



VLSI Testing

積體電路測試

Introduction

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“Testing is a skill.

***While this may come as a surprise
to some people it is a simple fact.”***

(Graham Fewster)

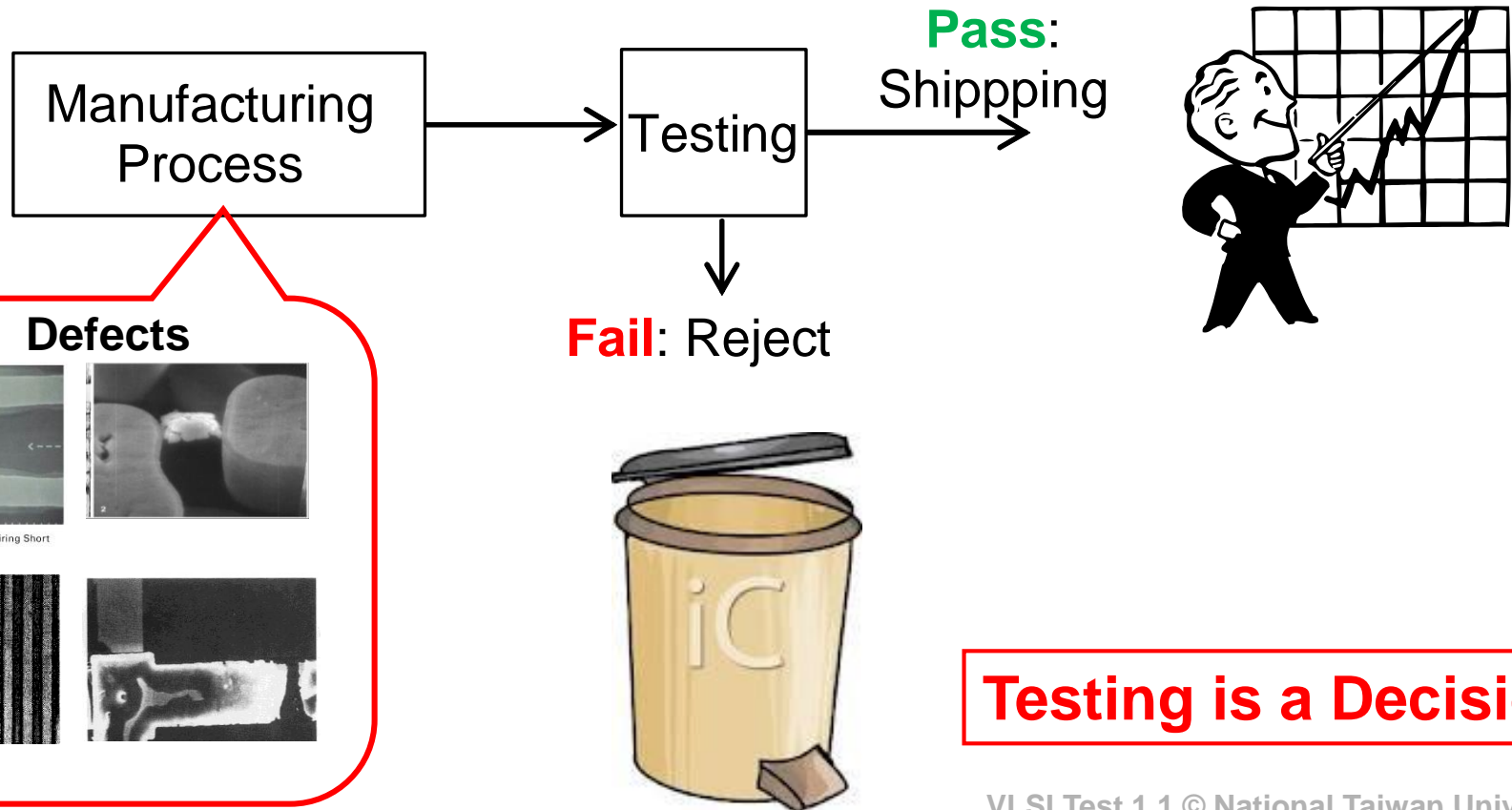
Outline

- **Introduction**
 - ◆ **What is Testing**
 - ◆ **Why is Testing Important**
- **Types of Testing**
- **Test Quality**
- **Test Economics**
- **Important Issues in Testing**
- **Conclusion**



What is Testing?

