

数字世界精彩无限

Unit 7

— Multiplexers and Decoders

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7.3 代码转换译码器及显示译码器

- 代码转换译码器
- 显示译码器

1. 代码转换译码器

功能：从一种编码转换为另一种编码

例：设计一个译码器，将输入的4位二进制数转换为格雷码

Karnaugh map for W=A. The map shows that W is equal to A, as the output is 1 for all input combinations where A=1 (rows 11 and 10).

CD \ AB	00	01	11	10
00	0	0	0	0
01	0	0	0	0
11	1	1	1	1
10	1	1	1	1

Karnaugh map for X=A⊕B. The map shows that X is 1 for input combinations where A and B have different values (01 and 10 rows).

CD \ AB	00	01	11	10
00	0	0	0	0
01	1	1	1	1
11	0	0	0	0
10	1	1	1	1

Karnaugh map for Y=B⊕C. The map shows that Y is 1 for input combinations where B and C have different values (01 and 11 columns).

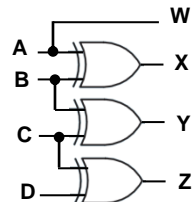
CD \ AB	00	01	11	10
00	0	0	1	1
01	1	1	0	0
11	1	1	0	0
10	0	0	1	1

Karnaugh map for Z=C⊕D. The map shows that Z is 1 for input combinations where C and D have different values (01 and 10 columns).

CD \ AB	00	01	11	10
00	0	1	0	1
01	0	1	0	1
11	0	1	0	1
10	0	1	0	1

ABCD	WXYZ	ABCD	WXYZ
0000	0000	1000	1100
0001	0001	1001	1101
0010	0011	1010	1111
0011	0010	1011	1110
0100	0110	1100	1010
0101	0111	1101	1011
0110	0101	1110	1001
0111	0100	1111	1000

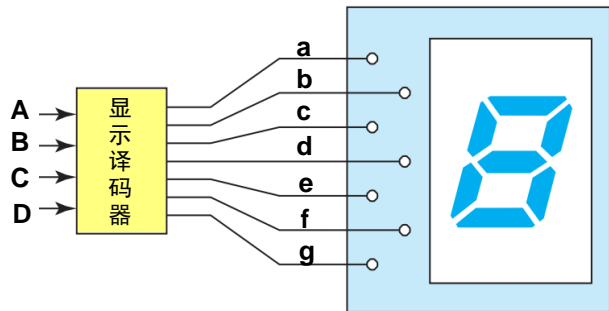
$$\begin{cases} W = A \\ X = A \oplus B \\ Y = B \oplus C \\ Z = C \oplus D \end{cases}$$



2. 显示译码器

显示译码器:与显示器件（如数码管）配合，将输入代码转换为十进制码或特定编码，并在显示器件上显示相应的字形

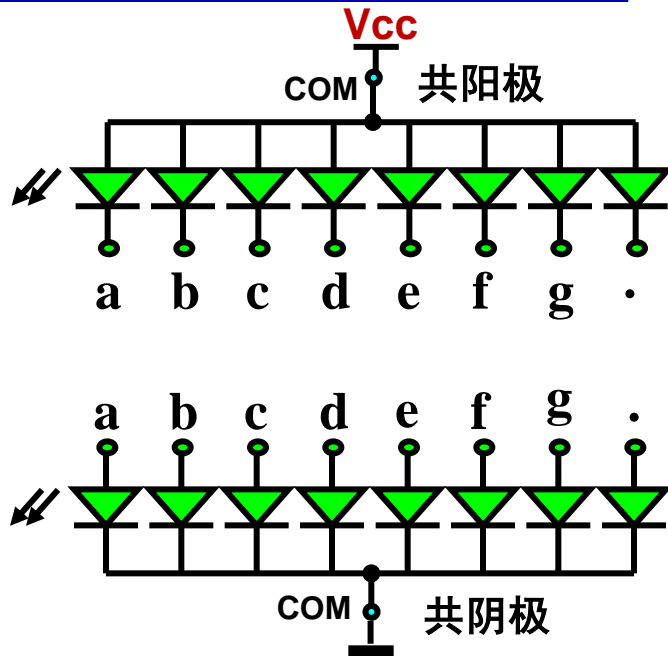
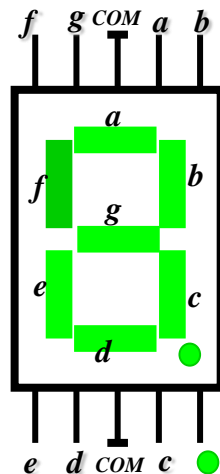
任务: 设计一个8421BCD码驱动的共阴极七段数码管显示译码器，能显示十进制数字0-9。



