What effects LDO PSRR?

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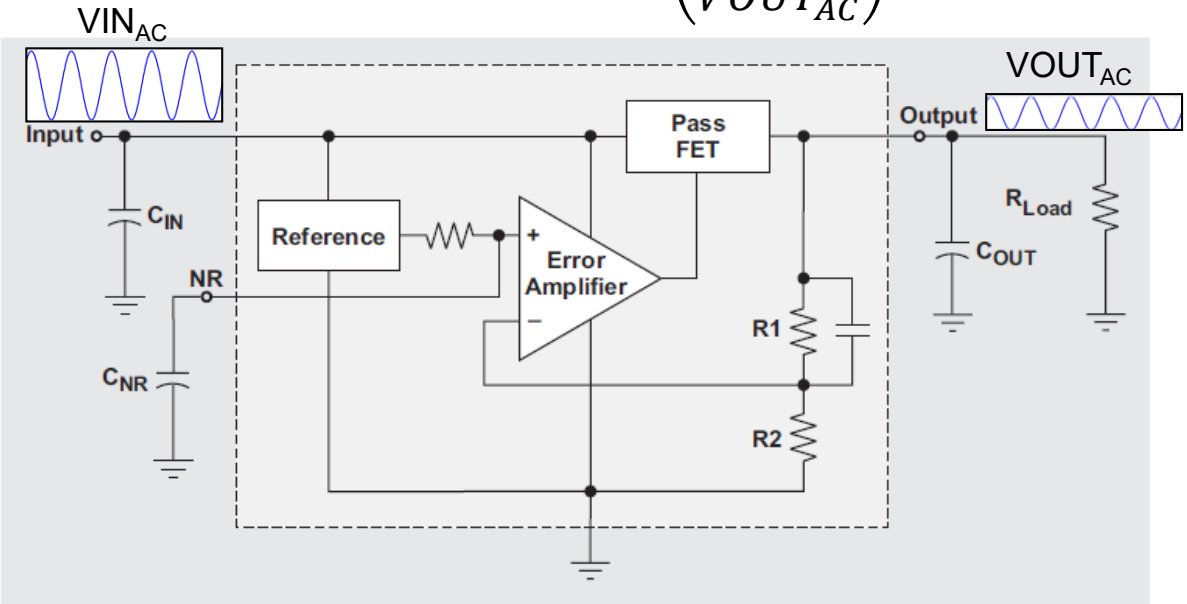
PSRR

PSRR (Power Supply Rejection Ratio) represents the ability of the LDO to filter input voltage changes. This is critical for low-noise applications.

