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Carry Select Adder

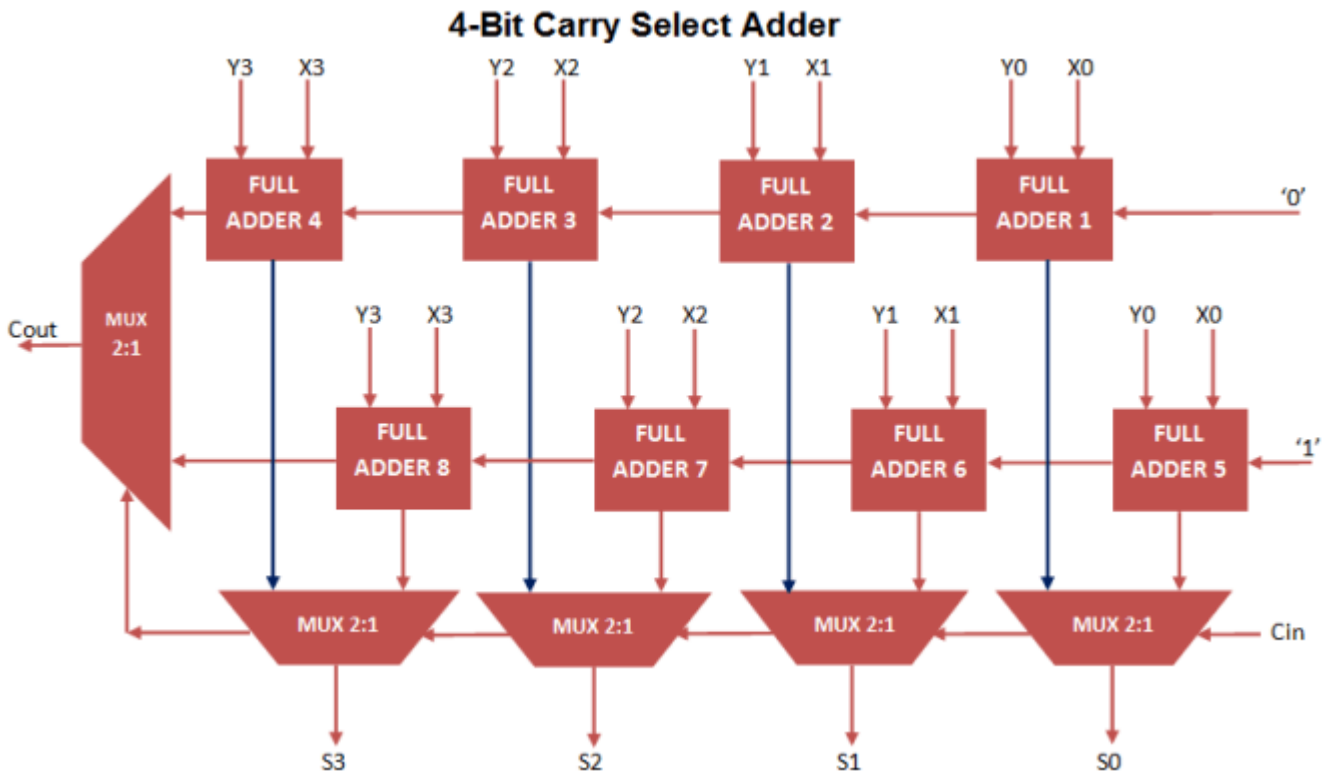
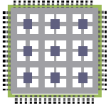
Carry Select Adder VHDL Code can be Constructed by implementing 2 stage Ripple Carry Adder and multiplexer circuit. Carry Select Adder select the sum and carry output from stage 1 ripple carry adder when carry input '0' and select Sum and carry output from stage 2 ripple carry adder, when carry input '1'.

For the purpose of selecting sum and carry output, N+1 Multiplexer is implemented for N bit Addition Operation.

4 Bit Carry Select Adder VHDL Code consist 2 numbers of 4- bit Ripple Carry Adder and 5 numbers of 2 to 1 Mux. For constructing Ripple carry Adder again implement [Full Adder VHDL code](#) using Port Mapping technique.

The Carry select Adder can also constructed using carry look ahead adder to decrease propagation delay. 4-bit Carry Select Adder Circuit can be constructed as follow.

