Why Is DC Used Inside Electronic Devices When AC Is Available in Homes?

1. Nature of Electronic Components

- **Electronic components (e.g., transistors, ICs, LEDs):**
  Most modern electronic devices use semiconductors and other components that require a **stable and constant voltage** to operate.
    - These components are designed to work with **DC** because:
        - Alternating voltage (AC) can cause them to malfunction or behave unpredictably.
        - AC introduces noise, and its constant change in polarity is incompatible with components that need steady operation.

2. Stability of DC for Logic Circuits

- **Digital circuits (e.g., microcontrollers, processors):**
  These rely on consistent voltage levels to differentiate between binary states (0 and 1). AC's fluctuating voltage would make it impossible to maintain stable logic levels.

3. Safety

- DC is often used because:
    - It's easier to regulate and limit its voltage to safe levels for internal circuitry.
    - AC's high voltage (110-240V) is dangerous for small-scale devices and could cause severe damage.

Why Is AC Converted to DC Inside Devices?

1. Efficiency of AC for Transmission

- **AC is supplied to homes and industries** because:
    - It is more efficient for long-distance power transmission (reduces losses).
    - Voltage can be stepped up or down using transformers.

2. Conversion Process

- Once AC reaches a device:
    1. **Step-Down Transformer:** Reduces the high-voltage AC (e.g., 240V) to a lower voltage (e.g., 5V, 12V, etc.).
    2. **Rectifier Circuit:** Converts AC to DC using diodes or bridge rectifiers.
    3. **Filter Circuit:** Smooths the pulsating DC to remove ripples.
    4. **Voltage Regulator:** Provides a stable DC voltage suitable for the device's components.

Why Not Supply DC Directly to Homes?

1. **Transmission Losses:**
    - DC is inefficient for long-distance transmission due to higher energy losses from resistance.
2. **Voltage Conversion Difficulty:**
    - It is harder to step DC voltage up or down efficiently.
    - AC can use transformers for easy and efficient voltage adjustment.
3. **Infrastructure Compatibility:**
    - Electrical grids and most appliances (e.g., refrigerators, washing machines) are designed to work with AC.

Summary

- **AC is used for transmission and home supply** because it is efficient for long distances and easily transformable.
- **DC is used in electronic devices** because it provides a stable, constant voltage necessary for the operation of sensitive components.

A Tale of Two Currents: AC vs. DC

Alternating current, direct current & what is frequency? | Physics | Khan Academy

Understanding AC/DC Power Supplies