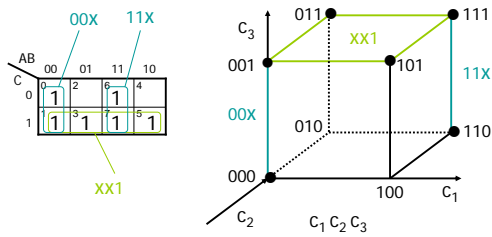


用多维体表示逻辑函数



第三章 门电路

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集成门电路的外特性

- 标称逻辑电平
表示逻辑值1和0的理想电平值，称为标称逻辑电平。
记为 $U(1)=5V$ 和 $U(0)=0V$
- 开门电平 (U_{OH}) 与关门电平 (U_{OL})
逻辑值1的最小高电平称为开门电平
逻辑值0的最大低电平称为关门电平

集成门电路的外特性

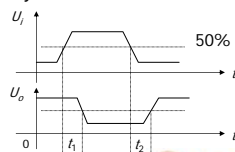
- 输入高电平电流 (I_{IH}) 与输入低电平电流 (I_{IL})
 I_{IH} - 拉出前级门电路输出端的电流
 I_{IL} - 灌入前级输出端的电流
- 输出高电平电流 (I_{OH}) 与输出低电平电流 (I_{OL})
 I_{OH} - 输出高电平时流出该输出端的电流
 I_{OL} - 输出低电平时灌入该输出端的电流

集成门电路的外特性

- 扇入系数 (N_f): 门电路允许的输入端数目
- 扇出系数 (N_o): 门的输出端所能连接的下一级门输入端的个数
- 平均传输延迟时间 (\bar{t}_y)

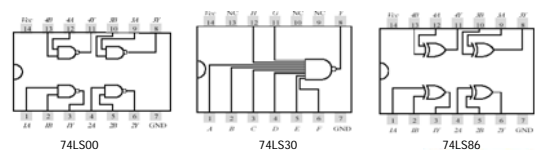
$$\bar{t}_y = (t_1 + t_2) / 2$$

$$U_i \rightarrow \text{AND} \rightarrow U_o$$



集成门电路的外特性

- 空载功耗
 P_{on} - 空载导通功耗 P_{off} - 空载截止功耗
 $P = (P_{on} + P_{off}) / 2$ 平均功耗
- 标准小规模集成门的封装与管脚



集成门电路的外特性

表3.8.1所示为部分TTL电路系列和CMOS电路系列的参数

电路种类 参数名称	TTL (74系列)	TTL (74LS系列)	CMOS (74HC系列)	CMOS (74HCT系列)
$V_{OH(min)}/V$	2.4	2.7	4.4	4.4
$V_{OL(max)}/V$	0.4	0.5	0.1	0.1
$I_{OH(max)}/mA$	-0.4	-0.4	-4	-4
$I_{OL(max)}/mA$	16	8	4	4
$V_{IH(min)}/V$	2	2	3.5	2
$V_{IL(max)}/V$	0.8	0.8	1	0.8
$I_{IH(max)}/\mu A$	40	20	0.1	0.1
$I_{IL(max)}/mA$	-1.6	-0.4	-0.1×10^{-3}	-0.1×10^{-3}

74系列的功耗和传播延迟

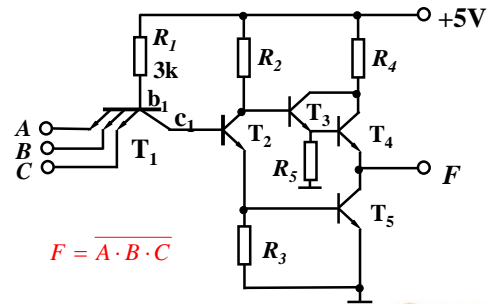
• $1 \text{ ns} = 10^{-9} \text{ s}$; (1纳秒)

Logic Family	Propagation Delay $t_{pd}(ns)$	Power Dissipation Per Gate (mW)	Technology
7400	10	10	Standard TTL
74100	6	22	High-speed TTL
74L00	33	1	Low-power TTL
74LS00	9.5	2	Low-power Schottky TTL
74S00	3	19	Schottky TTL
74ALS00	3.5	1.3	Advanced low-power Schottky TTL
74AS00	3	8	Advanced Schottky TTL
74HC00	8	0.17	High-speed CMOS

