Page No.
Date.

Experiment-3

Realisation of Parallel adder using IC 4008.

Aim: To realise parallel adder using IC 4008.

Theory: A digital circuit that adds two binary numbers of any bit length in parallel form and produces the sum of those number in parallel form is called a parallel adder.

⇒ A parallel adder basically consists of full adders in a chain form.
⇒ Here, the output bit of each full adder is connected to the input carry terminal of the next full adder circuit in the chain.

Working Principle of Parallel Adder:

The parallel adder performs the binary addition of two numbers as per the following step:

Step 1: Firstly the full adder circuit FA_1, adds the bits A_1 and B_1 along with the input carry bit C_{in} to produce the sum bit S_1, where it is the LSB of the output sum. At this stage,

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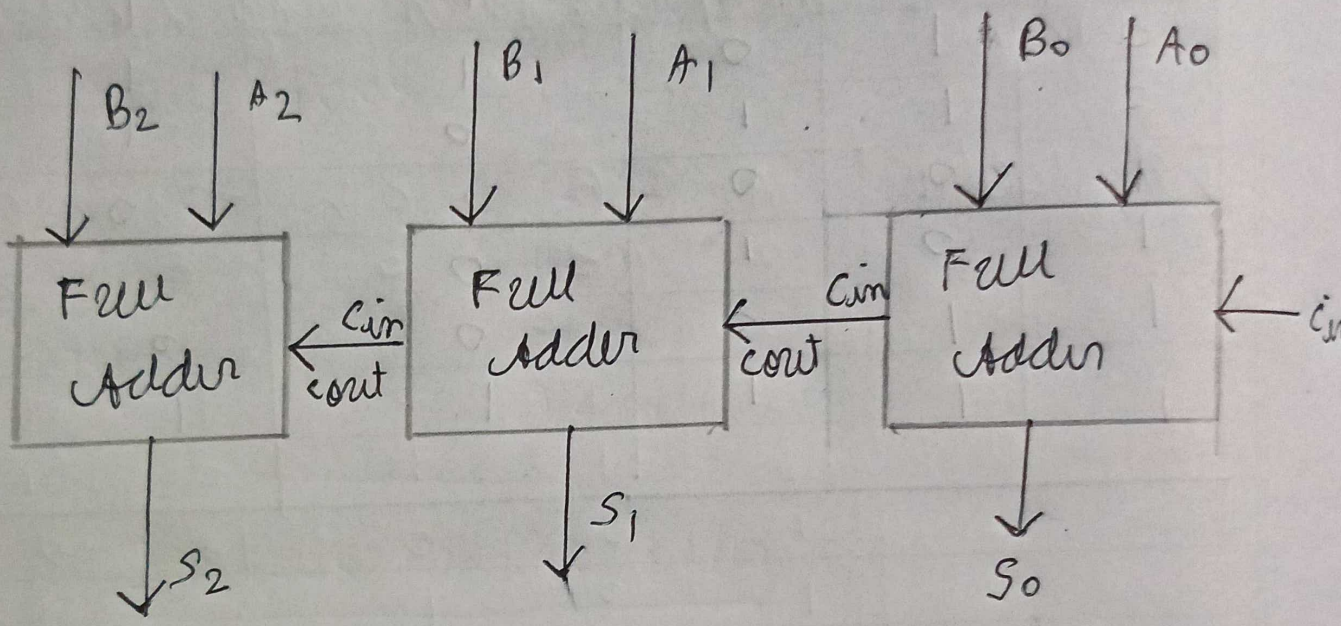

Block diagram of 3-bit parallel adder

Expt.No.

Page No.
Date.

a carry bit C_1 is generated which is transferred to the next full adder circuit in the chain.

Step 2: The full adder circuit FA_2 adds bits A_2 and B_2 along with the carry bit C_1 from the previous addition. It produces the sum bit S_2 which is the second bit of the output sum, and a carry bit C_2 is also produced which again forwarded to the next full adder FA_3.

Step 3: The full adder circuit FA_3 adds input bits A_3 and B_3 along with the carry bit C_2 from previous addition to produce sum bit S_3 and carry bit C_3.

