**EXPERIMENT NO 5 : Half Adder ,Full Adder ,4 Bit full Adder**

Half Adder

**Program:**

module ha(s,c,a,b);

input a,b;

output s,c;

wire s1,c1,c2;

xor(s1,a,b);

and(c1,a,b);

xor(s,s1);

and(c2,s1);

xor(c2,c1);

endmodule

**Testbench:**

`timescale 1ns/1ps

module fatest\_v;

reg a,b;

wire s;

ha uut(s,c,a,b);

initial

begin

a=0;b=0;

#50 a=0; b=1;

#50 a=1; b=0;

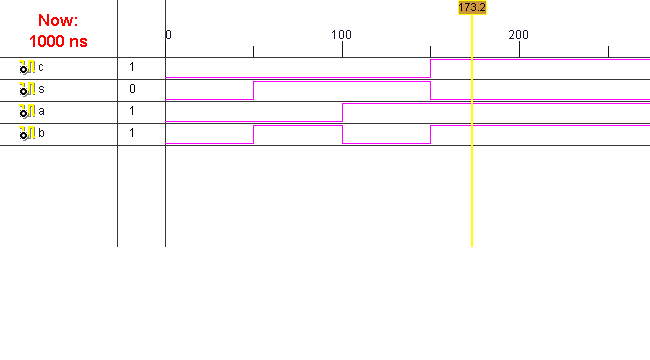
#50 a=1; b=1;

#50;

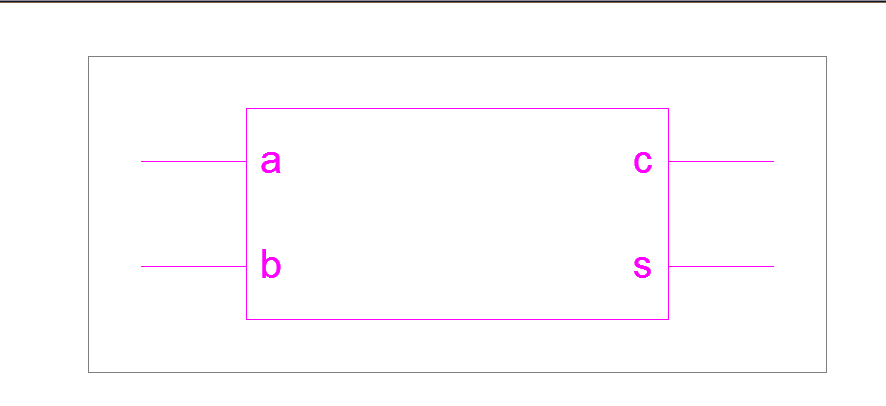
end

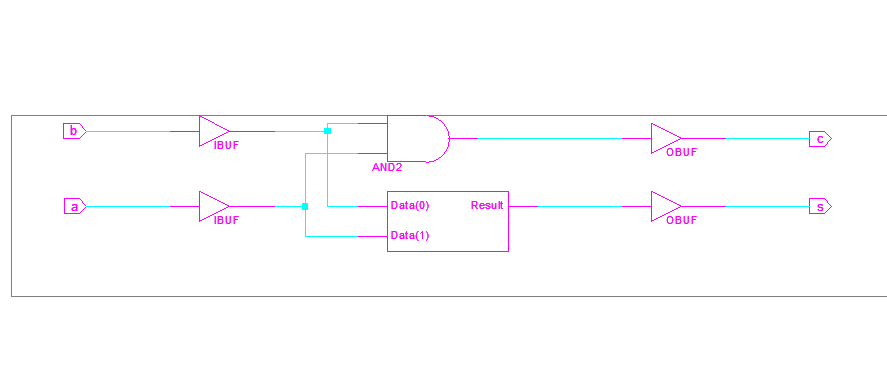
endmodule

**Waveforms:**



**Half adder:**





Final Results

RTL Top Level Output File Name : ha1.ngr

Top Level Output File Name : ha1

Output Format : NGC

Optimization Goal : Speed

Keep Hierarchy : YES

Target Technology : Automotive 9500XL

Macro Preserve : YES

XOR Preserve : YES

Clock Enable : YES

wysiwyg : NO

Design Statistics

# IOs : 4

Cell Usage :

# BELS : 2

# AND2 : 1

# XOR2 : 1

# IO Buffers : 4

# IBUF : 2

# OBUF : 2

CPU : 1.41 / 1.56 s | Elapsed : 2.00 / 2.00 s

Total memory usage is 114468 kilobytes

Number of errors : 0 ( 0 filtered)

Number of warnings : 0 ( 0 filtered)

Number of infos : 0 ( 0 filtered)

**Full adder:**

Program:

module fa(s,cn,a,b,an);

input a,b,an;

output s,cn;

wire s1,c1,c2;

xor(s1,a,b);

and(c1,a,b);

xor(s,s1,an);

and(c2,s1,an);

xor(cn,c2,c1);

endmodule

**Test bench:**

`timescale 1ns/1ps

module fatest\_v;

reg a,b,an;

wire s,cn;

fa uut(s,cn,a,b,an);

initial

begin

a=0;b=0;an=0;

#50 a=0; b=0;an=0;

#50 a=0; b=0;an=1;

#50 a=0; b=1;an=0;

#50 a=0; b=1;an=1;

