, automotive lighting and traffic light. LED light also powerful enough to light the room or place than normal lamp.

**Figure 3.13** Light Emitting Diode (Brian Nitz, 2012)

# CHAPTER 4

# RESULT AND DISCUSSION

## 4.1 INTRODUCTION

This chapter present and discussed the experimental result on device monitoring system in FKP electronic laboratory. Analysis and discussion regarding this system were explain in this chapter. The result is extract from the series of experimental trial based on the performance of this system to detect and arrange by systematic function. The experiment is based on user data form and code were generated. After that the barcode will scan by scanner and the pass indicator light were on then user will receive the component. This chapter also shows the prototype of inventory system, the diagram and result based in this system.

## 4.2 RESULT OF SYSTEM

In order to obtain the result of this system, the table will applicable to give the clear function of this system. The timeline graph also were generate regarding the table to ensure the system is correct and follow the theory in electronics system.

**Table 4.1** Output Table

| **Output From Parallel Port** | **plunger** | **LED (Green)** | **LED (Red)** |
|---|---|---|---|
| **1** | ON | ON | OFF |
| **2** | OFF | OFF | ON |
| **3** | ON | ON | OFF |
| **4** | OFF | OFF | ON |
| **5** | ON | ON | OFF |
| **6** | OFF | OFF | ON |

The explaination from the table will be determined into this rule :

If output 1 is ON,then Plunger 1 and LED green will ON
If output 2 is ON,then Plunger 2 and LED green will OFF
If output 3 is ON,then Plunger 2 and LED green will ON
If output 4 is ON,then Plunger 2 and LED green will OFF
If output 5 is ON,then Plunger 3 and LED green will ON
If output 6 is ON,then Plunger 3 and LED green will OFF

The data from the table also can be turbulate into timeline graph.The result will appear below. When output 1 will trigger, the Plunger 1 and LED green will ON and the duration to off back the system is 25 second. After the output 1 turn off, the system will lock back as usual.

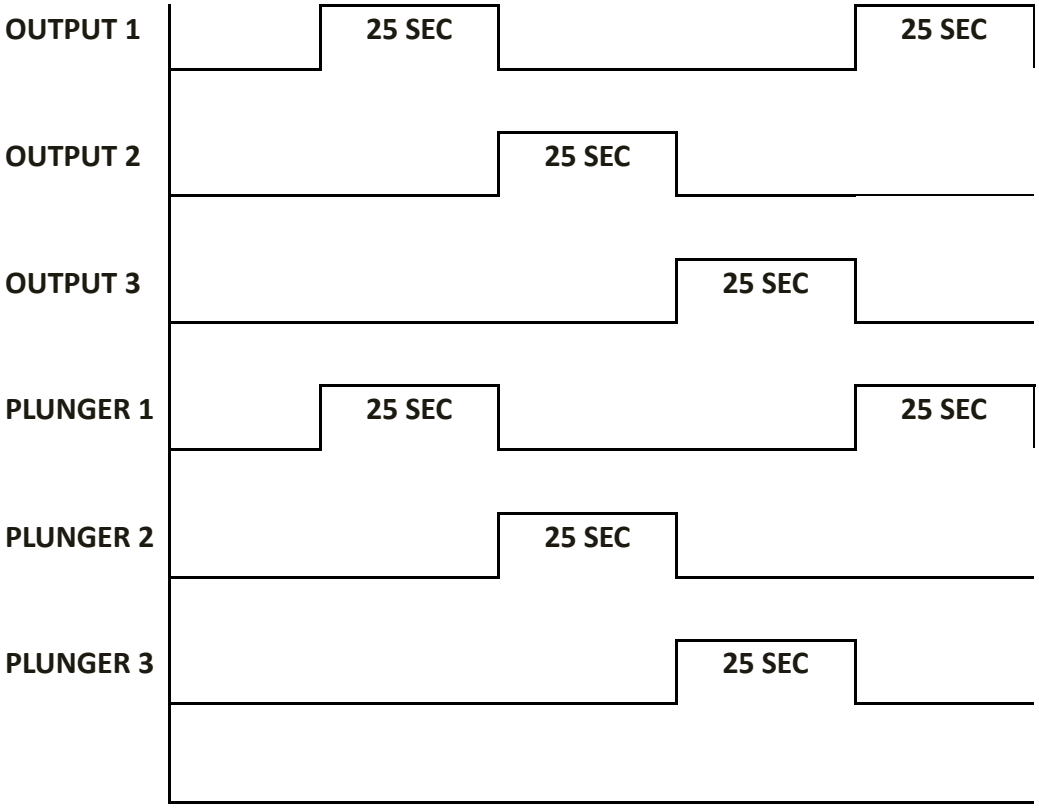


**Figure 4.1** Waveform Diagram

## 4.3 CIRCUIT DIAGRAM

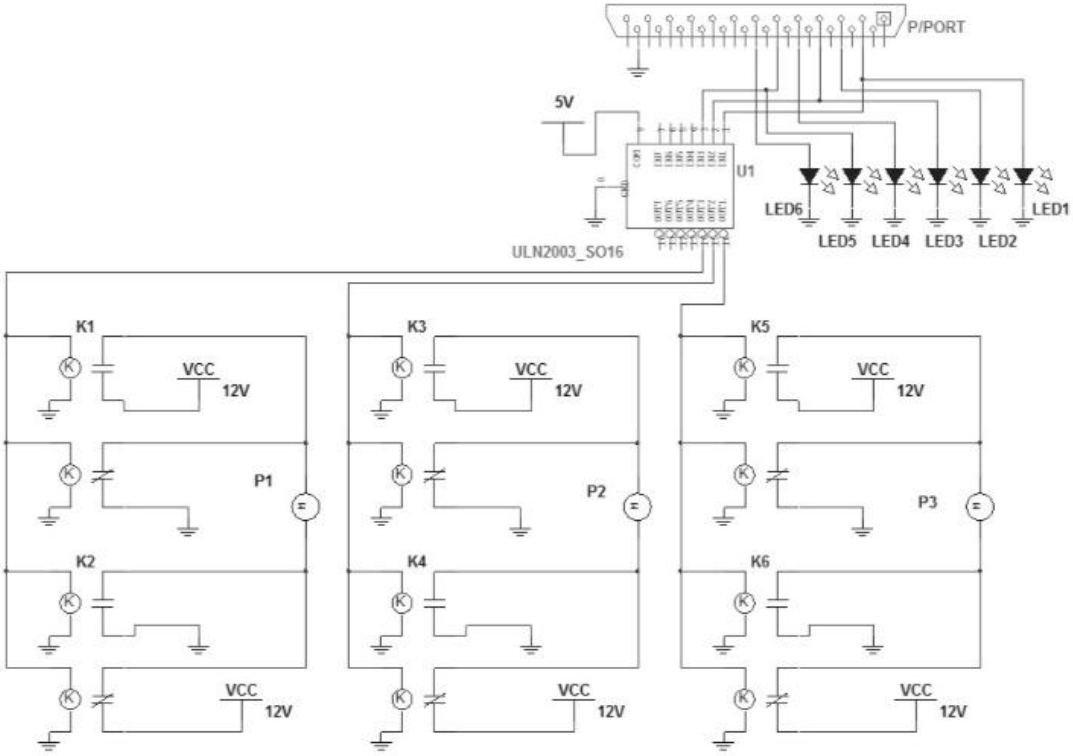


**Figure 4.2** Circuit Diagram

The circuit contain 6 relays ( K1,K2,K3,K4,K5 and K6) as the medium to switch the signal from ULN2003 to plunger. ULN2003 function as transfer the output data to relay and safety purpose when short circuit and overcurrent were happened. Six LED light as indicator were tringger if output 1 until 6 from parralel port were activated and is 3 of LED (LED1, LED3 and LED5) is green and others (LED2, LED4 and LED6) is red. The ULN2003 were used 5v and therefore the plunger use 12v external supply as the power source.

