Lecture 4

Amplifiers

-

-

- many applications

-

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Symbol

Characteristics

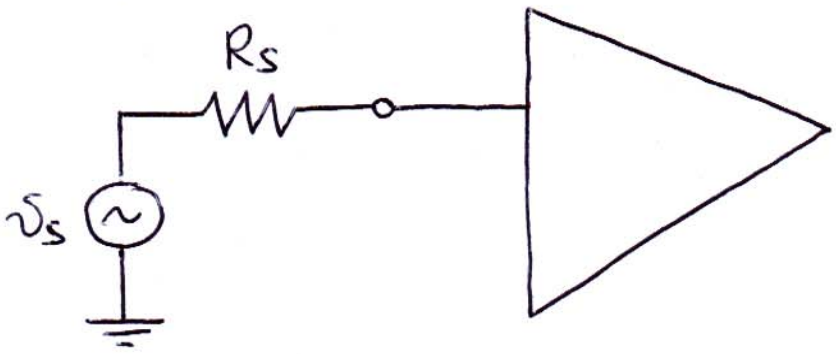
① Gain

decibels

Q: why dB?

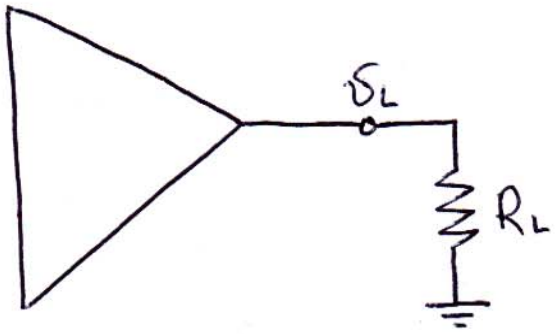
$G = v_{out} / v_{in}$	G_{dB}
1	0 dB
$\sqrt{2}$	+3 dB
2	+6 dB
10	+20 dB
$\frac{1}{10}$	−20 dB

(2) Input resistance



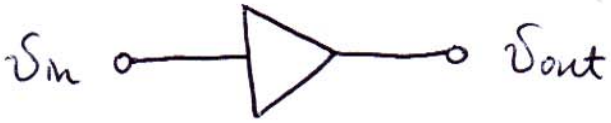
Q: what input impedance is ideal ?

(3) Output impedance

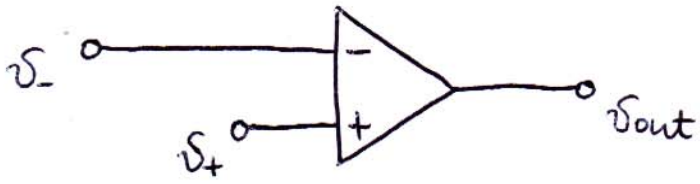


Input types

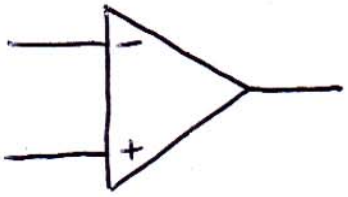
a) single input

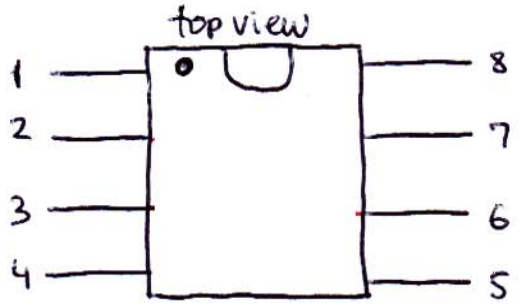


b) differential



Operational amplifier



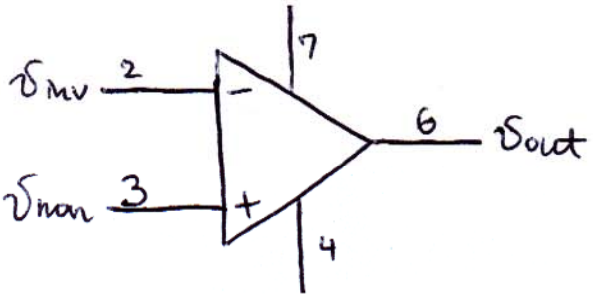


741 and 3140 op-amps used in the lab

Manufacturer spec sheets

- everything you need to know about an IC
- see PDF's on the course web-site / books in the lab

