CEC Continuing Education Center

DesignNews

Field-Programmable Gate Array (FPGA) Primer

Day 3:
Vivado Simulation

Sponsored by

Digi-Key ELECTRONICS

informa markets

Webinar Logistics

- Turn on your system sound to hear the streaming presentation.
- If you have technical problems, click “Help” or submit a question asking for assistance.
- Participate in ‘Attendee Chat’ by maximizing the chat widget in your dock.

Fred Eady

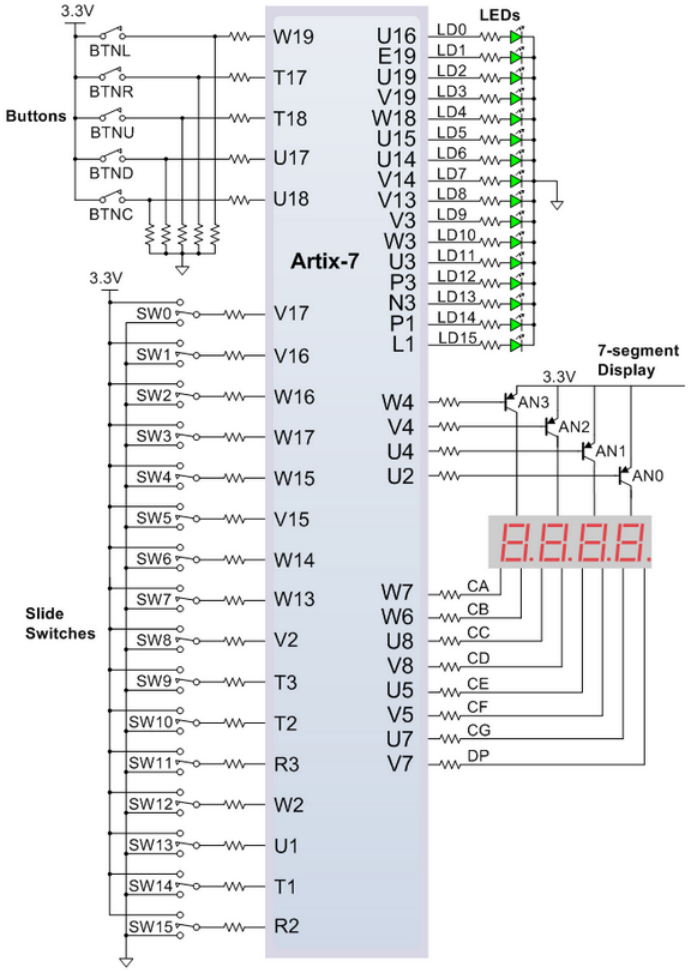
Visit ‘Lecturer Profile’ in your console for more details.

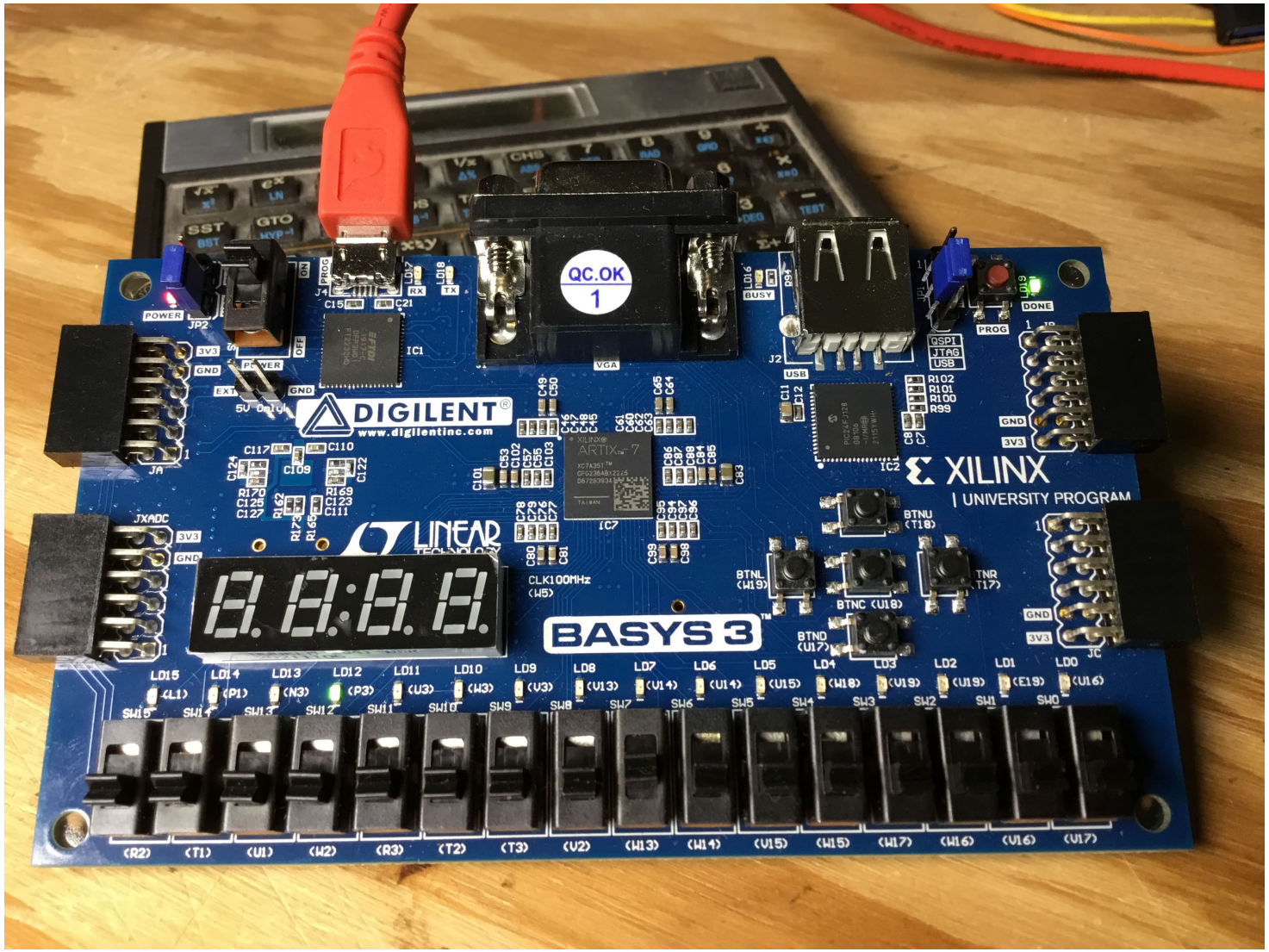
CEC Continuing Education Center

Sponsored By Digi-Key Corporation

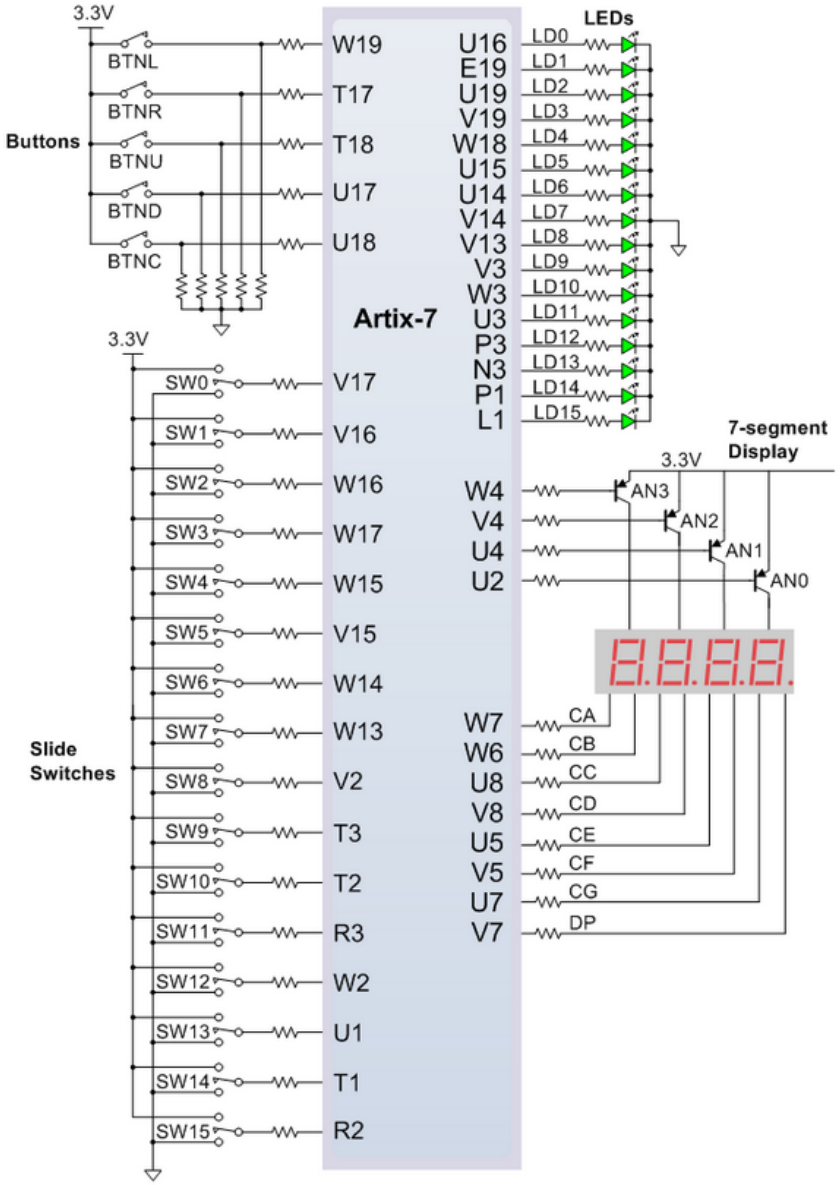
AGENDA

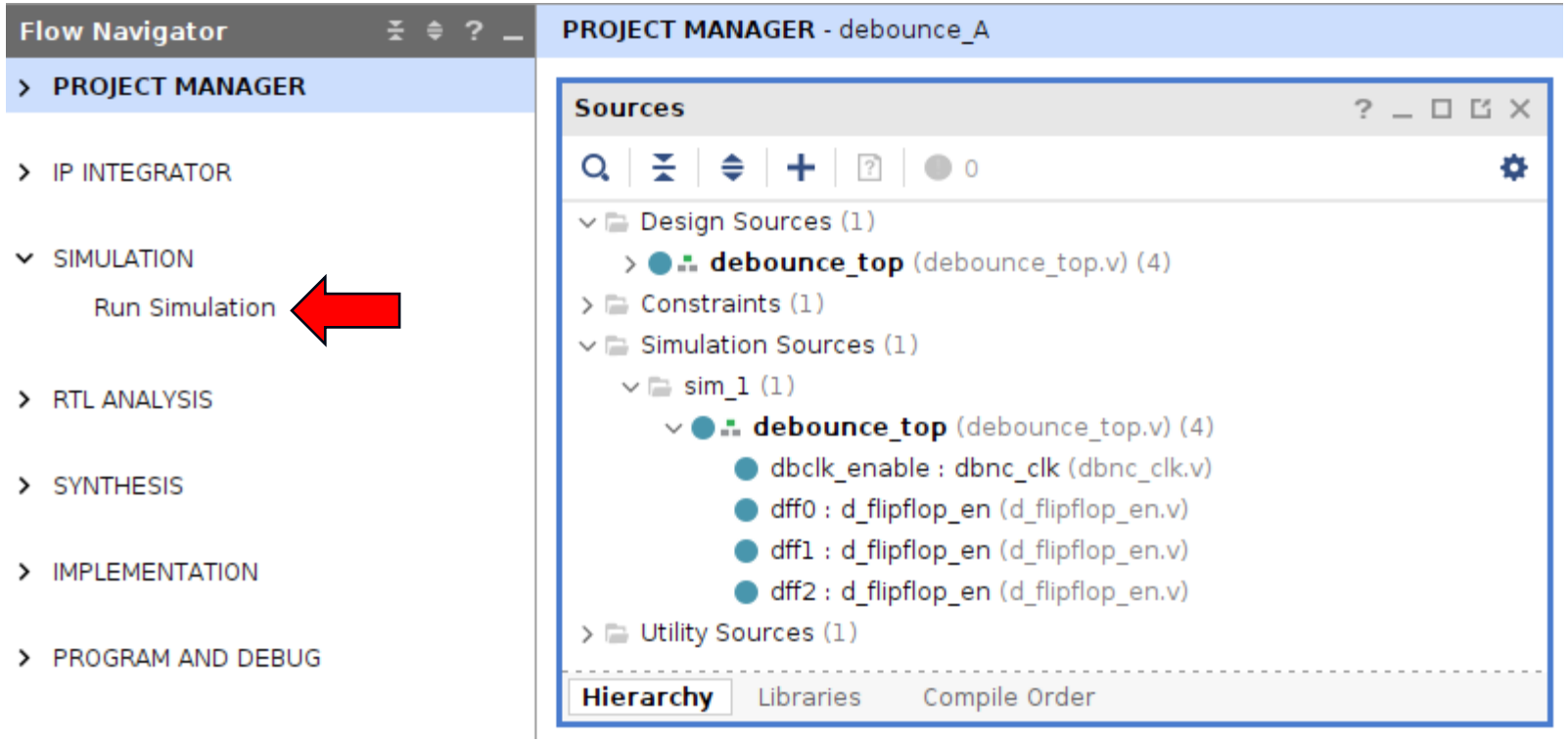
- Simulation by Force
- Simulation by Code