- **Testing** is process of determining whether a piece of hardware
 - ♦ Functioning correctly (**PASS**) or defective (**FAIL**)
- Why do we need to test Integrated Circuit (IC)?
 - ♦ Because *defects* occur in manufacturing process



Four Possible Outcomes

- True pass and true reject are correct decision
- **Test escapes** = defective chips that pass test
 - ♦ also known as (aka.) **under-testing**
- **Yield loss** = good chips that fail the tests
 - ♦ aka. **overkill, over-testing**
- Goal of good testing: **reduce both test escape and yield loss**
 - ♦ Trade off between test cost and test quality
 - * Quality test **reduces test escape** but **increases yield loss**
 - * Low cost test **reduces yield loss** but **increase test escape**

	Good IC	Defective IC
Pass tests	True PASS	Test Escapes (less is better)
Fail tests	Yield Loss (less is better)	True Reject

Quiz

Q: Which of following is NOT IC testing?

- A: Run SPICE simulation on amplifier design to check if output is correctly amplified**
- B: Apply analog signal to an ADC IC and check if output is correctly digitized**
- C: Apply two numbers to an adder IC and check if output number is correctly added**

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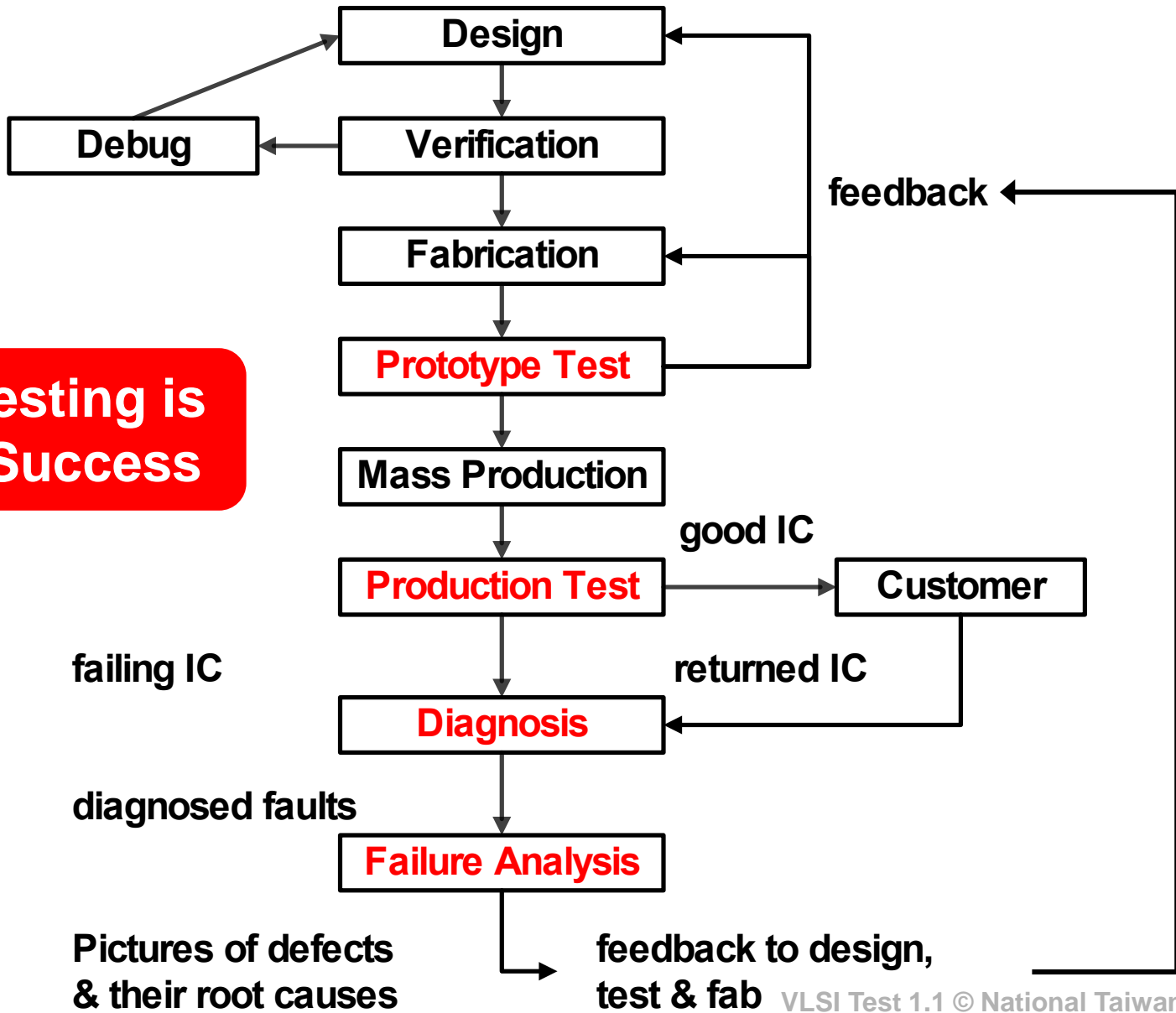
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Why is Testing Important?

