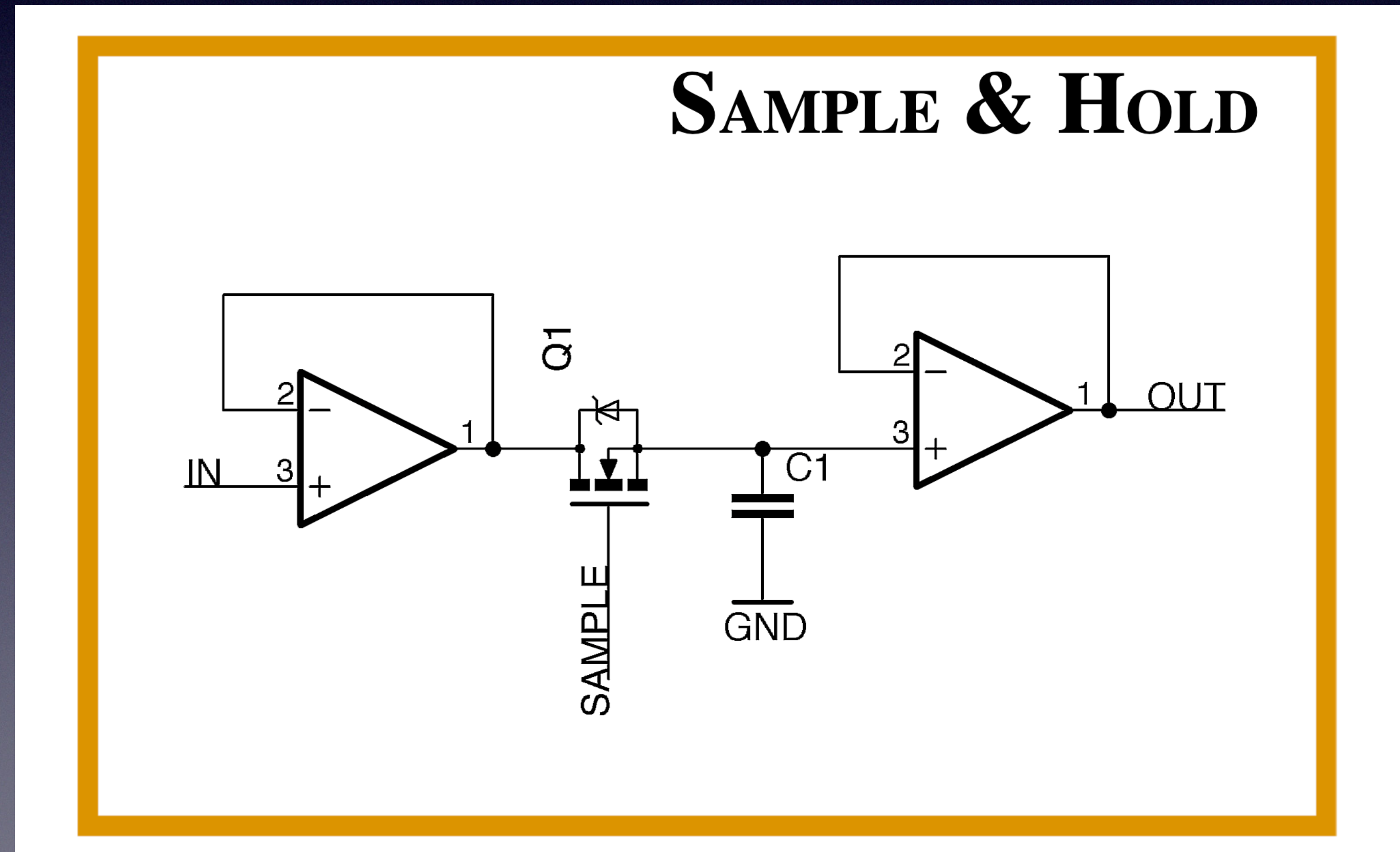# Sample and Hold

Joshua Laureles
