

Lecture 3: Op Amp Basics

0. Quiz

1. Review

2. Op Amp Intro

3. Some useful op amp circuits

- Quiz next Tue (sep 24)

- PreLab 2 ← due at lab session

- Lab 1 report

↑ see course website for template

- HW2 due next Fri (sep 27)

Textbook reading: 16-1 Intro to Op Amps

16-4 Non-inverting amplifier

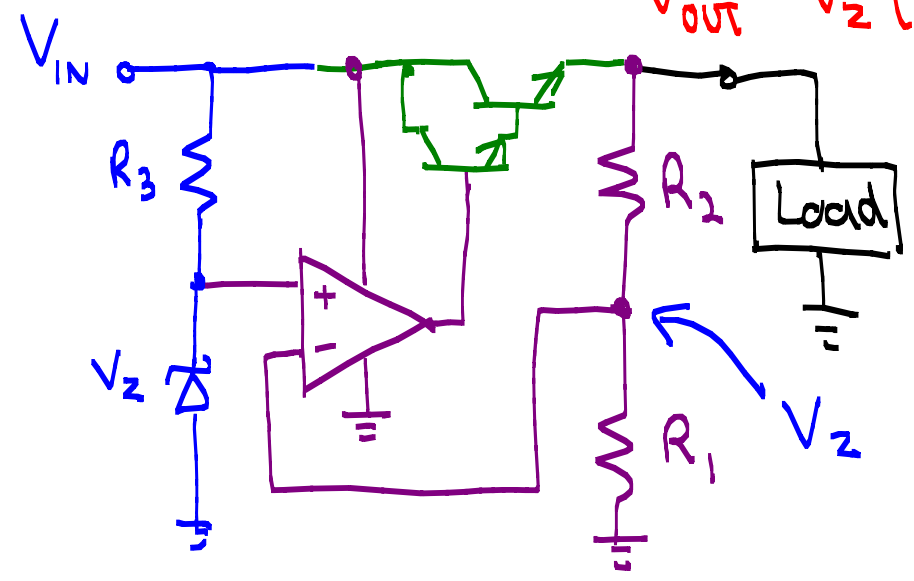
0. Review

- Zener follower + neg feedback

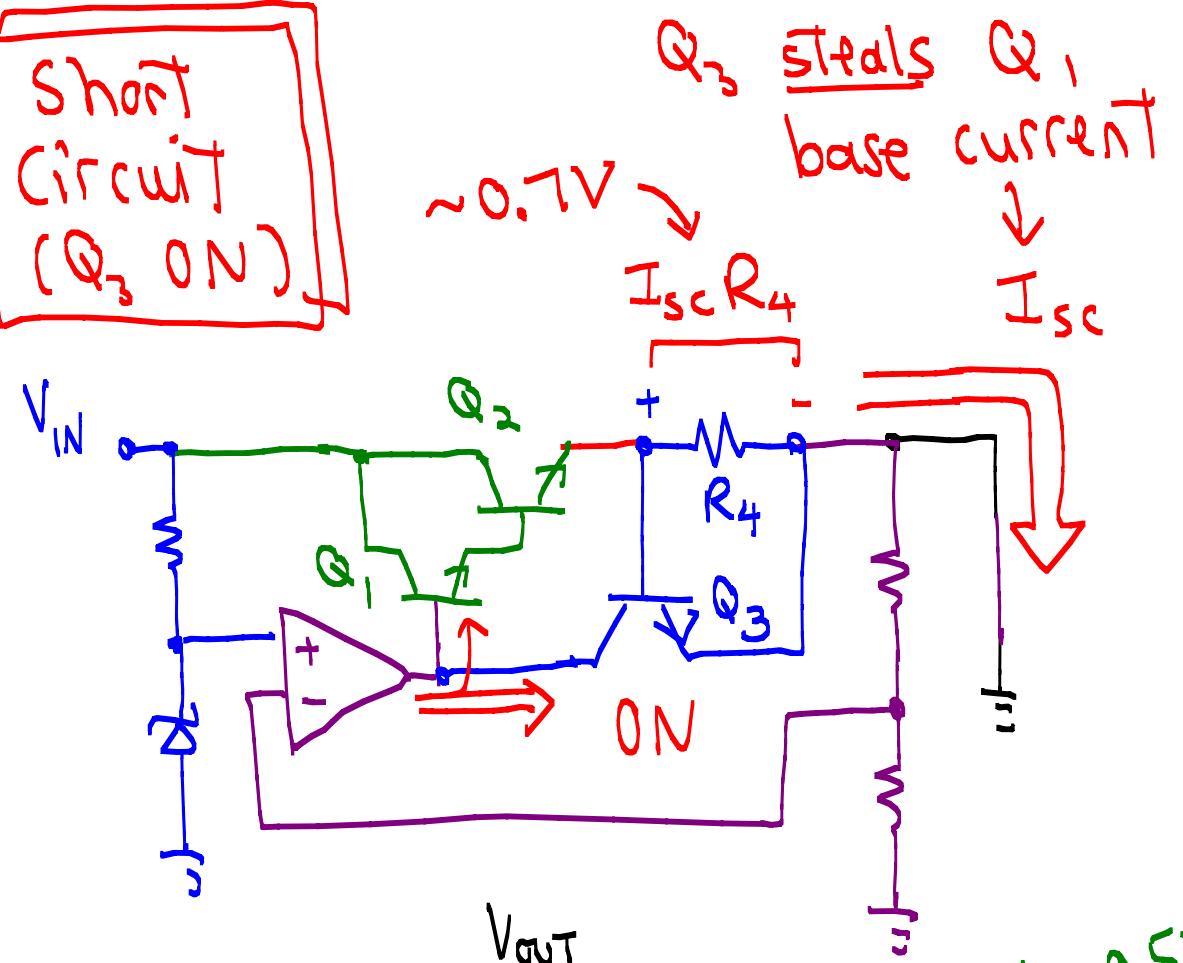
→ V_{out} no longer depends on V_{BE} !