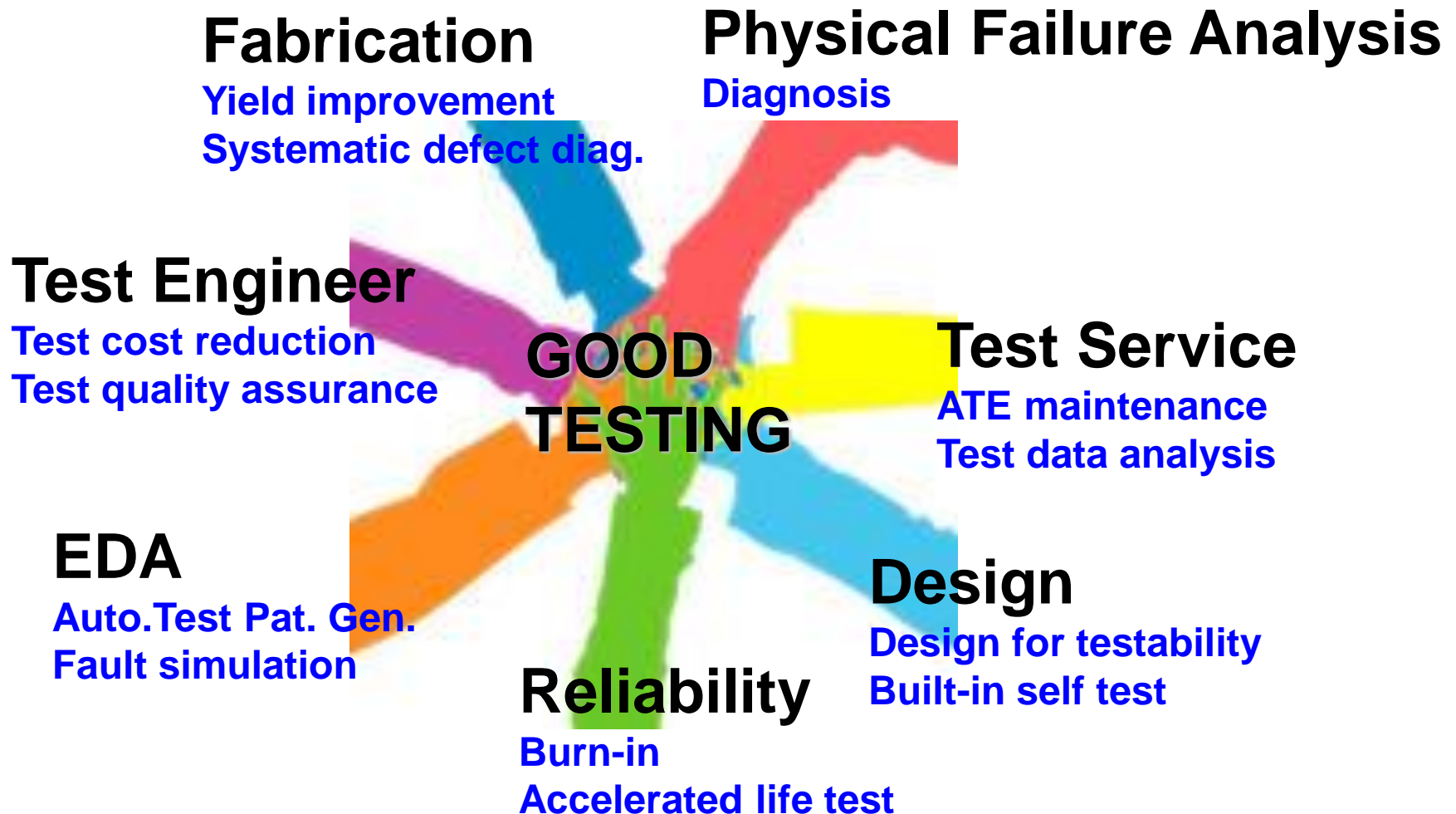
- **1. Guarantee IC quality**
 - ◆ Reduces test escapes
 - ◆ Not only functionally correct but also reliable IC
- **2. Shorten Time to Market**
 - ◆ Prototype testing to debug silicon
 - ◆ Improve efficiency of production test
 - ◆ Diagnose defective IC to improve yield
- **3. Enhance Profit**
 - ◆ Reduce test cost
 - ◆ Fix defective chips if possible (like memory)
 - ◆ Reduce yield loss

Stages of IC Product



**Good Testing is
Key to Success**

Testing is Everyone's Responsibility



Summary

- Testing is decision: whether IC is PASS or FAIL
- Good testing requires low
 - ◆ **Test escapes** = defective chips that pass test
 - ◆ **Yield loss** = good chips that fail the tests
- Test is key to success of IC product
 - ◆ **Guarantee quality**
 - ◆ **Shorten time to market**
 - ◆ **Enhance profit**
- Testing is everybody's responsibility
 - ◆ Designer, manufacturer, test engineer, EDA