

**APPLICATION OF LEAST-SQUARES METHOD TO FORECAST THE
RELIABILITY PROBLEM BASED ON THE WELL AND REJECTED
ITEMS PRODUCED**

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Tajuk Projek : APPLICATION OF LEAST-SQUARES METHOD TO FORECAST
THE RELIABILITY PROBLEM BASED ON THE WELL AND
REJECTED ITEMS PRODUCED

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Thank you to my lovely parents that were gives me a support until I had successfully completed this PSM report.

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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

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ABSTRAC

This research is concerned to develop a software that can be used to solve the reliability problem. A reliability is concerned with random accuracies of undesirable events, or failures during the life of a physical system. In order to fulfill the objective of this research, we have used the Least-squared method and Matlab software as a tool to solve the problem. The data that we have collected from semiconductor company shown that they produce diode in range 1000000 to 1500000 units per day. Based on our observations, we found that about 0.2551 % units are rejected. Based on our developed software we can forecast or estimate the number of unreject and reject items.

ABSTRAK

Kajian ini adalah bertujuan untuk menghasilkan perisian yang digunakan untuk menyelesaikan masalah reliabiliti. Reliabiliti adalah berkaitan dengan ketepatan perkara yang tidak dijangka secara rawak atau kegagalan semasa penghasilan produk. Bagi memenuhi objektif kajian ini, Least-squared method dan pengaturcaraan computer, Matlab digunakan untuk menyelesaikan masalah. Maklumat yang diperolehi dari syarikat semiconductor menunjukkan diod dihasilkan sebanyak 1000000 hingga 1500000 unit sehari. Melalui kajian, didapati sebanyak 0.2551% produk rosak. Melalui perisian yang dihasilkan, kami dapat mengjangkakan produk yang boleh digunakan serta product yang rosak.

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CHAPTER 1

INTRODUCTION

1.1 PROJECT OVERVIEW

Application of Least-Squares method to forecast the reliability problem based on the well and rejected items produced is one of the projects that will develop a mathematical model of the data from reliability problem electronics product or devices. This model will be use to predict the reliability problem of data.

This project will develop software by using the Matlab Programming. From the statistics of the data that has been collected, it will produce the graph. From the graph, it could find the mathematical model. This software will be useful to make easier the synthesis process and will give many advantages in the future.

The aspect that will cover in this project is including of the study the literature review, data collection and analysis, mathematical modeling, Matlab software programming and implement result. This project will apply the least square method and Regression Analysis.

1.2 OBJECTIVES OF THE PROJECT

In this project, there are an objective to be achieved. The objectives of this project are listed as follows:

- a) This project is to apply the Least-Square Method to the data that has been collected from the factory.
- b) This project is to forecast the reliability problem in electronics devices.

1.3 PROBLEMS STATEMENT

Nowadays, the calculation is very important to us especially for the factory that needed to calculate their reliability data. While doing the calculation, many error will occurred or possible happen, therefore in this project, we want to solve the problems by develop a new software by using the Matlab software programming. This software will be use to predict the reliability problem of data in the future. This new software will give the advantages to the company especially for the factory while doing the forecasting. This project will help the costumer to know whether the devices or product is in good quality or not.

1.4 SCOPE OF WORK

This project will focus the reliability problem in electronics devices. It will develop mathematical model from the data. From the statistic of data that had been collected from the factory, students need to analyze the data to fit the best curve on the data. Furthermore, scope of this project is to minimize the procedure error. In this project, Matlab software programming is used to analysis, to solve and to simulate the mathematical model. In this project, we modeled the data in such way we could find the linear model. In order to solve the model, we used the Least Square Method and apply the Regression Analysis.

1.5 METHODOLOGY

There have a right procedure to make sure that this project is successful and the objective is achieved. The methodology that include in this project is:

a) Synopsis of the project

For this project, firstly need to understand and study the synopsis, objective and scope of the project based on the research from internet and the reference books.

b) Data collection

Then, data was collected from the factory. Data of the device is collected daily for 30 day. From the amount, we can determine the probability. Then, from the result, reliability was calculated.

c) Analysis

The data collection will analyze and it will be represented in the graph form. From the graph, we can determine the mean, variation and standard distribution point. Besides that, the Least Square Method is use to get the mathematical model.

d) Matlab Software Programming

This project will develop by using the Matlab software programming especially Matlab simulation programming. It will apply the Least Square Method and get the mathematical model.

e) Implement result

This project will produce the new software and mathematical model that use to predict the problem data of the device that collected from the factory. Complete report PSM.

1.6 THESIS OUTLINE

There have 5 chapter for this PSM report which have more explanation and easier to understand about this topic.

In this project, chapter 1 is introduction of the project. For the chapter 1 it will focus on the brief of overview regarding project including introduction, objectives of the project that have achieved, problem statement that need to solve, scope of the project and simple methodology.