→ Use Darlington for larger I_{out}

$$V_{out} = V_z \left(1 + \frac{R_2}{R_1} \right)$$

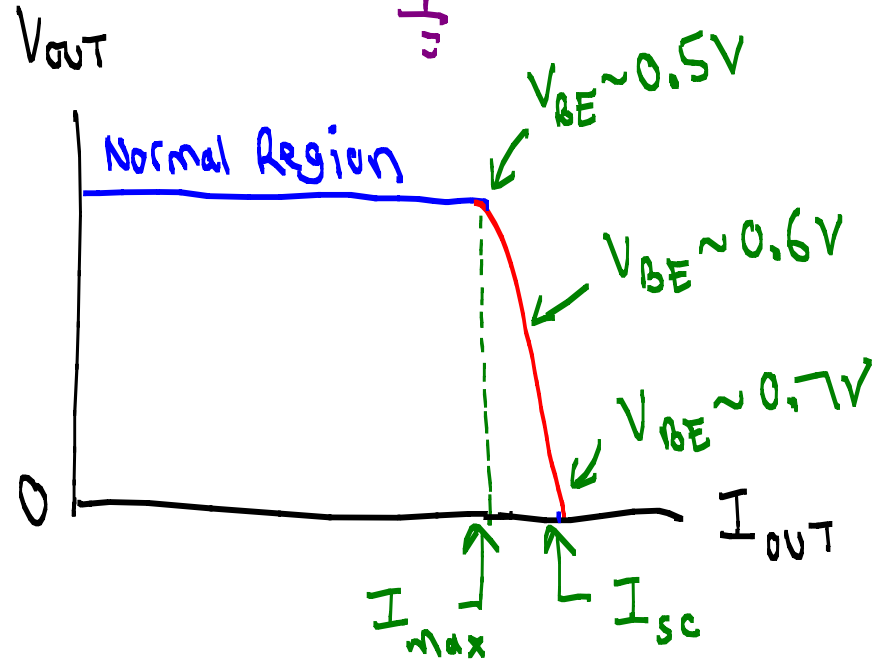


Short Circuit (Q_3 ON)



NOTE:

- ① Q_3 does not abruptly turn ON
- ② Q_3 can dissipate lots of power!

