A 1-V, SELF CALIBRATING, 16MHZ CMOS RC-OSCILLATOR

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ABSTRACT

Self calibrating RC oscillator architecture and its CMOS implementation are described in this paper. The ability to power down a system when not in use and reliably restart when needed has a great benefit when it comes to saving power. This RC oscillator consumes less power than the crystal oscillator and has faster startup time. The oscillator is capable of operating with a 1-V power supply and it features low current consumption(30uA@1V) and low sensitivity to supply voltage and temperature variations. The total accuracy of the oscillator is within 1% with component tolerances in internal elements R and C. The RC oscillator is designed in 0.18um CMOS process.

I. INTRODUCTION

In 2000, IEEE started to standardize IEEE 802.15.4 exclusively for these kinds of low-rate wireless personal area network applications. The battery life required for this type of application could be as much as five to seven years. When designing these types of circuits, it is crucial that power consumption is minimized. One of the best ways to conserve power is to turn off as much circuitry as possible when their functions are not needed.

During the off time, the digital domain will still have its power supply and retain its logical states and memory without consuming power. Each analog block will have a power down state that will be controlled by the system's power management controller. The faster system can be powered up, perform its function and power down, the less power is needed[1]. Hence, start-up time and current consumption is very important in reference oscillator.

Crystal oscillator takes both time and energy to start oscillating due to the fact typically crystal oscillators are allowed time to self-start by amplifying internally generated noise to a operating level. As to start-up time and current consumption, crystal oscillator is not suitable device in power down mode[1].

On the other hand, the merits of RC oscillator include low cost, no inductors, low current consumption, fast start-up time and the ability to adjust the frequency. Disadvantages are low operating frequency, a high temperature sensitivity and a wide variation in frequency over process. These limitations are greatly reduced by using self-calibrating topologies.[2] [3]

In this paper, a design approach to quickly start and low current consumption RC oscillator circuit will be presented.

II. TOP LEVEL ARCHITECTURE

Figure 1 shows the simplified block diagram of the self calibrating RC oscillator. There are four major blocks. First, Voltage regulator for supply voltage. It can save the power consumption as reducing the supply voltage to 1V.