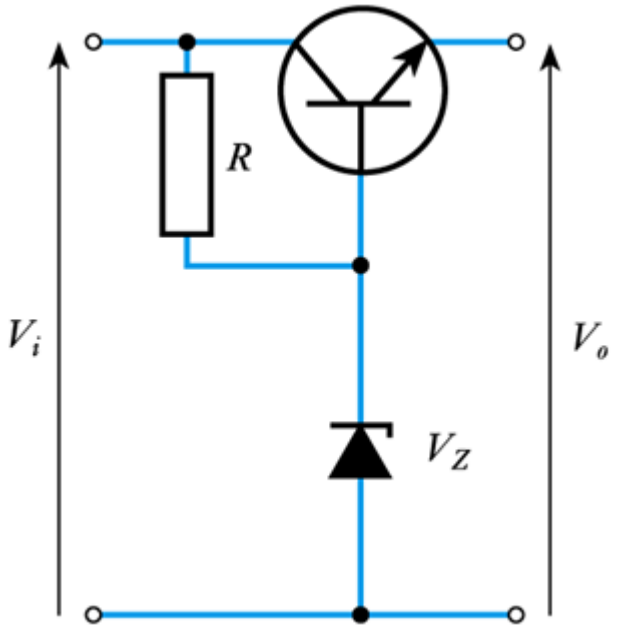
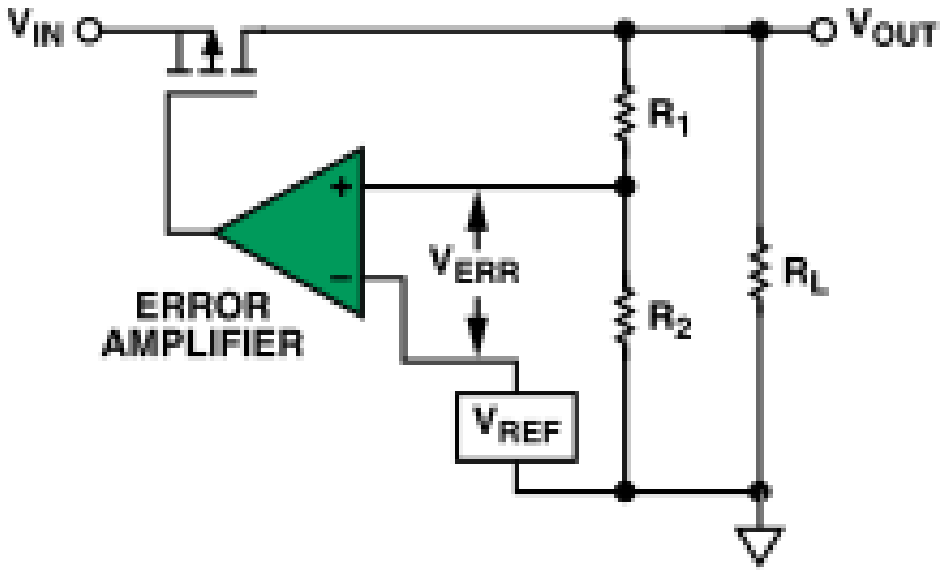
LDOs

[AD_vol41n2, TI_slyy151a, AD_57-3, AN-1120,TI_sbva026f,TI_slva068a]

LDO: introduction

- Standard regulators typically employ NPN pass transistors, usually drop out at about 1-2 V.
- LDO regulators normally use (normally P-channel) MOSFETs; dropout voltage is typically 100-200 mV.
- *Dropout voltage* refers to the minimum voltage differential that the input voltage V_{IN} must maintain above the desired output voltage $V_{OUT(nom)}$ for proper regulation.