度量单位

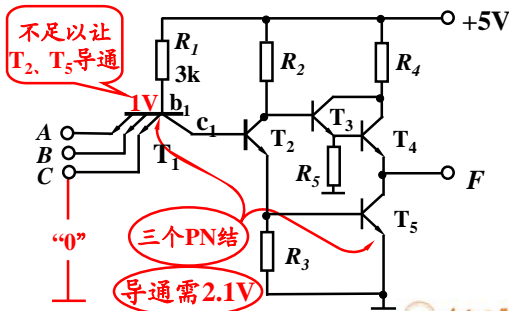
太 2^{40}	10^{12}	THz TeraHz
吉 2^{30}	10^9	GHz GigaHz
兆 2^{20}	10^6	MHz MegaHz
千 2^{10}	10^3	KHz KiloHz
毫 2^{-10}	10^{-3}	ms millisecond
微 2^{-20}	10^{-6}	μs microsecond
纳 2^{-30}	10^{-9}	ns nanosecond
皮 2^{-40}	10^{-12}	ps picosecond

TTL与非门的内部结构

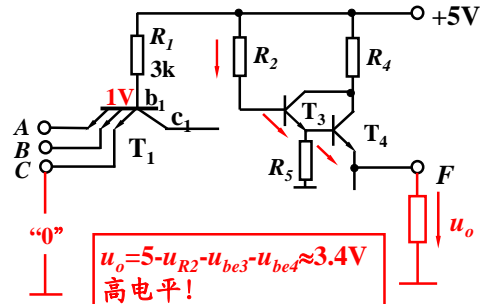


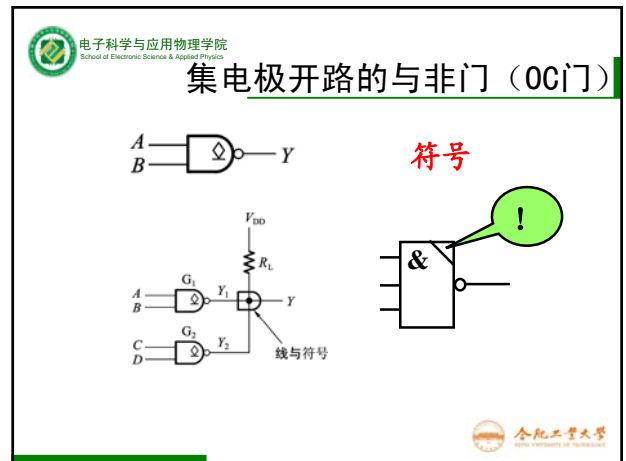
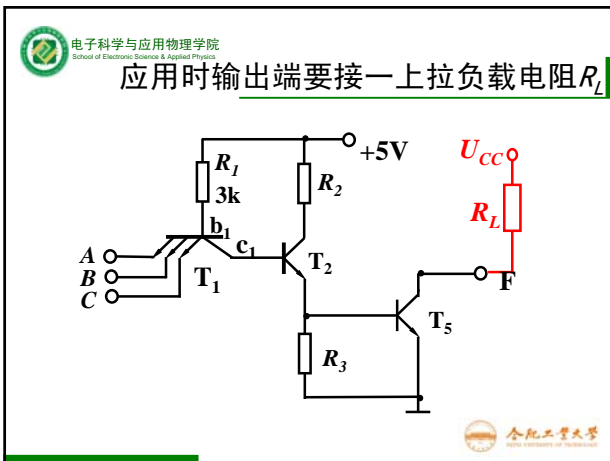
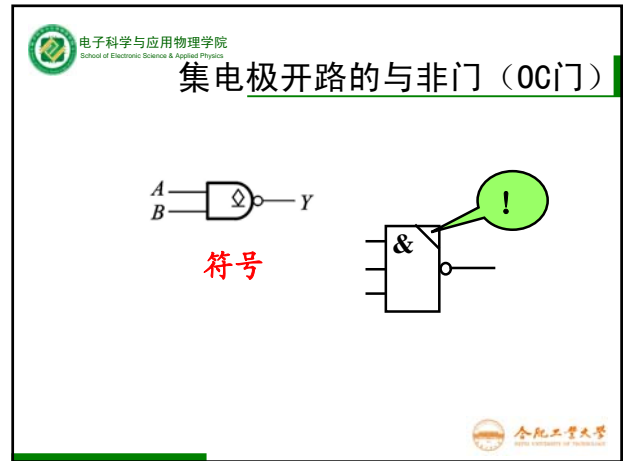
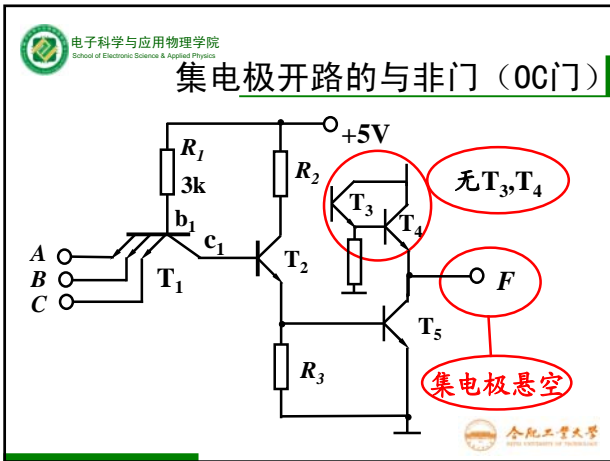
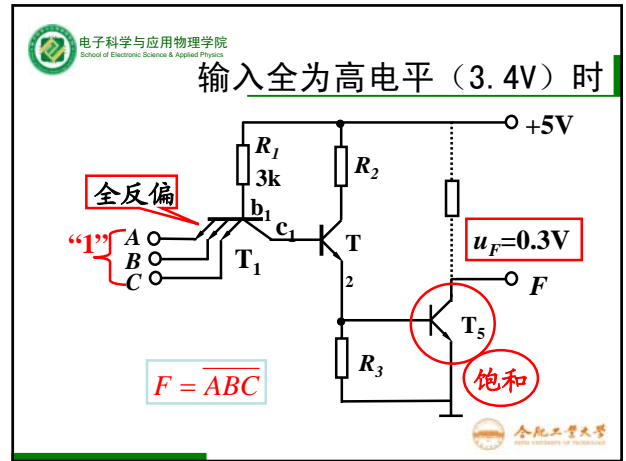
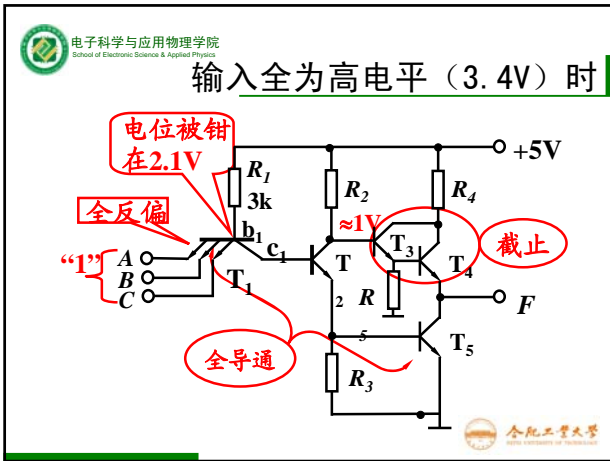
$$F = \overline{A \cdot B \cdot C}$$