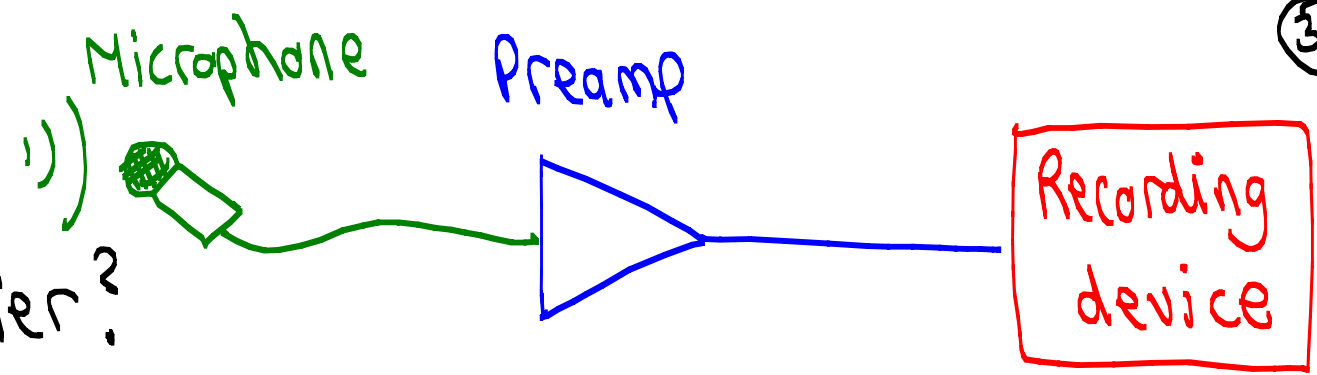


1. Op Amp Intro

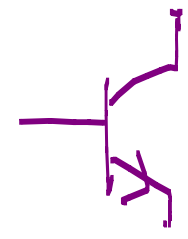
• Consider the following application ...

Q: How to make an audio preamplifier?

• How about a common emitter amplifier?



EX:

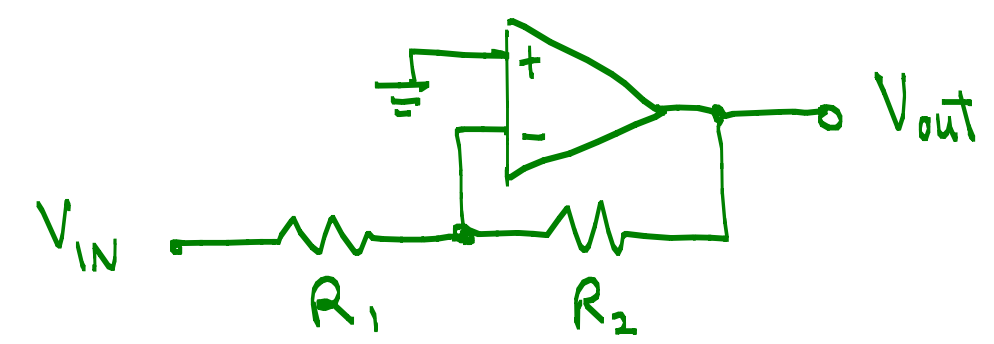


• Most op amp circuits can be understood by using two

Ex: Inverting Amplifier

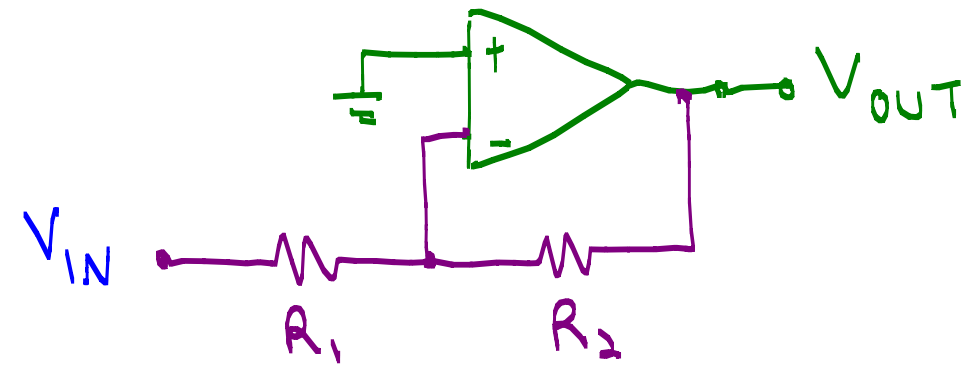
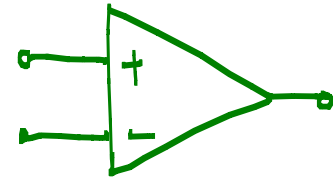
① The two input terminals

② the two input terminals .



