TITLE : Design and Simulation of a Low-Voltage Cross-Coupled Charge Pump

STUDENT NAME : PRAVIN A

COLLEGE NAME : Sri Eshwar College of Engineering

PROBLEM STATEMENT :

The demand for low-power circuits in portable and IoT devices requires efficient on-chip voltage boosting techniques.Traditional charge pump topologies suffer from large ripple, reduced efficiency, and poor performance at low supply voltages.A cross-coupled charge pump provides improved pumping efficiency and reduced threshold voltage losses.However, its performance depends heavily on input clock characteristics and transistor sizing.This research investigates the design, simulation, and analysis of a cross-coupled charge pump.

ABSTRACT :

The increasing demand for low-voltage, low-power portable systems necessitates efficient voltage boosting circuits.Conventional charge pump architectures face limitations such as high threshold losses, reduced output swing, and large voltage ripple.The cross-coupled charge pump offers improved efficiency by reducing threshold drop and providing better charge transfer between stages.In this work, a two-phase cross-coupled charge pump is designed and simulated using eSim with NMOS and PMOS transistors.Clock inputs are provided through complementary sinusoidal or pulse waveforms, and the effect of frequency and amplitude on output voltage is analyzed.Simulation results demonstrate that the proposed design can achieve nearly double the supply voltage, making it suitable for low-voltage applications in VLSI and IoT systems.

PROPOSED CIRCUIT :

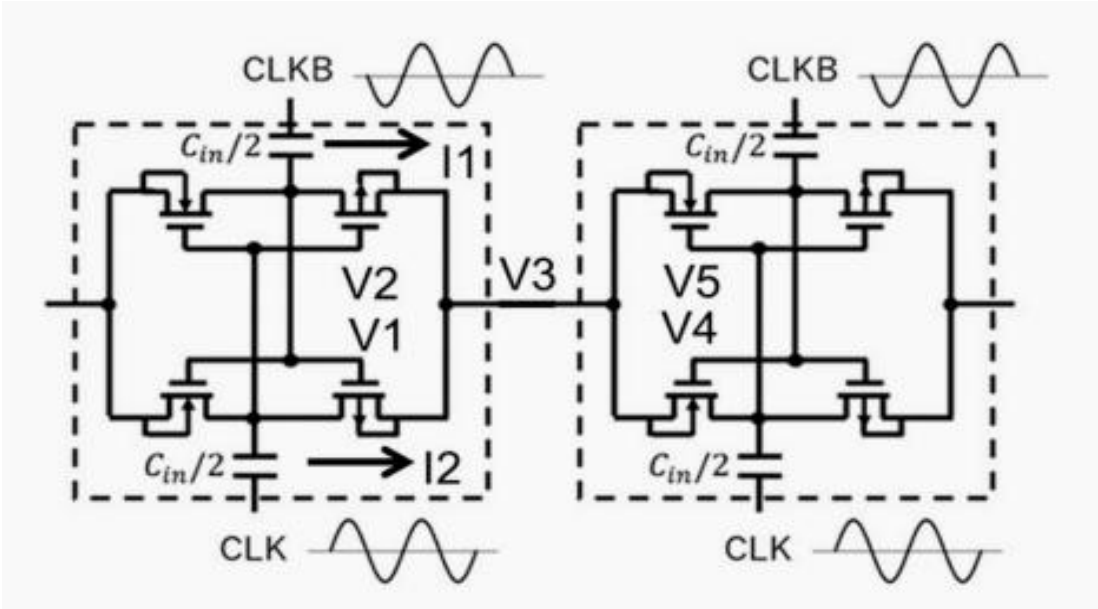

Fig 1 : Cross-Coupled Charge Pump

REFERENCES :

[1] R. Kotsubo and T. Tanzawa,*"Modeling of Cross-Coupled AC-DC Charge Pump Operating in SubthresholdRegion,"*Electronics,vol.12,no.24,p.5031,Dec.2023.

[2] J. Marek, J. Hospodka, and O. Šubrt, *"Cross-Coupled Charge Pump Synthesis Based on Full Transistor-Level,"* Advances in Electrical and Electronic Engineering, vol. 17, no. 4, pp. 480–487, 2019.