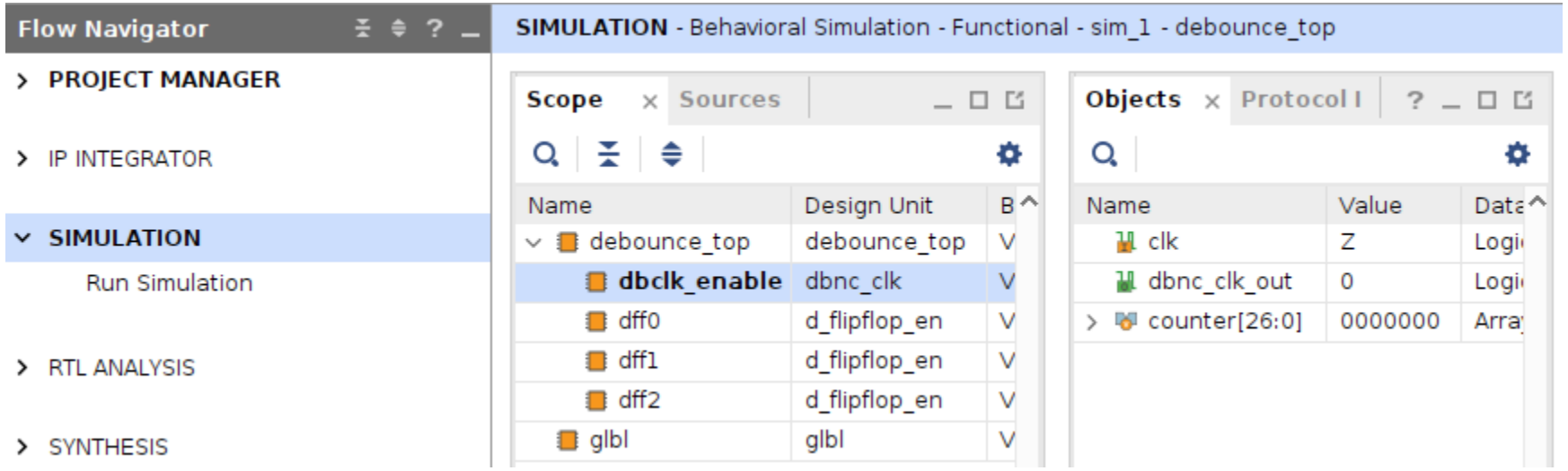


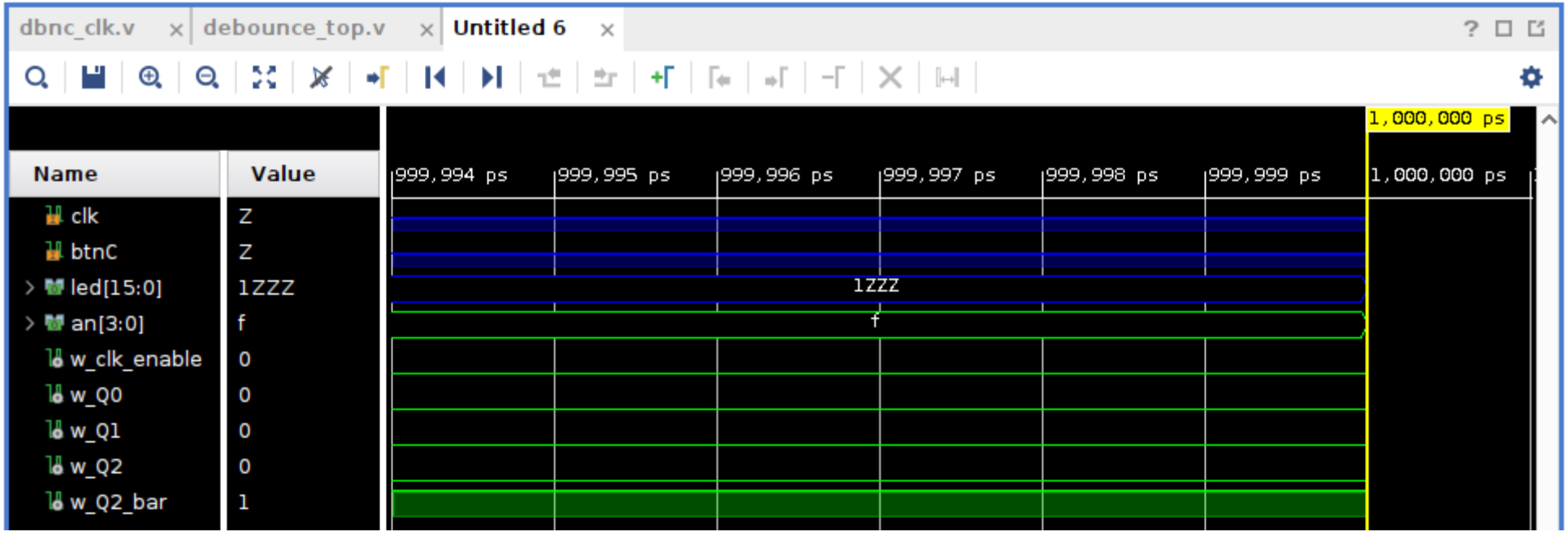
Simulation Sources – debounce_top





Simulation Sources – debounce_top





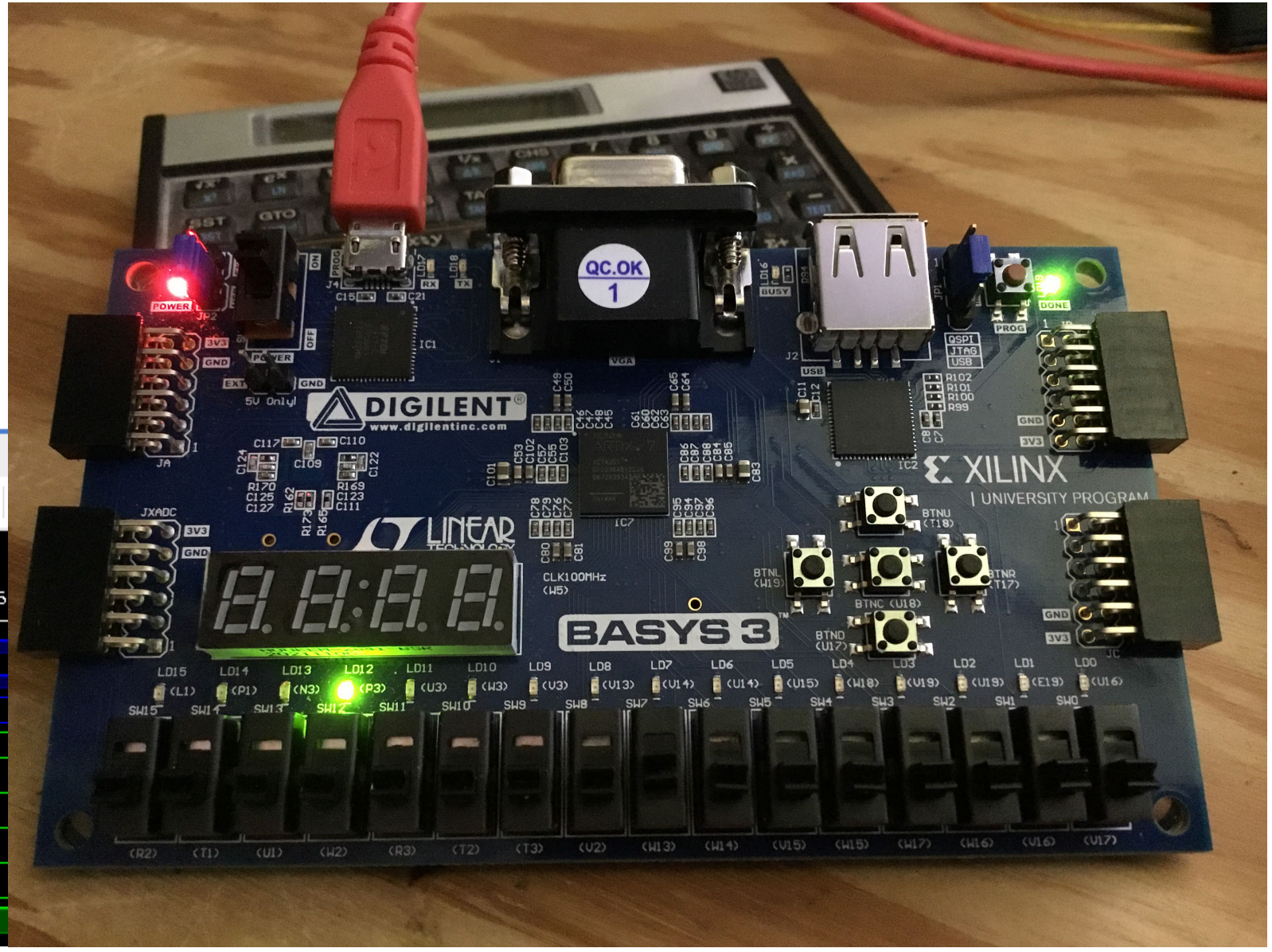
Forced Simulation Setup – Initial Sim Run

```
57  //led[1] on as long as btC is depressed
58  assign led[1] = w_Q2;
59  //led[0] on for 1 second
60  assign w_Q2_bar = ~w_Q2;
61  assign led[0] = w_Q1 & w_Q2_bar;
62  assign led[15] = w_Q0;
63  assign led[14] = w_Q1;
64  assign led[13] = w_Q2;
65  assign led[12] = w_Q2_bar;
```

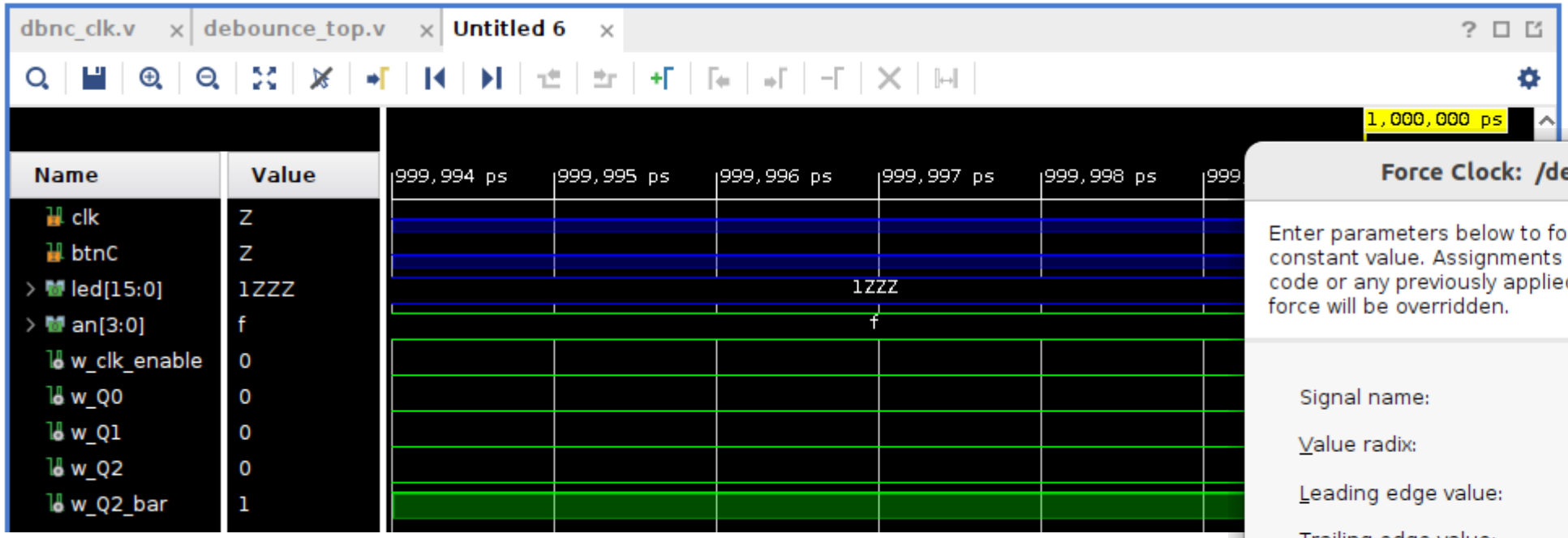
dbnc_clk.v | debounce_top.v | Untitled 6

