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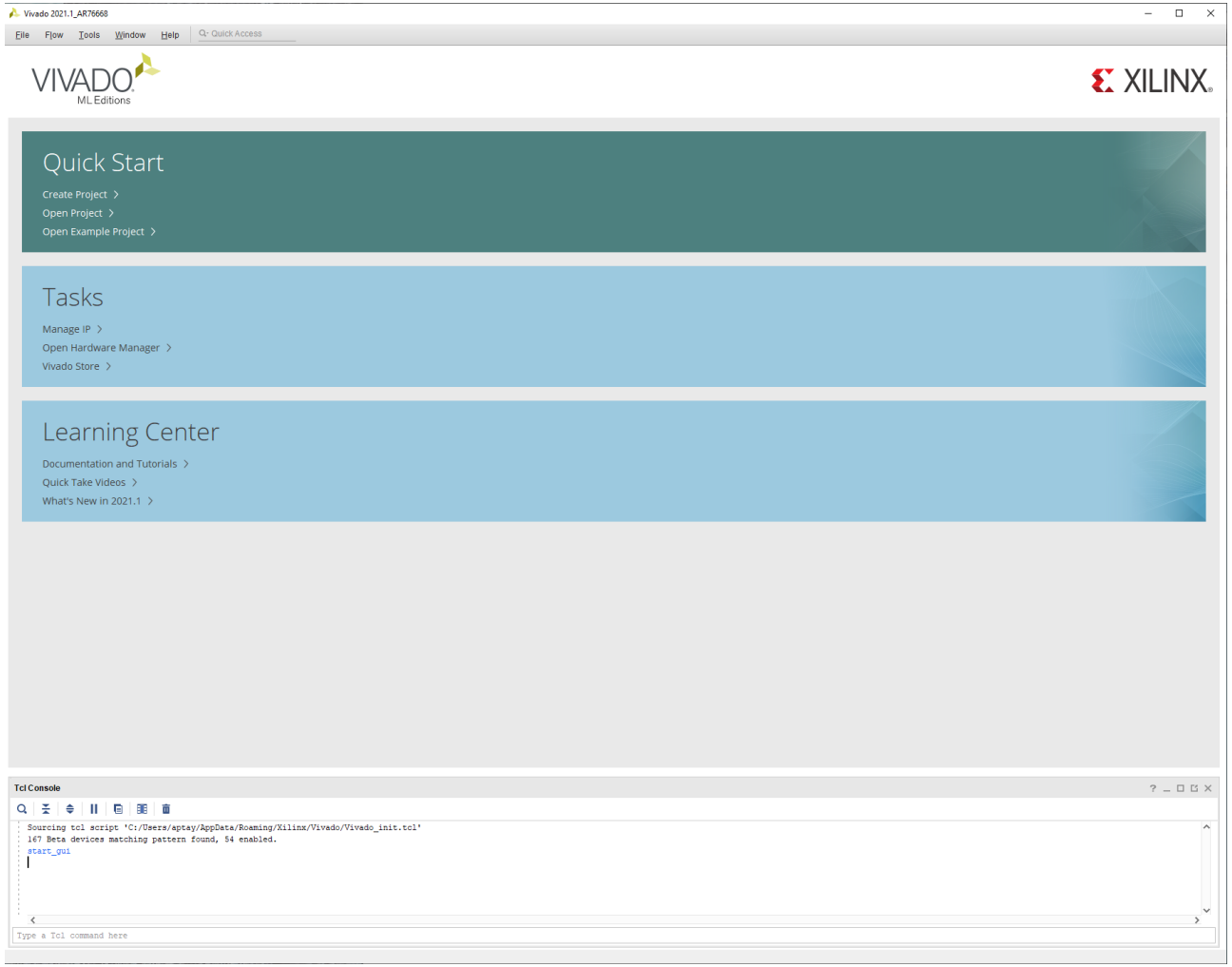
Mastering MicroBlaze

Lab Book

Lab: Mastering MicroBlaze

Open Vivado and Create a new project



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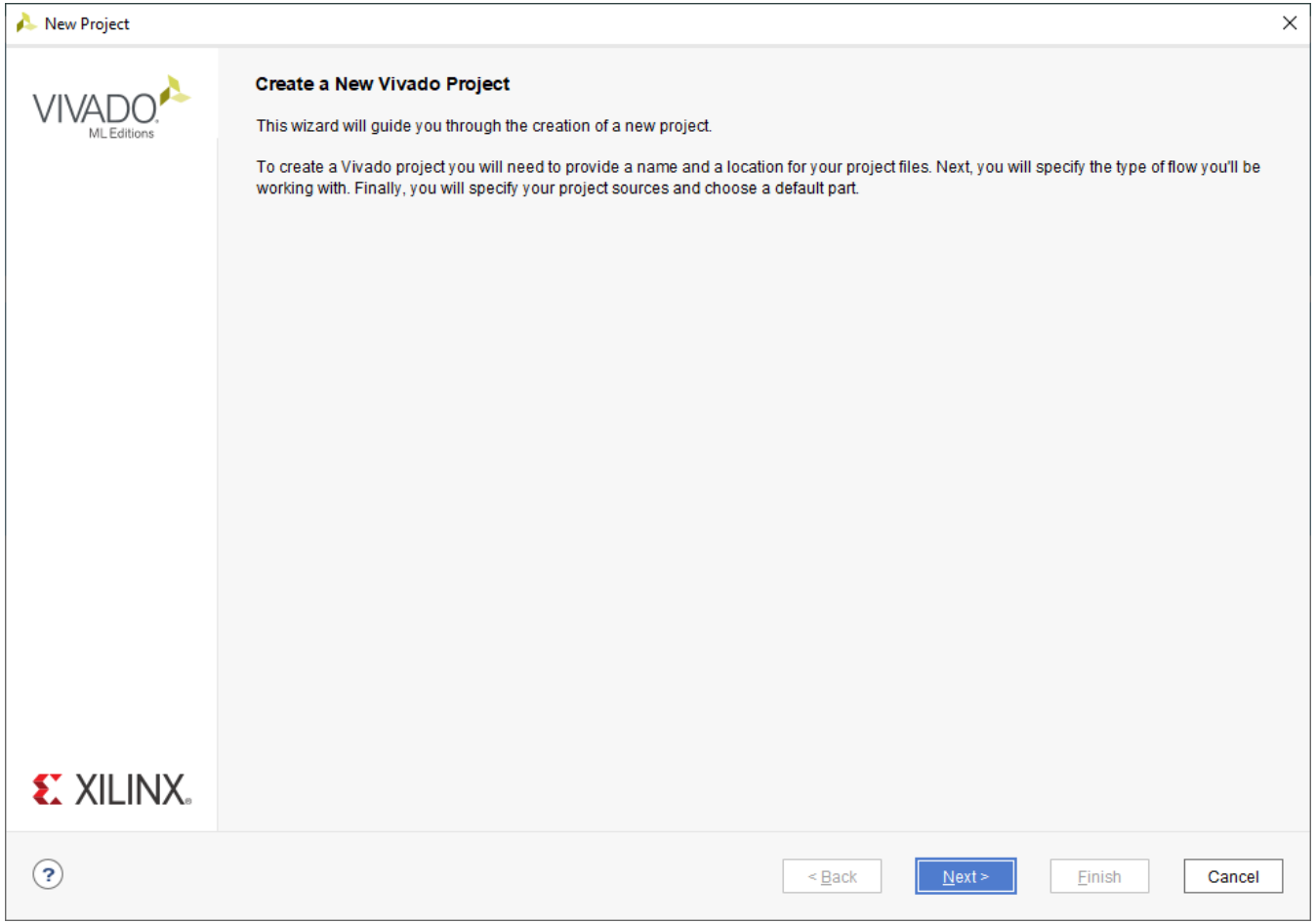
Click Next



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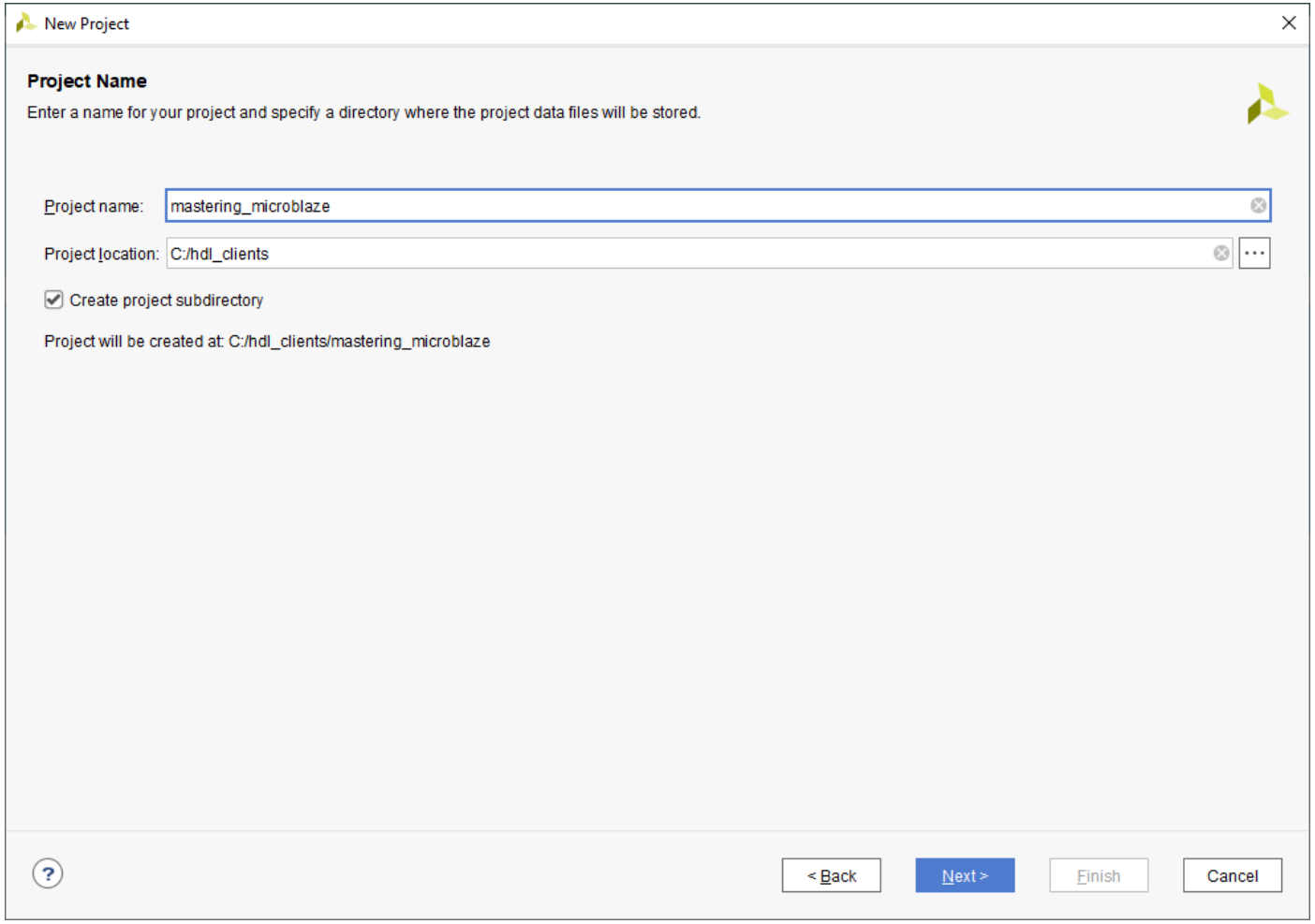
Enter a location and project name



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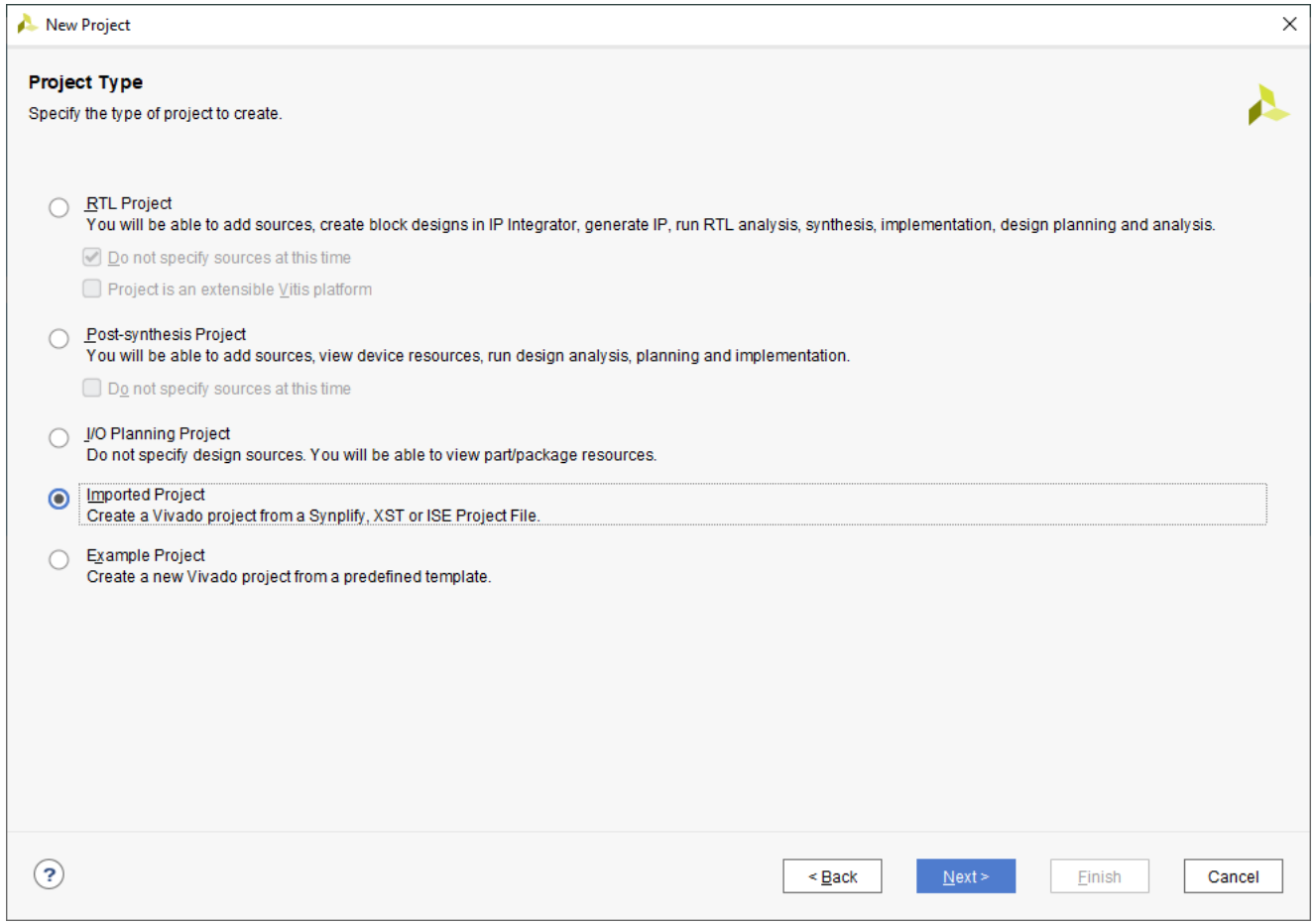
Select project type as RTL Project and check Do Not Specify Sources at this time.



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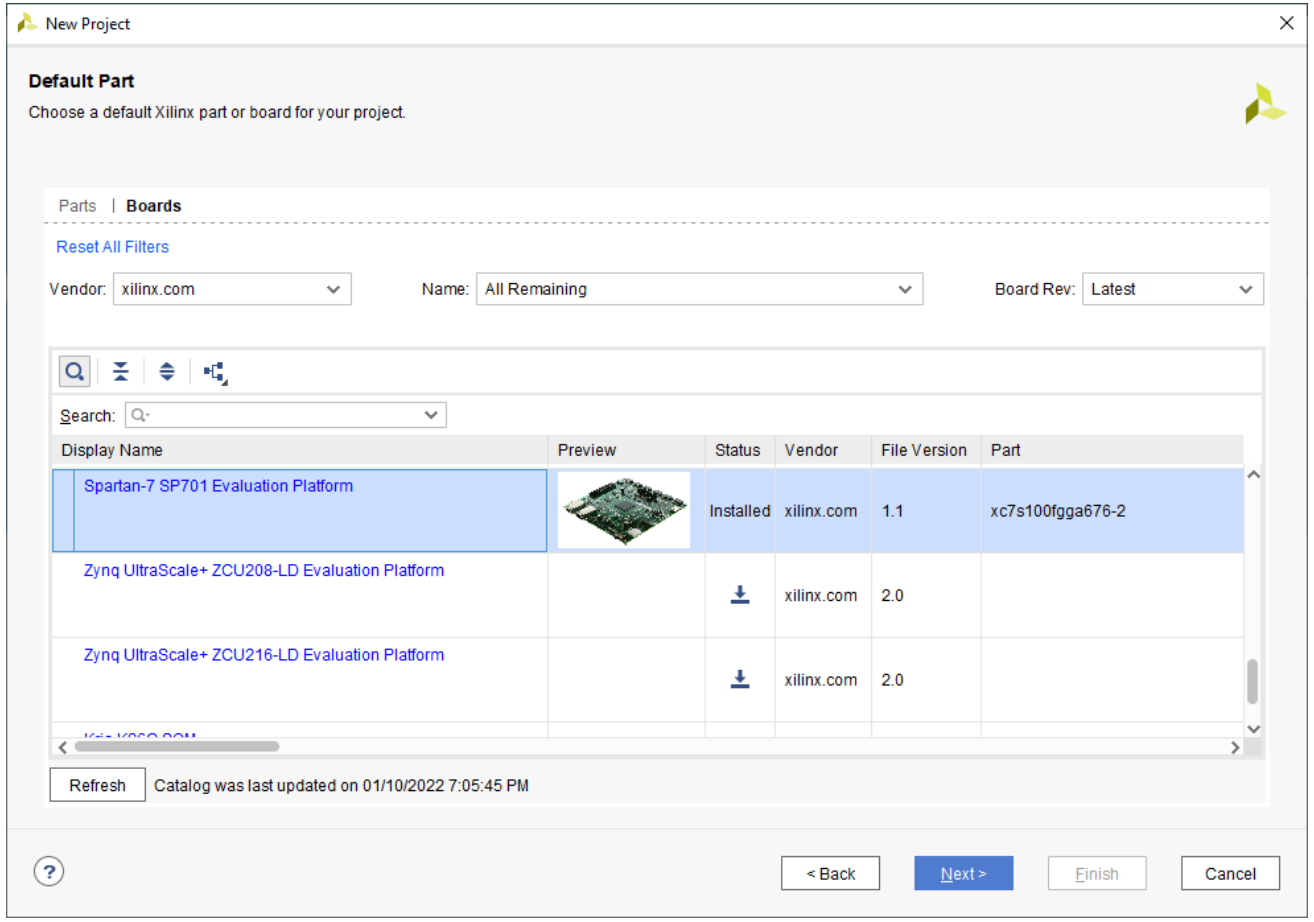
Select your development board – I will be using the SP701. But ANY 7 Series / UltraScale (+) board with a LED connected to the IO should work.



