

1.8 OP AMP POWERING

In order to function, op amps need to be externally powered. Powering serves the twofold purpose of biasing the internal transistors and providing the power that the op amp must in turn supply to the output load and the feedback network. Figure 1.36 shows a recommended way of powering op amps. To prevent the ac noise usually present on the supply lines from interfering with the op amps, the supply pins of each IC must be bypassed to ground by means of low-inductance capacitors ($0.1\text{-}\mu\text{F}$ ceramic capacitors are usually adequate). These decoupling capacitors also help neutralize any spurious feedback loops arising from the nonzero impedances of the supply and ground lines, or busses, which might pose stability problems. For this cure to be effective, the leads must be kept short to minimize their distributed inductance, which rises at the rate of about 1 nH/mm , and the capacitors must be mounted as close as possible to the op amp pins. A well-constructed circuit board will also include $10\text{-}\mu\text{F}$ polarized capacitors at the points of entry of the supply voltages to provide board-level bypass. Moreover, using wide ground traces will help maintain an electrically clean ground reference.

Typically V_{CC} and V_{EE} are generated with a dual $\pm 15\text{-V}$ regulated power supply. Though these values have long been the standard in analog systems, today's

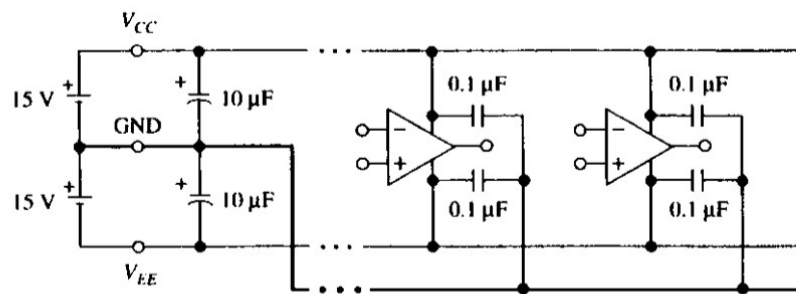


FIGURE 1.36
Op amp powering with bypass capacitors.

mixed-mode applications call for a single 5-V supply to power both digital and analog circuitry. In this case we have $V_{CC} = 5\text{ V}$ and $V_{EE} = 0\text{ V}$. Unless otherwise specified, we assume $V_{CC} = 15\text{ V}$ and $V_{EE} = -15\text{ V}$. Though the power-supply interconnections are normally omitted from circuit diagrams for the sake of simplicity, we must remember to power our op amps when we try them out in the lab. Some of the most frequent sources of frustration for the beginner are due to improper powering, such as faulty wire connections, interchanging V_{CC} and V_{EE} , or even forgetting to turn the power on! When troubleshooting, it is good practice to check the voltages right at the supply pins of the op amp.