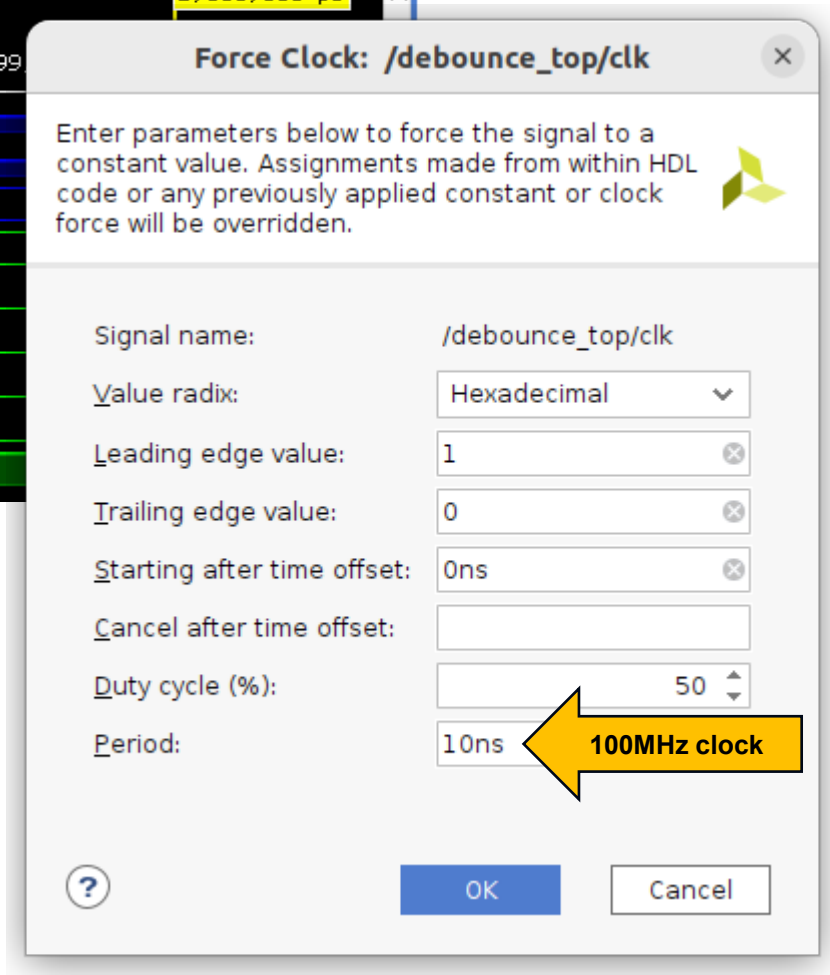
Name	Value
clk	Z
btnC	Z
led[15:0]	1ZZZ
an[3:0]	f
w_clk_enable	0
w_Q0	0
w_Q1	0
w_Q2	0
w_Q2_bar	1

999,994 ps | 999,995

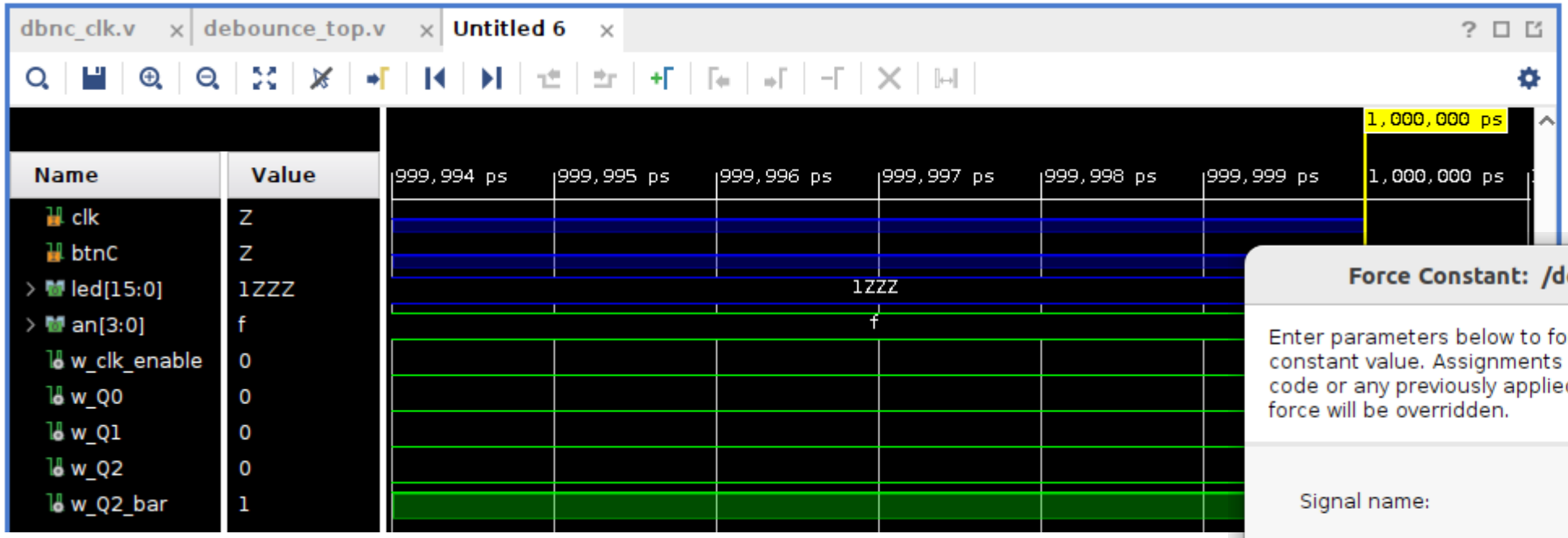


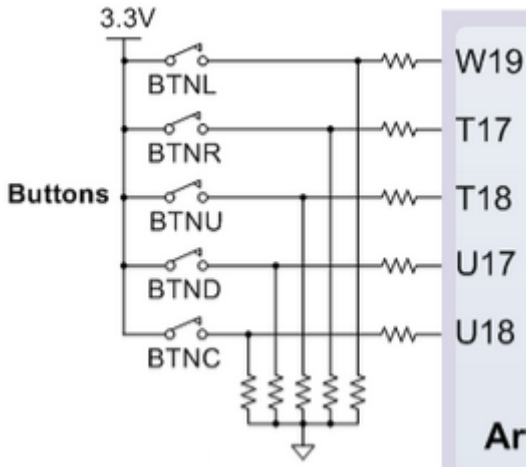
Forced Simulation Setup – Force a Clock Signal

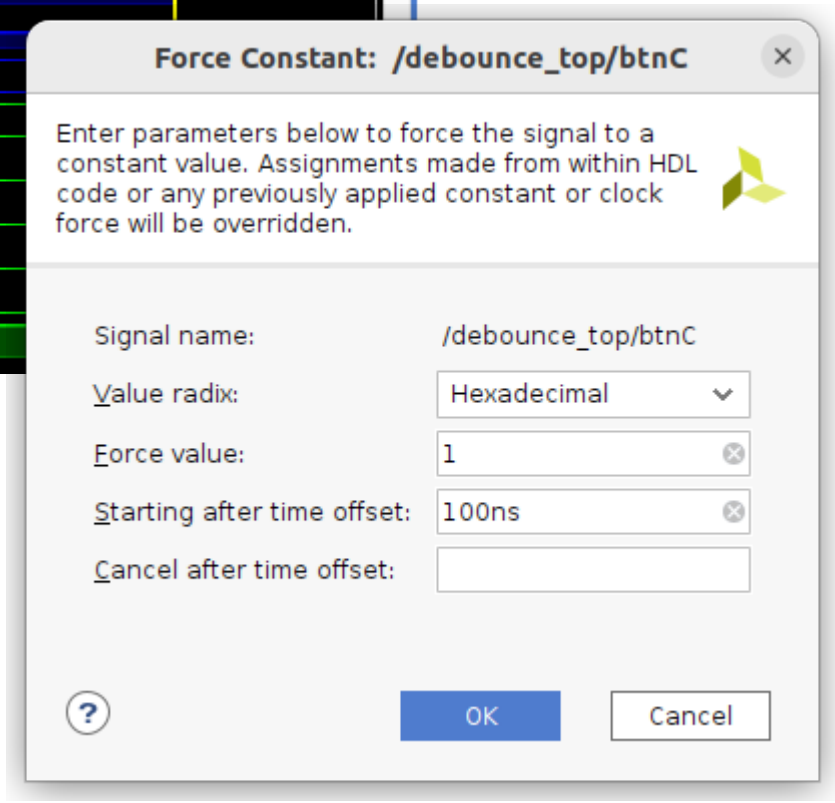




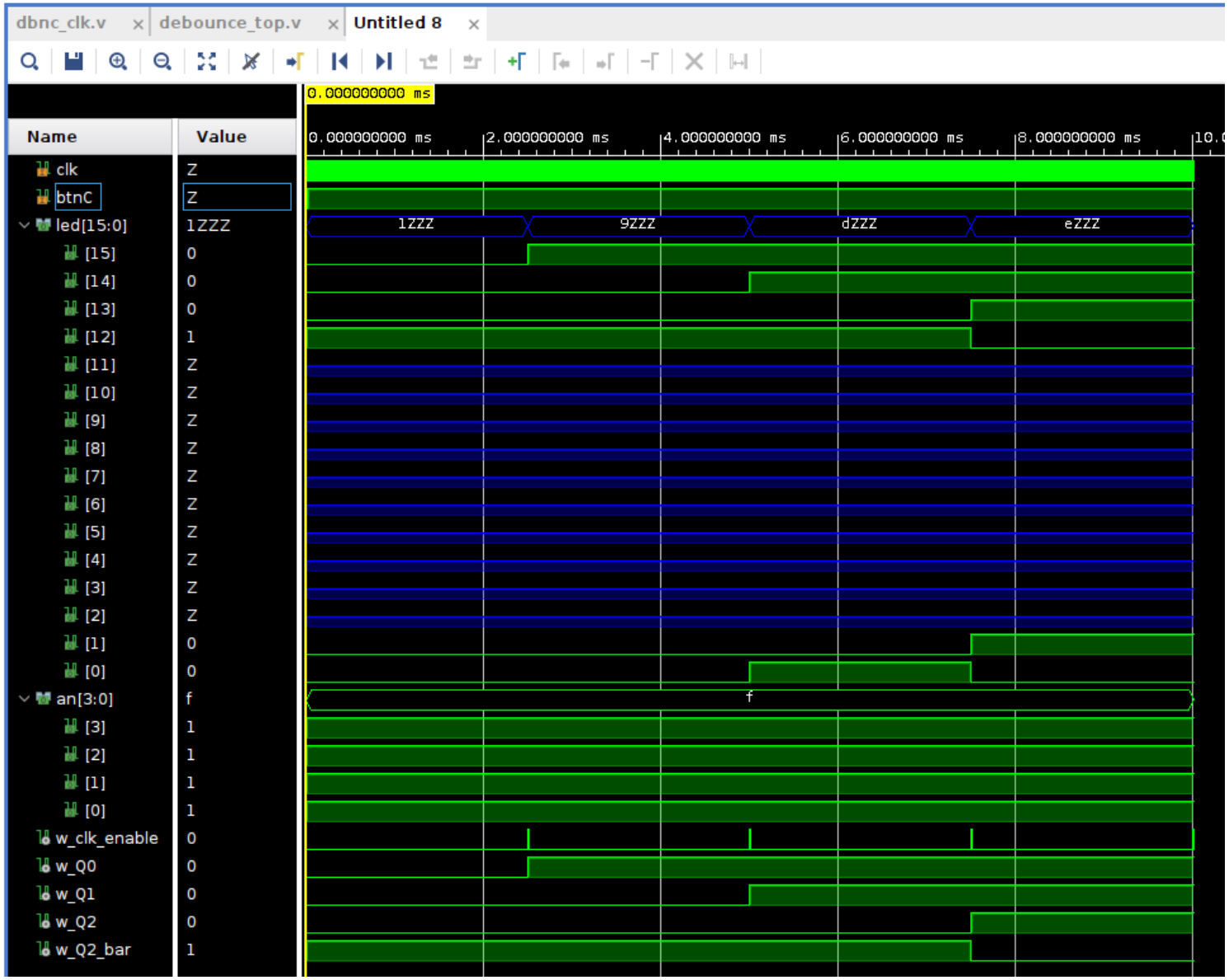
Forced Simulation Setup – Force a Sim Button Push