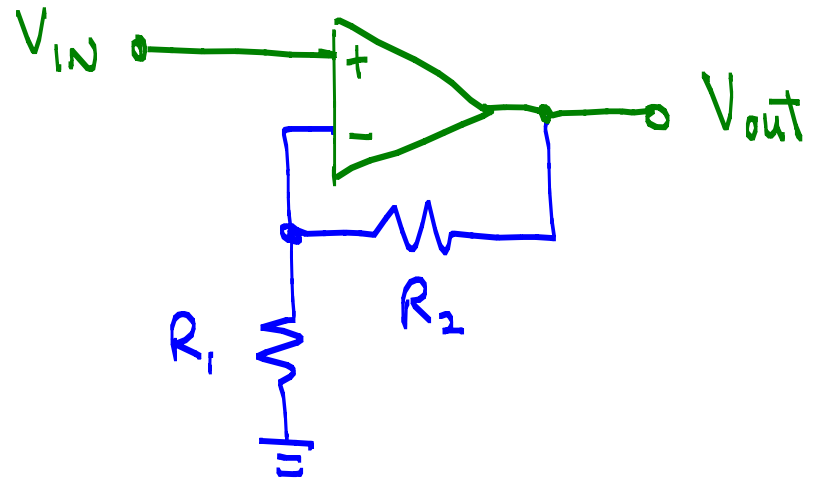
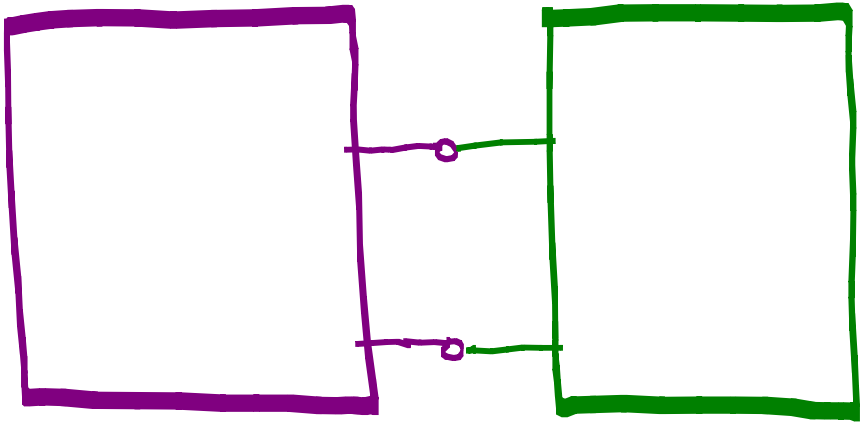
NOTE :

