Comparators

The basic function of a **comparator** is to compare the magnitudes of two binary quantities to determine the relationship of those quantities

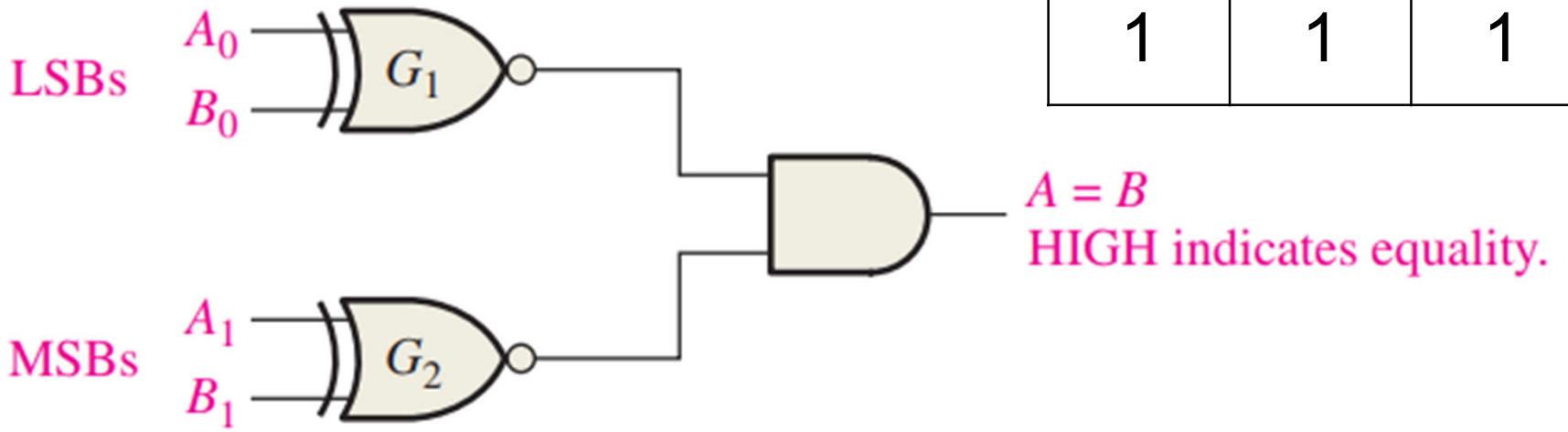
A	B	A<B	A=B	A>B
0	0	0	1	0
0	1	1	0	0
1	0	0	0	1
1	1	0	1	0