## 4.4 INTERFACE PROGRAM

Idle program

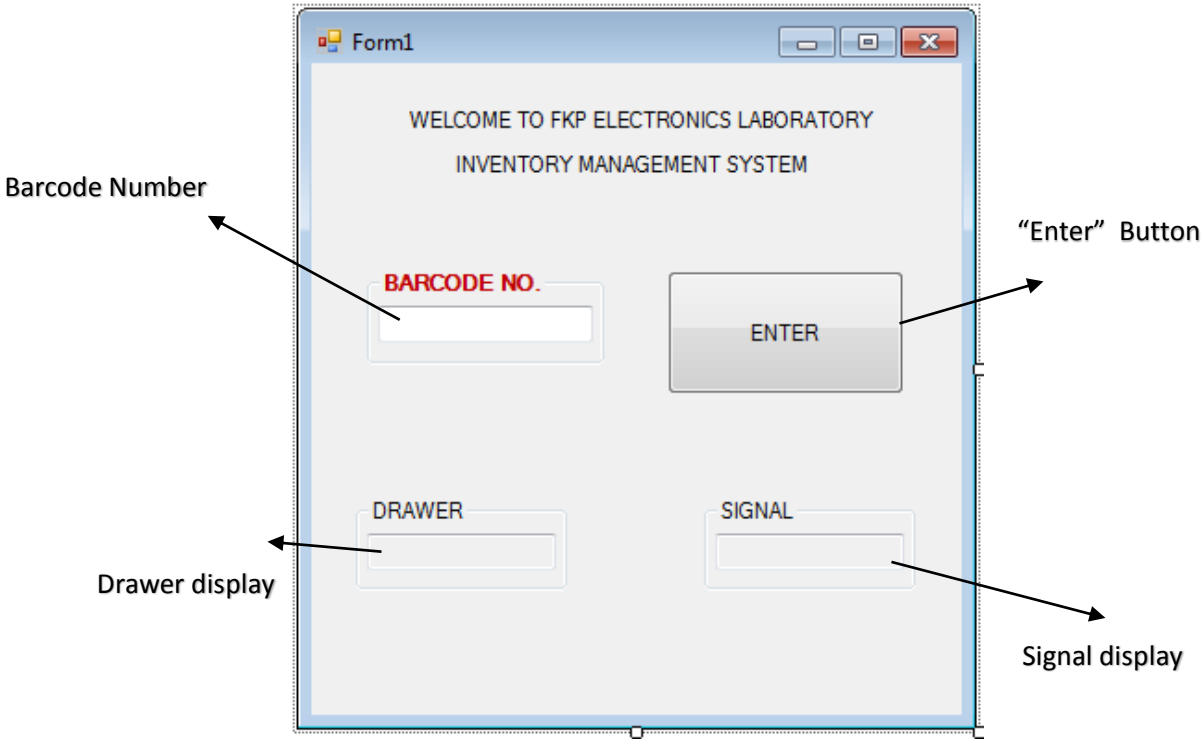


**Figure 4.3** Interface program

Activated/Unlock the Drawer

**Table 4.2** Drawer and signal code

| Barcode Number | Drawer | Signal |
|---|---|---|
| 100 | Drawer 1 | Open |
| 200 | Drawer 2 | Open |
| 300 | Drawer 3 | Open |
| 400 | Drawer 1 and 2 | Open |
| 500 | Drawer 1 and 3 | Open |
| 600 | Drawer 2 and 3 | Open |
| 700 | All drawer | Open |
| Others numbers | error | error |

This project were set for the certain barcode number to unlock the the system. Plunger can't active when the wrong and invalid code were entered. The code were set is 100 for drawer 1, 200 for drawer 2 and 300 for drawer 3. If user want take the 2 component, the code 400, 500 and 600 will be set for drawer 1 and 2, drawer 1 and 3 and drawer 2 and 3 as well. When wanted to take 3 component, the code 700 will be set. Others number than that, the user were facing the error message and the drawer can't opened.

After drawer were opened, the user only left or remain 25 second to grab the component in drawer. Then the plunger will extend back and the drawer will lock back as normal. The reason why choose 25 second because the longest duration for user to take the component for one drawer is 8 second. Then the total time for user to take at all drawer is 25 second. That's the reason why 25second remaining time were choose and implement it in this system as well.

Example when code is valid

When user want component in drawer 1, the code for the drawer set to 100 ( figure 4.4 ). After scan the barcode and press enter button,the drawer and signal were display “drawer 1” and “open” message in figure 4.5. The system will delay 25 second to user take out the component. After the duration ended, the system will lock back as normal position. For the others valid code number and drawer can see appendix C.

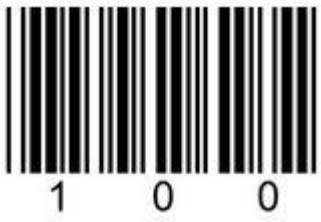


**Figure 4.4** Code number 100

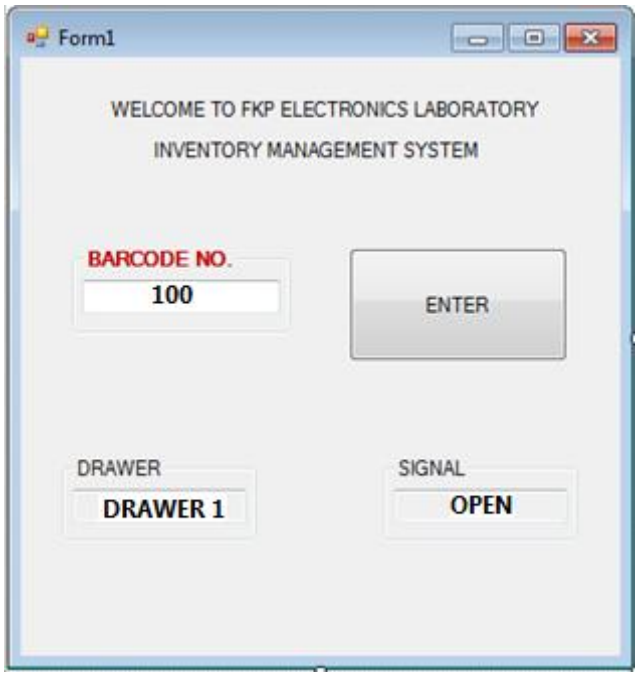


**Figure 4.5** Drawer 1 Activated

Example when code is invalid

When user was entered others or invalid barcode number like 50 ( figure 4.6 ). After scan the barcode and press enter button,the drawer and signal were display “error” message in figure 4.7.The system will delay 5 second and clear the message. That time the plunger and indicator still remain unchanged.