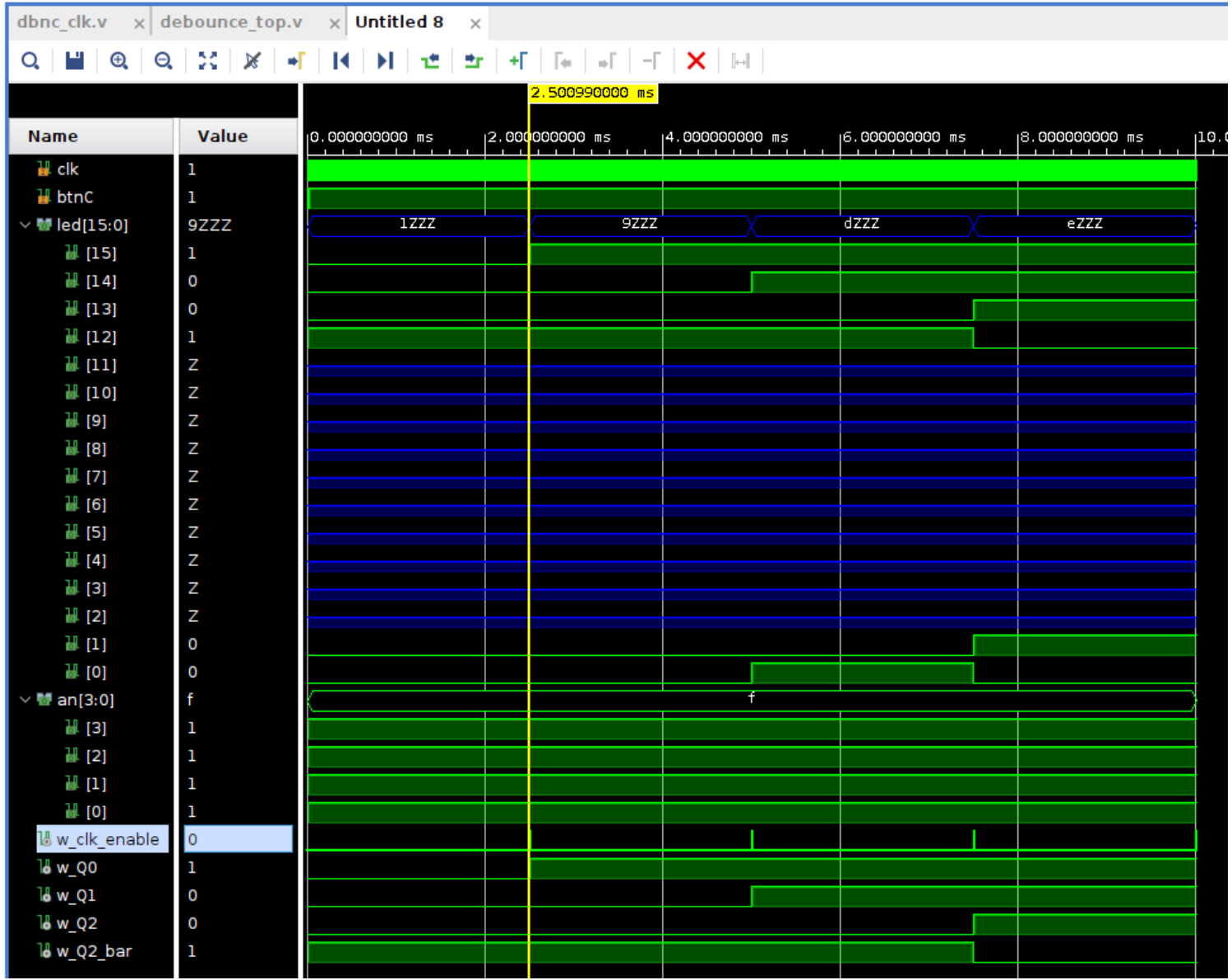




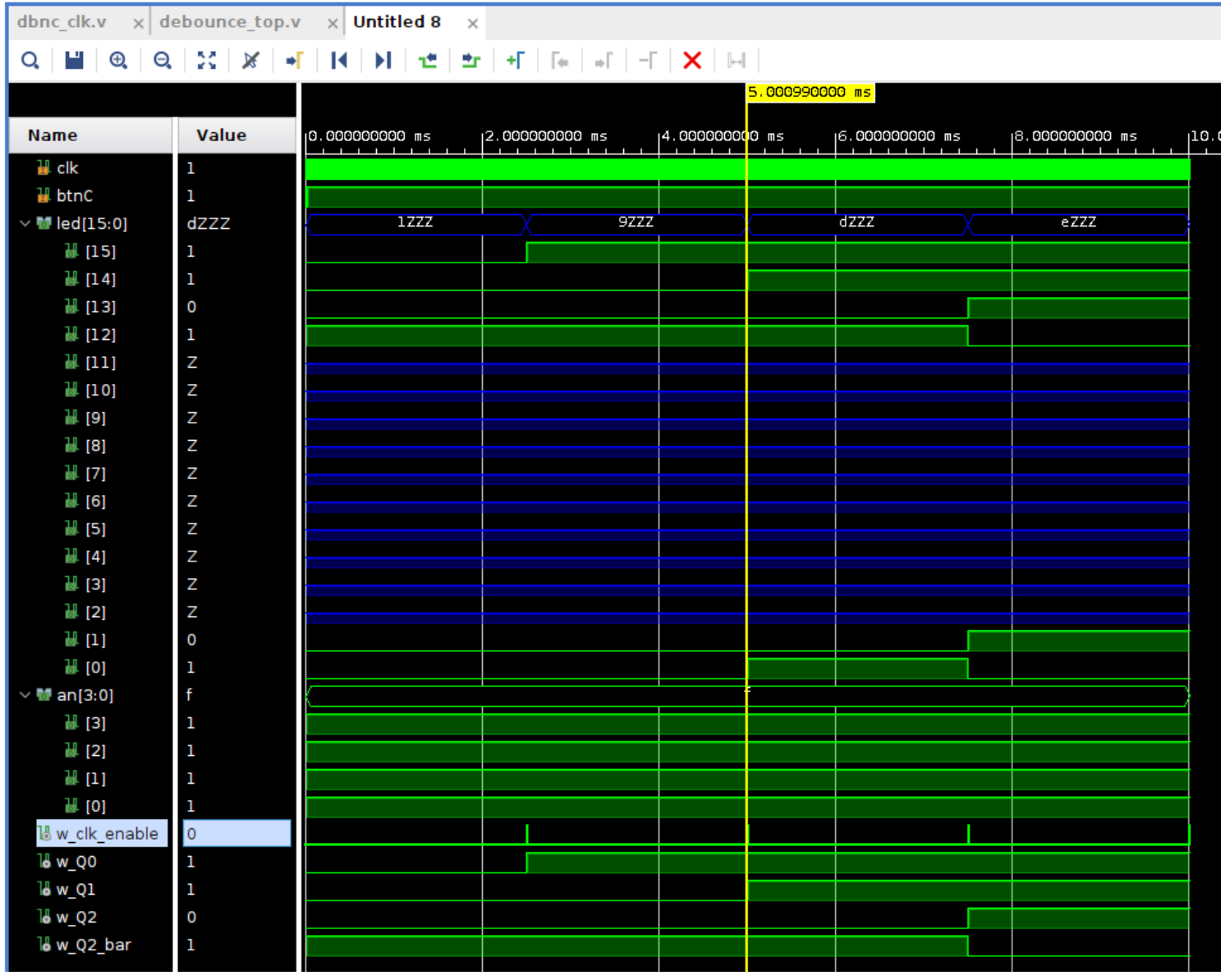
Forced Simulation Run – 10mS



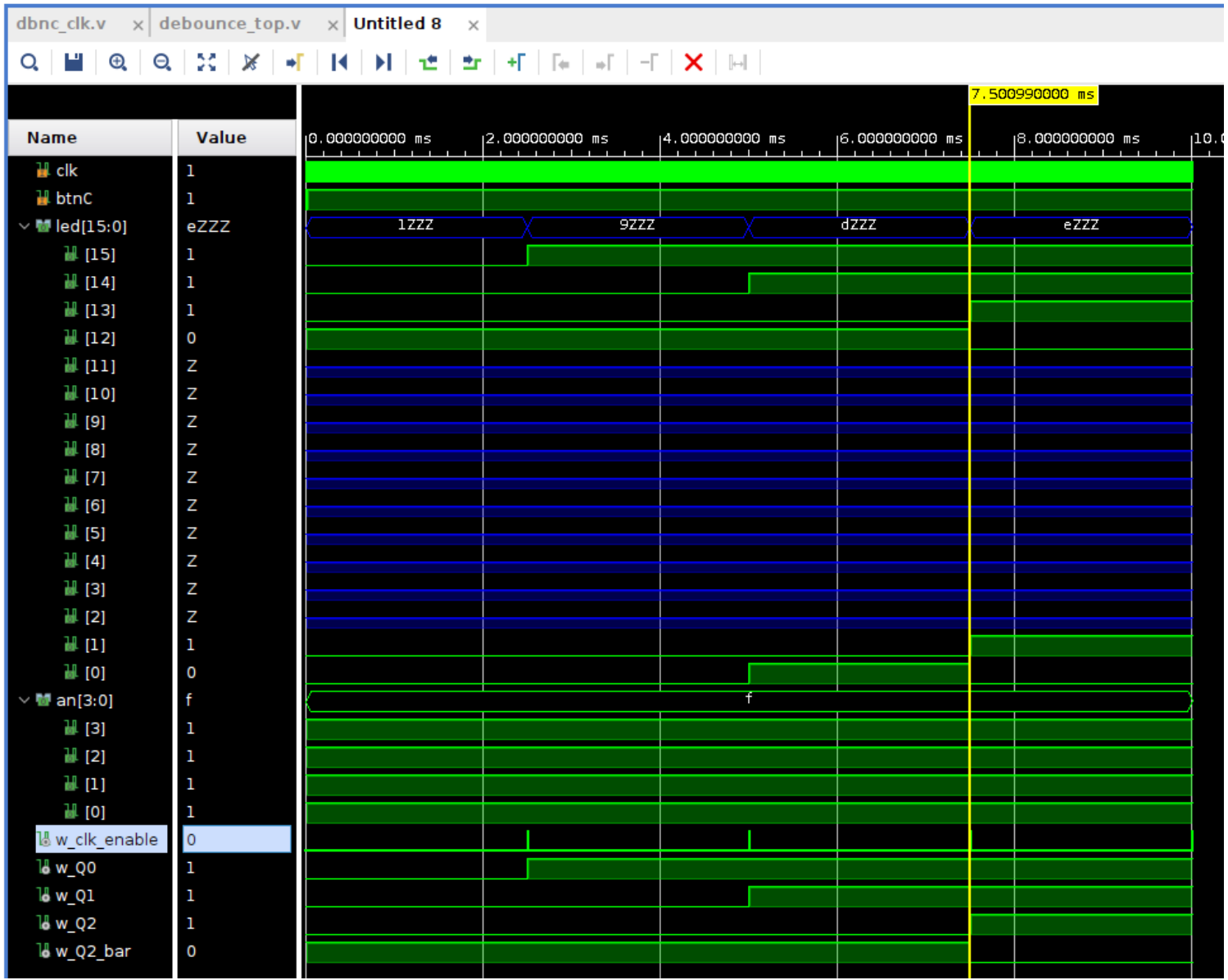
Forced Simulation Run – clk enable pulse 1



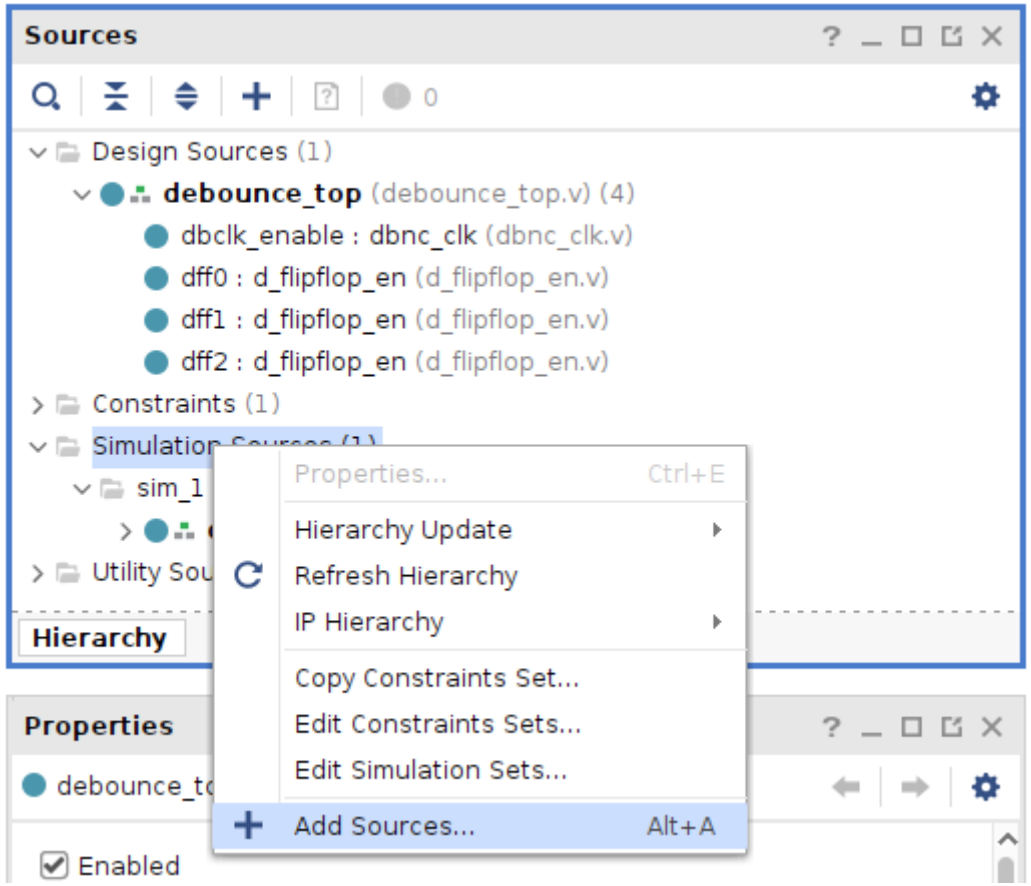
Forced Simulation Run – clk enable pulse 2