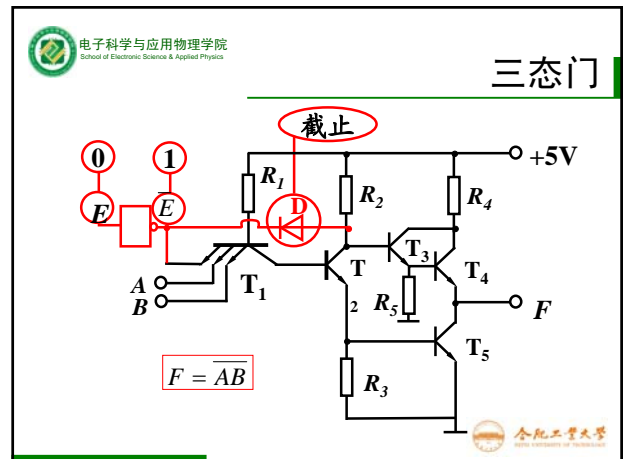
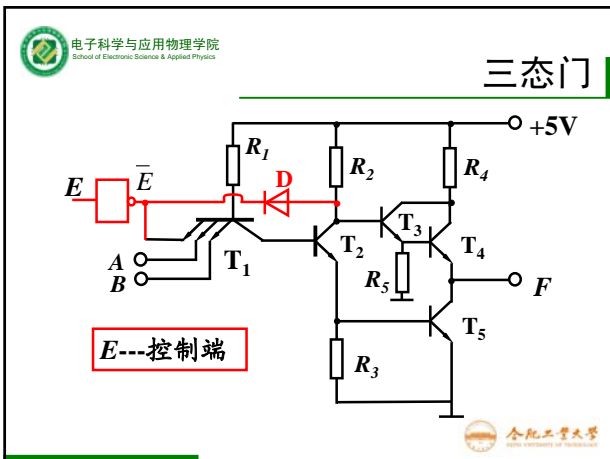
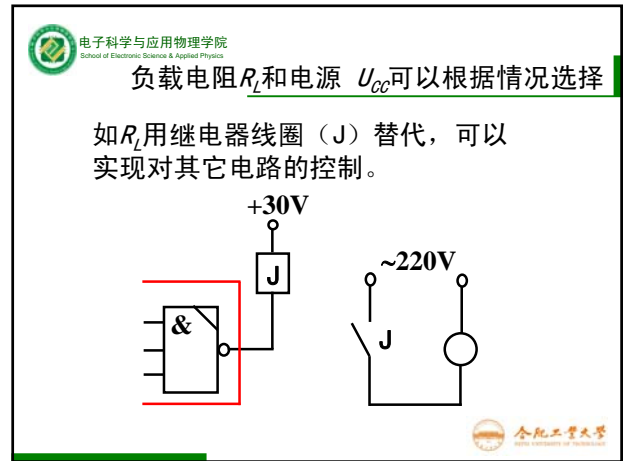
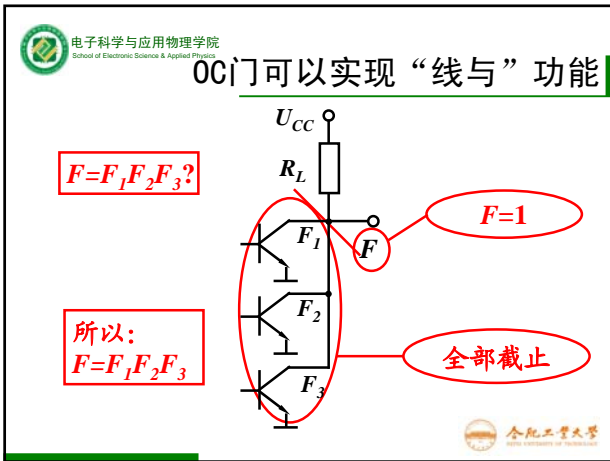
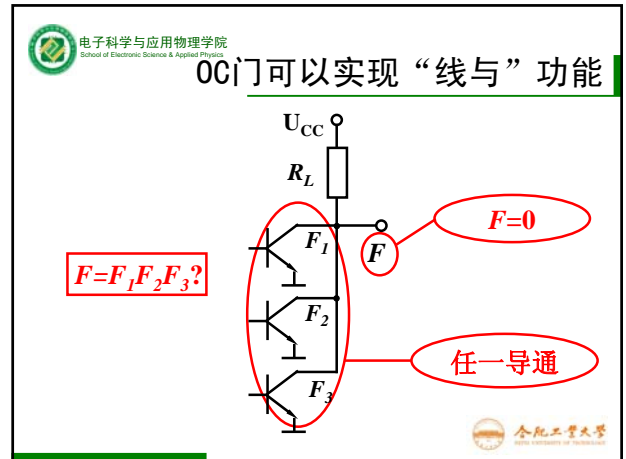
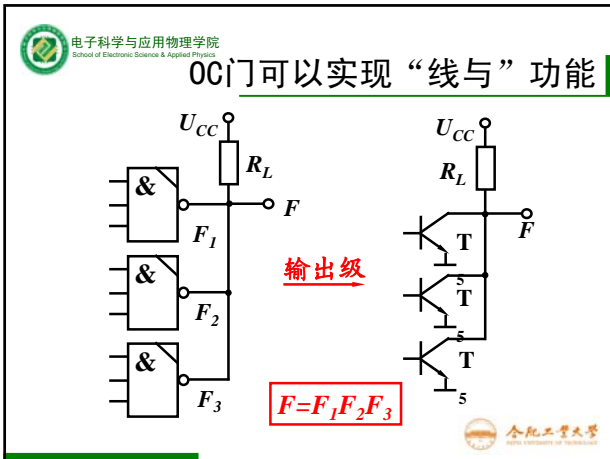
任一输入为低电平 (0.3V) 时

