Setting up the ADC
Analog-to-digital converter (ADC)
Chapter 11 – Ref. Manual

Updated: 4/9/18
Basics

- The 12-bit ADC is a successive approximation analog-to-digital converter.
- It has up to 19 multiplexed channels allowing it to measure signals from 16 external sources, two internal sources, and the VBAT channel.
- The A/D conversion of the channels can be performed in single, continuous, scan or discontinuous mode.
  - Single and continuous conversion modes
  - Scan mode for automatic conversion of channel 0 to channel ‘n’
- The result of the ADC is stored into a left or right-aligned 16-bit data register.
ADC Registers

Setting ADC_CR2 register (for a regular channel only)

Find the registers in the ref. manual and read about them!

The converted data are stored into the 16-bit ADC_DR register
Channel Selection

- There are 16 multiplexed channels.
- It is possible to organize the conversions in two groups: **regular and injected**.
- A **group** consists of a sequence of conversions that can be done on any channel and in any order. For instance, it is possible to implement the conversion sequence in the following order: ADC_IN3, ADC_IN8, ADC_IN2, ADC_IN2, ADC_IN0, ADC_IN2, ADC_IN2, ADC_IN15.
- A **regular group** is composed of up to 16 conversions. The regular channels and their order in the conversion sequence must be selected in the ADC_SQRx registers.
  - The total number of conversions in the regular group must be written in the L[3:0] bits in the ADC_SQR1 register.
- An **injected group** is composed of up to 4 conversions. The injected channels and their order in the conversion sequence must be selected in the ADC_JSQR register.
  - The conversion is done on one channel in each group at a time.
ADC: Regular vs injected
Ax IS ANALOG/ Dx IS DIGITAL

AN0 = PA0
ADC Mode

Single Channel, Single Conversion Mode
- CONT in ADC_CR2 = 0
- SCAN in ADC_CR2 = 0

Single Channel, Continuous Conversion Mode
- CONT in ADC_CR2 = 1
- SCAN in ADC_CR2 = 0

Scan Mode with Single Conversion
- SCAN in ADC_CR2 = 1
- CONT in ADC_CR2 = 0

Scan Mode with Continuous Conversion
- SCAN in ADC_CR2 = 1
- CONT in ADC_CR2 = 1
ADC Mode

- Channels are selected by ADC_SQRx registers for regular channels, and by ADC_JSQR register for injected channel.

- All channels in a regular group share the same result register ADC_DR. Make sure to read data between consecutive sampling.

Scan Mode with Single Conversion
- SCAN in ADC_CR2 = 1
- CONT in ADC_CR2 = 0

Scan Mode with Continuous Conversion
- SCAN in ADC_CR2 = 1
- CONT in ADC_CR2 = 1
ADC Mode

**Regular channel:**
1. Set SWSTART in ADC_CR2
2. The channel is selected by SQ1[4:0] in SQR5
3. Result is stored in ADC_DR
4. EOC is set after conversion
5. Interrupt is generated if EOCIE is set

**Injected channel:**
1. Set JSWSTART in ADC_CR2
2. The channel is selected by JSQ1[4:0] in JSQR
3. Result is stored in ADC_JDR1
4. JEOC is set after conversion
5. Interrupt is generated if JEOCIE is set
Data Alignment

Right alignment for a regular channel:

- 6 bits: 00000000
- 8 bits: 00000000 0000
- 10 bits: 00000000 0000 0000
- 12 bits: 00000000 0000 0000 0000

Right alignment for an injected channel:

- 6 bits: Sign Ext [9:0] XXXXXX
- 8 bits: Sign Ext [7:0] XXXXXX
- 10 bits: Sign Ext [5:0] XXXXXX
- 12 bits: Sign Ext [3:0] XXXXXX

Left alignment for a regular channel:

- 6 bits: 00000000 XX
- 8 bits: 00000000 000000
- 10 bits: 00000000 000000 0000
- 12 bits: 00000000 000000 0000 0000

Left alignment for an injected channel:

- 6 bits: Sign Ext [8:0] XXXXXX
- 8 bits: Sign Ext [7:0] 00000000
- 10 bits: Sign Ext [5:0] 00000000
- 12 bits: Sign Ext [3:0] 00000000 0000

S = Sign bit