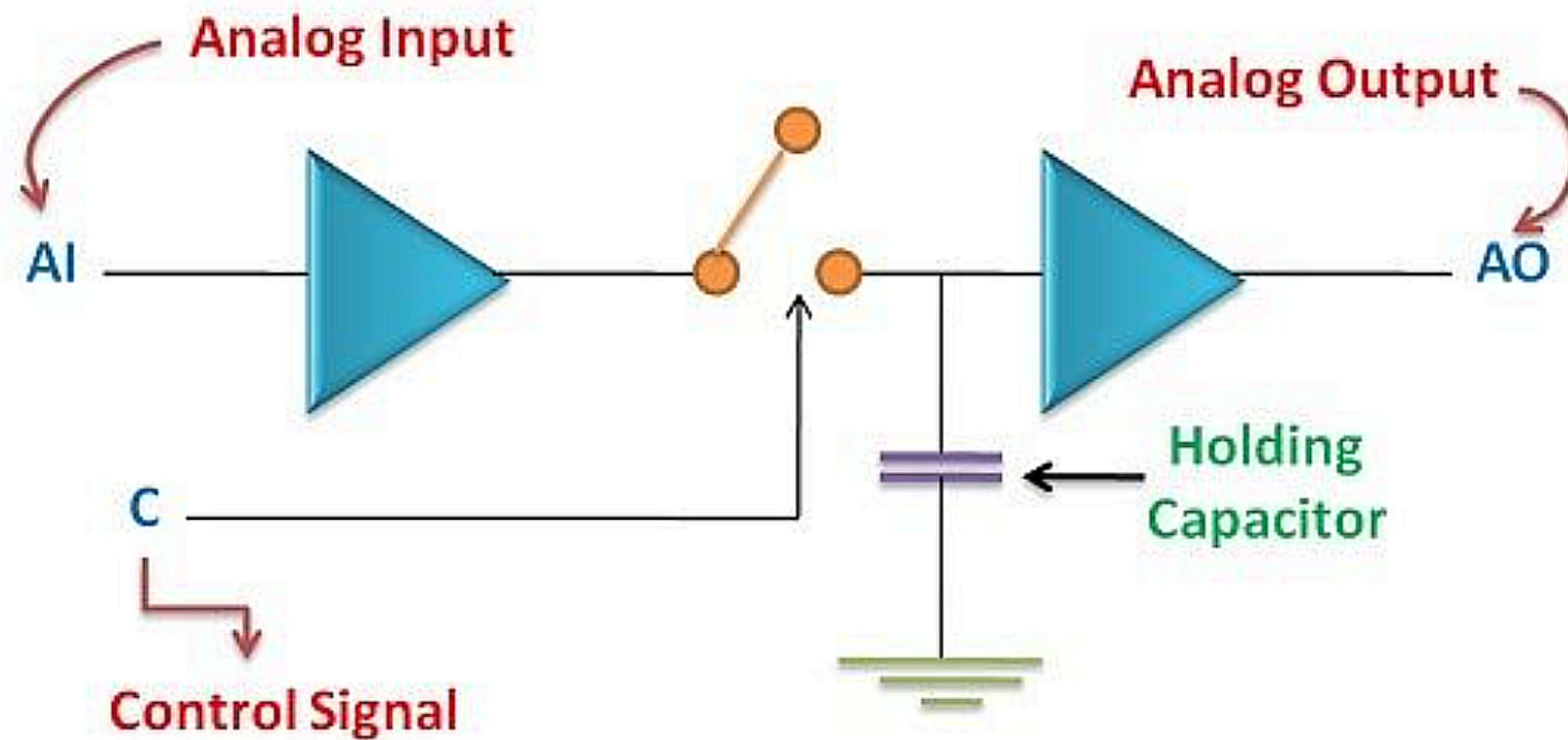
What is a sample and Hold circuit used for?

