GLOSSARY

Supply voltage (VCC) – Voltage difference between the two power pins where the op amp works correctly. In ST’s portfolio, one can find 5V, 16V and 36V products.

Quiescent current / Supply current (ICC) – Supply current needed for each operational amplifier in the package for its operation.

Input offset voltage (VIO) – Differential input voltage of the + and - pins to get the output at the mid-range of the supply voltage. It originates from the mismatching of internal transistors.

Input bias current (IIB) – Current flowing through an op amp’s inputs. Due to op amp biasing requirements and normal operation leakage, a very small amount of current (pA or nA range, depending on the technology) is flowing through the inputs. This may cause problems when large value resistors or sources with higher output impedances are connected at the op amp inputs. This causes relevant voltage drops at the op amp input and therefore errors.

Gain bandwidth product (GBP or GBW) – Product of an op amp’s gain and bandwidth. It is measured at 20 dB gain. Defined for small signals.

Slew rate (SR) – How fast an op amp can change voltage on its output. An op amp’s voltage output rate of change is limited to the slew rate value. It causes distortion if the signal to be amplified is too fast.

Capacitive load – Can cause an op amp to become an oscillator. The op amp output resistance in connection with a capacitive load results in an additional pole in the circuit transfer function. From the Bode, then its clearly visible under which operating conditions the circuit can become unstable.

Thermal noise – Random voltages generated constantly at the output even when there is no signal applied on its input. Such noise comes from the thermal noise of the resistors or FETs, also called Johnson noise. For applications with high gain or bandwidth, a noise level may become considerable.

EMI hardening – An op amp’s input pins are very sensitive and might act as a gate for electromagnetic interference in your design. Some op amps embed EMI filters to attenuate high-frequency signals for 60 dB or more.

For more information, visit us on www.st.com/opamps
In today's digital world, many signals start as an analog signal. Many sensors already have their own analog signal conditioning circuit, but an operational amplifier is still a key device when you need more complex amplification and filtering, or just for interfacing analog signals with an ADC or a microcontroller. This reference guide provides you information about ST's most recent operational amplifiers and their characteristics.

How do I pick the right op amp for an application?

Even though some may consider op amps as a commodity, they are not. Modern high-performance devices have a wide range of parameters. One device can have almost ideal parameters, while another may be little worse and others can be completely different. The main key performance indicators for operational amplifiers can be listed as following:

- Gain bandwidth product (MHz)
- Slew rate (V/µs)
- Rail-to-rail input and output
- Noise level (nV/VHz)
- Supply voltage (V)
- Quiescent current (µA)
- Input offset voltage (mV)
- Input bias current (pA)

Typical op amp applications and key parameters

Each application has different key requirements for operational amplifier performance. Generally, we can divide applications into several different categories:

Amplification of low voltage signals

When amplifying low voltage signals, you definitely need high-precision op amps since the input offset voltage directly affects your measurement. On the other hand, most low-voltage signals come from low-voltage sources. Therefore, the input bias current is not critical. A differential amplifier or an instrumentation amplifier is a typical circuit. Current sensing is a typical application where you usually need low or high-level features and often use an appropriate bandwith with a low-robust back EMF. Other applications include Wheatstone bridges circuits e.g. strain gauges, RTD sensors or resistive sensors. In such applications, rail-to-rail inputs are not needed in most cases, but you may require a low-robust device. The same can be applied to control systems or more general purpose circuits.

Small current amplification

Sensors providing a small current will require an op amp with a low input bias current. All of these applications use a transimpedance amplifier where the input offset voltage is not usually critical. A typical application is a photodiode current-sensing circuit used in communications, light curtains, smoke detectors, etc. A differential amplifier or an instrumentation amplifier is a typical circuit. Current sensing is a typical application where you definitely need high-precision op amps since the input offset voltage directly affects your measurement.

Don't get lost in ST's op amp naming convention

In your circuit

Simulate the selected op amp

Add more search filters

Too many choices?

Use product selector

Tape and reel

TO-252

1.0 MHz

2.7 MHz

11 kHz

400 kHz

8 MHz

3.1 MHz

5 MHz

22 MHz

30 MHz

50 MHz

10 MHz

Uncompensated

Automotive

Grade

None

Standard qualification

Standard device

Automotive grade

H

I

Z

V

V 3 V 3.3

V 5

V 10

V 30

Vcc

1.1 MHz

120 kHz

880 kHz

900 kHz

560 kHz

2.5 MHz

Legend:

High precision

General purpose

Low power

High temperature

Under development

OPT AMP LONGEVITY COMMITMENT

Most ST's newly developed high-performance op amps come with a 10-year longevity commitment. The list gets longer every year.

STEP-BY-STEP OP AMP SELECTION USING THE ST OP AMPS APP

What is the application?

www.st.com/opamps-app

In it current sensing?

Operating voltage level?

What precision (VIO) is needed?

What input bias (IIB) is needed?

What slew rate is required?

What input offset voltage is needed?

What rail-to-rail input and output is required?

What precision voltage (VIO) is needed?

What speed (GBP) is needed?

What operating voltage level?

Is it current sensing?

Other signal conditioning

More complex signal conditioning circuits have different requirements and designers should keep in mind all the above-mentioned parameters and how they affect both quality and performance.