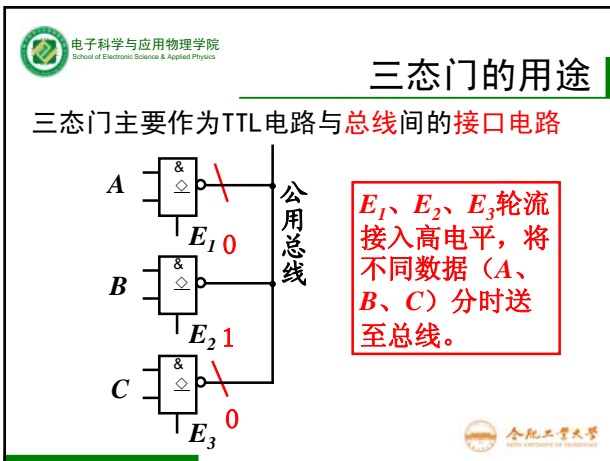
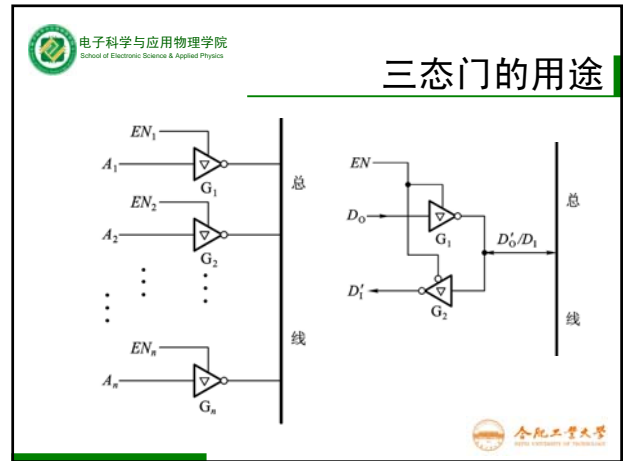
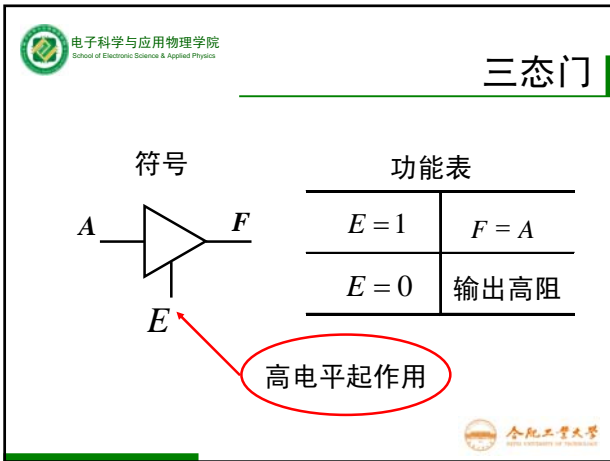
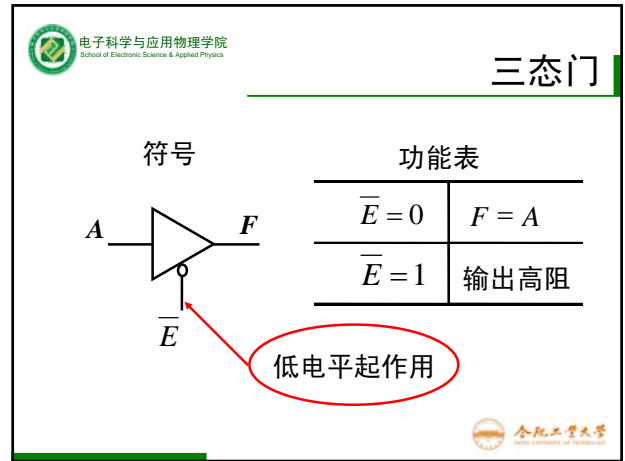
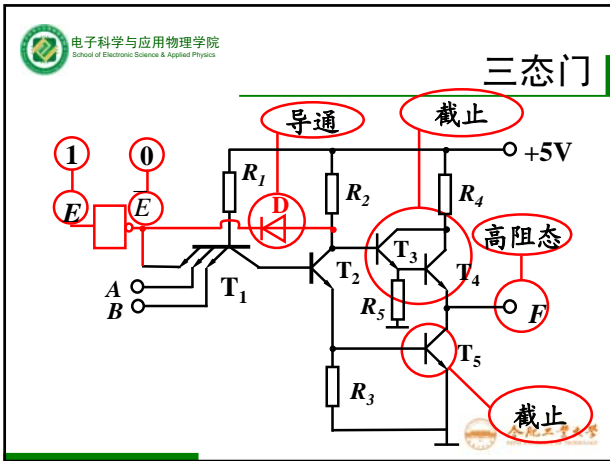


任一输入为低电平 (0.3V) 时









电子科学与应用物理学院
School of Electronic Science & Applied Physics

习题

P150-152
题3.2、3.3、3.4、3.8