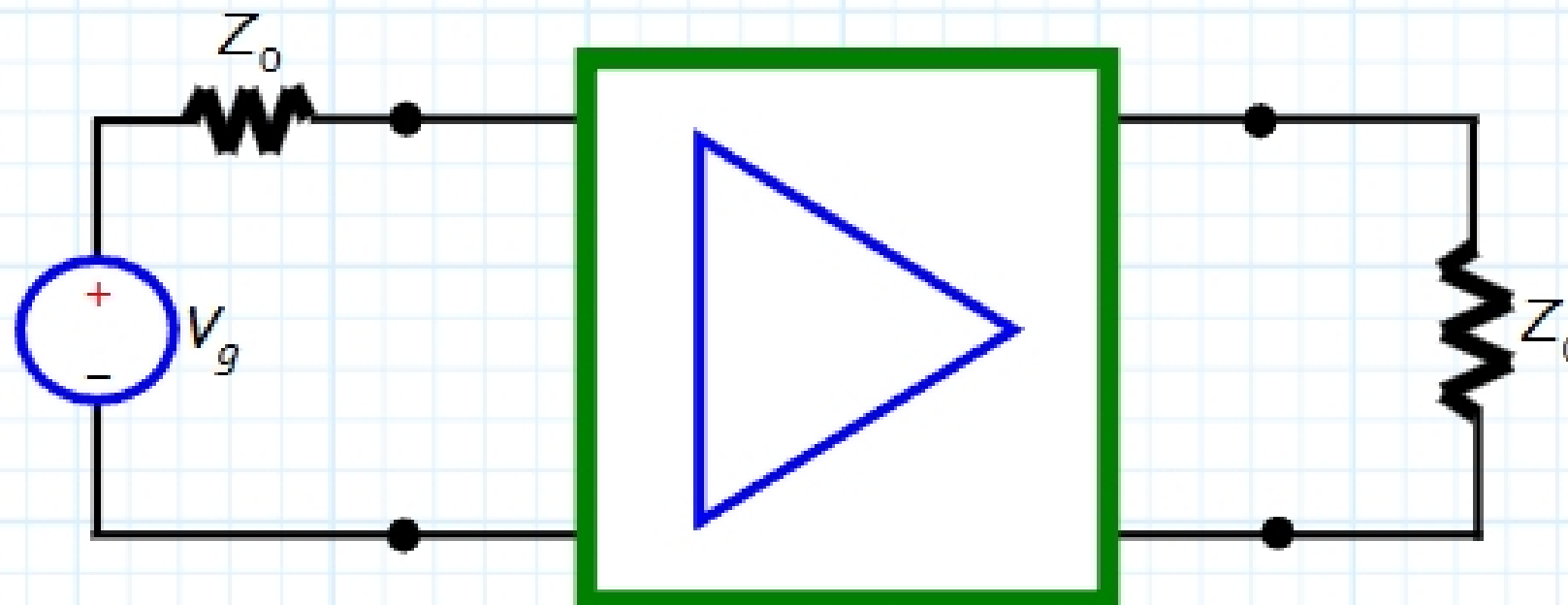


Amplifier Gain

Q: *So how do we specify gain in microwave amplifiers?*

A: **First**, for a given microwave amplifier, we connect a **matched source** (e.g., $Z_g = Z_0$) to a **matched load** (e.g., $Z_L = Z_0$).



Gain is a ratio of power—a real value!

We then determine/measure the available power of the source:

$$P_{avl} = \frac{|V_g|^2}{8Z_0}$$

And also, the power delivered the load:

$$P_{abs} = \frac{|V_L|^2}{2Z_0}$$

The gain G of a microwave amplifier is typically defined as the ratio of these two real values:

$$G = \frac{P_{abs}}{P_{avl}}$$

Gain is frequency dependent

More specifically, the gain of a microwave receiver is **dependent on frequency**:

$$G(\omega) = \frac{P_{abs}(\omega)}{P_{avl}(\omega)}$$

Generally speaking, there will be a **range** of frequencies ω between ω_L and ω_H where the gain $G(\omega)$ will be (approximately) be equal to a **constant** G_{mid} (i.e., the mid-band gain).

For frequencies outside this range, the gain will typically be small (i.e. $G(\omega) \ll G_{mid}$):

$$G(\omega) = \begin{cases} G_{mid} & \text{for } \omega_L < \omega < \omega_H \\ \ll G_{mid} & \text{for } \omega < \omega_L \text{ or } \omega > \omega_H \end{cases}$$