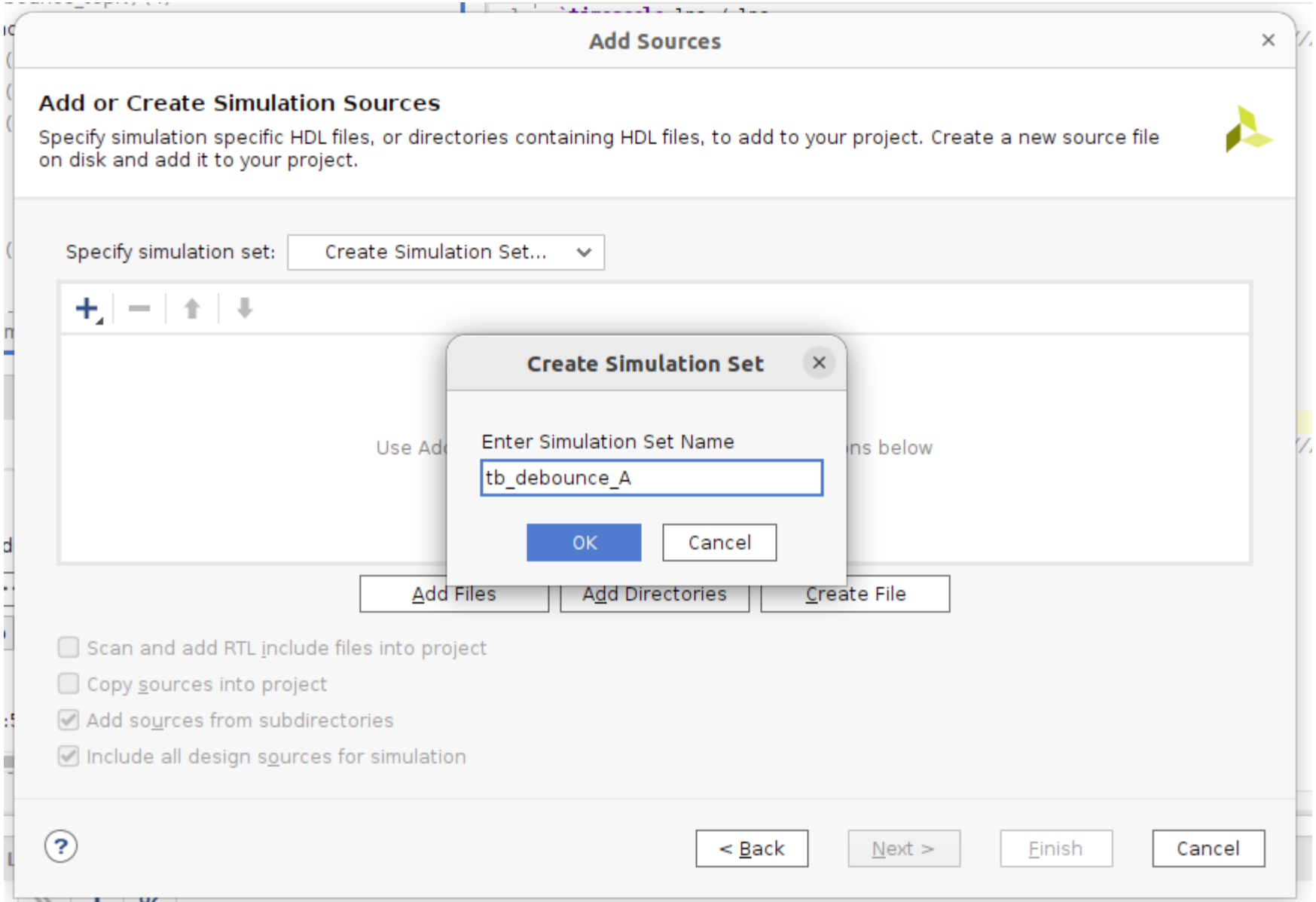
Forced Simulation Run – clk enable pulse 3



