MAGNITUDE COMPARATOR

MAGNITUDE COMPARATOR: DIGITAL COMPARATOR

- It is a combinational logic circuit.
- Digital Comparator is used to compare the value of two binary digits.
- There are two types of digital comparator (i) Identity Comparator (ii) Magnitude Comparator.
- IDENTITY COMPARATOR: This comparator has only one output terminal for when A=B, either A=B=1 (High) or A=B=0 (Low)
- MAGNITUDE COMPARATOR: This Comparator has three output terminals namely A>B, A=B, A<B. Depending on the result of comparison, one of these output will be high (1)
- Block Diagram of Magnitude Comparator is shown in Fig. 1

BLOCK DIAGRAM OF MAGNITUDE COMPARATOR

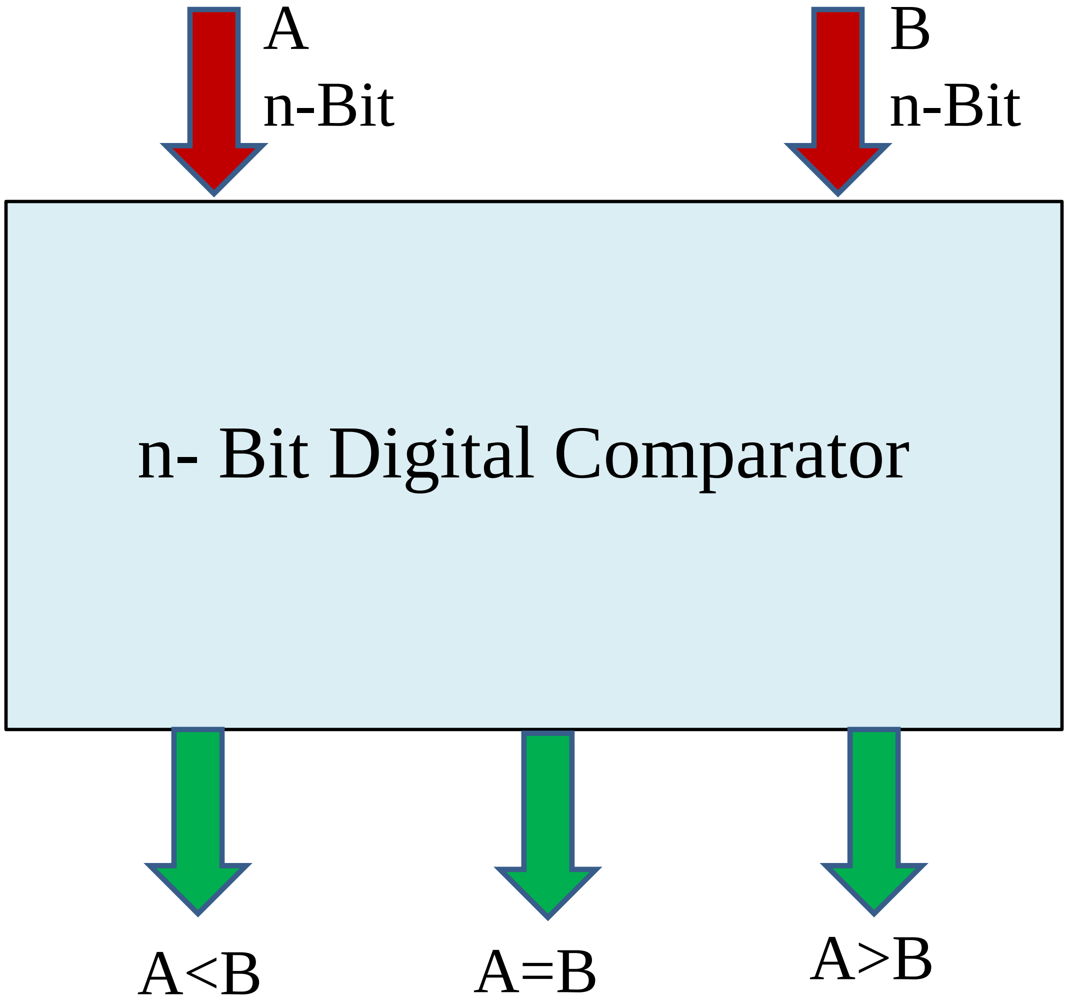


Fig. 1

1- Bit Magnitude Comparator:

- This magnitude comparator has two inputs A and B and three outputs A<B, A=B and A>B.
- This magnitude comparator compares the two numbers of single bits.
- Truth Table of 1-Bit Comparator

