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# Common Stage Amplifiers Gain Formulas

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## List of 13 Common Stage Amplifiers Gain Formulas

### Common Stage Amplifiers Gain

#### 1) Common Base Current Gain

$$\text{fx } \alpha = \left( A_v \cdot \frac{R_e}{R_c} \right)$$

[Open Calculator !\[\]\(a870788d6ed9b8fd294b7654a8c8526b\_img.jpg\)](#)

$$\text{ex } 0.279277 = \left( 4.21 \cdot \frac{0.067\text{k}\Omega}{1.01\text{k}\Omega} \right)$$

#### 2) Current Gain of Controlled Source Transistor

$$\text{fx } A_i = \frac{1}{1 + \frac{1}{g_{mp} \cdot R_{dg}}}$$

[Open Calculator !\[\]\(c50c8b7b2cc2cf9ff925edec0ee94c0d\_img.jpg\)](#)

$$\text{ex } 0.82593 = \frac{1}{1 + \frac{1}{19.77\text{mS} \cdot 0.24\text{k}\Omega}}$$

#### 3) Emitter Voltage with respect to Voltage Gain

$$\text{fx } V_e = \frac{V_c}{A_v}$$

[Open Calculator !\[\]\(f60b7a900783ac3fd531bfd9c111be6d\_img.jpg\)](#)

$$\text{ex } 24.56532\text{V} = \frac{103.42\text{V}}{4.21}$$

#### 4) Negative Voltage Gain from Base to Collector

$$\text{fx } A_{vn} = -\alpha \cdot \left( \frac{R_c}{R_e} \right)$$

[Open Calculator !\[\]\(83bbbd261710c59db0214aa27b2edc0d\_img.jpg\)](#)

$$\text{ex } -4.070149 = -0.27 \cdot \left( \frac{1.01\text{k}\Omega}{0.067\text{k}\Omega} \right)$$




5) Open-Circuit Voltage Gain of CS Amplifier 

$$\text{fx } A_{oc} = \frac{R_{out}}{R_{out} + \frac{1}{g_{mp}}}$$

Open Calculator 


$$\text{ex } 0.873729 = \frac{0.35k\Omega}{0.35k\Omega + \frac{1}{19.77mS}}$$

6) Overall Feedback Voltage Gain of Common-Collector Amplifier 

$$\text{fx } G_v = \frac{(\beta + 1) \cdot R_L}{(\beta + 1) \cdot R_L + (\beta + 1) \cdot R_e + R_{sig}}$$

Open Calculator 


$$\text{ex } 0.868668 = \frac{(12 + 1) \cdot 1.013k\Omega}{(12 + 1) \cdot 1.013k\Omega + (12 + 1) \cdot 0.067k\Omega + 1.12k\Omega}$$

7) Overall Feedback Voltage Gain of Common-Emitter Amplifier 

$$\text{fx } G_{fv} = -\alpha \cdot \frac{R_c}{R_e} \cdot \left( \frac{R_{in}}{R_{in} + R_{sig}} \right)$$

Open Calculator 

$$\text{ex } -0.86215 = -0.27 \cdot \frac{1.01k\Omega}{0.067k\Omega} \cdot \left( \frac{0.301k\Omega}{0.301k\Omega + 1.12k\Omega} \right)$$

8) Overall Feedback Voltage Gain of Common-Source Amplifier 

$$\text{fx } G_{fv} = -g_{mp} \cdot \left( \frac{R_{in}}{R_{in} + R_{sig}} \right) \cdot \left( \frac{1}{R_d} + \frac{1}{R_L} + \frac{1}{R_{out}} \right)^{-1}$$

Open Calculator 

$$\text{ex } -0.632389 = -19.77mS \cdot \left( \frac{0.301k\Omega}{0.301k\Omega + 1.12k\Omega} \right) \cdot \left( \frac{1}{0.36k\Omega} + \frac{1}{1.013k\Omega} + \frac{1}{0.35k\Omega} \right)^{-1}$$