$$PSRR = 20 * \log\left(\frac{VIN_{AC}}{VOUT_{AC}}\right)$$



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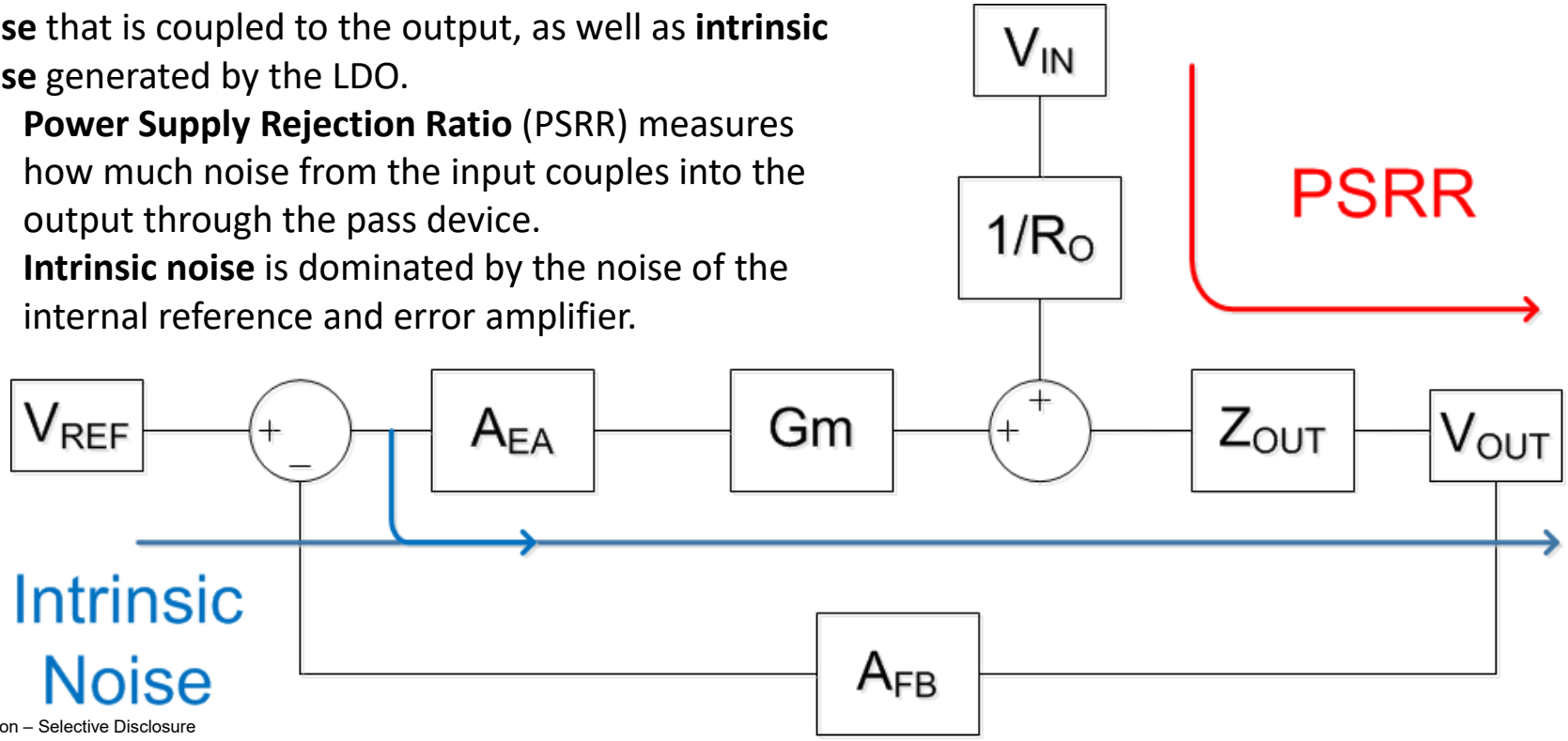
How PSRR/Noise Relate to the LDO AC Model

- Total LDO output voltage noise is composed of **Input noise** that is coupled to the output, as well as **intrinsic noise** generated by the LDO.
  - **Power Supply Rejection Ratio** (PSRR) measures how much noise from the input couples into the output through the pass device.
  - **Intrinsic noise** is dominated by the noise of the internal reference and error amplifier.



