

Linear vs Switching

Electrical Engineering

Two ways to make a stable rail, weighed on efficiency, noise and parts.

Linear regulator

- Passes current through a control device
- Efficiency roughly $V_{out} \div V_{in}$
- Very low output noise
- Steps voltage down only
- Needs heatsinking at real current

Switching regulator

- Chops and filters at high frequency
- Efficiency often above 90%
- Ripple and EMI at the switching rate
- Steps up, down or inverts
- Needs an inductor and careful layout

THE DIFFERENCE THAT MATTERS

Dropping 12 V to 5 V at 1 A wastes 7 W in a linear regulator and well under 1 W in a switcher.

Low-noise analogue front ends often use both: a switcher for the bulk conversion, then a small linear regulator to clean it up.