

Rarely Asked Questions

Strange stories from the call logs of Analog Devices

Do Something with that Unused Pin!

Q: What should I do with the unused terminals of analog ICs?

A: Treat them with kindness and consideration—never ignore them.

According to Goethe, "An unused life is an early death."¹ Similarly, an unused pin on an analog IC may greatly increase the risk of its early death by electrostatic discharge (ESD). Although unused outputs may, and generally should, be left unconnected, it is usually best to connect unused inputs, both analog and digital, to a supply. The connection will usually be to the negative ground in a single-supply system and to the center rail in a dual-supply system—but there are important exceptions. As always, it is essential to RTFDS (Read The Friendly Data Sheet²) and do as it advises. If there is no mention of the topic, however, grounding is usually the best policy.

Unused amplifier inputs are one of the important exceptions. As we saw in RAQ Issue 46³, grounding an unused amplifier's inputs may increase its current consumption, so the best policy here, and often the only safe one, is to connect the amplifier as a buffer, tying the input to a potential somewhere between the supply rails.

CMOS switches and multiplexers are symmetrical devices; their signal input and output terminals are interchangeable, so unused ones should all be considered to be inputs, not outputs. Thus, they should all be grounded. The reasons for this were discussed in more detail in RAQ Issue 3.⁴

Internal pull-up or pull-down resistors connect an input to a positive supply (pull-up) or ground (pull-down). If an unused input



has one of these resistors, it is not necessary to make any connection to it. If the pin is tied down, however, it should be connected to the same supply as its resistor, as any other connection will cause current to flow in the resistor, wasting power (the wasted power is likely to be quite small, but any waste is to be avoided if possible).

It is particularly important to consider unused logic inputs, as some must be tied to Logic-1 when unused. Also some logic inputs have three states, not two, with the open circuit condition defined as a logic state. Such inputs may need to be left unconnected.

To summarize, considering the connection of unused IC pins is an important part of the analog circuit design process and must never be overlooked.

¹ Johann Wolfgang von Goethe - from his play "Iphigenie in Tauris" (1779).
² RAQ Issue 4 - "Caveat Emptor."
³ RAQ Issue 46 - "What shall we do with the Unused Op-Amp?"
⁴ RAQ Issue 3 - "Isolating the Key Detail (or Lunching With a Mermaid and Pickled Herring)."



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