8421BCD码驱动的共阴极七段数码管显示译码器功能表

输入				译码输出							字形
A	B	C	D	a	b	c	d	e	f	g	
0	0	0	0	1	1	1	1	1	1	0	0
0	0	0	1	0	1	1	0	0	0	0	1
0	0	1	0	1	1	0	1	1	0	1	2
0	0	1	1	1	1	1	1	0	0	1	3
0	1	0	0	0	1	1	0	0	1	1	4
0	1	0	1	1	0	1	1	0	1	1	5
0	1	1	0	1	0	1	1	1	1	1	6
0	1	1	1	1	1	1	0	0	0	0	7
1	0	0	0	1	1	1	1	1	1	1	8
1	0	0	1	1	1	1	1	0	1	1	9

七段数码管



2. 显示译码器

CD \ AB	00	01	11	10
00	1	0	1	1
01	0	1	1	1
11	X	X	X	X
10	1	1	X	X

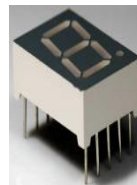
$$a = A + C + BD + \bar{B}\bar{D}$$

CD \ AB	00	01	11	10
00	1	1	1	1
01	1	0	1	0
11	X	X	X	X
10	1	1	X	X

$$b = \bar{B} + CD + \bar{C}\bar{D}$$

CD \ AB	00	01	11	10
00	1	1	1	0
01	1	1	1	1
11	X	X	X	X
10	1	1	X	X

$$c = B + \bar{C} + D$$



CD \ AB	00	01	11	10
00	1	0	1	1
01	0	1	0	1
11	X	X	X	X
10	1	1	X	X

$$d = A + C\bar{D} + \bar{B}C + \bar{B}\bar{D} + B\bar{C}D$$

CD \ AB	00	01	11	10
00	1	0	0	1
01	0	0	0	1
11	X	X	X	X
10	1	0	X	X

$$e = C\bar{D} + \bar{B}\bar{D}$$

CD \ AB	00	01	11	10
00	1	0	0	0
01	1	1	0	1
11	X	X	X	X
10	1	1	X	X

$$f = A + \bar{C}\bar{D} + B\bar{C} + B\bar{D}$$

CD \ AB	00	01	11	10
00	0	0	1	1
01	1	1	0	1
11	X	X	X	X
10	1	1	X	X

$$g = A + C\bar{D} + \bar{B}C + B\bar{C}$$

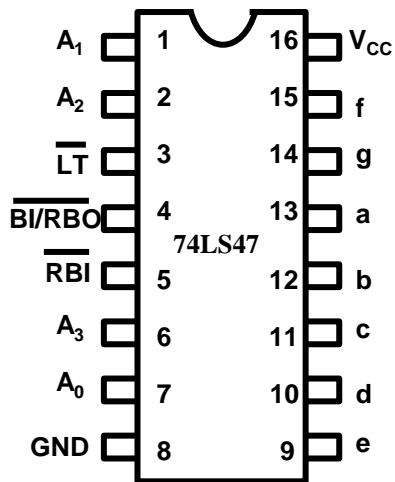
2. 显示译码器

典型芯片：74LS47, 74LS48

中规模显示译码器74LS47功能表

功能和十进制数	输入				输出							显示
	$\overline{\text{LT}}$	$\overline{\text{RBI}}$	$\overline{\text{BI/RBO}}$	$A_3A_2A_1A_0$	a	b	c	d	e	f	g	
试灯	0	×	1	×	×	×	×	×	×	×	×	8
灭灯	×	×	0	×	×	×	×	×	×	×	×	全灭
灭0	1	0	0	0	0	0	0	0	0	0	0	灭0
0	1	1	1	0	0	0	0	0	0	0	1	0
1	1	×	1	0	0	0	1	1	1	1	1	1
2	1	×	1	0	0	1	0	0	1	0	0	2
3	1	×	1	0	0	1	1	0	1	1	0	3
4	1	×	1	0	1	0	0	1	1	0	0	4
5	1	×	1	0	1	0	1	0	1	0	0	5
6	1	×	1	0	1	1	0	0	0	0	0	6
7	1	×	1	0	1	1	1	0	1	1	1	7
8	1	×	1	1	0	0	0	0	0	0	0	8
9	1	×	1	1	0	0	1	0	0	0	0	9

输出低电平有效



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