

Circuit Simulation Project

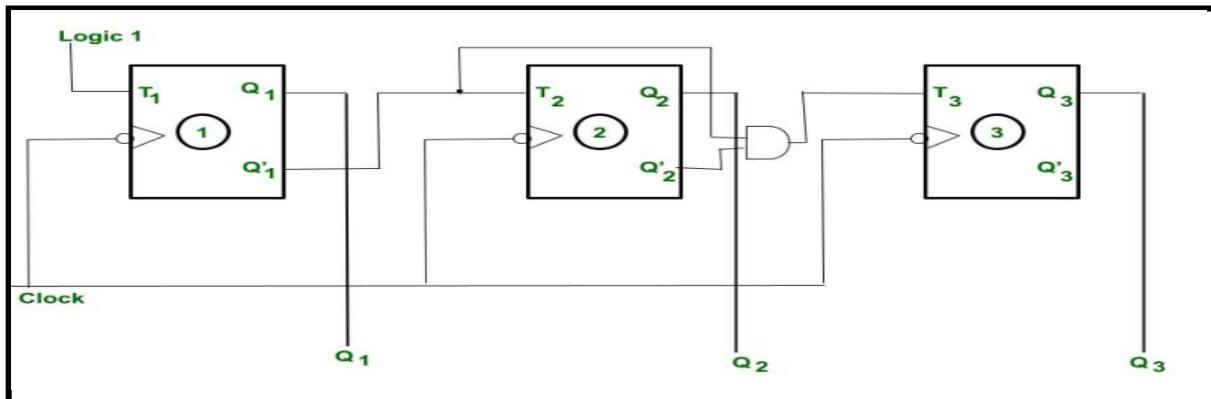
<https://esim.fossee.in/circuit-simulation-project>

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Project Guide: Dr R. Maheswari

Title of the circuit: 3-Bit Synchronous Down Counter

Theory/Description:



In synchronous down counter with JK Flip-Flops, a single clock pulse drives all JK flip-flops. Circuit becomes complex as the number of states increases. Speed is high.

The 3-bit asynchronous up counter consists of 3 JK flip flops and 1 AND gate. The output conditions are $Q_2 Q_1 Q_0$

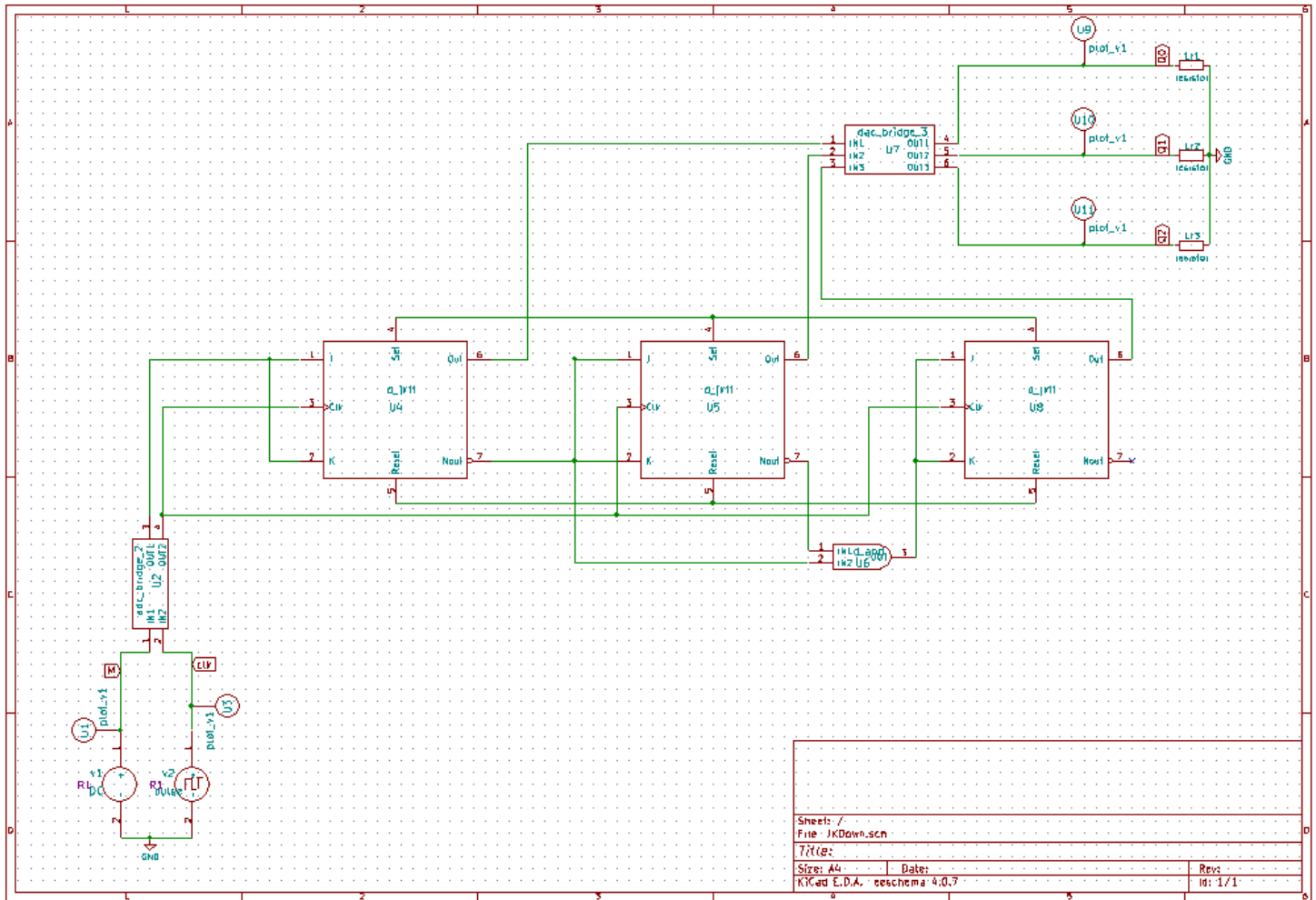
The output of the flip flops is a binary number equivalent to the number of clock pulses received. The output conditions are as shown in the truth table.

