CHAPTER 1

INTRODUCTION

1.1 Background

The company is a subcontractor for Integrated Circuits (ICs) assembly and testing. The circuit chips are fabricated and sent from customers to the company for assembly into ICs packages. There are 2 major types of ICs packages classified by material used, i.e., ceramic and plastic (mould). Most of the orders from customers are plastic packages. Therefore, plastic packages are major products of the company. Plastic packages are split into many types by package dimensions. Different package dimensions are called in different names. For example, Plastic Dual Inline Package (PDIP), Small Outline Integrated Circuit (SOIC), Plastic Lead less Chip Carriers (PLCC), Shrunk Small Outline Package (SSOP), Thin Small Outline Package (TSOP), etc. The following figures are examples of plastic packages. (See Figure 1.1)

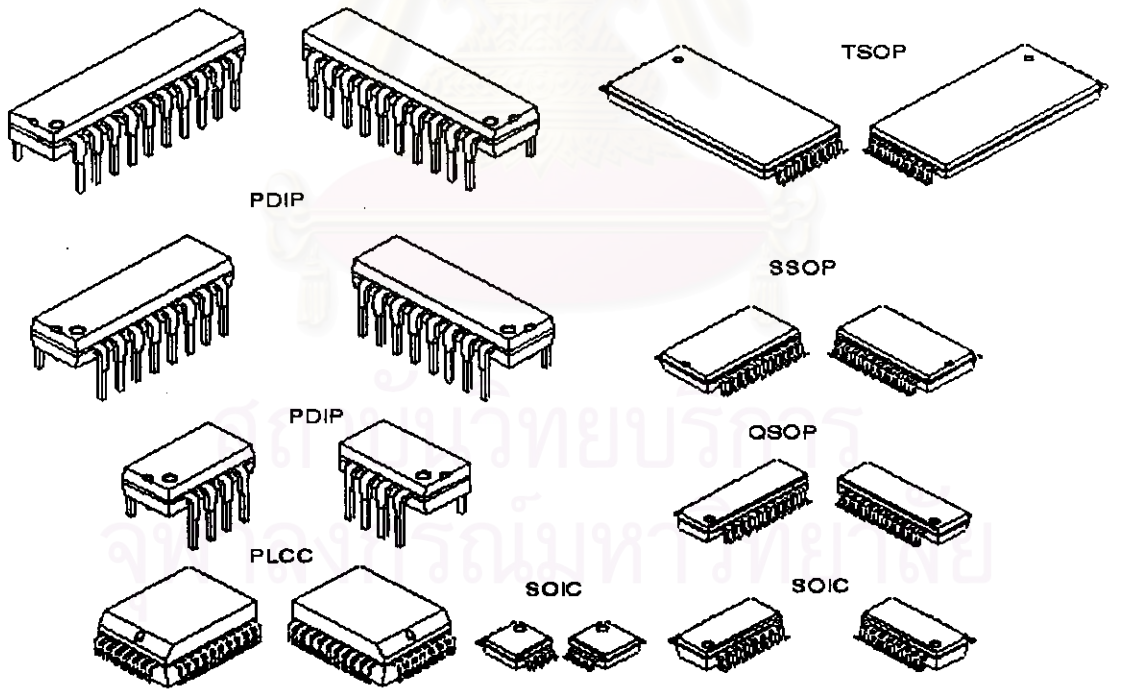


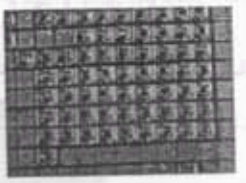
Figure 1.1: Examples of plastic packages.

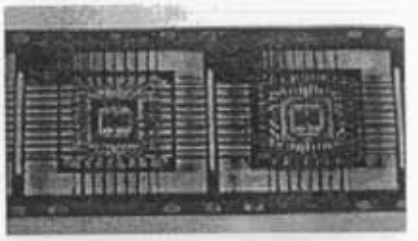
Although package dimensions are different, the production process is quite similar and can use the same machines in the production line. Therefore, the company uses same machine types to produce the plastic packages.

The company has both overseas and domestic customers but the major ones are overseas customers. All customers directly order to the company while sending their circuit chips to the company. Operations will be started after the company has received the order and circuit chips from the customer. The circuit chips usually are sent in the form of wafer (thin plate of silicon, which is doped to be circuits by semiconductor processes).

The following is integrated circuit assembly flow chart. It starts from receiving circuit chips from customer in the form of wafer. All wafers are inspected by Incoming Quality Control (IQC) before releasing to the production line.

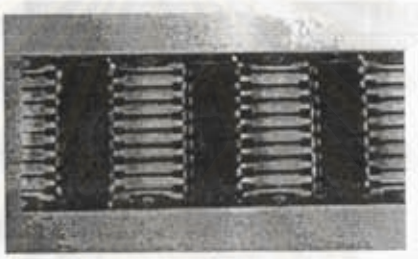
Process steps		Process description
Start process		
	Wafer mount	Mount wafer on a tape to hold all chips after sawn.
FOL	Wafer saw	Wafer is sawn by a diamond blade to be chip.