An op amp is really a differential amplifier

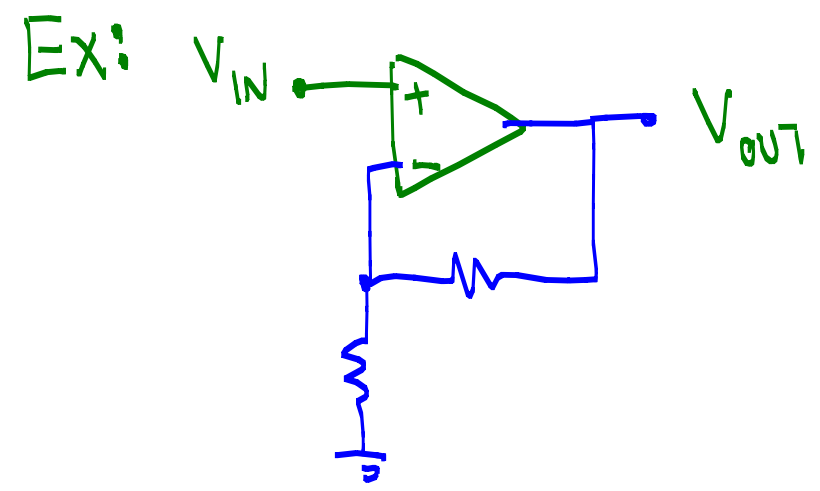


2. Some useful op amp circuits

- Non-inverting amplifier



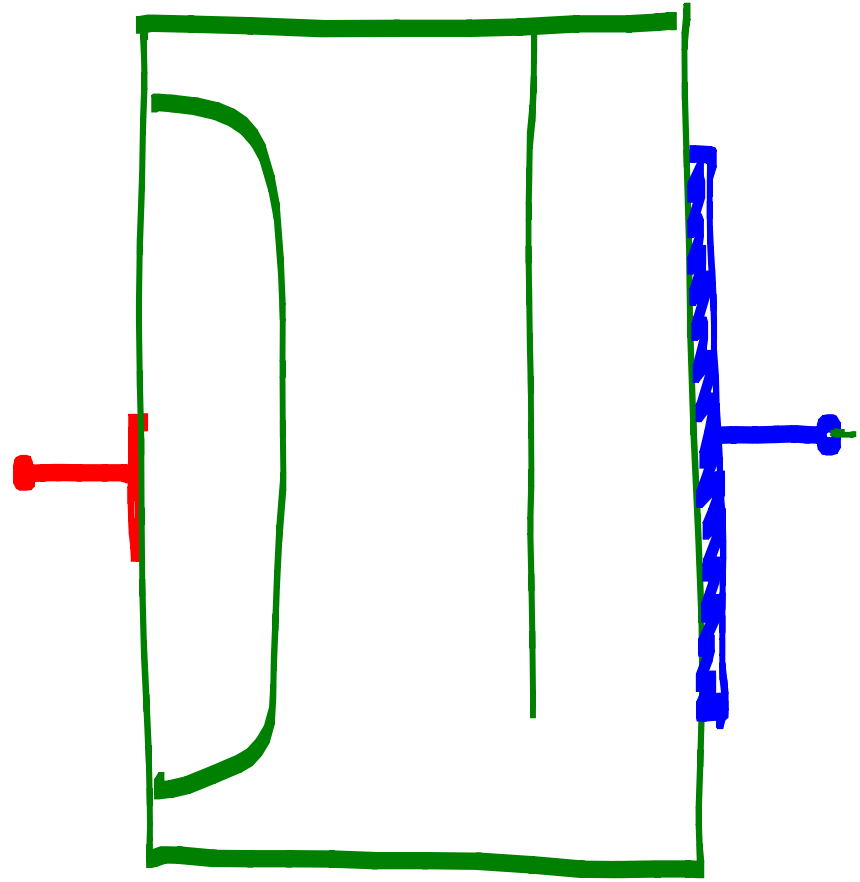
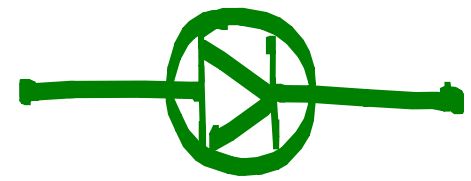
NOTE:



• Photodetector Amplifier

Many photodetectors produce a _____ output. Why?