Counter State	Q2	Q1	Q0
7	1	1	1
6	1	1	0
5	1	0	1
4	1	0	0
3	0	1	1
2	0	1	0
1	0	0	1
0	0	0	0

e-Sim Required Components

Synchronous Down counter	
Component	Type
d_jkff	JK flip flop
pulse	Clock
DC	DC Source for logic high
AND Gate	Logic Gates

e-Sim Schematic

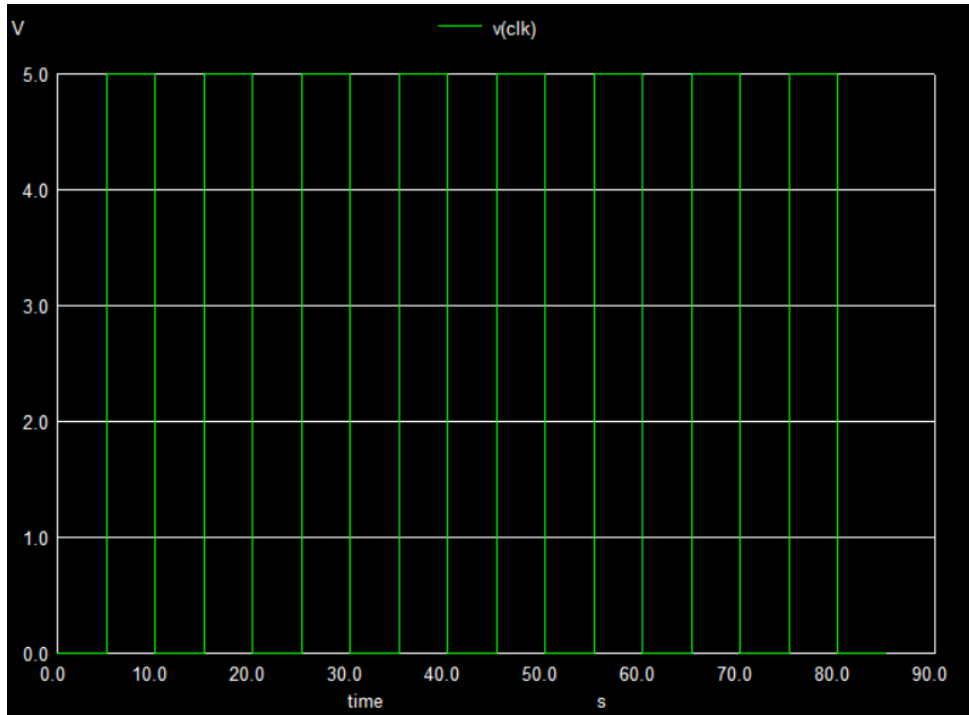


Sheet: /			
File: JKDown.scn			
Title:			
Size: A4	Date:	Rev:	
Kicad E.D.A. - eschema 4.0.7		Id: 1/1	

