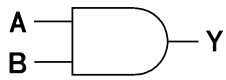


Basic Logic Functions

AND

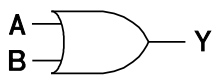
$$Y = A \cdot B = AB$$



A	B	Y
0	0	0
0	1	0
1	0	0
1	1	1

OR

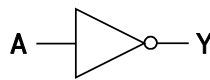
$$Y = A + B$$



A	B	Y
0	0	0
0	1	1
1	0	1
1	1	1

NOT

$$Y = \bar{A}$$



A	Y
0	1
1	0

M3S10002

EE for $\bar{E}\bar{E}$

Basic Logic Functions

NAND

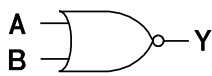
$$Y = \overline{A \cdot B} = \overline{AB}$$



A	B	Y
0	0	1
0	1	1
1	0	1
1	1	0

NOR

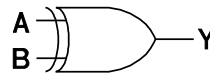
$$Y = \overline{A + B}$$



A	B	Y
0	0	1
0	1	0
1	0	0
1	1	0

Exclusive-OR

$$Y = A \oplus B$$



A	B	Y
0	0	0
0	1	1
1	0	1
1	1	0

M3S10003

EE for $\bar{E}\bar{E}$

Truth Table

$$Y = AB + \overline{BC} + C\overline{A}$$

A	B	C	AB	\overline{BC}	$C\overline{A}$	Y
0	0	0	0	1	0	1
0	0	1	0	0	1	1
0	1	0	0	0	0	0
0	1	1	0	0	1	1
1	0	0	0	1	0	1
1	0	1	0	0	0	0
1	1	0	1	0	0	1
1	1	1	1	0	0	1

M3S10005

EE for EE

Truth Table to Equation

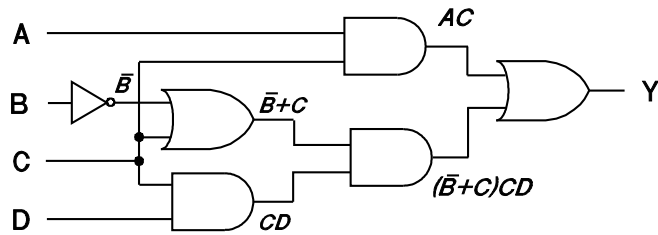
A	B	C	Y
0	0	0	1 ← $\overline{A}\overline{B}\overline{C}$
0	0	1	0
0	1	0	1 ← $\overline{A}B\overline{C}$
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	1 ← $A\overline{B}\overline{C}$
1	1	1	1 ← ABC

$$Y = \overline{A}\overline{B}\overline{C} + \overline{A}B\overline{C} + A\overline{B}\overline{C} + ABC$$

M3S1005a

EE for EE

Circuit to Equation



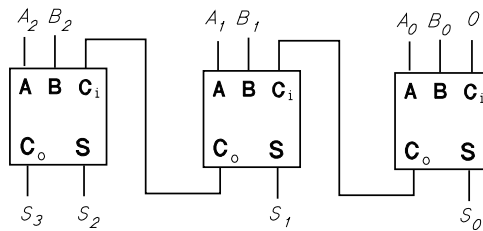
$$Y = AC + (\bar{B}+C)CD$$

$$= AC + \bar{B}C + CD$$

M3S1005b

EE for EE

Full Adder Design



A	B	C _i	C _o	S
0	0	0	0	0
0	0	1	0	1
0	1	0	0	1
0	1	1	1	0
1	0	0	0	1
1	0	1	1	0
1	1	0	1	0
1	1	1	1	1

M3S10008

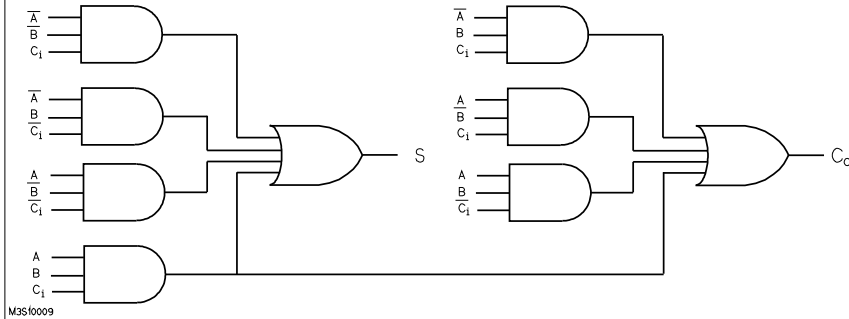
EE for EE

Full Adder Design

One Solution:

$$S = \overline{A}B\overline{C}_i + \overline{A}\overline{B}C_i + A\overline{B}C_i + ABC_i$$

