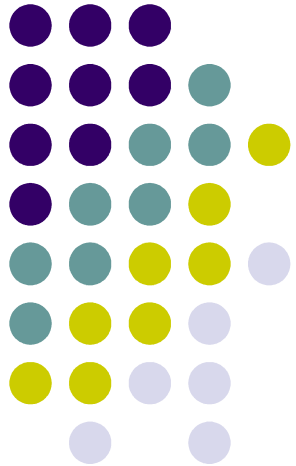
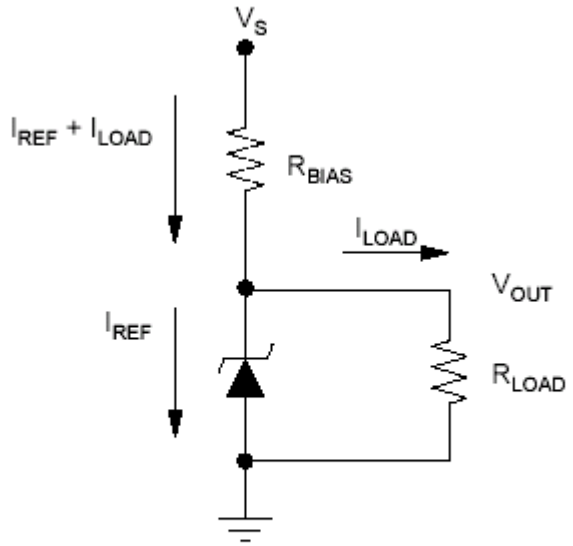
Voltage Reference Circuit

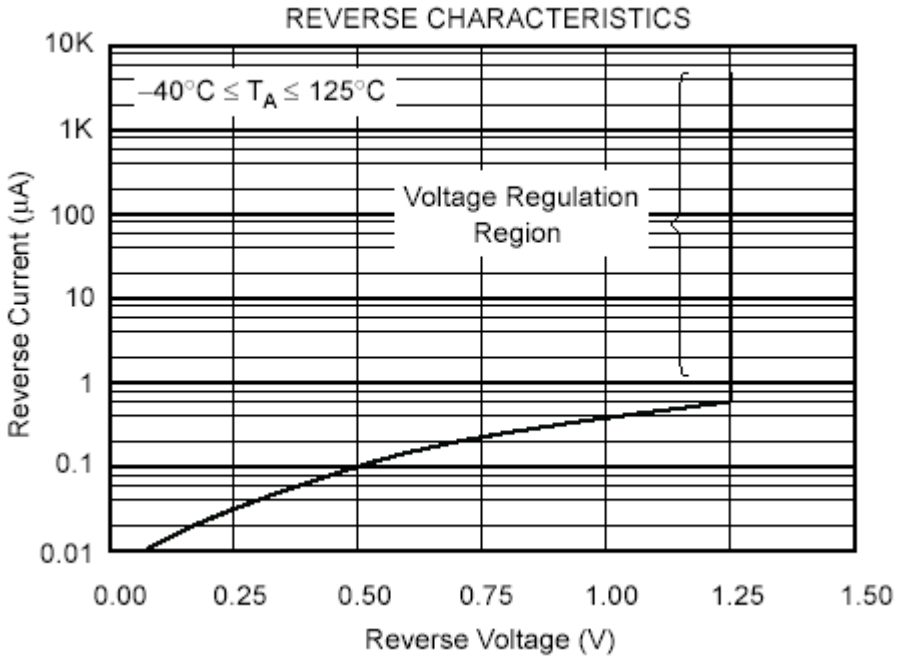
- ✓ Reference Circuit
- ✓ Regulator Circuit