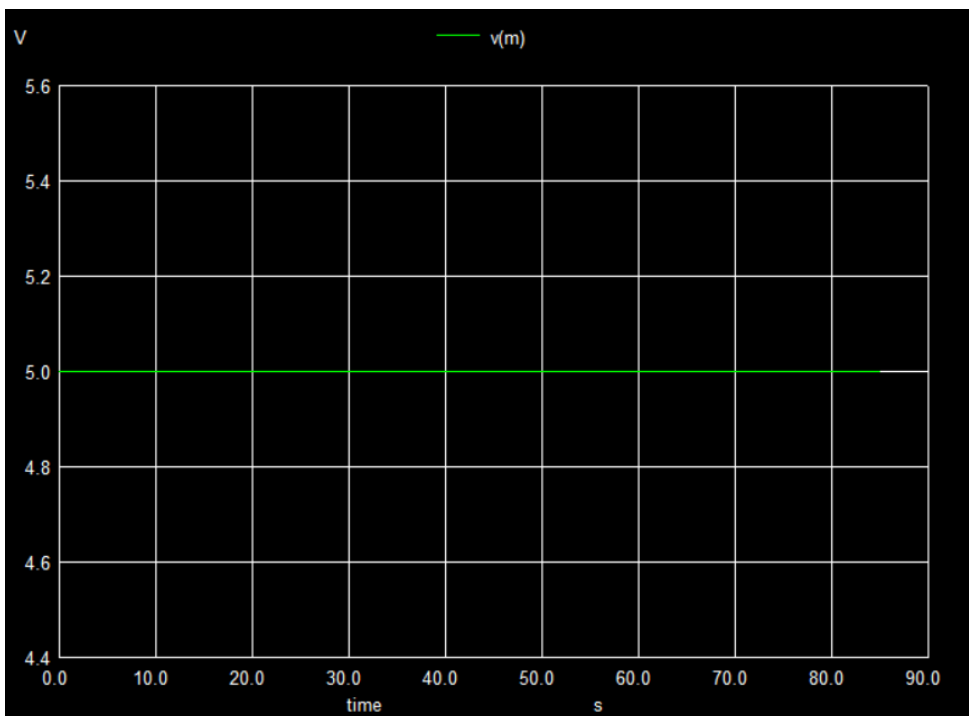
Simulation Result

(i) NG Spice Waveforms:

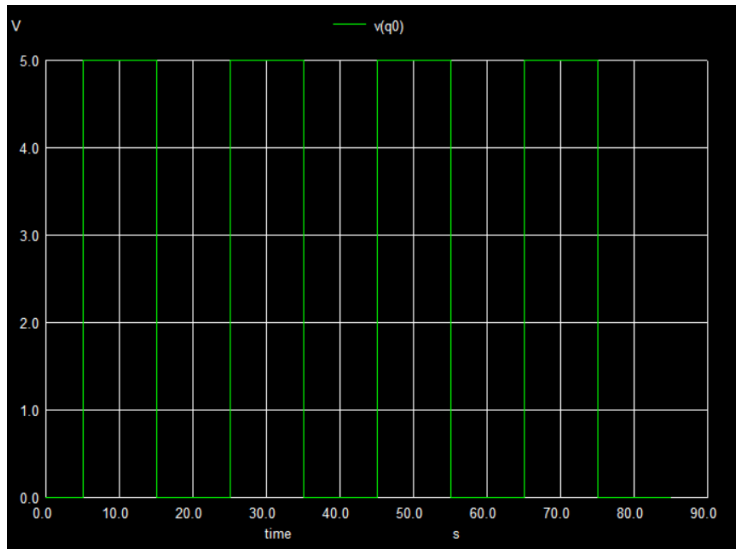
clk (Clock Pulse)