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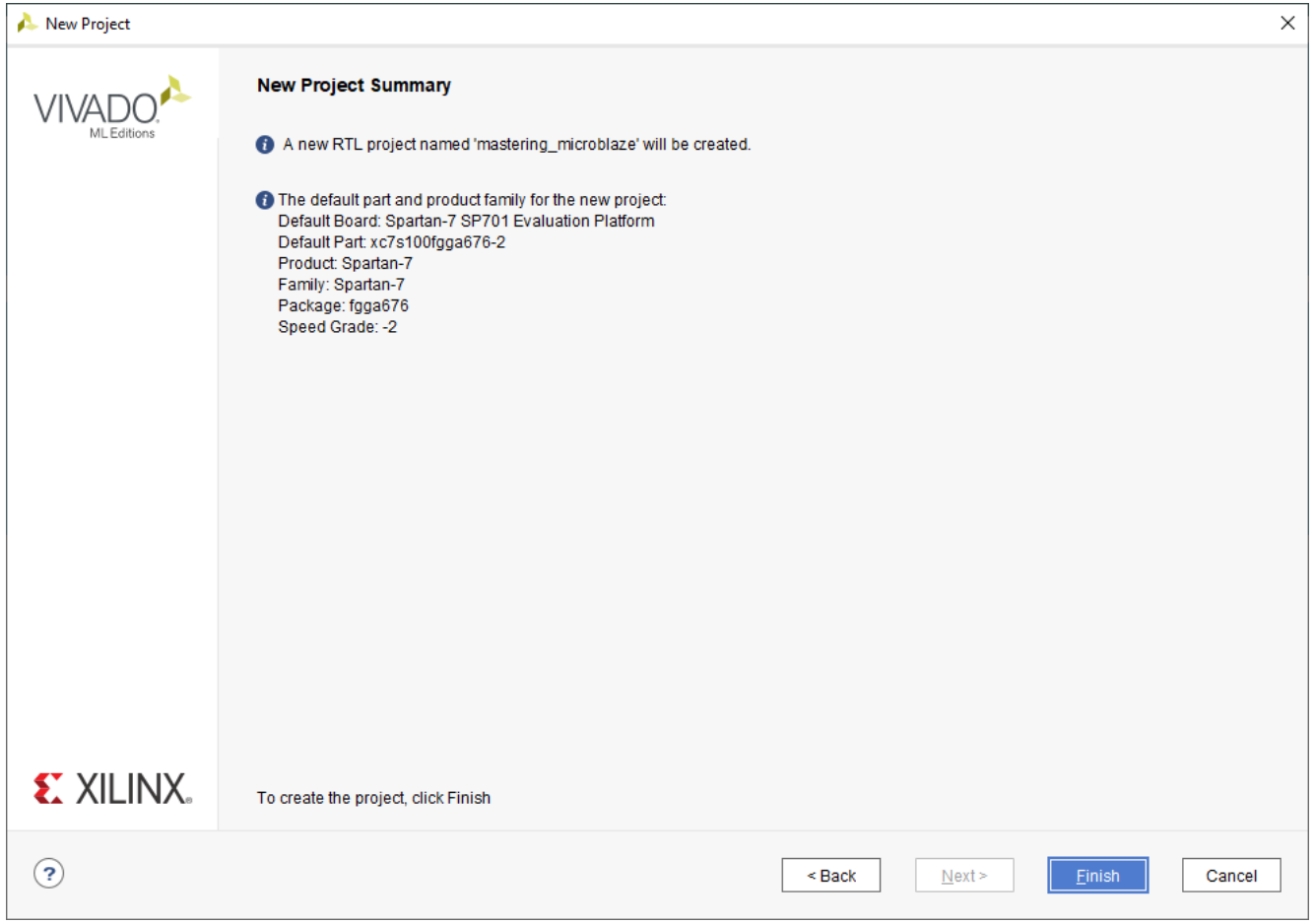
Click Finish



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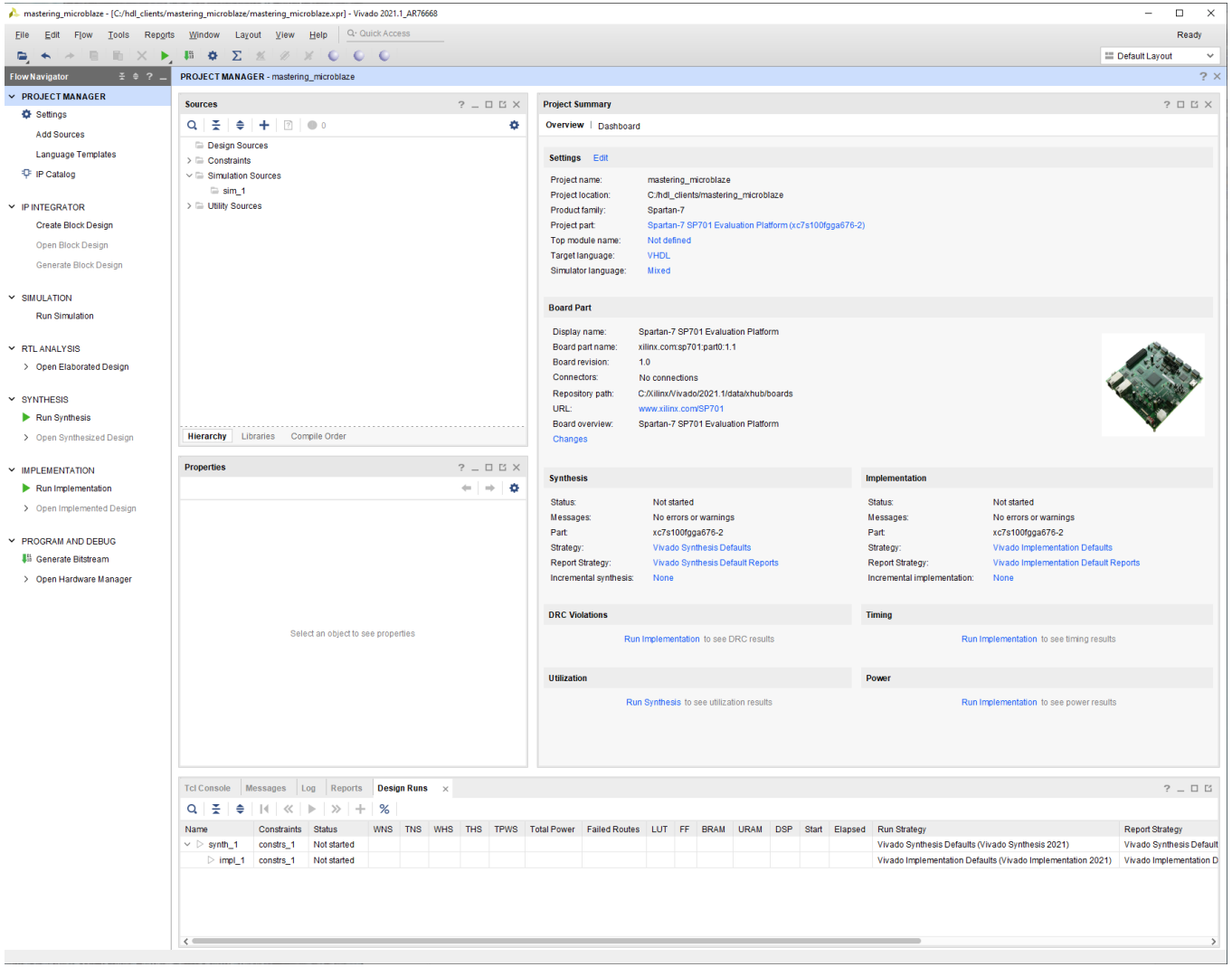
The open project should look as below



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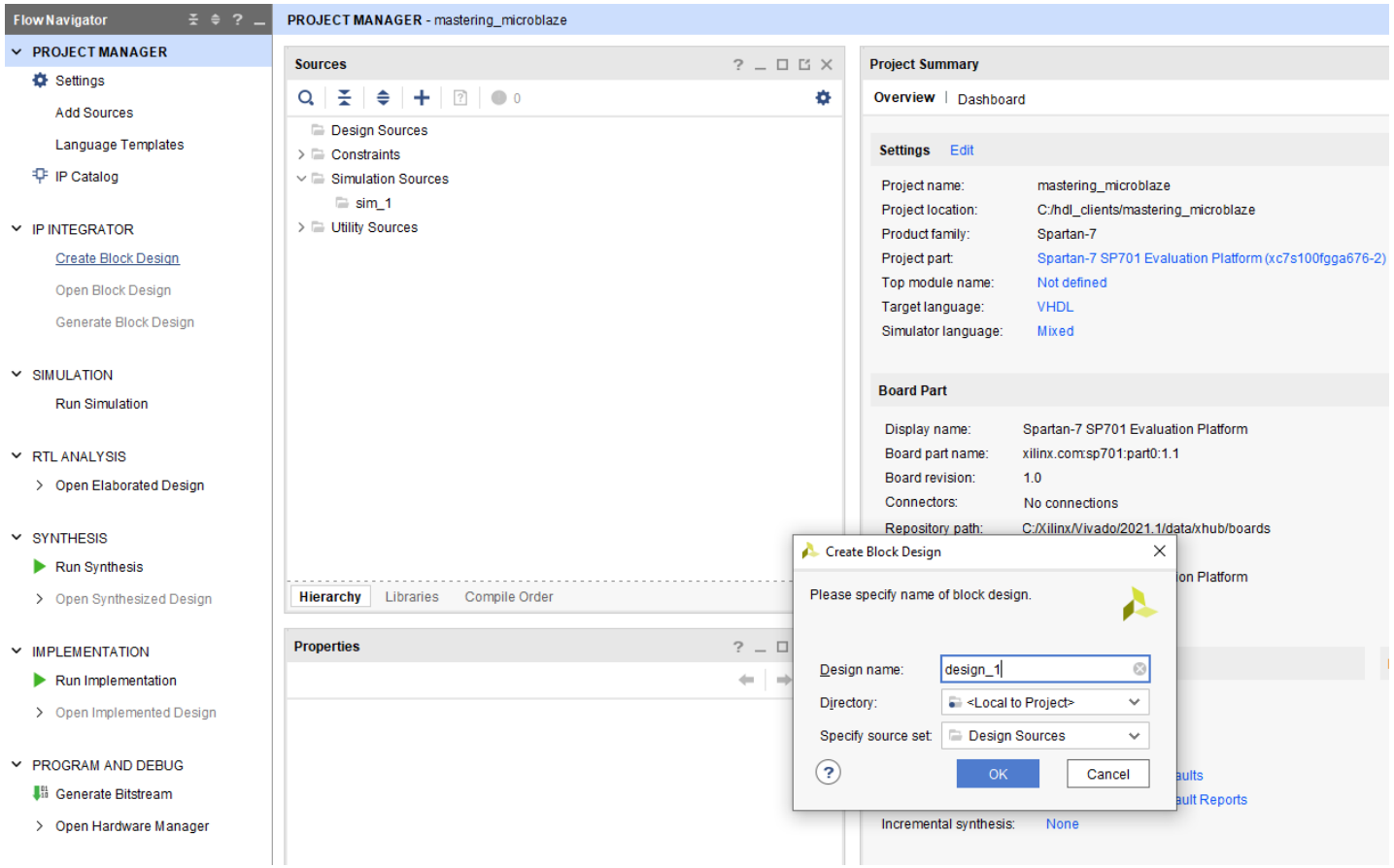
Click Create Block Design and leave the name unchanged



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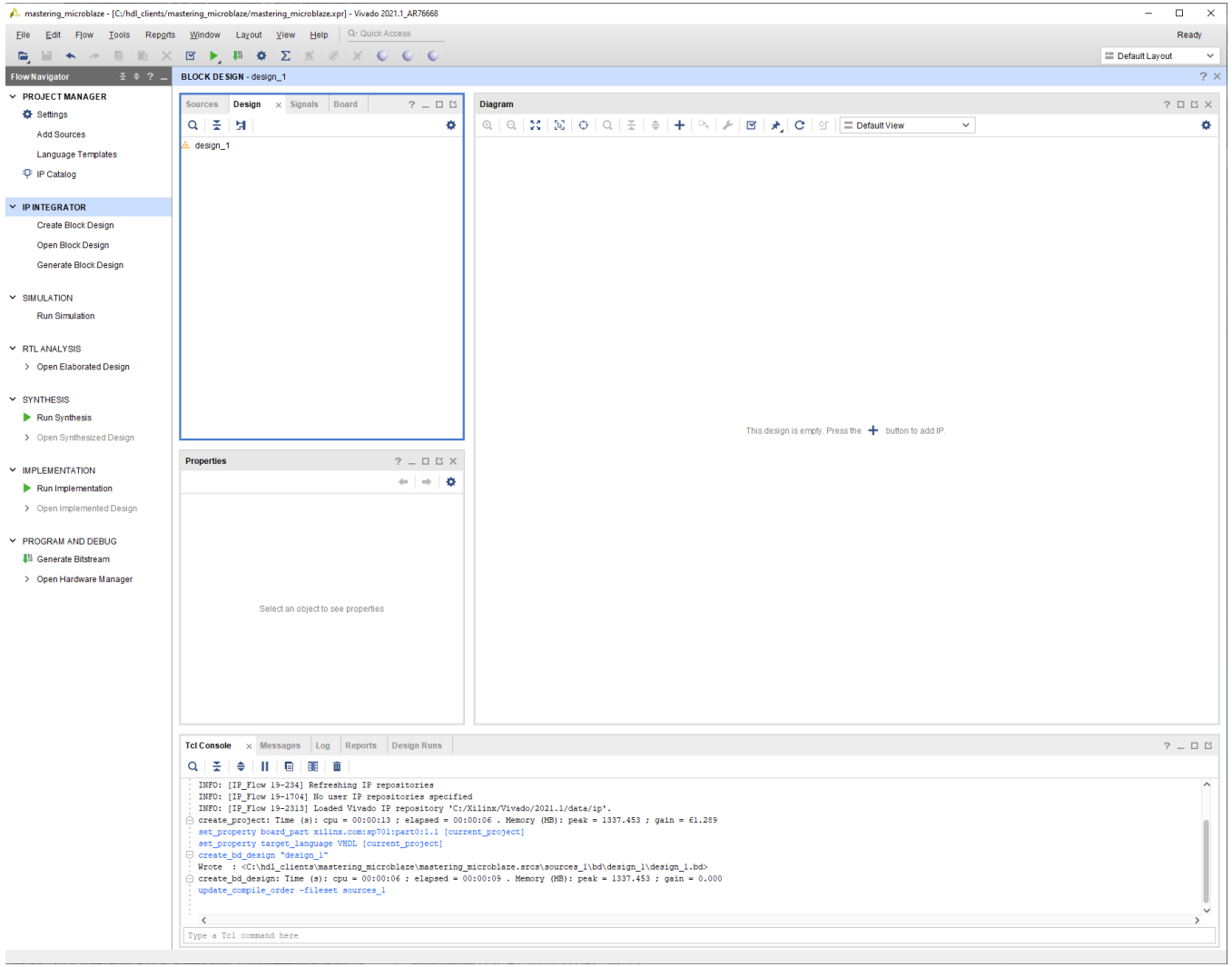
The Block Diagram should look as below



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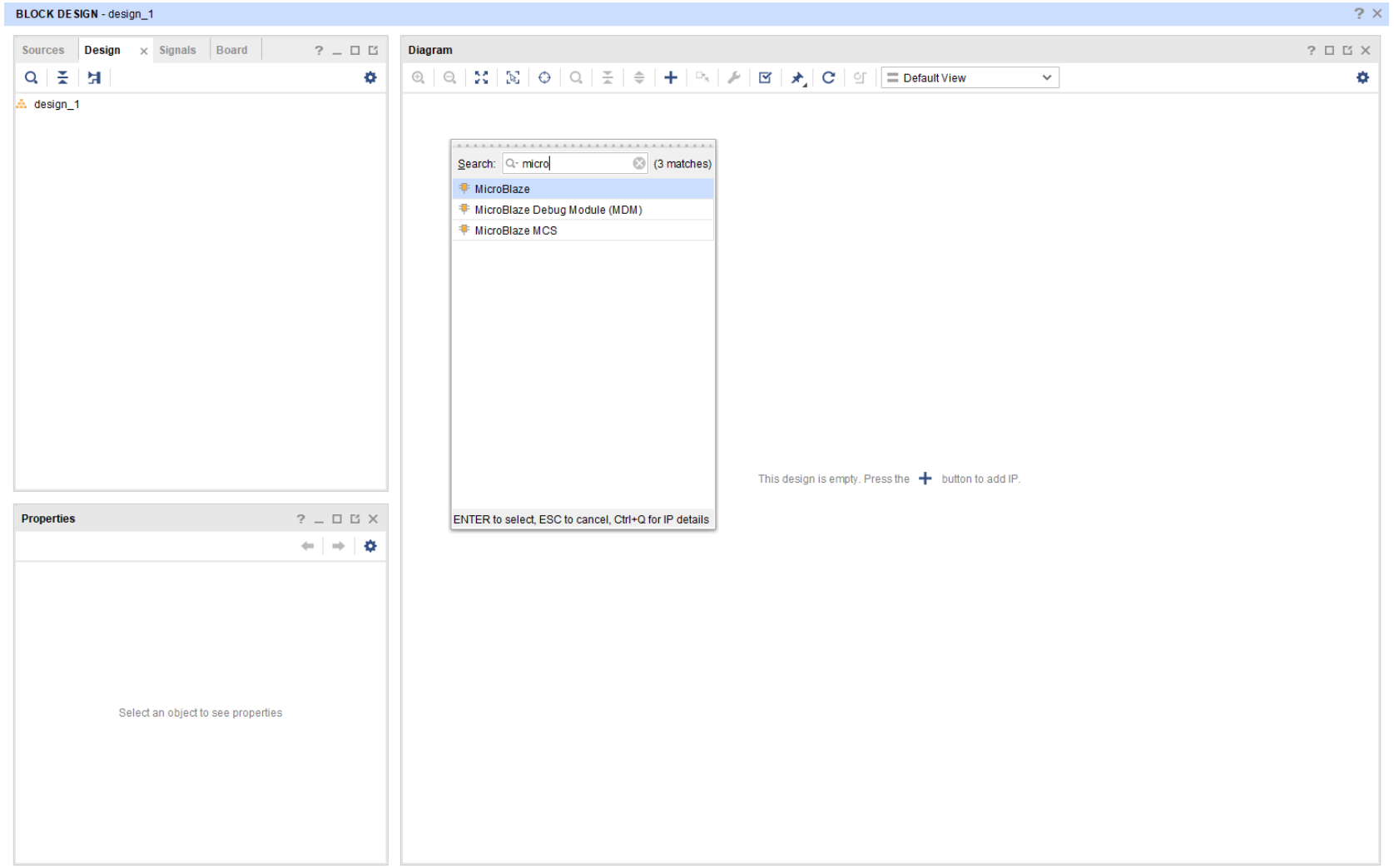
Click on the + in the block diagram and type in MicroBlaze



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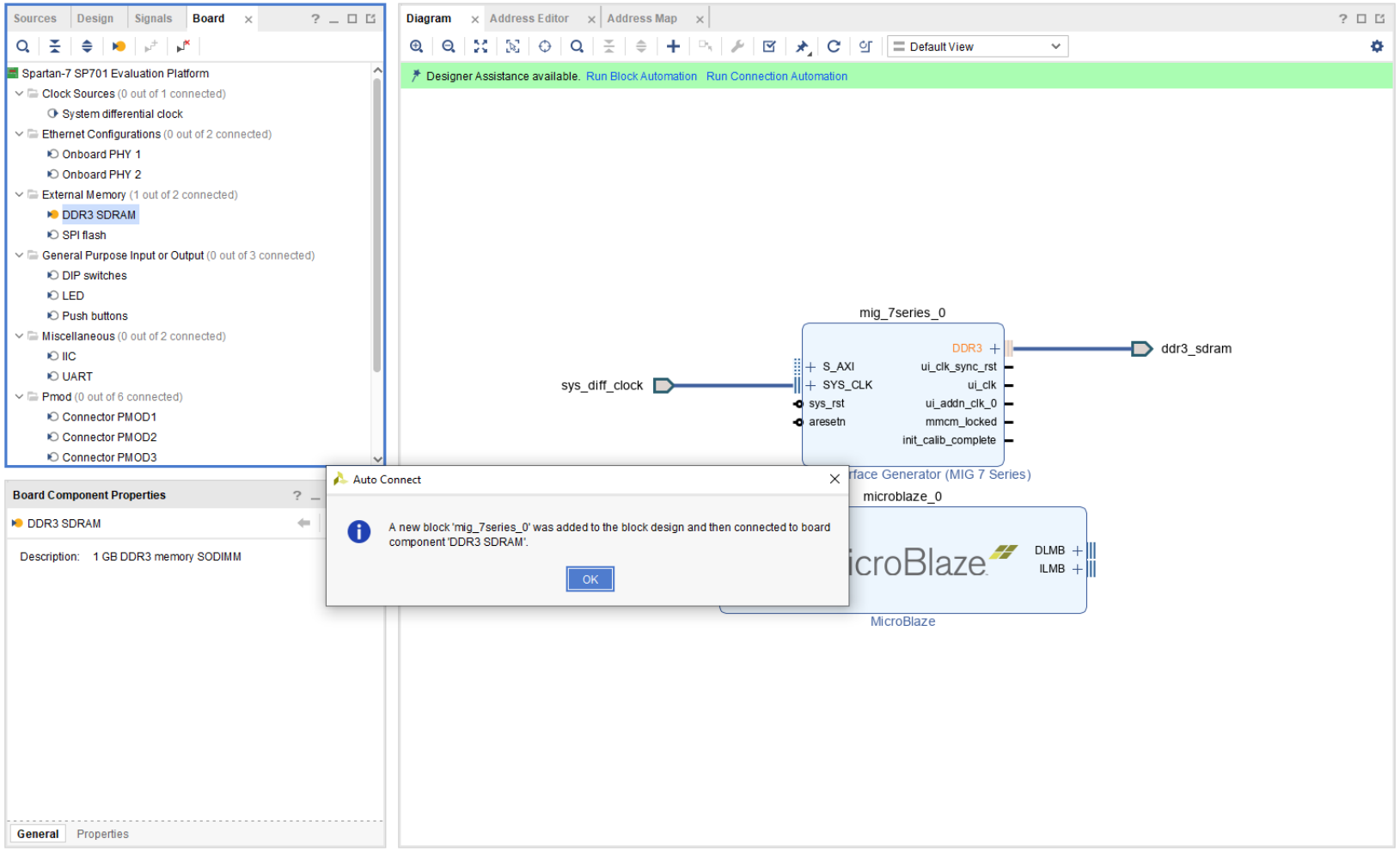
From the board tab select and drag the DDR3 onto the block diagram