**Figure 4.6** Code number 50

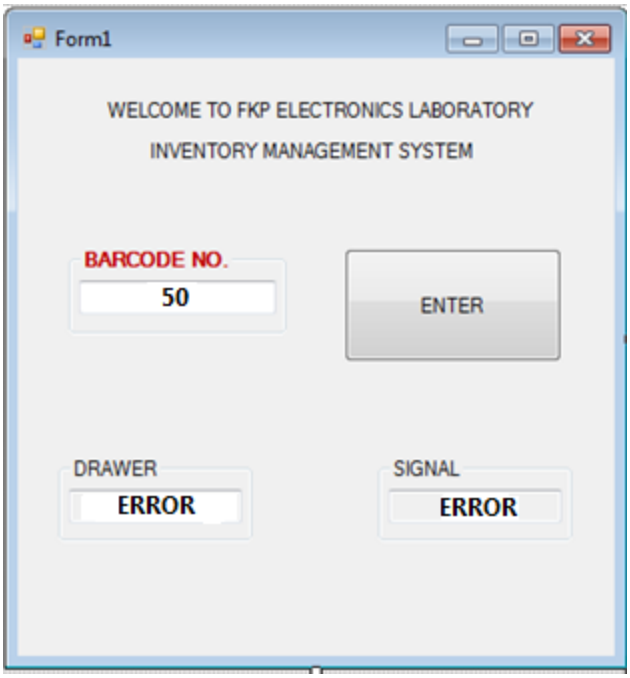


**Figure 4.7** Error massage will display

## 4.5 COMPLETE PRODUCT

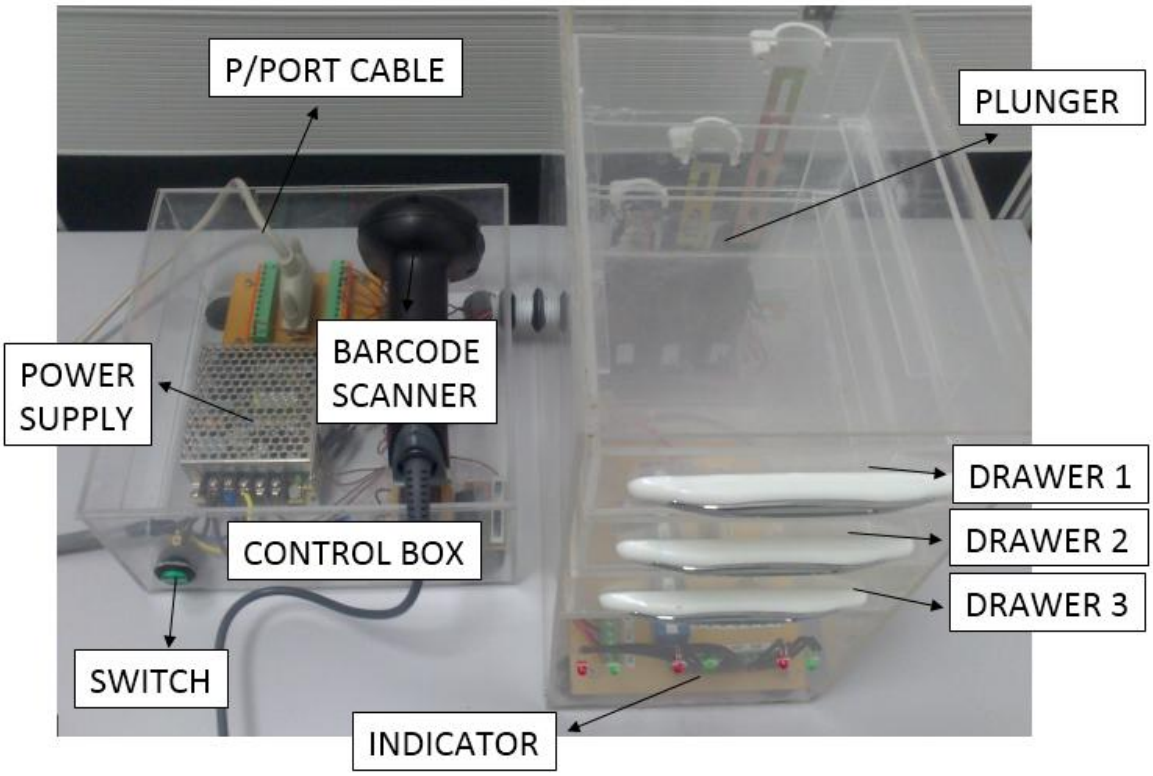


**Figure 4.8** Complete Product

# CHAPTER 5

# CONCLUSION AND RECOMMENDATIONS

## 5.1 INTRODUCTION

This chapter will summarize the whole study and recommendations about way to improve this study for the next time. The summarize of this project based on the chapter before. Upon completion of the project, the objective and scope of the project are successfully met the target.

## 5.2 CONCLUSION

Based on all the data gathered from result and discussion,the following conclusion were drawn :

1. The inventory management system is important to all staff and student especially in Faculty of Manufacturing department as the guided and easier way to keep in track of record.
2. This system used as component rack for electronic laboratory purpose and using the plunger to lock and unlock the system and barcode scanner is an authorise system to give the user receive the component part.

## 5.3 RECOMMENDATIONS

From the result that been obtained in the previous chapters,the following future work can be recommended are :

1. Change the barcode system to RFID tag because the barcode system is old version for inventory system and not stable than RFID.
2. Use more security system like fingerprint or other because more safety than barcode system.
3. Add more drawer to give more component can store and easier to staff and student used.
4. Use wireless or sms system to give more applicable and interesting.

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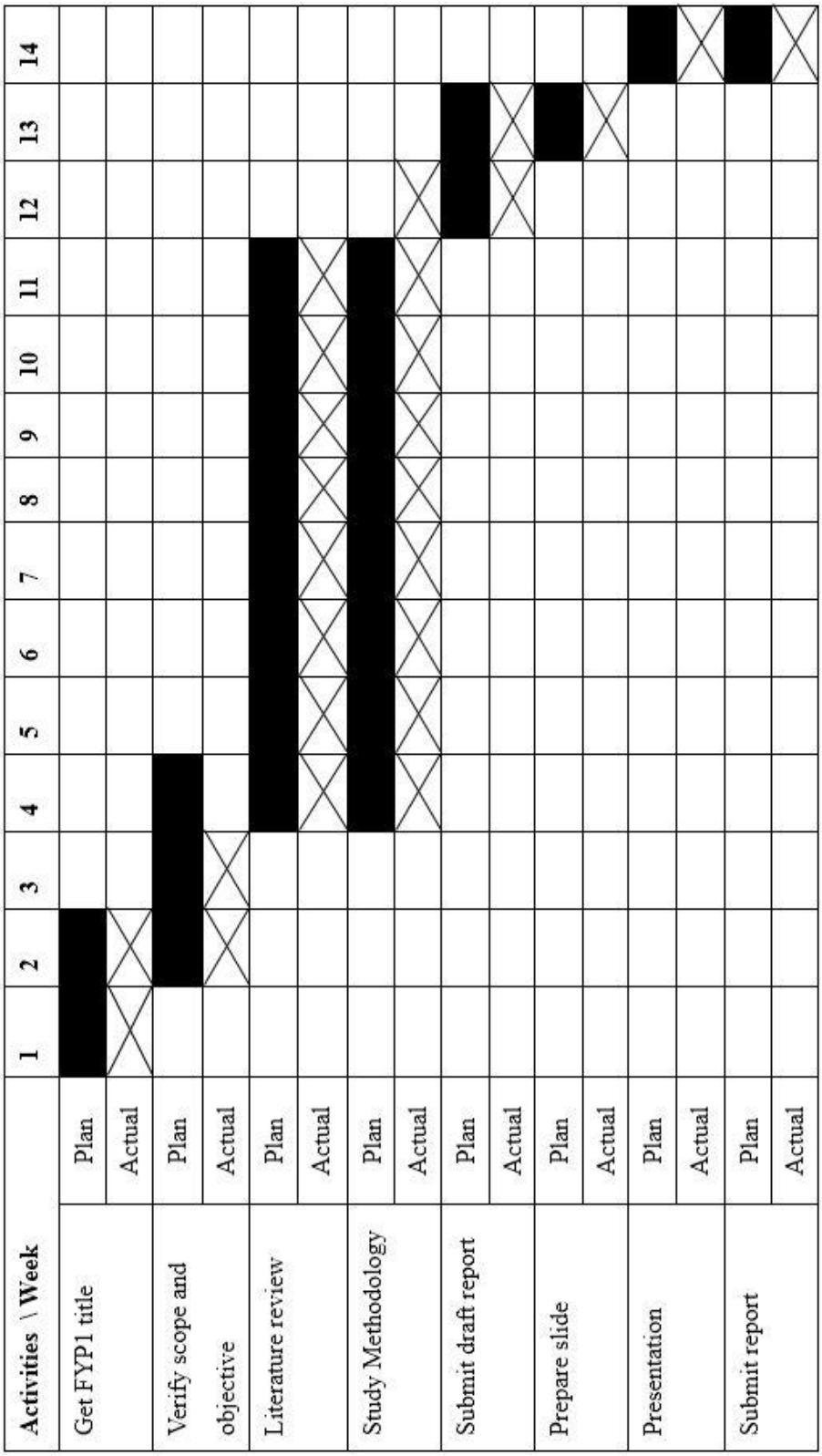
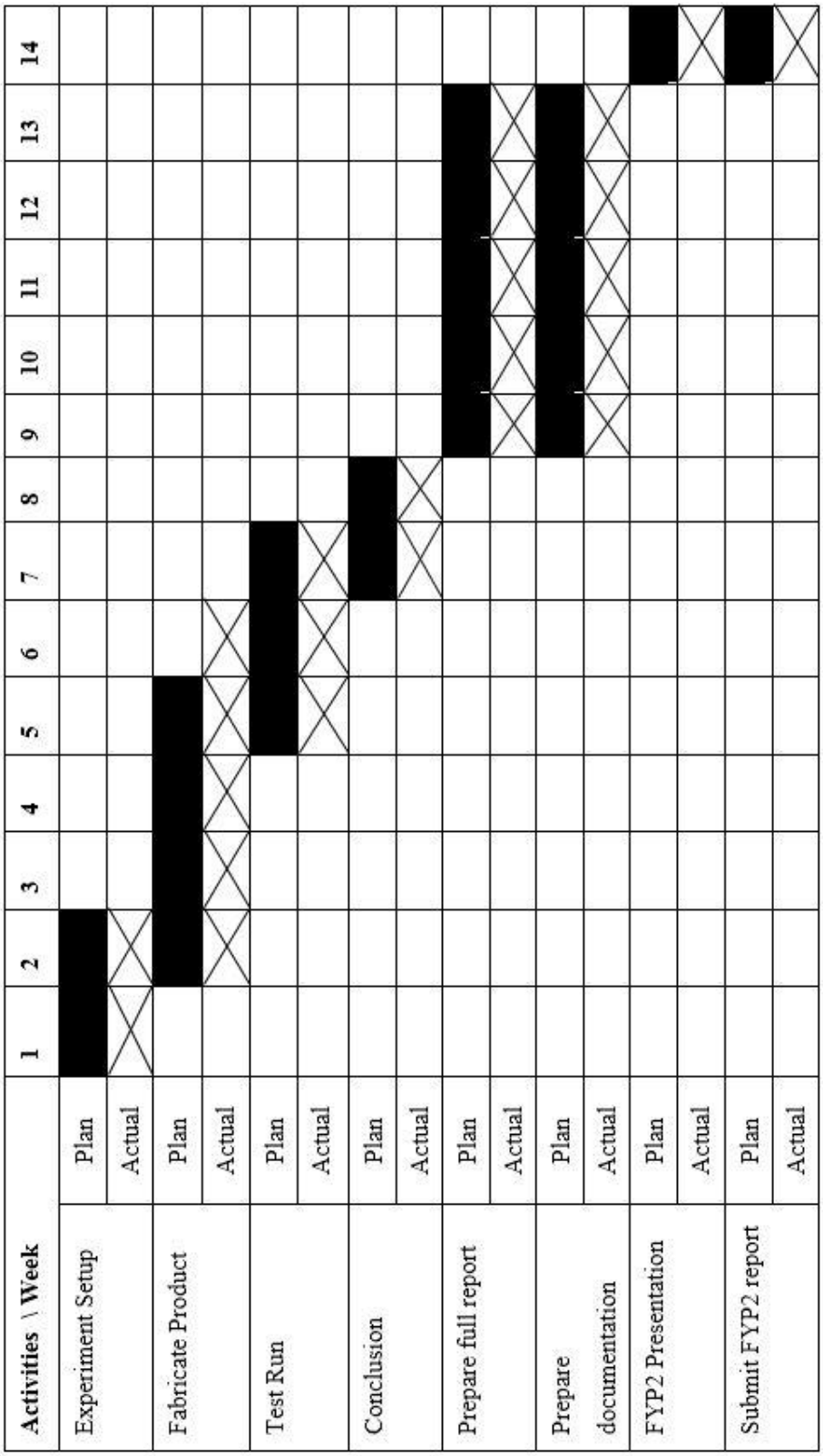
**APPENDIX A1 GANTT CHART FINAL YEAR PROJECT 1**