Comparators

Equality comparator

A	B	A=B
0	0	1
0	1	0
1	0	0
1	1	1

2-bit Equality comparator

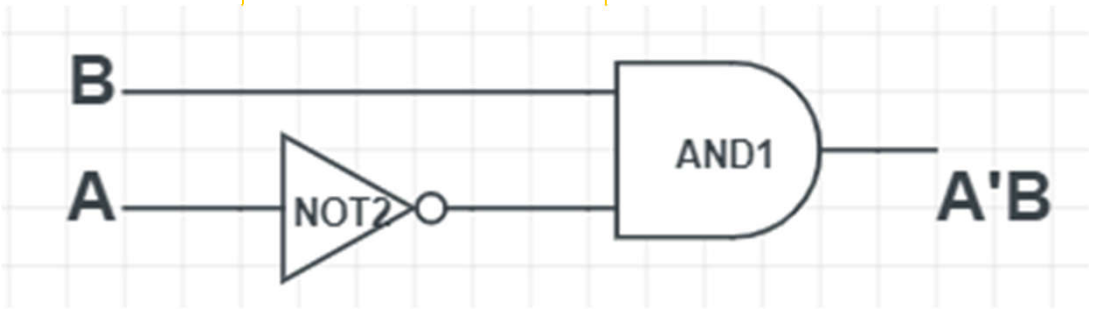


Comparators

Inequality Comparator

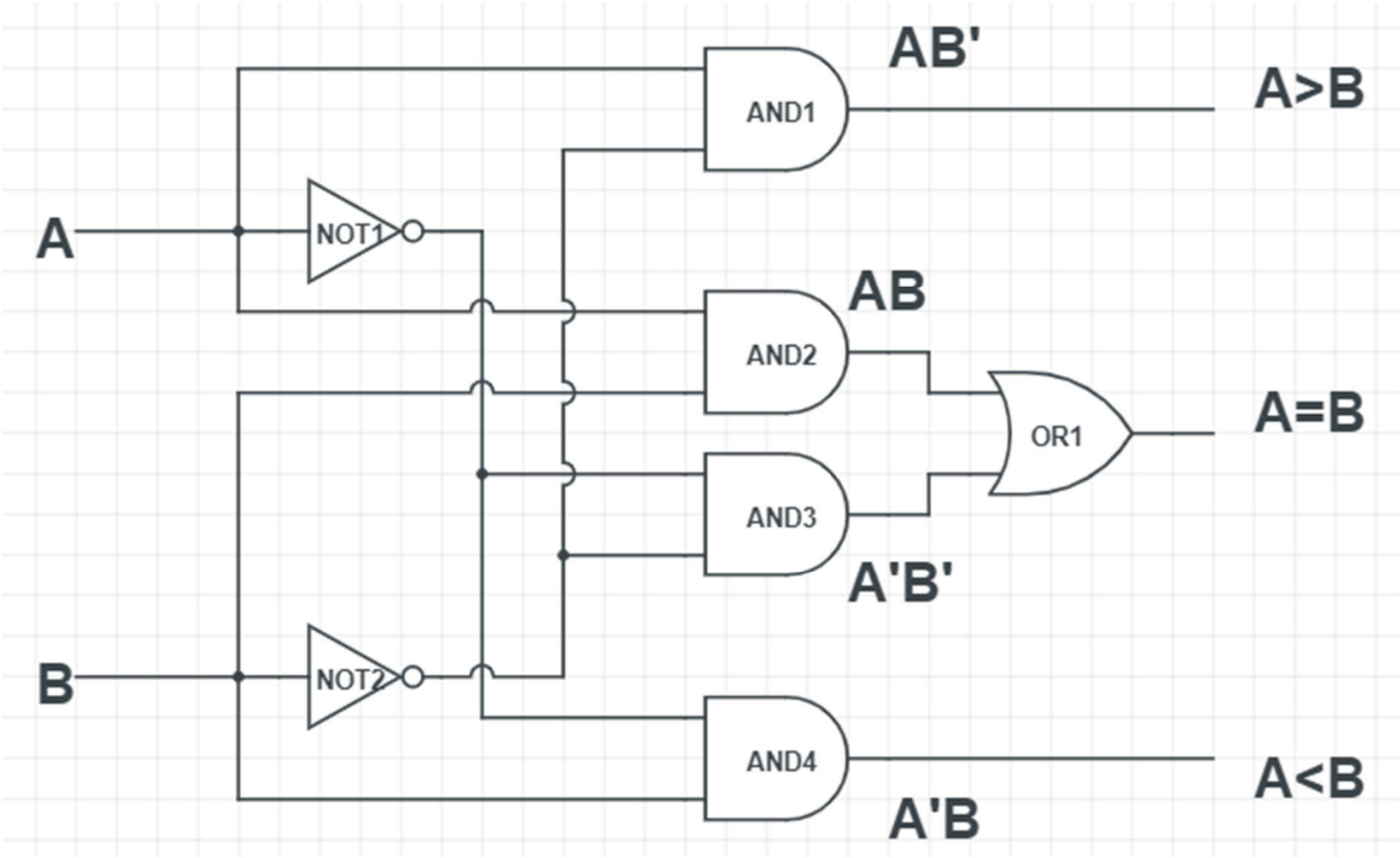
$A > B = AB'$

$A < B = A'B$



A	B	A<B	A>B
0	0	0	0
0	1	1	0
1	0	0	1
1	1	0	0

Comparators



