

3-Bit Binary Counter With Astable Multivibrator As Clock Circuit

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Abstract:

I supposed to propose 3-bit binary counter with astable multivibrator as a clock circuit using sky130. This circuit contains astable multivibrator, 3-bit binary counter and 1-bit adc bridge. Astable multivibrator contains avsd_opamp, sky130_fd_pr_cap_mim_m3_1, sky130_fd_pr_r_resgeneric_pd, 1-bit bridge adc and dc power supply.

Reference Circuit Details:

Astable multivibrator is designed by using capacitor of capacitance 10nF, two resistors R_1 , R_2 of resistance of $1K\Omega$ and feedback resistor of resistance $4.5K\Omega$.

$$\text{Now, feedback factor } \beta = \frac{R_2}{R_1 + R_2} = \frac{1k\Omega}{2k\Omega} = 0.5$$

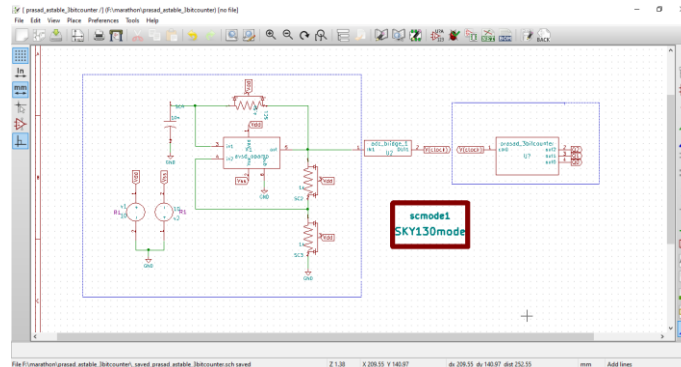
$$\begin{aligned}\tau &= 2R_f C \ln\left(\frac{1+\beta}{1-\beta}\right) \\ &= 2(4.5K)(10^{-8})\ln(3) \\ &= 0.1\text{ms.}\end{aligned}$$

$$f = \frac{1}{\tau} = 10\text{KHz}$$

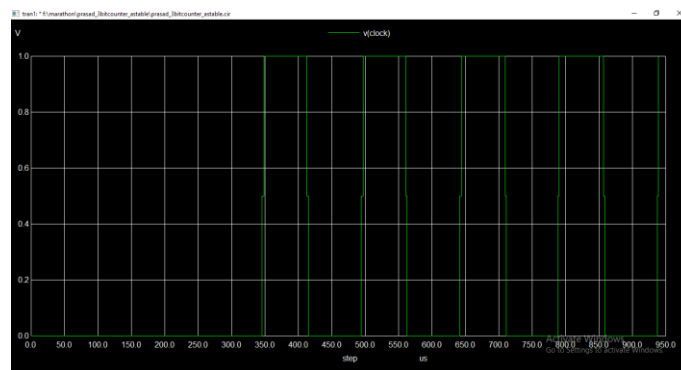
Astable multivibrator produces clock to Prasad_3bit counter with 10KHz frequency. Fig-2 shows the output of the astable multivibrator which is input to the counter as a clock.

Apply output of the astable multivibrator as input of adc_bridge_1 and output of this adc bridge is connected as clock to the prasad_3bitcounter.

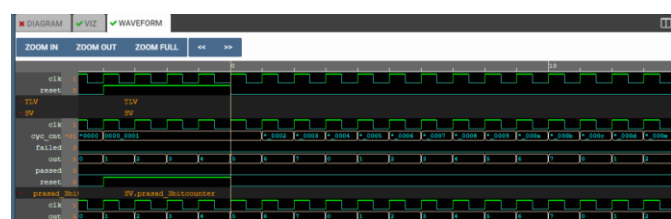
Output of astable multivibrator oscillates $-V_{\text{sat}}$ to V_{sat} i.e -10V to 10V. After passing through adc bridge clock oscillates between 0 to 1 i.e desired clock pulse. This counter has 8 states. They are 000, 001, 010, 011, 100, 101, 110, 111. Initially counter is in 000 state, for every positive edge of clock pulse count increased by 1. These eight states repeat for every eight clock pulses.



Implemented Circuit



Implemented Waveforms



Implemented Waveforms

References:-

- <https://youtu.be/Vp0VLd4io0c>
- <https://youtube.com/user/SpokenTutorialIITB>