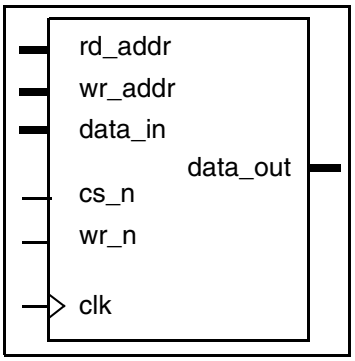
DW_ram_r_w_s_lat

Sync. Write-Port, Async. Read-Port RAM (Latch-Based)

Version, STAR and Download Information: IP Directory

Features and Benefits

- Parameterized word depth
- Parameterized data width
- Synchronous static memory



Description

DW_ram_r_w_s_lat implements a parameterized synchronous, dual-port static RAM. The RAM can perform simultaneous read and write operations.

Table 1-1 Pin Description

Pin Name	Width	Direction	Function
clk	1 bit	Input	Clock
cs_n	1 bit	Input	Chip select, active low
wr_n	1 bit	Input	Write enable, active low
rd_addr	ceil($\log_2$[*depth*]) bit(s)	Input	Read address bus
wr_addr	ceil($\log_2$[*depth*]) bit(s)	Input	Write address bus
data_in	*data_width* bit(s)	Input	Input data bus
data_out	*data_width* bit(s)	Output	Output data bus

Table 1-2 Parameter Description

Parameter	Values	Description
data_width	1 to 256 Default = none	Width of `data_in` and `data_out` buses
depth	2 to 256 Default = none	Number of words in the memory array (address width)

Table 1-3 Synthesis Implementations

Implementation Name	Function	License Feature Required
str	Synthesis model	DesignWare

Table 1-4 Simulation Models

Model	Function
DW06.DW_RAM_R_W_S_LAT_CFG_SIM	VHDL simulation configuration
dw/dw06/src/DW_ram_r_w_s_lat_sim.vhd	VHDL simulation model source code
dw/sim_ver/DW_ram_r_w_s_lat.v	Verilog simulation model source code

Write data enters the RAM through the `data_in` input port and is read out at the `data_out` port. The RAM is constantly reading regardless of the state of `cs_n`.

The `rd_addr` and `wr_addr` ports are used to address the *depth* words in the memory. For `rd_addr` beyond the maximum depth (for example, `rd_addr` = 7 and `depth` = 6), the `data_out` bus is driven low. For `wr_addr` beyond the scope of the depth, nothing occurs and the data is lost. No warnings are given during simulations when an address beyond the scope of `depth` is used.

This component contains enable signals for internal latches that are derived from the `wr_n` port. To keep hold times to a minimum, you should consider instances of this component to be individual floor planning elements.

Chip Selection, Reading and Writing

The `cs_n` input is the chip select, active low signal, that enables data to be written to the RAM. The RAM is constantly reading, regardless of the state of `cs_n`.

When `cs_n`, `wr_n` (write enable, active low), and `clk` are LOW, `data_in` is transparent to the internal memory cell being accessed by `wr_addr` (`data_in` = output data of the memory cell). Therefore, during the period when `clk` is LOW, a change in data in is reflected on the output of the internal memory cell being accessed. If `rd_addr` = `wr_addr` and `wr_n` is LOW, data passes through the RAM (`data_in` = `data_out`) when `clk` is LOW. The data is captured into the memory cell on the rising edge of `clk`.

When `cs_n` is high, writing to the RAM is disabled.