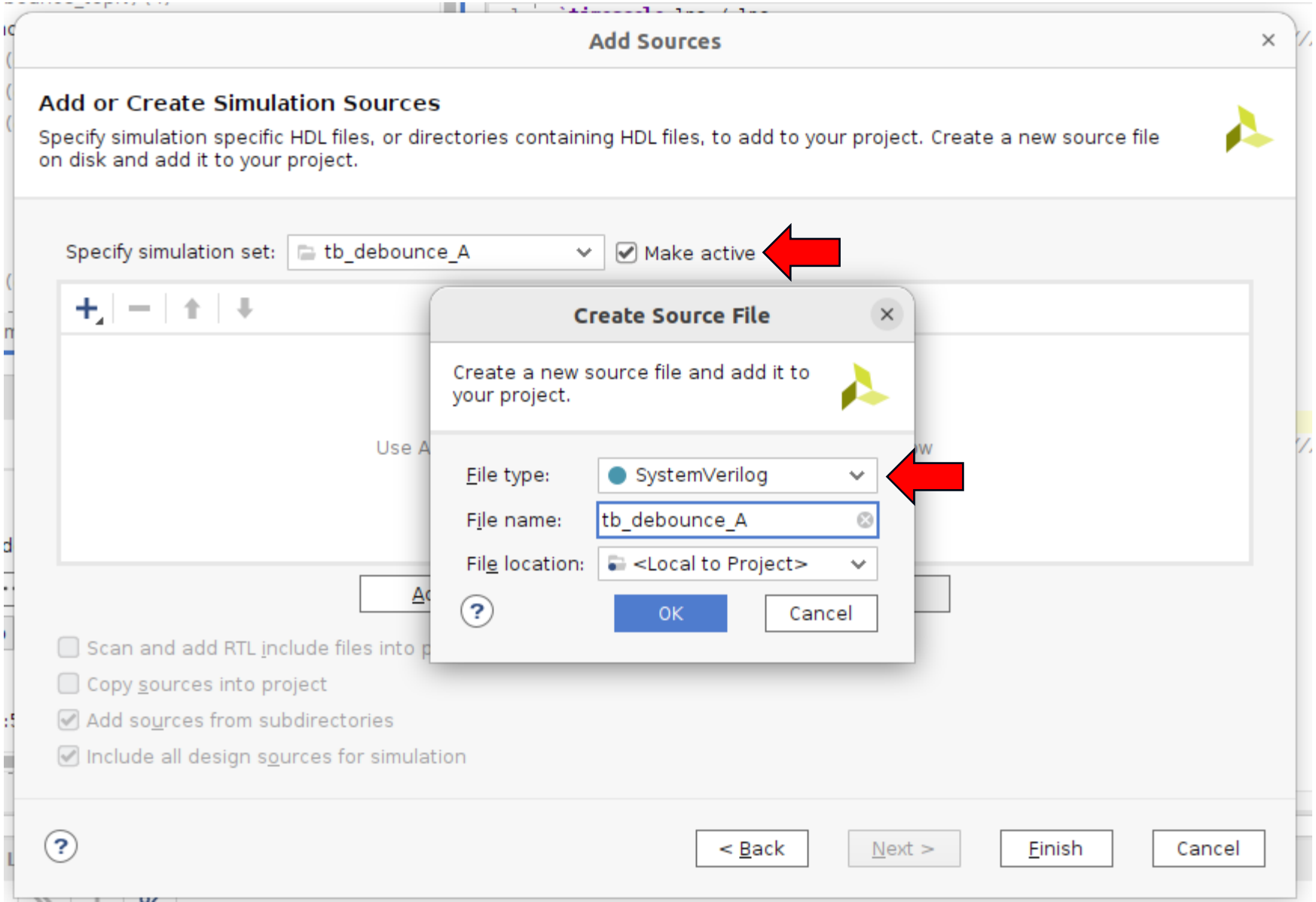
Coded Simulation Setup



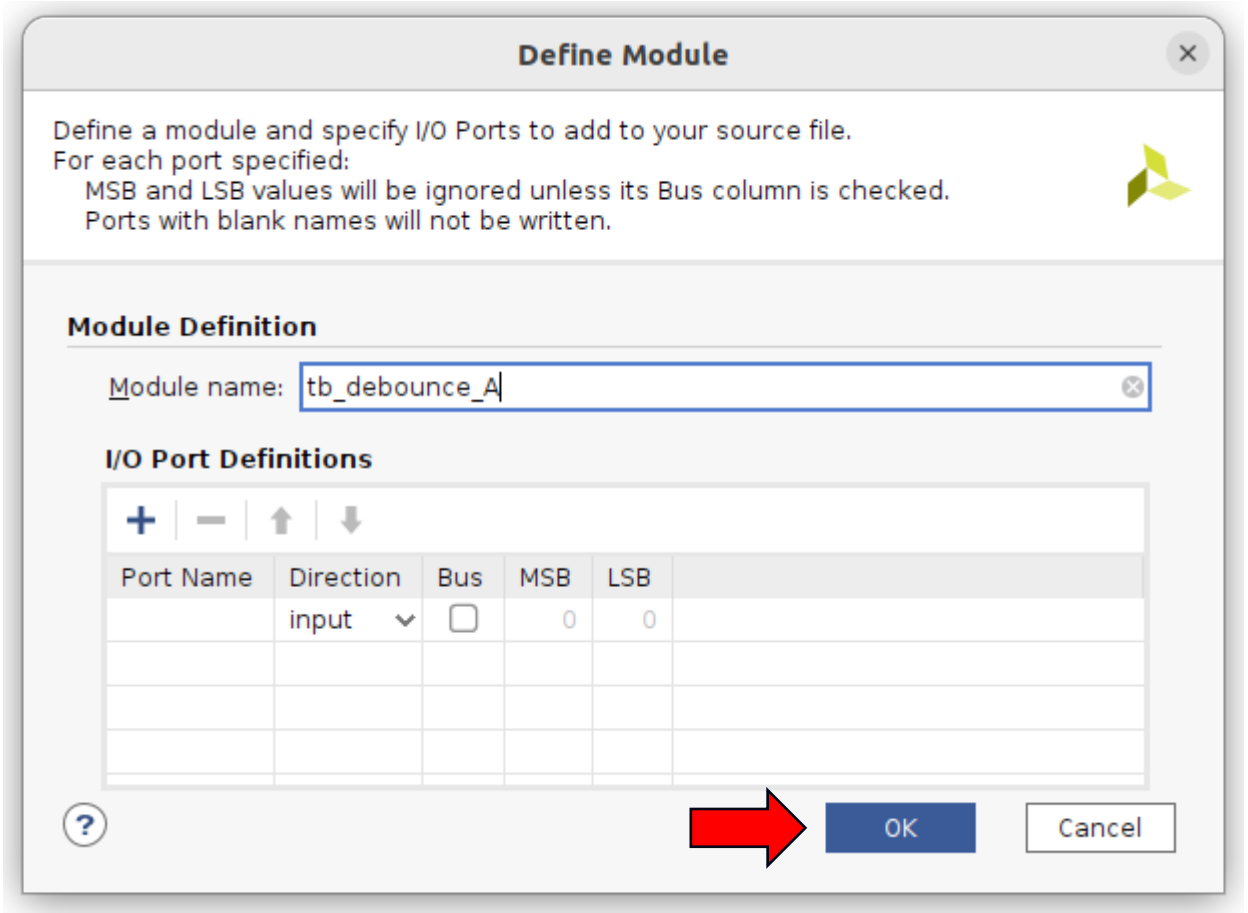
Coded Simulation Setup



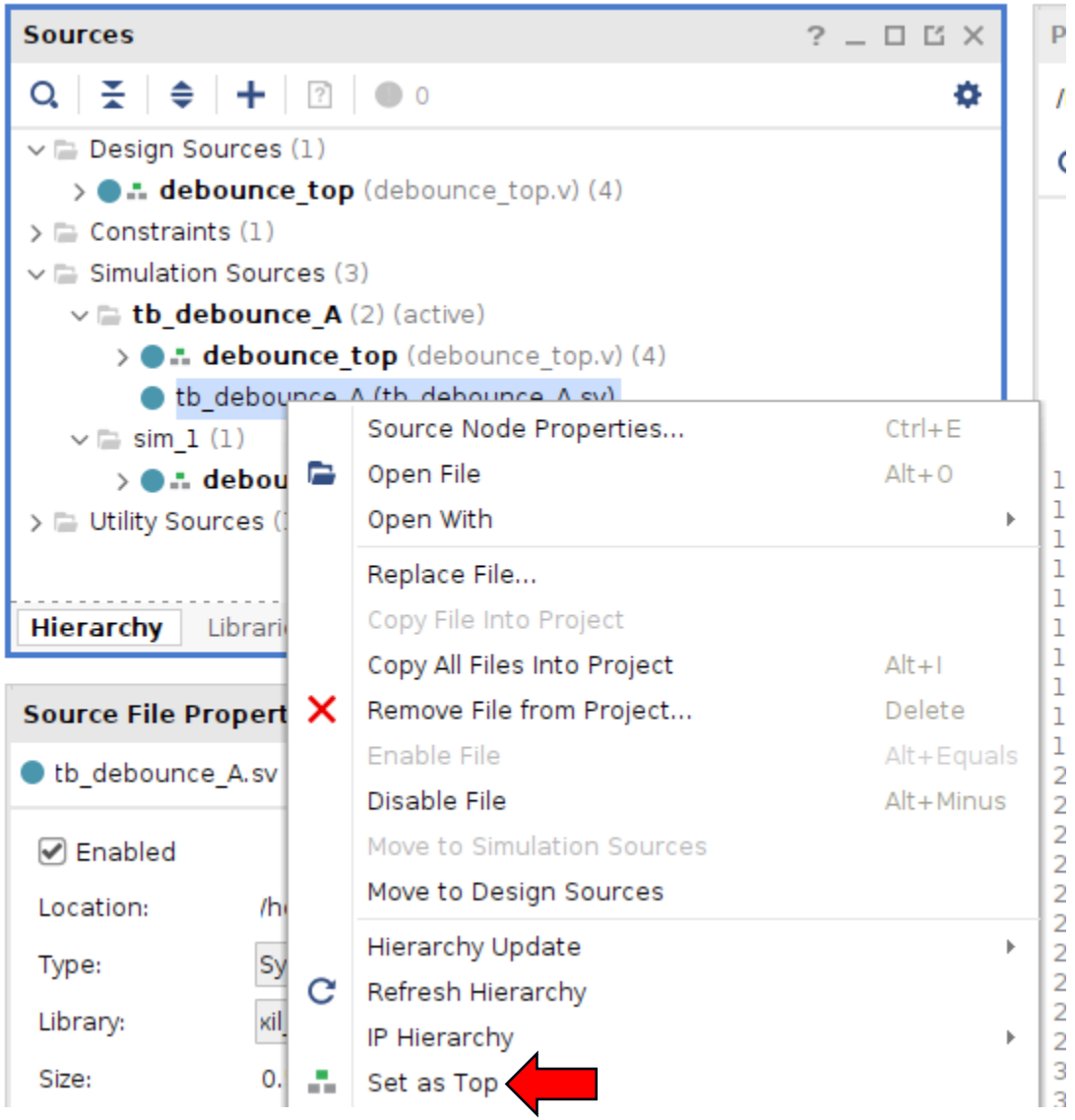
Coded Simulation Setup



Coded Simulation Setup

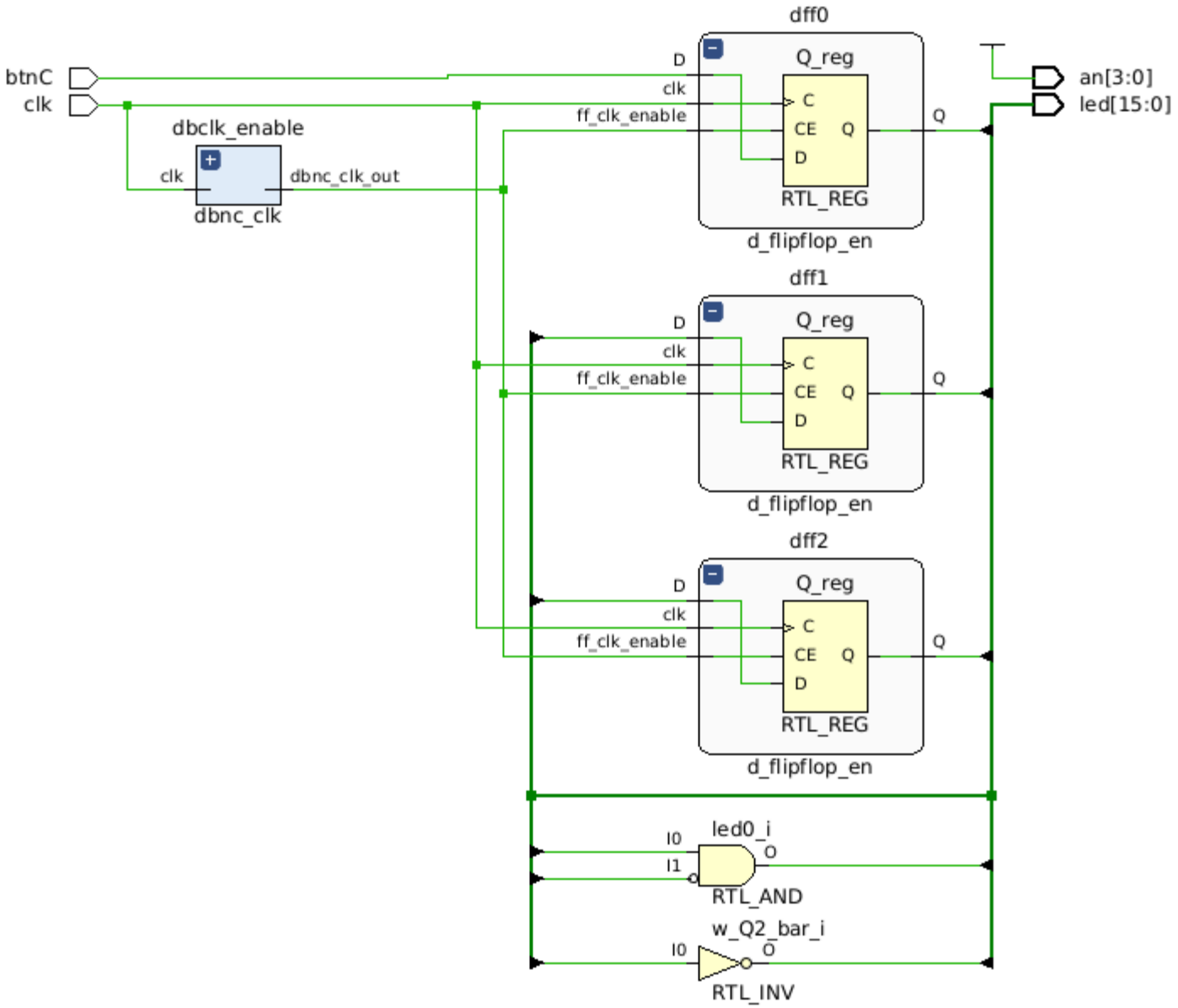


Coded Simulation Setup



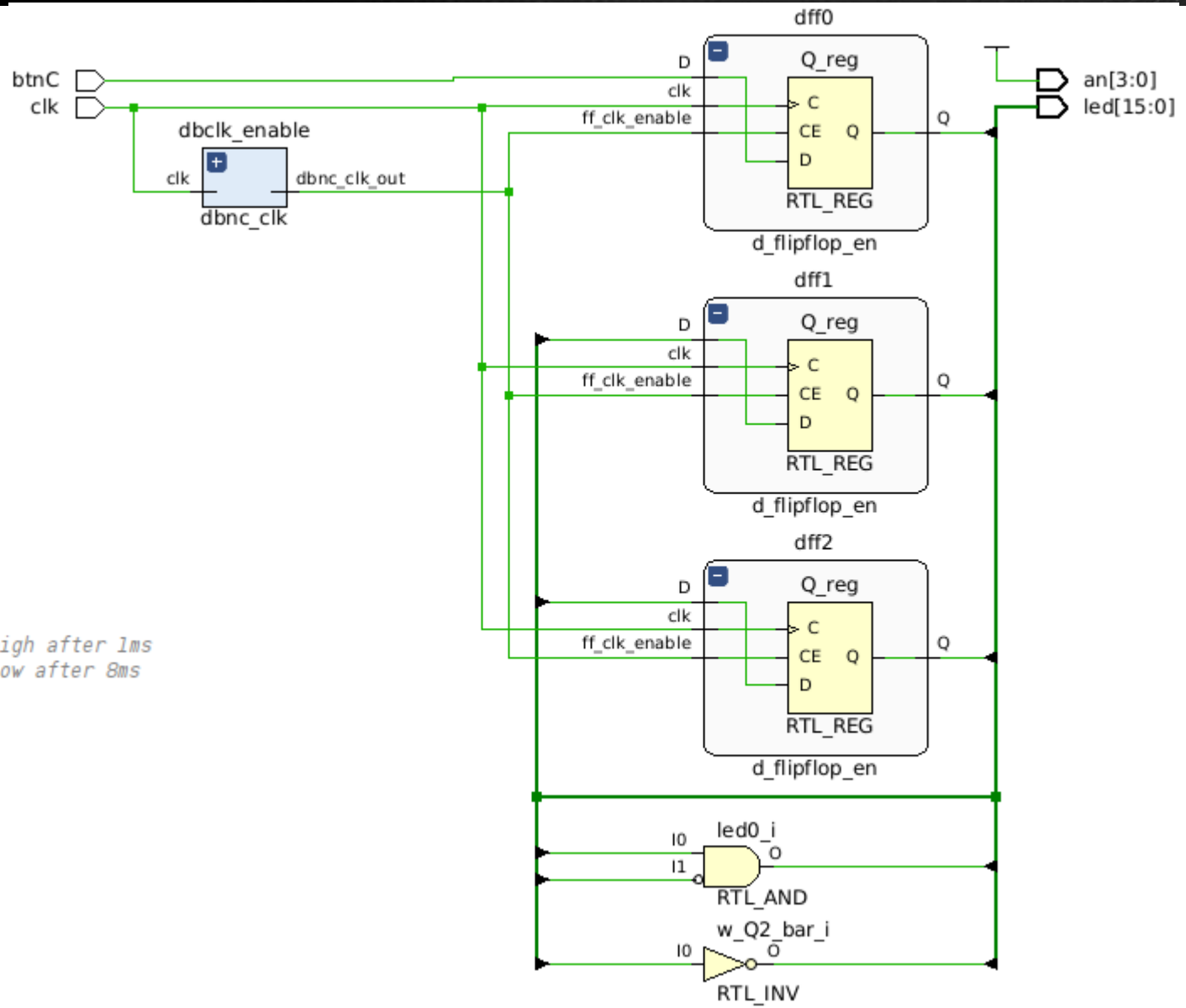
Simulation Code – tb_debounce_A.sv

```
22
23  module tb_debounce_A();
24
25  reg clk;
26  reg btnC;
27  wire [15:0] led;
28  wire [3:0]an;
29  wire w_clk_enable;
30  wire w_Q0,w_Q1,w_Q2,w_Q2_bar;
31
32  debounce_top tbdebnc_top(
33  .clk(clk),
34  .btnC(btnC),
35  .led(led),
36  .an(an)
37  );
38  dbnc_clk dbclk_enable(
39   .clk(clk),
40   .dbnc_clk_out(w_clk_enable)
41  );
42  d_flipflop_en dff0(
43   .clk(clk),
44   .ff_clk_enable(w_clk_enable),
45   .D(btnC),
46   .Q(w_Q0)
47   );
48  d_flipflop_en dff1(
49   .clk(clk),
50   .ff_clk_enable(w_clk_enable),
51   .D(w_Q0),
52   .Q(w_Q1)
53   );
54  d_flipflop_en dff2(
55   .clk(clk),
56   .ff_clk_enable(w_clk_enable),
57   .D(w_Q1),
58   .Q(w_Q2)
```