INPUTS		OUTPUTS		
A	B	Y_1 (A<B)	Y_2 (A=B)	Y_3 (A>B)
0	0	0	1	0
0	1	1	0	0
1	0	0	0	1
1	1	0	1	0

K-Maps For All Three Outputs :

A \ B	$\overline{B}$ 0	B 1
$\overline{A}$ 0	0	1
A 1	0	0

K-Map for Y_1 : A<B

$$Y_1 = \overline{A}B$$

K-Maps For All Three Outputs :

A \ B	$\overline{B}$ 0	B 1
$\overline{A}$ 0	0	1
A 1	0	0

K-Map for Y_1 : A<B

$$Y_1 = \overline{A}B$$

A \ B	$\overline{B}$ 0	B 1
$\overline{A}$ 0	1	0
A 1	0	1

K-Map for Y_2 : A=B

$$Y_2 = \overline{A}\,\overline{B} + AB$$

K-Maps For All Three Outputs :

A \ B	$\overline{B}$ 0	B 1
$\overline{A}$ 0	0	1
A 1	0	0

K-Map for Y_1 : A<B

$$Y_1 = \overline{A}B$$

A \ B	$\overline{B}$ 0	B 1
$\overline{A}$ 0	1	0
A 1	0	1

K-Map for Y_2 : A=B

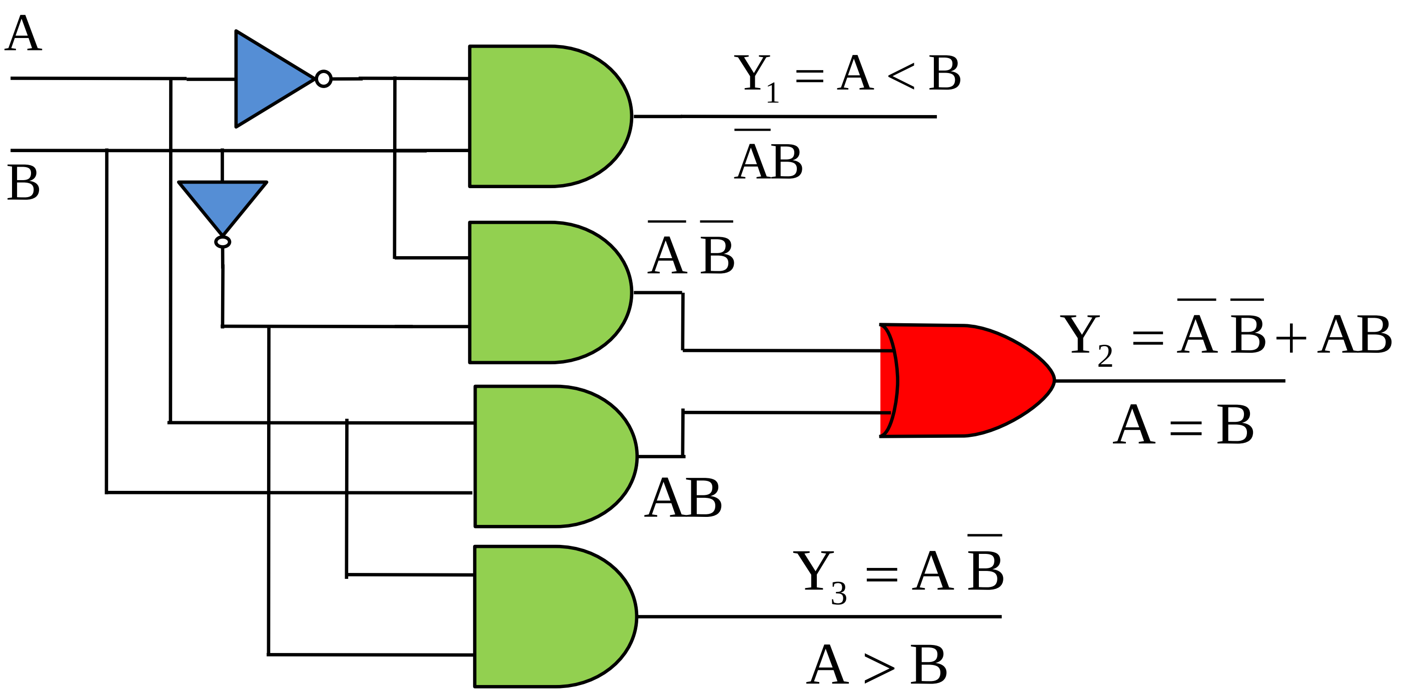
$$Y_2 = \overline{A}\,\overline{B} + AB$$

