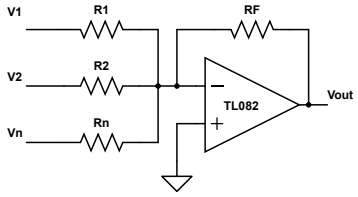
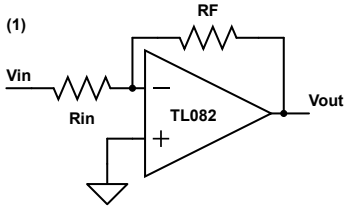
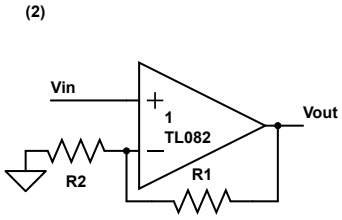
OP-AMPS

Virtual short: V+ = V-

There's a PDF in the comment, read it and grab the relevant parts.



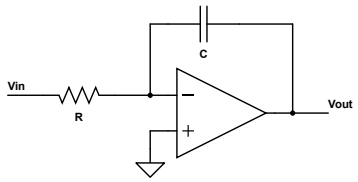


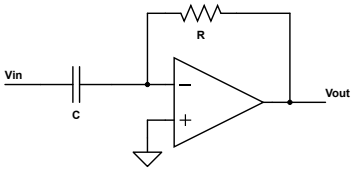


$$V_{out} = -\frac{R_F}{R_{in}} \cdot V_{in} \quad \text{(1) Inverting}$$

$$V_{out} = (1 + \frac{R_1}{R_2}) \cdot V_{in} \quad \text{(2) Non-inverting}$$

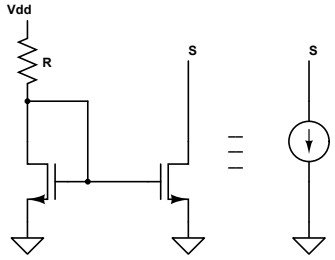
$$V_{out} = -(\frac{R_F}{R_1} \cdot V_1 + \frac{R_F}{R_2} \cdot V_2 \cdots + \frac{R_F}{R_n} \cdot V_n)$$





$$V_{out} = -\int_0^t \frac{V_{in}}{RC}\,dt + V_{initial} \quad \text{Integrator / Low-pass}$$

$$V_{out} = -RC\frac{dV_{in}}{dt} \quad \text{Differentiator / High-pass}$$



$$I_{current\ source} = \frac{W_2/L_2}{W_1/L_1} \cdot I_{REF}$$

MOSFET current mirror circuit

MOSFETs

$$g_m = \sqrt{2\mu_n \cdot C_{ox} \cdot I_d} = \sqrt{2I_D \cdot K} \quad (1)$$

(2)

High input impedance ($R \to \infty$)

BJTs

$$I_C = I_S \cdot e^{\frac{V_{BE}}{V_T}} \quad (3)$$

$$I_C = \beta \cdot I_B, I_C = \alpha I_E \quad (4)$$

$$g_m = \frac{I_c}{V_t} \quad (5)$$

$$I_E = I_C + I_B \quad (6)$$

$$r_\pi = \frac{V_T}{I}, r_0 = \frac{|V_A|}{I} \quad (7)$$

HSV, DJS, RDN