0.14V RC Oscillator Circuit with Separate Logic Output Buffer

Description

This circuit is a low voltage EPAD MOSFET RC oscillator that operates at V+= 0.14V. In this circuit U1A, U1B and U1C form the basic three-stage oscillator with feedback resistor and capacitor network R4, C_{OSC} and R5. The output is tapped and buffered with U1D as an output buffer stage. Power to the output stage is supplied by V_L. V1 can be either at V+ or at a different value, depending on the desired output high level. If V1 is at a different voltage level, then the output buffer also acts as a level shifter. To minimize power consumption, R6 value is maximized for proper output voltage-swing levels.

Using a low threshold enhancement mode EPAD MOSFET, the ALD110804 (quad with $V_{GS(TH)}$= 0.40V), this oscillator operates on 0.14V supply voltage and at 1nW of power, at a frequency of 40 Hz. Capacitor C_{OSC} and Resistor R5 determine oscillating frequency of the RC oscillator, is generally given by $f_{OSC} = 1 / (2 Pi * R5 * C_{OSC})$. However, the EPAD MOSFET is operating entirely in the subthreshold operating region of the MOSFET device. The charging of C_{OSC} is limited by R3+R4 and the discharging of C_{OSC} is limited by the current drive of U1C. These factors tend to decrease the actual oscillating frequency significantly. The remaining resistors R1 through R6 help determine the power dissipation as well as the oscillating frequency, and can be optimized for minimum power consumption of the circuit for a given desired frequency.

For full schematic diagram and notes, please register and login at aldinc.com