A/D conversion

CPE 381 Foundations of Signals & Systems for Computer Engineers

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A/D conversion Background

- sampling analog signals
- fs > 2 B
- signal to noise ratio
- dynamic range

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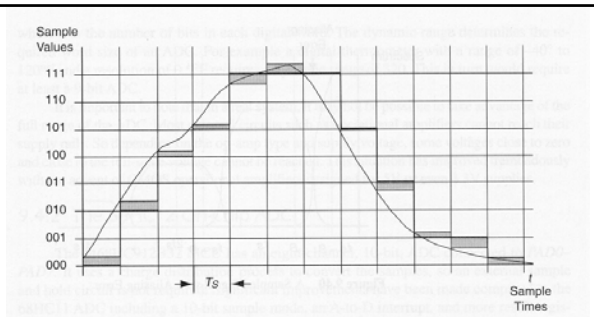

Figure 9.38 A-to-D Conversion Samples in the Time Domain

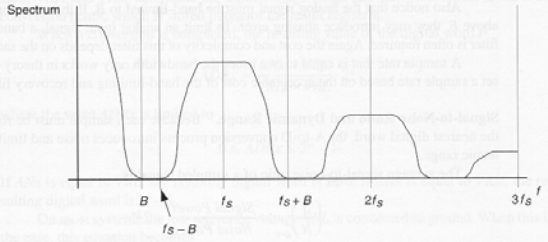

Figure 9.39 Frequency Spectrum of a Sampled Signal

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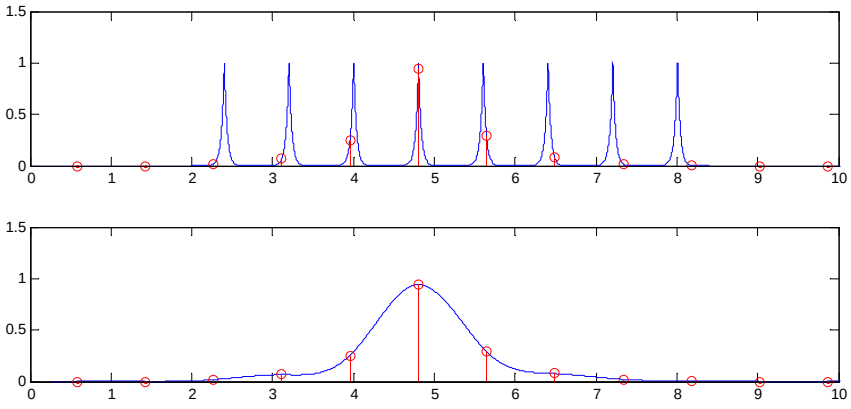
A/D conversion example



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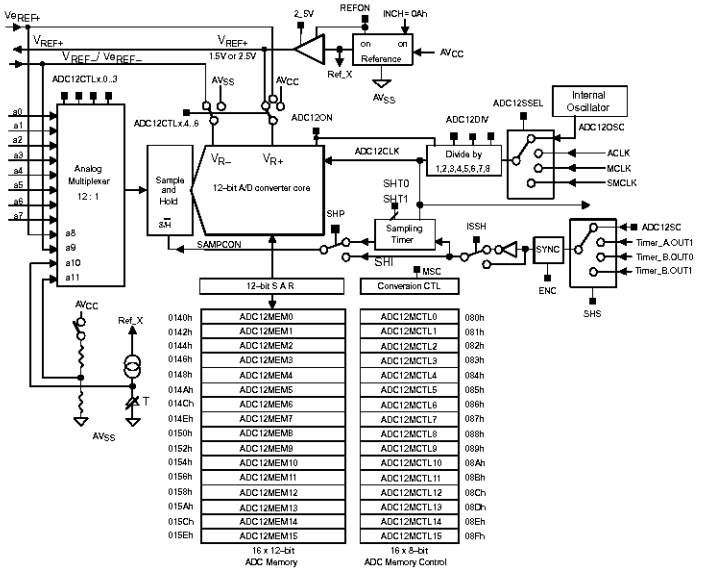
F149 AD converter block diagram

Figure 15–1. ADC12 Schematic



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F149 A/D converter

- 8 external inputs
- 4 internal inputs
  - Vref+
  - Vref-
  - Vcc
  - Temperature
- Conversion (CONSEQ)
  - Single channel
    - Single conversion
    - Multiple conversions
  - Sequence of channels
    - Single conversion
    - Multiple conversions
  - Sequence starts from CStartAdd in ADC12CTL1
- 200 ksps, on chip RC oscillator
- Sixteen storage registers for conversion results
- Separate power down

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AD conversion

- *n* – bit AD converter
  - range of values: 0 .. $2^n - 1$
- References V_{r+} and V_{r-}
- AD resolution $\Delta = \frac{range}{number\ of\ steps} = \frac{V_{r+} - V_{r-}}{2^n - 1}$
- AD converter output

$$N_{adc} = \frac{v_{in} - V_{r-}}{\Delta}$$

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F149 A/D converter #2

- 12-bit converter; values: 0 – 4095
- Nadc = 4095*(Vin-Vr-)/(Vr+-Vr-)
- 3 LSBs resolved resistively
  - 200 µA from the reference
  - possible problems with external reference
  - Vcc
  - Temperature
- Possible errors
  - Coupling (PCB techniques)
  - Leakage current
    - ± 50 nA (page 43 F149 datasheet)
  - Err=4.096*(leakage_curr[µA]*source_resistance[kΩ])/(Vr+-Vr-)
    - 10 KΩ source resistance with 1.5V reference gives 1.4LSB error
  - Input switching currents

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