Chapter 2 is about the explanation of the research and literature review. All of the facts and information which were found from the journals or other references will be compared to choose the most accurate and satisfy methods. The literature review and the software development of the project which uses is Matlab software programming. This chapter is also shown the theory and the concept that use to solve the project problem.

Chapter 3 is a methodology of the research. This chapter is defines and illustrates the steps that need to do in this project. All these methodology should be followed for a greater performance. In this chapter, it will consider the step or method that we use of this project.

Chapter 4 will covered the results and the discussion of the project. The new software that development on the reliability problem will occur and will make a analysis and testing the implements result.

Chapter 5 will include the conclusion of the PSM project and the future recommendations.

CHAPTER 2

LITERATURE REVIEW

2.0 INTRODUCTION

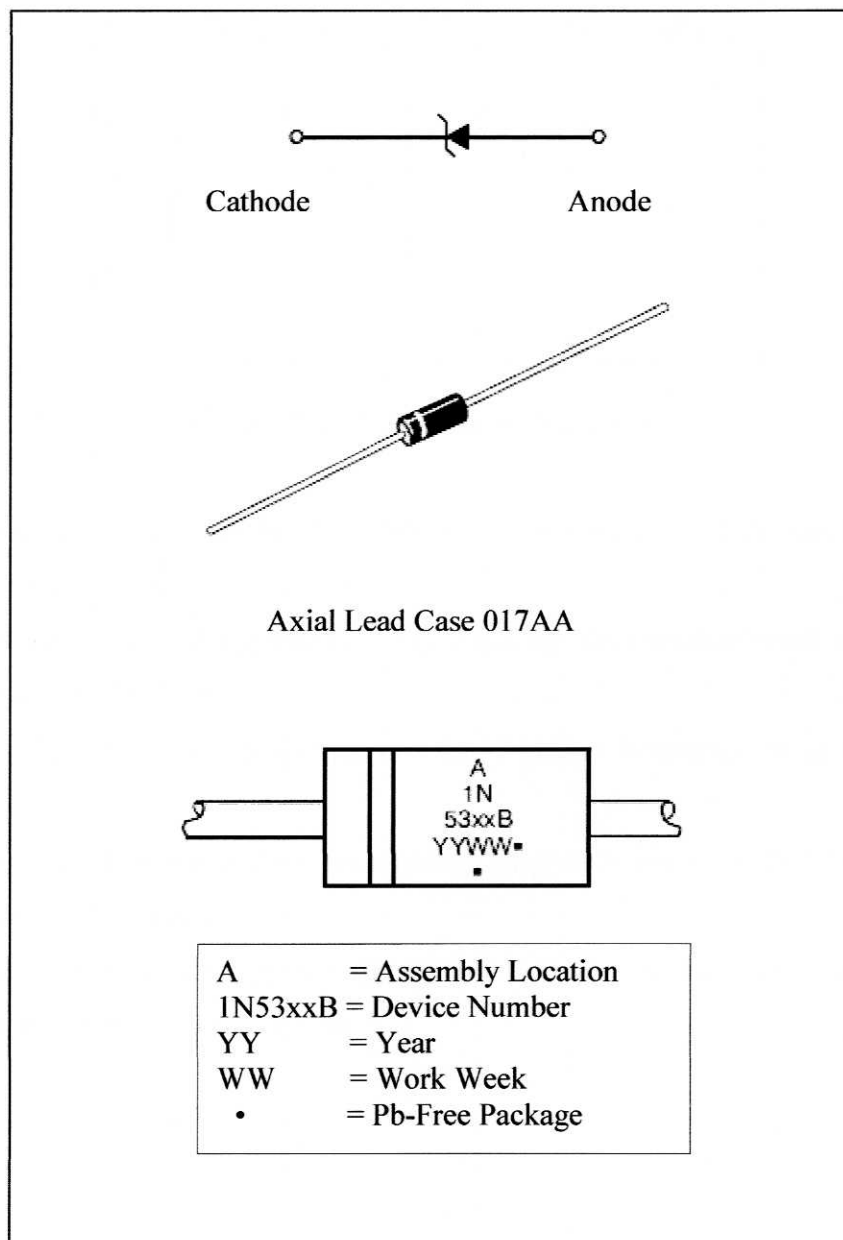
For this project of Software development on reliability problem, zener diode is the product that was analytical. Type of zener diode that was analyzed is 1N5333B. Zener diode is a type of diode that permits current to flow in the forward direction like a normal diode, but also in the reverse direction if the voltage is larger than the breakdown voltage known as "Zener voltage".

Zener diode (1N5333B)

This is a complete series of 5 Watt Zener Diodes with tight limits and better operating characteristics that reflect the superior capabilities of silicon-oxide-passivated junctions. All this is in an axial-lead, transfer-molded plastic package that offers protection in all common environmental conditions 1N5333B Series Datasheet.

