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Amplifier Functions and Network Formulas

Calculators! Examples! Conversions!

List of 15 Amplifier Functions and Network Formulas

Amplifier Functions and Network

Miller's Theorem

1) Change in Drain Current

Open Calculator

fx $$i_d = -\frac{V_a}{Z_2}$$

ex $$-15.727273\text{mA} = -\frac{17.3\text{V}}{1.1\text{k}\Omega}$$

2) Current at Primary Node of Amplifier

Open Calculator

fx $$i_1 = \frac{V_a}{Z_1}$$

ex $$173\text{mA} = \frac{17.3\text{V}}{0.1\text{k}\Omega}$$

3) Miller Capacitance

Open Calculator

fx $$C_m = C_{gd} \cdot \left(1 + \frac{1}{g_m \cdot R_L}\right)$$

ex $$2.7024\mu F = 2.7\mu F \cdot \left(1 + \frac{1}{0.25S \cdot 4.5k\Omega}\right)$$

4) Primary Impedance in Miller Capacitance

Open Calculator

fx $$Z_1 = \frac{Z_t}{1 - (A_v)}$$

ex $$0.109333k\Omega = \frac{1.23k\Omega}{1 - (-10.25)}$$

5) Secondary Impedance in Miller Capacitance

Open Calculator

fx $$Z_2 = \frac{Z_t}{1 - \left(\frac{1}{A_v}\right)}$$

ex $$1.120667k\Omega = \frac{1.23k\Omega}{1 - \left(\frac{1}{-10.25}\right)}$$

6) Total Current in Miller Capacitance

Open Calculator

$$i_t = V_p \cdot \frac{1 - (A_v)}{Z_t}$$

$$215.8537\text{mA} = 23.6\text{V} \cdot \frac{1 - (-10.25)}{1.23\text{k}\Omega}$$

STC Filter

7) Magnitude Response of STC Network for High-Pass Filter

Open Calculator

$$M_{hp} = \frac{\text{modulus}(K)}{\sqrt{1 - \left(\frac{f_{hp}}{f_t}\right)^2}}$$

$$0.490334 = \frac{\text{modulus}(0.49)}{\sqrt{1 - \left(\frac{3.32\text{Hz}}{90\text{Hz}}\right)^2}}$$

8) Magnitude Response of STC Network for Low-Pass Filter

Open Calculator

$$M_{Lp} = \frac{\text{modulus}(K)}{\sqrt{1 + \left(\frac{f_t}{f_{hp}}\right)^2}}$$

$$0.018063 = \frac{\text{modulus}(0.49)}{\sqrt{1 + \left(\frac{90\text{Hz}}{3.32\text{Hz}}\right)^2}}$$

9) Phase Response Angle of STC Network for High-Pass Filter

Open Calculator

fx $$\angle T_{j\omega} = \arctan\left(\frac{f_{hp}}{f_t}\right)$$

ex $$2.11262° = \arctan\left(\frac{3.32\text{Hz}}{90\text{Hz}}\right)$$

10) Time Constant of STC Network

Open Calculator

fx $$\tau = \frac{L_H}{R_L}$$

ex $$2.055556\text{ms} = \frac{9.25\text{H}}{4.5\text{k}\Omega}$$

STC Network

11) Input Capacitance of STC Circuit

Open Calculator

fx $$C_{stc} = C_t + C_{gs}$$

ex $$5.7\mu\text{F} = 4\mu\text{F} + 1.70\mu\text{F}$$

12) Input Capacitance with reference to Corner Frequency

Open Calculator

fx $$C_{in} = \frac{1}{f_{stc} \cdot R_{sig}}$$

ex $$200.3205\mu\text{F} = \frac{1}{4.16\text{Hz} \cdot 1.2\text{k}\Omega}$$

13) Pole Frequency of STC Circuit

Open Calculator

fx $$f_{stc} = \frac{1}{C_{in} \cdot R_{sig}}$$

ex $$4.166667\text{Hz} = \frac{1}{200\mu\text{F} \cdot 1.2\text{k}\Omega}$$

14) Pole Frequency of STC Circuit for High-Pass

Open Calculator

fx $$f_{hp} = \frac{1}{(C_{be} + C_{bj}) \cdot R_{in}}$$

ex $$3.292615\text{Hz} = \frac{1}{(100.75\mu\text{F} + 150.25\mu\text{F}) \cdot 1.21\text{k}\Omega}$$