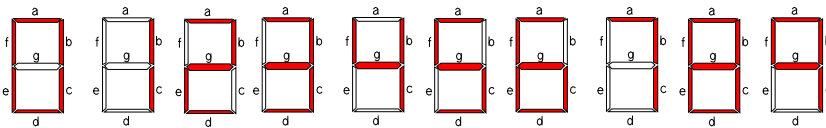
$$C_o = \overline{A}BC_i + \overline{A}\overline{B}C_i + A\overline{B}C_i + ABC_i$$



M3Sf0009

EE for EE

Seven Segment Display Driver



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	1	0	1	1	0	0	0	0
0	0	1	0	1	1	0	1	1	0	1
0	0	1	1	1	1	1	1	0	0	1
0	1	0	0	0	1	1	0	0	1	1
0	1	0	1	1	0	1	1	0	1	1
0	1	1	0	1	0	1	1	1	1	1
0	1	1	1	1	1	1	0	0	0	0
1	0	0	0	1	1	1	1	1	1	1
1	0	0	1	1	1	1	0	0	1	1

M3Sf0012

EE for EE

Boolean Transformations

A	B	\bar{A}	\bar{B}	\overline{AB}	$\overline{A+B}$	$\overline{A+B}$	\overline{AB}
0	0	1	1	1	1	1	1
0	1	1	0	0	0	1	1
1	0	0	1	0	0	1	1
1	1	0	0	0	0	0	0

$\underbrace{\hspace{10em}}$ same
 $\underbrace{\hspace{10em}}$ same

Demorgan's Theorems:

$$\overline{AB} = \overline{A+B}$$

NOR

$$\overline{A+B} = \overline{AB}$$

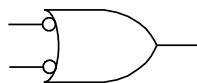
NAND

M3510006

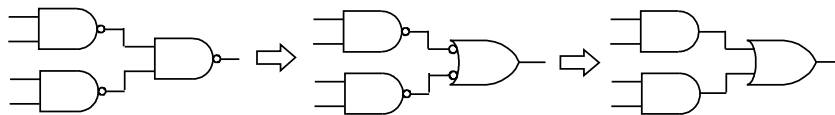
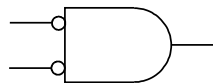
EE for EE

