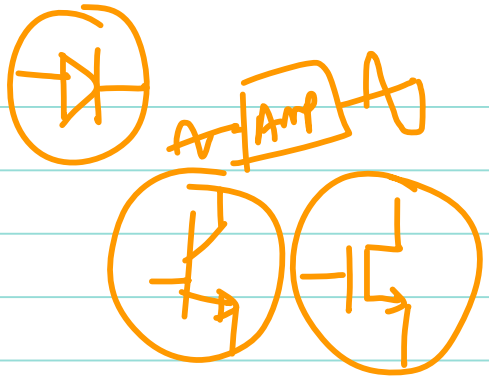
Lec-25



Operational Amplifier (Op-Amp)

↓

Addition, substraction, integration, differentiation → operations

made by.

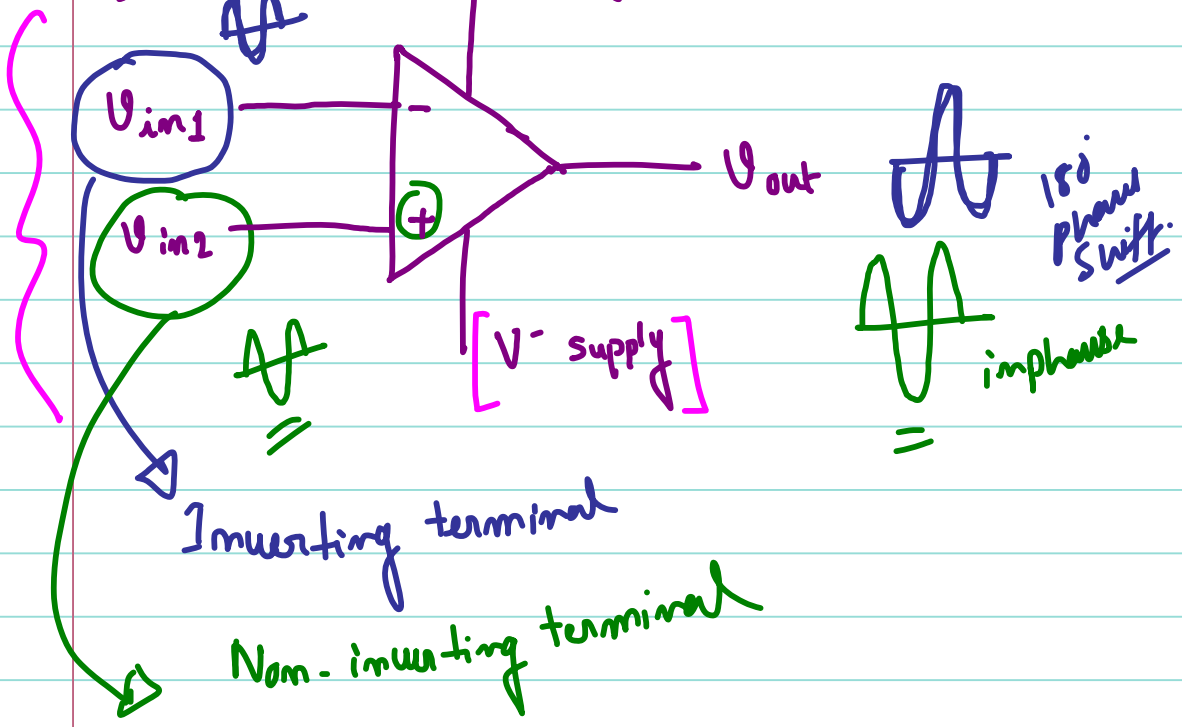
20-30 transistors (MOSFET, BJT) IC

First introduced in 1965 → μA 709