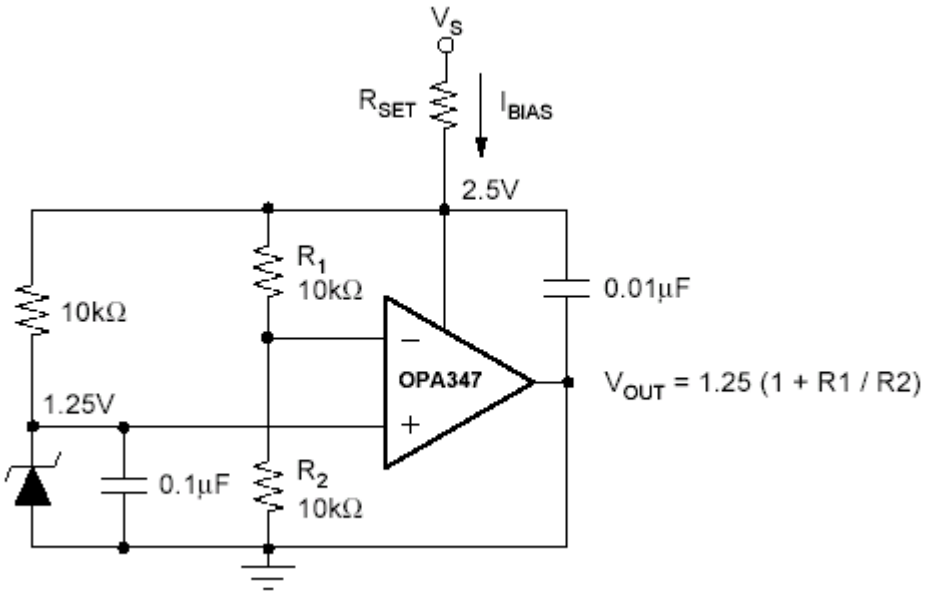
Shunt Voltage Reference



$$R_{BIAS} = \frac{V_S - V_D}{I_{LOAD} + I_{REF}}$$



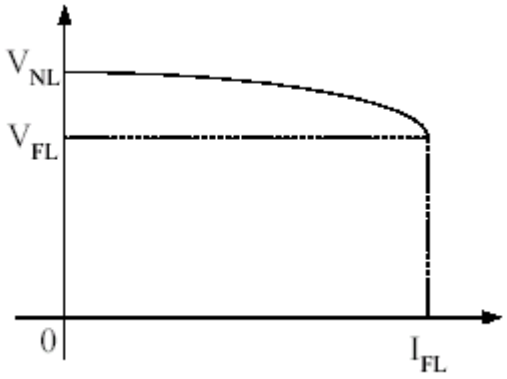
Adjustable


V_S
R_{SET}
I_{BIAS}
2.5V
R_1
10kΩ
10kΩ
0.01µF
OPA347
V_{OUT} = 1.25 (1 + R1 / R2)
1.25V
0.1µF
R_2
10kΩ

Regulator

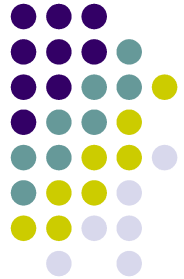
- maintain a constant voltage level.
- PERCENT OF REGULATION