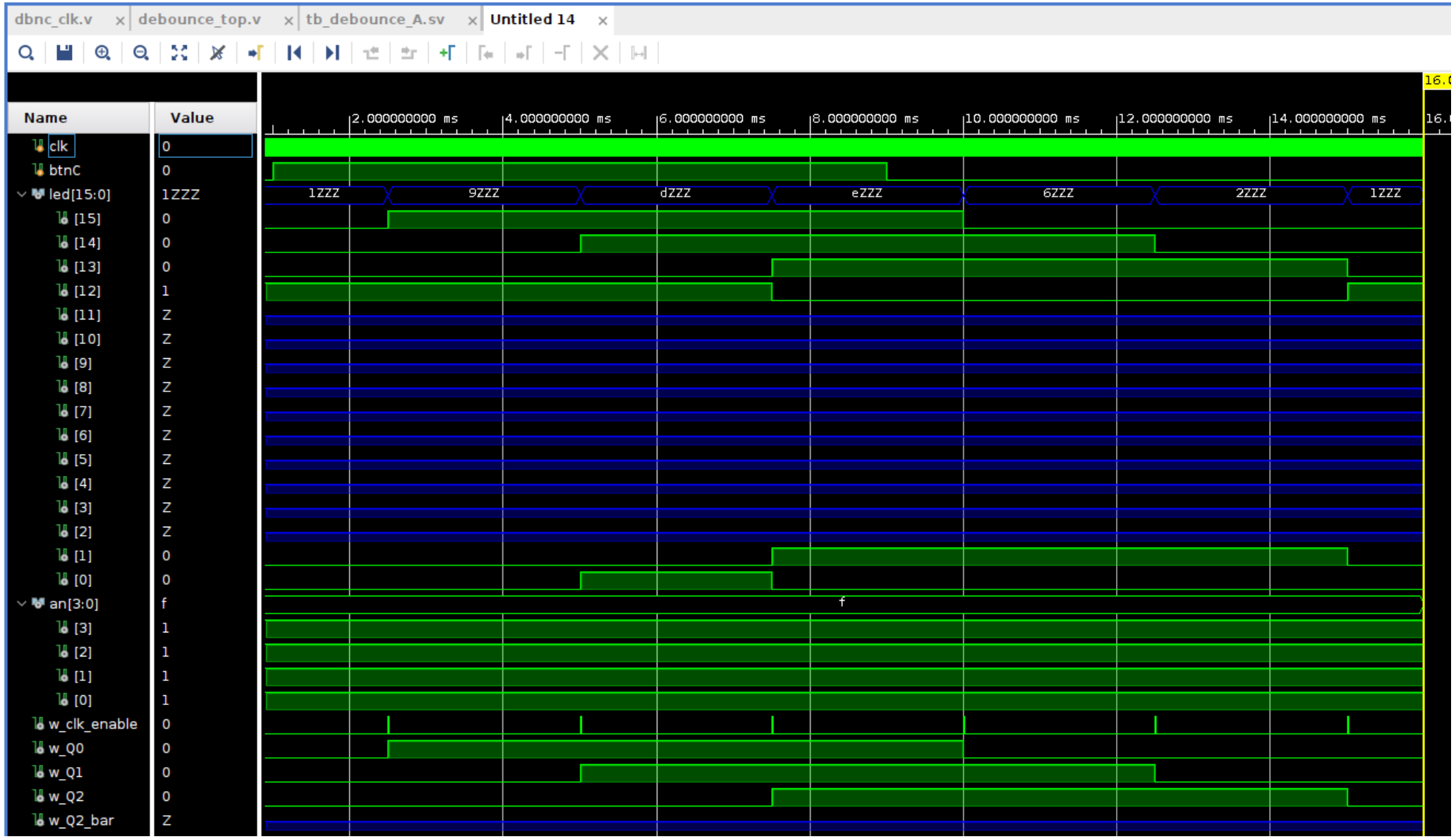


Simulation Code – tb_debounce_A.sv

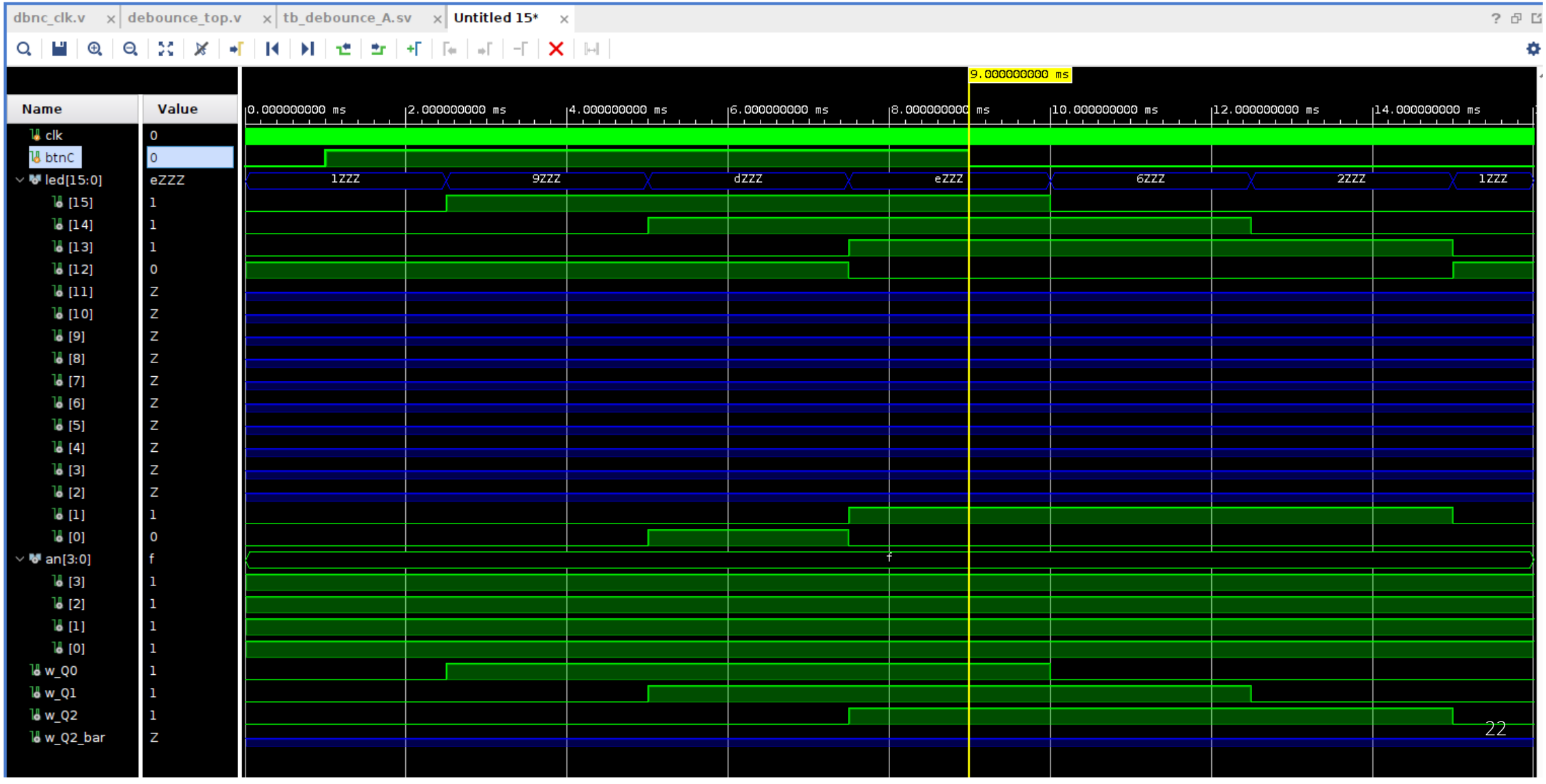
```
61  initial
62  begin
63      btnC <= 0;
64      clk <= 0;
65  end
66
67  always
68  begin
69      #5 clk <= ~clk;
70  end
71
72  initial
73  begin
74      #1000000; btnC <= 1;     //force btnC high after 1ms
75      #8000000; btnC <= 0;     //force btnC low after 8ms
76  end
```



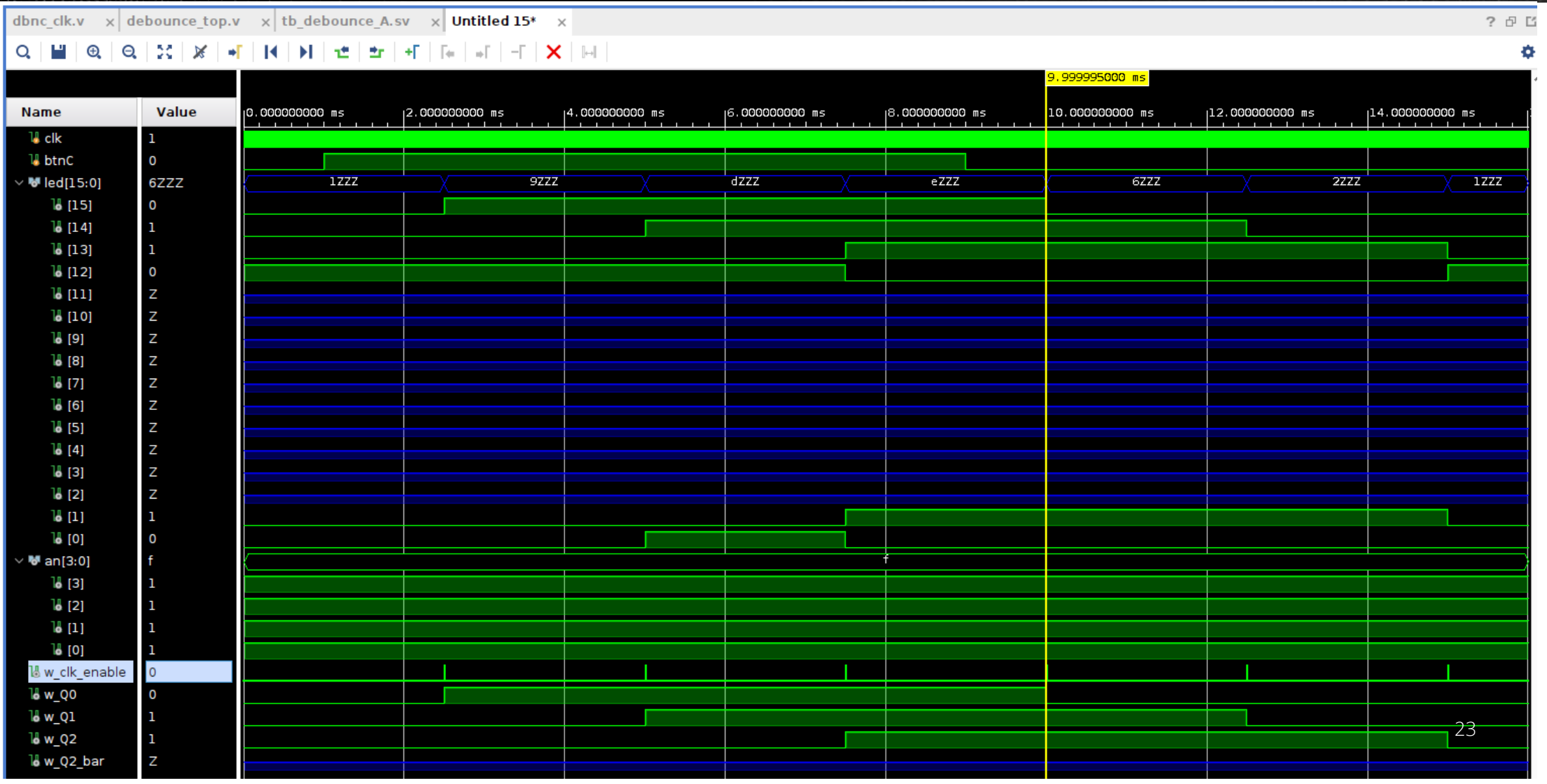
Coded Simulation Run – 16ms



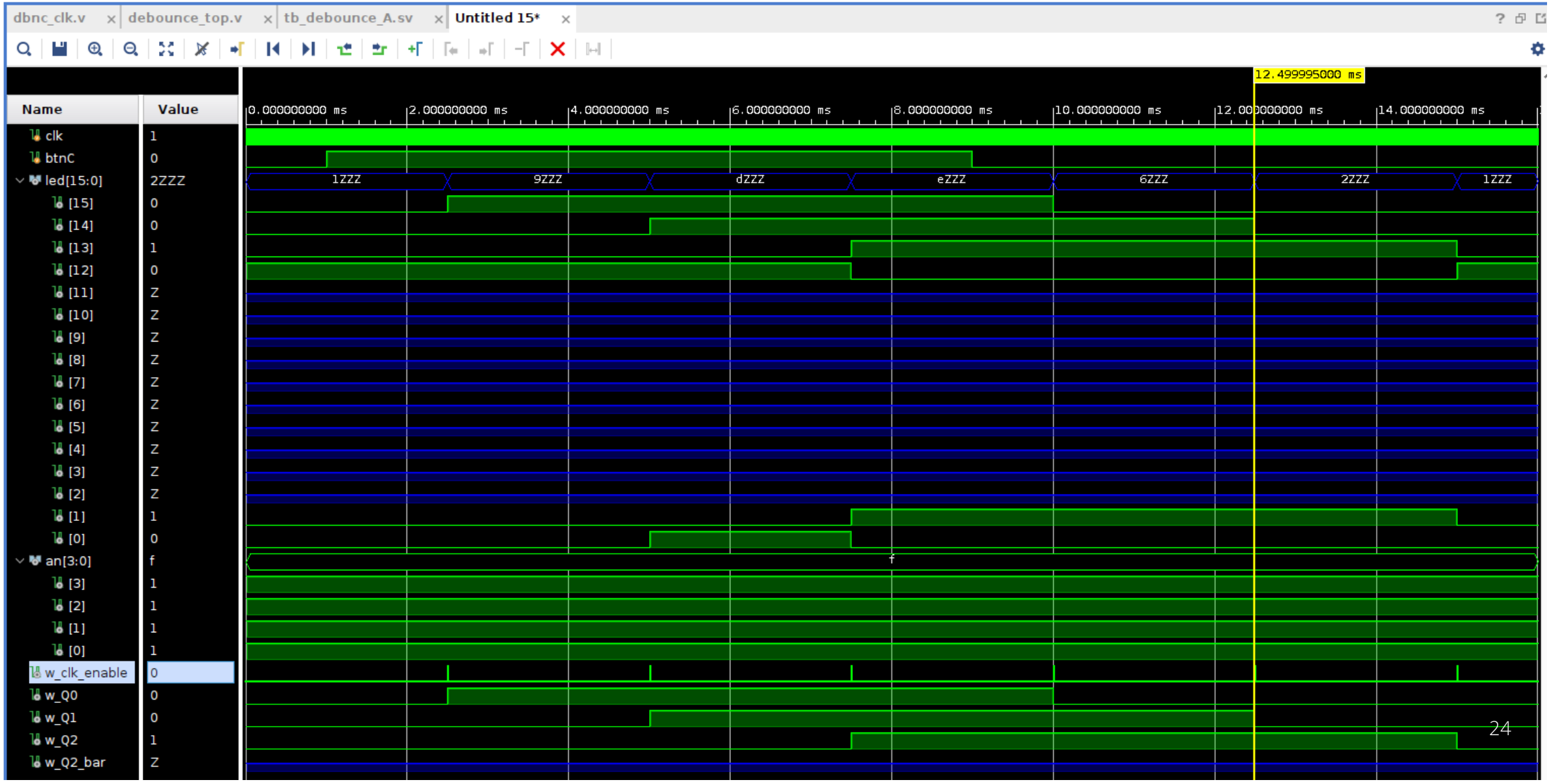
Coded Simulation Run – Release Pushbutton