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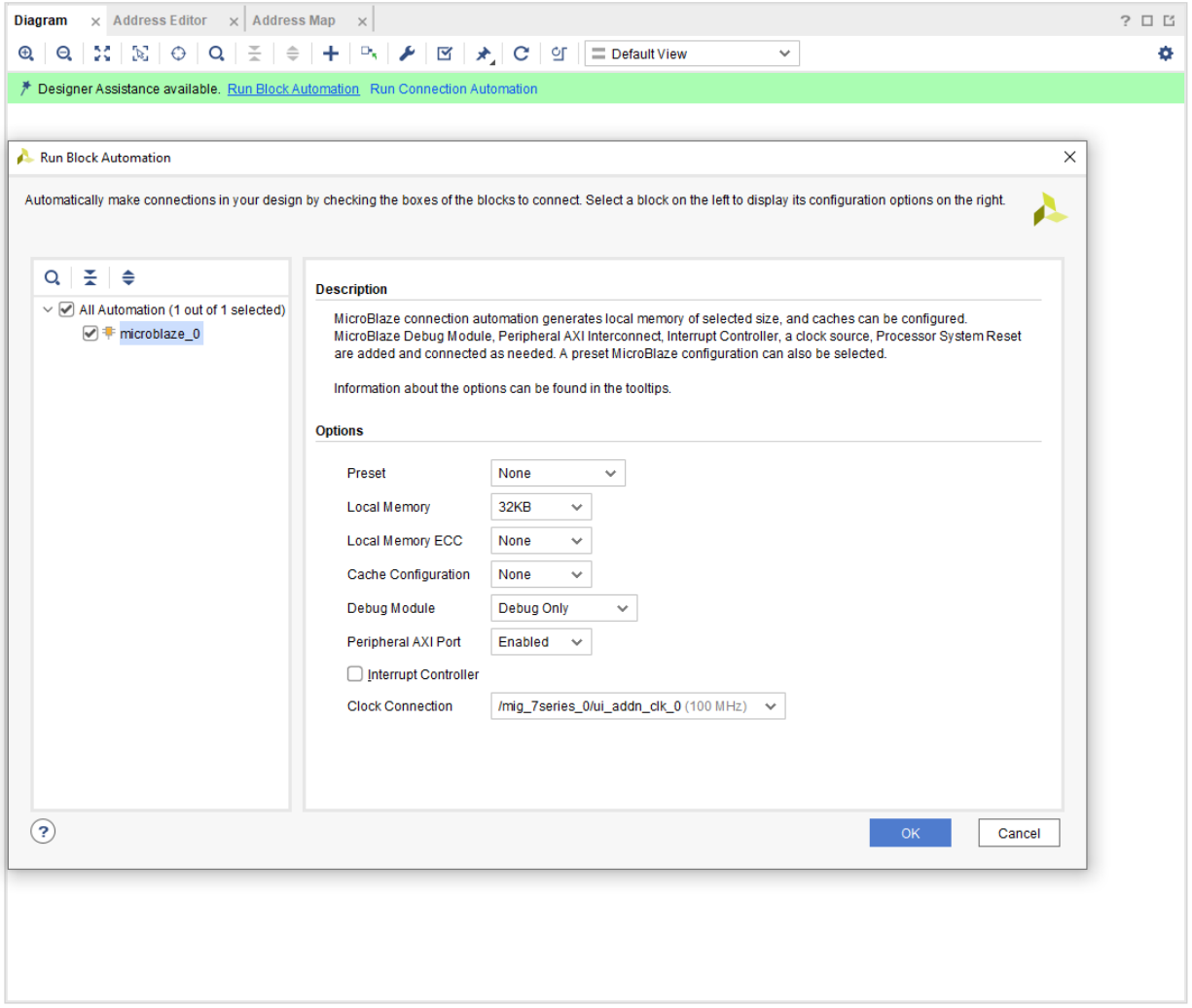
Run the Block Automation and configure 32KB of local memory and no cache



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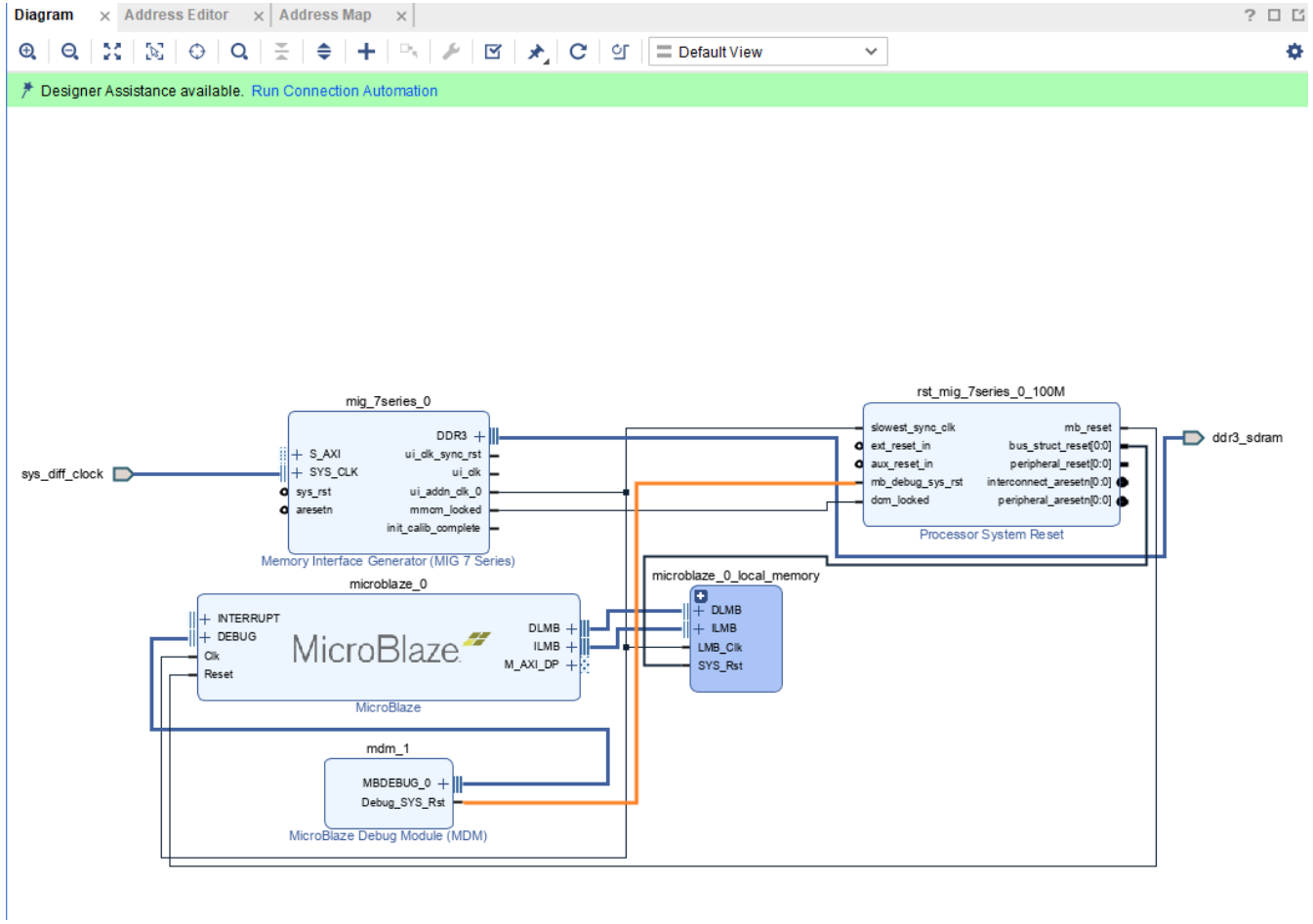
The result of the block automation should be as below



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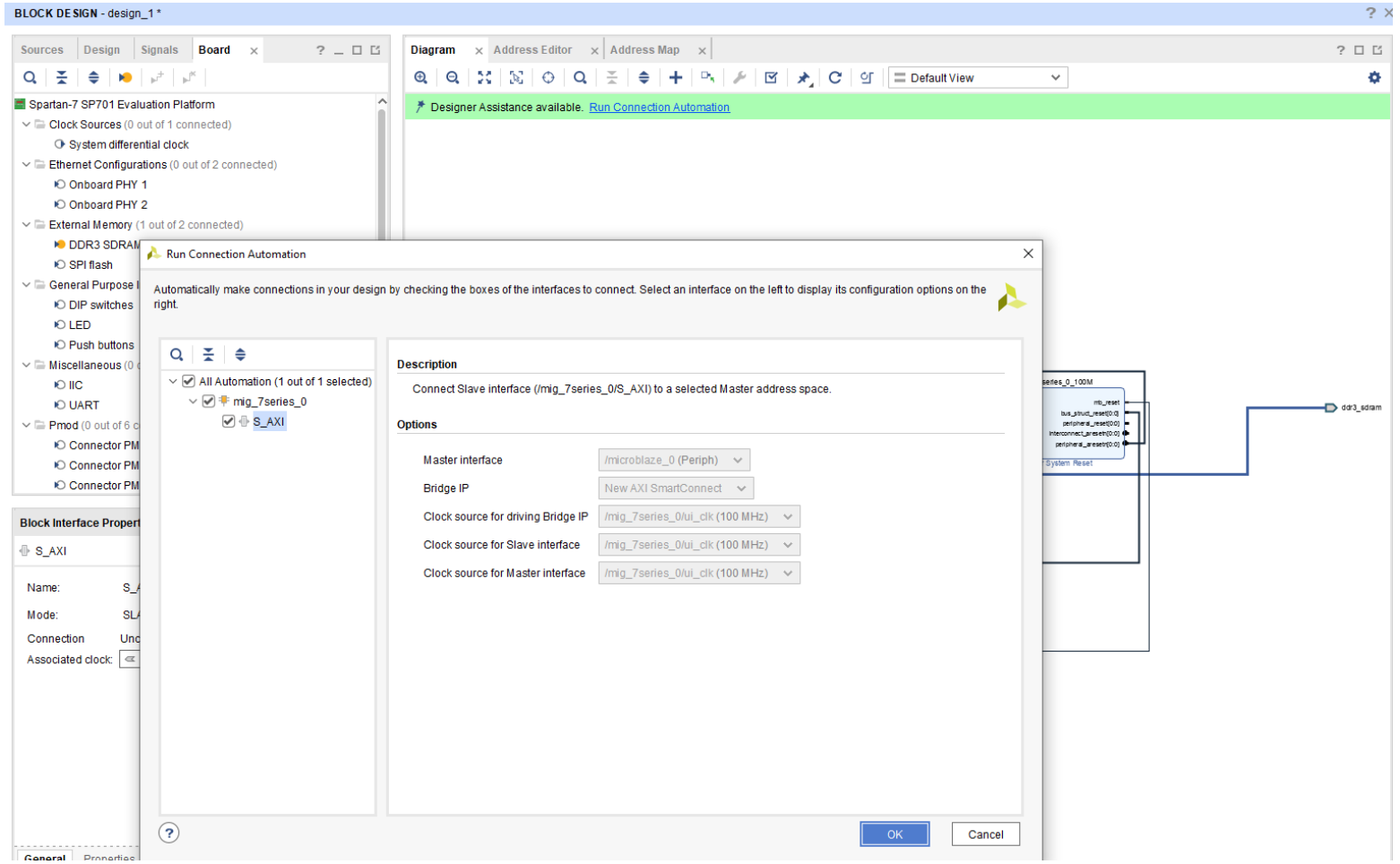
Run the Connection Automation to connect in the DDR3



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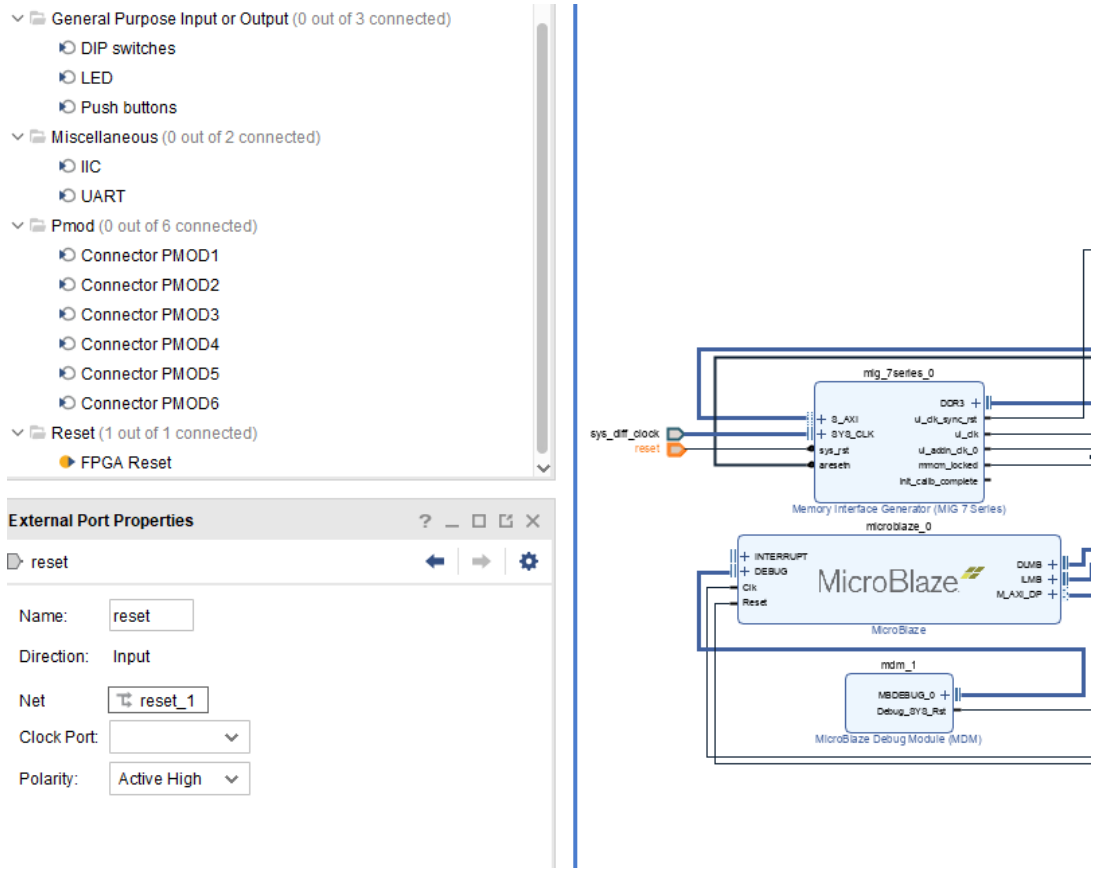
Drag and drop the reset port onto the diagram, select the port properties to determine its polarity



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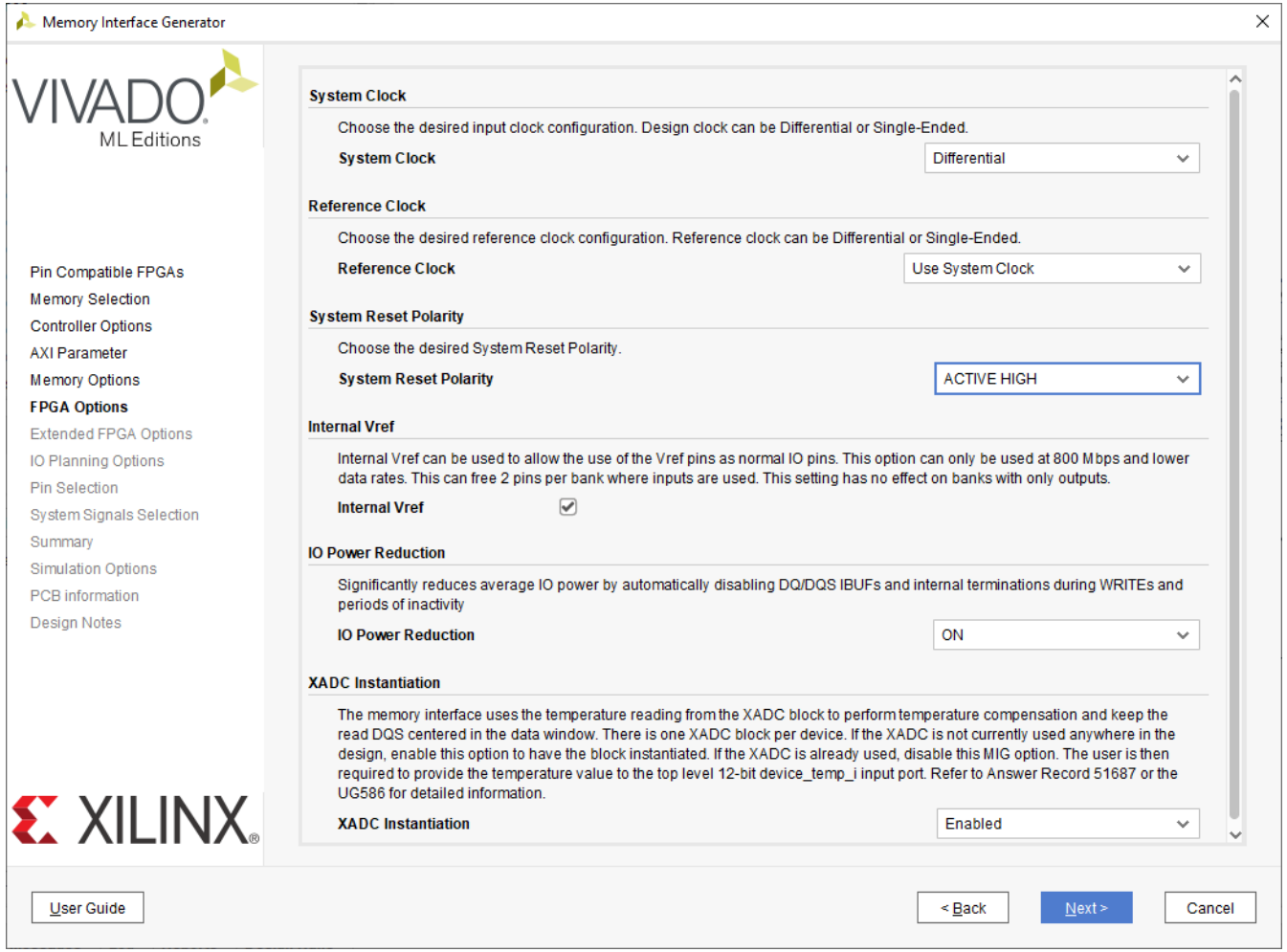
Re Customize the MIG and set the System Reset Polarity for Active High



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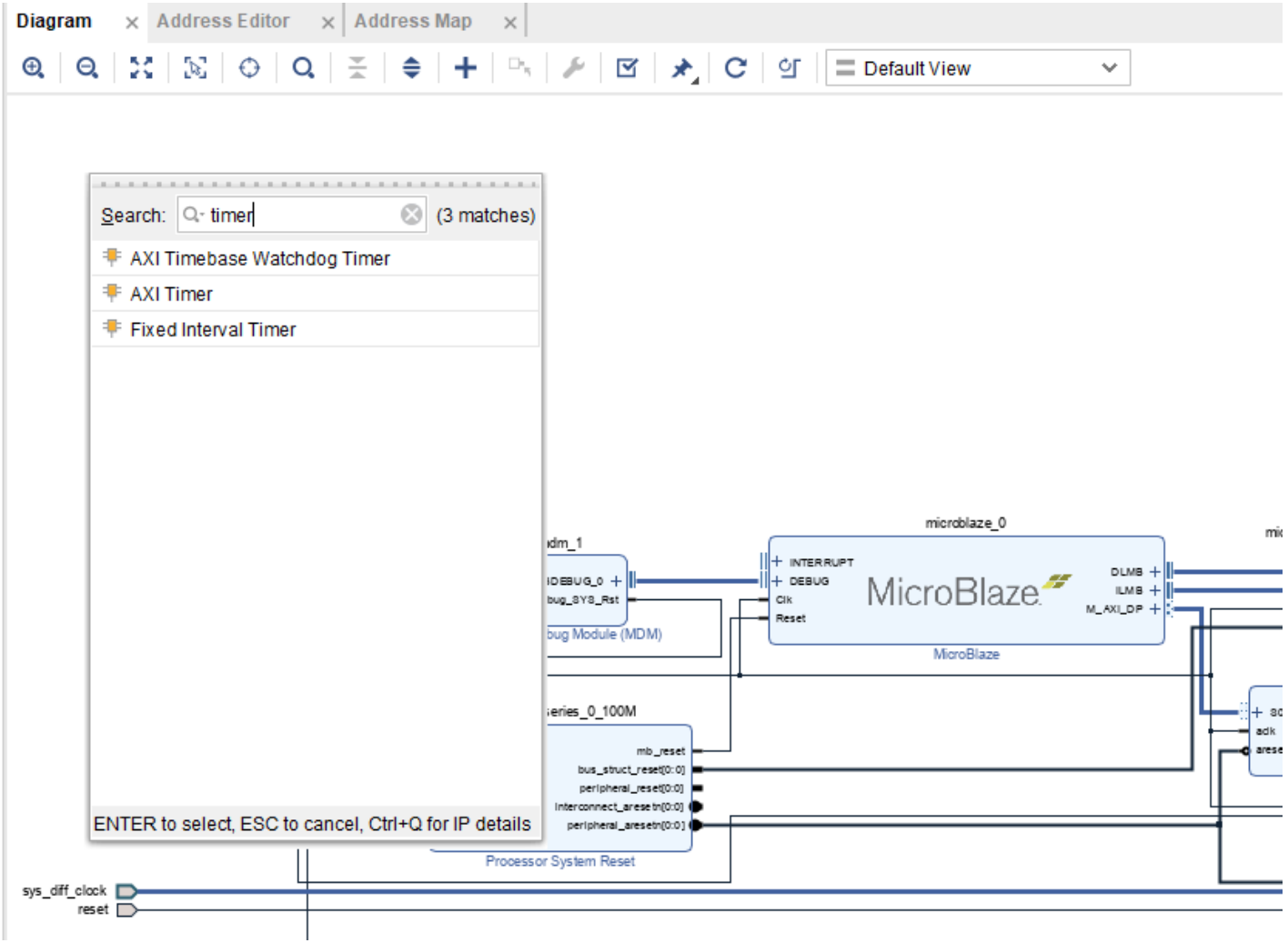
Add in a AXI Timer