4-Bit Carry Select Adder Architecture

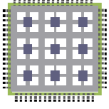


Carry Select Adder VHDL Code

```
library IEEE;
use IEEE.STD_LOGIC_1164.ALL;

entity carry_select_adder is
Port ( X : in STD_LOGIC_VECTOR (3 downto 0);
      Y : in STD_LOGIC_VECTOR (3 downto 0);
      CARRY_IN : in STD_LOGIC;
      SUM : out STD_LOGIC_VECTOR (3 downto 0);
      CARRY_OUT : out STD_LOGIC);
end carry_select_adder;

architecture Behavioral of carry_select_adder is
```



```
component full_adder_vhdl_code
Port ( A : in STD_LOGIC;
      B : in STD_LOGIC;
      Cin : in STD_LOGIC;
      S : out STD_LOGIC;
      Cout : out STD_LOGIC);
end component;

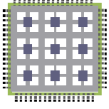
component mux2_1
port(
A,B : in STD_LOGIC;
Sel: in STD_LOGIC;
Z: out STD_LOGIC
);
end component;

signal A,B,C0,C1: STD_LOGIC_VECTOR( 3 DOWNT0 0);
begin

FA1: full_adder_vhdl_code PORT MAP(X(0),Y(0),'0' ,A(0),C0(0));
FA2: full_adder_vhdl_code PORT MAP(X(1),Y(1),C0(0),A(1),C0(1));
FA3: full_adder_vhdl_code PORT MAP(X(2),Y(2),C0(1),A(2),C0(2));
FA4: full_adder_vhdl_code PORT MAP(X(3),Y(3),C0(2),A(3),C0(3));

FA5: full_adder_vhdl_code PORT MAP(X(0),Y(0),'1' ,B(0),C1(0));
FA6: full_adder_vhdl_code PORT MAP(X(1),Y(1),C1(0),B(1),C1(1));
FA7: full_adder_vhdl_code PORT MAP(X(2),Y(2),C1(1),B(2),C1(2));
FA8: full_adder_vhdl_code PORT MAP(X(3),Y(3),C1(2),B(3),C1(3));

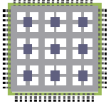
MUX1: mux2_1 PORT MAP(A(0),B(0),CARRY_IN,SUM(0));
MUX2: mux2_1 PORT MAP(A(1),B(1),CARRY_IN,SUM(1));
MUX3: mux2_1 PORT MAP(A(2),B(2),CARRY_IN,SUM(2));
MUX4: mux2_1 PORT MAP(A(3),B(3),CARRY_IN,SUM(3));
```



```
MUX5: mux2_1 PORT MAP(C0(3),C1(3),CARRY_IN,CARRY_OUT);  
  
end Behavioral;
```

2 to 1 Mux VHDL Code implementation for Port Mapping in Carry Select Adder

```
library IEEE;  
use IEEE.STD_LOGIC_1164.all;  
  
entity mux2_1 is  
port(  
  
A,B : in STD_LOGIC;  
Sel: in STD_LOGIC;  
Z: out STD_LOGIC  
);  
end mux2_1;  
  
architecture bhv of mux2_1 is  
begin  
process(A,B,Sel)  
begin  
if Sel = '0' then  
Z <= A;  
else  
Z <= B;  
end if;  
end process;  
end bhv;
```



Testbench VHDL Code for Carry Select Adder

```
LIBRARY ieee;
USE ieee.std_logic_1164.ALL;

ENTITY Tb_carry_select_adder IS
END Tb_carry_select_adder;

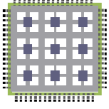
ARCHITECTURE behavior OF Tb_carry_select_adder IS

-- Component Declaration for the Unit Under Test (UUT)

COMPONENT carry_select_adder
PORT(
X : IN std_logic_vector(3 downto 0);
Y : IN std_logic_vector(3 downto 0);
CARRY_IN : IN std_logic;
SUM : OUT std_logic_vector(3 downto 0);
CARRY_OUT : OUT std_logic
);
END COMPONENT;

--Inputs
signal X : std_logic_vector(3 downto 0) := (others => '0');
signal Y : std_logic_vector(3 downto 0) := (others => '0');
signal CARRY_IN : std_logic := '0';

--Outputs
signal SUM : std_logic_vector(3 downto 0);
signal CARRY_OUT : std_logic;
```



```
BEGIN

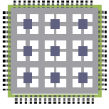
-- Instantiate the Unit Under Test (UUT)
 uut: carry_select_adder PORT MAP (
  X => X,
  Y => Y,
  CARRY_IN => CARRY_IN,
  SUM => SUM,
  CARRY_OUT => CARRY_OUT
 );

-- Stimulus process
 stim_proc: process
 begin
  -- hold reset state for 100 ns.
  wait for 100 ns;
  X <= "1011";
  Y <= "1111";

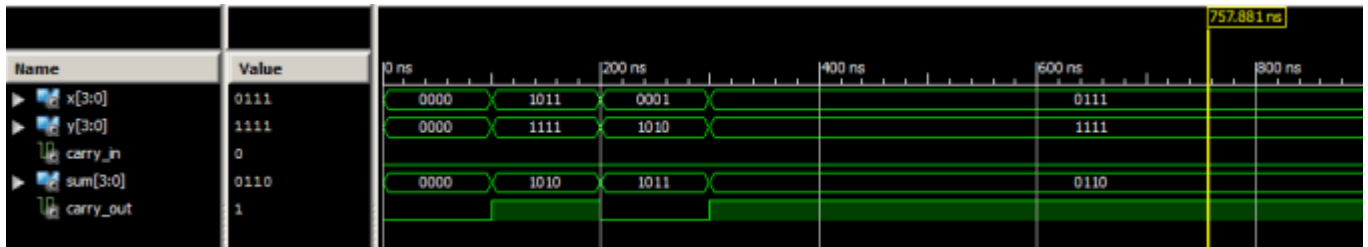
  wait for 100 ns;
  X <= "0001";
  Y <= "1010";

  wait for 100 ns;
  X <= "0111";
  Y <= "1111";
  wait;
 end process;

END;
```



Output Waveform for Carry Select Adder VHDL Code



In the above waveform, it simply perform 4 bit addition operation for input X, Y, Carry_in and Outputs Sum and Carry_out using Carry Select Adder.