15) Pole Frequency of STC Networks for Low-Pass

Open Calculator

fx $$f_{Lp} = \frac{1}{\tau}$$

ex $$487.8049\text{Hz} = \frac{1}{2.05\text{ms}}$$

Variables Used

- $\angle T_{j\omega}$ Phase Angle of STC *(Degree)*
- A_v Voltage Gain
- C_{be} Emitter-Base Capacitance *(Microfarad)*
- C_{bj} Collector-Base Junction Capacitance *(Microfarad)*
- C_{gd} Gate to Drain Capacitance *(Microfarad)*
- C_{gs} Gate to Source Capacitance *(Microfarad)*
- C_{in} Input Capacitance *(Microfarad)*
- C_m Miller Capacitance *(Microfarad)*
- C_{stc} Input Capacitance of STC *(Microfarad)*
- C_t Total Capacitance *(Microfarad)*
- f_{hp} Pole Frequency High Pass *(Hertz)*
- f_{Lp} Pole Frequency Low Pass *(Hertz)*
- f_{stc} Pole Frequency of STC Filter *(Hertz)*
- f_t Total Pole Frequency *(Hertz)*
- g_m Transconductance *(Siemens)*
- i_1 Current in Primary Conductor *(Milliampere)*
- i_d Change in Drain Current *(Milliampere)*
- i_t Total Current *(Milliampere)*
- K DC Gain
- L_H Load Inductance *(Henry)*

- **M_{hp}** Magnitude Response of High Pass Filter
- **M_{Lp}** Magnitude Response of Low-Pass Filter
- **R_{in}** Finite Input Resistance *(Kilohm)*
- **R_L** Load Resistance *(Kilohm)*
- **R_{sig}** Signal Resistance *(Kilohm)*
- **V_a** A-Phase Voltage *(Volt)*
- **V_p** Primary Voltage *(Volt)*
- **Z_1** Impedance of Primary Winding *(Kilohm)*
- **Z_2** Impedance of Secondary Winding *(Kilohm)*
- **Z_t** Total Impedance *(Kilohm)*
- **τ** Time Constant *(Millisecond)*

Constants, Functions, Measurements used

- Function: **arctan**, arctan(Number)
  Inverse trigonometric tangent function
- Function: **ctan**, ctan(Angle)
  Trigonometric cotangent function
- Function: **modulus**, modulus
  Modulus of number
- Function: **sqrt**, sqrt(Number)
  Square root function
- Function: **tan**, tan(Angle)
  Trigonometric tangent function
- Measurement: **Time** in Millisecond (ms)
  Time Unit Conversion
- Measurement: **Electric Current** in Milliampere (mA)
  Electric Current Unit Conversion
- Measurement: **Angle** in Degree (°)
  Angle Unit Conversion
- Measurement: **Frequency** in Hertz (Hz)
  Frequency Unit Conversion
- Measurement: **Capacitance** in Microfarad (μF)
  Capacitance Unit Conversion
- Measurement: **Electric Resistance** in Kilohm (kΩ)
  Electric Resistance Unit Conversion
- Measurement: **Electric Conductance** in Siemens (S)
  Electric Conductance Unit Conversion
- Measurement: **Inductance** in Henry (H)
  Inductance Unit Conversion

- Measurement: **Electric Potential** in Volt (V)
  Electric Potential Unit Conversion

Check other formula lists

- **Amplifier Characteristics Formulas**
- **Amplifier Functions and Network Formulas**
- **BJT Differential Amplifiers Formulas**
- **Feedback Amplifiers Formulas**
- **Low Frequency Response Amplifiers Formulas**
- **MOSFET Amplifiers Formulas**
- **Operational Amplifiers Formulas**
- **Output Stages and Power Amplifiers Formulas**
- **Signal and IC Amplifiers Formulas**

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