

General Considerations in Choosing an Op-Amp

by Kenneth A. Kuhn
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The following are some brief notes to think about when choosing an op-amp for a particular application. There are many op-amps to choose from and you want to pick the one that has the best overall specs that apply to your application.

Gain

Generally, an op-amp stage is not designed with for a gain of more than several hundred. The non-ideal characteristics of a real op-amp become increasingly significant as the closed loop gain is increased.

Phase inversion or non-inversion

Before selecting which op-amp configuration to use, check to see if output signal phase is important. If it is, then you must use the appropriate configuration. Otherwise use whichever configuration you like or is required by some other constraint.

Frequency response

An amplifier needs to have a certain minimum frequency response in order to accurately amplify a signal. Generally, this means that the open-loop gain of the op-amp at the highest signal frequency should be at least 25 to 100 times the desired closed loop gain. This in turn implies a certain minimum unity gain frequency.

Output signal swing

The output signal swing of an op-amp is generally to about 2 or 3 Volts of either power supply.

Maximum slew rate of desired output signal

Compute the maximum desired output signal slew rate in Volts per microsecond. Choose an op-amp that has an output slew rate capability of at least twice this value.

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Output Impedance

Most typical op-amps have an open loop output impedance of between 35 and 100 Ohms. Because of negative feedback, the closed loop output impedance is typically less than 1 Ohm.

Maximum output drive current

Most typical op-amps can source or sink about 5 mA. This is 10 Volts across a net load resistance of 2 Kilo-Ohms.

Output DC errors

These errors come primarily from the input offset voltage, input bias current, and input bias offset current. All of these vary with temperature. The circuit design should always compensate for bias current. Manual offset adjustment can reduce the effect of offset voltage and offset bias current at a particular temperature. Based on an analysis of these parameters, choose an op-amp that has small values of these parameters such that the output DC error specification can be met.

Input Impedance

Bi-polar transistor op-amps typically have an input impedance of between 1 and 20 Mega-Ohms. FET op-amps typically have an input impedance of 100's to 1000's of Mega-Ohms.

Input voltage range

Note that the input voltage range of a typical op-amp is to about 3 to 5 Volts of either power supply. The op-amp will not work properly above the input voltage range.

Input bias current

All op-amps have an input bias current. For this reason, there must be a DC path (through some resistance) to a voltage (could be ground) within the input voltage range of the op-amp.

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Power supply rejection

At low frequencies, the op-amp may have between 60 and 90 dB of power supply rejection. At frequencies above 100 kHz, the power supply rejection falls to about 20 dB and may reach 0 or negative in the lower MHz range. When using switching power supplies or if there is any kind of interference on the power supply voltages, be sure to use RC decoupling networks on the Vcc and Vee power pins.

Noise

All amplifiers have noise (in audio terms, referred to as hiss). BE sure to check the noise characteristics before choosing an op-amp if output noise is a consideration.