- The sample-and-hold circuit (track-and-hold circui)t perform the sampling operation. These circuits operate at the highest signal levels and speeds, which makes their design a challenge. The trade-off between noise, speed, distortion, and power requires a careful balance to achieve the optimum performance

- In a very basic sense, it is used to maintain a voltage or charge when a switch is turned off. It retains the charge, and allows whatever component is attached to the output to use the same amount of charge that was inputted

SAMPLE & HOLD

What are the main parts of sample and hold circuit?

- The sample and hold circuit is in essence a product of the capacitors which maintain the charge, yet there is always a leakage in some minimal way, so this device is constructed in such a way to minimize the leakage of current and to utilize the charge that was stored there to go into the necessary component by way of a switch. There are a multitude of ways that this switch can be activated and deactivated.The time during which sample and hold circuit generates the sample of the input signal is called **sampling time.** Similarly, the time duration of the circuit during which it holds the sampled value is called **holding time.**

Circuit diagram of Sample and Hold Circuit

Here is a basic diagram of a Sample and hold Circuit
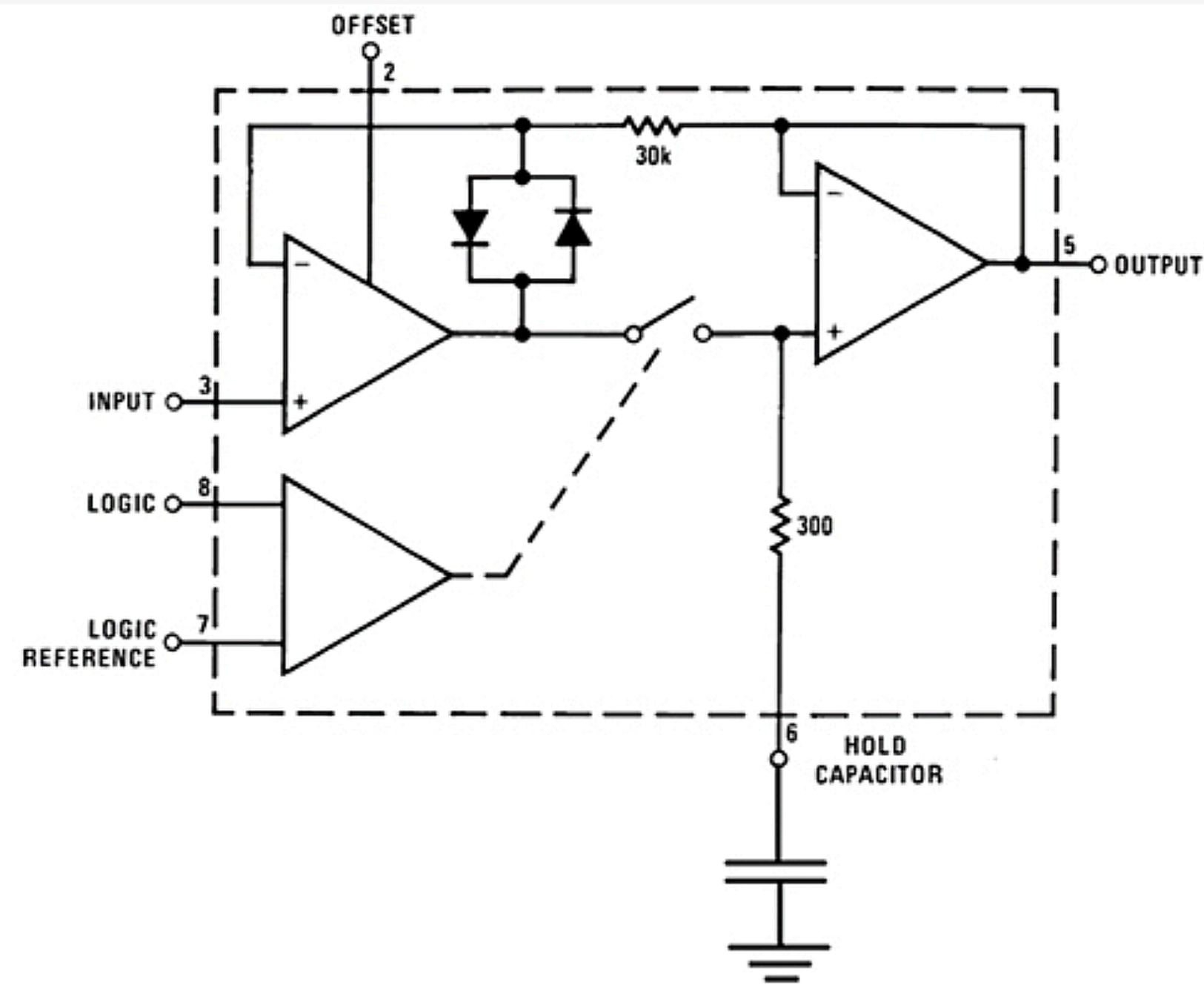
What are some Variations?