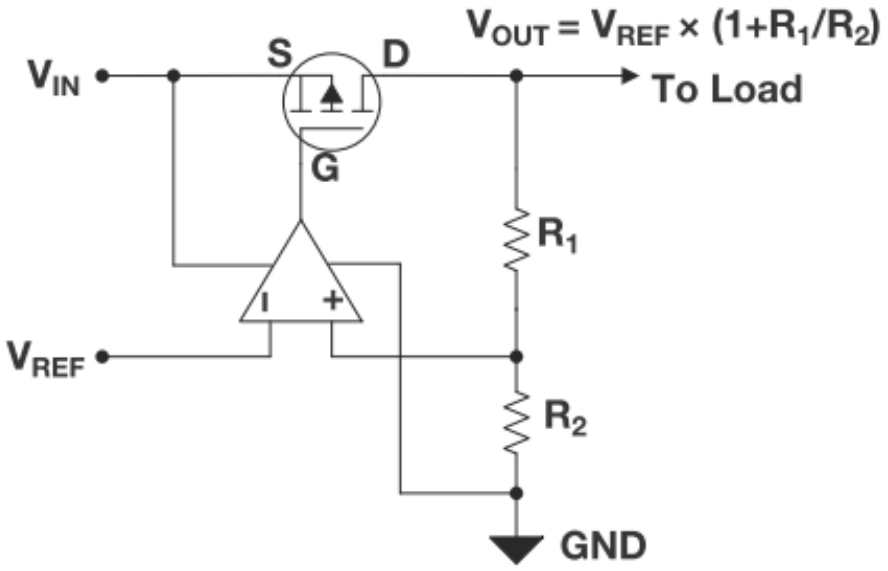


LDO: low-dropout voltage regulators

- The voltage reference is usually a band-gap type
- The error amplifier
  - takes a scaled-down version of the output

$$V_{OUT}\, R_2 / (R_1 + R_2),$$

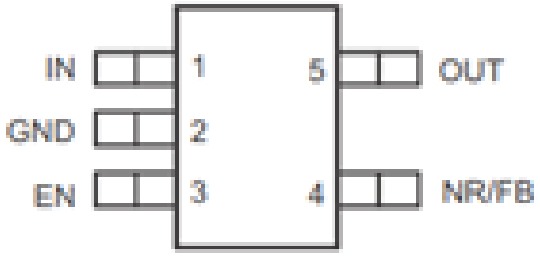
  - compares it against the reference voltage,
  - and adjusts V_{OUT} via the series-pass element (the MOSFET).



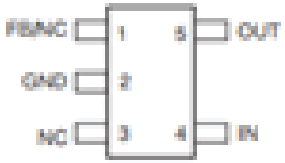
LDOs: power dissipation

- Heat sinks decrease $R_{\theta JA}$, but add size and cost to the system

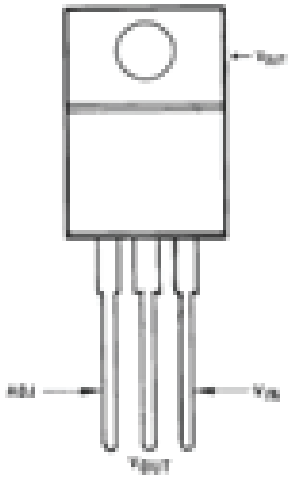
SOT-23



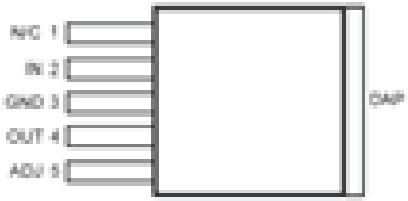
SC-70



TO-220



TO-263



LDOs: quiescent current

- *Quiescent current* is the current drawn by a system in standby mode with light or no load

$$P_D = (V_{IN} - V_{OUT}) \times I_{OUT} + (V_{IN} \times I_Q)$$

- Quiescent current is commonly confused with *shutdown current*, which is the current drawn when a device is turned off but the battery is still connected to the system
- Both specifications are important in any low battery-consumption design