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High-Speed CMOS Ring Voltage Controlled Oscillator With Low Supply Sensitivity

Tech ID: 21210 / UC Case 2011-114-0

BRIEF DESCRIPTION

Voltage-controlled oscillator (VCO) with reduced sensitivity to perturbations in the supply voltage. Features include a CMOS fabrication process, no requirement of a dedicated clean power supply or extra regulator circuitry, and compensation circuitry in parallel with each stage of ring oscillator.

FULL DESCRIPTION

This invention is an enhancement of a voltage-controlled oscillator (VCO), realized using a CMOS fabrication process. The purpose of which is to reduce the oscillator's sensitivity to perturbations in the supply voltage as such perturbations lead to excess jitter in the VCO output.

The fundamental principle of the invention is to insert compensation circuitry in parallel with each stage of the CML-based ring oscillator. This compensation circuitry exhibits a dependence on the supply voltage that is the opposite of that of the stage, thereby minimizing the frequency variation in the presence of supply perturbations.

Internal and external noise can cause jitter or deviation from true periodicity in a Voltage Controlled Oscillator (VCO). Low jitter in the VCO output is crucial to proper signal integrity, as excess jitter in the VCO output increases the bit error-rate of the system in which it is implemented.

In the past, techniques to reduce a VCO's sensitivity to the perturbations have involved employing an additional dedicated power supply that provides a very clean supply voltage or adding extra regulator circuitry, such as a low drop-out regulator, which consumes considerable extra power. This invention reduces jitter and minimizes frequency variation without requiring either a dedicated power supply or extra regulator circuitry.

SUGGESTED USES

For use in communication IC (integrated circuit) chip products

ADVANTAGES

Can suppress the supply noise-induced periodic jitter and minimize the frequency variation of the VCO without requiring a dedicated clean power supply or extra regulator circuitry.

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	9,319,031	04/19/2016	2011-114
United States Of America	Issued Patent	8,692,622	04/08/2014	2011-114

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OTHER INFORMATION

KEYWORDS

CMOS, CML, ring oscillator, VCO, IC

CATEGORIZED AS

- » **Communications**
 - » Wireless
- » **Semiconductors**
 - » Design and Fabrication

RELATED CASES

RELATED MATERIALS

X. Gui, Green M.M., High-Speed CMOS ring oscillators with low supply sensitivity, Custom Integrated Circuits Conference (CICC), 2010 IEEE. doi: [10.1109/CICC.2010.5617609](https://doi.org/10.1109/CICC.2010.5617609)

X. Gui, M. M. Green, Design of ring oscillators with low supply sensitivity, IEEE Transactions on Circuits and Systems I:Regular Papers, vol. 60, July 2013, pp. 1753-1763.

STATE OF DEVELOPMENT

A prototype has been built and tested.

LEAD INVENTOR

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ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- ▶ [Referenceless Clock Recovery Circuit with Wide Frequency Acquisition Range](#)

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