Die attach — Chip is attached on copper lead frame by using Epoxy (Glue)

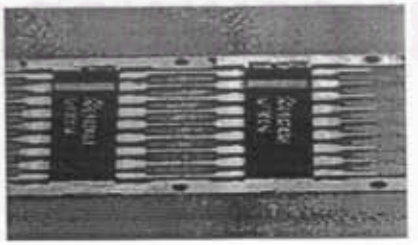
Wire bond — Connection circuits to outside by gold wire.



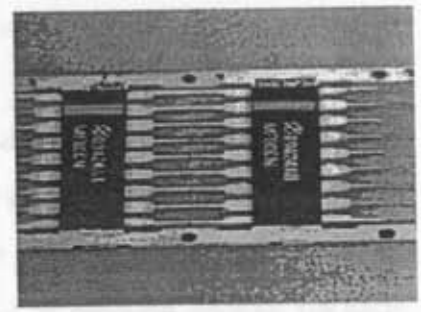
Moulding — Encapsulation of the chip and protection from mechanical and chemical hazard.

De-junk — Remove the thin flash of moulding compound that flows onto the lead fingers.

Honing — Water de-flash use a high-pressure water jet to blast the moulding compound off the leads.



EOL — Marking — Locate where legible information is put on top surface of package such as Date of manufacturing, etc.



Plating

Plating material is used to coat on the leads to facilitate high attachment to the Print Circuit Board (PCB).

Trim and Form

The leads are trimmed to a specific length and formed to a required form.

Packing

Packing IC and send to customers.

End process

Note: 1. Integrated circuits assembly is grouped into 2 groups; Front Of Line (FOL) and End Of Line (EOL). FOL starts from Wafer mount to Wire bond. EOL starts from Moulding to Packing.

2. This is a brief description of process that does not include inspection points.

1.2 Statement of the problems

1) Machine utilisation and machine down time recording

Although the company uses the same machine type to assemble ICs, the machines have been set at different conditions for different package types. Whenever, the machine is switched to produce another package, it will be set up for a new package. Time that technician spends for setting up machine is non-productive. At this moment, this time is approximately recorded in down time card by technician. In addition, when the machine stops because of errors, technician will repair it and also record the repair time in down time card. The time of repair is also non-productive. In down time card, the characteristic of error has been recorded with time of adjustment or repair. However, it is recorded manually by technicians. They usually estimate the taken time and record into the card. Therefore, the machine down time is not the actual non-production time. The company wants to increase machine utilisation by reducing non-production time. Therefore, the exact non-production time is an important information.

2) Traceability problem

Sometimes the machine stops because of small problems. Technician spends a short time to repair or correct it and then continue machine running. If he thinks that it is not important, he will not record the error and down time into down time card. However, it is possible to have defect on the product because of such problem. The defective product may be delivered to customers or create problems at the next operation. In this case we can not go back to check the cause of defect because it was not recorded in the card. It makes the company lose traceability system.

3) Machine prediction problem

The repeated error in the same part of the machine is possible to be the problem in the future. The problem will not be serious if we often review the down time card. The error should be detected and corrected before the machine destroys the product. Currently, we always check down time card too late so that machine usually destroys product before we know the problem. It means that we can not know the machine problem until defect is detected. It is not a good detection system. In order to protect the problem, the status of machine should be monitored in real time. Moreover, data of machine errors can help to predict the machine problem by using statistics method.

In order to solve these problems, all machine errors and status of machine should be monitored in real time. Communication equipment can provide real time information. Moreover, all machine error will be recorded in the host. Whenever, the status of machine is known in real time, it is easy to manage it. Most of semiconductor equipment is designed for communication. Machines can be connected to the host computer and transfer data through serial port, RS-232. Communication protocol should follow SECS (SEMI Equipment Communication Standard) standard that established by Semiconductor Equipment and Materials International association (SEMI). The propose is to be a standard for exchange of messages between semiconductor equipment and a host.

The basic of these problem solving is machine error detection. Whenever, machine is interfaced and communicated, all machine error will be detected and recorded. The data of machine error detection will be used as based information for problem traceability and machine problem prediction.

1.3 Objective of the research

To develop a machine error detection system for the machine capability increasing.

1.4 Outcome of the research

The outcome of the research is software to detect the status and equipment error on the ESEC die attach machine model 2007.

1.5 Scopes of the research

1. The project will be conducted in the Die attach operation of the case study company.
2. Die attach machines which are manufactured by ESEC is used. This die attach machine has been designed for machine interface and communications.
3. Machine error data will be used for the system development.

1.6 Expected benefits

The successful of the project will directly benefit the engineering and manufacturing departments. Moreover, machine communications in real time is a new technology in Thai semiconductor manufacturer. Benefits of this project include:

1. Introduce new technology to Integrated Circuit manufacturer in Thailand.
2. Machine status can be monitored in real time.
3. Actual machine utilisation will be known.
4. The data can be used for quality improvement.
5. Machine repair time will be reduced, since real time information is known.

1.7 Research plan and procedure

1. Literature survey.
2. Study on the machine interface and communications.
3. Design the overall system.
4. Machine interface and communications.
5. Test on the machine communications.
6. Design and develop software.
7. Final testing the system and modification.
8. Conclude the result of project.
9. Prepare thesis.

1.8 Schedule of the research