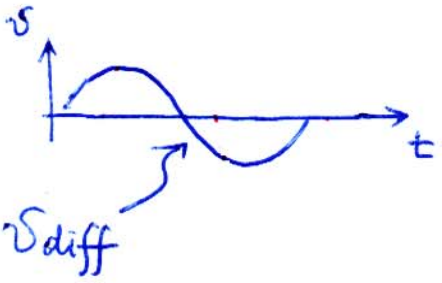
Powering op-amp



Lecture 5

Op-amp characteristics

Gain



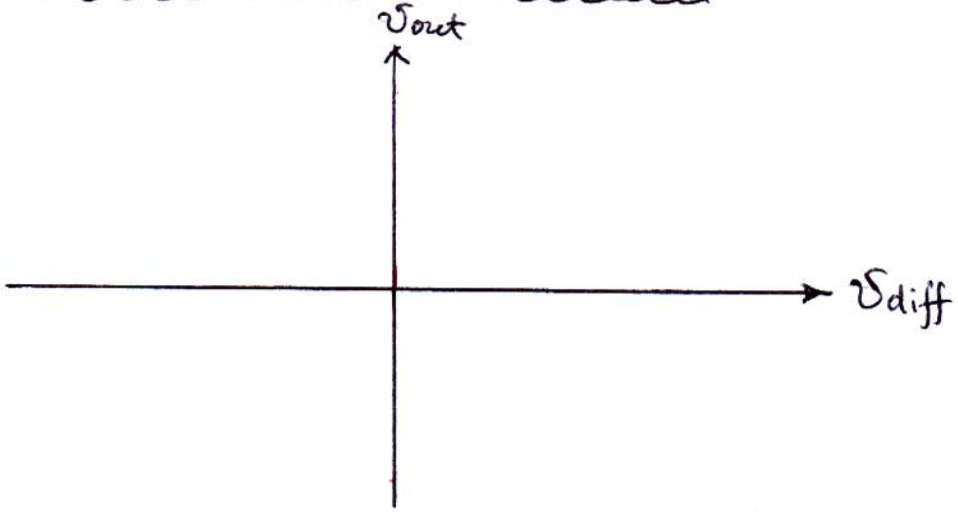
Typically

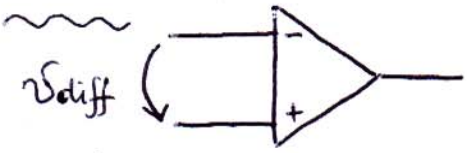
$G =$

Unity gain bandwidth

—

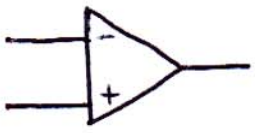
Transfer characteristic



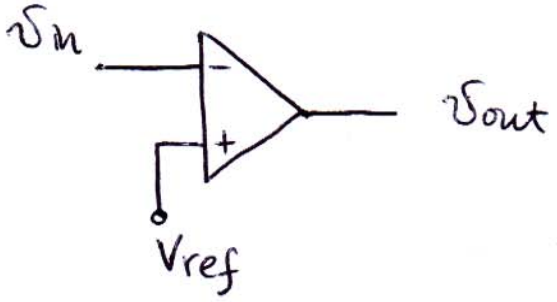


- bare op-amp is a _____ amplifier

Input offset voltage



Slew rate & propagation delay



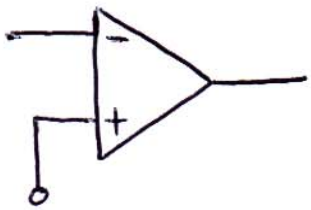
Ideal op-amp

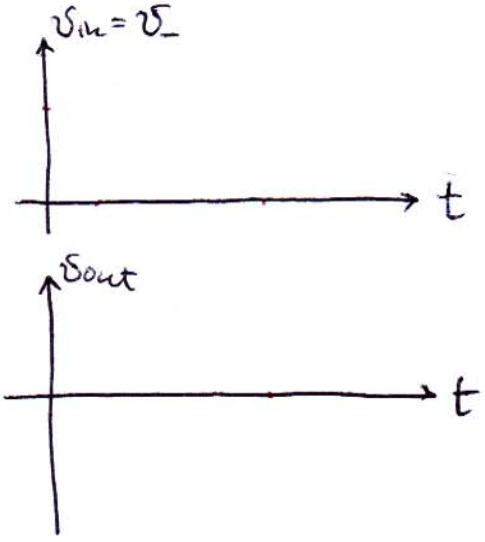
1) input draw _____
2) output resistance
3) V_{sat+} =
   V_{sat-} =
4) $G \sim \infty$
5) $V_{os} \to 0$, S.R. $\to \infty$, $T_{p.d.} \to 0$

- always start with _____ , then apply non-ideal properties _____ .

