

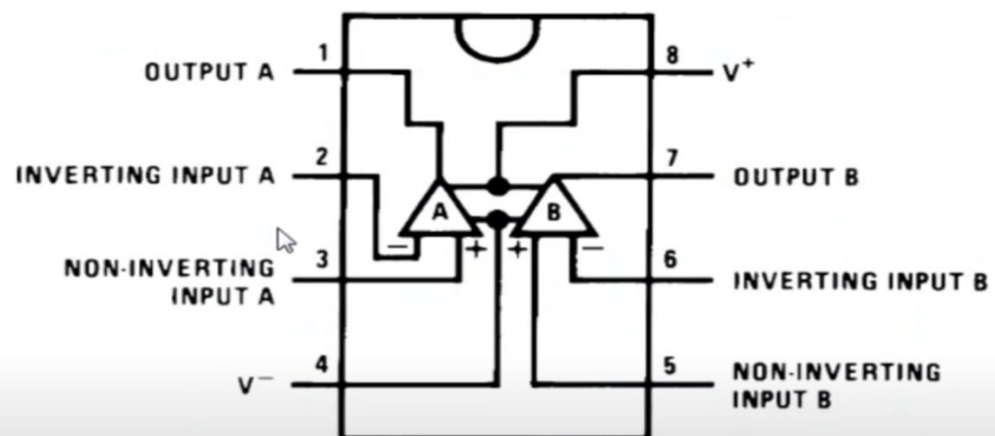
#VIDEO21 : Electronic Basics #21: Op Amp (Operational Amplifier)

1. Introduction to Op-Amps

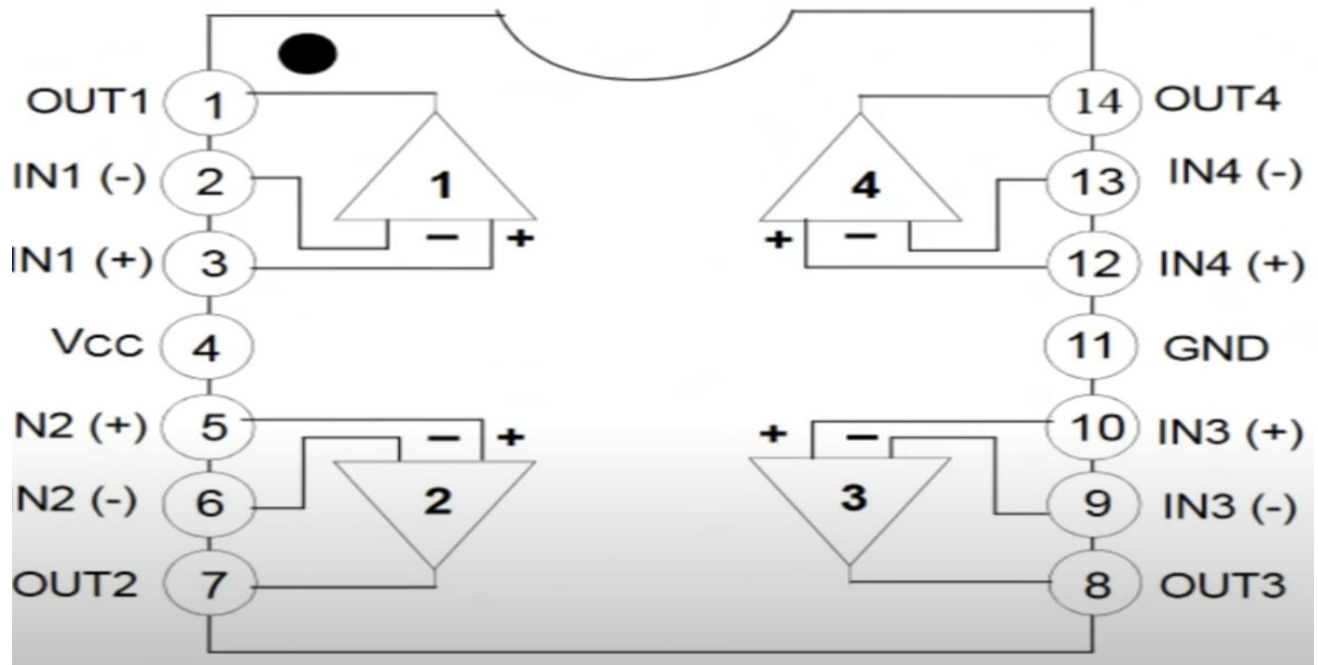
- Op-amps are crucial components in both analog and digital electronics, often represented as triangle-shaped symbols in schematics. They are widely used for various applications due to their versatility.

2. Types and Packages

- Op-amps can be found in different packages, such as:
 - Dual inline package (DIP) with 14 pins, typically housing four op-amps.
 - Smaller packages with two or one op-amp inside.