**APPENDIX A2 GANTT CHART FINAL YEAR PROJECT 2**



# APPENDIX B

## PROGRAM CODE

```
Public Class Form1

    Public Declare Sub Out Lib "inpout32.dll" Alias "Out32" _
    (ByVal PortAddress As Integer, _
    ByVal Value As Integer)

    Private Sub Button1_MouseClick(ByVal sender As Object, ByVal e As
    System.Windows.Forms.MouseEventArgs) Handles Button1.MouseClick
    Dim value As Single
    value = TextBox1.Text

    Select Case value

    Case 100

    TextBox3.AppendText("OPEN")
    TextBox2.AppendText("DRAWER 1")
    System.Threading.Thread.Sleep(10)
    Out(888, 1)
    System.Threading.Thread.Sleep(25000)
    Out(888, 0)
    TextBox1.Text = ""
    TextBox2.Text = ""
    TextBox3.Text = ""
    Out(888, 42)

    Case 200

    TextBox3.AppendText("OPEN")
    TextBox2.AppendText("DRAWER 2")
    System.Threading.Thread.Sleep(10)
    Out(888, 4)
```

```
System.Threading.Thread.Sleep(25000)
Out(888, 0)
TextBox1.Text = ""
TextBox2.Text = ""
TextBox3.Text = ""
Out(888, 42)

Case 300

TextBox3.AppendText("OPEN")
TextBox2.AppendText("DRAWER 3")
System.Threading.Thread.Sleep(10)
Out(888, 16)
System.Threading.Thread.Sleep(25000)
Out(888, 0)
TextBox1.Text = ""
TextBox2.Text = ""
TextBox3.Text = ""
Out(888, 42)

Case 400

TextBox3.AppendText("OPEN")
TextBox2.AppendText("DRAWER 1,2")
System.Threading.Thread.Sleep(10)
Out(888, 5)
System.Threading.Thread.Sleep(25000)
Out(888, 0)
TextBox1.Text = ""
TextBox2.Text = ""
TextBox3.Text = ""
Out(888, 42)

Case 500

TextBox3.AppendText("OPEN")
TextBox2.AppendText("DRAWER 1,3")
```

```
System.Threading.Thread.Sleep(10)
Out(888, 17)
System.Threading.Thread.Sleep(25000)
Out(888, 0)
TextBox1.Text = “”
TextBox2.Text = “”
TextBox3.Text = “”
Out(888, 42)

Case 600

TextBox3.AppendText(“OPEN”)
TextBox2.AppendText(“DRAWER 2,3”)
System.Threading.Thread.Sleep(10)
Out(888, 20)
System.Threading.Thread.Sleep(25000)
Out(888, 0)
TextBox1.Text = “”
TextBox2.Text = “”
TextBox3.Text = “”
Out(888, 42)

Case 700

TextBox3.AppendText(“OPEN”)
TextBox2.AppendText(“ALL DRAWER”)
System.Threading.Thread.Sleep(10)
Out(888, 21)
System.Threading.Thread.Sleep(25000)
Out(888, 0)
TextBox1.Text = “”
TextBox2.Text = “”
TextBox3.Text = “”
Out(888, 42)
```

```
Case Else

TextBox3.AppendText("ERROR")
TextBox2.AppendText("ERROR")
System.Threading.Thread.Sleep(5000)
Out(888, 0)
TextBox1.Text = ""
TextBox2.Text = ""
TextBox3.Text = ""
Out(888, 42)

End Select

End Sub


Private Sub Form1_Load(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles MyBase.Load
Out(888, 42)

End Sub

Private Sub Button1_Click(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles Button1.Click

End Sub
End Class
```