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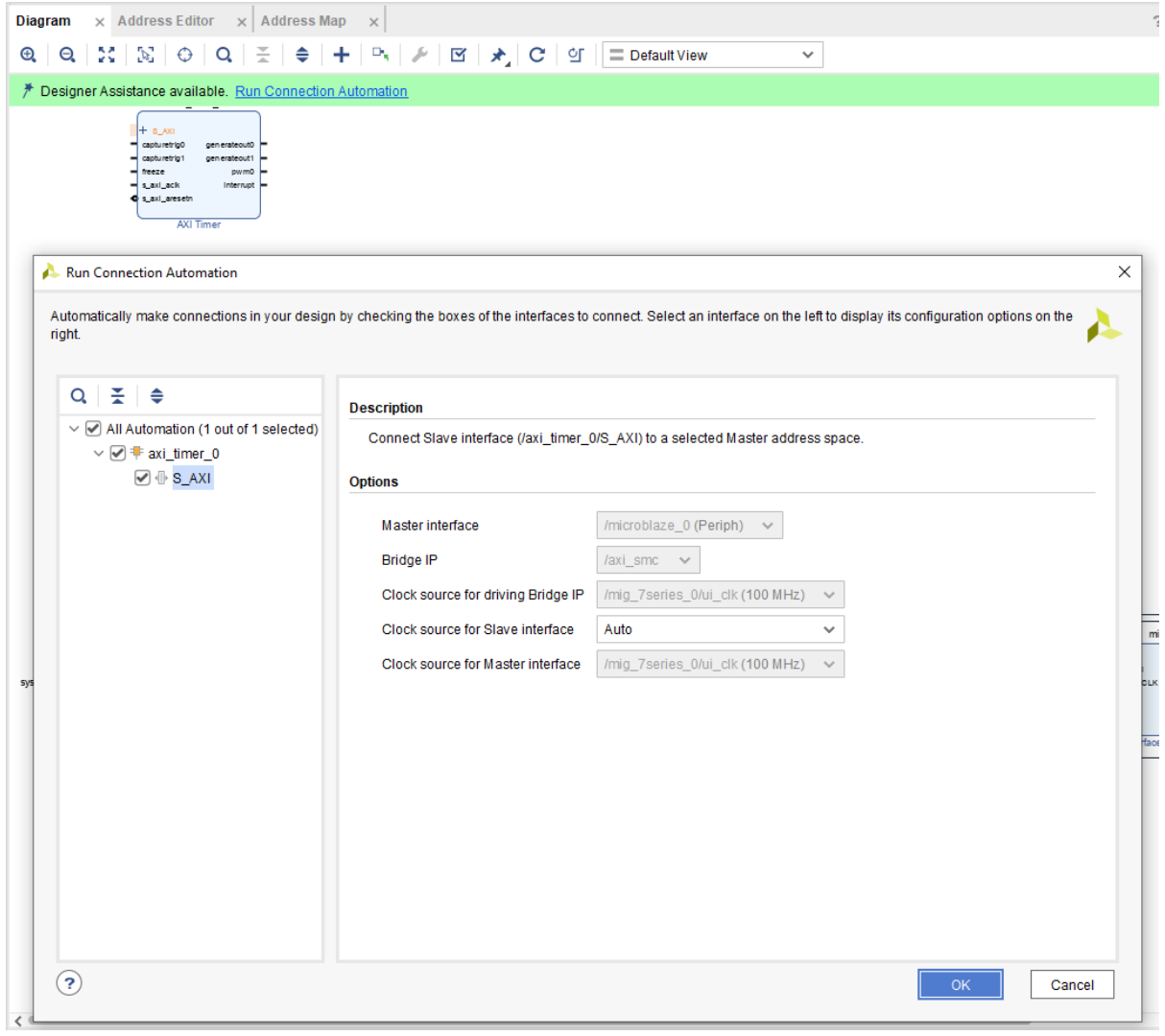
Run the Connection Automation



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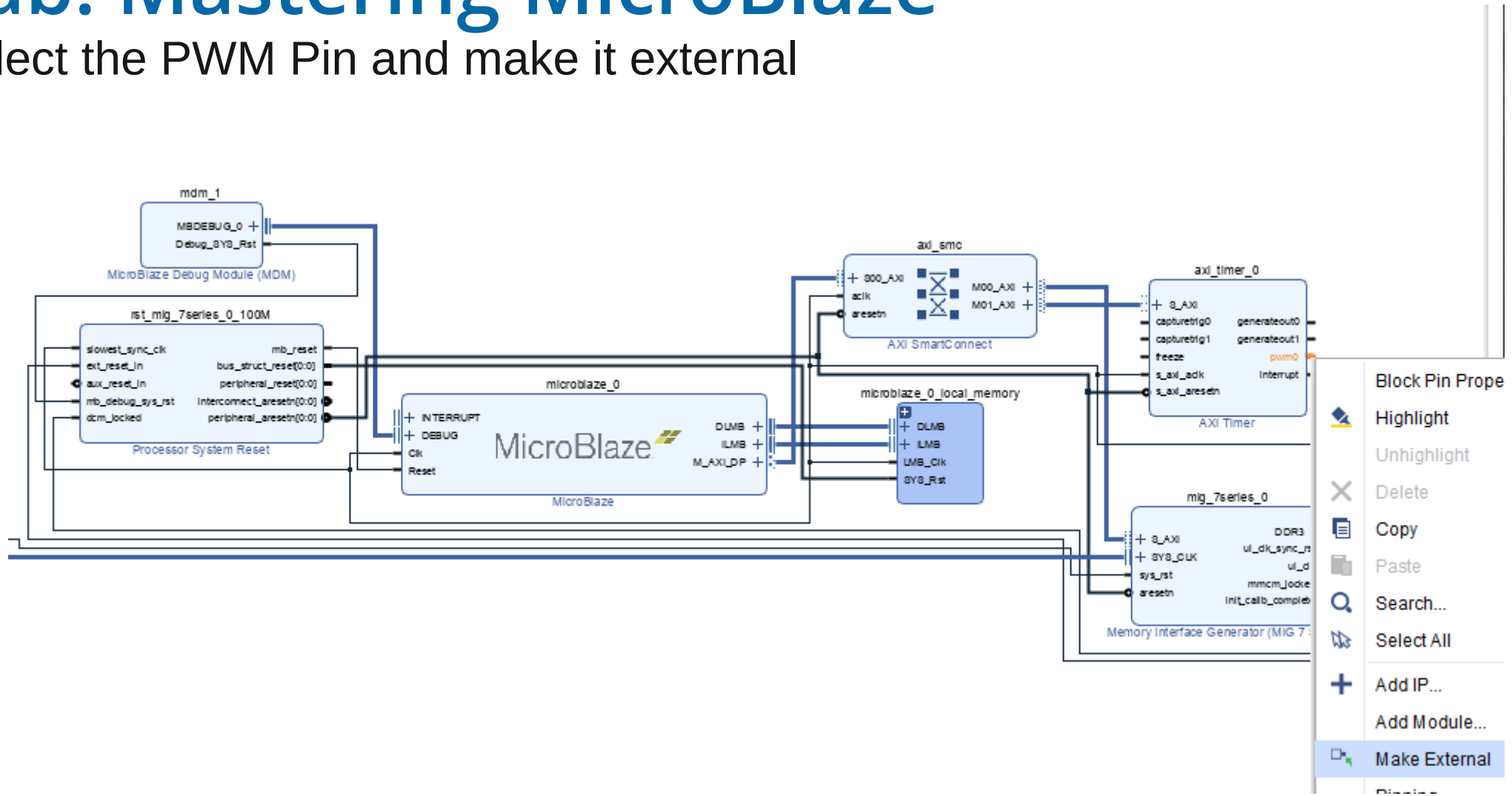
Select the PWM Pin and make it external



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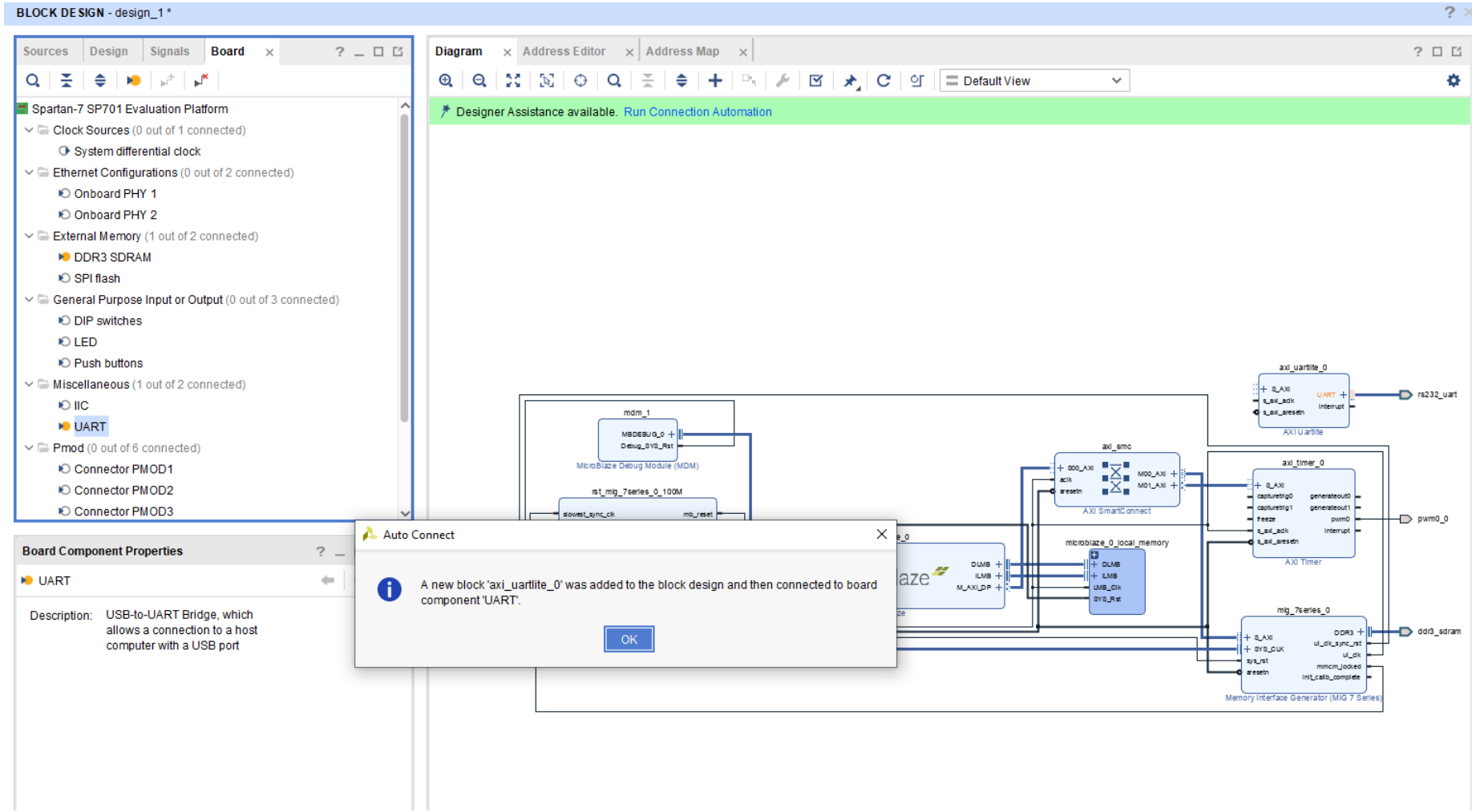
From the board menu drag and drop the UART onto the diagram



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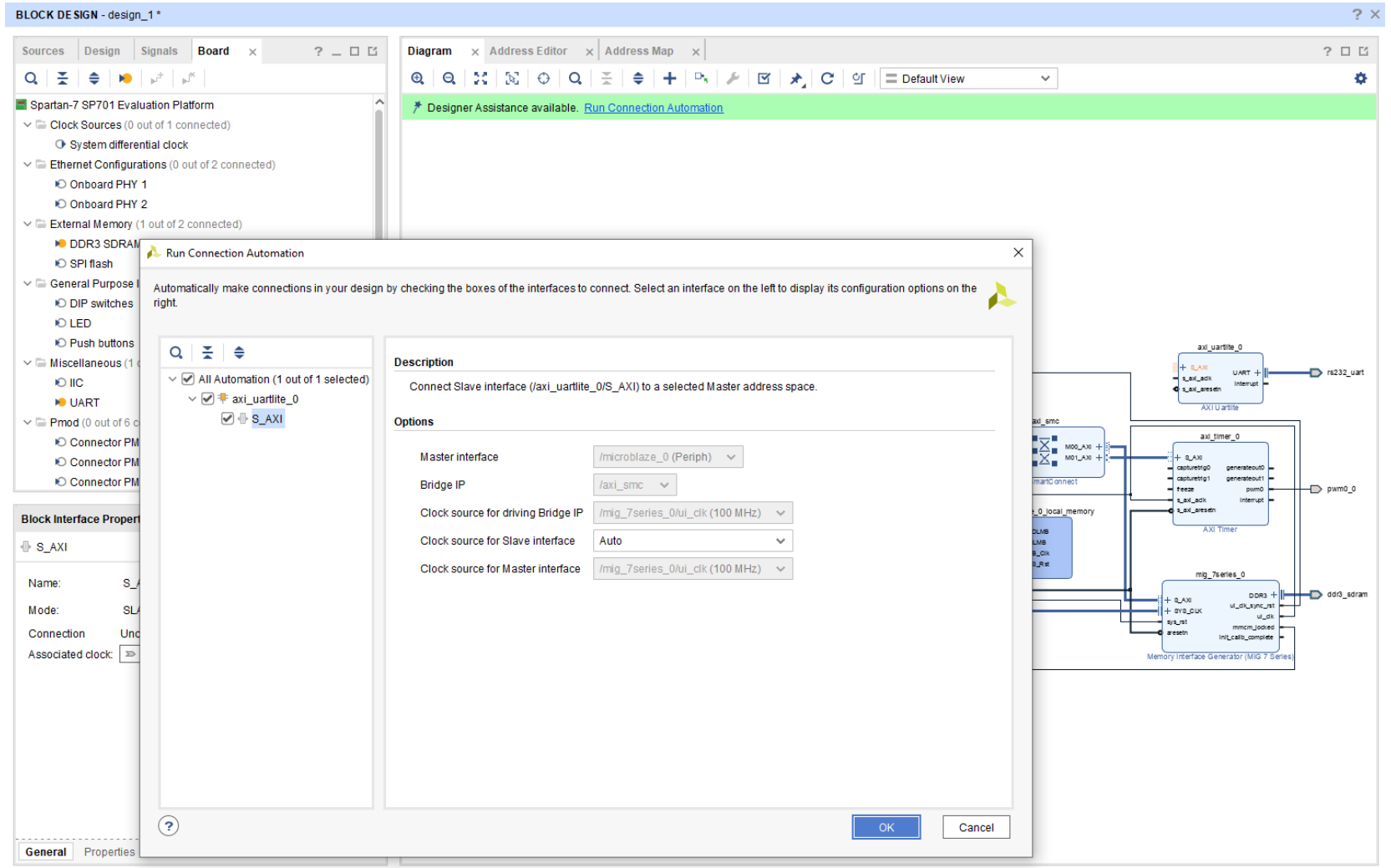
Run the connection automation



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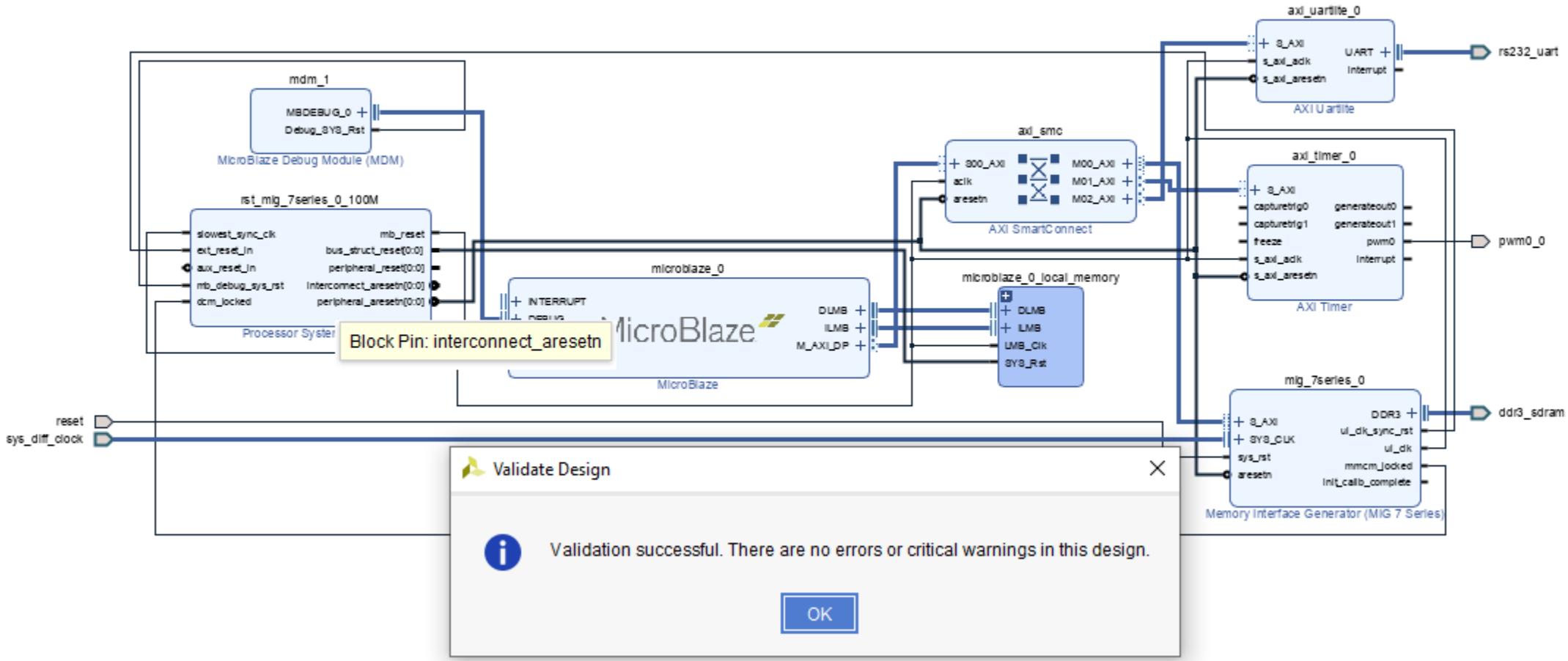
Validate the design = No errors or critical warnings should appear



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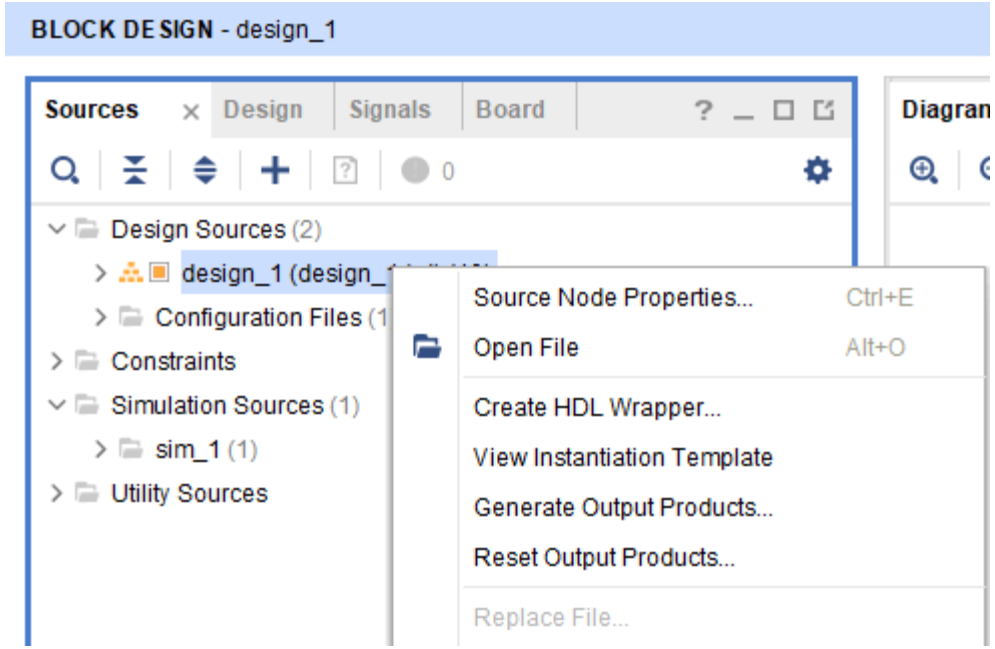
Create an HDL Wrapper



