



# 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)***

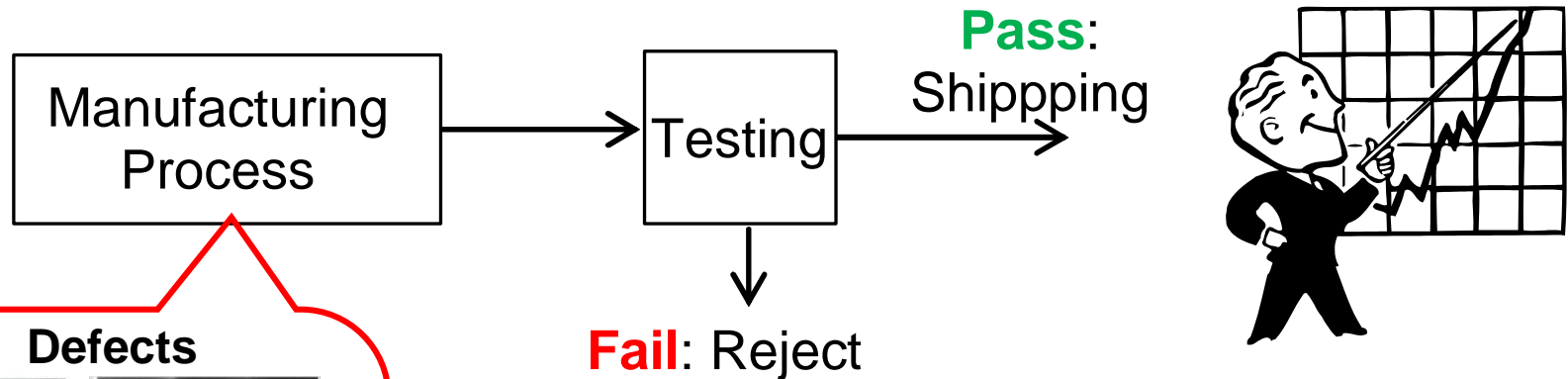
# Outline

- 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



## Defects

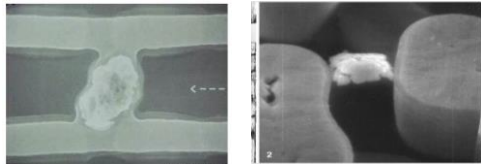
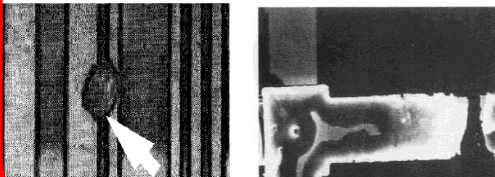


Photo 2-4 Dust-induced Wiring Short



**Testing is a Decision**

# 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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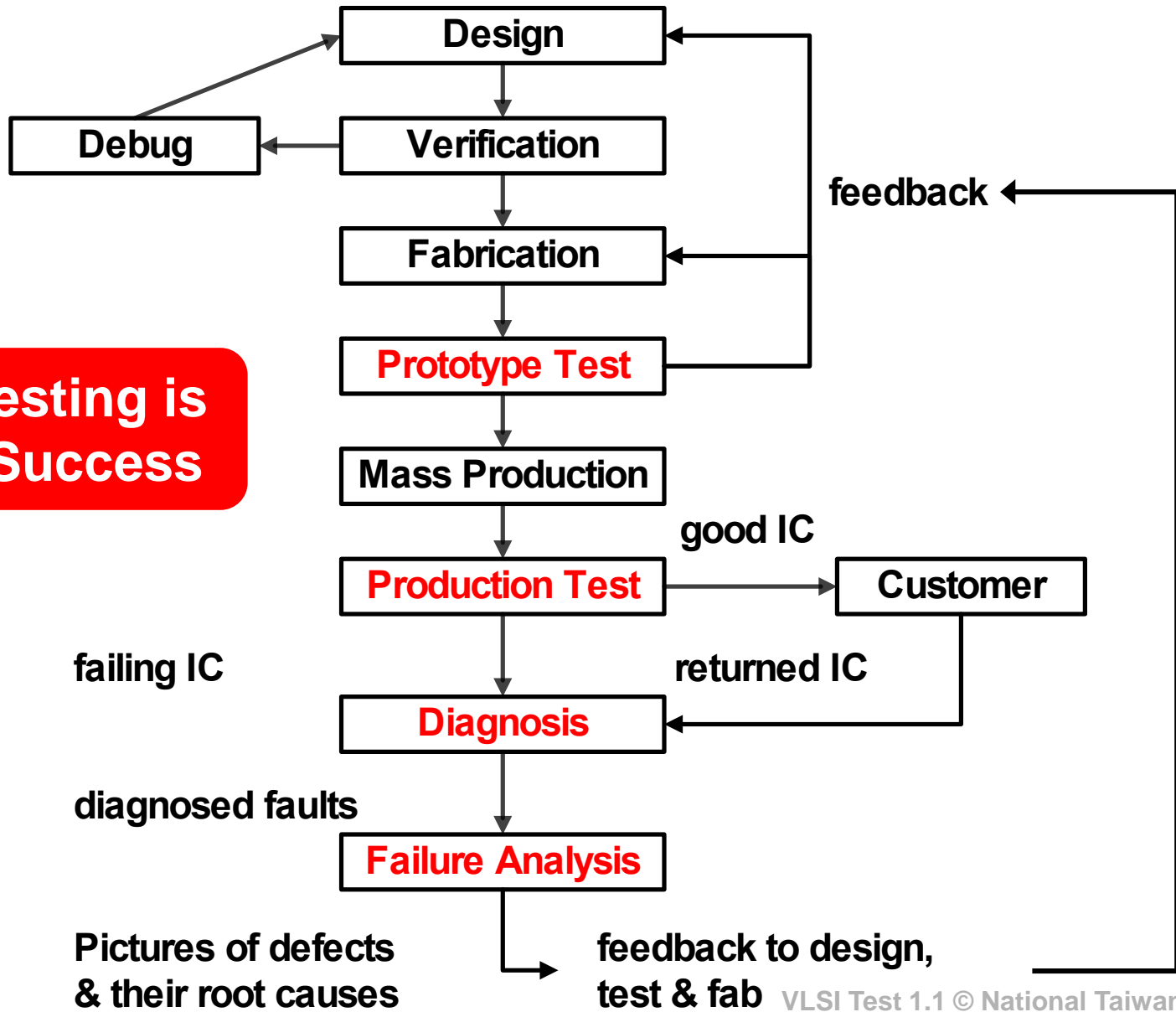