# APPENDIX C

## BARCODE NUMBER AND DRAWER ACTIVATE

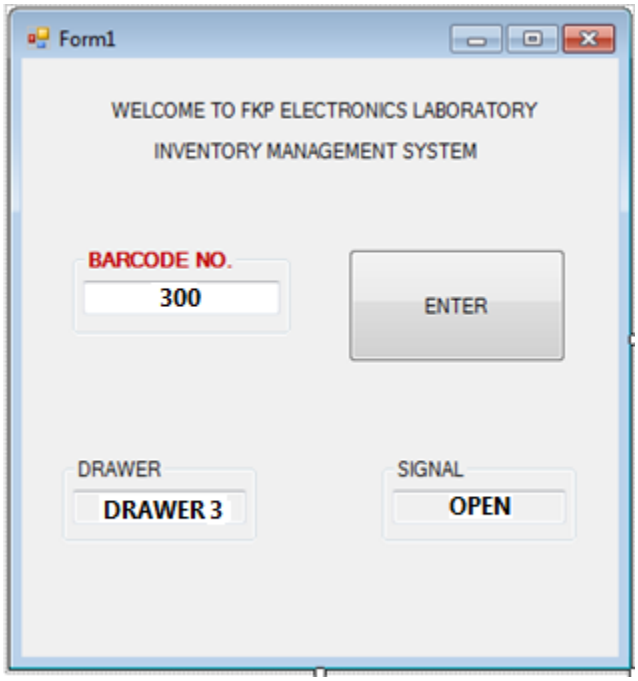
**Drawer 2**


Code number 200


Drawer 2 Activated

**Drawer 3**

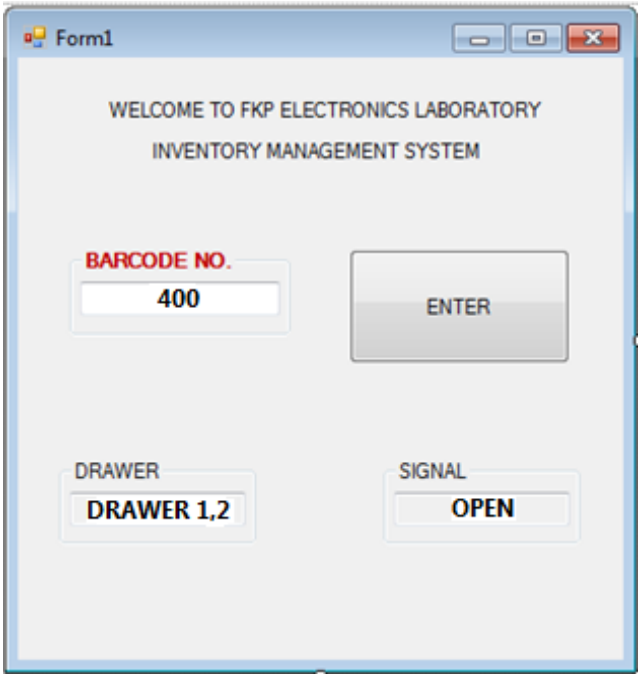

Code number 300




Drawer 3 Activated

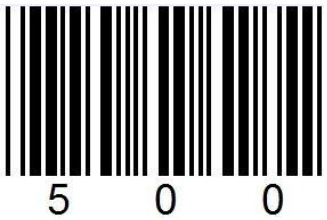
**Drawer 1 and 2**


Code number 400

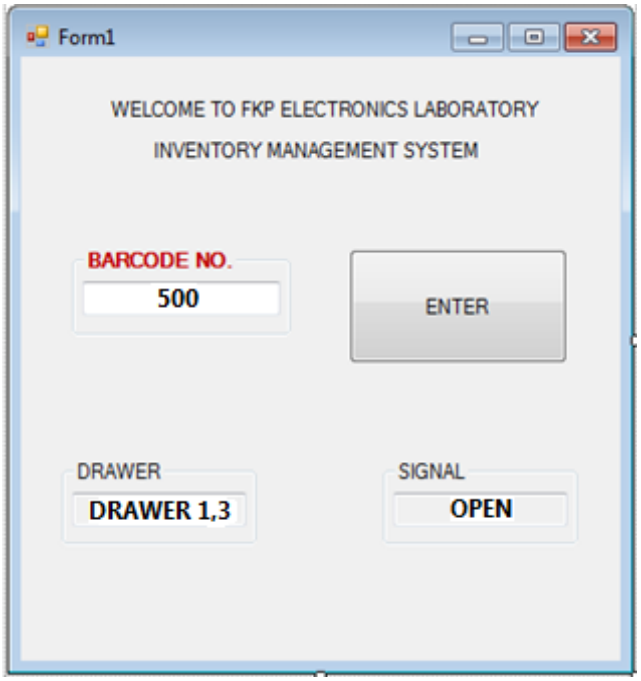



Drawer 1 and 2  Activated

**Drawer 1 and 3**



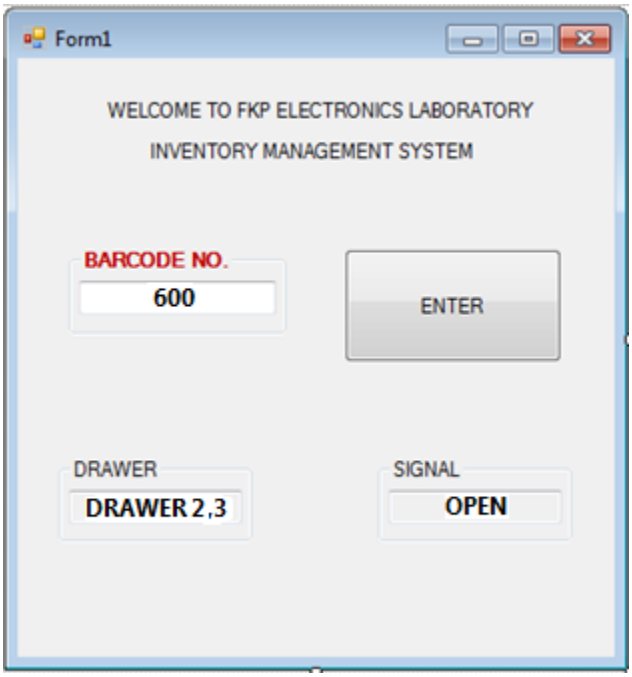

Code number 500




Drawer 1 and 3  Activated

**Drawer 2 and 3**

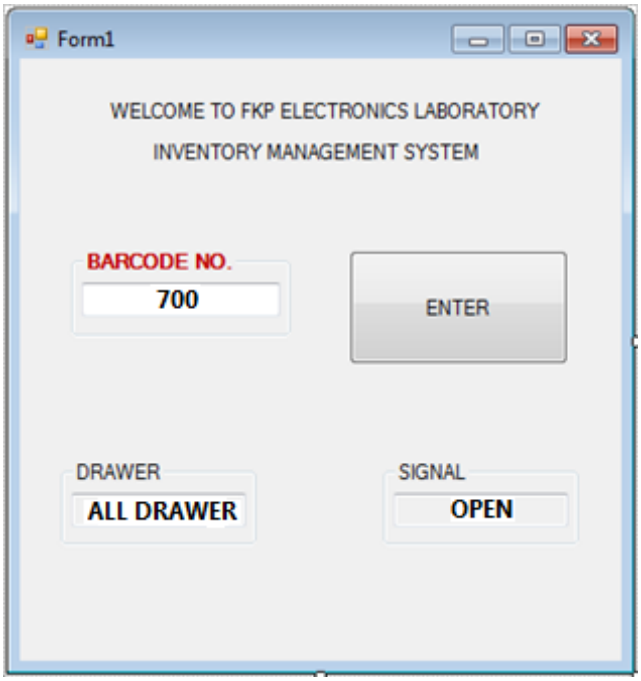

Code number 600




Drawer 2 and 3  Activated

**All drawer**


Code number 700



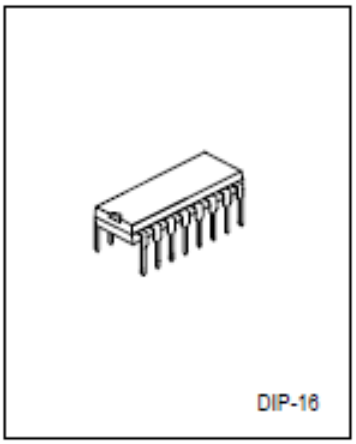

All drawer Activated

# APPENDIX D

## ULN 2003

ULN2003 LINEAR INTEGRATED CIRCUIT

### HIGH VOLTAGE AND HIGH CURRENT DARLINGTON TRANSISTOR ARRAY




#### DESCRIPTION

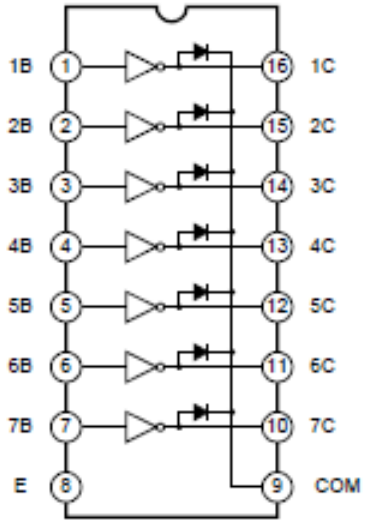
The ULN2003 is a monolithic high voltage and high current Darlington transistor arrays. It consists of seven NPN darlington pairs that features high-voltage outputs with common-cathode clamp diode for switching inductive loads. The collector-current rating of a single darlington pair is 500mA. The darlington pairs may be parrileled for higher current capability. Applications include relay drivers,hammer drivers, lampdrivers,display drivers(LED gas discharge),line drivers, and logic buffers.

The ULN2003 has a 2.7kΩ series base resistor for each darlington pair for operation directly with TTL or 5V CMOS devices.

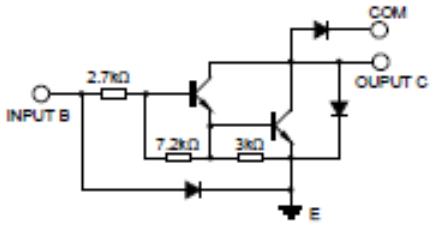
#### FEATURES

* 500mA rated collector current(Single output)
* High-voltage outputs: 50V
* Inputs compatibale with various types of logic.
* Relay driver application

#### LOGIC DIAGRAM




#### SCHEMATIC(EACH DARLINGTON PAIR)



**ABSOLUTE MAXIMUM RATINGS**(Ta=25°C)

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Colletor-Emitter Voltage | $V_{CE}$ | 50 | V |
| Input Voltage | $V_I$ | 30 | A |
| Peak Collector Current | $I_O$ | 500 | mA |
| Total Emitter-terminal | $I_{OK}$ | 500 | mA |
| Power Dissipation | Pd | 950 Tamb=25°C<br>495 Tamb<85°C | mW<br>mW |
| Operating Temperature | Topr | -20~ +85 | °C |
| Storage Temperature | Tstg | -65 ~ +150 | °C |

Note: All volatge values are with repect to the emitter/substrate terminal E, unless otherwise noted.

