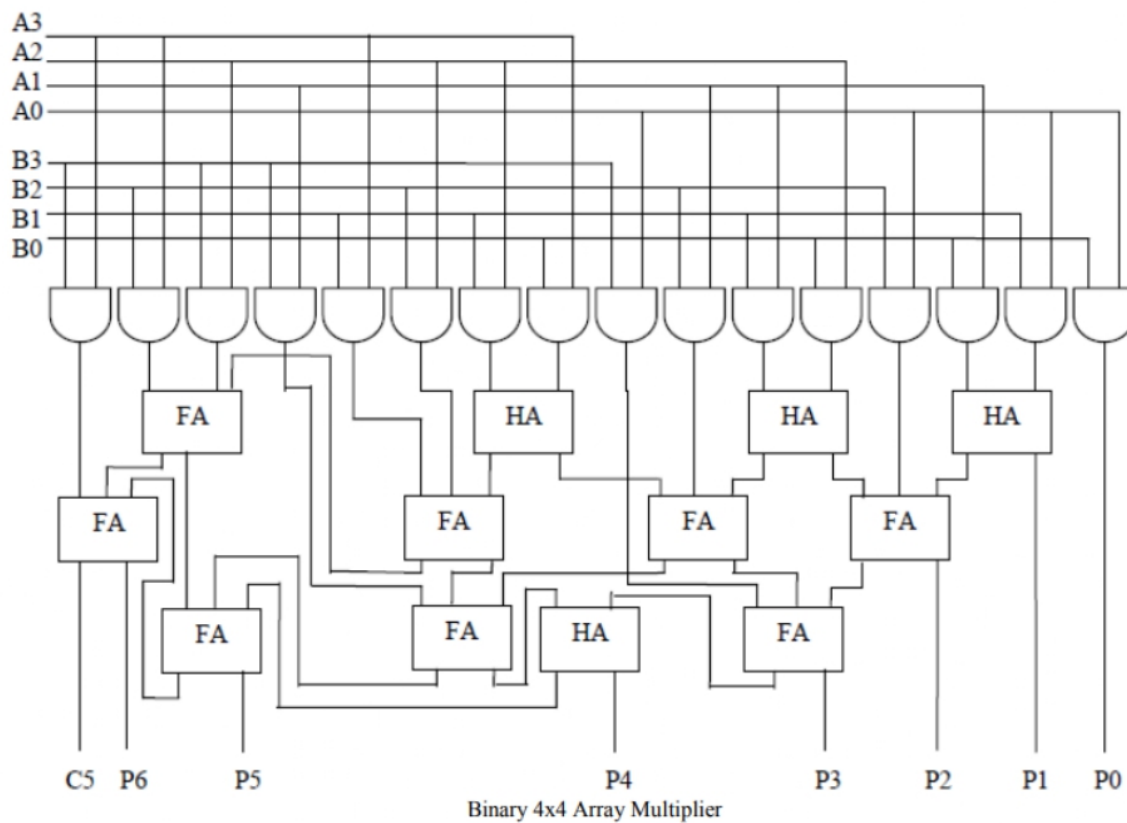


Vlsi final project :2

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The circuit need to be implemented



Implementation by ngspice:

The technology file taken is 180nm. The implementation is by using 4 four-bit adders which are implemented by xor gates. For the final circuit different subcircuits are called accordingly.

And then delay is calculated and shown below .

Delay calculation shown below

```
1 A0: 0 A1: 0 A2: 0 A3: 0
2 B0: 0 B1: 0 B2: 0 B3: 0
3 Maximum Delay: 3.56815E-11
4 -----
5 A0: 0 A1: 0 A2: 0 A3: 0
6 B0: 0 B1: 0 B2: 0 B3: 0
7 Maximum Delay: 3.56815E-11
8 -----
9 A0: 0 A1: 0 A2: 0 A3: 0
10 B0: 0 B1: 0 B2: 0 B3: 0
11 Maximum Delay: 3.56815E-11
12 -----
13 A0: 0 A1: 0 A2: 0 A3: 0
14 B0: 0 B1: 0 B2: 0 B3: 0
15 Maximum Delay: 3.56815E-11
16 -----
17 A0: 0 A1: 0 A2: 0 A3: 0
18 B0: 0 B1: 0 B2: 0 B3: 0
19 Maximum Delay: 3.56815E-11
20 -----
21 A0: 0 A1: 0 A2: 0 A3: 0
22 B0: 0 B1: 0 B2: 0 B3: 0
23 Maximum Delay: 3.56815E-11
24 -----
```

Implementation in verilog

Logic file are written for all the subfiles and finally included in the multiplier file.

Command in the terminal : 1. iverilog -o test_tb Multiplier_4x4.v Multiplier_4x4_tb.v

2. vvp test_tb

Output:

The logic implementation can be verified by the following output.

```
U+  [ajay@ray: ~/Desktop/vlsi_2021102032/verilog]
on
time =191000    A =1111, B =1011 and Product =10100101
time =192000    A =0000, B =1100 and Product =10100100
time =192000    A =0000, B =1100 and Product =01101100
time =192000    A =0000, B =1100 and Product =01001000
time =192000    A =0000, B =1100 and Product =01000000
time =192000    A =0000, B =1100 and Product =00100000
time =192000    A =0000, B =1100 and Product =00101000
time =192000    A =0000, B =1100 and Product =00011000
time =192000    A =0000, B =1100 and Product =00010000
time =192000    A =0000, B =1100 and Product =00000000
time =193000    A =0001, B =1100 and Product =00000100
time =193000    A =0001, B =1100 and Product =00001100
time =193000    A =0001, B =1100 and Product =00011100
time =193000    A =0001, B =1100 and Product =00001100
time =194000    A =0010, B =1100 and Product =00001000
time =194000    A =0010, B =1100 and Product =00011000
```

Implementation by magic:

Here the technology file included is TSMC_180nm.txt .

Command in terminal: magic multiplier.mag

In magic nand gate implementation is done. Xor gate is implemented by using 4 nand gate.

After then using xor gate half adder and full adder is designed to get the final multiplier circuit.

Output