Comparators

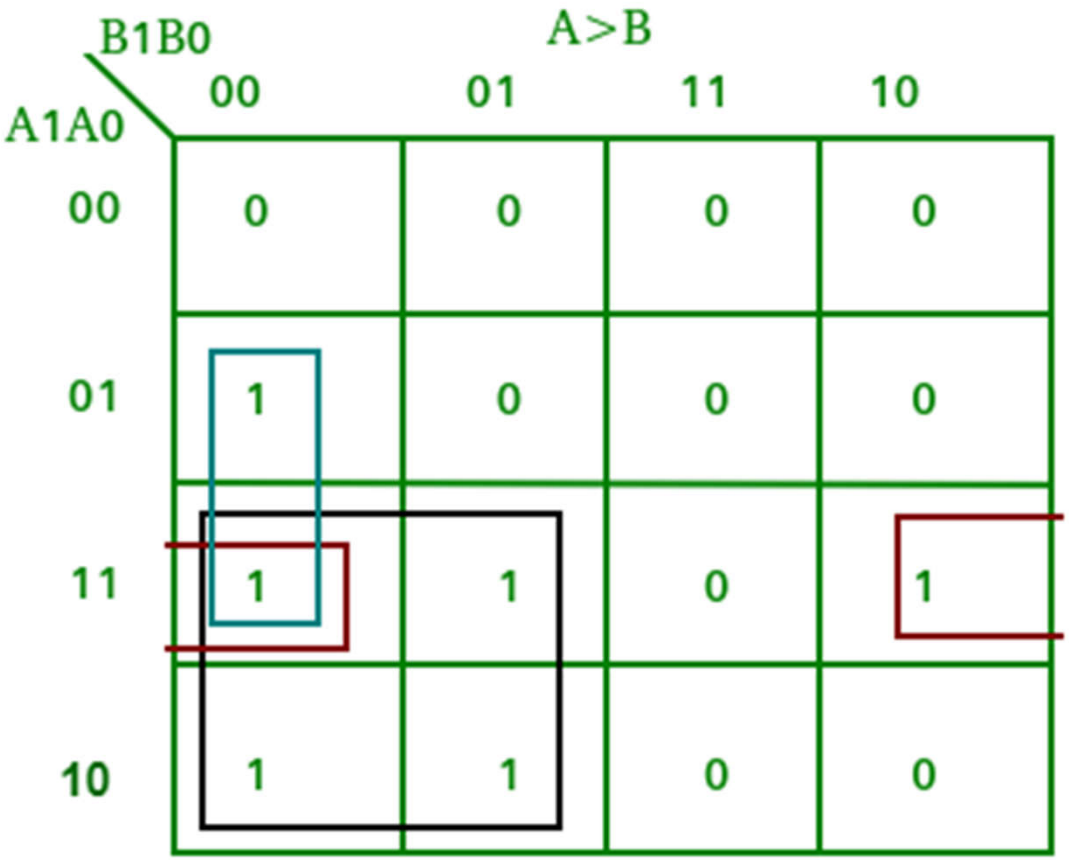
2-bit Comparator

INPUT				OUTPUT		
A1	A0	B1	B0	A<B	A=B	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

The table shows all the possible comparisons for two 2-bit numbers.

We can use Karnaugh maps to identify the implementation circuits.