Features:

- Zener Voltage Range - 3.3 V to 200 V
- ESD Rating of Class 3 (>16 kV) per Human Body Model
- Surge Rating of up to 180 W @ 8.3 ms
- Maximum Limits Guaranteed on up to Six Electrical Parameters

**Figure 2.1: 1N5333B Series**

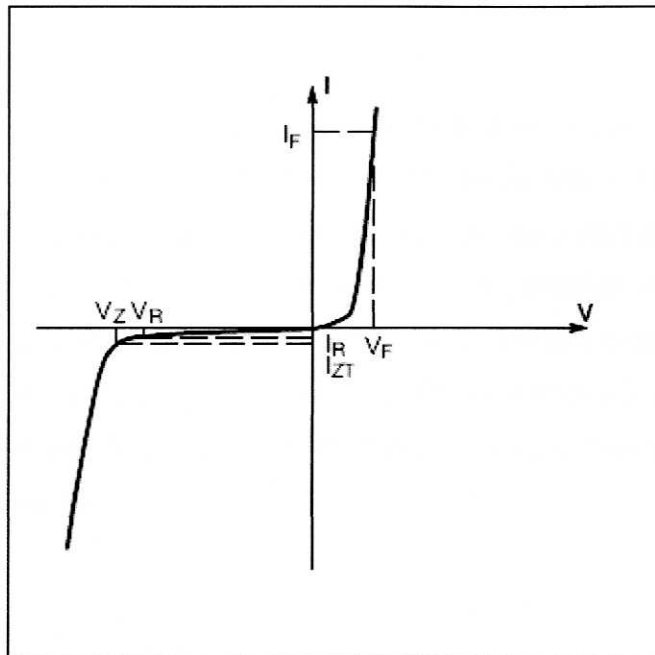


Figure 2.2: Zener Voltage Regulator

From the interview, it notices that there have factors caused the product was rejected.

Some of the reasons are:

- Voltage range of the product was not achieved. This product needs a voltage range 3.3V to 200V.
- Temperature of the diode was not qualified that is average range 65°C to 200°C.
- Maximum lead temperature for soldering purpose is over than 260°C from the case for 10 seconds
- Characteristic of the operation for the product was not achieved for example forward voltages not 1.2V max.

2.1 STATISTICS

A statistic is the result of applying a function to a set of data. More formally, statistical theory defines a statistic as a function of a sample where the function itself is independent of the sample's distribution. Statistics is also a mathematical science pertaining to the collection, analysis, interpretation or explanation, and presentation of data. Statistical methods can be used to summarize or describe a collection of data, this is called descriptive statistics. Function of descriptive statistics is used to describe the basic features of the data in a study. They provide simple summaries about the sample and the measures.

2.2 PROBABILITY

Probability is a number between 0-1 that states the proportion of times we expect a certain thing to happen, such as the proportion of product that pass a test. A probability measure $P [A]$ is a function that assigns a number between 0 and 1 to every event A in a sample space. The assigned probabilities conform to the three axioms presented. Sample space, event and outcome is a probability terms for the set theory concepts of universal set and element David & Roy, (2005).

Average is value of a collection of numerical observation is a statistic of the collection, a single number that describes entire collection. The one that used the most are the mean, median, mode, variance and standard deviation.

- **Mean**

Mean is the value of a set number is perhaps the most familiar. Mean value will get by adding up all the number in the collection and dividing by the number of them in the sum David & Roy, (2005). The mean is often along with the standard deviation. The mean describes the central location of the data, and the standard deviation describes the spread.

- **Median and Mode**

In probability theory and statistics, a median is described as the number separating the higher half of a sample, a population, or a probability distribution, from the lower half. The median of a finite list of numbers can be found by arranging all the observations from lowest value to highest value and picking the middle one David & Roy, (2005). Median is the number of the middle of the set of number. In statistics, the mode is the value that occurs the most frequently in a data set or a probability distribution. Mode is common number in collection of observations.

- **Variance**

In probability theory and statistics, the variance of a random variable, probability distribution, or sample is one measure of statistical dispersion, averaging the squared distance of its possible values from the expected value (mean).

- **Standard Deviation**

In probability and statistics, the standard deviation of a probability distribution, random variable, or population or multiset of values is a measure of the spread of its values. The standard deviation is usually denoted with the letter σ . It is defined as the square root of the variance means the addition of all the values subtracted by the mean, over the amount of values (n).

2.3 QUALITY AND RELIABILITY

In semiconductor marketplace, two important elements for the success of a company are its quality and reliability systems. Both of them are interrelated. Reliability being the quality extended over the expected life of the product. For any manufacturer, all the products must meet or exceed the basic quality and reliability standards.

Quality may be defined as reduction of variability around a target so that conformance to customer requirements and expectations can be achieved in a cost effective way Quality and Reliability Handbook, (2005). Besides that, quality is the probability that a device for example equipment and parts will have performance characteristics within specified limits.

Reliability is defined as quality in time and environment such as temperature, voltage and etc. Besides that, the reliability is also the probability that a semiconductor device, which initially has satisfactory performance and will continue to perform its intended function for a given time under actual usage environments Quality and Reliability Handbook, (2005).