**ELECTRICAL CHARACTERISTICS**(Ta=25°C,unless otherwise specified)

| Characteristic | Test Figure | Symbol | Test Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|---|
| On-state Input Voltage | 6 | $V_{I(ON)}$ | $V_{CE}$=2V,Ic=200mA | | | 2.4 | V |
| | | | $V_{CE}$=2V,Ic=250mA | | | 2.7 | |
| | | | $V_{CE}$=2V,Ic=300mA | | | 3 | |
| Collector-Emitter Saturation Voltage | 5 | $V_{CE(SAT)}$ | $I_I$=250μA,Ic=100mA | | 0.9 | 1.1 | V |
| | | | $I_I$=350μA,Ic=200mA | | 1 | 1.3 | |
| | | | $I_I$=500μA,Ic=350mA | | 1.2 | 1.6 | |
| Collector Cutoff Current | 1 | $I_{CEX}$ | $V_{CE}$=50V,$I_I$=0 | | | 50 | μA |
| | 2 | | $V_{CE}$=50V,$I_I$=0,Ta=70°C | | | 100 | |
| Clamp Forward Voltage | 8 | $V_F$ | $I_F$=350mA | | 1.7 | 2 | V |
| Off-state Input Current | 3 | $I_{I(OFF)}$ | $V_{CE}$=50V,Ic=500mA, Ta=70°C | 50 | 65 | | μA |
| Input Current | 4 | $I_I$ | $V_I$=3.85V | | 0.95 | 1.35 | mA |
| Clamp Reverse Current | 7 | $I_R$ | $V_R$=50V | | | 50 | μA |
| | | | $V_R$=50V, Ta=70°C | | | 100 | |
| Input Capacitance | – | $C_I$ | $V_I$=0,f=1MHz | | 15 | 25 | pF |
| Propagation delay time, low-to-high-level output | 9 | $t_{PLH}$ | | | 0.25 | 1 | μs |
| Propagation delay time, high-to-low-level output | 9 | $t_{PHL}$ | | | 0.25 | 1 | μs |
| High-level output Voltage after switching | 10 | $V_{OH}$ | Vs=50V,Io=300mA | Vs-20 | | | mV |

**TEST CIRCUITS**

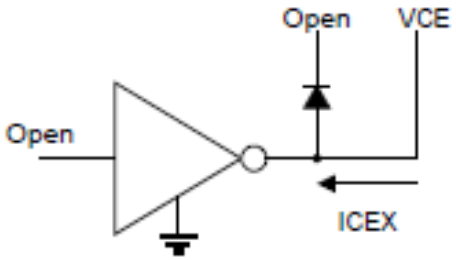



Figure 1 ICEX Test Circuit

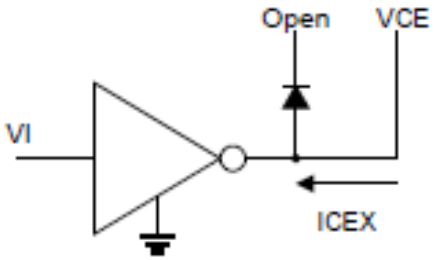



Figure 2 ICEX Test Circuit

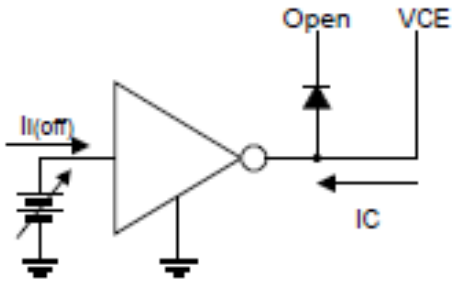



Figure 3 II(off) Test Circuit

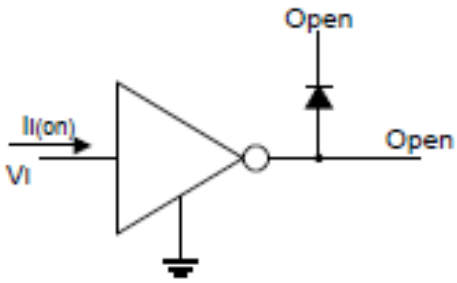
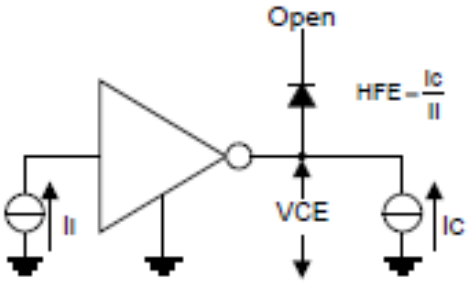



Figure 4 II(on) Test Circuit




Note: II is fixed for measuring VCE(sat),variable for measuring HFE.

Figure 5 HFE,VCE(sat) Test Circuit

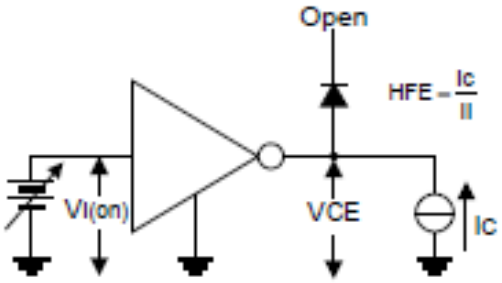



Figure 6 VI(on) Test Circuit

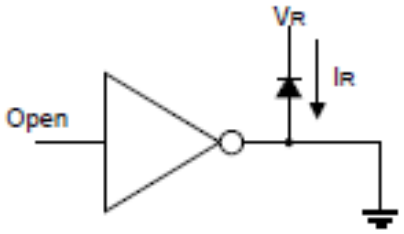



Figure 7 IR Test Circuit

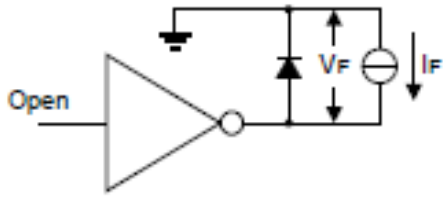



Figure 8 VF Test Circuit

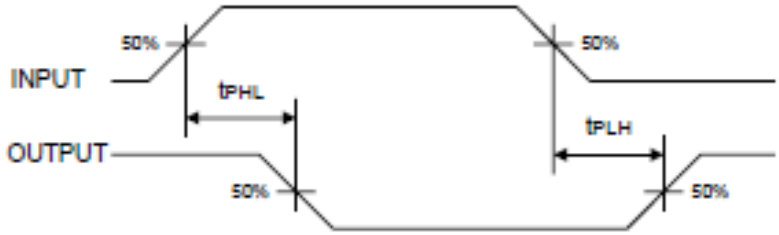
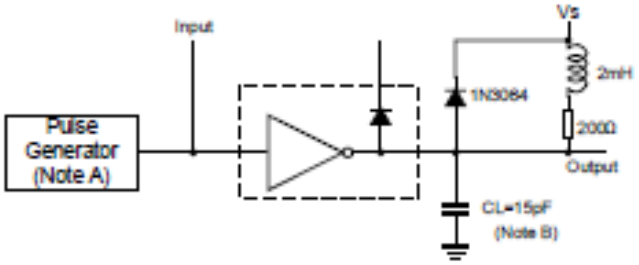
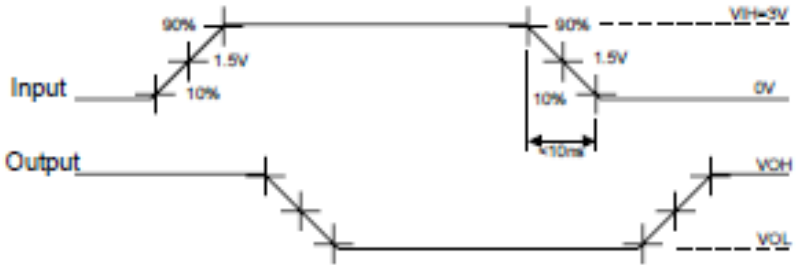



Figure 9. Propagation Delay Time Waveforms



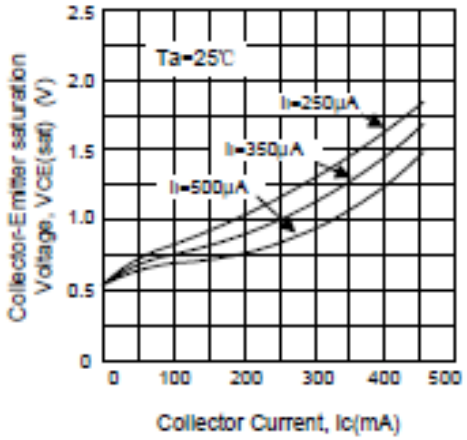

Note: A. The Pulse generatoe has the following characteristics: PRR=12.5kHz, Zo=50Ω

B. CL includes proble and jig capacitance.

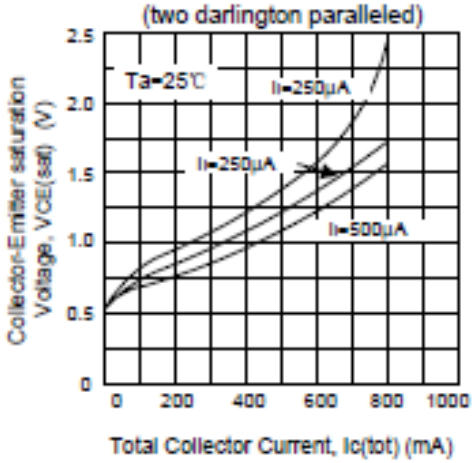
Figure 10. Latch-up Test Circuit and Voltage Waveforms