Step 4: The full adder circuit FA_4 adds input bits A_4 and B_4 along with the carry bit C_3 forward from FA_3. It generates the last sum bit S_4 and a last carry bit C_4.

Step 5: The output sum of the parallel adder is then given by $SOut = C_4 S_4 S_3 S_2 S_1$

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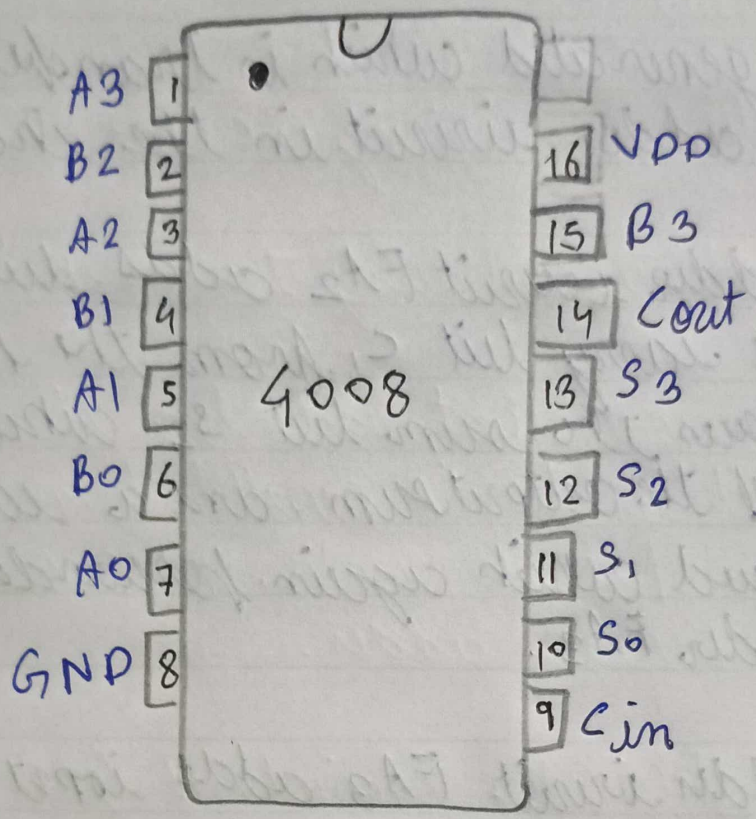

IC 4008 Parallel Adder

Expt.No.

Page No./
Date./

Constructing a Parallel Adder

1) The A0 to A3 pins are the inputs for the 4 bits of the number A.

2) The B0 to B3 pins are the inputs for the 4 bits of number B.

3) The Cin Pin is the input for a carry in bit. It's only used if you are combining several adders. set to Low when not in used.

4) The S0 to S3 pins are the outputs for the 4 bits of the sum S.

5) The Cout pin is the output for the 5th bit of the sum S (or Carry out bit)

Pin Overview:

Pin Name	Pin #	Type	Description
VDD	16	Power	Supply voltage (-3 to -15 V)

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Expt. No.

Page No. /
Date. /

GND	8	Power	Ground (0V)
A0 to A3	7, 5, 3, 1	Input	Bits 0 to 3 for input number A
B0 to B3	6, 4, 2, 15	Input	Bits 0 to 3 for input number B
C_{IN}	9	Input	Carry-In bit
S0 to S3	10, 11, 12, 13	Output	Bits 0 to 3 for output sum's
Cout	14	Output	Carry out Bit (Bit 4 o

Conclusion :

Consider an example of $(100)_2 + (011)_2$

Here, X = 100 (X2 = 1, X1 = 0, X0 = 0)
Y = 011 (Y2 = 0, Y1 = 1, Y0 = 1)

In 1st Full Adder,

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Expt.No.

Page No.
Date.

$S_0 = X_0 + Y_0 + C_{in} = 0 + 1 + 0 = 1$

$C_0 = 0$

In 2nd full adder,

$S_1 = X_1 + Y_1 + C_0 = 0 + 1 + 0 = 1$

$C_1 = 0$

In 3rd full adder,

$S_2 = X_2 + Y_2 + C_1 = (+0)1^0 = 1$

$C_2 = 0$

Thus, $X = 100 = 4$

$Y = 011 = 3$

$Sum = 0111 = 7$