- ① Light
- ② Internal field
- ③ output



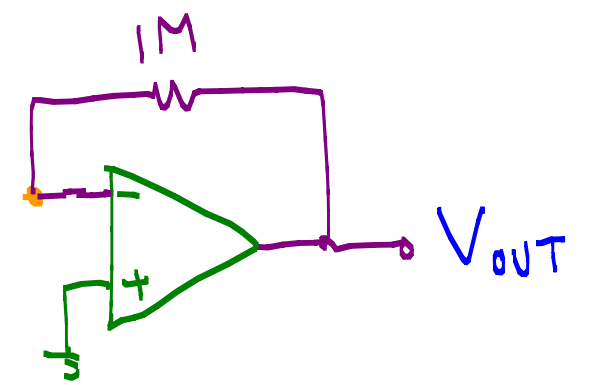
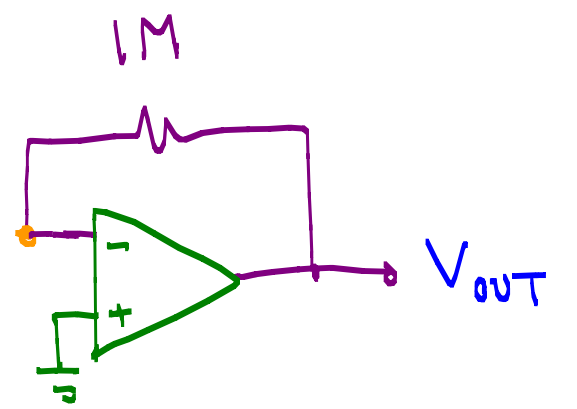
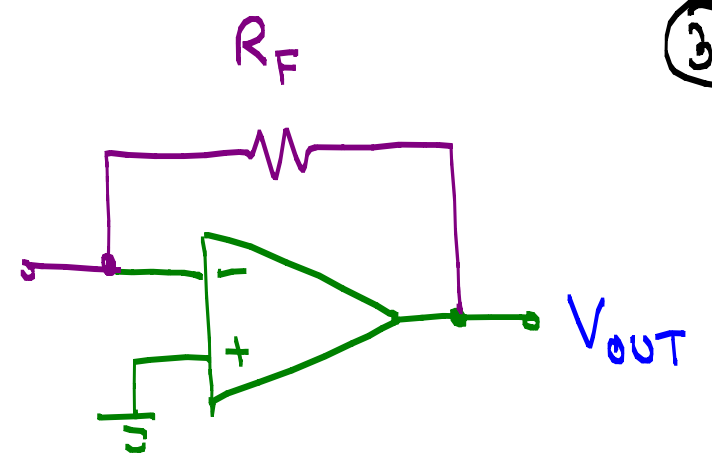
• Transimpedance Amplifier ← Also called "current-to-voltage converter"

KCL at node v_- :

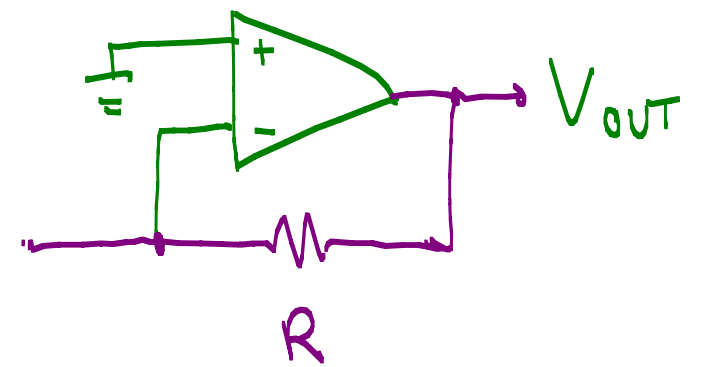
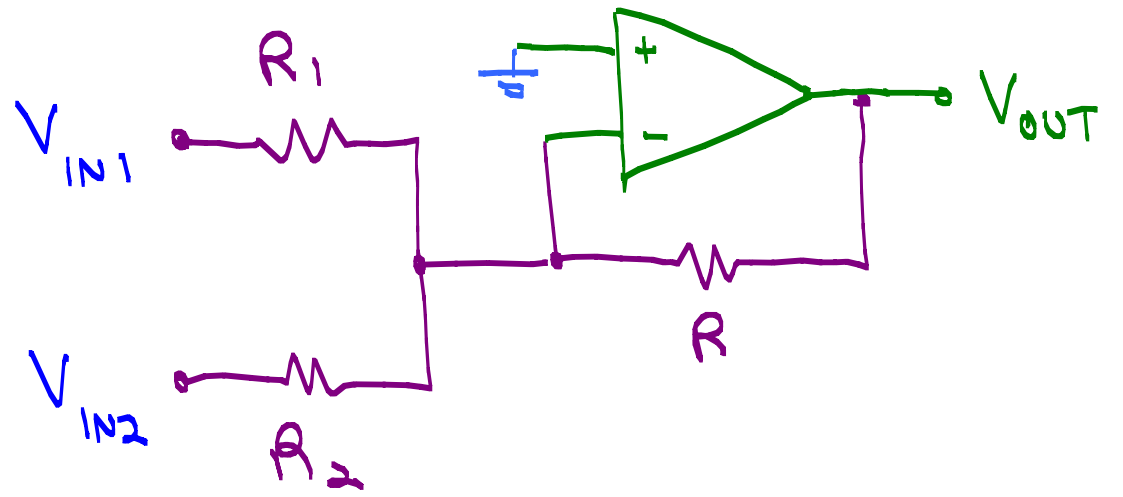
$$I_{IN} =$$

★ Very useful for photodetectors!

