Applications of Power-on-Reset Circuit

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***Abstract*—This paper presents an accurate low-power power-on-reset (POR) circuit utilizing SKY130 PDK technology, addressing the demand for efficient solutions in IoT applications. By implementing a current reference and comparator architecture, the design achieves configurable trip voltages with minimal power overhead, enhancing performance in low-voltage systems while effectively managing supply noise and brown-out events.**

Keywords*— *Power-on-reset, low-voltage, low-power, high accuracy, area efficient, Brown-out detection

I. INTRODUCTION

The increasing demand for low-power integrated circuits in Internet of Things (IoT) applications necessitates efficient power-on-reset (POR) circuits. These circuits are essential for ensuring that memory elements maintain a known state during power-up, thus preventing erratic behaviour in digital systems. Traditional POR designs often rely on bandgap references, which, while robust, can consume significant power. In contrast, this paper presents an accurate low-power POR circuit utilizing SKY130 PDK technology. By implementing a current reference and comparator architecture, our design achieves configurable trip voltages with minimal power overhead, enhancing performance in low-voltage applications while addressing challenges like supply noise and brown-out events.

II. APPLICATIONS

Power-On Reset (POR) circuits are commonly used in various electronic systems to ensure that components start up in a defined, predictable state. Here are some circuits where POR is used, along with brief descriptions and the impact of POR on each circuit:

A. *Digital Signal Processors (DSPs)*

DSPs, which handle signal processing tasks, use POR to reset internal logic, registers, and memory upon powering up, setting the processor to a controlled state.

Impact of POR: Ensures the DSP begins processing data from a clean, consistent state, avoiding errors in signal computation and processing.

B. *Analog-to-Digital Converters (ADCs)*

ADCs use POR to reset internal calibration registers and start at a default setting, ensuring accurate conversions.

Impact of POR: Enhances accuracy by preventing erroneous data conversions due to uninitialized states, crucial for high-precision applications.

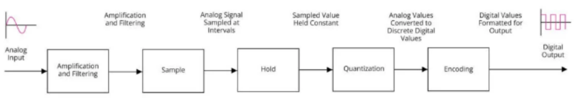

Fig 1. Block Diagram of ADC

C. *Power Management ICs*

Power management ICs, responsible for distributing power to various components, utilize POR to ensure that the power sequencing begins in a controlled state.

Impact of POR: Avoids power sequencing errors that could damage components or cause system instability by ensuring consistent power-up sequences.

D. *Field Programmable Gate Arrays (FPGAs)*

FPGAs use POR to initialize internal configuration memory, logic blocks, and registers before loading user-defined configurations.

Impact of POR: Ensures that the FPGA configuration is loaded reliably and the logic circuits operate as expected, preventing logic errors and configuration corruption.

E. *Voltage Regulators*

Voltage regulators often integrate POR circuits to ensure output voltage stabilization before the connected circuits begin operating.

Impact of POR: Protects downstream circuits from voltage fluctuations during power-up, reducing the risk of component damage or erratic behavior.

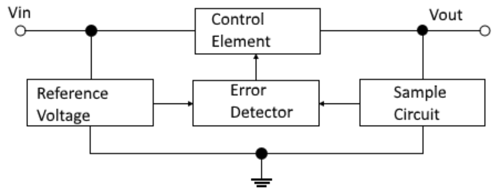

Fig 2. Block Diagram of Voltage Regulator

III. CONCLUSION

In conclusion, the proposed low-power power-on-reset circuit demonstrates significant advancements in reliability and efficiency for low-voltage applications. By employing a current reference and comparator architecture, the design ensures accurate trip voltage detection while minimizing power consumption.

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