



## FACULTY OF ENGINEERING & TECHNOLOGY

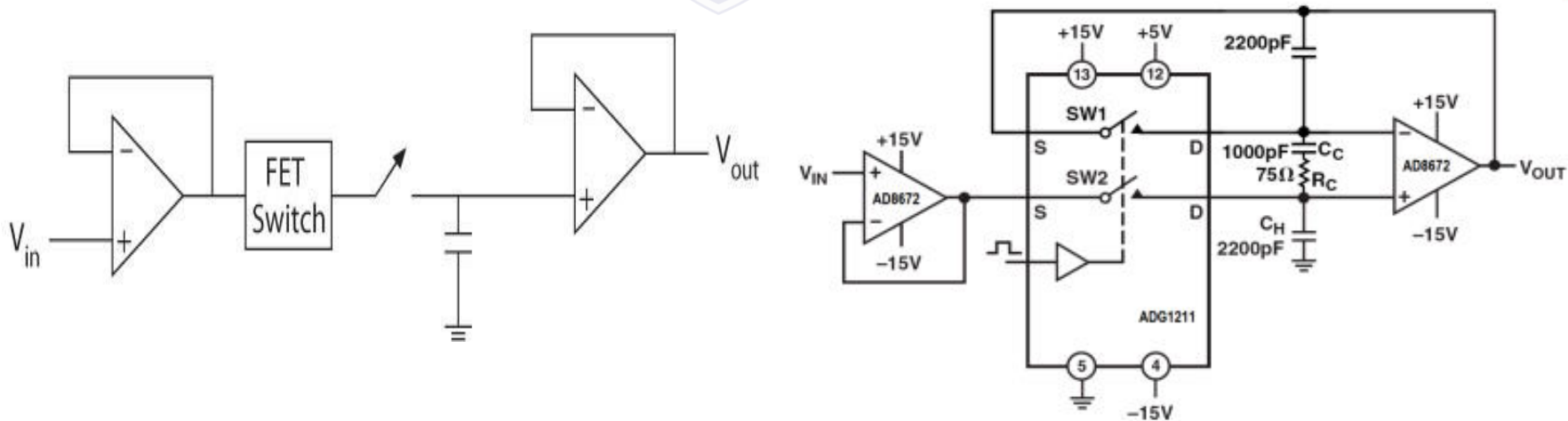
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# A/D & D/A CONVERTERS

## Sample and Hold Circuit

- If the input voltage to an A/D converter is variable, the digital output is likely to be unreliable and unstable. Therefore, the varying voltage source is connected to the ADC through a sample and hold circuit.
- Basic Operation:
  - When the switch is connected, it samples the input voltage.
- When the switch is open, it holds the sampled voltage by charging the capacitor.
- Acquisition time: time to charge the capacitor after the switch is open and settle the output.
- Conversion time: total time needed from the start of a conversion (turning on the MSB in the SAR) until the end of the conversion (turning on/off Bit0 in the SAR) - TAD: conversion time per bit.



# A/D & D/A CONVERTERS

- Example 1
  - Assumes the input analog voltage is changing between 0-5 V.
  - Using a 3-bit A/D converter draw the output as the input signal ramps from 0 to 5V.
  - Calculate the resolution.
  - What is the maximum possible voltage out? (this is called the full-scale output)
  - If the output is 1000 0000, what is the input?
- Example 2
  - Assumes the input analog voltage is changing between -5 to 5 V; using a 10-bit A/D converter.
  - Calculate the number of quantization levels.
  - Calculate the voltage resolution.