Op-amp circuits

Comparator





analog signal in

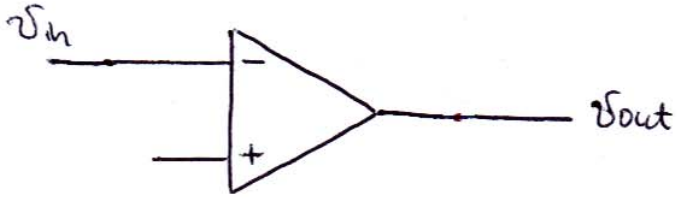
- comparator =

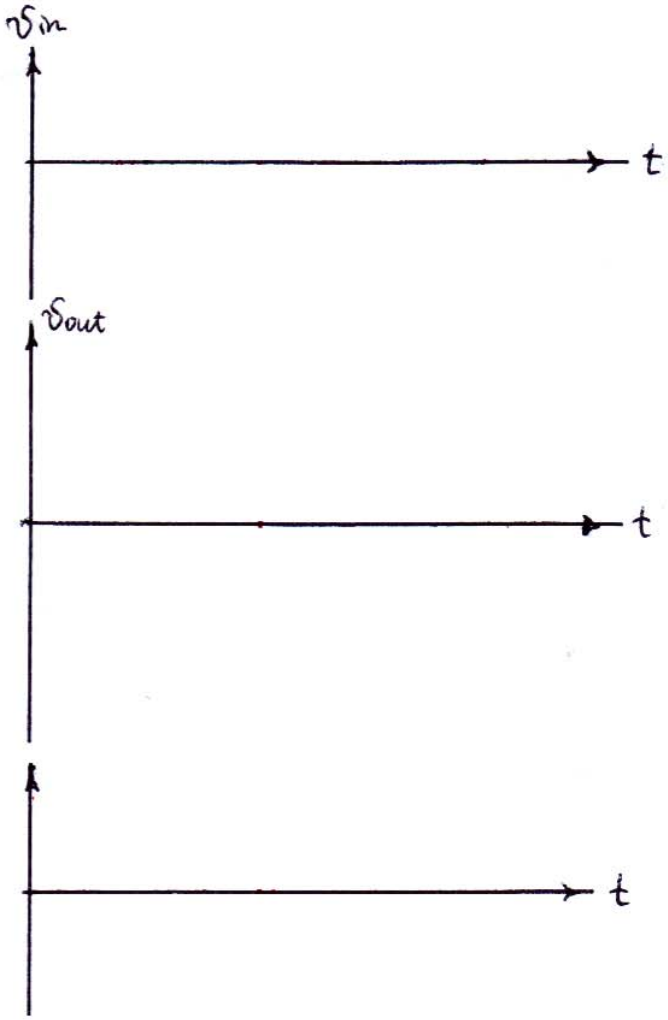
problems with comparator

soln.:

Lecture 6

Schmitt trigger

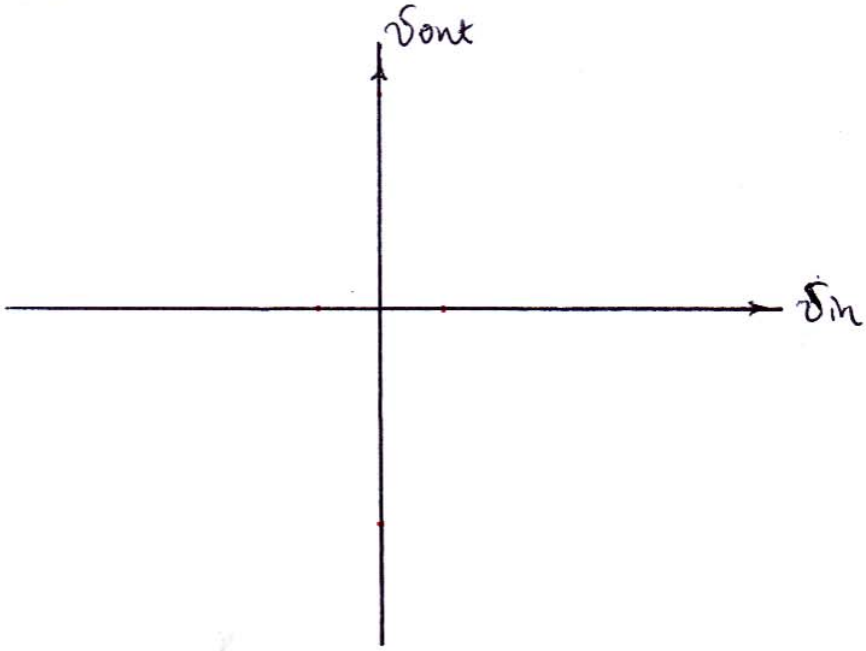




- this is an example of _____

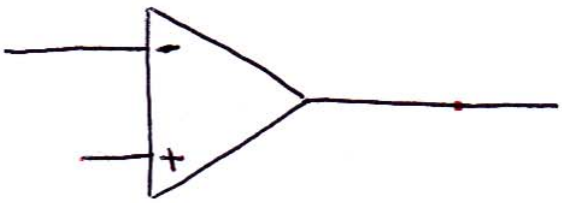
- positive feedback _____ the current trend through whisking the threshold

Transfer characteristic

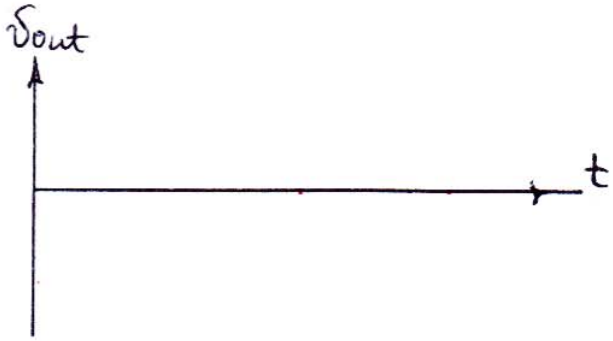


- threshold now depends _____

Astable multivibrator



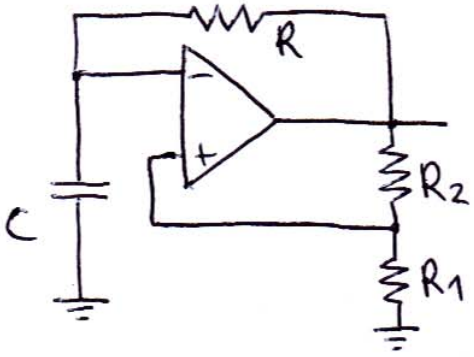
- op-amp supplies



Strategy for solving unknown circuits:

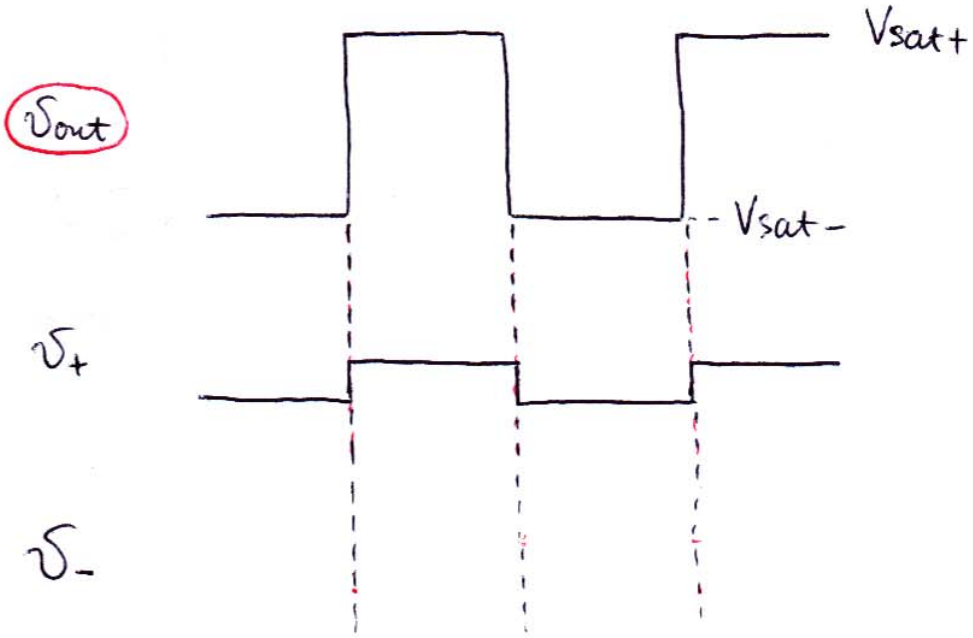
Starting oscillations:

- assume ideal op-amp
- there is always noise, so $v_+ = v_-$ is never true for long



Analyze oscillator

volt. vs time



For simplicity $V_{sat+} = |V_{sat-}| = V_{sat}$

$$v_c(\Delta t) = V_F + (V_I - V_F)\, e^{-\frac{\Delta t}{RC}} \qquad (*)$$

$V_I =$, $V_F =$

$v_c(\Delta t) =$