



積體電路與數位邏輯閘

國立新竹高中


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生活中哪裡有積體電路？



生活中所有的3C產品內都有積體電路的蹤跡
例如你手中的手機 假日看的電視 玩的電腦
抑或是早上到學校所搭的交通工具
近幾年所流行的聲控家具等等

The background features several abstract, three-dimensional wireframe structures. These structures are composed of thin, dark lines forming various geometric shapes, including what appear to be truncated pyramids and other polyhedrons. They are rendered in a light gray color, creating a sense of depth and complexity. The shapes are scattered across the frame, with some appearing more prominent than others, all set against a plain, light gray background.

I. 積體電路

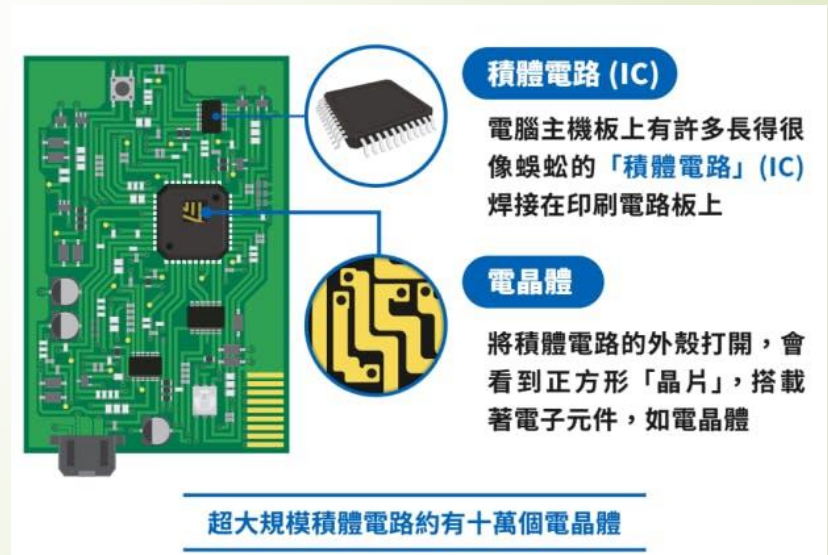
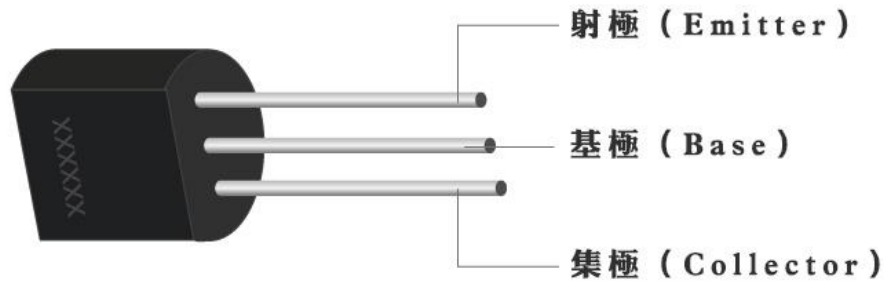
積體電路IC

- IC是由晶圓分割而成
- IC上具有很多電晶體，電阻.....等電子元件
- 因為有很多種電子元件，所以可以用來判斷你想要的東西
- 積體電路的尺寸從1平方毫米到200多毫米不等
- 簡單來說，IC其實就是放在電路板上的超小電路