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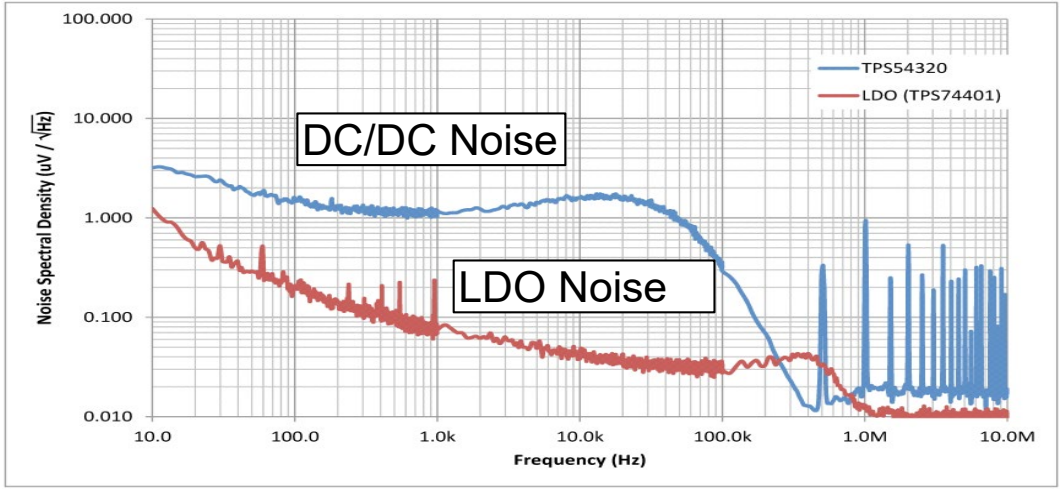
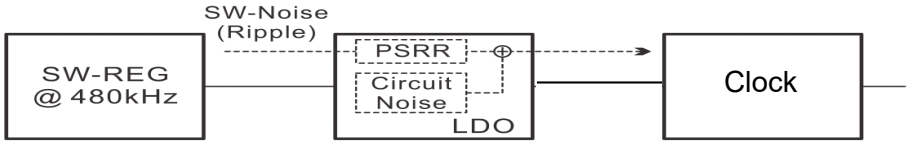
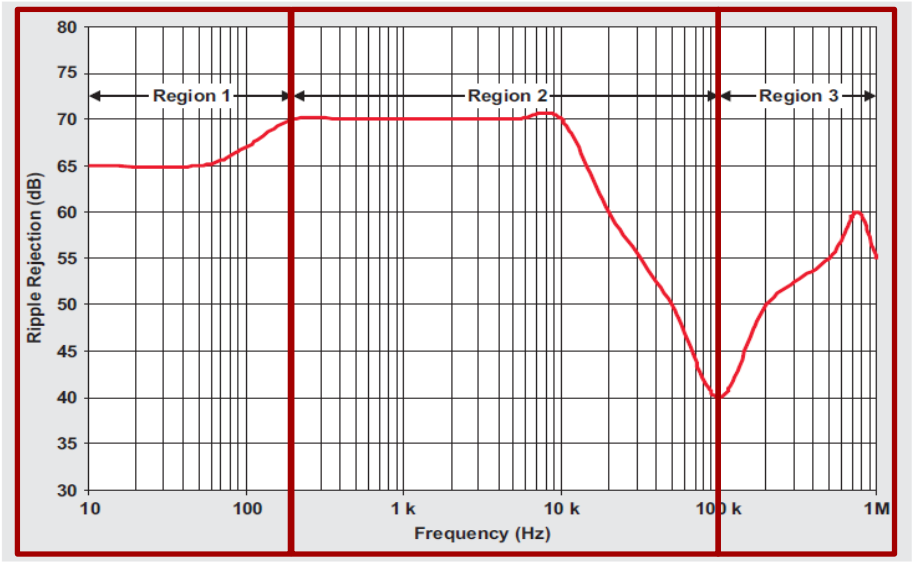
The Importance of LDO PSRR

- DC/DC (switching) converters are necessary for efficiency, however they are very noisy
  - most clock generators and clocking devices are very sensitive to power supply noise
  - DC/DC converters are commonly followed by an LDO to clean the supply





Typical PSRR Curve



Region 1 is determined by:

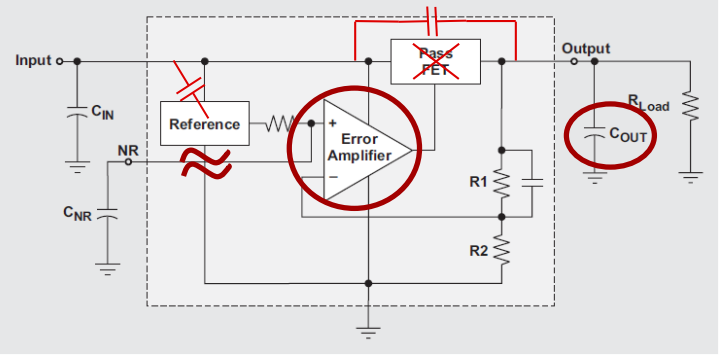
- PSRR of the Reference and the effectiveness of the RC filter

Region 2 is determined by:

- Open-Loop Gain of Error Amplifier

Region 3 is determined by:

- Parasitic capacitance of the FET and the output capacitor (capacitive divider)
  - The smaller the parasitic cap the less the Vin is AC coupled to Vout
  - The larger Cout the more noise is shunted to GND



