**How To Bound A/D Converter Sampling Window Errors**

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Table of Contents

[1 Introduction and Overview 4](#_Toc527206615)

[2 Document Notation 4](#_Toc527206616)

[2.1 Variables 4](#_Toc527206617)

[2.2 Operators 4](#_Toc527206618)

[2.3 SI Prefixes 4](#_Toc527206619)

[3 Electric Circuit Theory 4](#_Toc527206620)

[3.1 Charge, Current, Voltage, Capacitance, Energy, and Power 4](#_Toc527206621)

[3.2 Ohm’s Law 4](#_Toc527206622)

[3.3 Capacitor Behavior 4](#_Toc527206623)

[3.4 Capacitor Frequency Response 4](#_Toc527206624)

[3.5 Kirchoff’s Voltage Law and Node Analysis 4](#_Toc527206625)

[3.6 The First-Order RC Circuit 4](#_Toc527206626)

[3.6.1 Charging from No Voltage 5](#_Toc527206627)

[3.6.2 Discharging to No Voltage 5](#_Toc527206628)

[3.6.3 Switching Between Voltages 5](#_Toc527206629)

[3.6.4 The RC Time Constant 5](#_Toc527206630)

[3.7 Transferring Charge Between Capacitors 5](#_Toc527206631)

[3.8 The Voltage Divider 5](#_Toc527206632)

[3.9 The Loaded Voltage Divider 5](#_Toc527206633)

[3.10 The Potentiometer 5](#_Toc527206634)

[3.11 Ideal Voltage Sources 5](#_Toc527206635)

[3.12 The Thevenin Equivalent of a Voltage Divider 5](#_Toc527206636)

[3.13 The Thevenin Equivalent of a Potentiometer 5](#_Toc527206637)

[3.14 Determining the Time Required to Achieve a Specific Fraction of Ultimate Response 5](#_Toc527206638)

[4 A/D Converter Behavior 5](#_Toc527206639)

[4.1 Topology 5](#_Toc527206640)

[4.2 Conversion Behavior 6](#_Toc527206641)

[4.3 Circuit Models 6](#_Toc527206642)

[5 Practical Error Analyses and Error Mitigation 6](#_Toc527206643)

[5.1 Ideal Voltage Source Connected Directly to A/D Input 6](#_Toc527206644)

[5.2 Ideal Voltage Source Connected Through Resistor to A/D Input 6](#_Toc527206645)

[5.2.1 Without Bypass Capacitor, No Residual Charge from Previous Conversion 6](#_Toc527206646)

[5.2.2 Without Bypass Capacitor, Residual Charge from Previous Conversion 6](#_Toc527206647)

[5.2.3 With Bypass Capacitor, No Residual Charge from Previous Conversion 6](#_Toc527206648)

[5.2.4 With Bypass Capacitor, Residual Charge from Previous Conversion 6](#_Toc527206649)

[5.3 Ideal Voltage Source Connected Through Voltage Divider to A/D Input 6](#_Toc527206650)

[5.3.1 Without Bypass Capacitor, No Residual Charge from Previous Conversion 6](#_Toc527206651)

[5.3.2 Without Bypass Capacitor, Residual Charge from Previous Conversion 6](#_Toc527206652)

[5.3.3 With Bypass Capacitor, No Residual Charge from Previous Conversion 6](#_Toc527206653)

[5.3.4 With Bypass Capacitor, Residual Charge from Previous Conversion 6](#_Toc527206654)

[5.4 Ideal Voltage Source Connected Through Potentiometer to A/D Input 6](#_Toc527206655)

[5.4.1 Without Bypass Capacitor, No Residual Charge from Previous Conversion 7](#_Toc527206656)

[5.4.2 Without Bypass Capacitor, Residual Charge from Previous Conversion 7](#_Toc527206657)

[5.4.3 With Bypass Capacitor, No Residual Charge from Previous Conversion 7](#_Toc527206658)

[5.4.4 With Bypass Capacitor, Residual Charge from Previous Conversion 7](#_Toc527206659)

[6 References 8](#_Toc527206660)

# Introduction and Overview

This document explains:

* The origin of the errors that occur when an A/D converter that is used with a sampling window that is short relative to the impedance of an input circuit.
* How to mathematically bound the error due to sampling window size.
* How to modify a circuit so as to reduce the error due to the sampling window size.

Because the intended audience for this document includes those without an electrical engineering background, the necessary electric circuit theory is included as well.

# Document Notation

TBD.

## Variables

TBD.

## Operators

TBD.

## SI Prefixes

TBD.

# Electric Circuit Theory

## Charge, Current, Voltage, Capacitance, Energy, and Power

TBD.

## Ohm’s Law

TBD.

## Capacitor Behavior

TBD.

## Capacitor Frequency Response

TBD.

## Kirchoff’s Voltage Law and Node Analysis

TBD.

## The First-Order RC Circuit

TBD.

### Charging from No Voltage

TBD.

### Discharging to No Voltage

TBD.

### Switching Between Voltages

TBD.

### The RC Time Constant

TBD.

## Transferring Charge Between Capacitors

TBD.

## The Voltage Divider

TBD.

## The Loaded Voltage Divider

TBD.

## The Potentiometer

TBD.

## Ideal Voltage Sources

TBD.

## The Thevenin Equivalent of a Voltage Divider

TBD.

## The Thevenin Equivalent of a Potentiometer

TBD.

## Determining the Time Required to Achieve a Specific Fraction of Ultimate Response

TBD.

# A/D Converter Behavior

TBD.

## Topology

TBD.

## Conversion Behavior

TBD.

## Circuit Models

TBD.

# Practical Error Analyses and Error Mitigation

TBD.

## Ideal Voltage Source Connected Directly to A/D Input

TBD.

## Ideal Voltage Source Connected Through Resistor to A/D Input

TBD.

### Without Bypass Capacitor, No Residual Charge from Previous Conversion

TBD.

### Without Bypass Capacitor, Residual Charge from Previous Conversion

TBD.

### With Bypass Capacitor, No Residual Charge from Previous Conversion

TBD.

### With Bypass Capacitor, Residual Charge from Previous Conversion

TBD.

## Ideal Voltage Source Connected Through Voltage Divider to A/D Input

TBD.

### Without Bypass Capacitor, No Residual Charge from Previous Conversion

TBD.

### Without Bypass Capacitor, Residual Charge from Previous Conversion

TBD.

### With Bypass Capacitor, No Residual Charge from Previous Conversion

TBD.

### With Bypass Capacitor, Residual Charge from Previous Conversion

TBD.

## Ideal Voltage Source Connected Through Potentiometer to A/D Input

TBD.

### Without Bypass Capacitor, No Residual Charge from Previous Conversion

TBD.

### Without Bypass Capacitor, Residual Charge from Previous Conversion

TBD.

### With Bypass Capacitor, No Residual Charge from Previous Conversion

TBD.

### With Bypass Capacitor, Residual Charge from Previous Conversion

TBD.

# References