**Figure 1. PDIP/SOIC Package (Top View)
See Package Number D0008A or P0008E**

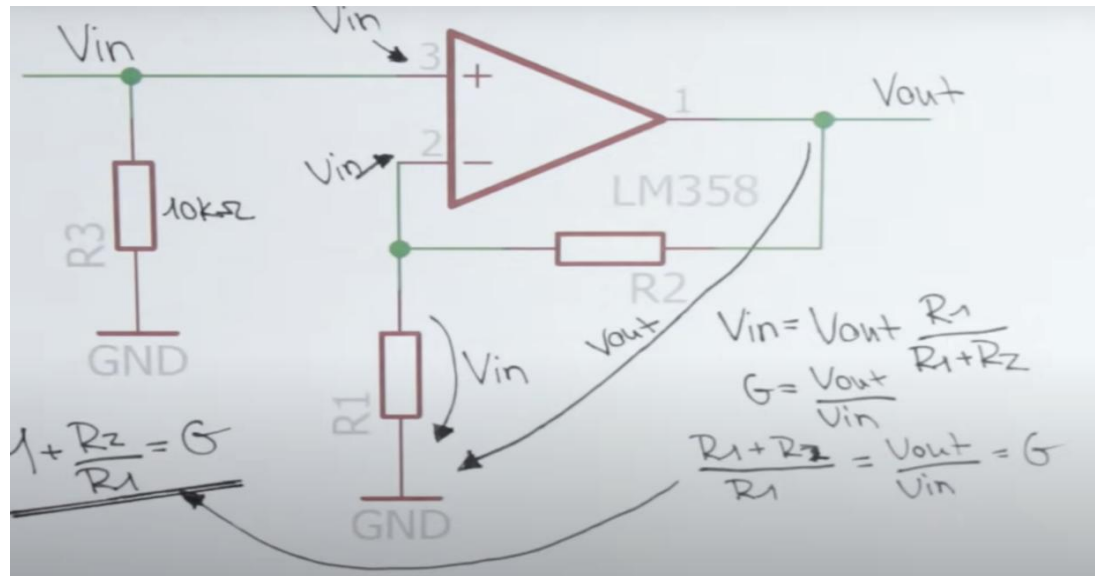


3. Basic Configuration and Functionality

- For example, using the LM358 op-amp:
 - Connect the ground pin to 0 volts and the V+ pin to 12 volts (within the IC's supply range).
 - Apply a voltage of +1 volt to the non-inverting input, with a 10 kΩ pulldown resistor to ground.

4. Gain Calculation

- The output voltage can be calculated using the formula for gain in a non-inverting op-amp configuration:
 - Gain = Output Voltage / Input Voltage
 - Example: Using a voltage divider with resistors, an output of 6.1 volts was achieved with a gain of 6.1.



5. Limitations and Considerations

- Op-amps have limitations, such as:
 - Output voltage swing is limited to the supply voltage (e.g., +12 volts).
 - To amplify AC signals, a DC offset may be needed to avoid hitting output limits.

6. Ideal vs. Non-Ideal Op-Amps

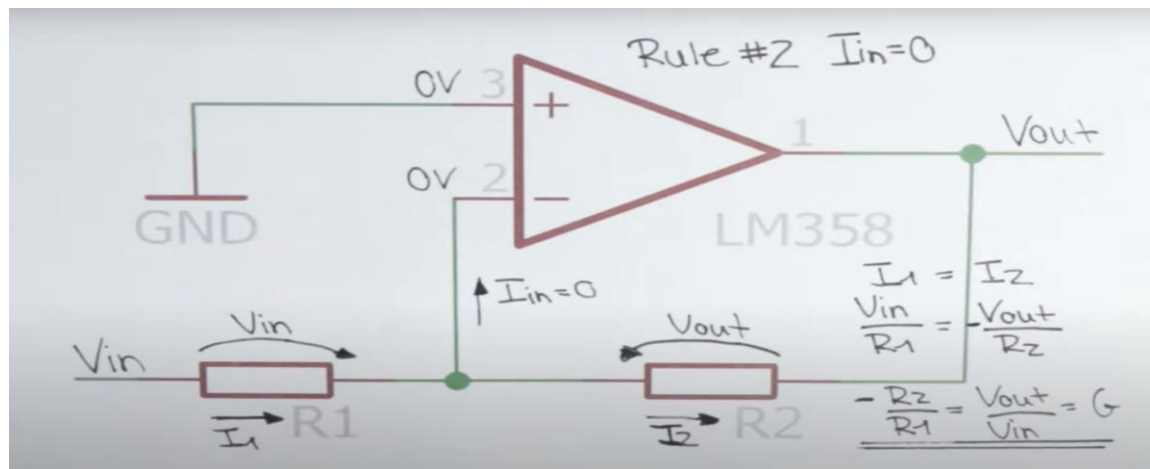
- An ideal op-amp would have infinite input impedance(which is not true) and zero output impedance(which is not true), but real op-amps have non-ideal characteristics. However, rail-to-rail op-amps can output voltages close to their supply limits.
- A datasheet of lm358 op amp is given below as pdf:



LM258.PDF

7. Inverting Op-Amp Configuration

- In an inverting configuration, the non-inverting input is grounded, allowing for the amplification of AC signals without amplifying DC voltages. The formula for this configuration is also essential for understanding its behavior.



8. Comparator Functionality

- When no feedback is applied, the op-amp acts as a comparator, which can switch outputs based on the input voltage levels. This high open-loop gain leads to rapid output changes.

9. Applications

- Op-amps can be used in various applications, including:
 - Constant current sources
 - Voltage followers
 - Integrators and differentiators
 - Inverting and non-inverting amplifiers
 - Schmitt triggers