#50 a=1; b=0;an=0;

#50 a=1; b=0;an=1;

#50 a=1; b=1;an=0;

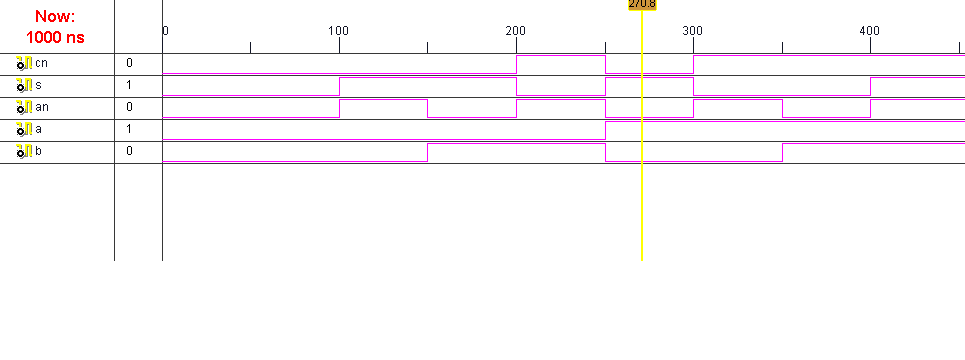
#50 a=1; b=1;an=1;

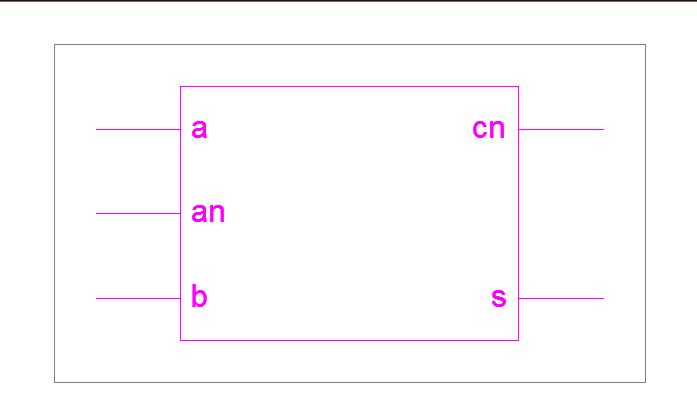
#50;

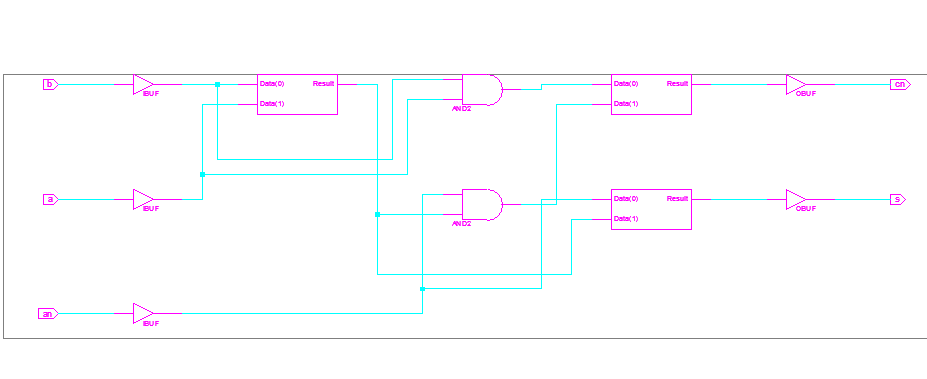
end

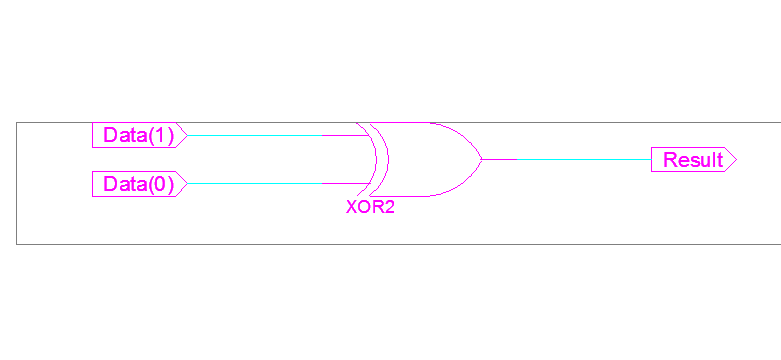
endmodule

**Waveform:**

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**Final Report:**

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\* Final Report \*

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Final Results

RTL Top Level Output File Name : fa.ngr

Top Level Output File Name : fa

Output Format : NGC

Optimization Goal : Speed

Keep Hierarchy : YES

Target Technology : Automotive 9500XL

Macro Preserve : YES

XOR Preserve : YES

Clock Enable : YES

wysiwyg : NO

Design Statistics

# IOs : 5

Cell Usage :

# BELS : 5

# AND2 : 2

# XOR2 : 3

# IO Buffers : 5

# IBUF : 3

# OBUF : 2

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CPU : 1.42 / 1.58 s | Elapsed : 2.00 / 2.00 s

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Total memory usage is 133320 kilobytes

Number of errors : 0 ( 0 filtered)

Number of warnings : 0 ( 0 filtered)

Number of infos : 0 ( 0 filtered)