電晶體

- ➔ 電晶體透過改變電流大小，來傳達訊息
- ➔ 電晶體的大小可達奈米等級，是IC上的一種電子元件

電晶體的零件

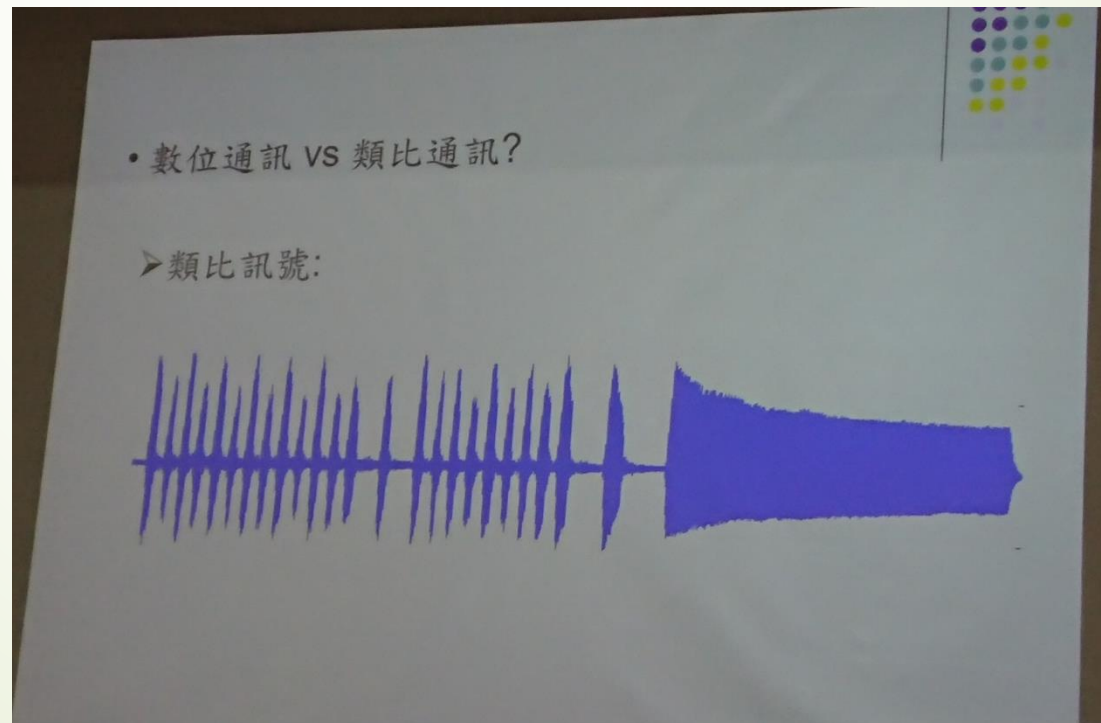


The background features several abstract, three-dimensional wireframe structures. These structures are composed of thin, dark lines forming various geometric shapes, including what appear to be truncated pyramids and other polyhedrons. They are rendered in a light gray color, creating a subtle, technical aesthetic. The shapes are scattered across the page, with some appearing more prominent than others, and they seem to be floating or layered in a three-dimensional space.