A \ B	$\overline{B}$ 0	B 1
$\overline{A}$ 0	0	0
A 1	1	0

$$Y_3 = A\overline{B}$$

K-Map for Y_2 : A>B

Realization of One Bit Comparator

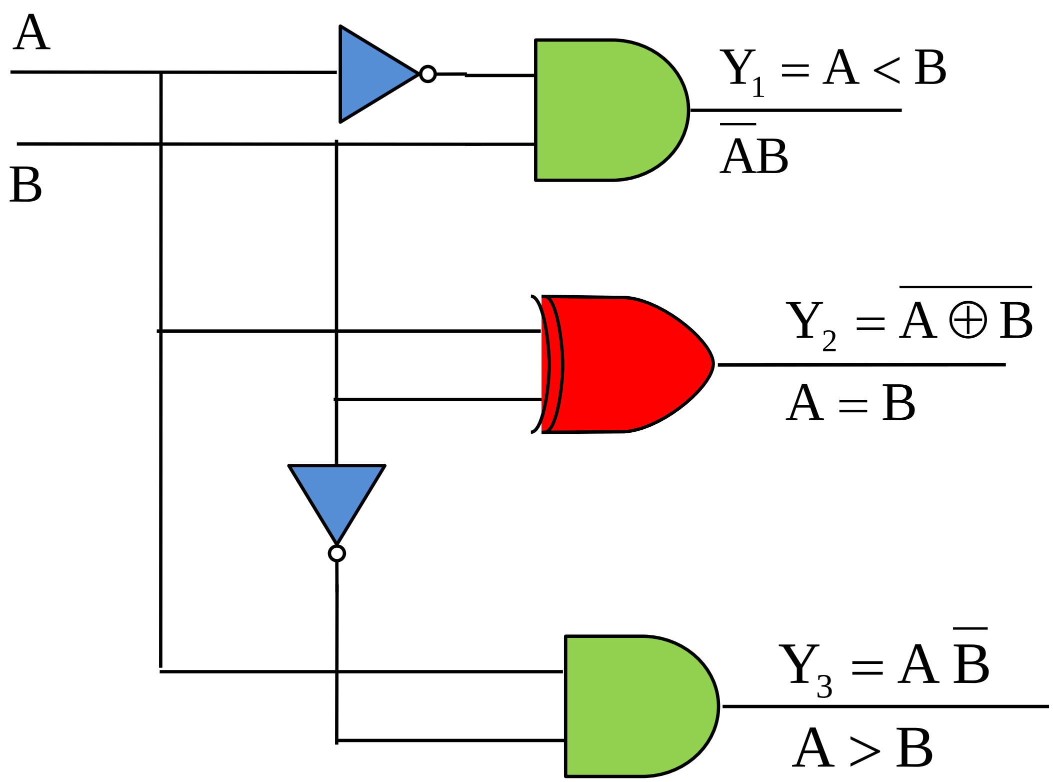


$$Y_1 = \bar{A}B$$

$$Y_2 = \bar{A}\bar{B} + AB$$

$$Y_3 = A\bar{B}$$

Realization of by Using AND , EX-NOR gates



2-Bit Comparator:

- A comparator which is used to compare two binary numbers each of two bits is called a 2-bit magnitude comparator.
- Fig. 2 shows the block diagram of 2-Bit magnitude comparator.
- It has four inputs and three outputs.
- Inputs are A_0 ,A_1,B_0 and B_1 and Outputs are Y_1, Y_2 and Y_3