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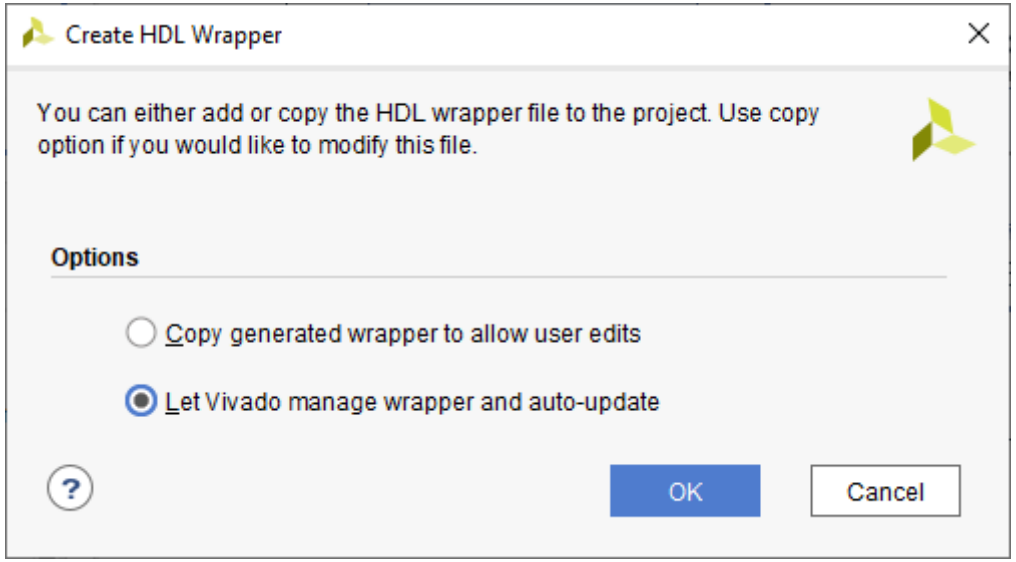
Let Vivado manage the wrapper



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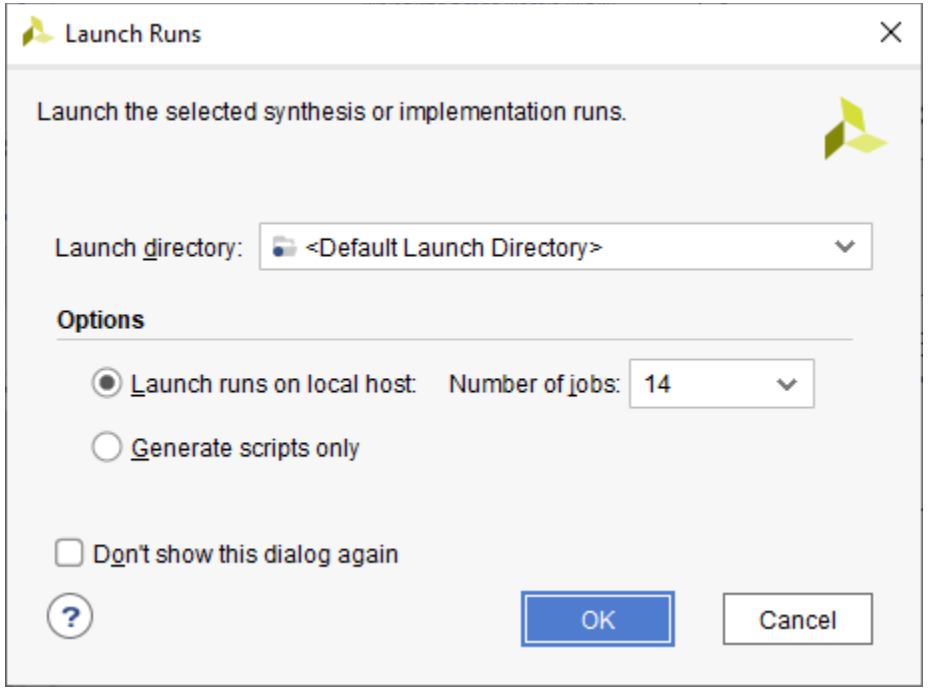
Synthesize the design



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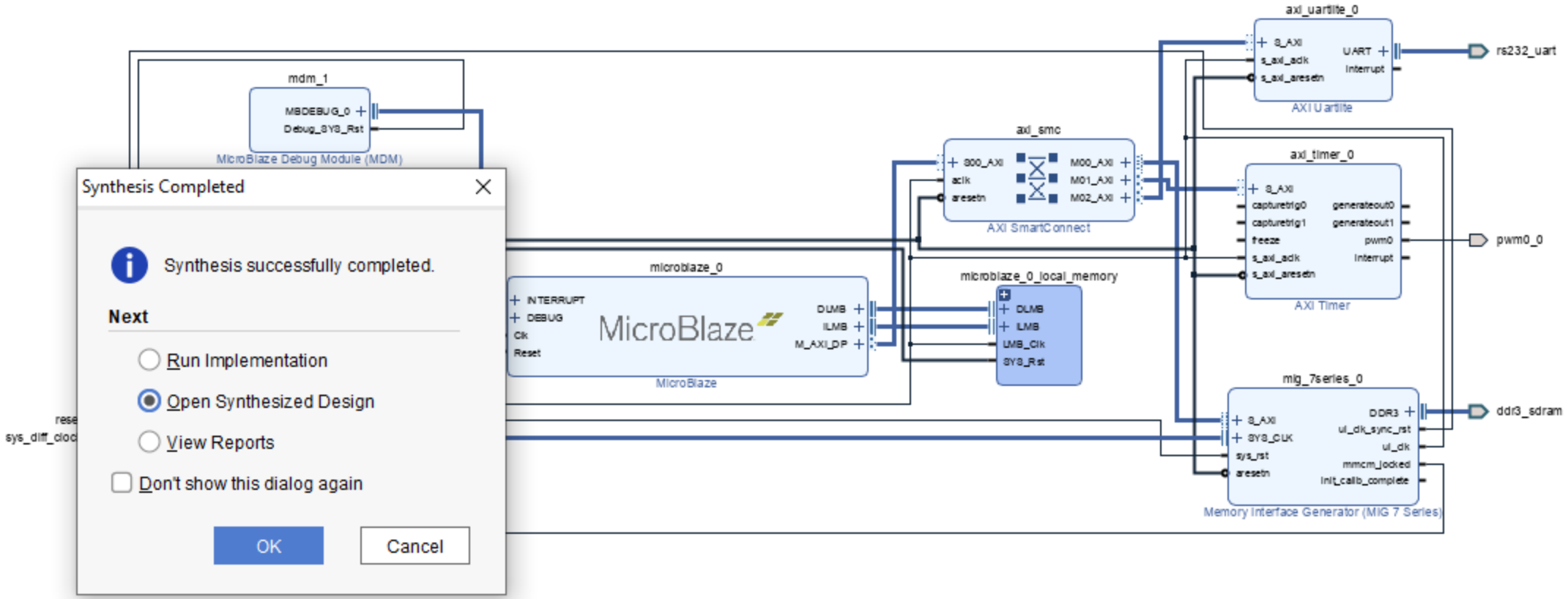
Once synthesis completes open the synthesized view



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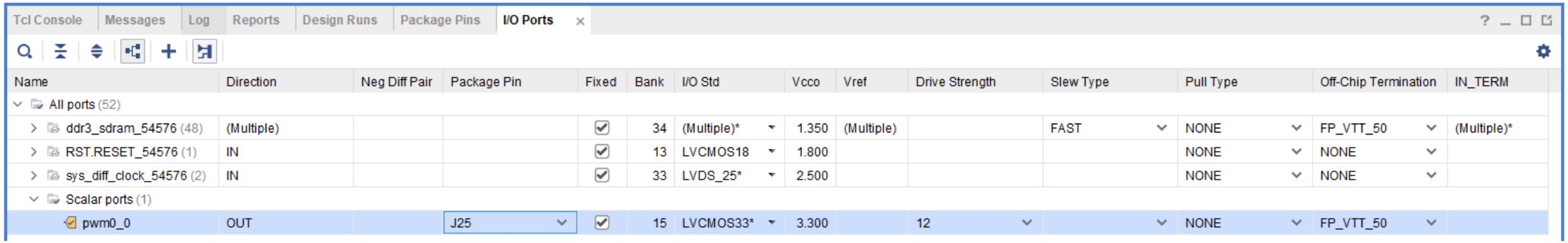
In the IO Ports view assign the PWM output to a pin connected to the LED



Name	Direction	Neg Diff Pair	Package Pin	Fixed	Bank	I/O Std	Vcco	Vref	Drive Strength	Slew Type	Pull Type	Off-Chip Termination	IN_TERM
All ports (52)													
ddr3_sdram_54576 (48)	(Multiple)			☑	34	(Multiple)*	1.350	(Multiple)		FAST	NONE	FP_VTT_50	(Multiple)*
RST.RESET_54576 (1)	IN			☑	13	LVCMOS18	1.800				NONE	NONE	
sys_diff_clock_54576 (2)	IN			☑	33	LVDS_25*	2.500				NONE	NONE	
Scalar ports (1)													
pwm0_0	OUT		J25	☑	15	LVCMOS33*	3.300		12		NONE	FP_VTT_50	

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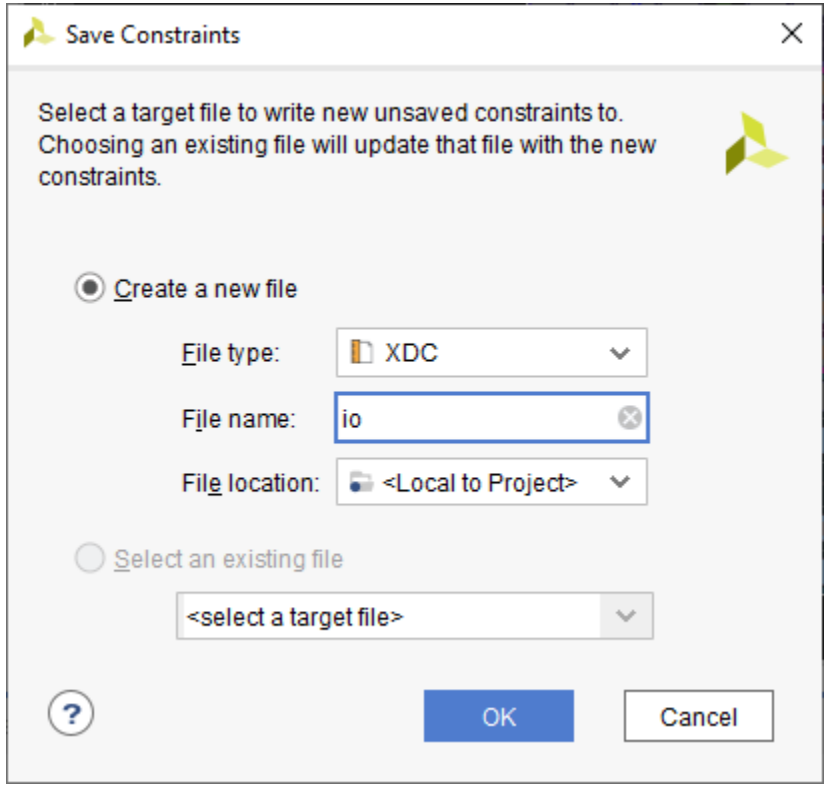
Save the constraints



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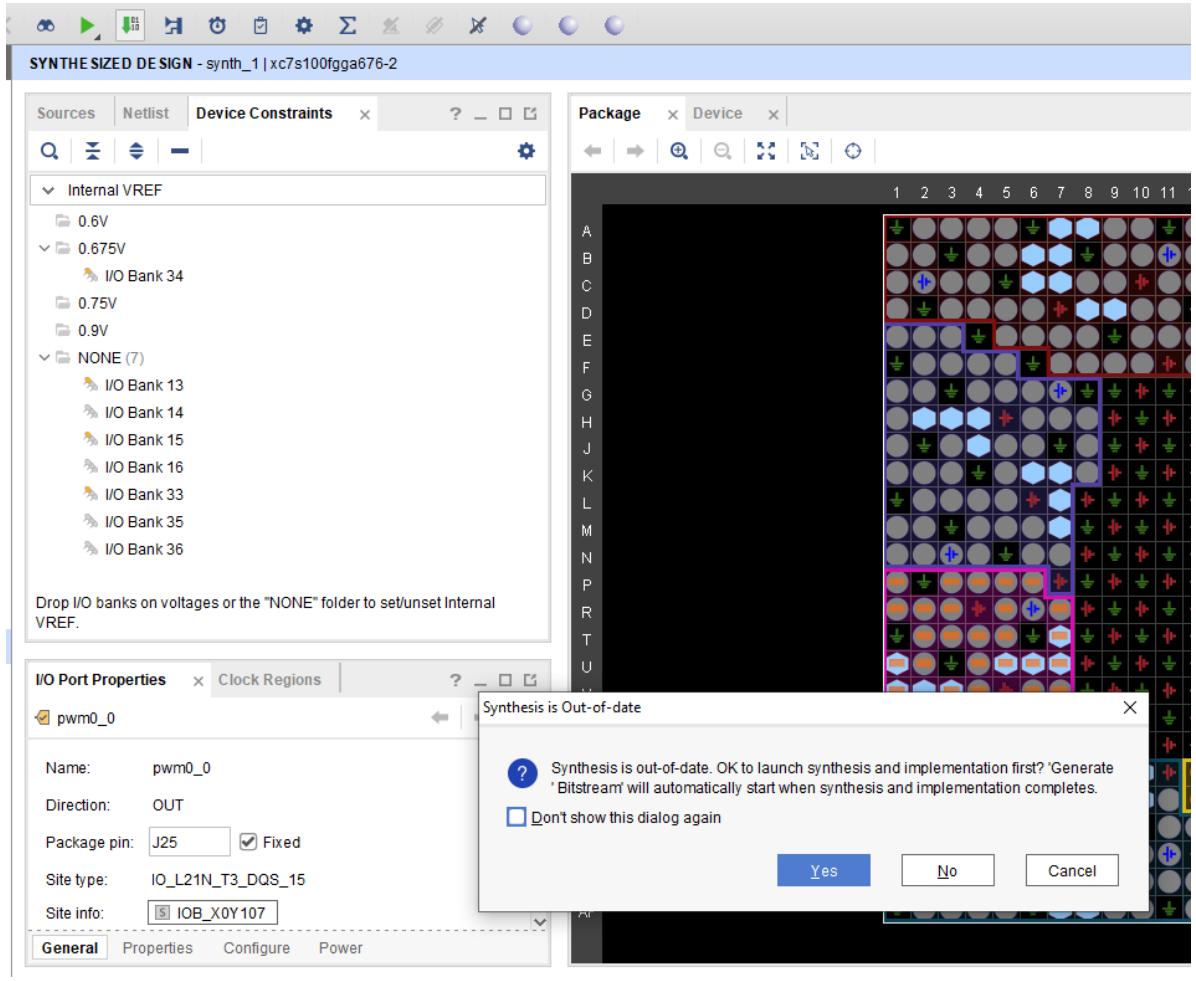
Generate the bitstream – if you see an out-of-date warning click yes



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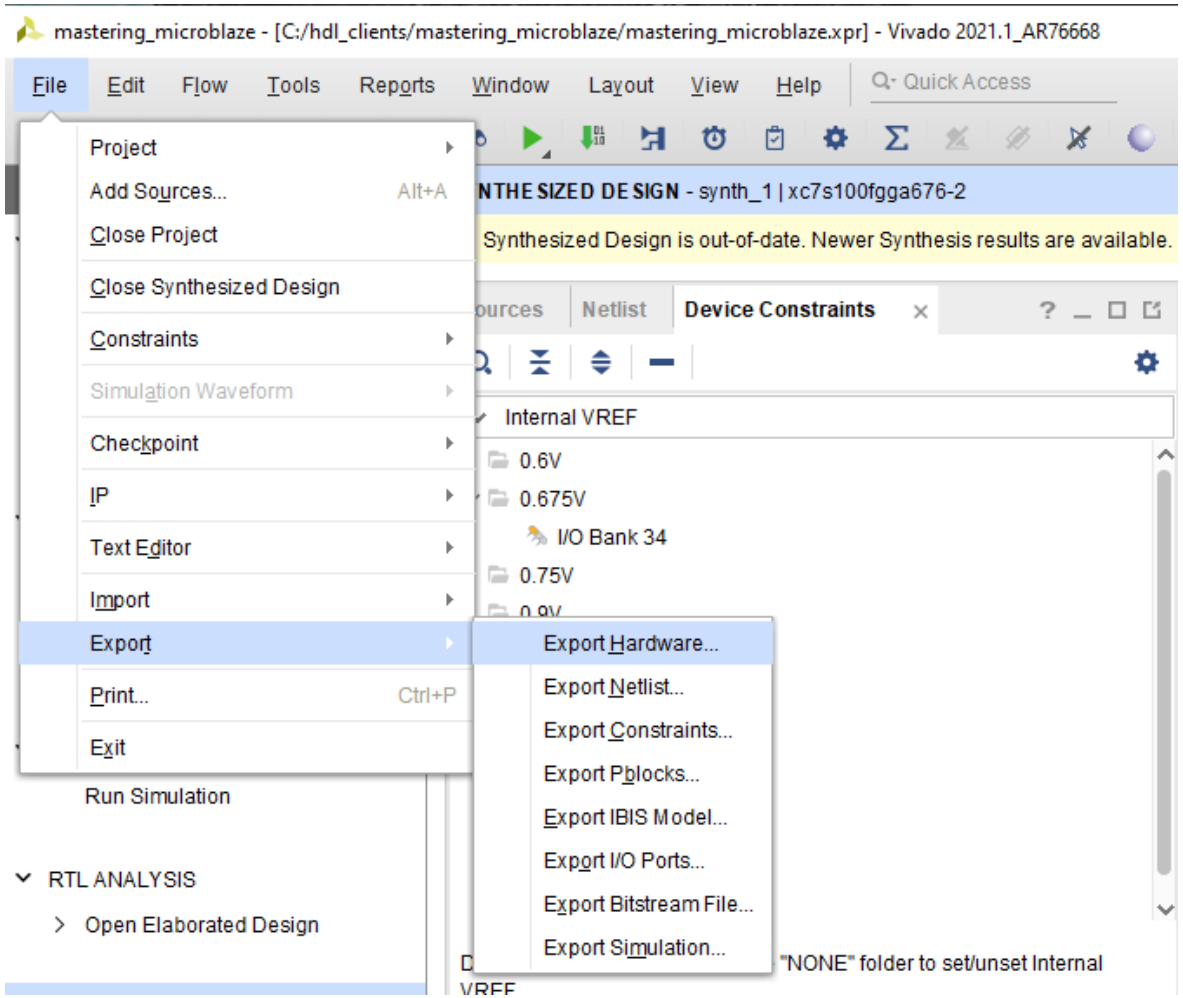
Once the bit stream is completed, export the hardware definition to Vitis



