My Simple Serial Protocol receiver

Rev	Date	Notes	By
0.1	2021-10-15	Initial	Zhangqc
0.2	2022-5-6	Update signal des.	Zhangqc
0.3	2022-11-22	Update des of IFG	Zhangqc

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Protocol frame:

01010101	xxx 6bits xxx	xxxx8bitsxxxx	000x	000···0(>2 bits 0)
preamble	signature	data	3'b000+parity	Inter-frame-gap

Design and verify a module that is based on this protocol:

1. Detect preamble from serial stream
2. Once preamble is detected, start to extract 6bits signature from serial stream
3. Compare signature with "magic number" input
4. If signature doesn't match "magic number", assert output s_err for 2 cycles, then go to step 1
5. If signature matches, continue to receive remaining data(8 bits)
6. Continue to receive 3'b000+parity(1 bit), 4 bits Parity Field, calculate parity based on received data 8 bits and check it with received parity
7. If parity matches, output the recieved data to data_out, assert output r_done for one cycle then return to step 1
8. If parity fail, output the recieved data to data_out , assert output p_err and r_done for one cycle, then return to step 1

I/O	Name	Width(bits)	notes
I	clk	1	
I	rstn	1	
I	si	1	Serial Input
I	m_num	6	Magic number
O	s_err	1	Signature error
O	p_err	1	Parity error
O	data_out	8	Received data
O	r_done	1	Receive frame done