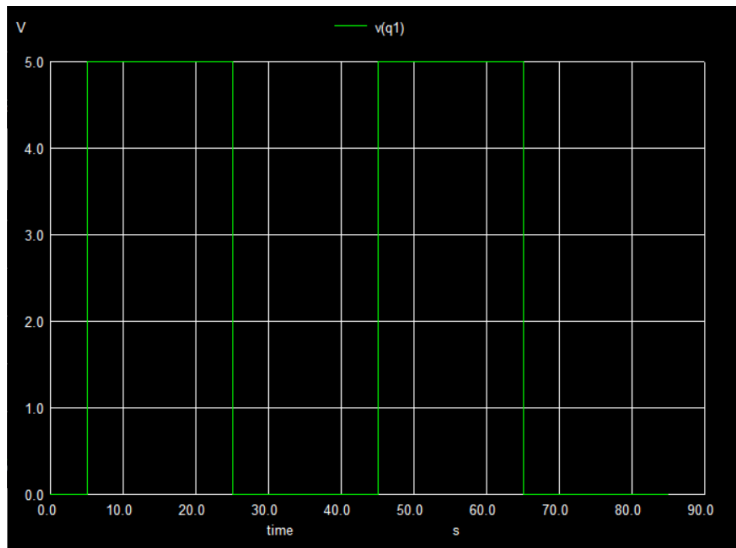
m (Logic High)



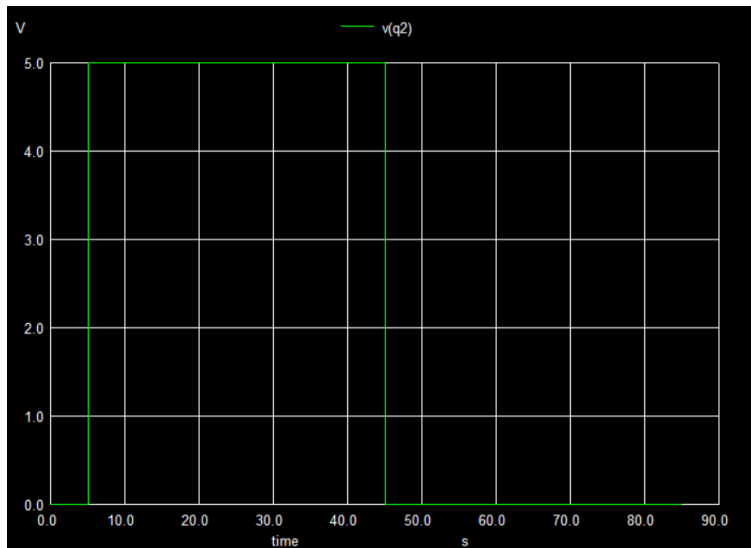
Q₀ (LSB)



