

Experiment 5

VLSI

Wallace Tree Multiplier

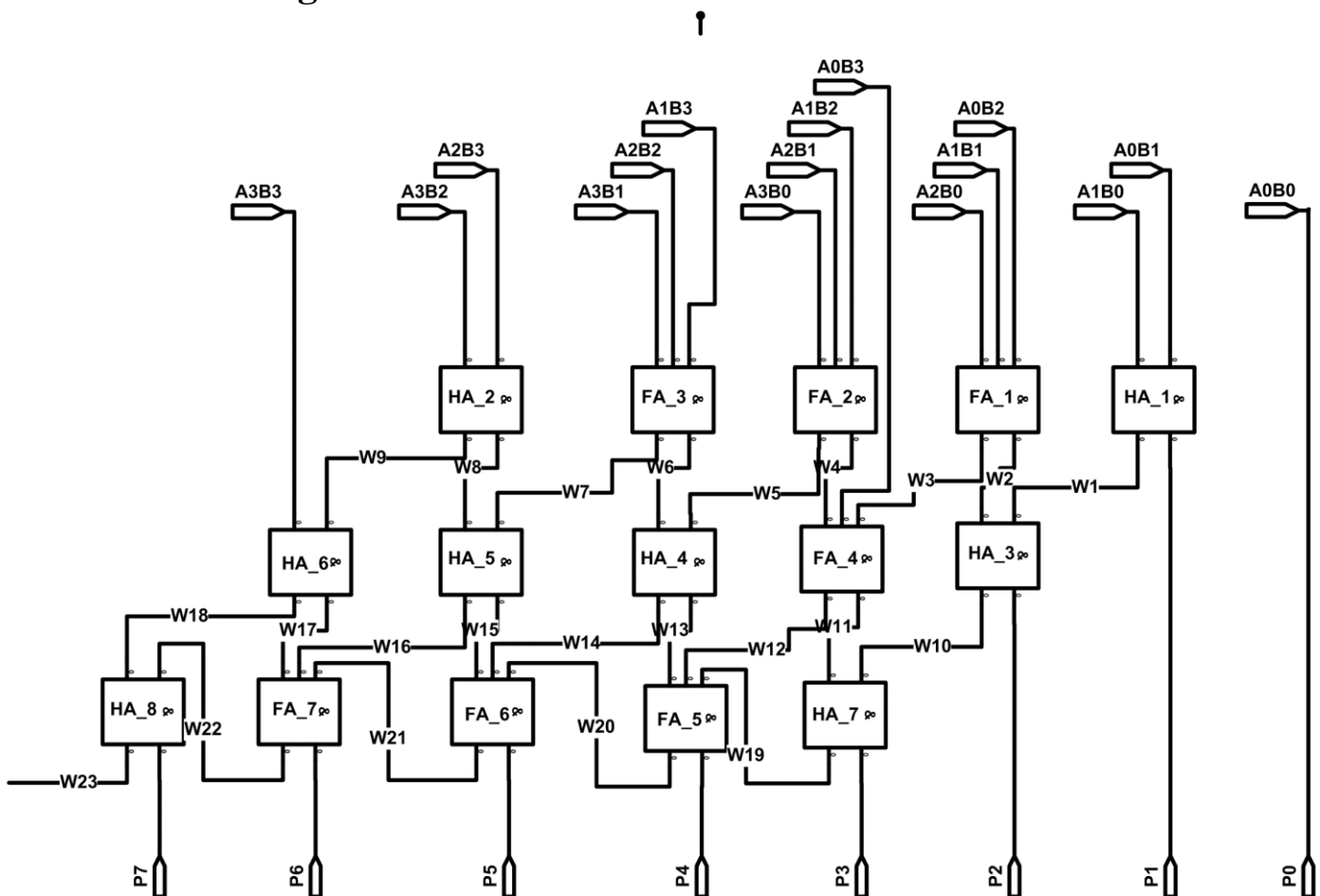
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L47+L48

Objective:

To design, implement and test Wallace Tree Multiplier circuit using Xilinx ISE Tool.

Circuit Diagram:

Design code:

```
module wt_4bit_mul(
    input [3:0] a,
    input [3:0] b,
    output [7:0] p);
    wire [23:1] w;
    assign p[0]=a[0]&b[0];
    ha_df ha1(a[1]&b[0],a[0]&b[1],p[1],w[1]);
    fa_df fa1(a[2]&b[0],a[1]&b[1],a[0]&b[2],w[2],w[3]);
    fa_df fa2(a[3]&b[0],a[2]&b[1],a[1]&b[2],w[4],w[5]);

    fa_df fa3(a[3]&b[1],a[2]&b[2],a[1]&b[3],w[6],w[7]);
    ha_df ha2(a[3]&b[2],a[2]&b[3],w[8],w[9]);
    ha_df ha3(w[2],w[1],p[2],w[10]);

    fa_df fa4(a[0]&b[3],w[4],w[3],w[11],w[12]);
    ha_df ha4(w[5],w[6],w[13],w[14]);
    ha_df ha5(w[7],w[8],w[15],w[16]);

    ha_df ha6(a[3]&b[3],w[9],w[17],w[18]);
    ha_df ha7(w[10],w[11],p[3],w[19]);
    fa_df fa5(w[12],w[13],w[19],p[4],w[20]);

    fa_df fa6(w[14],w[15],w[20],p[5],w[21]);
    fa_df fa7(w[16],w[17],w[21],p[6],w[22]);
    ha_df ha8(w[18],w[22],p[7],w[23]);
endmodule
```

Test Bench Code:

```
module wt_4bit_mul_test;

    // Inputs
    reg [3:0] a;
    reg [3:0] b;

    // Outputs
    wire [7:0] p;
    reg[7:0] check;

    // Instantiate the Unit Under Test (UUT)
    wt_4bit_mul uut (
        .a(a),
        .b(b),
        .p(p)
    );

    initial repeat(20) begin
        // Initialize Inputs
        a = $random;
        b = $random;
        check=a*b;

        // Wait 100 ns for global reset to finish
        #10 $display($time,"%d*%d=%d(%d)",a,b,p,check);
    end
endmodule
```

Result:

Successfully designed, implemented and tested Wallace Tree Multiplier circuit using Xilinx ISE Tool.

Device utilization summary:

Selected Device : 3s500efg320-4

Number of Slices:	18 out of 4656	0%
Number of 4 input LUTs:	32 out of 9312	0%
Number of IOs:	16	
Number of bonded IOBs:	16 out of 232	6%

Timing Summary:

Speed Grade: -4

Minimum period: No path found

Minimum input arrival time before clock: No path found

Maximum output required time after clock: No path found

Maximum combinational path delay: 15.104ns

