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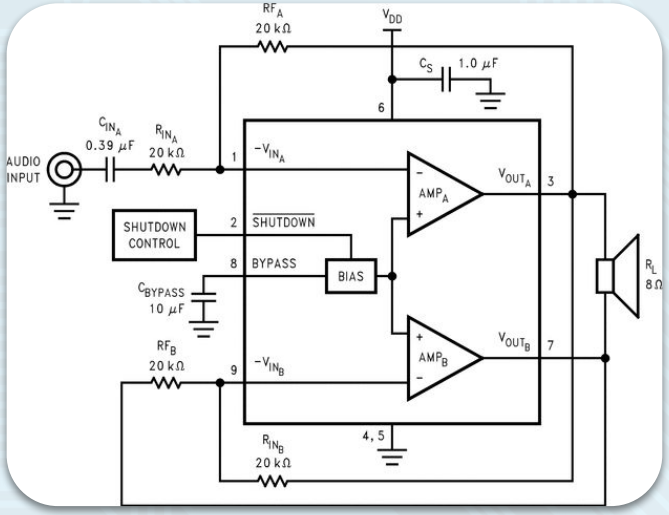
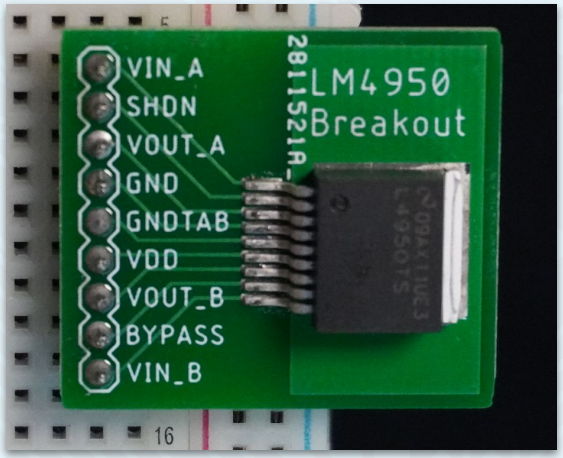
# IEEE Projects
# Amplifier Workshop

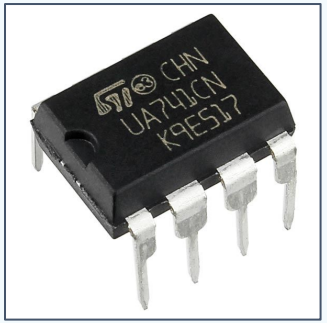



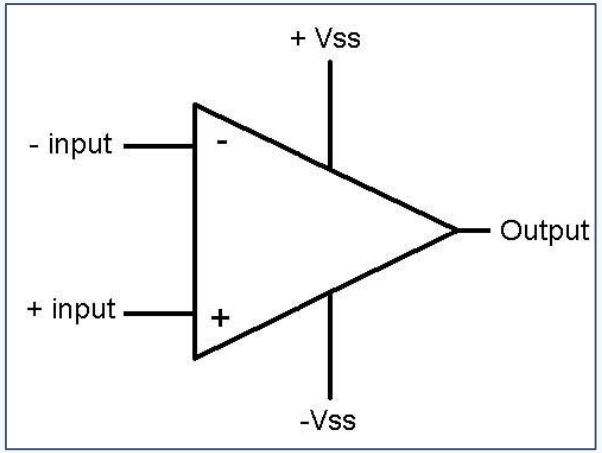



# What is an amplifier

## *Op-amps*

- Invented by Bell Labs in 1940s
  - Only became compact, cheap after transistors
- Amplifies the difference between two inputs
  - $V_{OUT}=A_{OL}(V_+-V_-)$
  - $V_{OUT}$ limited by voltage supplied
- Comparators
  - High-gain op-amp
  - Returns digital signal based on inputs
    - $V_+ > V_- \Rightarrow V_{OUT} = 1$
    - $V_+ < V_- \Rightarrow V_{OUT} = 0$

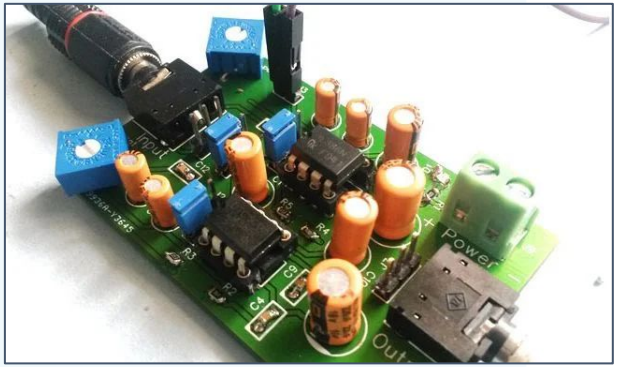




*Top Left: K2-W Op-Amp from Bell Labs*
*Top Right: The UA741 started the trend of compact, cheap op-amps*
*Bottom: Simplified pinout of an op-amp*

# Applications

- Audio Amplification
- Oscillators
- Signal Generators
- Filters
- Analog to Digital Converters (ADCs)
- Digital to Analog Converters (DACs)
- And More!

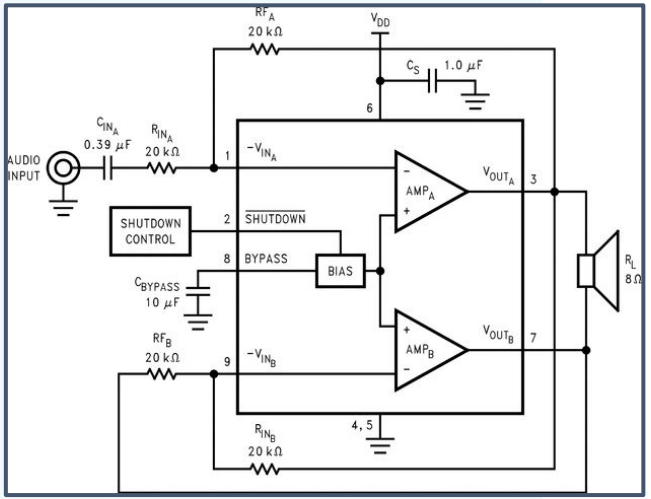



*Top Right: a stereo audio amplifier using two LM386 op amps*
*Bottom Left: A Wien-Bridge Oscillator using an op-amp*

# What IC are we using?

## *LM4950*

- The LM4950 is designed for sound amplification
  - ‘power amplifier’
- Composed of two op-amps
- Two Vin and two Vout for left and right channels
- Class AB audio amplifier
  - A: lower efficiency but highest sound fidelity
  - B: higher efficiency but worse sound quality



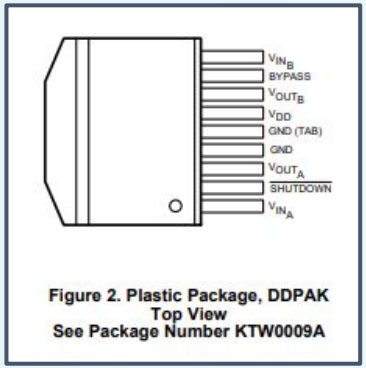




**Figure 2. Plastic Package, DDPAK**
**Top View**
**See Package Number KTW0009A**

# Circuit Overview

- The LM4950 is permanently configured for an inverting amplifier design!
- Why would it be configured this way?