

# axis\_1553\_decoder.v

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## AUTHORS

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JAY CONVERTINO

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## DATES

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## INFORMATION

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### Brief

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AXIS MIL-STD-1553 DECODER

### License MIT

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## axis\_1553\_decoder

---

```
module axis_1553_decoder #(
    parameter
    CLOCK_SPEED
    =
    20000000,
    parameter
    SAMPLE_RATE
    =
    2000000,
    parameter
    BIT_SLICE_OFFSET
    =
    0,
    parameter
```

```

INVERT_DATA
=
0,
parameter
SAMPLE_SELECT
=
0
) ( input aclk, input arstn, output [15:0] m_axis_tdata, output m_axis_tvalid

```

This core is a MIL-STD-1553 to AXI streaming decoder. It uses the positive edge of a clock to sample data. This restricts the core to 2 Mhz and above for a sample clock.

## Parameters

<b>CLOCK_SPEED</b> parameter	This is the aclk frequency in Hz, must be 2 MHz or above.
<b>SAMPLE_RATE</b> parameter	2 MHz or above rate that is an even divisor of CLOCK_SPEED
<b>BIT_SLICE_OFFSET</b> parameter	Changes the bit that is selected for data reduction.
<b>INVERT_DATA</b> parameter	Will invert all decoded data.
<b>SAMPLE_SELECT</b> parameter	Changes the bit that is sampled for data capture.

## Ports

<b>aclk</b>	Clock for all logic
<b>arstn</b>	Negative reset
<b>m_axis_tdata</b>	Output data for 1553 decoder.
<b>m_axis_tvalid</b>	When active high the output data is valid.
<b>m_axis_tuser</b>	Information about the AXIS data {TYY,NA,D,I,P} Bits explained below:

```

- TYY = TYPE OF DATA
  - 000 NA
  - 001 REG (NOT IMPLIMENTED)
  - 010 DATA
  - 100 CMD/STATUS
- NA = RESERVED FOR FUTURE USE.
- D = DELAY BEFORE DATA
  - 1 = Delay of 4us or more before data
  - 0 = No delay between data
- I = INVERT DATA
  - 1 = INVERT
  - 0 = NORMAL
- P = PARITY
  - 1 = GOOD
  - 0 = BAD

```

<b>m_axis_tready</b>	When active high the destination device is ready for data.
<b>diff</b>	Output data in TTL differential format.

## base\_1553\_clock\_rate

```
localparam integer base_1553_clock_rate = 1000000
```

1553 base clock rate

## **samples\_per\_mhz**

---

```
localparam integer samples_per_mhz = SAMPLE_RATE / base_1553_clock_rate
```

sample rate to capture transmission bits at

## **cycles\_per\_mhz**

---

```
localparam integer cycles_per_mhz = CLOCK_SPEED / base_1553_clock_rate
```

calculate the number of cycles the clock changes per period

## **delay\_time**

---

```
localparam integer delay_time = cycles_per_mhz * 4
```

delay time, 4 is for 4 us (min 1553 time)

## **samples\_to\_skip**

---

```
localparam integer samples_to_skip = (
    (cycles_per_mhz > samples_per_mhz) ? cycles_per_mhz /
    samples_per_mhz
    :
    0
)
```

calculate the number of samples to skip

## **round\_SAMPLE\_SELECT**

---

```
localparam integer round_SAMPLE_SELECT = (
    (SAMPLE_SELECT == 0) ? samples_to_skip /
    2
    :
    SAMPLE_SELECT % samples_to_skip
)
```

SAMPLE\_SELECT rounded

## **bit\_rate\_per\_mhz**

---

```
localparam integer bit_rate_per_mhz = samples_per_mhz
```

bit rate per mhz

## round\_BIT\_SLICE\_OFFSET

---

```
localparam integer round_BIT_SLICE_OFFSET = (
    (cycles_per_mhz > samples_per_mhz) ? ((
        BIT_SLICE_OFFSET == 0) ? bit_rate_per_mhz/4 : BIT_SLICE_OFFSET % bit_rate_per_mhz) :
    0
)
```

pick the middle of the samples generated by default

## sync\_pulse\_len

---

```
localparam integer sync_pulse_len = bit_rate_per_mhz * 3
```

sync pulse length

## bits\_per\_trans

---

```
localparam integer bits_per_trans = 20
```

bits per transmission

## synth\_bits\_per\_trans

---

```
localparam integer synth_bits_per_trans = (
    bits_per_trans*bit_rate_per_mhz
)
```

sync bits per trans

## sync\_cmd\_stat

---

```
localparam [sync_pulse_len-1:0]sync_cmd_stat = {
    sync_pulse_len/2{1'b0}},
    sync_pulse_len/2{1'b1}}
}
```

Command sync pulse

## sync\_data

---

```
localparam [sync_pulse_len-1:0]sync_data = {
    sync_pulse_len/2{1'b1}},
    sync_pulse_len/2{1'b0}}
}
```

Data sync pulse

## cmd\_data

---

```
localparam cmd_data = 3'b010
```

data tuser encode

## cmd\_data

---

command tuser encode

## bit\_pattern

---

```
localparam [(  
    bit_rate_per_mhz  
)-1:0]bit_pattern = {{bit_rate_per_mhz/2{1'b1}}, {bit_rate_per_mhz/2{1'b0}}}
```

create the bit pattern. This is based on outputting data on the negative and positive. This allows the encoder to run down to 1 mhz.

## synth\_clk

---

```
localparam [synth_bits_per_trans-1:0]synth_clk = {  
    bits_per_trans{bit_pattern}  
}
```

synth clock is the clock constructed by the repeating the bit pattern. this is intended to be a representation of the clock. Captured at a bit\_rate\_per\_mhz of a 1mhz clock.

## STATE MACHINE

---

Constants that makeup the decoder state machine.

## diff\_wait

---

```
localparam diff_wait = 5'h01
```

wait for diff

## data\_cap

---

```
localparam data_cap = 5'h03
```

data capture

## data\_reduce

---

```
localparam data_reduce = 5'h07
```

reduce data

## parity\_gen

---

```
localparam parity_gen = 5'h0F
```

parity generator

## trans

---

```
localparam trans = 5'h1F
```

transmit data

## error

---

```
localparam error = 5'h00
```

someone made a whoops