Foundations of Semiconductor Manufacturing

LAB ACTIVITY: MICROCHIP DECAPSULATION AND INSPECTION

Name	Class/Period	Date

1. Overview

In this lab activity, you will observe the internal structures of different integrated circuits. You will safely decapsulate (peel) the outer packaging of various microchips and examine their microscopic features, such as bond wires and the silicon die, using a high-magnification digital microscope.

2. Performance Objectives

After completing this lab activity, you will be able to:

- Identify the main internal components of a microchip, including the die, bond wires, and lead frame.
- Safely perform mechanical decapsulation on standard integrated circuits.
- Compare and contrast the internal structural differences between different chip types (e.g., logic versus memory).

3. Required Materials

The following materials are required to complete this lab activity:

- High-magnification digital microscope (capable of up to 2000X magnification) (1 per team)
- Assorted microchips (e.g., standard logic chips and memory chips) (2 different types per team)
- Precision side-cutting pliers (1 per team)
- Anti-static tweezers (1 per team)
- Safety goggles (1 per student)
- Isopropyl alcohol (IPA) wipes (2 per team)
- Cleanroom notepads and pens

4. Preparation Checklist

Before beginning the lab activity, review this checklist and mark off each item as you complete it.

- ☐ All hardware components are available for this lab activity.
- ☐ The digital microscopes are powered on, focused, and ready for observation.
- ☐ Safety goggles are distributed and worn by all participants.
- ☐ You have read through the entirety of this document to familiarize yourself with the requirements.

5. Lab Activity

5.1. Defining Microchip Components

Before beginning the physical extraction, define the following terms related to semiconductor packaging. You may use the Internet to help you.

1. Silicon Die:

   _____
   _____
   _____

2. Bond Wires:

   _____
   _____
   _____

3. Pins:

   _____
   _____
   _____

4. Lead Frame:

   _____
   _____
   _____

5.2. Mechanical Decapsulation

You and your team will now extract the silicon die from its packaging.

Perform the following:

1. Ensure your safety goggles are securely on to protect your eyes from flying debris.
2. Take your first microchip and use the precision side-cutting pliers to carefully nip away the black epoxy resin, starting from the corners.
3. Gently peel back the layers until the shiny silicon die in the center is exposed. **Be careful not to shatter the die itself.**
4. Use the tweezers to remove any loose resin.
5. Gently wipe the exposed die with an IPA wipe to clear away any dust.

5.3. Microscopic Observation

You will now observe the chip under the microscope.

Perform the following:

1. Place the decapsulated microchip under the digital microscope.
2. Start at a lower magnification to locate the silicon die and the bond wires connecting it to the lead frame.
3. Increase the magnification to closely observe the intricate microscopic circuits etched into the silicon.
4. On a notepad, make a rough sketch of the microchip's topography.
5. Repeat the decapsulation and observation process for a different type of microchip. Discuss with your team how the internal geometric patterns differ between the two types.

6. Authentic Skill Assessment

Have your instructor verify that you have met the requirements for the performance objectives and sign below. Keep this lab activity sheet for future reference.

Instructor Signature	Date