Figure 4: The block diagram of the Texas Instruments LF398MX/NOPB S&H shows the key components: a fast switch and an external hold capacitor. (Image source: Texas Instruments)
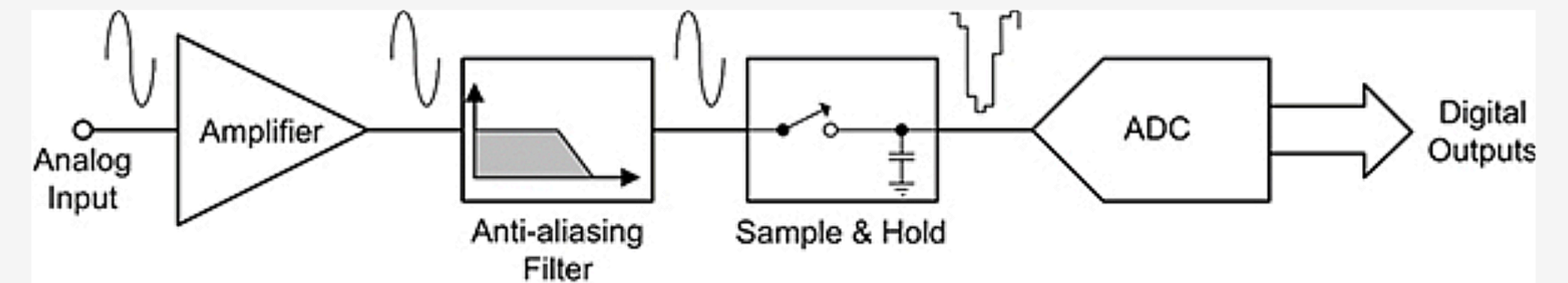

Figure 3: In the digitizer signal path, the S&H is placed between the anti-aliasing low-pass filter and the ADC. (Image source: DigiKey)

- In this case, S&H circuits are combined with ADC, amplifiers and Anti-aliasing filters in order to make the signal much more precise when dealing with immensely small intervals of time that have to be accounted for.

Advantages and disadvantages

- Important for moving a charge and signal from analogue to digital, minimizing interference

- Classic, simple concept that is a useful solution to basic implementations of electrical signal transference.

- By itself, doesn't always have the proper parameters in place to ensure a proper transference of signal, so additional components are required.

- Signal feedthrough — should be small during hold

- Speed — due to bandwidth and slew-rate limitations

- Droop rate — slow change during hold mode

- Aperture (or sampling) jitter — effective sampling time error in time; difficult in high-speed designs

Reference

What is Sample and Hold Circuit? - Circuit Diagram, Working & Applications. (2017, December 19). Electronics Coach. https://electronicscoach.com/sample-and-hold-circuit.html

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