II. 訊號類別

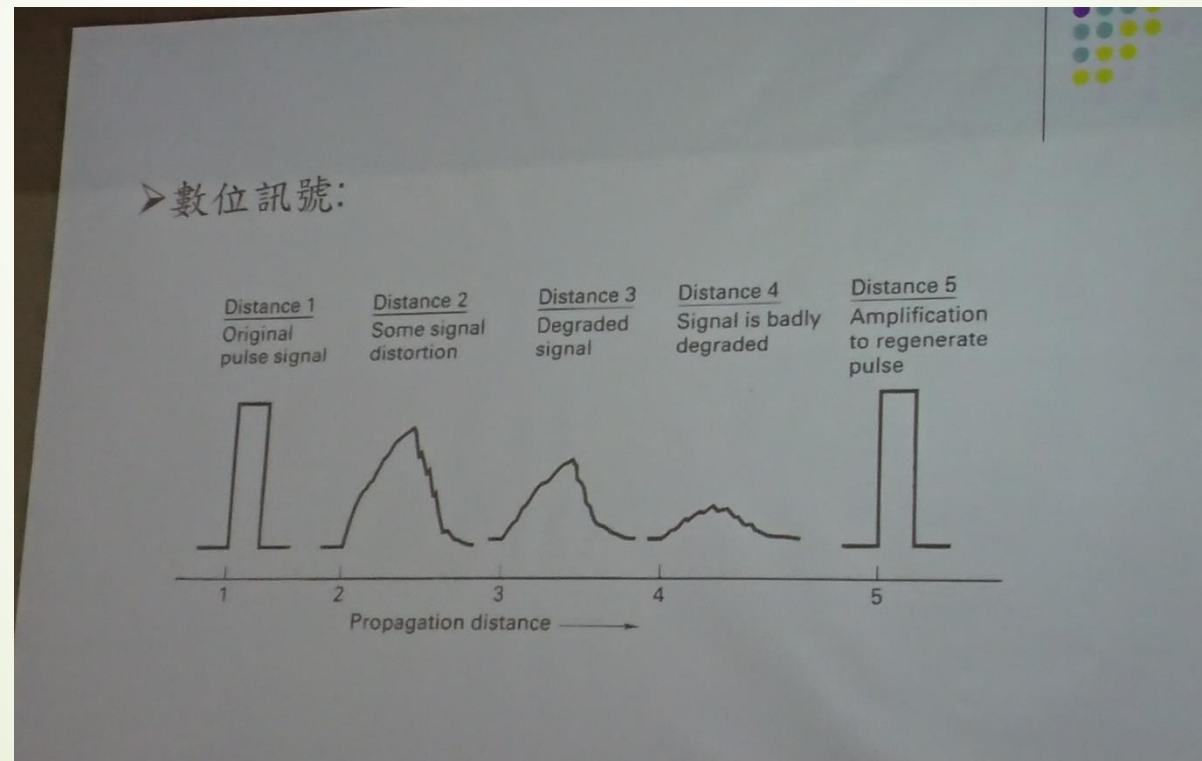
數位&類比

- ➡ 類比：是一種連續性的訊號，為連續波形，最大的缺點是容易受外在因素干擾使波形改變而影響訊號的判讀。



數位&類比

- ➡ 數位：是一種不連續性的訊號，由0和1組成。

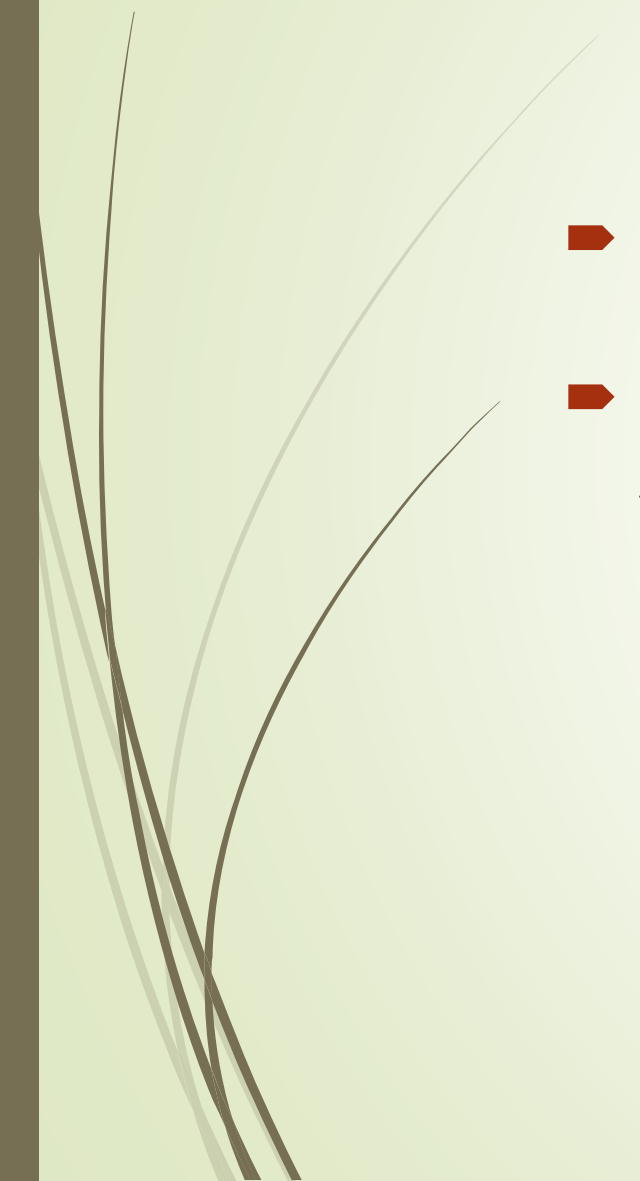


The background features several abstract, three-dimensional wireframe structures. These structures are composed of thin, dark lines forming various geometric shapes, including cubes and rectangular prisms, which are slightly offset and layered to create a sense of depth and movement. The overall aesthetic is clean, modern, and technical.

III. 數位邏輯閘



數位邏輯閘

- ▶ 由電晶體、二極體、電阻、電容所構成
 - ▶ 當有兩個以上的訊號輸入(非閘僅有一個訊號輸入及輸出)，使用者想要得到一個對他有用的訊息，就需要數位邏輯閘
- 

電晶體的邏輯閘

- 輸入電壓在0~0.8V之間被定義為邏輯0
- 輸入電壓在2~5V之間被定義為邏輯1
- 輸出電壓在0~0.4V之間被定義為邏輯0
- 輸出電壓在2.4~5V之間被定義為邏輯1