I_{IN}



- Summing amplifier ←
e.g. audio mixer



• For other useful circuits, consult

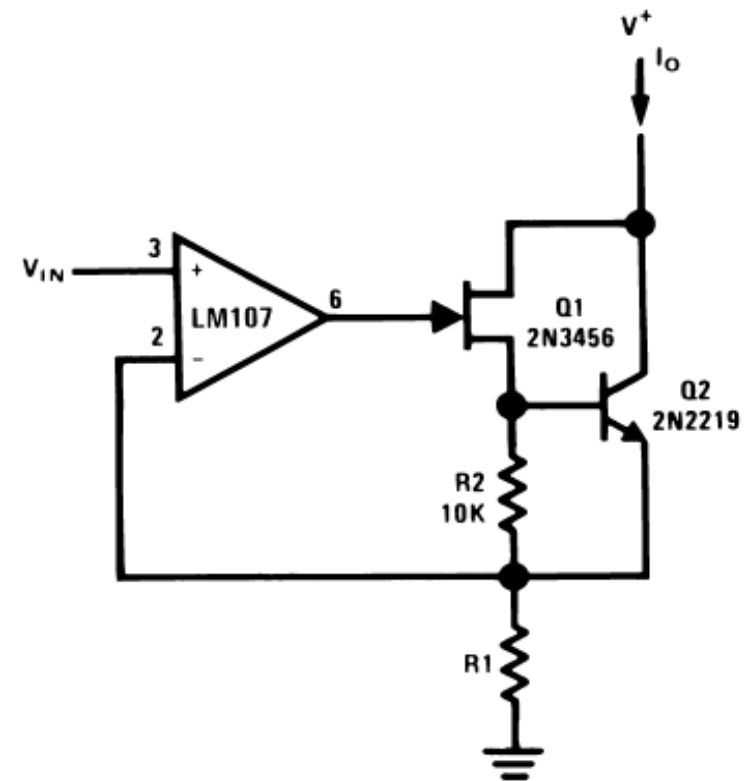
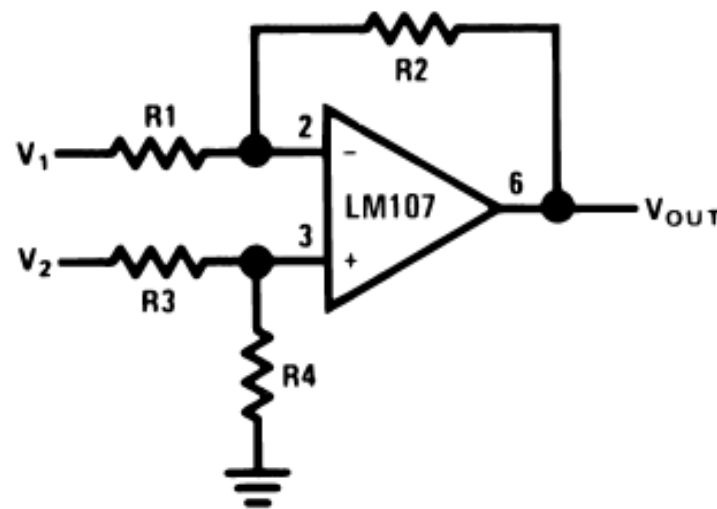
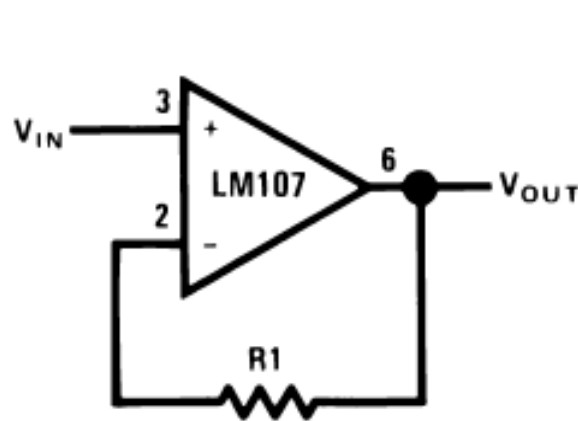
from manufacturers! 3.8

