RAQ's

Rarely Asked Questions

Strange stories from the call logs of Analog Devices

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What shall we do with an unused op-amp?

(Sung to the tune of "What shall we do with the drunken sailor?")

Q. In the RAQ on op-amps as comparators you mentioned an unused op-amp in a quad as being possible justification for using it as a comparator. What do you do if you've an unused op-amp and don't need a comparator?

A. This is a trickier than it looks. If an op-amp is overdriven, the output stage will saturate at one of the supply rails, and the op-amp will consume excess power. Many common configurations of an unused op-amp will overdrive it.

If the terminals are all left unconnected, there is a real risk that stray electrostatic fields will cause an input to go outside the supply rails. This can cause latch-up and destroy the whole chip. Even if latch-up does not happen, a dc field may cause saturation and power waste. In addition, the amplifier may amplify an ac field and, if overdriven, will heavily modulate its own supply current and cause crosstalk to other amplifier(s) on the chip.

Some users connect one input to the positive supply and the other input to the negative supply. This again saturates the output and wastes power; it may also exceed the differential input voltage rating and damage the device. Even if damage does not occur, some input stages draw several tens of milliamps under these conditions, wasting even more power.

Grounding both inputs, or shorting them together at some other potential, also causes the output stage to saturate, since the offset voltage of an op-amp is never exactly zero; shorting them together and not biasing them has the same latch-up risks that we have already mentioned.

What we should do is connect the device as a follower (output to inverting input) and connect the non-inverting input to a potential somewhere between the supply rails. With a dual-supply system, ground is ideal, but connecting to the positive or negative supply of a single supply system will cause saturation and the resulting power waste if the offset voltage has the wrong polarity. The "potential somewhere between the supply rails" may be any point in the circuit with a suitable potential, since the loading caused by the op-amp input is minimal. For diagrams see the linked article.

Or you might use it as a buffer amplifier in a part of your system that does not need one but might perform slightly better if it had one.

What shall we do with the unused op-amp? (X3)
Early in the morning.

Hook-up as a buffer with a dc input, (X3)
Early in the morning.

To Learn More About Op-Amps as Comparators
http://designnews.hotims.com/23107-100

Have a question involving a perplexing or unusual analog problem? Submit your question to: raq@reedbusiness.com

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