9) Overall Voltage Gain of Common-Emitter Amplifier 

$$\text{fx } G_{fv} = -g_{mp} \cdot \left( \frac{R_{in}}{R_{in} + R_{sig}} \right) \cdot \left( \frac{1}{R_c} + \frac{1}{R_L} + \frac{1}{R_{out}} \right)^{-1}$$

Open Calculator 

ex

$$-0.866235 = -19.77\text{mS} \cdot \left( \frac{0.301\text{k}\Omega}{0.301\text{k}\Omega + 1.12\text{k}\Omega} \right) \cdot \left( \frac{1}{1.01\text{k}\Omega} + \frac{1}{1.013\text{k}\Omega} + \frac{1}{0.35\text{k}\Omega} \right)^{-1}$$

10) Overall Voltage Gain of Source Follower 

$$\text{fx } G_v = \frac{R_L}{R_L + \frac{1}{g_{mp}}}$$

Open Calculator 

ex

$$0.952442 = \frac{1.013\text{k}\Omega}{1.013\text{k}\Omega + \frac{1}{19.77\text{mS}}}$$


11) Total Current Gain with respect to Voltage Gain 

$$\text{fx } \alpha = \frac{G_v}{\frac{R_c}{R_e} \cdot \left( \frac{R_{in}}{R_{in} + R_{sig}} \right)}$$

Open Calculator 

ex

$$0.269327 = \frac{0.86}{\frac{1.01\text{k}\Omega}{0.067\text{k}\Omega} \cdot \left( \frac{0.301\text{k}\Omega}{0.301\text{k}\Omega + 1.12\text{k}\Omega} \right)}$$

12) Total Voltage Gain of CS Amplifier 

$$\text{fx } A_v = \frac{V_L}{V_{in}}$$

Open Calculator 

ex

$$4.208 = \frac{10.52\text{V}}{2.5\text{V}}$$



13) Voltage Gain of Common-Base Amplifier [Open Calculator](#) 

$$\text{fx } A_v = \frac{V_c}{V_e}$$

$$\text{ex } 4.210912 = \frac{103.42\text{V}}{24.56\text{V}}$$






## Variables Used

- $A_i$  Current Gain
- $A_{oc}$  Open Circuit Voltage Gain
- $A_v$  Voltage Gain
- $A_{vN}$  Negative Voltage Gain
- $G_{fv}$  Feedback Voltage Gain
- $g_{mp}$  MOSFET Primary Transconductance (*Millisiemens*)
- $G_v$  Overall Voltage Gain
- $R_c$  Collector Resistance (*Kilohm*)
- $R_d$  Drain Resistance (*Kilohm*)
- $R_{dg}$  Resistance between Drain and Ground (*Kilohm*)
- $R_e$  Emitter Resistance (*Kilohm*)
- $R_{in}$  Input Resistance (*Kilohm*)
- $R_L$  Load Resistance (*Kilohm*)
- $R_{out}$  Finite Output Resistance (*Kilohm*)
- $R_{sig}$  Signal Resistance (*Kilohm*)
- $V_c$  Collector Voltage (*Volt*)
- $V_e$  Emitter Voltage (*Volt*)
- $V_{in}$  Input Voltage (*Volt*)
- $V_L$  Load Voltage (*Volt*)
- $\alpha$  Common Base Current Gain
- $\beta$  Collector Base Current Gain



## Constants, Functions, Measurements used

- **Measurement: Electric Resistance** in Kiloohm ( $k\Omega$ )  
*Electric Resistance Unit Conversion* 
- **Measurement: Electric Potential** in Volt (V)  
*Electric Potential Unit Conversion* 
- **Measurement: Transconductance** in Millisiemens (mS)  
*Transconductance Unit Conversion* 



## Check other formula lists

- [Common Stage Amplifiers Gain Formulas](#) 
- [CV Actions of Common Stage Amplifiers Formulas](#) 
- [Multi Stage Transistor Amplifiers Formulas](#) 
- [Transistor Amplifier Characteristics Formulas](#) 

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