$$(V_{reg}) = \frac{V_{NL} - V_{FL}}{V_{FL}} \times 100\%$$



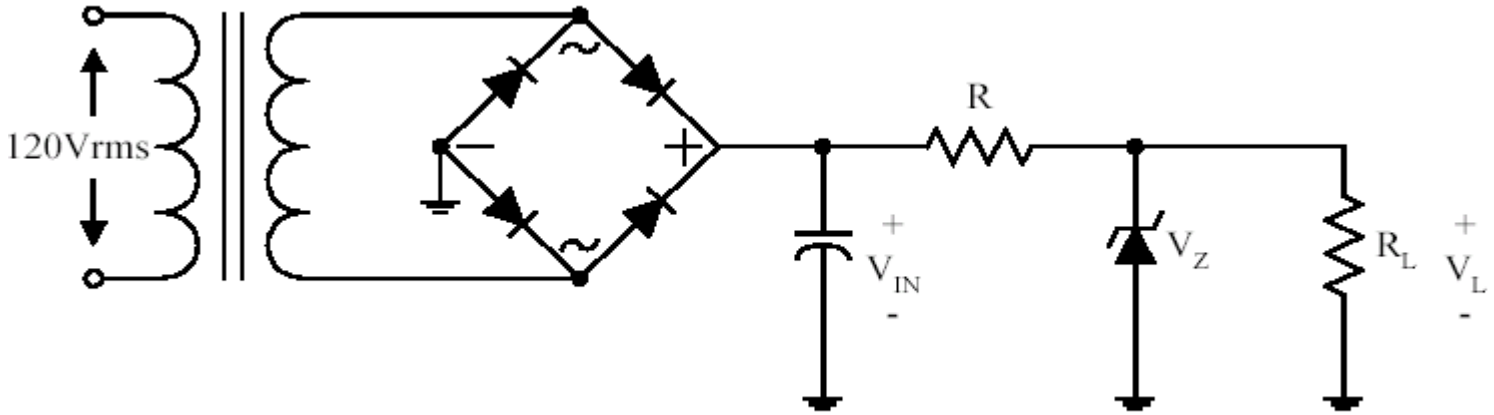
$$\%V_{reg} = \frac{\left(\frac{\Delta V_O}{V_O}\right)}{\Delta V_{in}} \times 100\%$$

Regulating Element



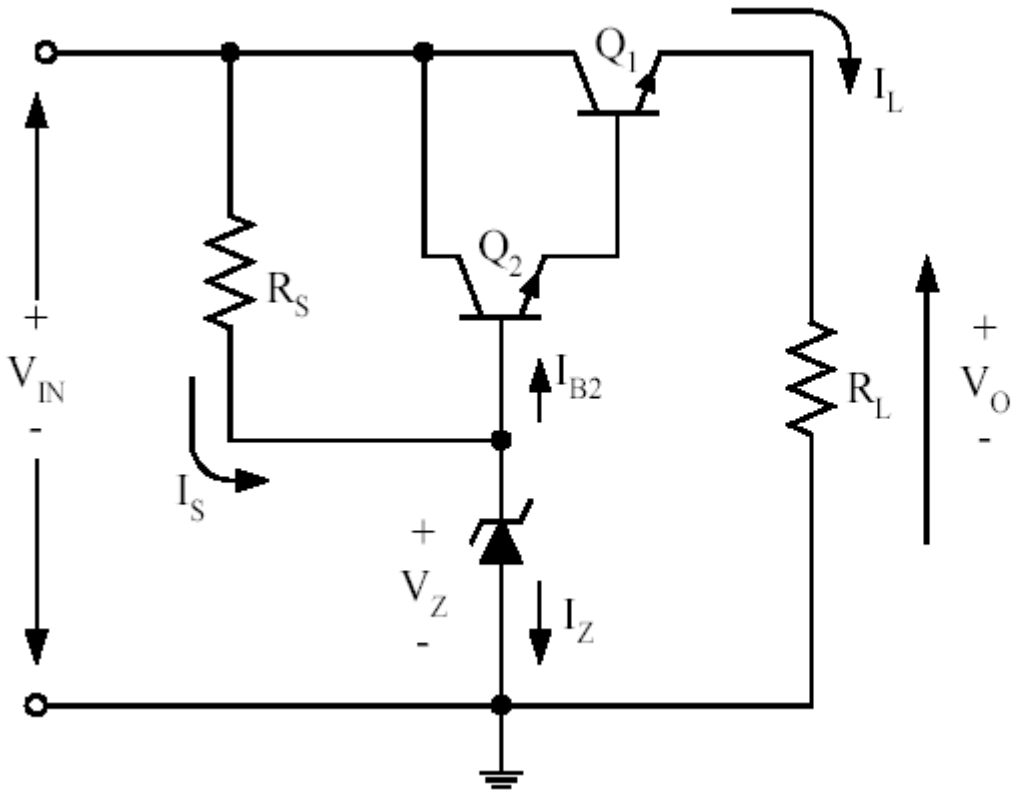
- Power Transistor
  - High Current
  - Low Rds