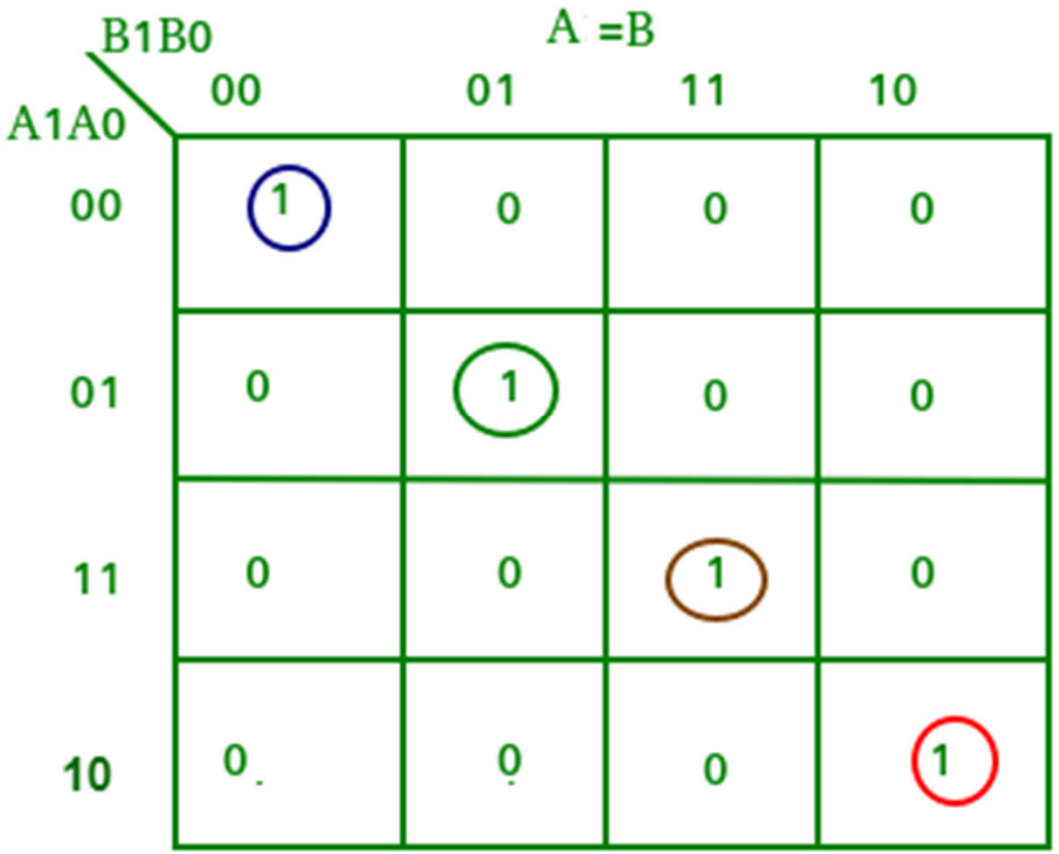
Comparators 2-bit Comparator



For A>B

= A1B1' +
A0B1'B0' +
A1A0B0'