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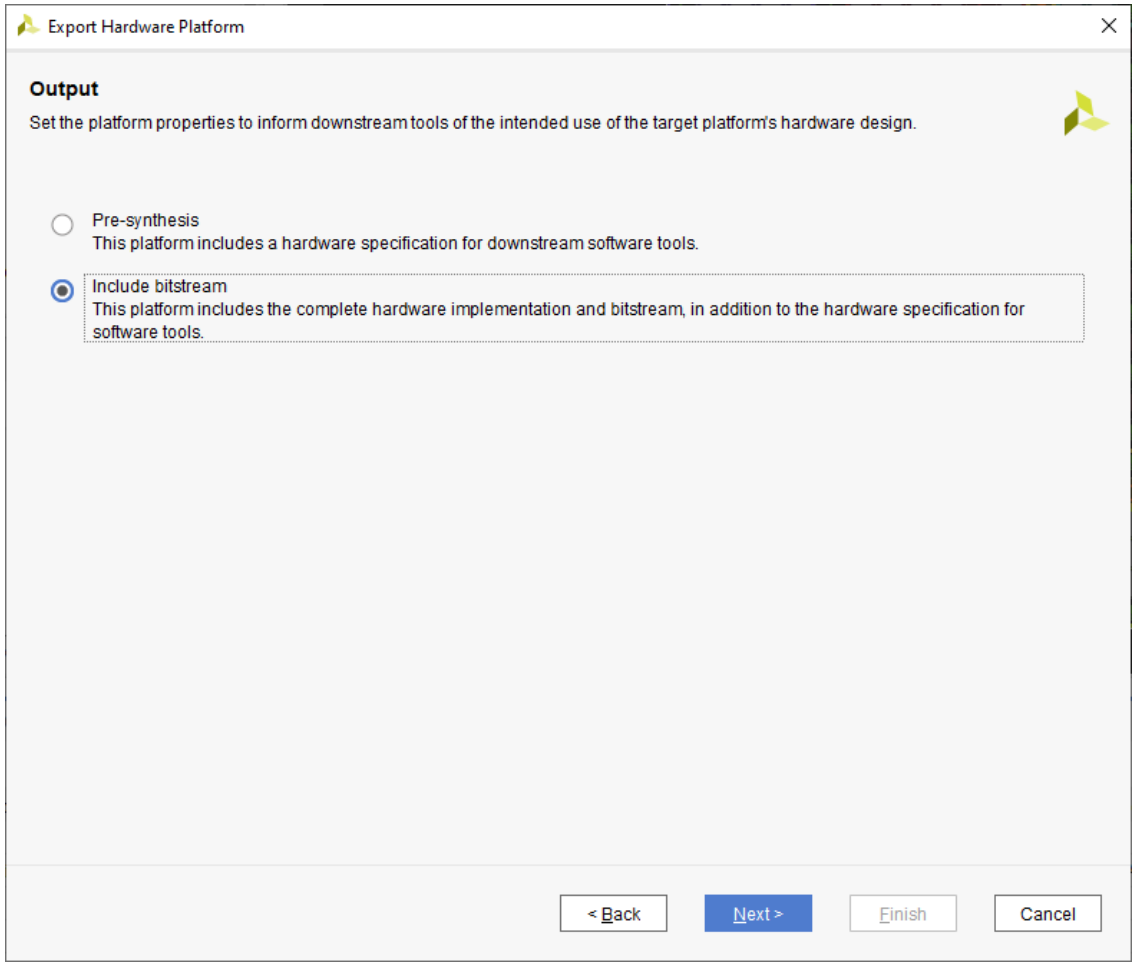
Export the Hardware with the bitstream



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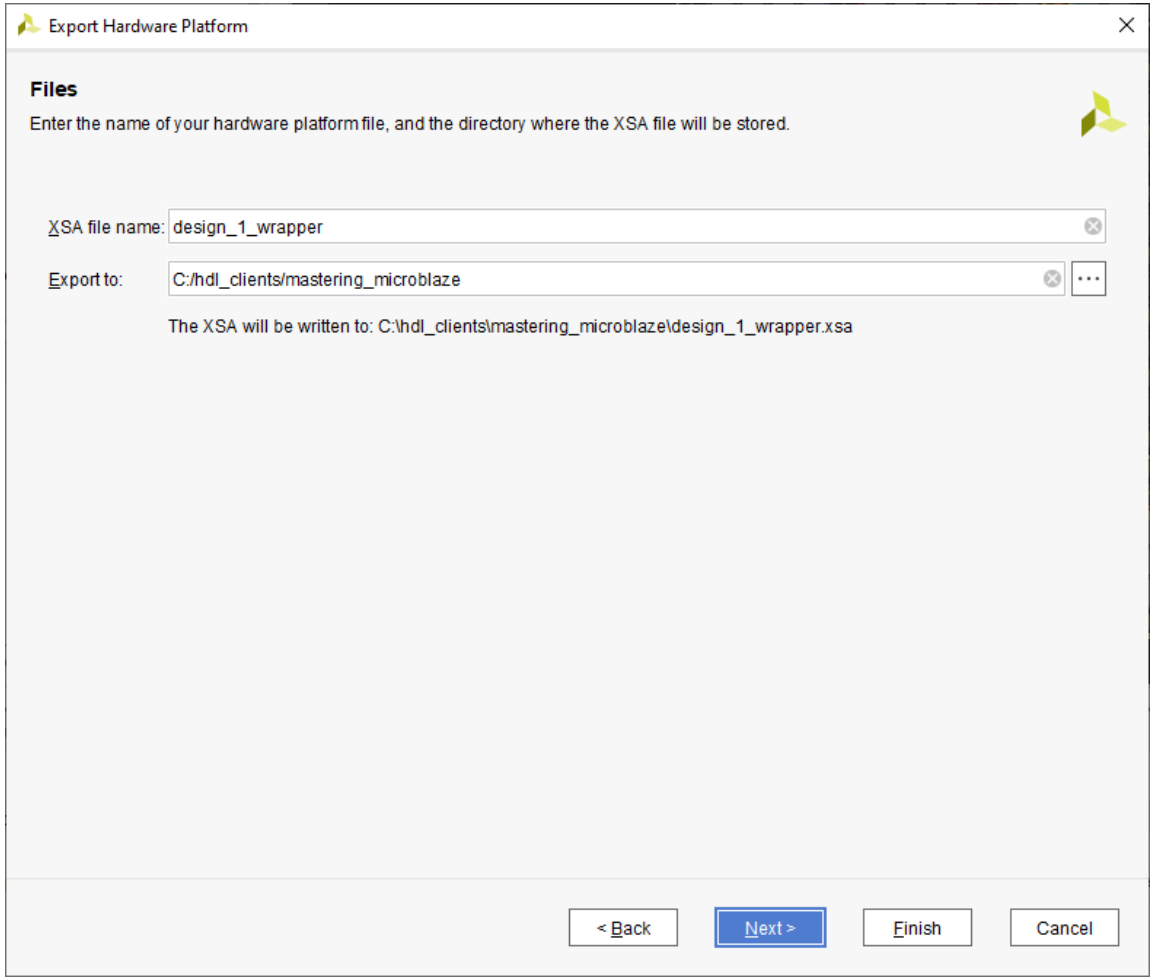
Leave the file name and location unchanged



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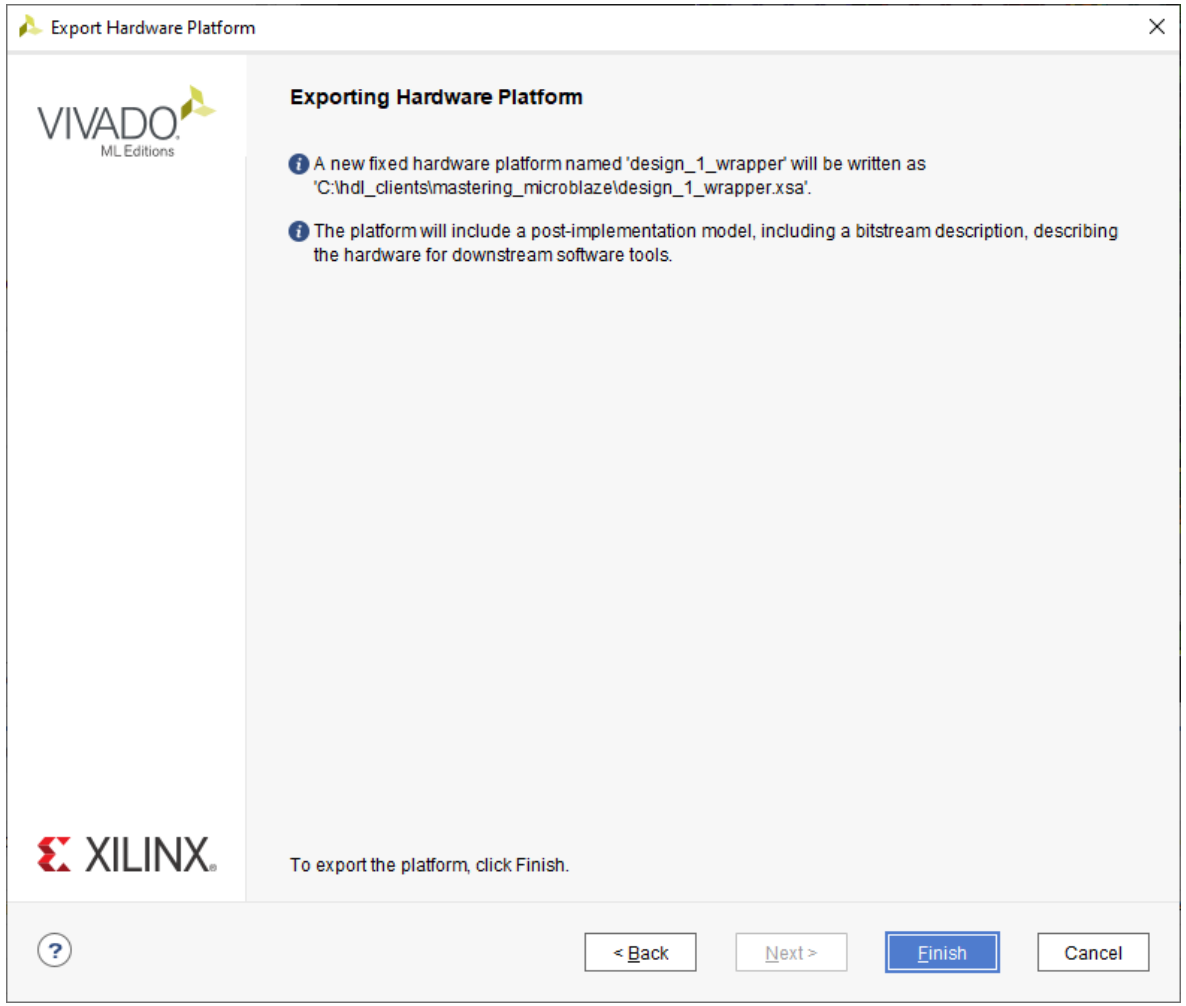
Click Finish



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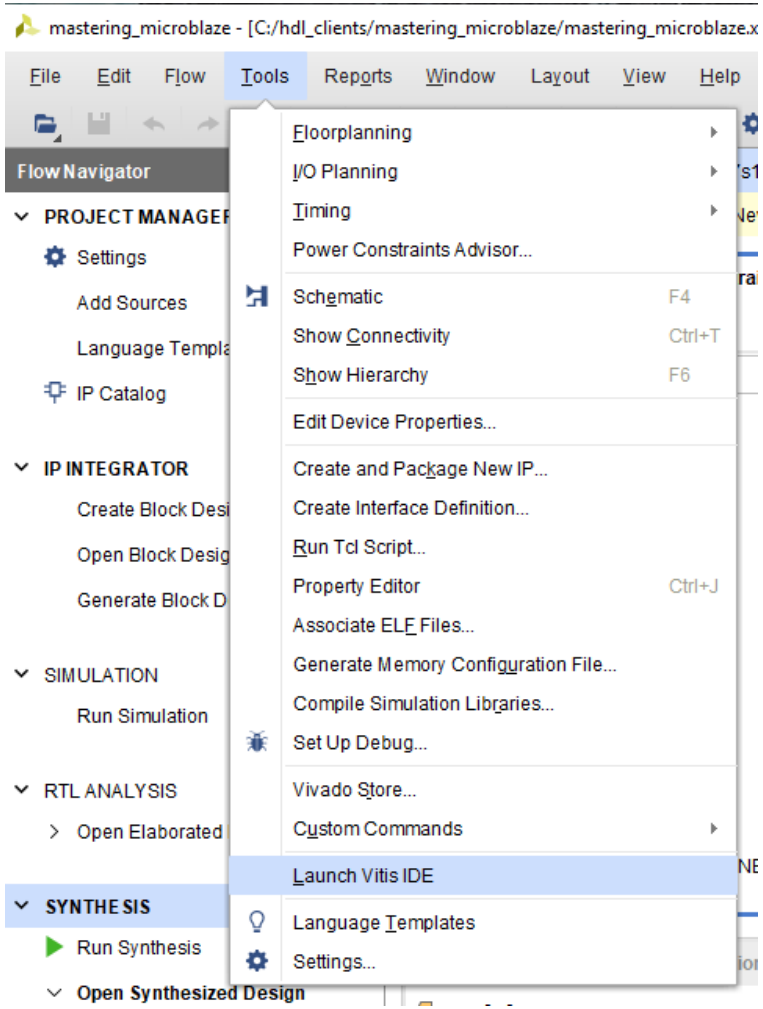
From the tools menu select Launch Vitis IDE



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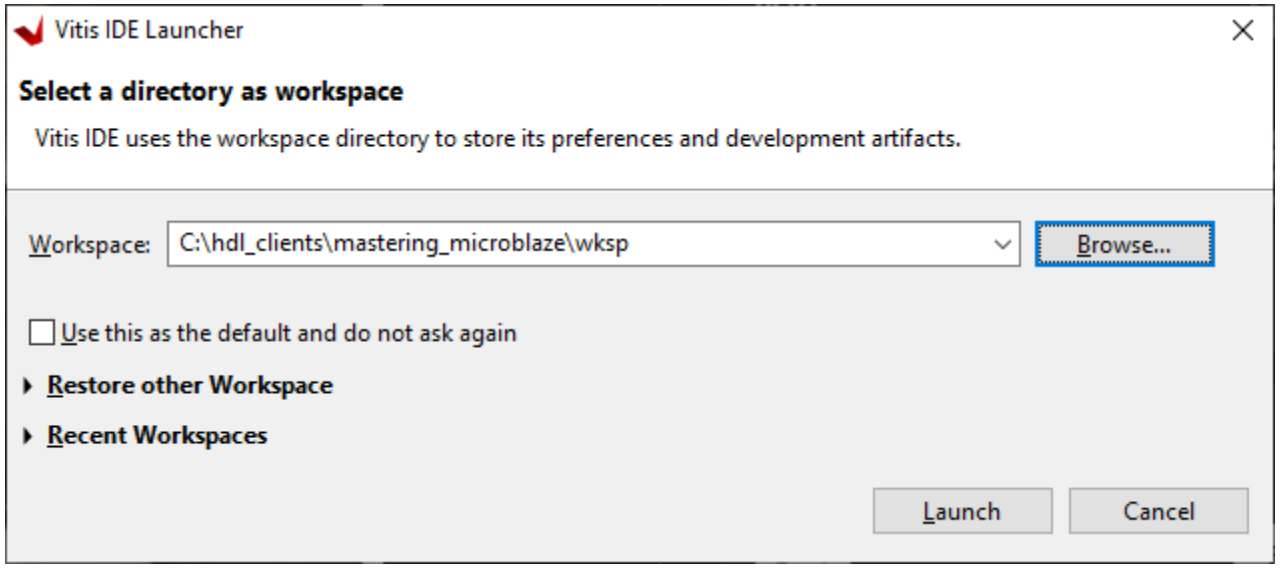
Select the workspace – this is where all the SW files and projects will be contained



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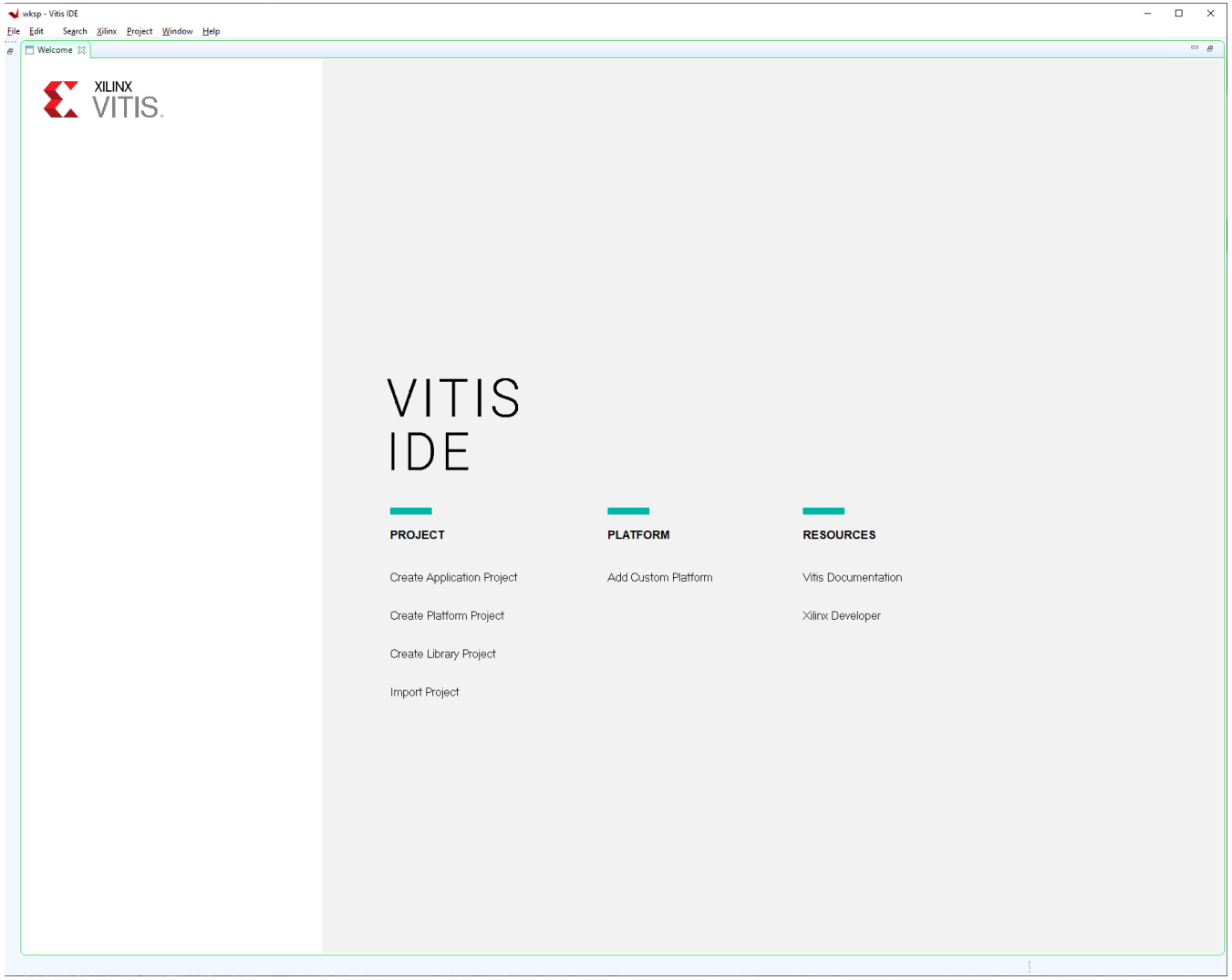
Once Vitis is Open, from the menu screen select Create-Application Project



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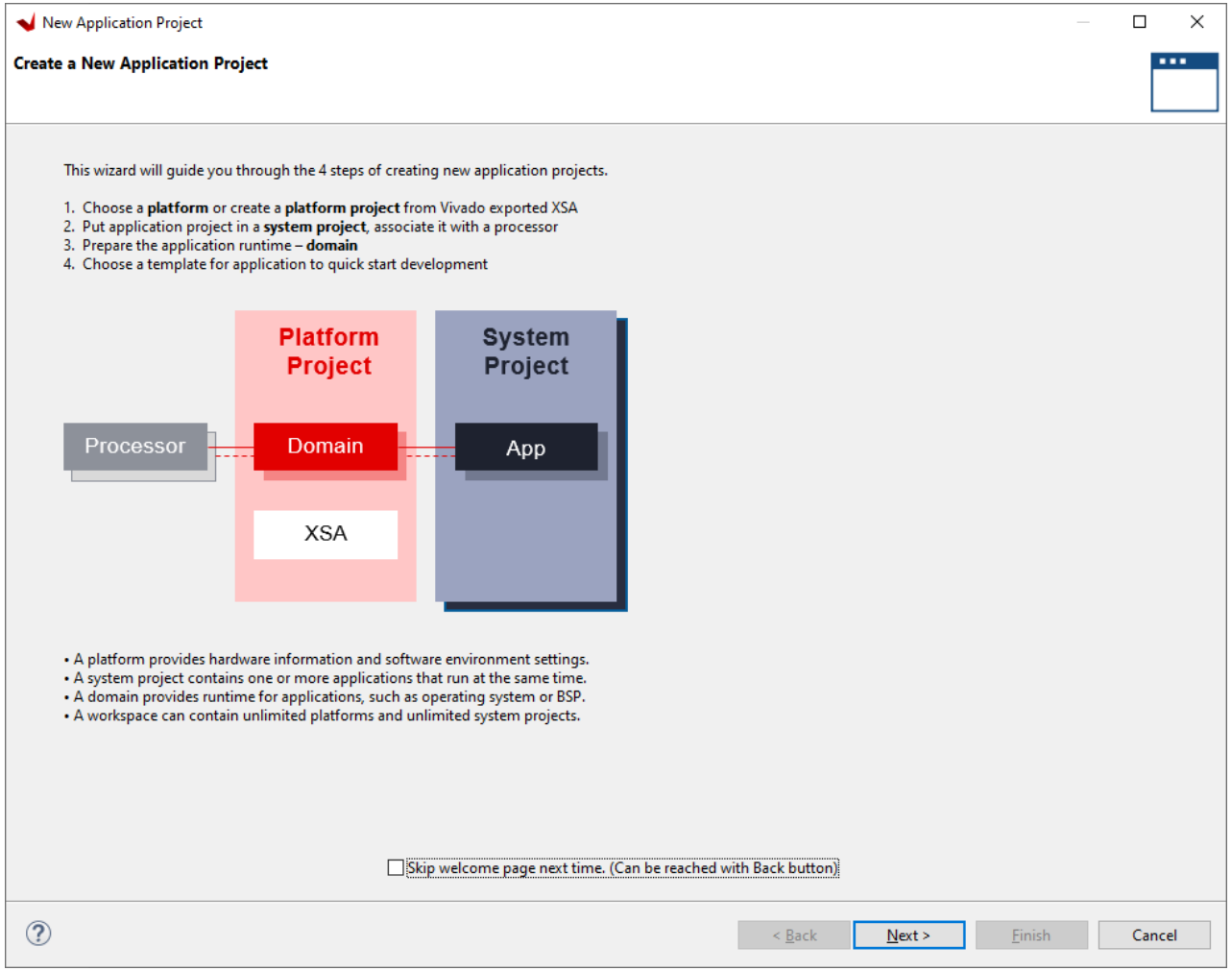
Click Next



