UNIT-4
Lecture-4

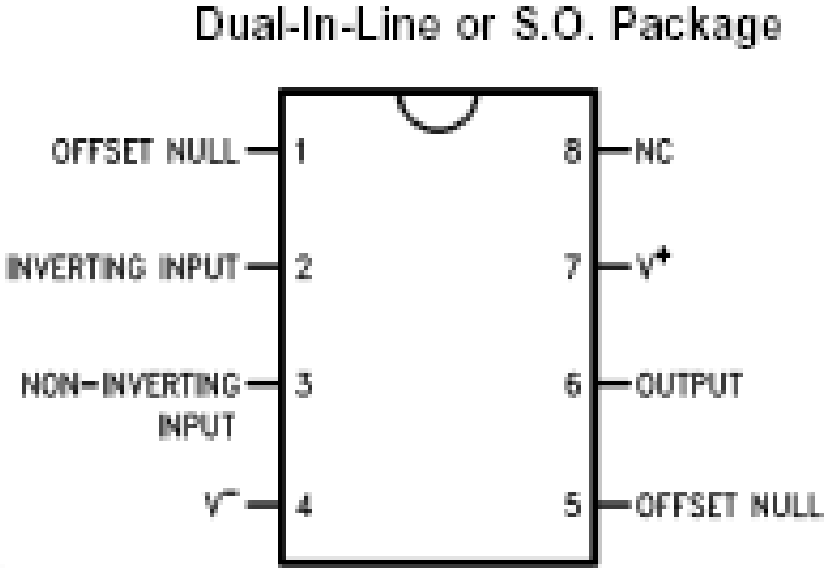
The 741 IC Op-Amp

Introduction to OP-Amp

- This IC is an 8 pin IC in the dual in line (DIP) package.
- This is the one of the oldest and one of the most popular Op-amp IC.
- It is a high performance monolithic operational amplifier.
- It has wide range of applications such as integrator, differentiator, summing amplifier etc.

Operational Amplifiers

The circuit in the previous slide is usually encapsulated into a dual in-line pack (DIP). For a single LM741, the pin connections for the chip are shown below.



Pin connection, LM741.

- *Pin 1 (Offset Null):* Offset voltage is nulled by application of a voltage of opposite polarity to the offset.
- *Pin 2 (Inverted Input):*All input signals at this pin will be inverted at output pin 6.
- *Pin 3 (Non-Inverted Input):*All input signals at this pin will be processed normally without inversion.
- *Pin 4 (-V):*The V- pin (also referred to as V_{cc}) is the negative supply voltage terminal.

- *Pin 5 (Offset Null):* Same pin 1.

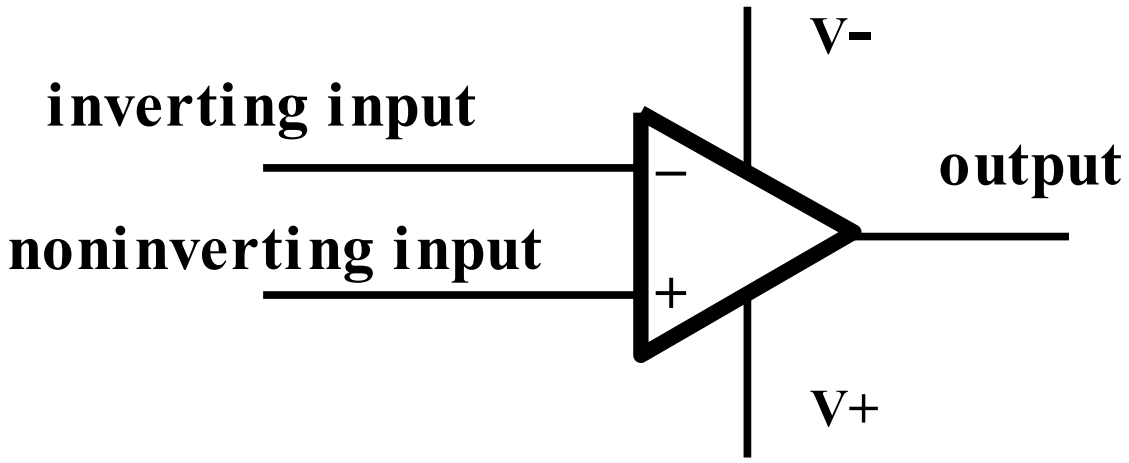
- *Pin 6 (Output):* Output signal's polarity will be the opposite of the input's when this signal is applied to the op-amp's inverting input

- *Pin 7 (+V):*The V+ pin (also referred to as V_{cc}) is the positive supply voltage terminal of the 741 Op-Amp IC.

- *Pin 8 (N/C):*The 'N/C' stands for 'Not Connected'. There is no other explanation. There is nothing connected to this pin, it is just there to make it a standard 8-pin package

Operational Amplifiers

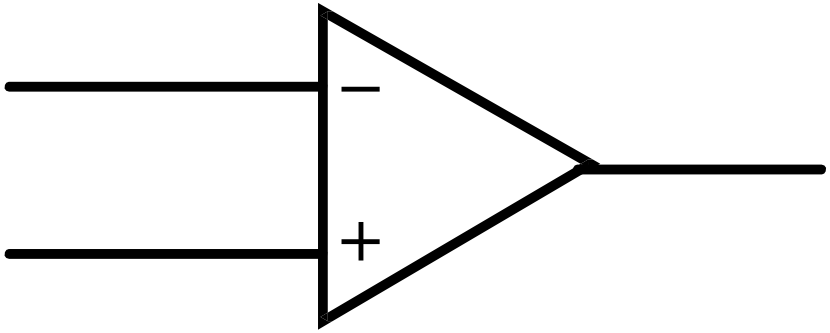
The basic op amp with supply voltage included is shown in the diagram below.



