



# ***Lab 1: Test Pattern Generation***

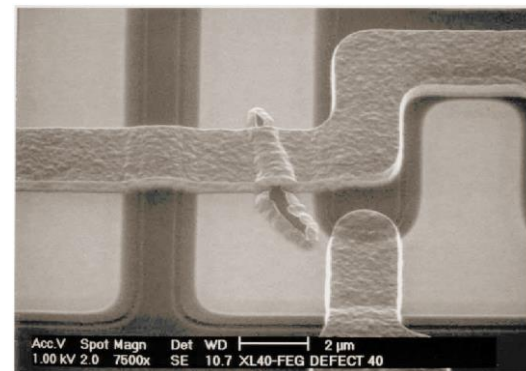
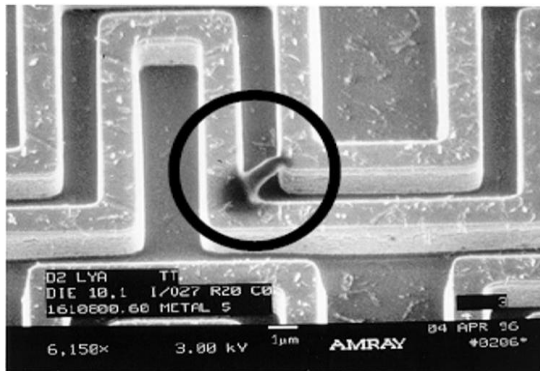
# Stuck-At Faults

## ■ How does a chip fail?

- ◆ Usually failures are **shorts** between two conductors or **opens** in a conductor
- ◆ This can cause very complicated behavior

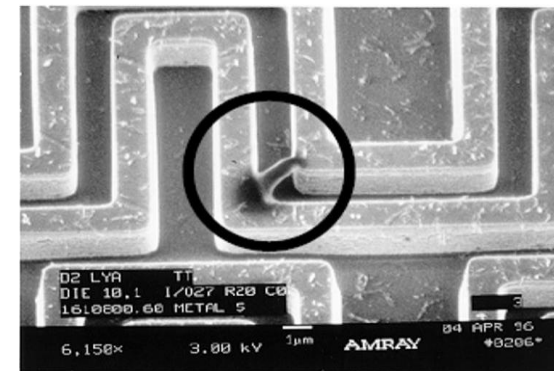
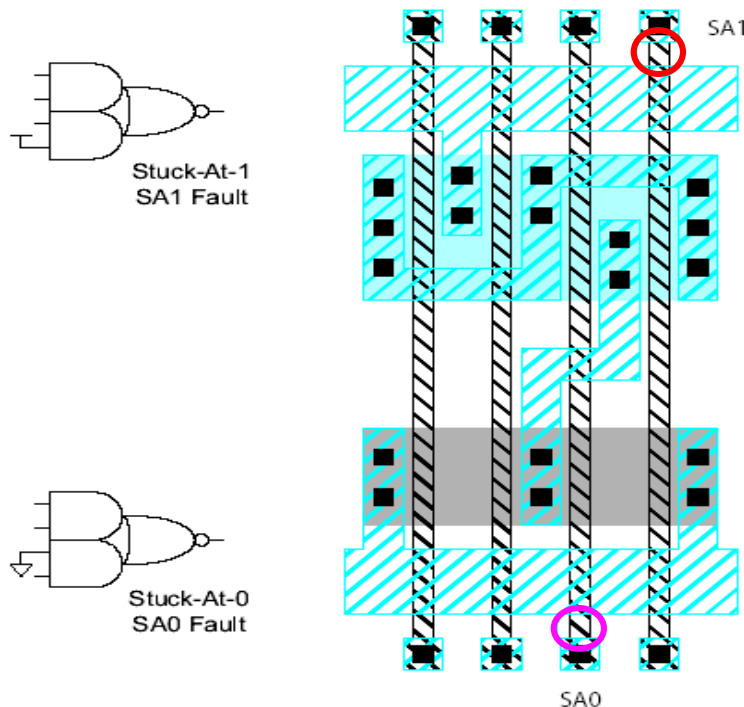
## ■ A simpler model: *Stuck-At*

