
数字世界精彩无限

Unit 5

——Multi-Level Gate Circuits
NAND and NOR Gates

张彦航

School of Computer Science
Zhangyanhang@hit.edu.cn

5.5 几种典型的组合逻辑部件

——全减器、OC门

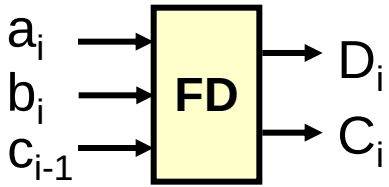
- 全减器
- OC门

全减器

$$
\begin{array}{rcl}
1\ 1\ 1\ 0 & \cdots\cdots\cdots & A \\
1\ 0\ 1\ 1 & \cdots\cdots\cdots & B \\
-\ 0\quad\ 0 & \cdots\cdots\cdots & C_{i-1} \\
\hline
 & \cdots\cdots\cdots & D_i
\end{array}
$$

$A = a_3\, a_2\, a_1\, a_0 = 1110$

$B = b_3\, b_2\, b_1\, b_0 = 1011$



真值表

a_i	b_i	C_{i-1}	D_i	C_i
0	0	0	0	0
0	0	1	1	0
0	1	0	1	0
0	1	1	0	1
1	0	0	1	0
1	0	1	0	1
1	1	0	0	1
1	1	1	1	1

全减器

真值表

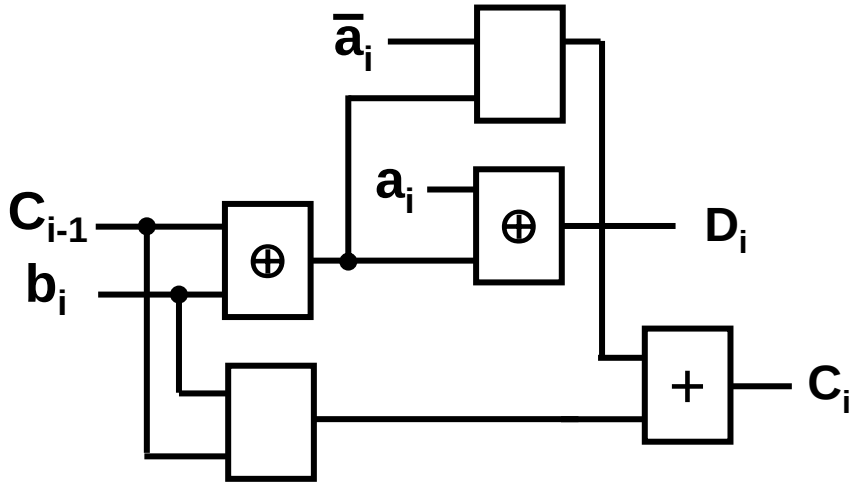
a_i	b_i	C_{i-1}	D_i	C_i
0	0	0	0	0
0	0	1	1	1
0	1	0	1	1
0	1	1	0	1
1	0	0	1	0
1	0	1	0	0
1	1	0	0	0
1	1	1	1	1

D_i

a_i \ b_ic_{i-1}	00	01	11	10
0	0	1	0	1
1	1	0	1	0

C_i

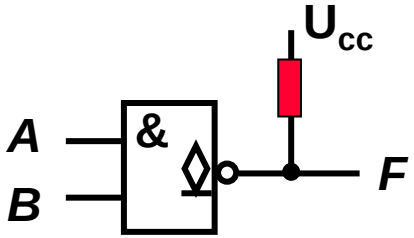
a_i \ b_ic_{i-1}	00	01	11	10
0	0	1	1	1
1	0	0	1	0



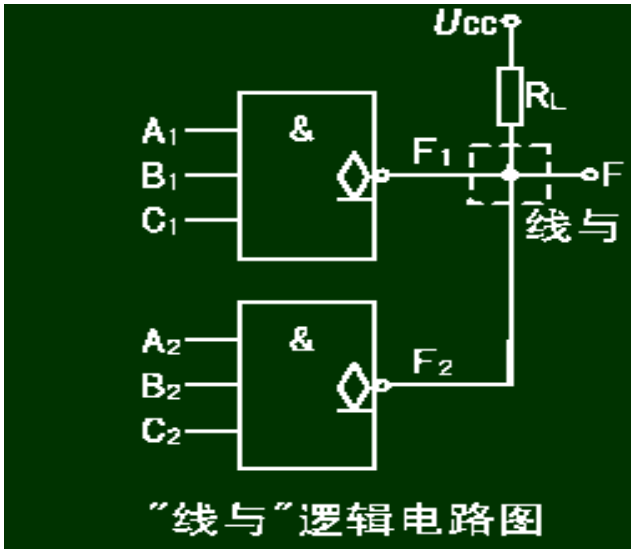
$$\begin{cases} D_i = a_i \oplus b_i \oplus C_{i-1} \\ C_i = (C_{i-1} \oplus b_i)\,\bar{a}_i + C_{i-1}b_i \end{cases}$$

OC门 (Open Collector)

- 几个OC门的输出端可以直接互连：“线与”
- 使用时必须加上拉电阻



$$F = \overline{AB}$$



$$F = F_1 \cdot F_2 = \overline{A_1B_1C_1} \cdot \overline{A_2B_2C_2}$$

5.5 几种典型的组合逻辑部件

——全减器与OC门

- 全减器
- OC门