## TYPICAL PERFORMANCE CHARACTERISTICS

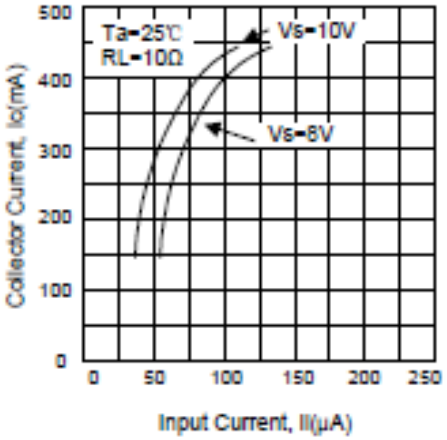
Collector-Emitter saturation Voltage vs. Collector Current



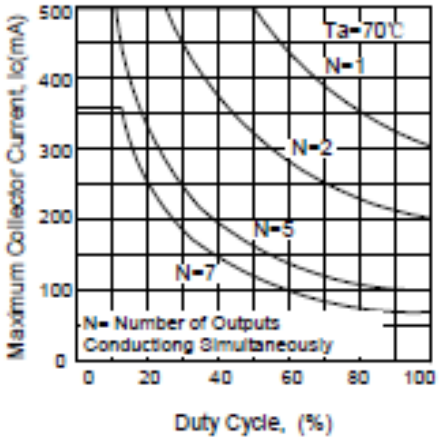

Collector-Emitter saturation Voltage vs. Total Collector Current (two darlington paralleled)



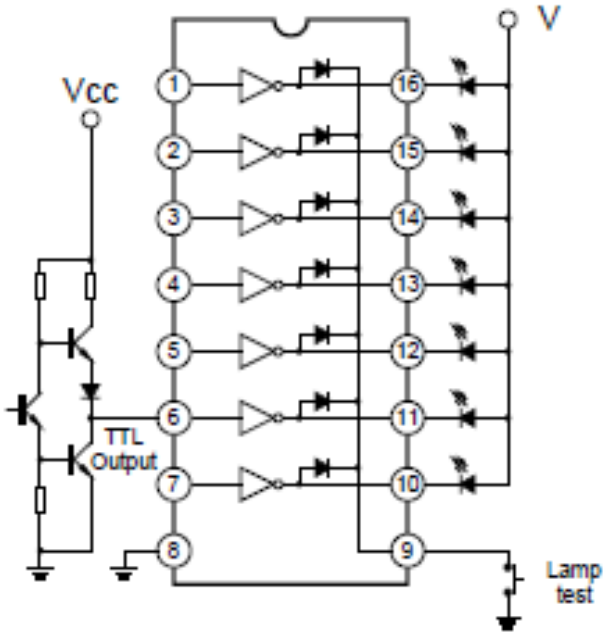

Collector Current Vs. Input Current



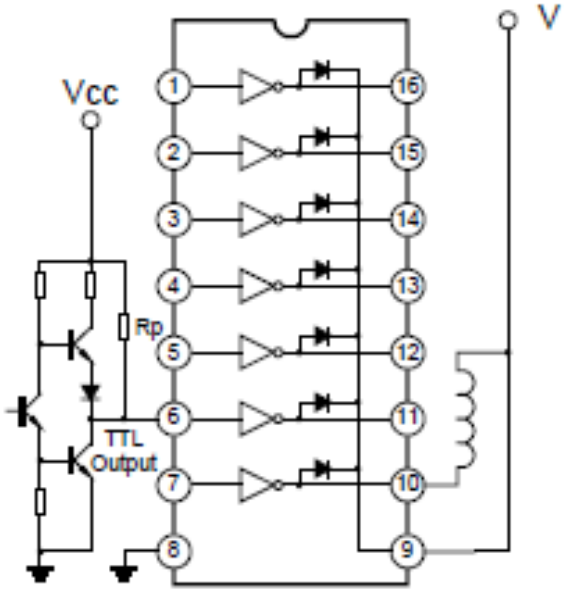

Maximum Collector Current Vs. Duty cycle



**TYPICAL APPLICATION CIRCUIT**




**TTL to Load**




**Use of pullup Resistor to increase drive Current**

# APPENDIX E

## RELAY

# SONGLE RELAY

| 松乐继电器 ® SONGLE RELAY | RELAY ISO9002 | SRD |
|---|---|---|

### 1. MAIN FEATURES

- Switching capacity available by 10A in spite of small size design for highdensity P.C. board mounting technique.
- UL,CUL,TUV recognized.
- Selection of plastic material for high temperature and better chemical solution performance.
- Sealed types available.
- Simple relay magnetic circuit to meet low cost of mass production.

### 2. APPLICATIONS

- Domestic appliance, office machine, audio, equipment, automobile, etc.

  ( Remote control TV receiver, monitor display, audio equipment high rushing current use application.)

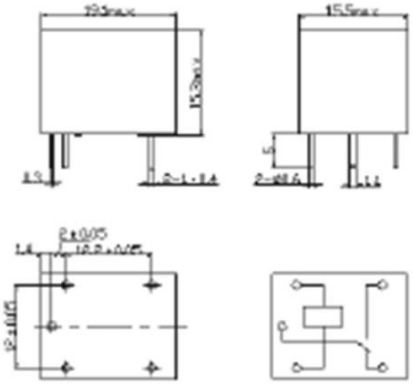
### 3. ORDERING INFORMATION

| SRD | XX VDC | S | L | C |
|---|---|---|---|---|
| Model of relay | Nominal coil voltage | Structure | Coil sensitivity | Contact form |
| SRD | 03、05、06、09、12、24、48VDC | S:Sealed type | L:0.36W | A:1 form A |
| | | | | B:1 form B |
| | | F:Flux free type | D:0.45W | C:1 form C |

### 4. RATING

| | | |
|---|---|---|
| CCC | FILE NUMBER:CH0052885-2000 | 7A/240VDC |
| CCC | FILE NUMBER:CH0036746-99 | 10A/250VDC |
| UL /CUL | FILE NUMBER: E167996 | 10A/125VAC 28VDC |
| TUV | FILE NUMBER: R9933789 | 10A/240VAC 28VDC |

### 5. DIMENSION(unit:mm) DRILLING(unit:mm) WIRING DIAGRAM



## 6. COIL DATA CHART (AT20°C)

| Coil Sensitivity | Coil Voltage Code | Nominal Voltage (VDC) | Nominal Current (mA) | Coil Resistance (Ω) ±10% | Power Consumption (W) | Pull-In Voltage (VDC) | Drop-Out Voltage (VDC) | Max-Allowable Voltage (VDC) |
|---|---|---|---|---|---|---|---|---|
| SRD (High Sensitivity) | 03 | 03 | 120 | 25 | abt. 0.36W | 75%Max. | 10% Min. | 120% |
| | 05 | 05 | 71.4 | 70 | | | | |
| | 06 | 06 | 60 | 100 | | | | |
| | 09 | 09 | 40 | 225 | | | | |
| | 12 | 12 | 30 | 400 | | | | |
| | 24 | 24 | 15 | 1600 | | | | |
| | 48 | 48 | 7.5 | 6400 | | | | |
| SRD (Standard) | 03 | 03 | 150 | 20 | abt. 0.45W | 75% Max. | 10% Min. | 110% |
| | 05 | 05 | 89.3 | 55 | | | | |
| | 06 | 06 | 75 | 80 | | | | |
| | 09 | 09 | 50 | 180 | | | | |
| | 12 | 12 | 37.5 | 320 | | | | |
| | 24 | 24 | 18.7 | 1280 | | | | |
| | 48 | 48 | 10 | 4500 | abt. 0.51W | | | |

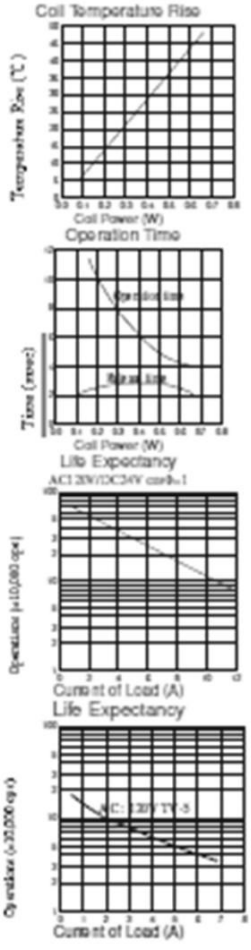
## 7. CONTACT RATING

| Item \ Type | SRD FORM C | SRD FORM A |
|---|---|---|
| Contact Capacity Resistive Load (cosΦ=1) | 7A 28VDC<br>10A 125VAC<br>7A 240VAC | 10A 28VDC<br>10A 240VAC |
| Inductive Load (cosΦ=0.4 L/R=7msec) | 3A 120VAC<br>3A 28VDC | 5A 120VAC<br>5A 28VDC |
| Max. Allowable Voltage | 250VAC/110VDC | 250VAC/110VDC |
| Max. Allowable Power Force | 800VAC/240W | 1200VA/300W |
| Contact Material | AgCdO | AgCdO |