Alternate Symbols

NAND

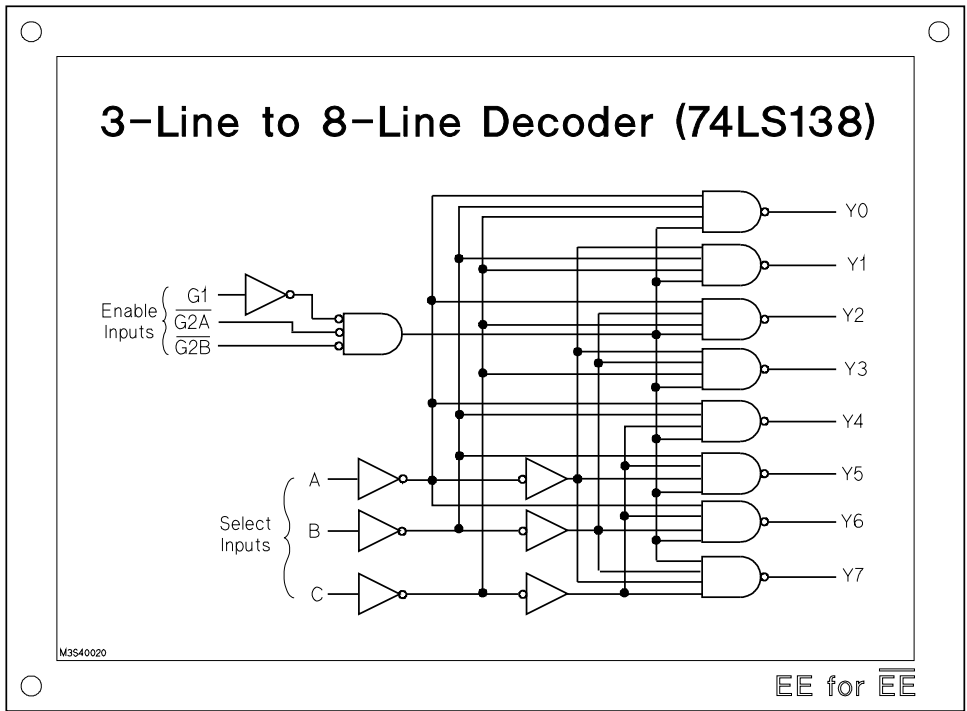
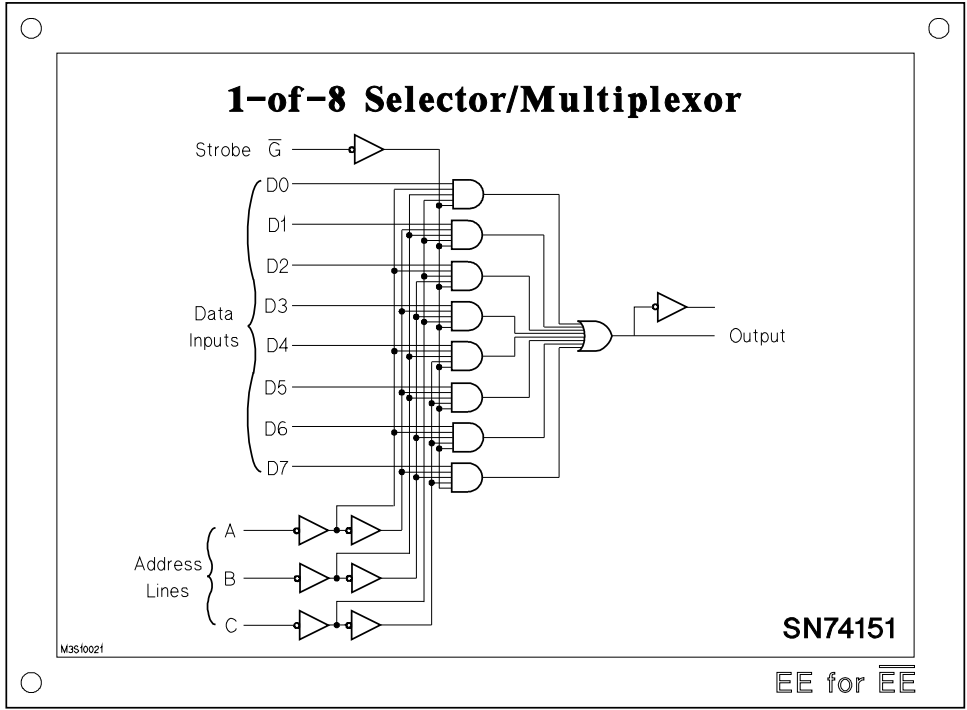


NOR

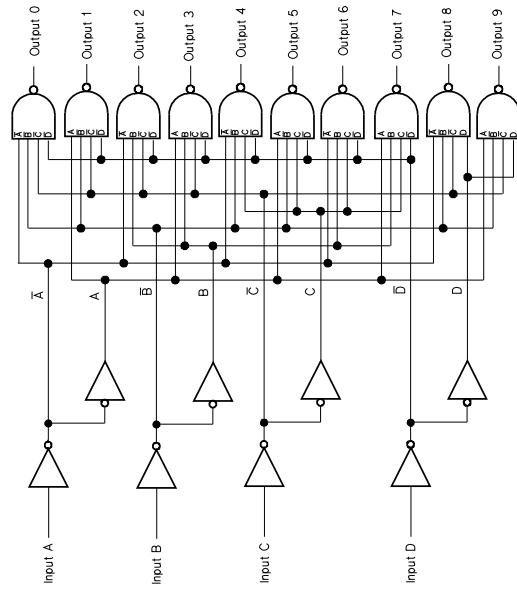


M3510007

EE for EE



4-Line to 10-Line Decoder



SN7442

MSS1627

EE for EE