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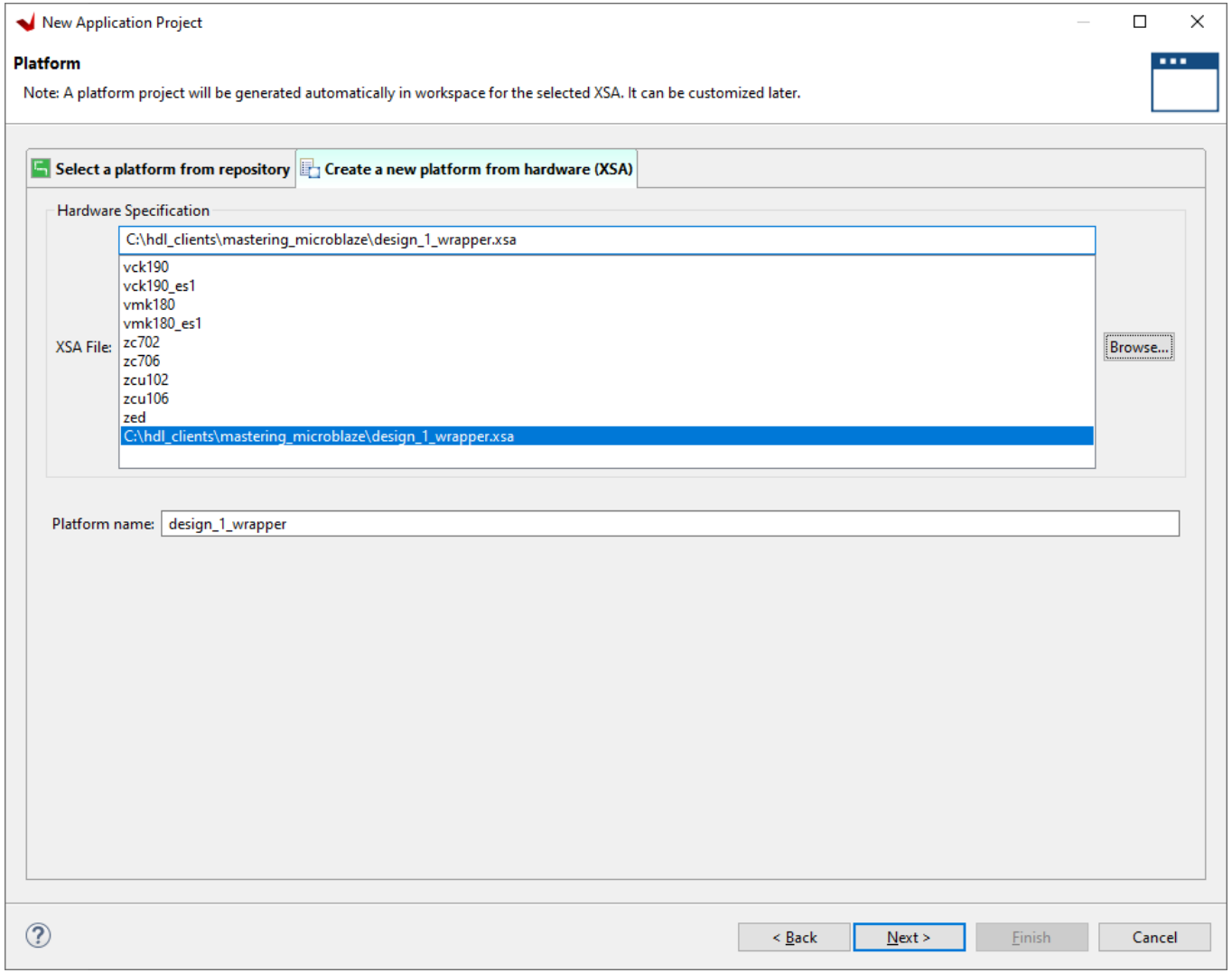
Select the XSA just exported from Vivado



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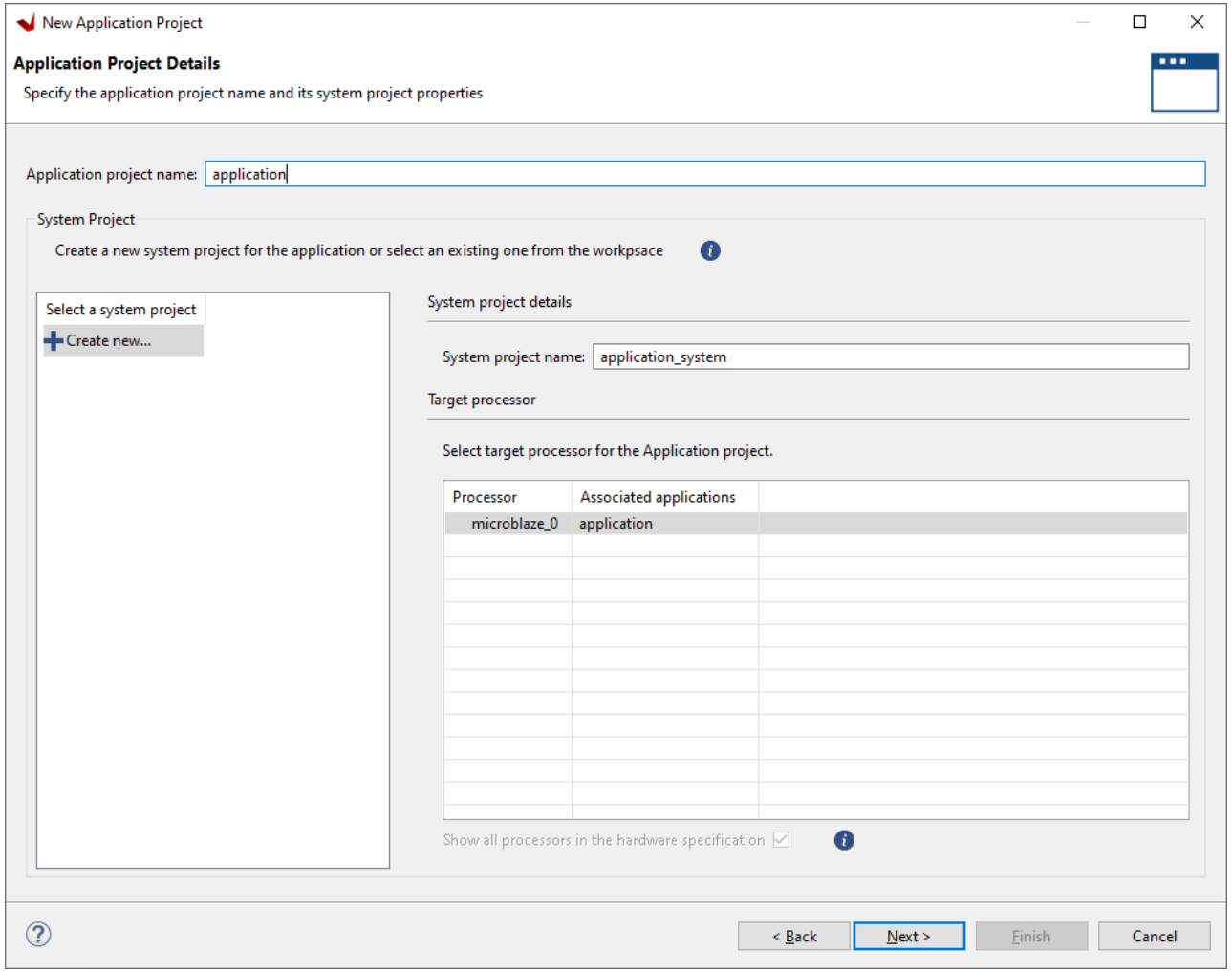
Enter a project name



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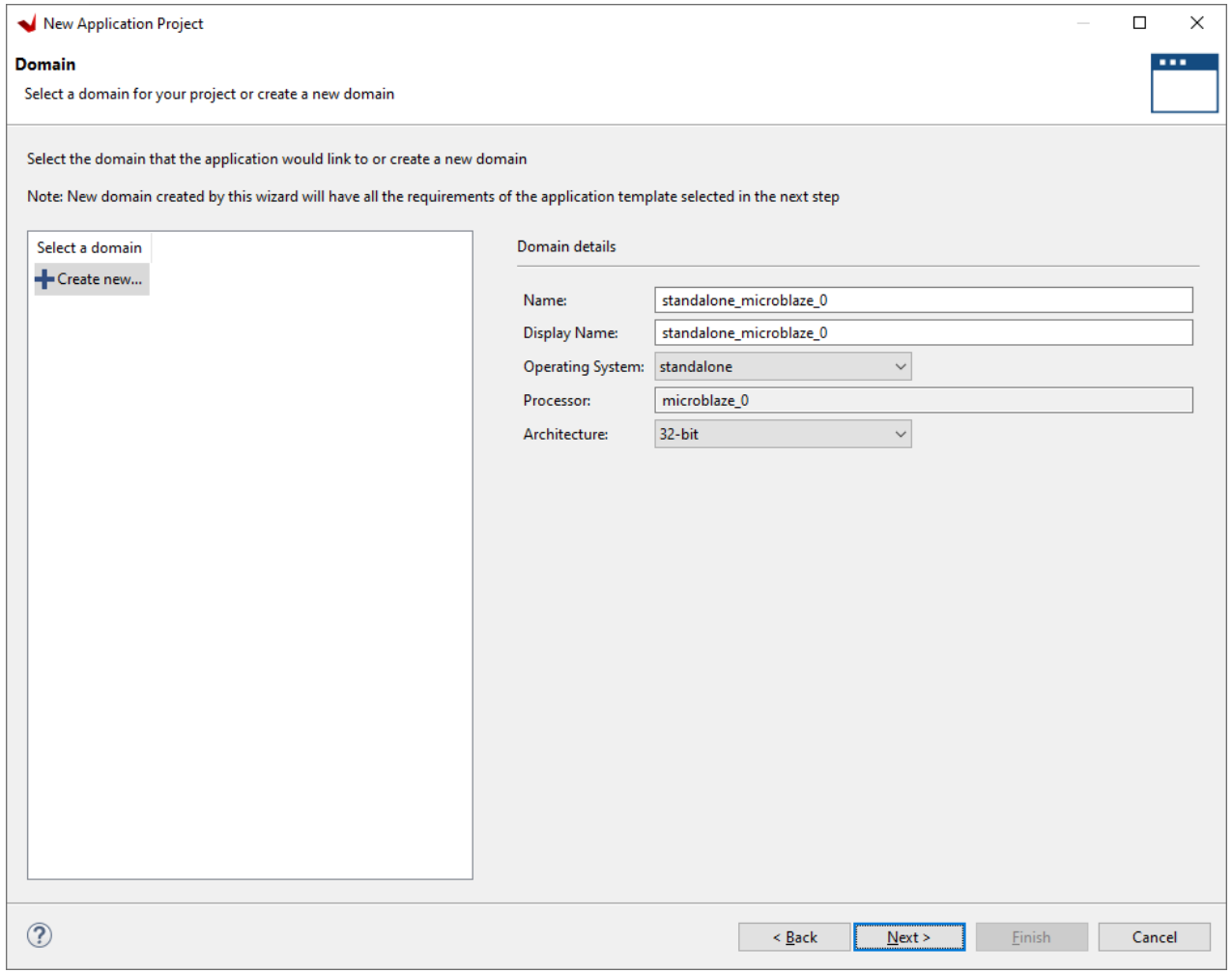
Leave the domain unchanged



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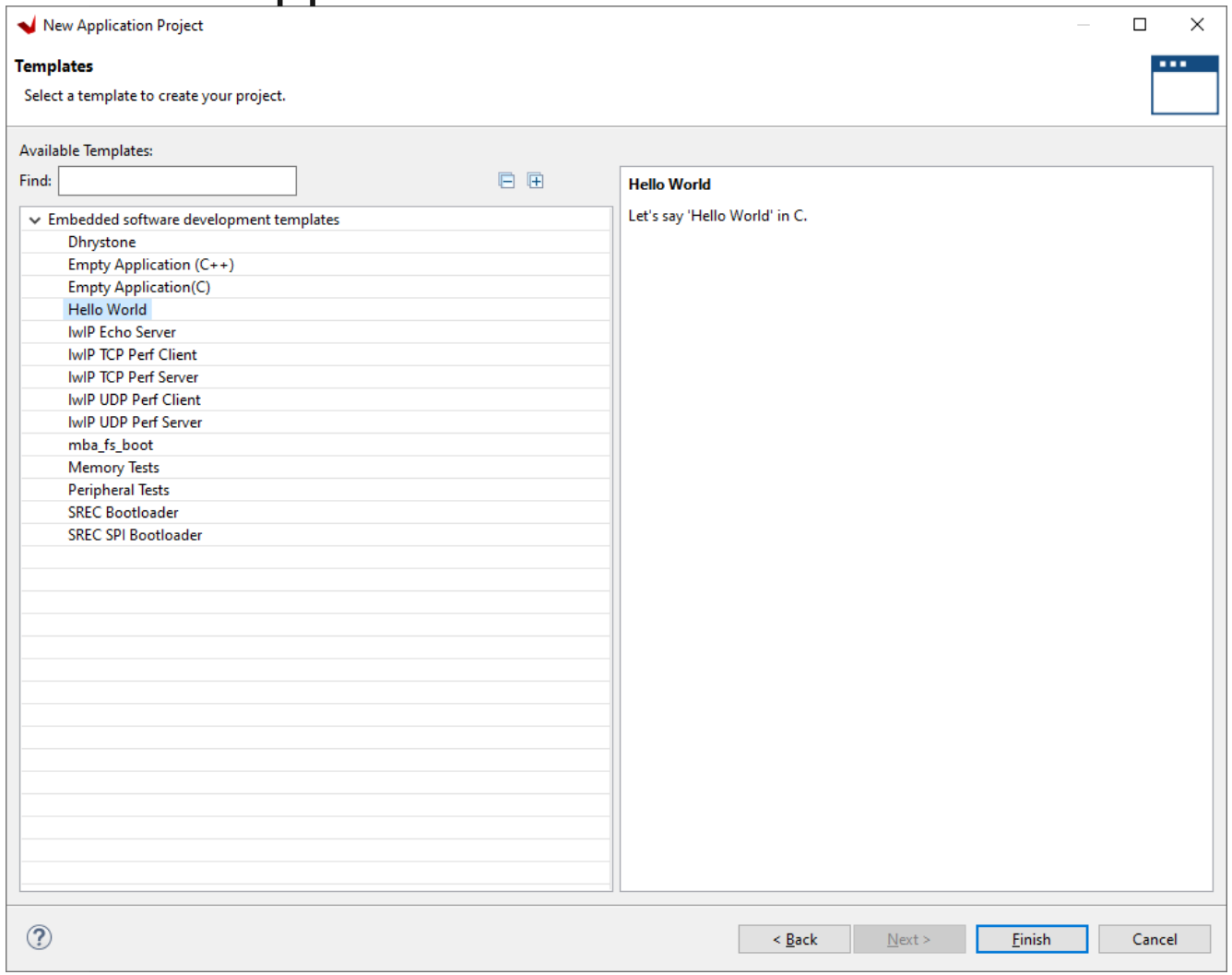
Select the Hello World Application



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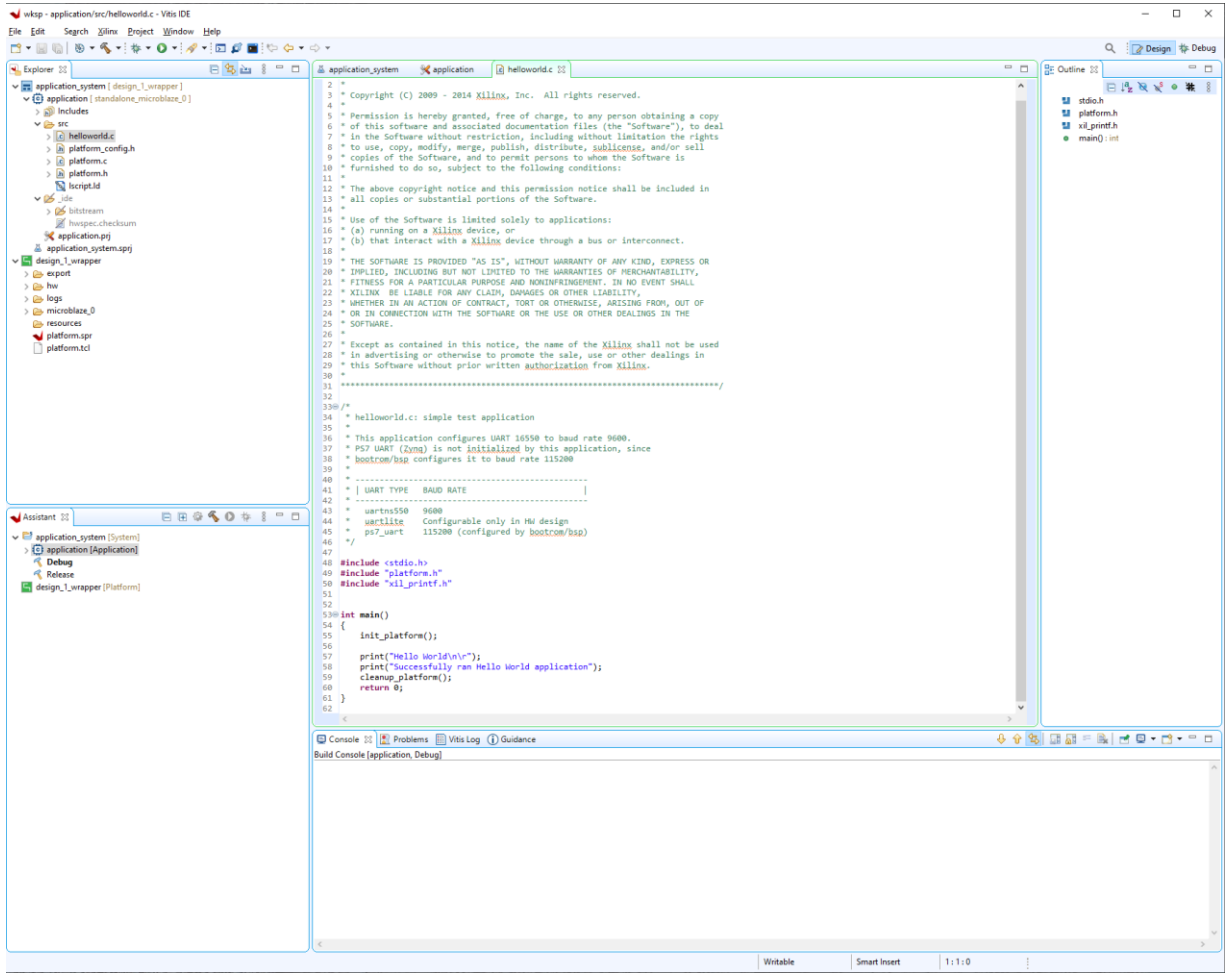
This will create a new application which prints hello world, we will use this to double check the correctness of the Vivado design. Click the Hammer to build the App