Q₁

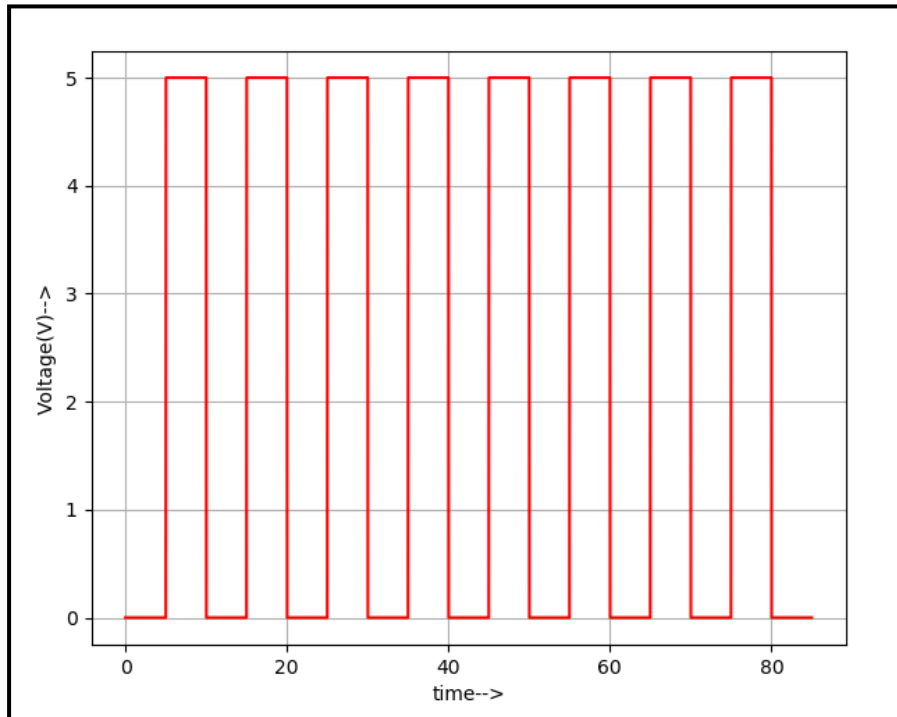


Q₂ (MSB)

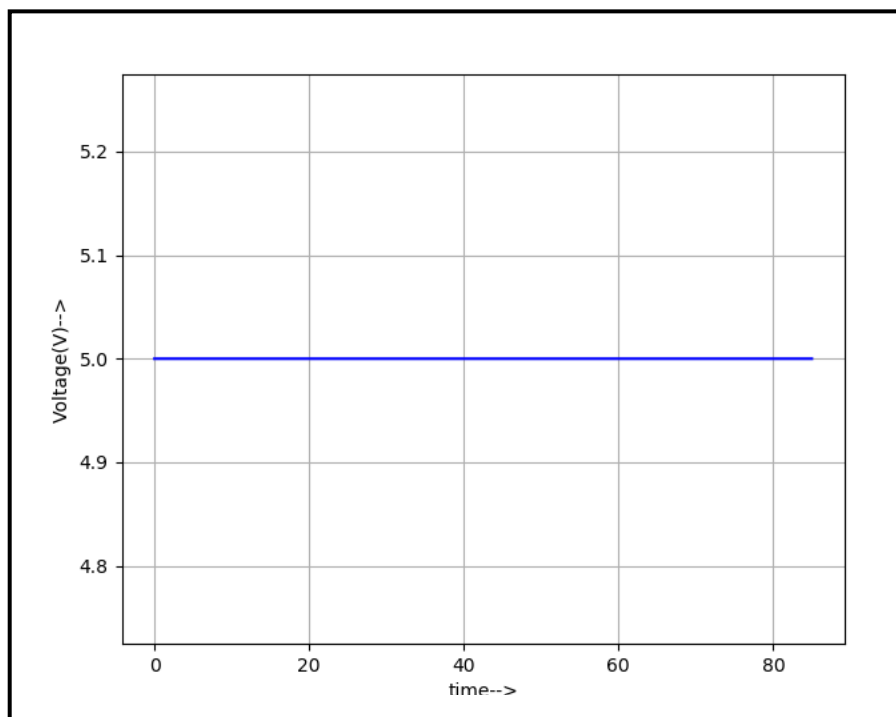


(ii) Python Waveforms (for better visualization)