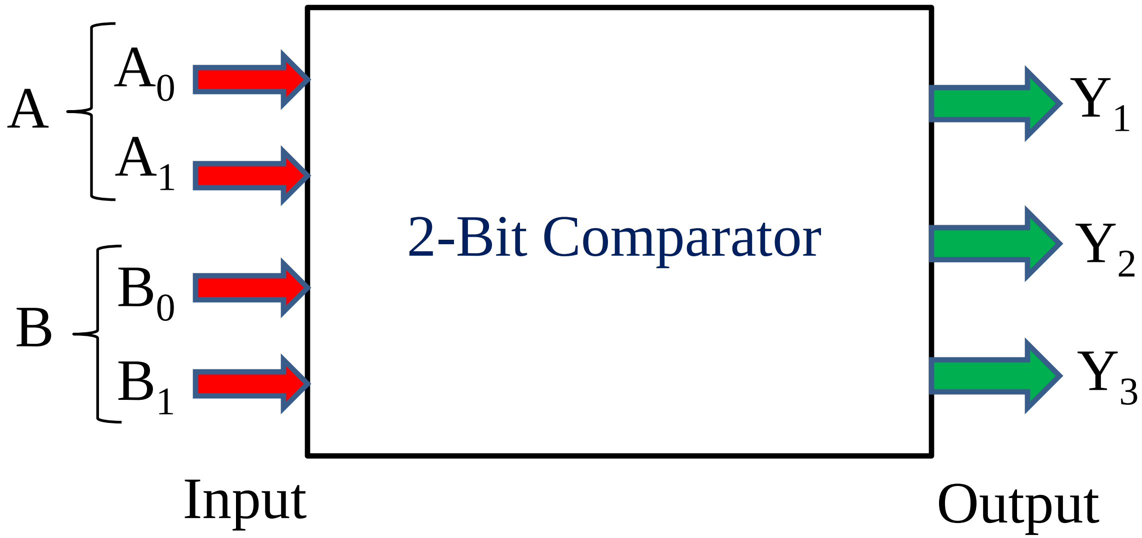


Fig. 2

GREATER THAN (A>B)

A_1	A_0	B_1	B_0
1	0	0	1
1	1	1	0
0	1	0	0

1. If A_1= 1 and B_1= 0 then A>B
2. If A_1 and B_1 are same, i.e A_1=B_1=1 or A_1=B_1=0 and A_0=1, B_0=0 then A>B

LESS THAN (A<B)

Similarly,

1. If A_1= B_1=1 and A_0= 0, B_0=1, then A<B
2. If A_1= B_1= 0 and A_0= 0, B_0=1 then A<B

TRUTH TABLE

INPUT				OUTPUT		
A_1	A_0	B_1	B_0	$Y_1=A<B$	$Y_2=(A=B)$	$Y_3=A>B$
0	0	0	0	0	1	0
0	0	0	1	1	0	0
0	0	1	0	1	0	0
0	0	1	1	1	0	0
0	1	0	0	0	0	1
0	1	0	1	0	1	0
0	1	1	0	1	0	0
0	1	1	1	1	0	0
1	0	0	0	0	0	1
1	0	0	1	0	0	1
1	0	1	0	0	1	0
1	0	1	1	1	0	0
1	1	0	0	0	0	1
1	1	0	1	0	0	1
1	1	1	0	0	0	1
1	1	1	1	0	1	0

K-Map for A<B:

A_1A_0 \ B_1B_0	00	01	11	10
00	0	1	1	1
01	0	0	1	1
11	0	0	0	0
10	0	0	1	0

K-Map for A=B:

A_1A_0 \ B_1B_0	00	01	11	10
00	1	0	0	0
01	0	1	0	0
11	0	0	1	0
10	0	0	0	1

For A<B

$$Y_1 = \overline{A_1}\,\overline{A_0}\,B_0 + \overline{A_1}\,B_1 + \overline{A_0}\,B_1\,B_0$$

For A=B

$$Y_2 = \overline{A_1}\,\overline{A_0}\,\overline{B_1}\,\overline{B_0} + \overline{A_1}\,A_0\,\overline{B_1}\,B_0 + A_1A_0B_1B_0 + A_1\,\overline{A_0}\,B_1\,\overline{B_0}$$

K-Map For A>B

A_1A_0 \ B_1B_0	00	01	11	10
00	0	0	0	0
01	1	0	0	0
11	1	1	0	1
10	1	1	0	0

$$Y_3 = A_0\,\overline{B_1}\,\overline{B_0} + A_1\,\overline{B_1} + A_1A_0\,\overline{B_0}$$

