Supply clock generation (driver) circuit for 2PASCL

Nazrul Anuar

Graduate School of Eng., Gifu University

Abstract

The paper presents a new quasi adiabatic logic family that uses two complementary split-level sinusoidal power supply clock for digital low power applications such as sensors. The proposed two-phase adiabatic static CMOS logic circuit (2PASCL) is using the principle of energy recovery and adiabatic switching. It has switching activity that is lower than dynamic logic and can be directly derived from static CMOS circuits. We have simulated the clock generation circuit using SPICE and investigate the most suitable scheme and highest energy efficiency for the energy recovery power supply/clocks.

1 Introduction

The design of highly efficient resonant drivers for generating energy-recovery supply clocks have been studied in [1]– [3]. The underlying idea of energy-recovery clock generation circuit is to use a resonant driver. For resonant circuits, sinusoidal waveform has the highest energy recycling percentage [4]. So far, the frequency range for the existing schemes is fairly low (below 100 MHz), prohibiting its use in a high-frequency environment. In addition, the existing schemes work in a frequency determined by inductor(s) and the capasitive load rather than the external reference frequency. Henceit is not possible to integrate an energy-recovery module into a VLSI system in which the rest of the system operates at a frequency defined by the system.

2 Simulation and results

We simulated a clock generation driver scheme which is shown in Fig. 1. The resonant circuit generates two almost-nonoverlapping sinusoidal waveform clock signal.

2.1 formulae

$$\omega_0 = \frac{1}{\sqrt{LC}}, f_r = \frac{1}{2\pi\sqrt{LC}}, L = \frac{1}{4\pi^2 f_r^2 C} \quad (1)$$

$$Q = \frac{\omega_0 L}{r}, \quad (2)$$

where ω_0 is the angular frequency in hertz.
L is the inductance of coil in Henry.
C is the capacitance of capacitor in micro farad
R is the resistance of resistor in Ohm
f_R is the resonant frequency of the series or parallel resonant circuit in Hertz
Q factor is dimensionless parameter that compares the time constant for decay of an oscillating physical system's amplitude to its oscillation period. The higher the Q, the lower the energy dissipation.

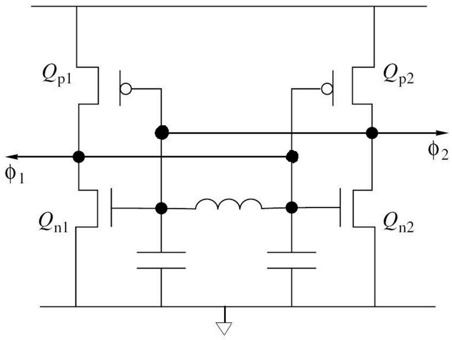

Fig. 1 Resonant driver for push-pull operation. Sources: Dickinson and Denker [2], [6].

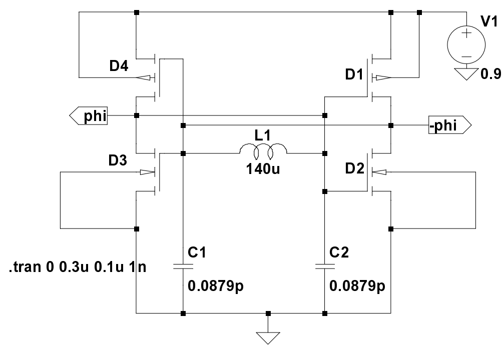

Fig. 2 Resonant oscillator schematic from SPICE.

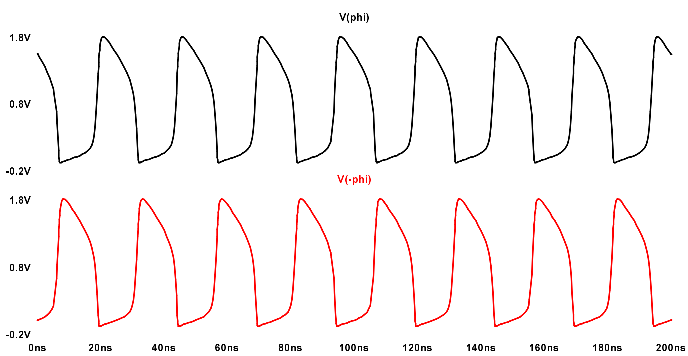

Fig. 3 Two phase nonoverlapping sinusoidal supply clock p-p 1.8 V, f=40 MHz.

3 Conclusion

In this paper, simulation on the first resonant circuit oscillator to be used in 2PASCL is carried out. Almost sinusoidal two phase waveforms are generated based on the schematic and the parameters given. Further enhancements need to be done including the inverting and the step up of one of the waveforms

References

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