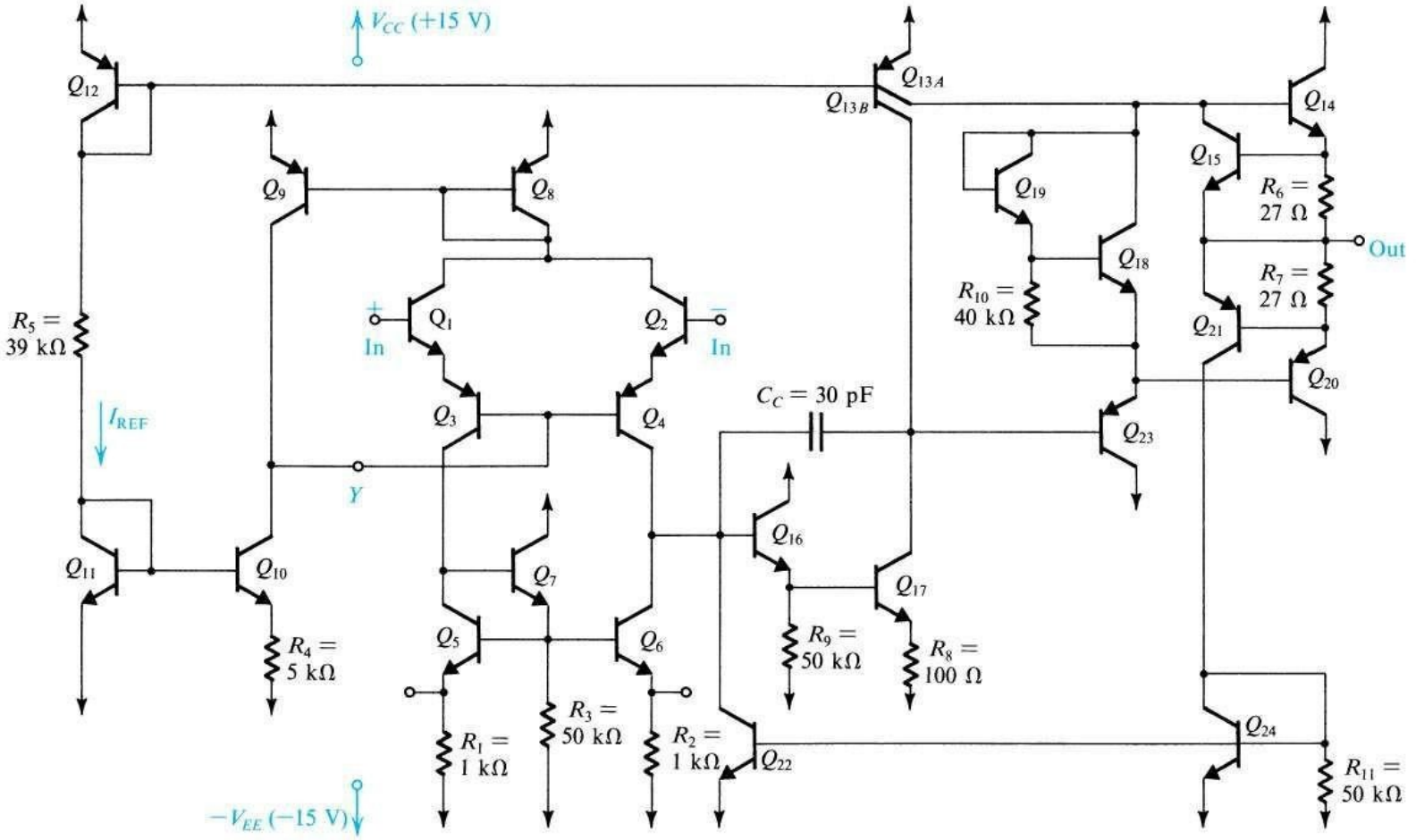
Basic op am diagram with supply voltage.

Operational Amplifiers

In most cases only the two inputs and the output are shown for the op amp. However, one should keep in mind that supply voltage is required, and a ground. The basic op am without a ground is shown below.



Outer op am diagram.



The 741 op-amp circuit. Q_{11}, Q_{12}, and R_5 generate a reference bias current, I_{REF}. Q_{10}, Q_9, and Q_8 bias the input stage, which is composed of Q_1 to Q_7. The second gain stage is composed of Q_{16} and Q_{17} with Q_{13B} acting as active load. The class AB output stage is formed by Q_{14} and Q_{20} with biasing devices Q_{13A}, Q_{18}, and Q_{19}, and an input buffer Q_{23}.
Transistors Q_{15}, Q_{21}, Q_{24}, and Q_{22} serve to protect the amplifier against output short circuits and are normally cut off.

- It consists of 24 transistors, 11 resistors and 1 capacitor.
- IC 741 requires two power supplies, $+V_{CC}$ and $-V_{EE}$.
- Normally $+V_{CC} = +15$ V and $-V_{EE} = -15$V.
- The IC 741 is capable of operating at much lower power supply voltages (up to 5 V)