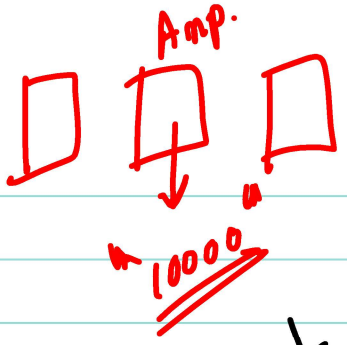
↑ Fairchild. Semiconductor

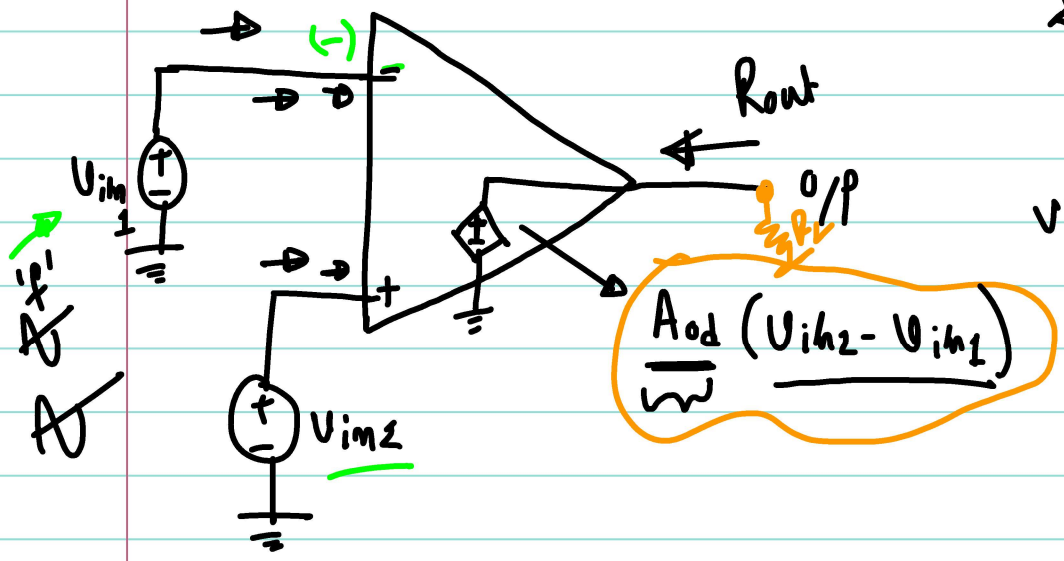
IC 741 → MA 741 → 60's

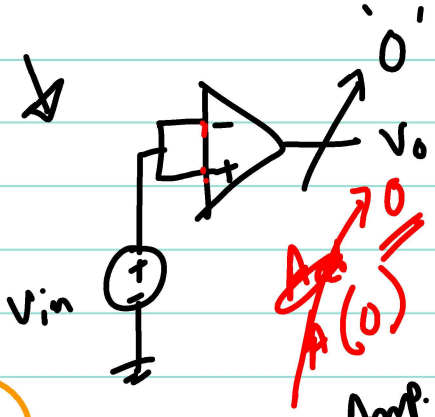
Circuit symbol

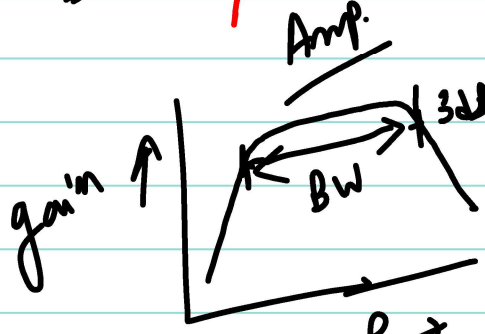


Ideal Op-Amp









Characteristics of Ideal op-Amp:

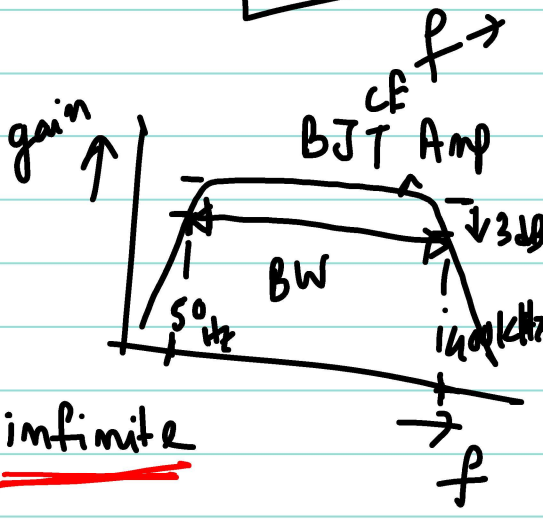
(i) Input Resistance → infinite

(ii) Output Resistance → zero

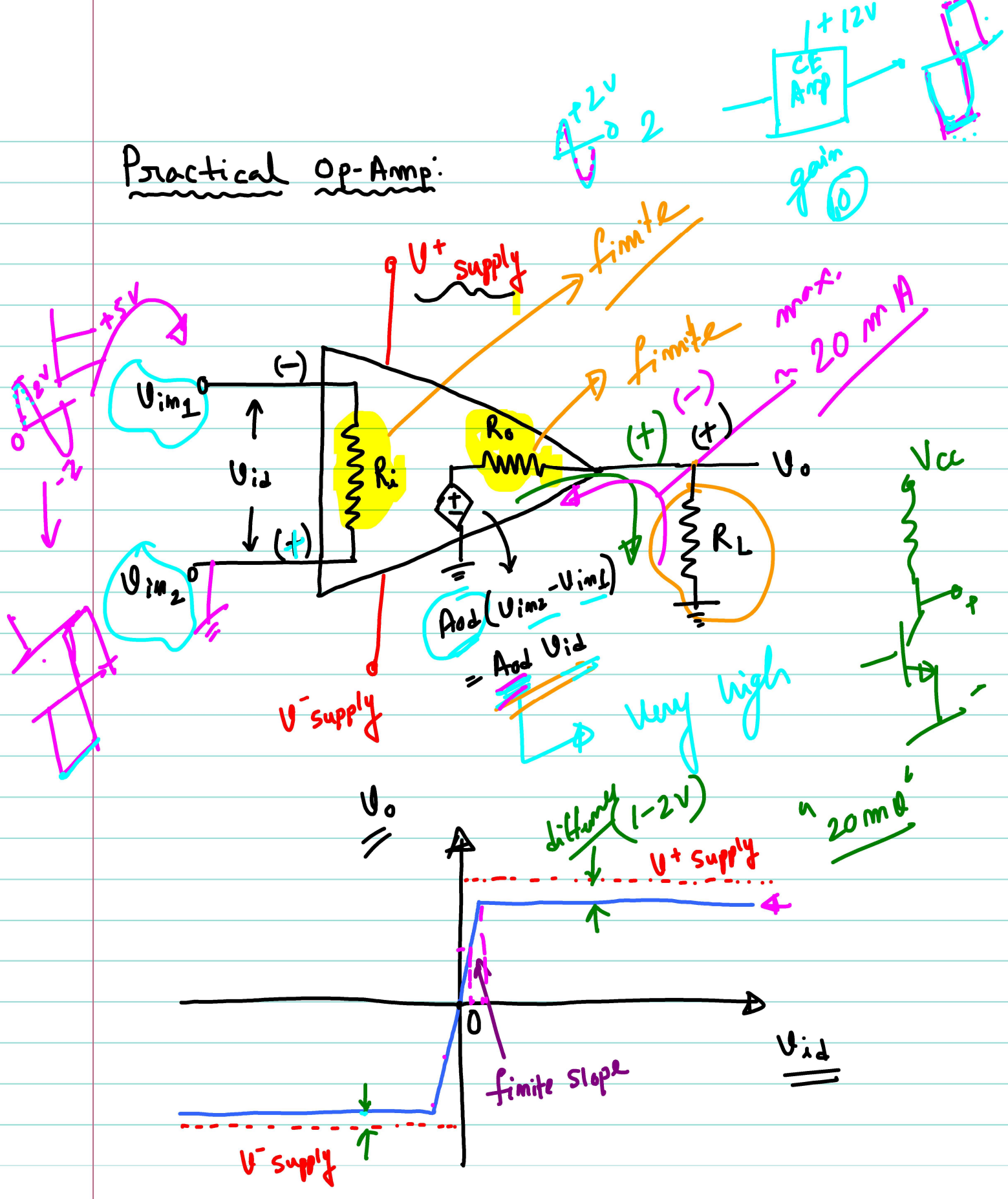
(iii) Open-loop differential gain → infinite

(iv) Common-mode gain → zero

(v) Bandwidth → infinite



Practical Op-Amp:



Naming of ICs

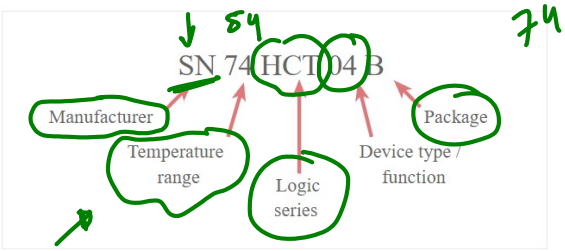
A. For more information on peripheral, temperature, and package availability for a specific device, see Table 3-1.

Figure 7-1. Device Nomenclature

https://electronics.stackexchange.com/questions/225557/how-are-ics-named

7400 series IC numbering

The most widely used logic family is the 7400 series, i.e. 74xx00 series and all its derivatives. The derivation of these IC numbers is given below:

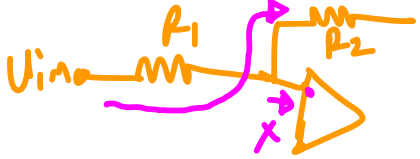


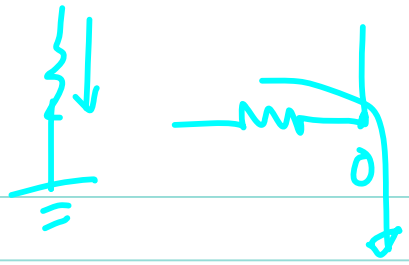
It can be seen that this IC part number consists of a number of elements:

PART NUMBERING SCHEME FOR 74XX00 SERIES LOGIC ICS

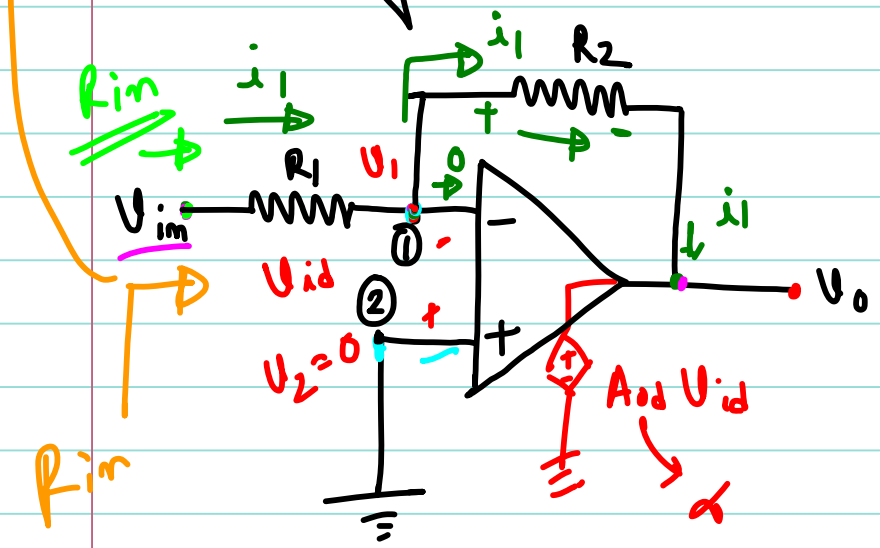
Manufacturer	This code normally consists of two letters and is a code normally used by a given manufacturer. SN is one used by Texas Instruments. Other manufacturers have their own codes that they place here.
Temperature range	This is indicated by these two figures. 74 indicates 0°C to 70°C commercial and 54 military: -55°C to +125°C. For most applications the 74 series is perfectly acceptable and this series will be found in consumer devices.
Logic series	This is the sub-family. 7400 for example is the basic series, but there are many others.
Device	This indicates the device function / type. For example devices with 04 are hex inverters, etc. They are the common across all sub-families.
Package code	This is the package suffix. It is necessary to refer to the manufacturers datasheets as these codes vary between manufacturers.

https://www.electronics-notes.com/articles/electronic_components/logic-ic-families-technologies/ic-numbering-schemes.php





Inverting Amplifier:



$V_{id} = V_2 - V_1 = 0 - V_1$

$V_{id} = -V_1$

$V_o = A_{od} \cdot V_{id}$

$V_o = A_{od} \cdot (-V_1)$

finite ∞

$V_1 \to 0$ V.

"Virtual ground."

"Virtual Short"

$$i_1 = \frac{V_{in} - 0}{R_1} = \frac{V_{in}}{R_1}$$

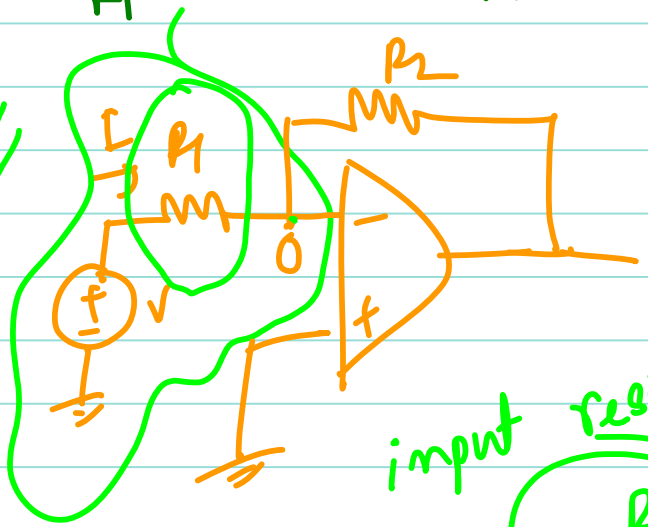
gain = 100 $= -\frac{R_2}{R_1}$

$R_1 = 50 k\Omega$

so $R_2 = 50 k\Omega \times 100 = 5000 k\Omega = 5 M\Omega$

$$V_o = -i_1 R_2 = -\frac{V_{in}}{R_1} \times R_2 = -\frac{R_2}{R_1} \cdot V_{in}$$

closed loop gain $= \frac{V_o}{V_{in}} = -\left(\frac{R_2}{R_1}\right)$



$V = IR$ $\quad R_{in} = \left(\frac{V}{I}\right) = R$

input resistance $= R_1$