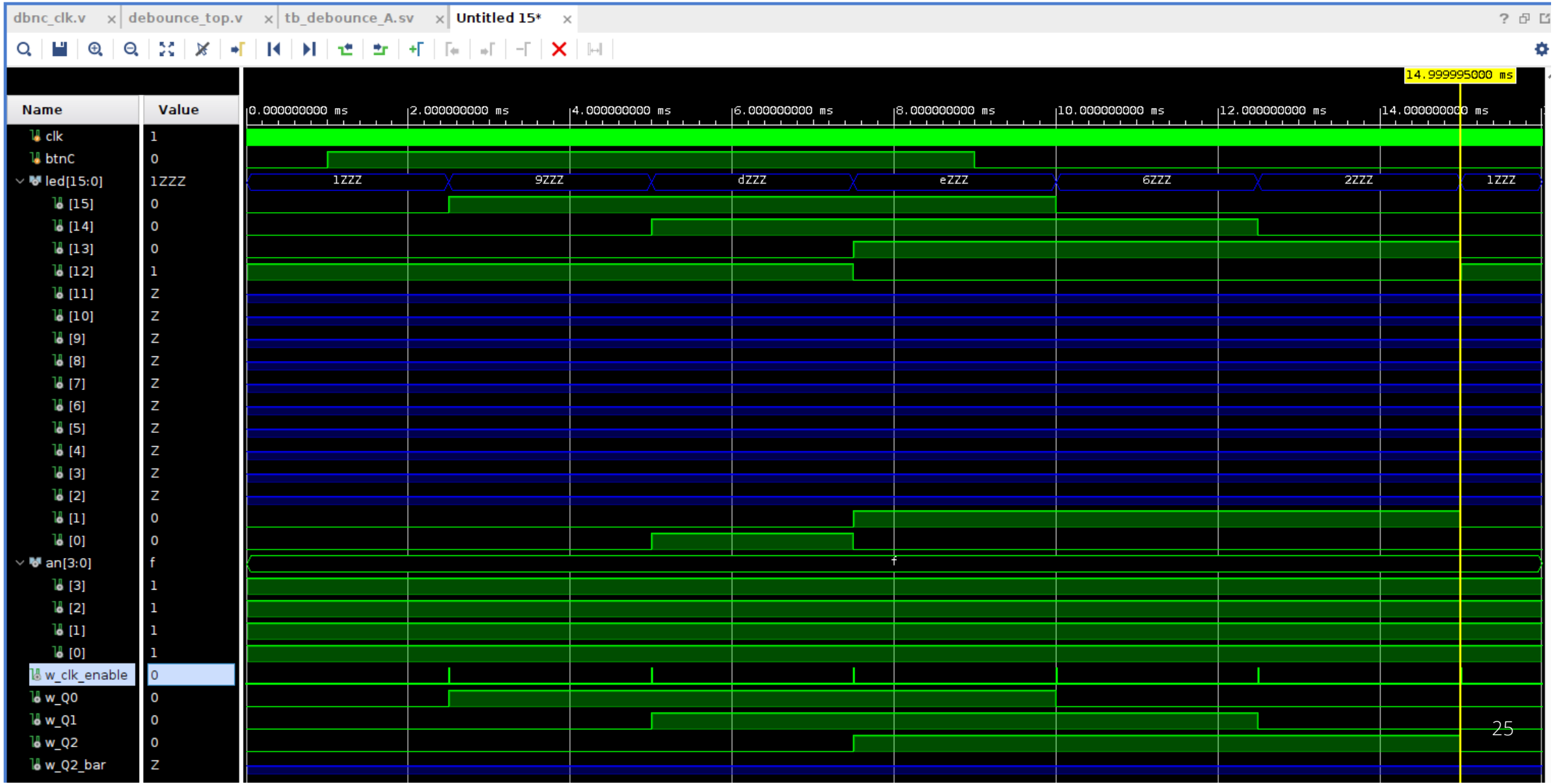
Coded Simulation Run – clk enable -1



Coded Simulation Run – clk enable -2

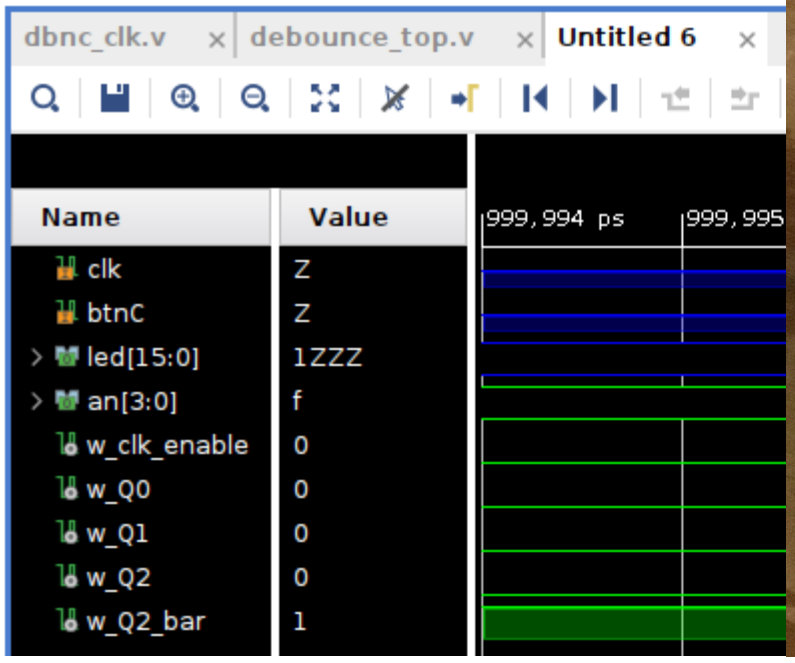


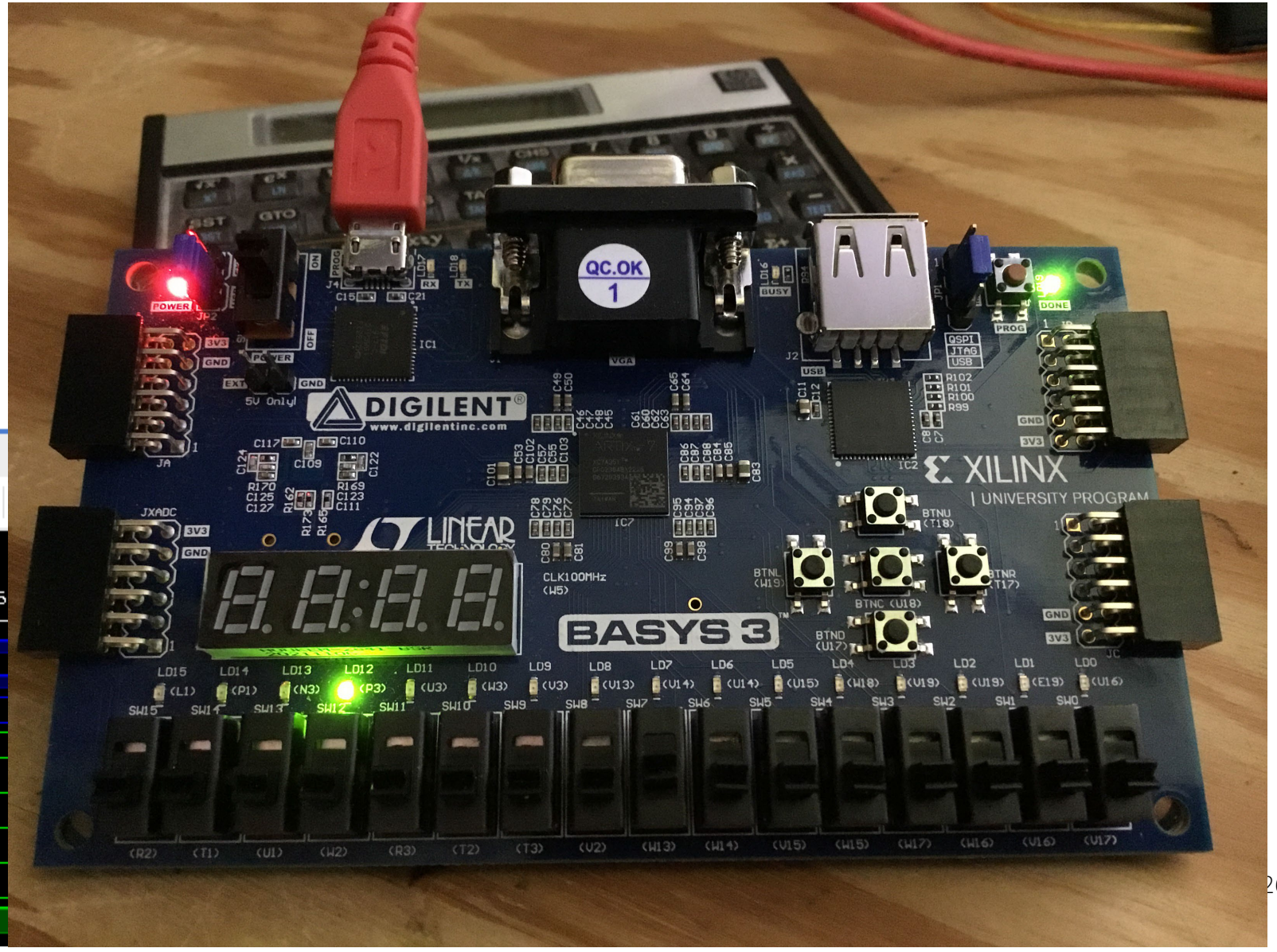
Coded Simulation Run – clk enable -3



Coded Simulation End

```
57  //led[1] on as long as btC is depressed
58  assign led[1] = w_Q2;
59  //led[0] on for 1 second
60  assign w_Q2_bar = ~w_Q2;
61  assign led[0] = w_Q1 & w_Q2_bar;
62  assign led[15] = w_Q0;
63  assign led[14] = w_Q1;
64  assign led[13] = w_Q2;
65  assign led[12] = w_Q2_bar;
```



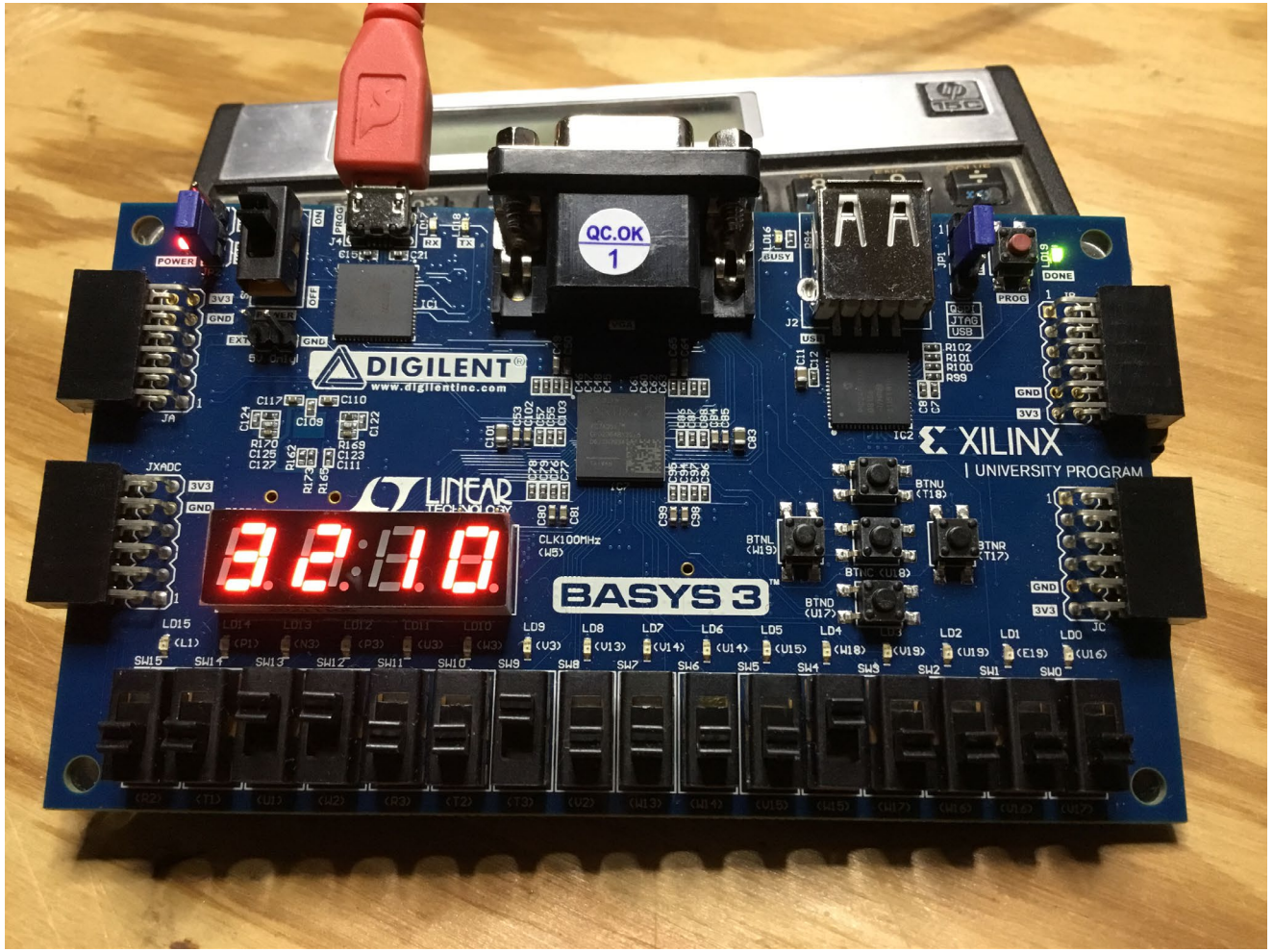


Thank you for attending!!!

Please consider the resources below:

- xilinx.com
- digilent.com
- Basys 3 Reference Manual

MORE TO COME..



CEC Continuing Education Center

DesignNews

Thank You

Sponsored by

Digi-Key ELECTRONICS

informa markets