EGC221 Class Notes 3/1/2023

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Designing a Circuit using Quartus and FPGA

Reference:

http://www.engr.newpaltz.edu/~bai/EGC221/Quartus_Prime_Introduction%20Schematic. pdf

Tutorial:

YouTube Quartus Prime Tutorial Schematic Capture Youtube Quartus Prime Tutorial Creating a Waveform Simulation



Design Steps

- From the specification of the circuit, determine the number of inputs and outputs and assign a symbol to each.
- Derive a truth table, assigning inputs to the left and outputs to the right.
- Place all possible combination of inputs i.e all 0's to all 1's
- Using the problem definition determine each output.
- If combinations are left without a specified output, mark them as don't cares.
- Simplify each output using K-map.
- Draw a circuit for each output per requirement ie. All NAND, all NOR, AND –OR, OR – AND, XOR, etc.



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Desig	n of	a fu	ull ac	lder	S=,	$S_{M}(1,2,4,7)$
	Table Full Ac	4.4 Ider	См		Cut-	=EM(3 9(7)
	X	y	z	<mark>ر</mark> ک	S	
	0	0	0	0	0	
	0	0	1	0	1	
	0	1	0	0	1	
	0	1	1	1	0	
	1	0	0	0	1	
	1	0	1	1	0	
	1	1	0	1	0	
	1	1	1	1	1	

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Device family	Show in 'Available	device <mark>s' li</mark> st	
Family: MAX 10 (DA/DF/DC/SA/SC)	Package:	Any	*
Device: All	Pin count:	Any	•
Target device	Core speed grade:	Any	-
 Auto device selected by the Fitter 	Name filter:		
Specific device selected in 'Available devices' list	Show advanced	d devices	
O Other: n/a			

Available devices:

Name	Core Voltage	LEs	Total I/Os	GPIOs	Memory Bits	Embed	ded multiplier ! ^	
10M50DAF484C7G	1.2V	49760	360	360	1677312	288		
<							>	
	PTPAL PTPAL 345 345 1400 140 14		10M50	X [®] 1 DAF484				
		666			Sig	jnal Name	FPGA Pin No.	Description
		1111	1111		Push Button x2	YO	PIN_B8	Push-button[0]
		53	********	******	KE KE	Y1	PIN_A7	Push-button[1]
			LED x10	8888888	1000			

BoardDevice NameDE10-LiteMAX 10:
10M50DAF484C7G

Pin Assignment

Signal Name	FPGA Pin No.	Description
SW0	PIN_C10	Slide Switch[0]
SW1	PIN_C11	Slide Switch[1]
SW2	PIN_D12	Slide Switch[2]
SW3	PIN_C12	Slide Switch[3]
SW4	PIN_A12	Slide Switch[4]
SW5	PIN_B12	Slide Switch[5]
SW6	PIN_A13	Slide Switch[6]
SW7	PIN_A14	Slide Switch[7]
SW8	PIN_B14	Slide Switch[8]
SW9	PIN_F15	Slide Switch[9]

Signal Name	FPGA Pin No.	Description
LEDR0	PIN_A8	LED [0]
LEDR1	PIN_A9	LED [1]
LEDR2	PIN_A10	LED [2]
LEDR3	PIN_B10	LED [3]
LEDR4	PIN_D13	LED [4]
LEDR5	PIN_C13	LED [5]
LEDR6	PIN_E14	LED [6]
LEDR7	PIN_D14	LED [7]
LEDR8	PIN_A11	LED [8]
LEDR9	PIN_B11	LED [9]



Pin Assignment

Signal Name	FPGA Pin No.	Description
KEY0	PIN_U7	Push-button[0]
KEY1	PIN_W9	Push-button[1]
KEY2	PIN_M7	Push-button[2]
KEY3	PIN_M6	Push-button[3]

Signal Name	FPGA Pin No.	Description
SW0	PIN_U13	Slide Switch[0]
SW1	PIN_V13	Slide Switch[1]
SW2	PIN_T13	Slide Switch[2]
SW3	PIN_T12	Slide Switch[3]
SW4	PIN_AA15	Slide Switch[4]
SW5	PIN_AB15	Slide Switch[5]
SW6	PIN_AA14	Slide Switch[6]
SW7	PIN_AA13	Slide Switch[7]
SW8	PIN_AB13	Slide Switch[8]
SW9	PIN_AB12	Slide Switch[9]

Signal Name	FPGA Pin No.	Description
LEDR0	PIN_AA2	LED [0]
LEDR1	PIN_AA1	LED [1]
LEDR2	PIN_W2	LED [2]
LEDR3	PIN_Y3	LED [3]
LEDR4	PIN_N2	LED [4]
LEDR5	PIN_N1	LED [5]
LEDR6	PIN_U2	LED [6]
LEDR7	PIN_U1	LED [7]
LEDR8	PIN_L2	LED [8]
LEDR9	PIN_L1	LED [9]

Note on Functional Simulation

- Before running function simulation, in .VWF file, go to simulation → simulation setting
 - In line 5, replace –novopt with –voptargs="+acc"
- Make sure you design is designated as top level design
 - Go to Project → set as top level entity
- When you start your simulation, go to Edit and set the End time to 8 Micro second and Grid size to 1 Micro second.