Comparators 2-bit Comparator



For A=B

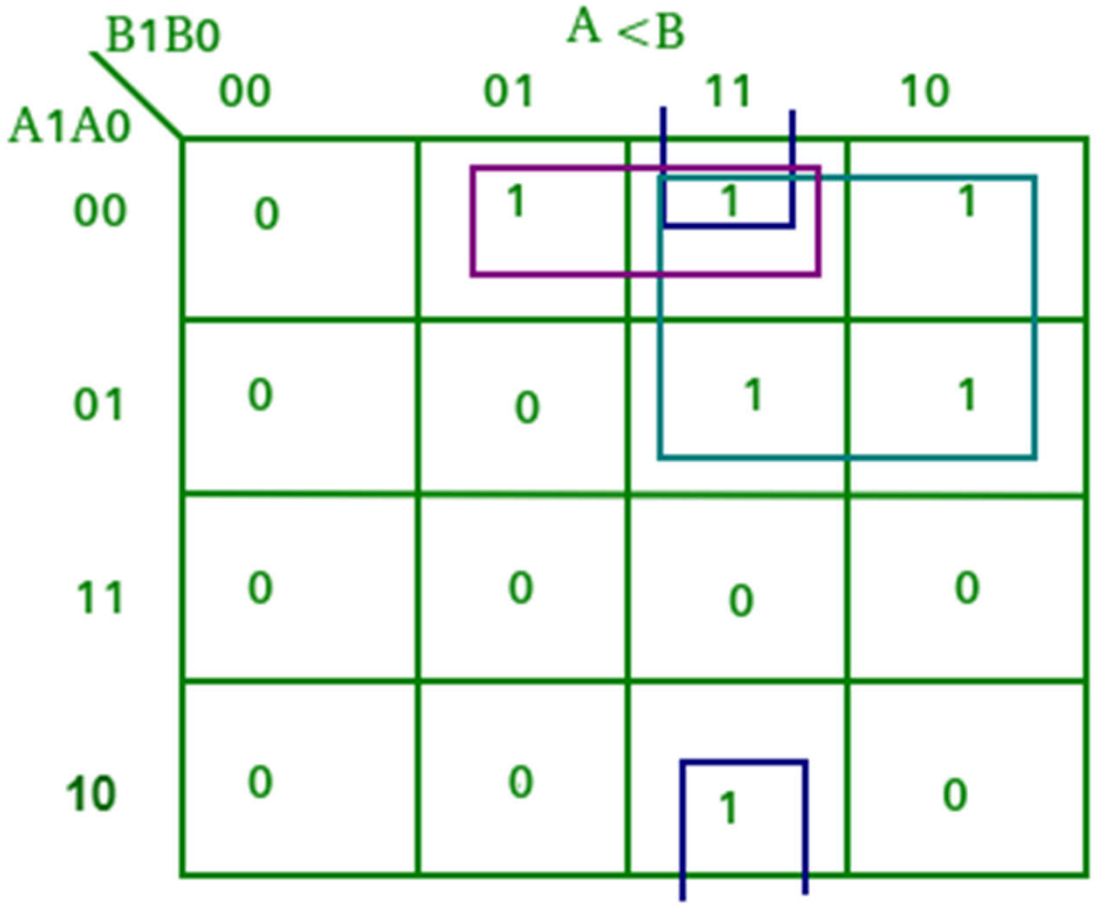
=

A1'A0'B1'B0' +
A1'A0B1'B0 +
A1A0B1B0 +
A1A0'B1B0'

=

(A0 XNOR B0) .
(A1 XNOR B1)