Application Notes

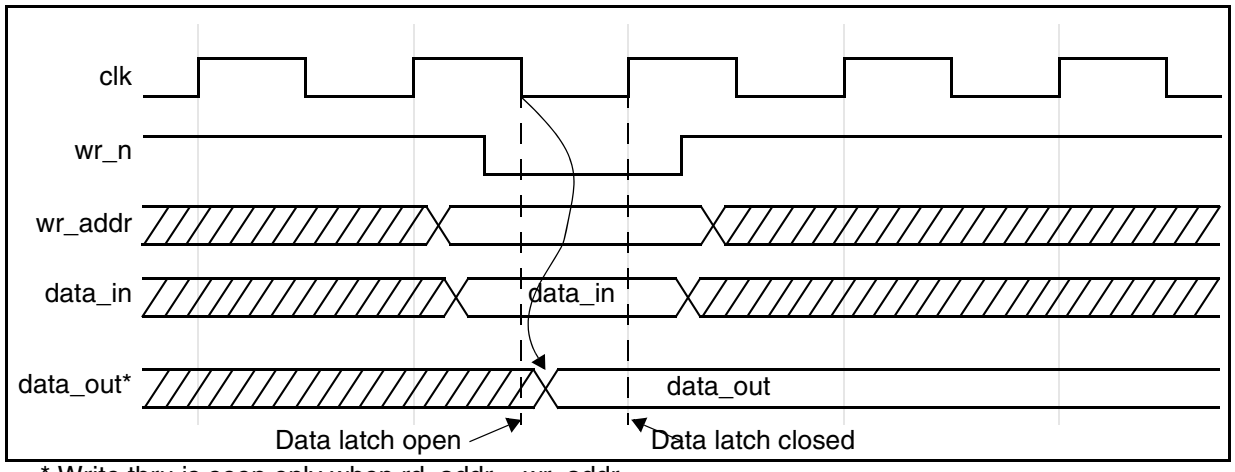
DW_ram_r_w_s_lat is intended to be used as small scratch-pad memory, programmable lookup tables, and writable control storage. Because DW_ram_r_w_s_lat is built from the cells within the ASIC cell library, it should be kept small to obtain an efficient implementation. If a larger memory is required, you should consider using a hard macro RAM from the ASIC library in use.

Timing Waveforms

Figure 1-1 shows timing diagrams for various conditions of DW_ram_r_w_s_lat.

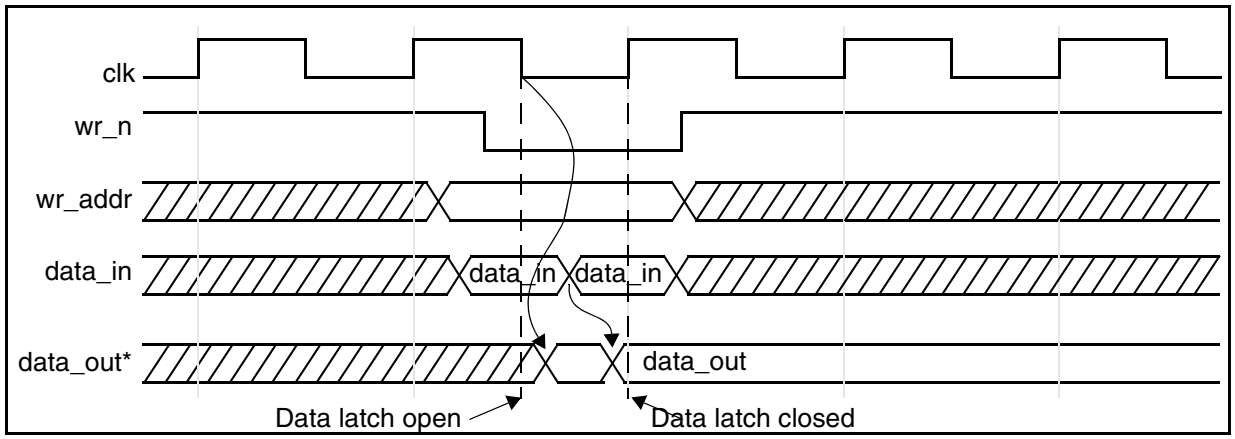
Figure 1-1 Instantiated RAM Timing Waveforms