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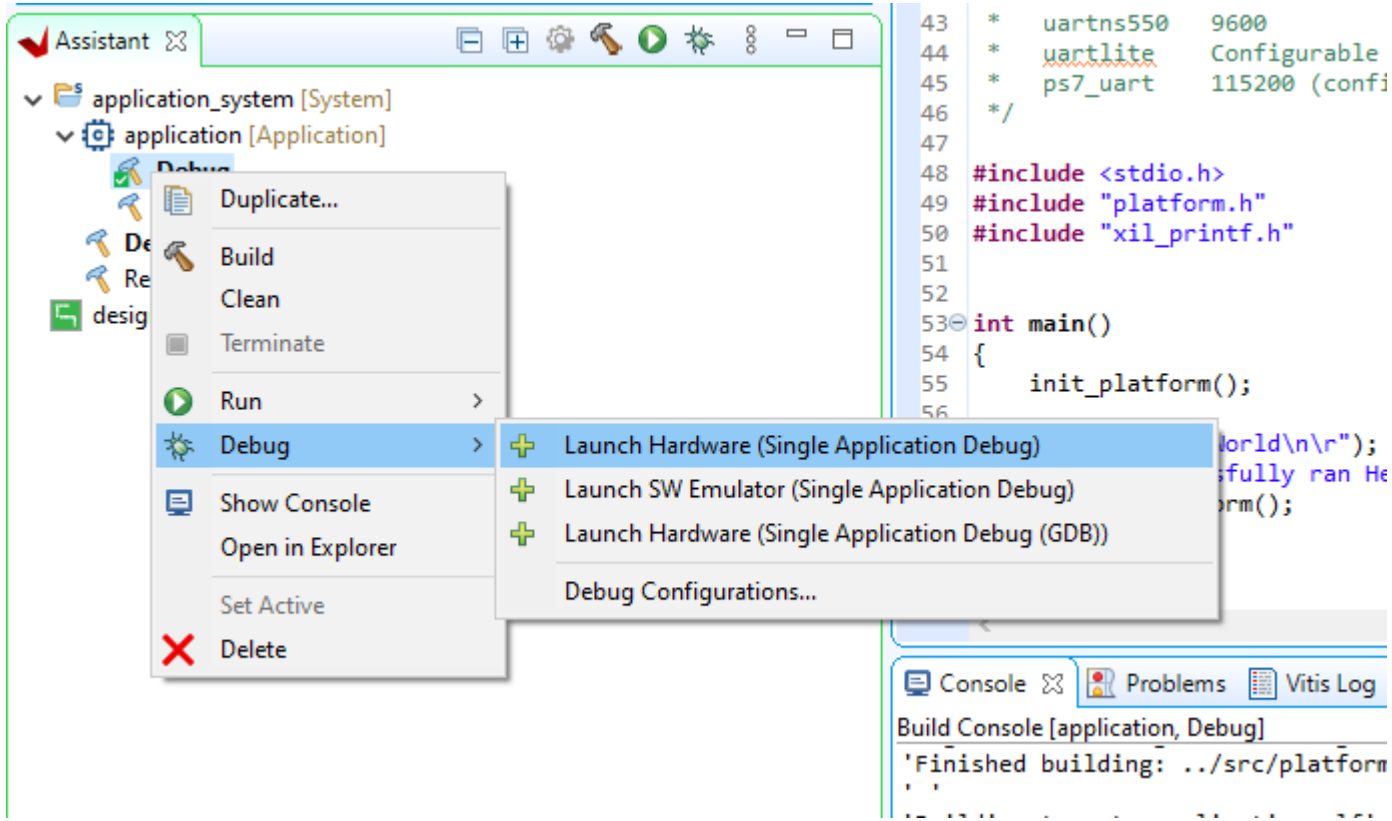
In the Assistant window select Debug, Launch on Hardware



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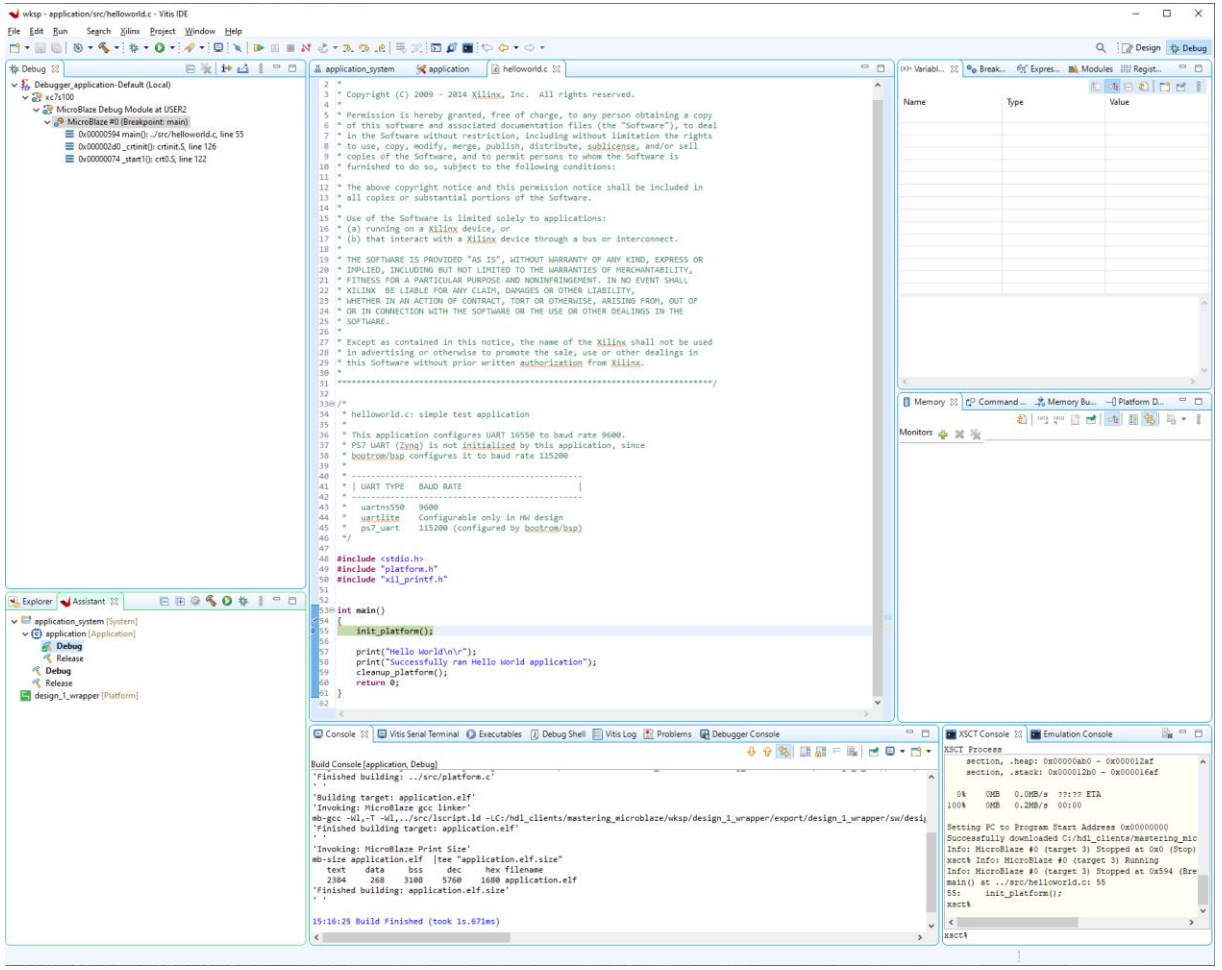
This will program the FPGA and download the application, halting it for execution at the first line.



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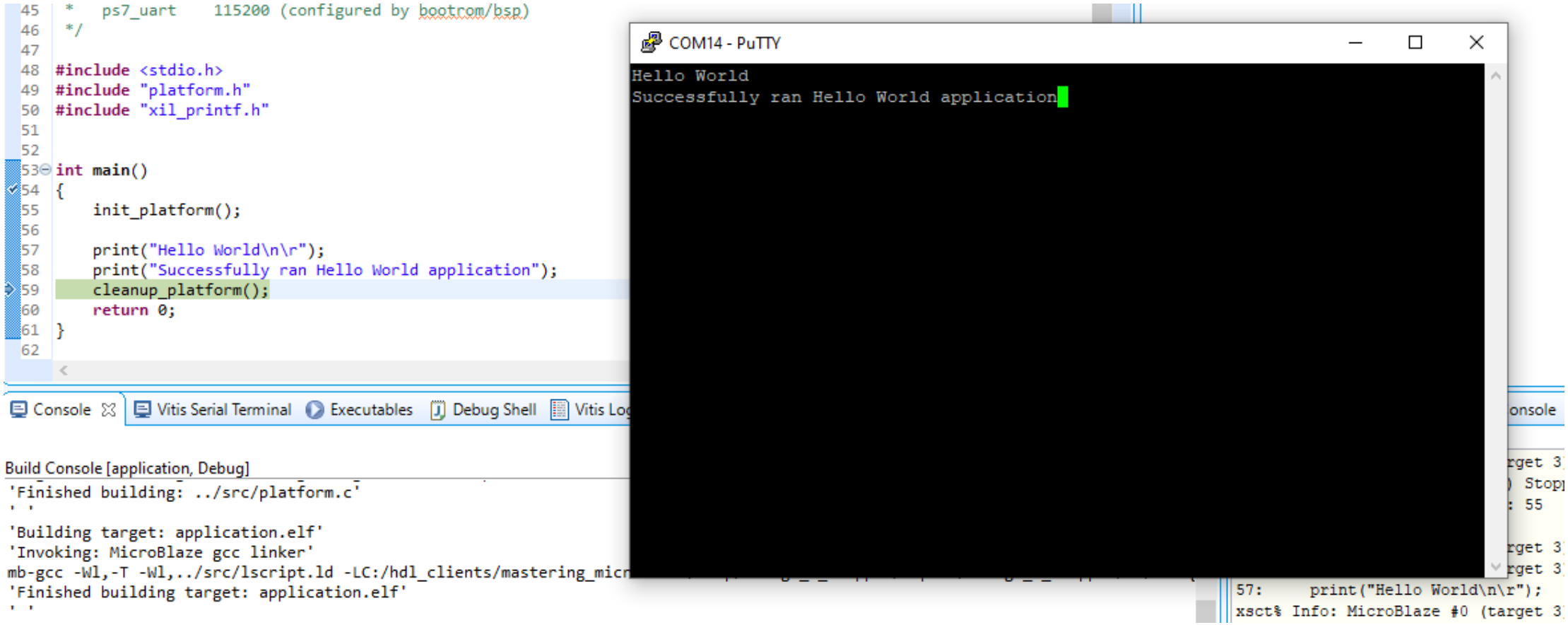
Single step through the code and observe the output in a terminal window



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Replace the code in the hello world application with that in the Git Repo, rebuild the code and download it to the development board.

```c
int main()
{
    u8  DutyCycle;
    u8  NoOfCycles;
    u8  Div;
    u8  Value;
    u32 Period;
    u32 HighTime;
    u64 WaitCount;
    int Status;
    float DivF;

    init_platform();

    print("Mastering MicroBlaze\n\r");


    XTmrCtr_Initialize(&TimerCounterInst, TMRCTR_DEVICE_ID);

    XTmrCtr_PwmDisable(&TimerCounterInst);

    Div = DUTYCYCLE_DIVISOR;
    Period = PWM_PERIOD;
    HighTime = PWM_PERIOD * (Div/10) ;

    DutyCycle = XTmrCtr_PwmConfigure(&TimerCounterInst, Period, HighTime);

    xil_printf("PWM Configured for Duty Cycle = %d\r\n", DutyCycle);

    /* Enable PWM */
    XTmrCtr_PwmEnable(&TimerCounterInst);

    while(1){
         print("Select a Brightness between 0 and 9\n\r");

         /* Read an input value from the console. */
         Value = inbyte();
         Div = Value - 0x30;
         DivF = (float) Div /10;
         HighTime = PWM_PERIOD * DivF;

         XTmrCtr_PwmDisable(&TimerCounterInst);
         DutyCycle = XTmrCtr_PwmConfigure(&TimerCounterInst, Period, HighTime);
         XTmrCtr_PwmEnable(&TimerCounterInst);
    }

    cleanup_platform();
    return 0;
}
```

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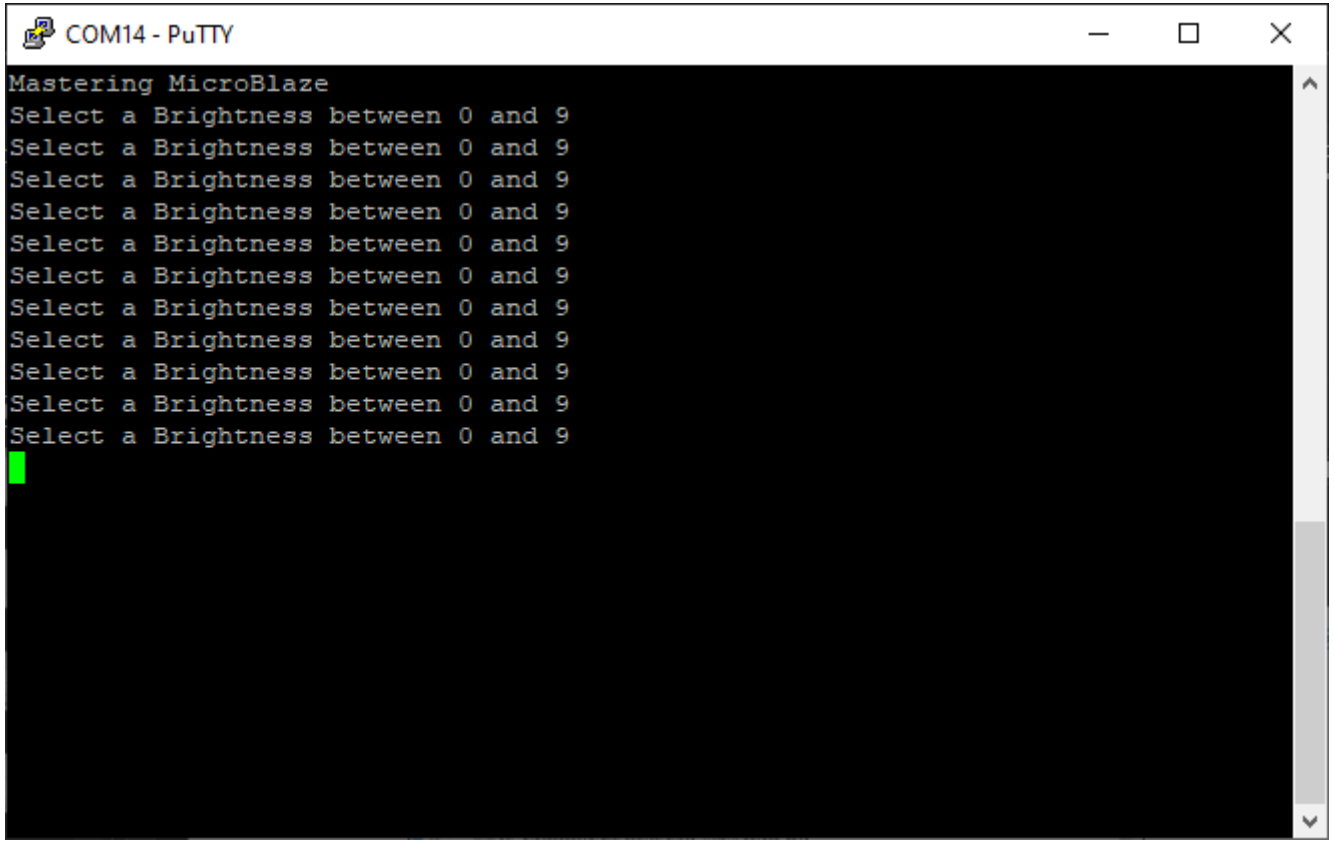
In a terminal window change the PWM to the LED and see the intensity change



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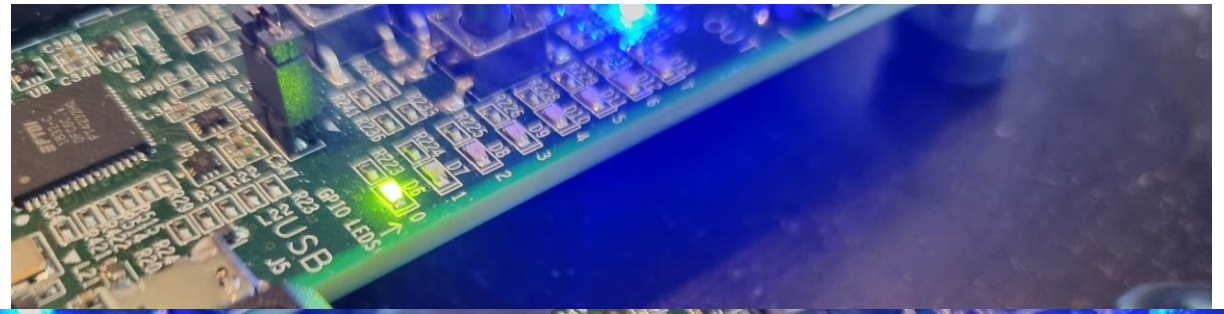

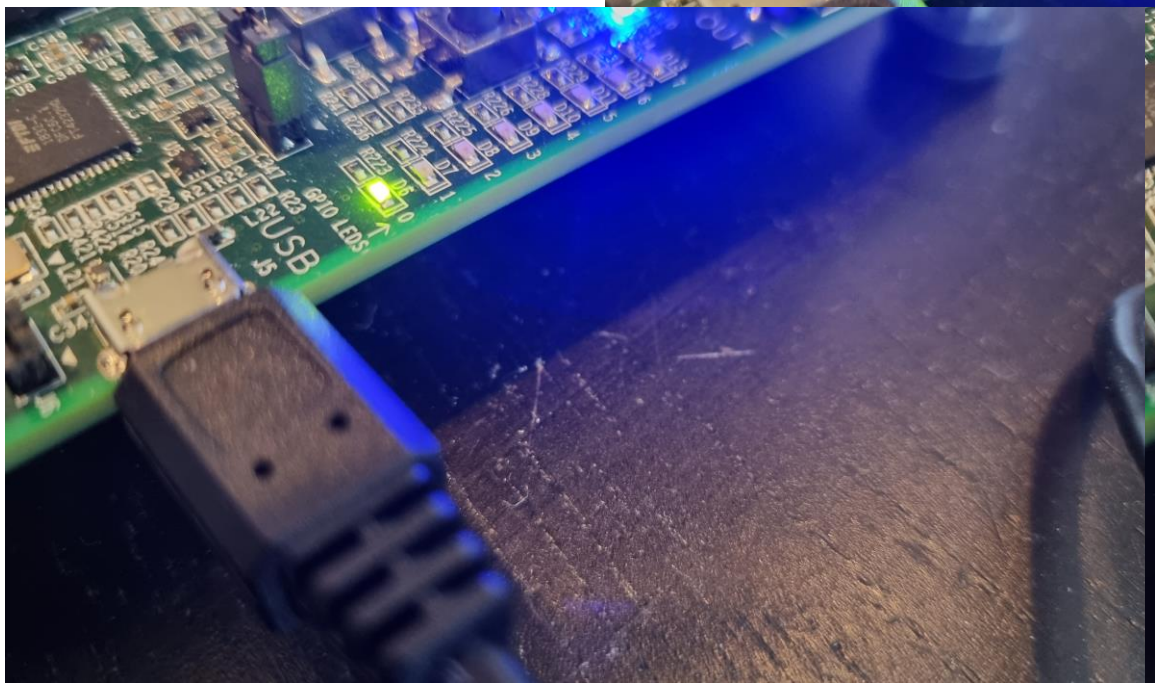

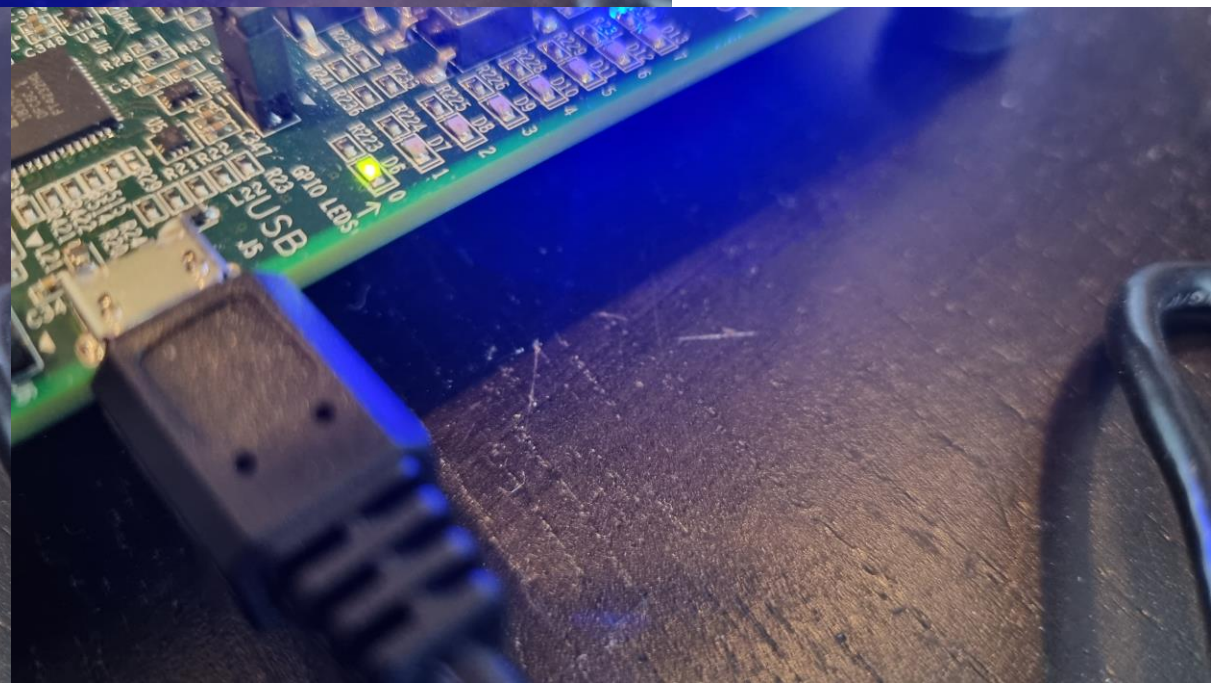

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