Simultaneous Sampling
ADC: Options of Multi-Channel Sampling

- Simultaneous Sampling
- Multiplexed Inputs
- Multiple Devices...
Why Sample Simultaneously?

• Preservation of Phase Relationship
  – Speed/position Sensors
  – Vibration Analysis

• Relative Signals for various Equations
  – Power
  – Torque, etc.
Simultaneous Sampling Applications

AC/DC  Inverter

R  S  T

ADC  OPA350  TLV3501

ADC  OPA350  TLV3501

F28xx  REF32xx  TMP122

Texas Instruments
Examples of Simultaneous Sampling ADCs

- **2x2 SAR – 2 ADCs with 2 S/H each**
  - ADS7861, ADS8361
  - ADS7862
- **3x2 SAR – 2 ADCs with 3 S/H each**
  - ADS7864
- **1x6 SAR – 6 ADCs with 1 S/H each**
  - ADS8364, ADS8365
- **Pipeline 1x2, 1x4, 1x8,**
  - ADS62xx, ADS64xx
  - ADS528x
  - THS10xx, THS12xx
Multiplexed vs Separate Converters

• If one channel has very different needs than all the others:
  – Consider using a separate ADC for that channel, and mux the others

• Mutliplexing implies time delay between channels
  – is that acceptable? Or do you have to use simultaneous sampling?

• Individual ADCs/channel is great, but can the digital side handle it?
  – And can you match the analog, if necessary?
Multiplexed Inputs

Settling time and maximum conversion speed/channel

The digital filter requires time for an instantaneous change to propagate to the output and settles when the input channels switches.

E.g. for ADS1605 allow 47 DRDY cycles \( t_{12} \) for output data to fully settle to 0.001% if \( F_{\text{CLK}} \) of 40MHz is applied before reading. Note, SAR-converters are usually quicker as they have the filter in front of the multiplexer.
2x2 SAR (ADS7861, ADS7862, ADS8361)
500kSPS, 12/16-Bit, 2-channel

Diagram showing the components and connections of the 2x2 SAR ADCs (ADS7861, ADS7862, ADS8361). The diagram includes labels for channels (CH A0+, CH A0D, CH A1+, CH A1D, CH B0+, CH B0D, CH B1+, CH B1D), reference inputs (REFIN, REFOUT), SAR, CDAC, SHA, COMP, and various control signals (M0, M1, A0, A1, CLOCK, CS, RD, BUSY, CONVST). The diagram also shows the internal 2.5V reference.
1x6 SAR (ADS8364, ADS8365)
250kSPS, 16-Bit, 6-channel

Diagram showing the block diagram of the 1x6 SAR with 6-channel inputs and 16-bit output, including components such as CDAC, SAR, SH Amp, and other control signals like ADDR, WR, RD, FD, and FIFO Register 8x.
2/4x1 pipeline (ADS62xx/64xx)
12/14-Bit, 65/80/105/125, 2/4-channel
8x1 pipeline (ADS5281/82)
12-bit, 50/65 MSPS, 8-channel