Ex:



Application Report
SNOA621C-February 1969-Revised May 2013

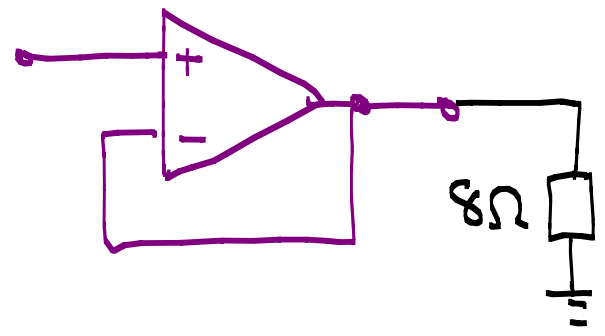
AN-20 An Applications Guide for Op Amps



3. Unidirectional Current Boosters

Example: Voltage Buffer

Op amps can be used to make a huge variety of circuits. (see App notes)

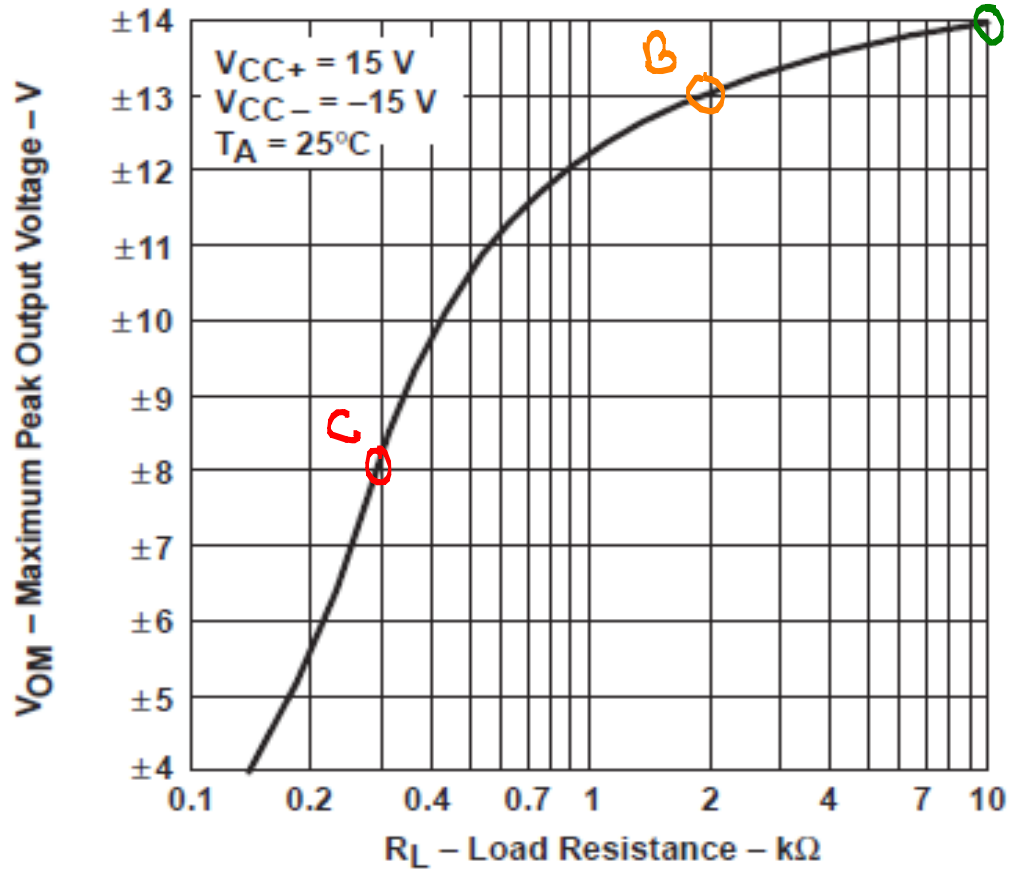


HOWEVER, most op amps

Max V_{OUT} I_{OUT} →

A:
B:
C:

MAXIMUM PEAK OUTPUT VOLTAGE VS LOAD RESISTANCE



LF356

$V_s = \pm 15V$

- Adding