- ◆ Assume all failures cause nodes to be “stuck-at” 0 or 1, i.e. shorted to GND or  $V_{DD}$
- ◆ Not quite true, but works well in practice



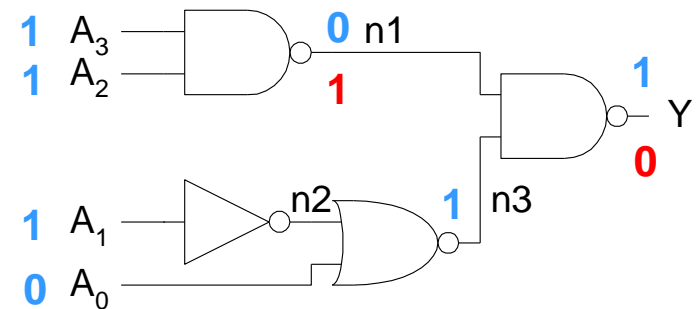
# Test Pattern Generation

- Manufacturing test ideally would check every node in the circuit to prove it is not stuck
- Apply the smallest sequence of test vectors necessary to prove each node is not stuck



# Test Example (1/2)

	SA1	SA0
■ $A_3$	{0110}	{1110}
■ $A_2$	{1010}	{1110}
■ $A_1$	{0100}	{0110}
■ $A_0$	{0110}	{0111}
■ n1	{1110}	{0110}
■ n2	{0110}	{0100}
■ n3	{0101}	{0110}
■ Y	{0110}	{1110}



■ Minimum set: {0100, 0101, 0110, 0111, 1010, 1110}

# Test Example (2/2)

{0000} {0001} {0010} {0011}      ...      {1110} {1111}

A3 SA1

A3 SA0

A2 SA1

A2 SA0

A1 SA1

A1 SA0

A0 SA1

A0 SA0

n1 SA1

n1 SA0

n2 SA1

n2 SA0

n3 SA1

n3 SA0

Y SA1

Y SA0

$$K = \{K_1, K_2, \dots, K_n\}$$

$$S = \{S_1, S_2, S_3, \dots, S_m\}$$

		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
S1	A3 SA1							1									
S2	A3 SA0															1	
S3	A2 SA1											1					
S4	A2 SA0															1	
S5	A1 SA1					1											
S6	A1 SA0							1									
S7	A0 SA1							1									
S8	A0 SA0								1								
S9	n1 SA1															1	
S10	n1 SA0							1									
S11	n2 SA1							1									
S12	n2 SA0					1											
S13	n3 SA1						1										
S14	n3 SA0							1									
S15	Y SA1							1									
S16	Y SA0															1	

# Lab 1: Test Pattern Generation

- 下載並安裝 Dev-C++
- 撰寫 Test Example 電路的 Test Pattern Generation 程式並找出 Minimum Set
- **Step1**: 寫一個程式找出所有可偵測到 A3 SA1 (亦即 S1) 的 Input Patterns
- **Step2**: 使用 Step1 的程式找出每一個 Stuck-At Fault (亦即 S1~S16) 對應的 Input Patterns
- **Step3**: 完成上一頁表格的完整內容，撰寫程式找出可偵測到所有 Stuck-At Faults 的 Minimum Test Pattern Set
- 撰寫並繳交實驗報告

# 實驗報告+程式碼

- **實驗報告及程式碼**以壓縮檔繳交，每位同學均須繳交
- 實驗報告壓縮檔請以實驗編號及自己的學號姓名命名，例如：**Lab1\_M999999999陳小華.rar**，於規定時間內上傳至“**中山大學網路大學-作業評量區**”繳交
- 實驗報告請於**2024/04/01晚上11:59**之前上傳網路大學
- 實驗報告內容包含
  - ◆ 實驗主題、實驗日期、學號姓名
  - ◆ 實驗內容、過程及結果
    - ⊕ 實驗內容、程式簡要說明...
    - ⊕ 實驗畫面、程式執行過程及結果截圖...
    - ⊕ 實驗結果及分析
  - ◆ 實驗心得