Measuring Noise in Voltage Regulators

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Introduction

Following presentation will cover state of the art in current methods of measuring noise generated by regulators. In addition, current progress of my work will be shown.

Agenda:

1. What is voltage regulator?
2. What noise regulators have?
3. How to combat them?
4. My progress.

Voltage regulator

> is a device which converts unregulated supply to more or less stable output.

Simple regulator with opamp:

Theory of operation

- Voltage reference.
- Feedback network.
- Error amplifier.
- Output stage.

Sources of noise in circuit

- Intrinsic semiconductor's noises:
  - popcorn noise,
  - shot noise,
  - 1/f (pink)noise.
  - Thermal noise (Johnson, wide-band, white)

    
- Effect of temperature dependency.
- Seebeck (Thermoelectric effect).

- Electromagnetic coupling
- Piezoelectric effects

Mitigation of noise

- Improving process of lithography.
- Using dynamic offset cancelation (chopper amplifier).
- Using smaller value of resistance:
    - 600 Ohm resistor, 1kHz BW: 0.098uV RMS
    - 50 Ohm resistor, 1kHz BW: 0.0089uV RMS
- Derating elements.
- Filtering the reference:

State of the art

Simplified block diagram:

Fully fledged block diagram:

First stage of amplifier:

My adaptation:

Stability of amplifier:

transfer Function:

ToDo:

- Order components
- create and validate layout
- perform meauserments