Lab4 FIFO

Synchronize FIFO：

图形用户界面, 文本

描述已自动生成Top-level:

Testbench:图形用户界面, 文本

描述已自动生成

图形用户界面, 文本

描述已自动生成

电脑萤幕画面

描述已自动生成Waveform:

This picture shows a complete cycle of Enqueue and Dequeue

I put value X in Row X, which is 0 in Row 0, 1 in Row 1, and so on.

You can clearly see that the waveform of Dequeue is the same as that of Enqueue. The Enqueue waveform can be seen from test vector “wdata”. And the Dequeue waveform can be seen from test vector “rdata”. I also show the pointer of write and read in “write\_ptr” and “read\_ptr”. The “full” parameter triggers when data can no longer be written in. The “empty” parameter triggers when all data has been read.

电脑萤幕画面

描述已自动生成

This picture shows a complete random write and read. The results of this test waveform is as my expectations. Because the test vector “error” has never been pulling high.

图示, 示意图

描述已自动生成RTL Viewer schematics

Asynchronous FIFO

Top-level:

图形用户界面, 文本

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图形用户界面, 文本

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Testbench:

图形用户界面, 文本

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Waveform:

电脑萤幕画面

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The write clock I set is 10, while the read cycle is 12.

In order to put in a picture, this is the max clock cycle I can set.

I set an extra bit in pointer, when the pointer advances and crosses the last FIFO address, the bit will advance 1 as well. The same applies to the read pointer. When 2 pointers meat together, if the bits of the two pointers are different, it means that the write pointer is folded back once more than the read pointer, and the FIFO is full. If the bits of two pointers are the same, it means that the number of times the two pointers are folded back is equal. The remaining bits are equal, indicating that FIFO is empty.

For the phase shift, I use the “Gray code” to balance it

Therefore, before the comparison, we need to synchronize the write pointer to the read clock domain, and then compare it with the read pointer to generate the empty signal. Synchronize the read pointer to the write clock domain, and then compare it with the write pointer to generate the full signal.

I convert the read and write pointers into Gray codes, and then synchronize them by hitting two beats.

电脑萤幕画面

描述已自动生成

This picture also shows a complete random write and read.

The results are as my expectations.

Test vector “error” has never been pulling high.

图示, 示意图

描述已自动生成RTL Viewer schematics