FORMULA SHEET

RLC

$$X_C = \frac{1}{2\pi fC}$$

$$X_L = 2\pi fL$$

$$f_r = \frac{1}{2\pi\sqrt{LC}}$$

Series

$$I_T = \frac{V_T}{Z}$$

$$V_L = I\,X_L$$

$$V_C = I\,X_C$$

$$V_T = I\,Z$$

$$Q = \frac{X_L}{Z} = \frac{X_C}{Z} = \frac{V_L}{V_S} = \frac{V_C}{V_S} = \frac{1}{R}\sqrt{\frac{L}{C}}$$

$$Z = \sqrt{R^2 + \left(X_L - X_C\right)^2}$$

$$V_T = \sqrt{V_R{}^2 + \left(V_L - V_C\right)^2}$$

$$Cos\theta = \frac{R}{Z}$$

$$Cos\theta = \frac{V_R}{V_T}$$

Parallel

$$Cos\theta = \frac{I_R}{I_T}$$

$$I_T = \sqrt{I_R{}^2 + \left(I_L - I_C\right)^2}$$

$$I_R = \frac{V_R}{R}$$

$$I_C = \frac{V_C}{X_C}$$

$$I_L = \frac{V_L}{X_L}$$

$$Q = \frac{X_L}{Z} = \frac{X_C}{Z} = \frac{I_L}{I_S} = \frac{I_C}{I_S} = \frac{1}{R}\sqrt{\frac{L}{C}}$$

$$BW = \frac{f_r}{Q}$$

SEMICONDUCTOR DEVICES

$$Gain\ A_V = \frac{V_{out}}{V_{in}} = -\left(\frac{Rf}{R_{in}}\right)$$

$$V_{out} = V_{in} \times \left(-\frac{R_F}{R\,in}\right)$$

$$V_{OUT} = V_{IN} \times \left(1 + \frac{R_F}{R_{in}}\right)$$

SWITCHING CIRCUITS

$$V_{out} = V_{in}1 \times \left(-\frac{R_F}{R1}\right) + V_{in}2 \times \left(-\frac{R_F}{R\,2}\right) + ...V_{in}N \times \left(-\frac{R_F}{RN}\right)$$

$$V_{out} = -\left(V_1 + V_2 + V_3 + ...V_N\right)$$

AMPLIFIERS

$$I_C = \frac{V_C}{R_C}$$

$$\boldsymbol{V_{CC} = V_{CE} + I_C R_C}$$

$$\boldsymbol{A = \beta_1 \times \beta_2}$$

$$\boldsymbol{A_i = 20log\frac{I_o}{I_i}}$$

$$\boldsymbol{A_V = 20log\frac{V_o}{V_i}}$$

$$P_O = I^2 \times Z_o$$

$$\boldsymbol{A_P = 10log\frac{P_o}{P_i}}$$

$$\boldsymbol{A_{V(dB)} = 20logA_V}$$

$$Gain\ A_V = \frac{V_{out}}{V_{in}} = -\left(\frac{RF}{R_{in}}\right)$$

$f_O = \dfrac{1}{2\pi\sqrt{L_T C}}$ Hartley oscillator

$f_O = \dfrac{1}{2\pi\sqrt{LC_T}}$ Colpitts oscillator

$f_O = \dfrac{1}{2\pi\sqrt{6RC}}$ RC phase-shift oscillator