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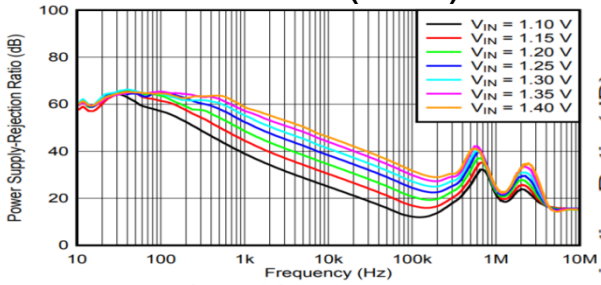
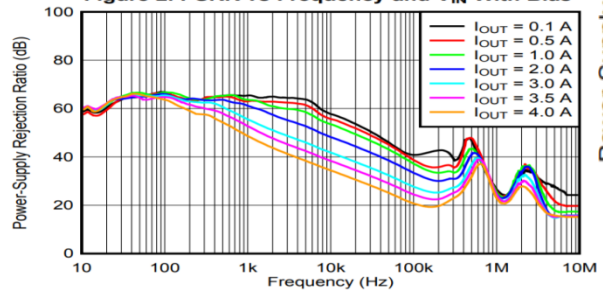
What Conditions Effect PSRR The Most

#1 thing that effects PSRR performance is the combo of Vin/Iout (Vdo)



I_{OUT} = 4 A, Vout = 0.8V

Figure 2. PSRR vs Frequency and V_{IN} With Bias



V_{IN} = 1.2 V, Vout = 0.8V

Figure 1. PSRR vs Frequency and I_{OUT}

The next thing that effects PSRR is the noise reduction capacitor

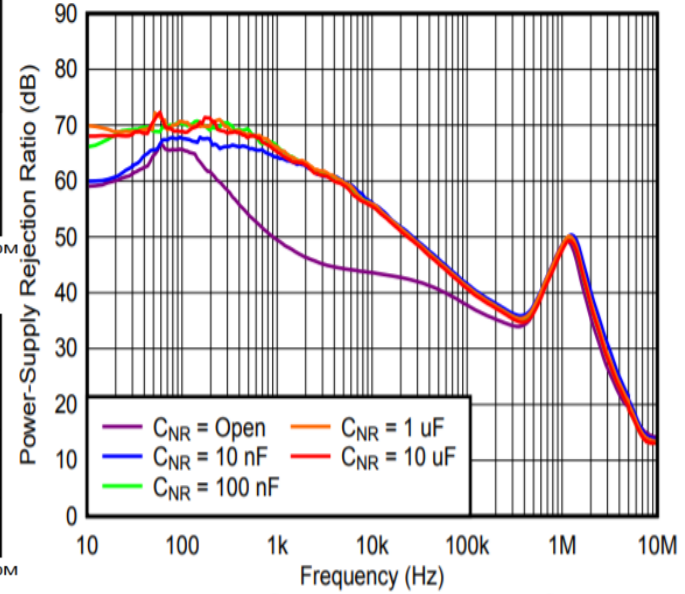


Figure 7. PSRR vs Frequency and $C_{NR/SS}$

The final thing that effects PSRR is the feedforward capacitor

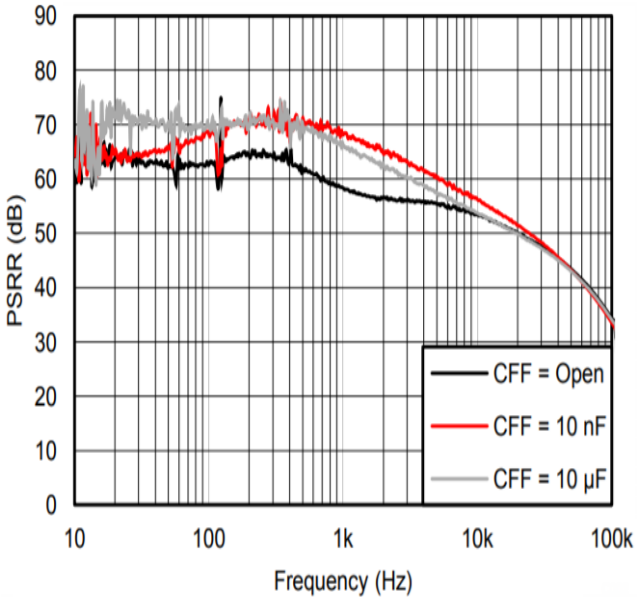


Figure 5. PSRR for Various C_{FF} Values

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What Conditions Do Not Effect PSRR Much