For A=B From K-Map

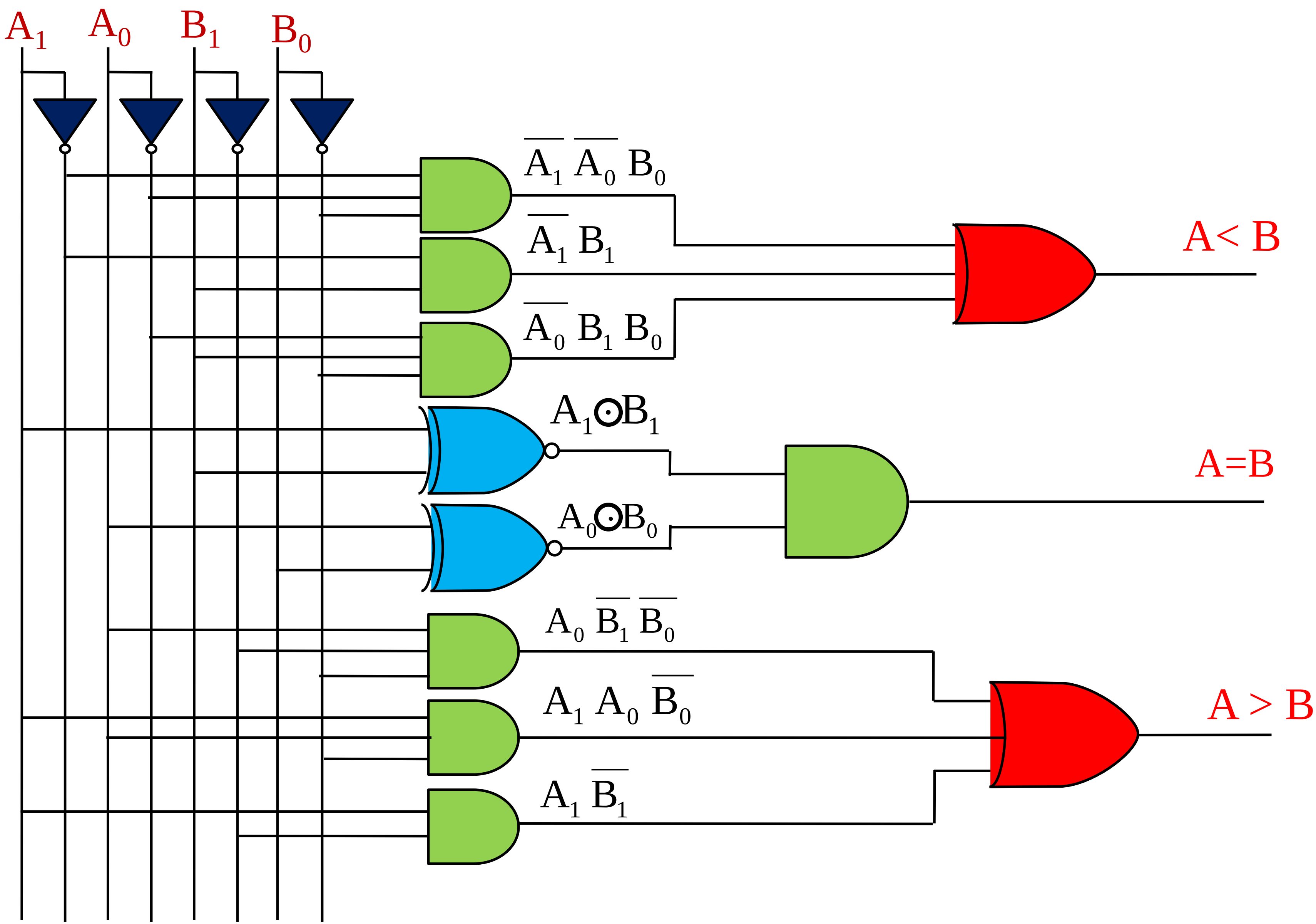
$$Y_2 = \overline{A_1}\,\overline{A_0}\,\overline{B_1}\,\overline{B_0} + \overline{A_1}\,A_0\,\overline{B_1}\,B_0 + A_1A_0B_1B_0 + A_1\,\overline{A_0}\,B_1\,\overline{B_0}$$

$$Y_2 = \overline{A_0}\,\overline{B_0}(\overline{A_1}\,\overline{B_1} + A_1B_1) + A_0B_0(\overline{A_1}\,\overline{B_1} + A_1B_1)$$

$$Y_2 = (\overline{A_1}\,\overline{B_1} + A_1B_1)\;(\overline{A_0}\,\overline{B_0} + A_0B_0)$$

$$Y_2 = (A_1 \odot B_1)(A_0 \odot B_0)$$

LOGIC DIAGRAM OF 2-BIT COMPARATOR:



THANK YOU

Quick Quiz (Poll 1)

- If two numbers are not equal then binary variable will be ______________
  a) 0
  b) 1
  c) A
  d) B

Quick Quiz (Poll 2)

- Comparators are used in ______________

  a) Memory
  b) CPU
  c) Motherboard
  d) Hard drive