## 8. PERFORMANCE (at initial value)

| Item \ Type | SRD |
|---|---|
| Contact Resistance | 100mΩ Max. |
| Operation Time | 10msec Max. |
| Release Time | 5msec Max. |
| Dielectric Strength<br>Between coil & contact<br>Between contacts | <br>1500VAC 50/60HZ (1 minute)<br>1000VAC 50/60HZ (1 minute) |
| Insulation Resistance | 100 MΩ Min. (500VDC) |
| Max. ON/OFF Switching<br>Mechanically<br>Electrically | <br>300 operation/min<br>30 operation/min |
| Ambient Temperature | -25°C to +70°C |
| Operating Humidity | 45 to 85% RH |
| Vibration<br>Endurance<br>Error Operation | <br>10 to 55Hz Double Amplitude 1.5mm<br>10 to 55Hz Double Amplitude 1.5mm |
| Shock<br>Endurance<br>Error Operation | <br>100G Min.<br>10G Min. |
| Life Expectancy<br>Mechanically<br>Electrically | <br>$10^7$ operations. Min. (no load)<br>$10^5$ operations. Min. (at rated coil voltage) |
| Weight | abt. 10grs. |

## 9.REFERENCE DATA



# APPENDIX F

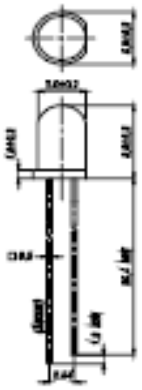
## LIGHT EMITTING DIODE ( LED )

EVERLIGHT

Technical Data Sheet
5.0mm Round Type LED Lamps

333-2SDRT/S530-A3

Package Dimensions



Notes: 1. All dimensions are in millimetres
2. The height of flange must be less than 1.5mm(0.059").
3. Without special declared,the tolerance is±0.25mm.

■ Absolute Maximum Ratings at Ta = 25℃

| Parameter | Symbol | Rating | Unit |
|---|---|---|---|
| Forward Current | IF | 25 | mA |
| Operating Temperature | Topr | -40 to +85 | ℃ |
| Storage Temperature | Tstg | -40 to +100 | ℃ |
| Electrostatic Discharge | ESD | 2000 | V |
| Soldering Temperature | Tsol | 260 ± 5 | ℃ |
| Power Dissipation | Pd | 60 | mW |
| Reverse Voltage | VR | 5 | V |

Note: *1:Soldering time ≦ 5 seconds.

EVERLIGHT

Technical Data Sheet
5.0mm Round Type LED Lamps

333-2SDRT/S530-A3

Electro-Optical Characteristics (Ta=25℃)

| Parameter | Symbol | Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Forward Voltage | VF | $I_F$= 20 mA | / | 2.0 | 2.4 | V |
| Reverse Current | IR | $V_R$= 5 V | / | / | 10 | μA |
| Luminous Intensity | Iv | $I_F$= 20 mA | 500 | 1250 | / | mcd |
| Viewing Angle | 2θ1/2 | $I_F$= 20 mA | / | 10 | / | deg |
| Peak Wavelength | λp | $I_F$= 20 mA | / | 632 | / | nm |
| Dominant Wavelength | λd | $I_F$= 20 mA | / | 624 | / | nm |
| Spectrum Radiation Bandwidth | Δλ | $I_F$= 20 mA | / | 20 | / | nm |

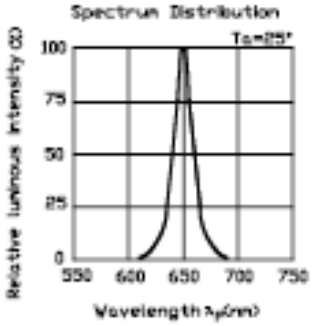
EVERLIGHT

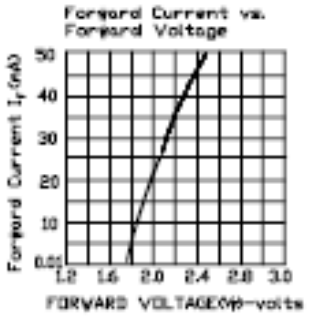
Technical Data Sheet
5.0mm Round Type LED Lamps

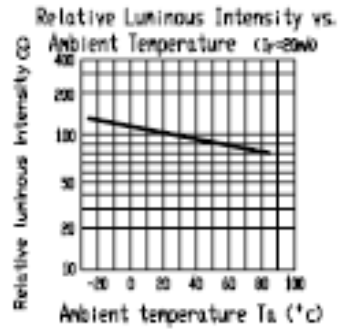
333-2SDRT/S530-A3

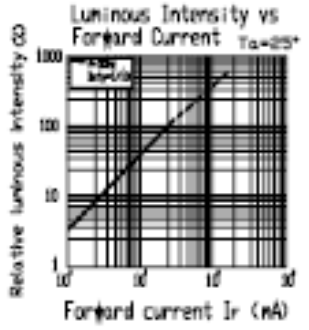
■ Typical Electro-Optical Characteristic Curves:

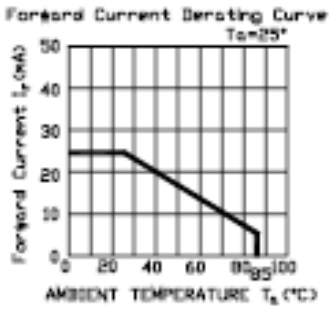
(SDR)

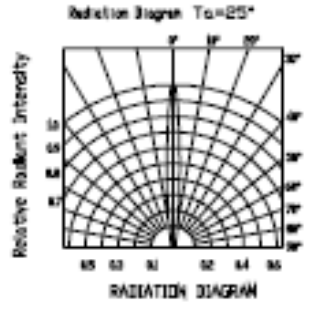


EVERLIGHT

Technical Data Sheet

5.0mm Round Type LED Lamps

333-2SDRT/S530-A3

## ■ Reliability test items and conditions:

The reliability of products shall be satisfied with items listed below.

Confidence level：97%

LTPD：3%

| NO | Item | Test Conditions | Test Hours/Cycle | Sample Size | Failure Judgment Criteria | Ac/Re |
|---|---|---|---|---|---|---|
| 1 | Solder Heat | TEMP : 260℃ ± 5 ℃ | 10 SEC | 76 PCS | Iv≦Ivt*0.5 or Vf≧U or Vf≦L | 0/1 |
| 2 | Temperature Cycle | H : +100℃ 15min ∫ 5 min L : -40℃ 15min | 300 CYCLES | 76 PCS | | 0/1 |
| 3 | Thermal Shock | H : +100℃ 5min ∫ 10 sec L : -10℃ 5min | 300 CYCLES | 76 PCS | | 0/1 |
| 4 | High Temperature Storage | TEMP : 100℃ | 1000 HRS | 76 PCS | | 0/1 |
| 5 | Low Temperature Storage | TEMP : -40℃ | 1000 HRS | 76 PCS | | 0/1 |
| 6 | DC Operating Life | TEMP : 25℃ IF = 20mA | 1000 HRS | 76 PCS | | 0/1 |
| 7 | High Temperature / High Humidity | 85℃ / 85% RH | 1000 HRS | 76 PCS | | 0/1 |

Note：Ivt：To test Iv value of the chip before the reliablility test

Iv：The test value of the chip that has completed the reliablility test

U：Upper Specification Limit

L：Lower Specification Limit

EVERLIGHT

Technical Data Sheet

5.0mm Round Type LED Lamps

333-2SDRT/S530-A3

Packing Quantity Specification

1. 500PCS/1 Bag * 5Bags/1 Box

2. 10Boxes/1Carton

Label Form Specification


CPN: Customer's Production Number

P/N : Production Number

QTY: Packing Quantity

CAT: Ranks

HUE: Dominant Wavelength

REF: Reference

LOT No: Lot Number

Notes

1. Above specification may be changed without notice. EVERLIGHT will reserve authority on material change for above specification.

2. When using this product, please observe the absolute maximum ratings and the instructions for using outlined in these specification sheets. EVERLIGHT assumes no responsibility for any damage resulting from use of the product which does not comply with the absolute maximum ratings and the instructions included in these specification sheets.

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