Comparators 2-bit Comparator



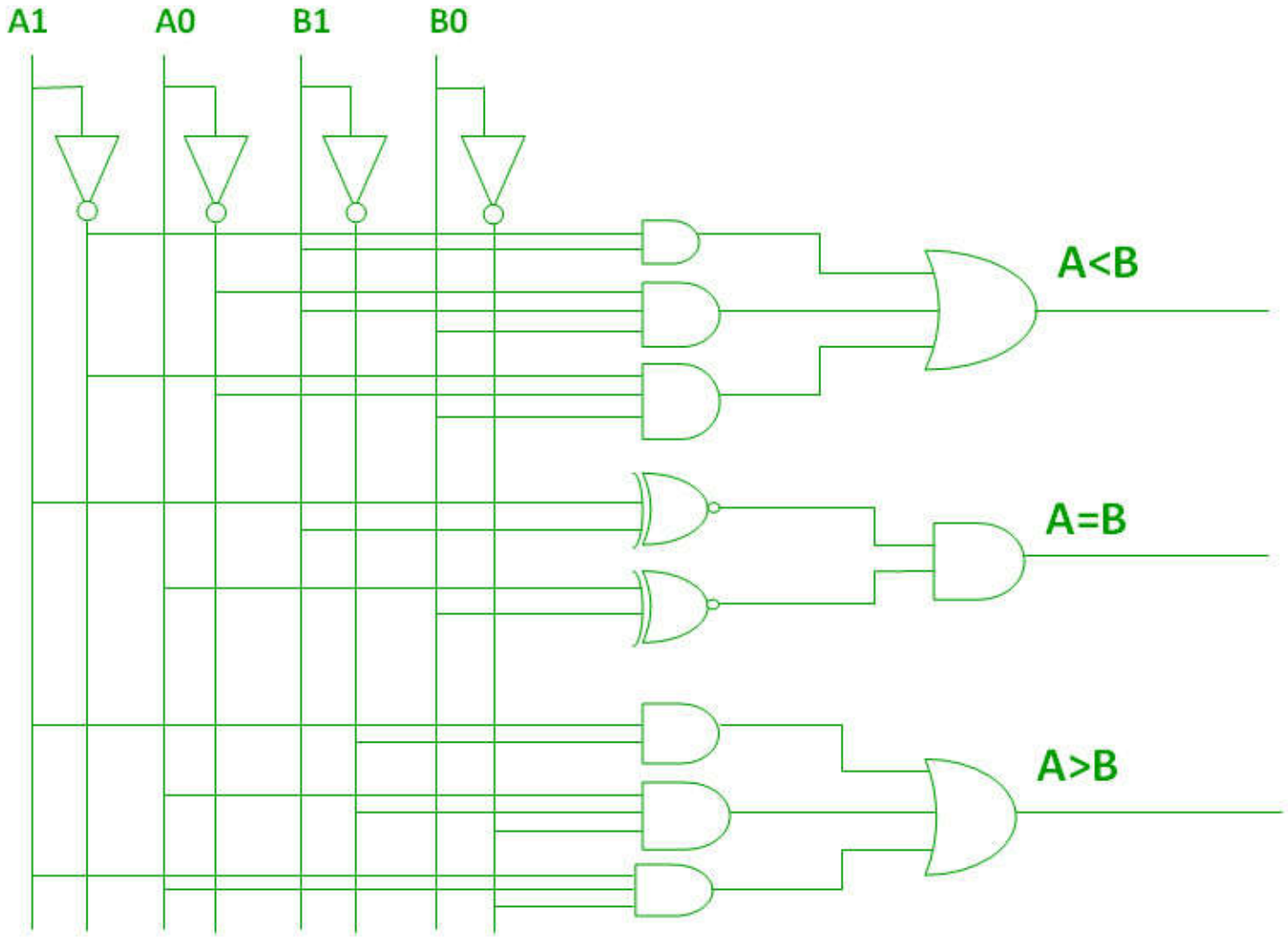
For A<B

=

A1’B1 +
A0’B1B0 +
A1’A0’B0

Comparators

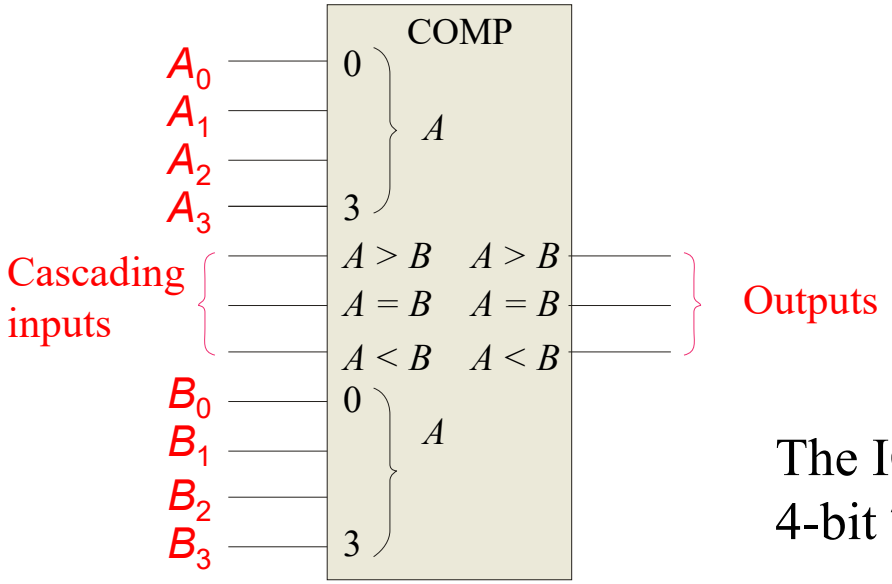
2-bit Comparator Circuit Implementation



Summary

Comparators

IC comparators provide outputs to indicate which of the numbers is larger or if they are equal. The bits are numbered starting at 0, rather than 1 as in the case of adders. Cascading inputs are provided to expand the comparator to larger numbers.