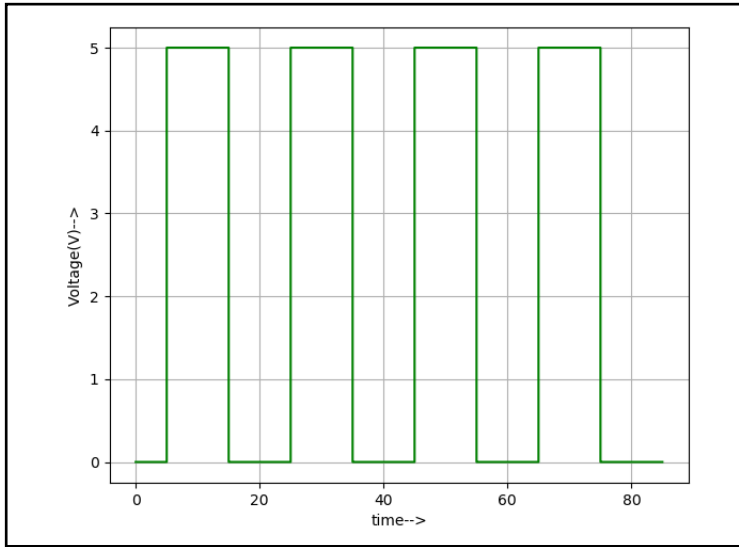
clk



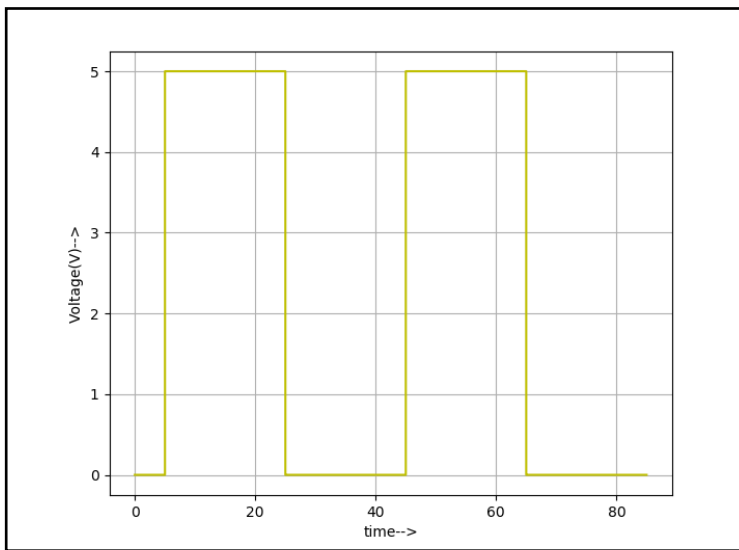
m (Logic High)



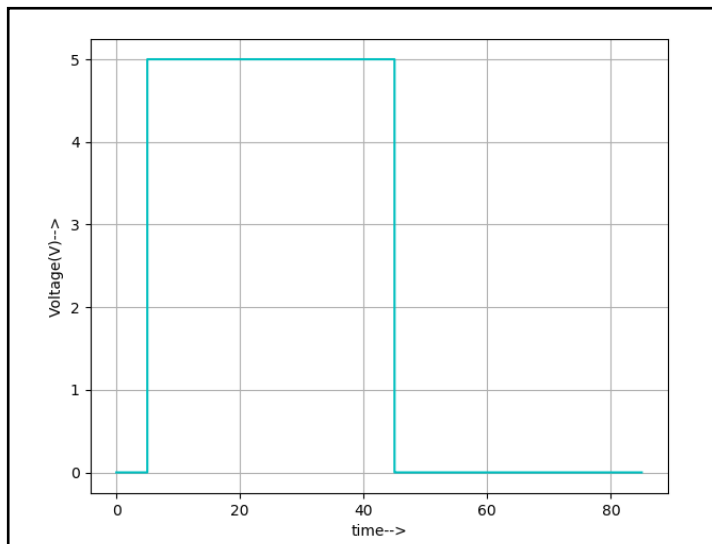
Q₀ (LSB)



Q₁

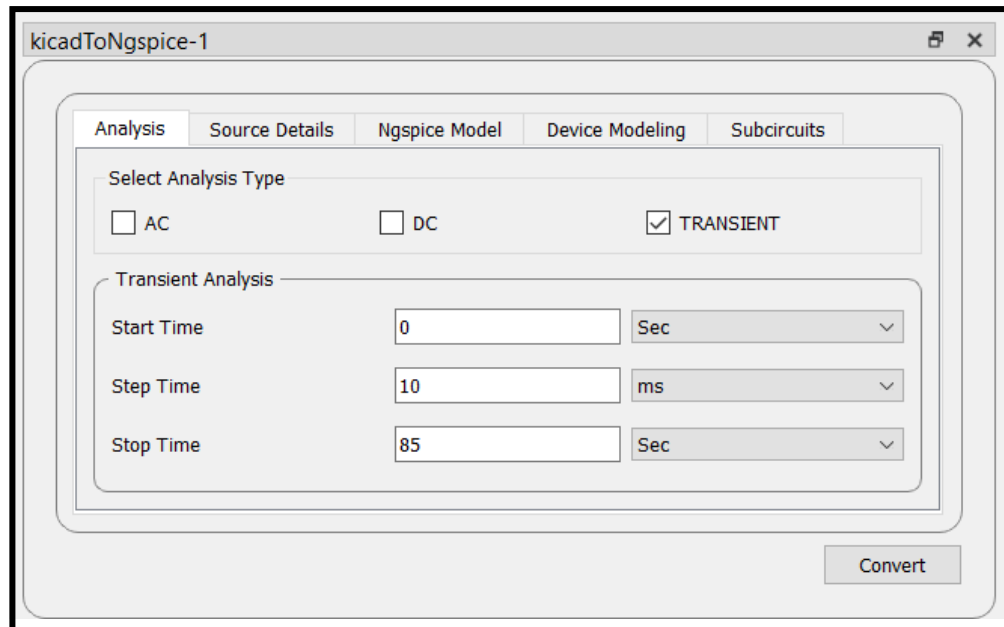


Q₂ (MSB)



