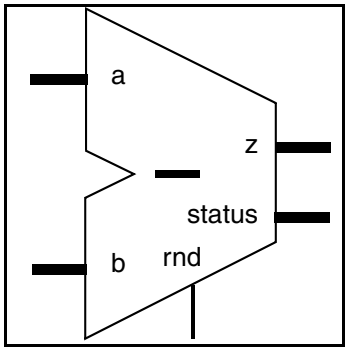
DW_fp_sub

Floating-Point Subtractor

Version, STAR and Download Information: IP Directory

Features and Benefits



- The precision is controlled by parameters, and covers formats in the IEEE standard
- Exponents can range from 3 to 31 bits
- Fractional part of the floating-point number can range from 2 to 253 bits
- Fully compatible with the IEEE 754 Floating-point standard[1] with proper set of parameters
- DesignWare datapath generator is employed for better timing and area

Description

DW_fp_sub is a floating-point component that subtracts two floating-point values, `a` and `b`, to produce a floating-point difference, `z`.

The input `rnd` is an 3-bit rounding mode (see Rounding Modes in the *Datapath Floating-Point Overview*) and the output `status` is an 8-bit vector of status flags.

Table 1-1 Pin Description

Pin Name	Width	Direction	Function
a	*sig_width* + *exp_width* + 1 bits	Input	Input data
b	*sig_width* + *exp_width* + 1 bits	Input	Input data
z	*sig_width* + *exp_width* + 1 bits	Output	`a - b`
status	8 bits	Output	See STATUS Flags in the *Datapath Floating-Point Overview*
rnd	3 bits	Input	Rounding mode

Table 1-2 Parameter Description

Parameter	Values	Description
sig_width	2 to 253 bits Default: 23	Word length of fraction field of floating-point numbers `a`, `b`, and `z`

1. For more information, see IEEE 754 Compatibility in the *Datapath Floating-Point Overview*.

Table 1-2 Parameter Description (Continued)

Parameter	Values	Description
exp_width	3 to 31 bits Default: 8	Word length of biased exponent of floating-point numbers `a`, `b`, and `z`
ieee_compliance	0 or 1 Default 0	When 1, the generated architecture is fully compliant with IEEE 754 standard, including the use of denormals and NaNs.

Table 1-3 Synthesis Implementations

Implementation Name	Function	License Feature Required
rtl	Synthesis model	DesignWare

Table 1-4 Simulation Models

Model	Function
DW02.DW_FP_SUB_CFG_SIM	Design unit name for VHDL simulation
dw/dw02/src/DW_fp_sub_sim.vhd	VHDL simulation model source code
dw/sim_ver/DW_fp_sub.v	Verilog simulation model source code

Table 1-5 Functional Description

a	b	status[a]	z[b]
a (floating-point)	b (floating-point)	*	a - b (floating-point)

a. The details of `status` flags, if used, can be found in Table 9 of the “Datapath – Floating-Point Overview” section.
b. The value for any a – b is defined by the rounding mode.

The parameter `ieee_compliance` controls the functionality of this component. When the parameter is set to 0, the component is backward compatible with the DW_add_fp component (previously available in this library). The DW_add_fp component does not work with NaNs and denormals. NaNs are considered infinities and denormals are considered zeros.

When the `ieee_compliance` parameter is set to 1, the component is fully compliant with the IEEE 754 standard and therefore operates with NaNs and denormals.

For more information about the floating-point system defined for all the DW_fp components, including `status` flag bits, and integer and floating-point formats, refer to the *Datapath Floating-Point Overview*.

Related Topics

- Datapath Floating Point Overview
- DesignWare Building Block IP Documentation Overview

HDL Usage Through Component Instantiation - VHDL

```
library IEEE,DWARE;
use IEEE.std_logic_1164.all;
use DWARE.dw_foundation_comp.all;
-- If using numeric types from std_logic_arith package,
-- comment the preceding line and uncomment the following line:
-- use DWARE.DW_Foundation_comp_arith.all;

entity DW_fp_sub_inst is
      generic(
        inst_sig_width : POSITIVE := 23;
        inst_exp_width : POSITIVE := 8;
        inst_ieee_compliance : INTEGER := 0
        );
      port (
       inst_a : in std_logic_vector(inst_sig_width+inst_exp_width downto 0);
       inst_b : in std_logic_vector(inst_sig_width+inst_exp_width downto 0);
       inst_rnd : in std_logic_vector(2 downto 0);
       z_inst : out std_logic_vector(inst_sig_width+inst_exp_width downto 0);
       status_inst : out std_logic_vector(7 downto 0)
         );
    end DW_fp_sub_inst;


architecture inst of DW_fp_sub_inst is

begin

    -- Instance of DW_fp_sub
    U1 : DW_fp_sub
    generic map ( sig_width => inst_sig_width,
                  exp_width => inst_exp_width,
                  ieee_compliance => inst_ieee_compliance )
    port map ( a => inst_a, b => inst_b, rnd => inst_rnd, z => z_inst, status =>
status_inst );


end inst;
-- pragma translate_off
configuration DW_fp_sub_cfg_inst of DW_fp_sub_inst is
 for inst
 end for; -- inst
end DW_fp_sub_cfg_inst;
-- pragma translate_on
```

HDL Usage Through Component Instantiation - Verilog

```
module DW_fp_sub_inst( inst_a, inst_b, inst_rnd, z_inst, status_inst );

parameter sig_width = 23;
parameter exp_width = 8;
parameter ieee_compliance = 0;


input [sig_width+exp_width : 0] inst_a;
input [sig_width+exp_width : 0] inst_b;
input [2 : 0] inst_rnd;
output [sig_width+exp_width : 0] z_inst;
output [7 : 0] status_inst;

    // Instance of DW_fp_sub
    DW_fp_sub #(sig_width, exp_width, ieee_compliance)
      U1 ( .a(inst_a), .b(inst_b), .rnd(inst_rnd), .z(z_inst), .status(status_inst) );

endmodule
```

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