**Output Stages**

- The goal of an output stage (for voltage output) for an amplifier is to achieve

Why?

- High efficiency is also needed so that lots of power can be transferred to the load without using too much power in the amp

Why is power-conversion efficiency so important?

Typically, output amps/power amps have a gain of ________________

Simplest output stage: ___________________________

(In power amp lingo, this is called a “Class A” amp or “Class A” output stage)
Note: These amplifiers will have a large signal swing on the output stage and so small-signal models will not be valid.
OUTPUT STAGES

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Instantaneous power dissipation

Power dissipation in Q1 is maximum when V0 = 0! Not good.
Efficiency for a Class A output stage?

- In practice, we make $V_o < V_{cc}$ to prevent nonlinear distortion near transistor saturation, so typical efficiency is 10-20%.
- Class A is rarely used in high-power (>1W) applications.
**Output Stages**

Class B output stage:

![Class B output stage diagram](image)

**Push-pull operation:**

![Push-pull operation diagram](image)