Simulation Parameters for reference:

Transient Analysis

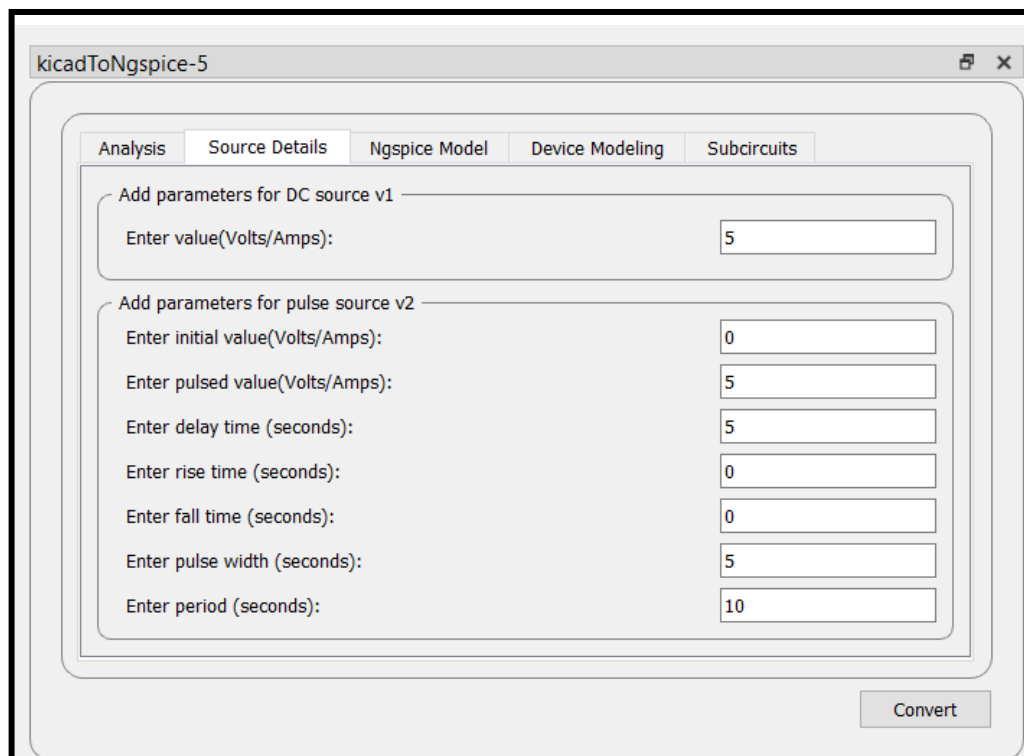


The screenshot shows the 'kicadToNgspice-1' dialog box with the 'Analysis' tab selected. Under 'Select Analysis Type', the 'TRANSIENT' checkbox is checked. The 'Transient Analysis' section contains the following settings:

Parameter	Value	Unit
Start Time	0	Sec
Step Time	10	ms
Stop Time	85	Sec

A 'Convert' button is located at the bottom right of the dialog.

Source Details



The screenshot shows the 'kicadToNgspice-5' dialog box with the 'Source Details' tab selected. It displays parameters for a pulse source v2:

Parameter	Value
Enter value(Volts/Amps):	5
Enter initial value(Volts/Amps):	0
Enter pulsed value(Volts/Amps):	5
Enter delay time (seconds):	5
Enter rise time (seconds):	0
Enter fall time (seconds):	0
Enter pulse width (seconds):	5
Enter period (seconds):	10

A 'Convert' button is located at the bottom right of the dialog.

Conclusion:

Hence, designed and verified 3-bit synchronous down counter using JK flip flops on eSim

References:

<https://www.geeksforgeeks.org/3-bit-synchronous-down-counter/>

https://www.tutorialspoint.com/digital_circuits/digital_circuits_counters.htm