邏輯0	邏輯1
偽(False)	真(True)
斷(OFF)	通(ON)
低(Low)	高(High)
否(No)	是(Yes)
閉(Closed)	開(Open)

邏輯0與邏輯1的同義名稱

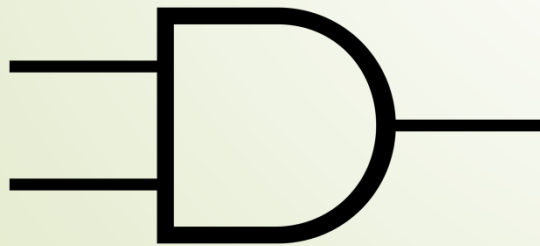
AND(及閘)

AND 輸出訊號由多個輸入組成

其中一個輸入為0

輸出就為0

A	B	output
0	0	0
0	1	0
1	0	0
1	1	1



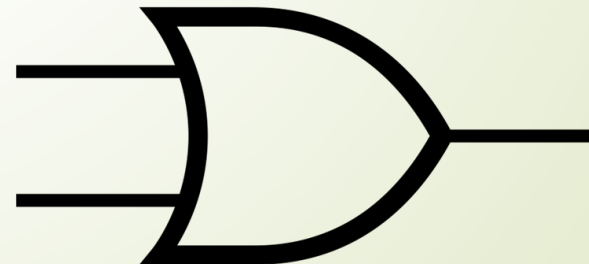
OR(或閘)

OR 輸出訊號由多個輸入組成

其中一輸入個為1

輸出就為1

A	B	output
0	0	0
0	1	1
1	0	1
1	1	1



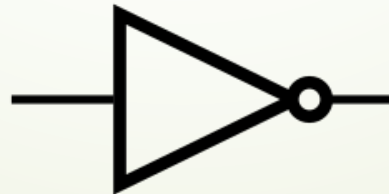
AND(且) OR(或)

- ▶ **AND** 就像燈泡串聯，如果有一個燈泡壞掉(0)，但其他燈泡都是正常的(1)，結果就是不會發亮(0)
- ▶ **OR** 就像燈泡並聯，就算有燈泡壞掉(0)，只要有燈泡是正常的(1)，電路就會有燈泡亮起(1)

非閘(NOT)

- ▶ NOT是僅有一個訊號輸入及輸出的電路，其輸出訊號狀態恰與輸入訊號相反，又稱反相器(inverter)

Input	Output
0	1
1	0



The background features several abstract, three-dimensional wireframe structures. These structures are composed of thin, dark lines forming various polyhedral shapes, including what appear to be truncated pyramids and other complex geometric forms. They are positioned in the corners and along the sides of the page, creating a sense of depth and architectural complexity. The overall aesthetic is clean, modern, and technical.

IV. 數字系統及其轉換

二進制(Binary)

- ➡ 因為電腦只有0跟1，為了讓電腦運作，就產生了二進制
- ➡ 範例： $(10100)_2$ 換成十進制 $1*2^4 + 0*2^3 + 1*2^2 + 0*2^1 + 0*2^0$

二進制	十進制
0	0
1	1
10	2
11	3
100	4

十進制轉二進制

- 使用連除基數法，將數字不斷除以2，若有餘數則從最後一位數記錄1，沒有餘數則記錄0，直到商式為0
- 範例：

例1.1 試將 $55_{(10)}$ 轉換成二進位數。

【解】

2		55		
2		27	餘數	1
2		13		1
2		6		1
2		3		0
2		1		1
		0		1

$55_{(10)} = 110111_{(2)}$

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V.問題與討論



問題一



電晶體跟積體電路是什麼關係？





ANSWER

- ➔ 電晶體是積體電路上的電子元件，
讓積體電路順利運作

問題二

- ▶ 如果有兩個訊號1和0同時輸入及閘(AND) , 輸出的訊號再經過非閘 , 最後輸出的訊號為何 ?

ANSWER

1

A	B	output
0	0	0
0	1	0
1	0	0
1	1	1

Input	Output
0	1
1	0

The background features several abstract, three-dimensional wireframe structures. These structures are composed of thin, dark lines that form various geometric shapes, including what appear to be truncated pyramids and other polyhedrons. They are rendered in a light gray color, creating a subtle, architectural aesthetic. The shapes are scattered across the page, with some appearing more prominent than others, adding depth and a modern feel to the design.

VI.心得感想



在完成作品路上的兩大難題

1.理解積體電路與電晶體的關聯

2.錄製影片



The End