Number one thing that has almost no effect on PSRR is Vbias>min

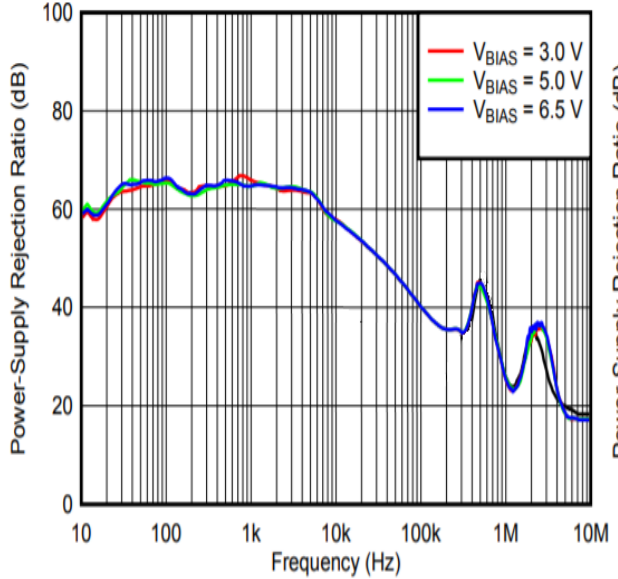

Figure 3. PSRR vs Frequency and V_{BIAS}

The next thing that only has a small effect on PSRR is Vout

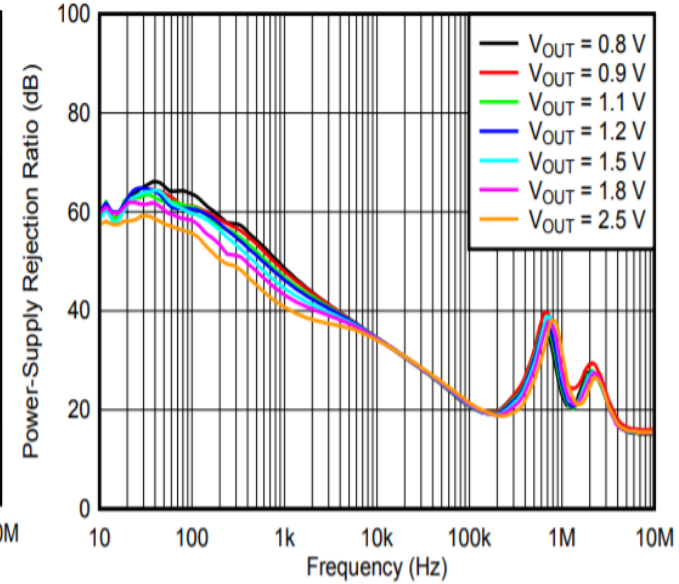

Figure 5. PSRR vs Frequency and V_{OUT} With Bias

And the final thing that has some effect (but only at high freq) is output capacitor

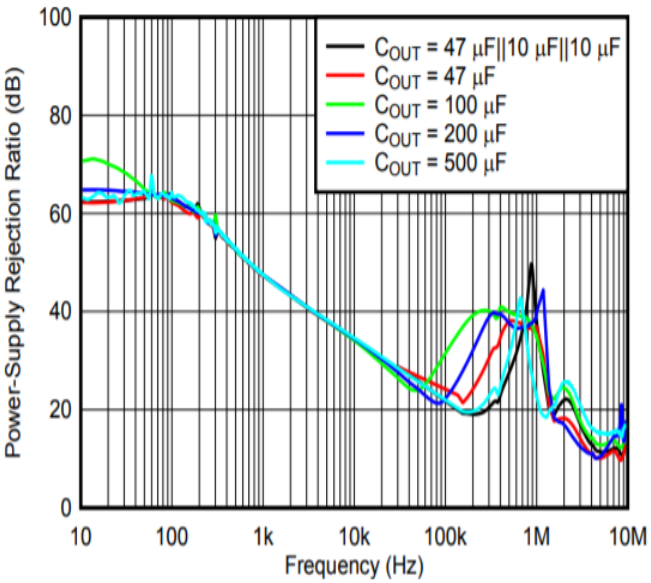

Figure 7. PSRR vs Frequency and C_{OUT}

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