Power Supply



- Vin > Vz
- Load Current sensitive

Add Emitter Follower to reduce the sensitivity of load current



$$I_{B2} = \frac{I_{E1}}{\beta_{DP}} = \frac{I_L}{\beta_{DP}}$$

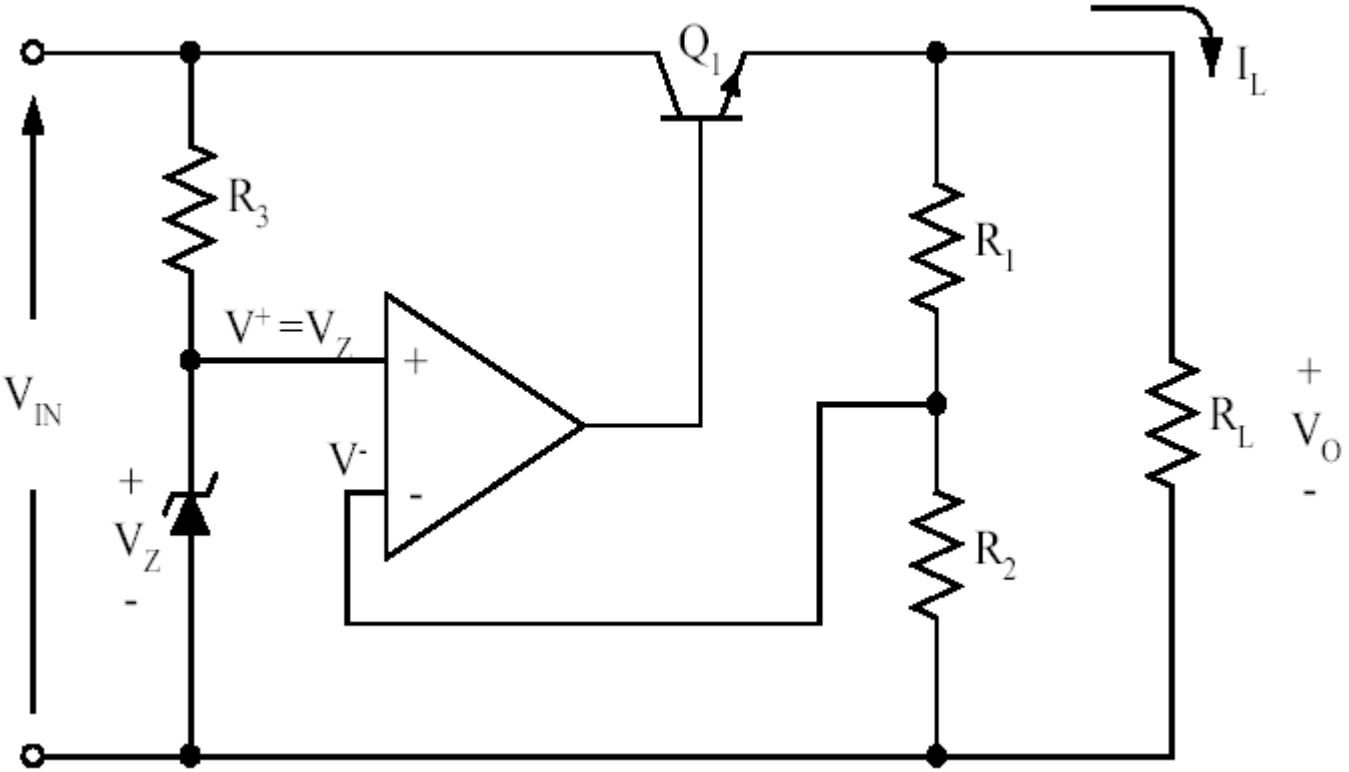
$$\beta_{DP} = \beta_1 + \beta_2 + \beta_1\beta_2$$

$$I_Z = I_S - I_{B2}$$

$$= I_S - \frac{I_L}{\beta_{DP}}$$

$$V_O = V_Z - 2V_{BE}$$

With Feedback



Shunt