Write Timing, cs_n = 0, Normal Data Input and Output



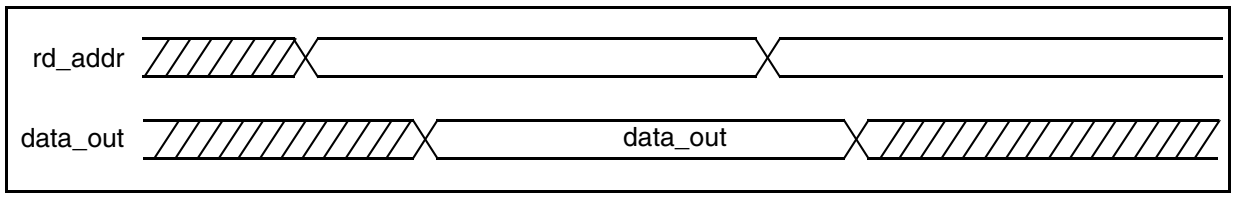
* Write thru is seen only when rd_addr = wr_addr.

Write Timing, cs_n = 0, Changing Data Input and Output



* Write thru is seen only when rd_addr = wr_addr.

Read Timing, address controlled, cs_n = don't care



Related Topics

- Memory – Synchronous RAMs Listing
- DesignWare Building Block IP Documentation Overview

HDL Usage Through Component Instantiation - VHDL

```
library IEEE,DWARE,DWARE;
use IEEE.std_logic_1164.all;
use DWARE.DWpackages.all;
use DWARE.DW_foundation_comp.all;

entity DW_ram_r_w_s_lat_inst is
  generic (inst_data_width : INTEGER := 8;
           inst_depth      : INTEGER := 8 );
  port (inst_clk     : in std_logic;
        inst_cs_n    : in std_logic;
        inst_wr_n    : in std_logic;
        inst_rd_addr : in std_logic_vector(bit_width(inst_depth)-1 downto 0);
        inst_wr_addr : in std_logic_vector(bit_width(inst_depth)-1 downto 0);
        inst_data_in : in std_logic_vector(inst_data_width-1 downto 0);
        data_out_inst : out std_logic_vector(inst_data_width-1 downto 0) );
end DW_ram_r_w_s_lat_inst;

architecture inst of DW_ram_r_w_s_lat_inst is
begin

  -- Instance of DW_ram_r_w_s_lat
  U1 : DW_ram_r_w_s_lat
    generic map ( data_width => inst_data_width,   depth => inst_depth )
    port map (clk => inst_clk,   cs_n => inst_cs_n,   wr_n => inst_wr_n,
              rd_addr => inst_rd_addr,   wr_addr => inst_wr_addr,
              data_in => inst_data_in,   data_out => data_out_inst );
end inst;

-- pragma translate_off
configuration DW_ram_r_w_s_lat_inst_cfg_inst of DW_ram_r_w_s_lat_inst is
  for inst
  end for; -- inst
end DW_ram_r_w_s_lat_inst_cfg_inst;
-- pragma translate_on
```

HDL Usage Through Component Instantiation - Verilog

```
module DW_ram_r_w_s_lat_inst(inst_clk, inst_cs_n, inst_wr_n, inst_rd_addr,
                             inst_wr_addr, inst_data_in, data_out_inst );
  parameter data_width = 8;
  parameter depth = 8;
  `define bit_width_depth 3 // ceil(log2(depth))

  input inst_clk;
  input inst_cs_n;
  input inst_wr_n;
  input [`bit_width_depth-1 : 0] inst_rd_addr;
  input [`bit_width_depth-1 : 0] inst_wr_addr;
  input [data_width-1 : 0] inst_data_in;
  output [data_width-1 : 0] data_out_inst;

  // Instance of DW_ram_r_w_s_lat
  DW_ram_r_w_s_lat #(data_width, depth)
    U1 (.clk(inst_clk),   .cs_n(inst_cs_n),   .wr_n(inst_wr_n),
        .rd_addr(inst_rd_addr),   .wr_addr(inst_wr_addr),
        .data_in(inst_data_in),   .data_out(data_out_inst) );
endmodule
```

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