# Why is Testing Important?

- **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

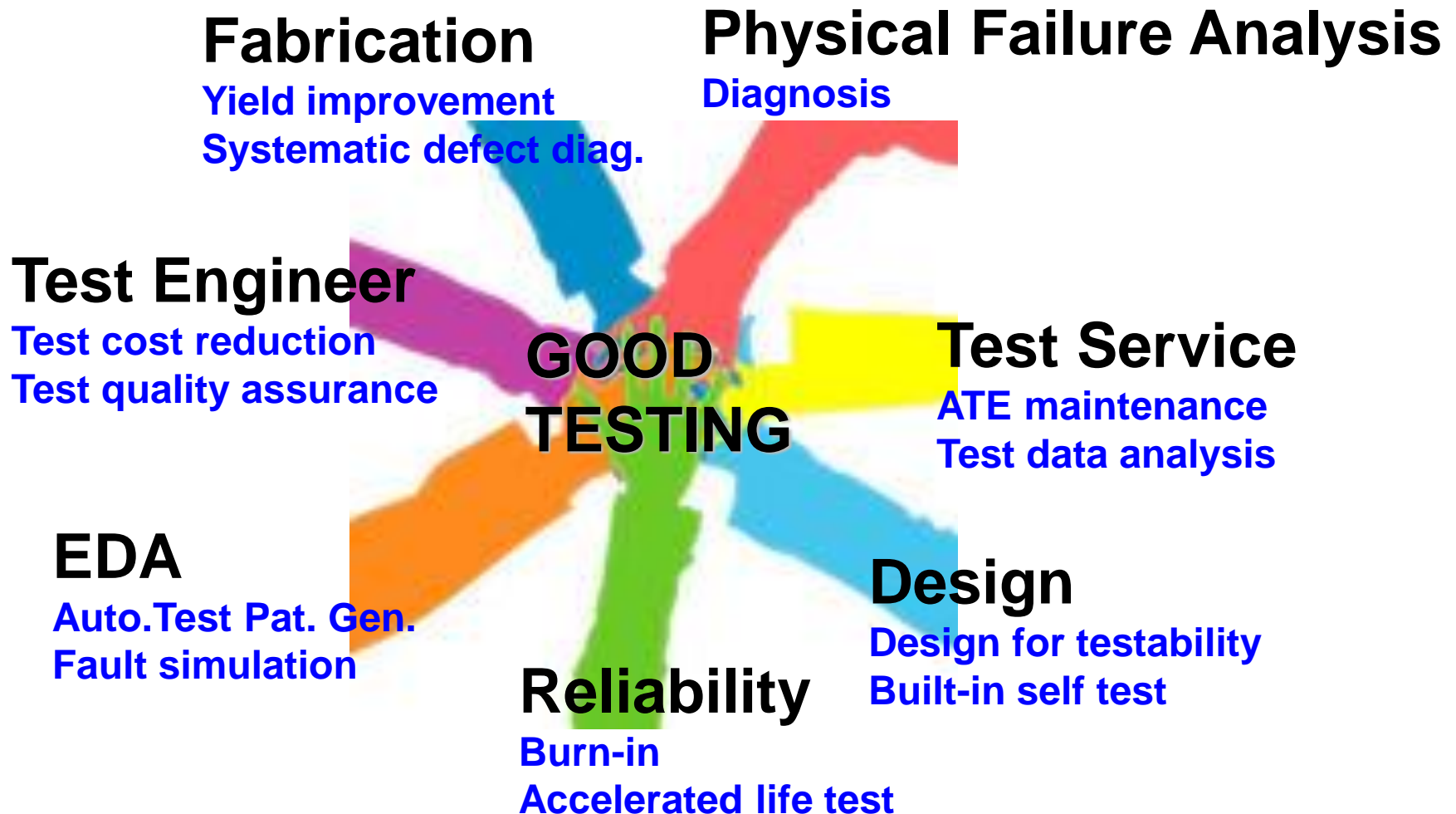


# Stages of IC Product



**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 ....