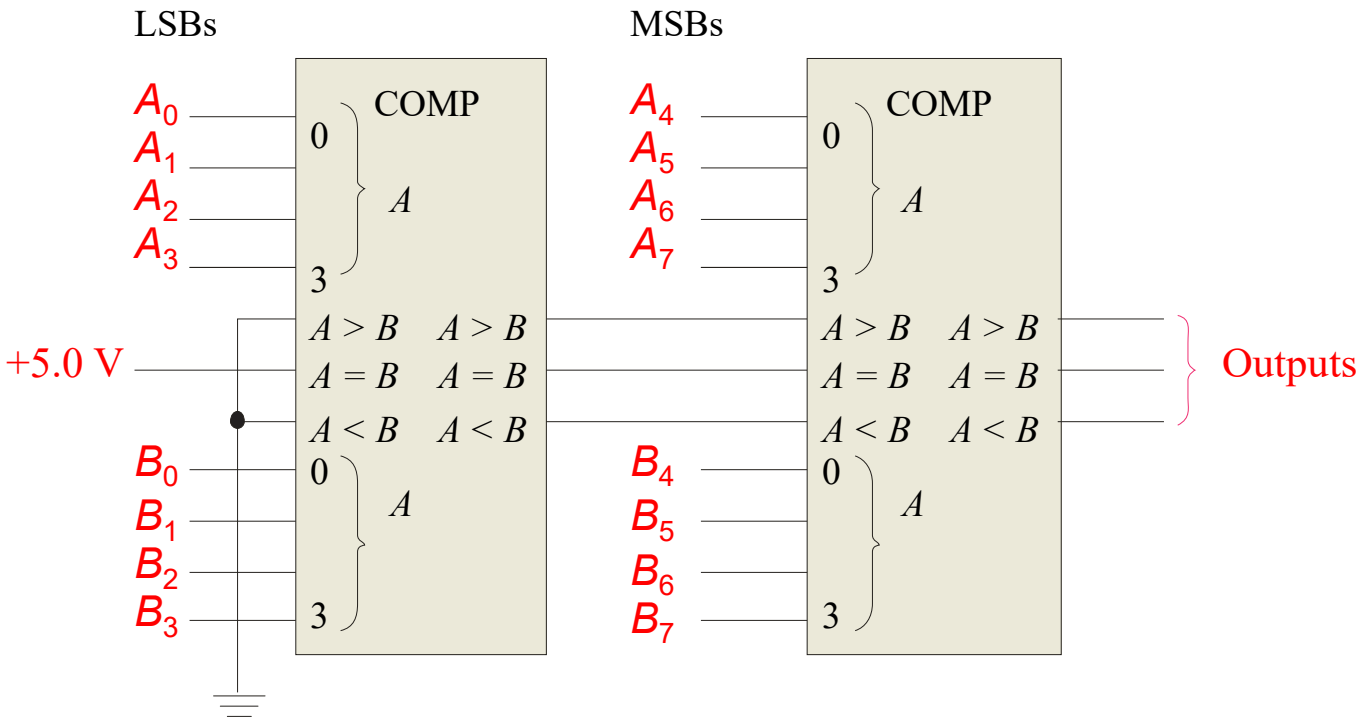


The IC shown is the 4-bit 74LS85.

Summary

Comparators

IC comparators can be expanded using the cascading inputs as shown. The lowest order comparator has a HIGH on the $A = B$ input.



Summary

Comparators

Example

Solution

How could you test two 4-bit numbers for equality?

Summary

Comparators

The function of a comparator is to compare the magnitudes of two binary numbers to determine the relationship between them. In the simplest form, a comparator can test for equality using XNOR gates.

Example

How could you test two 4-bit numbers for equality?

Solution

AND the outputs of four XNOR gates.