



MMS – MCD
Application Team

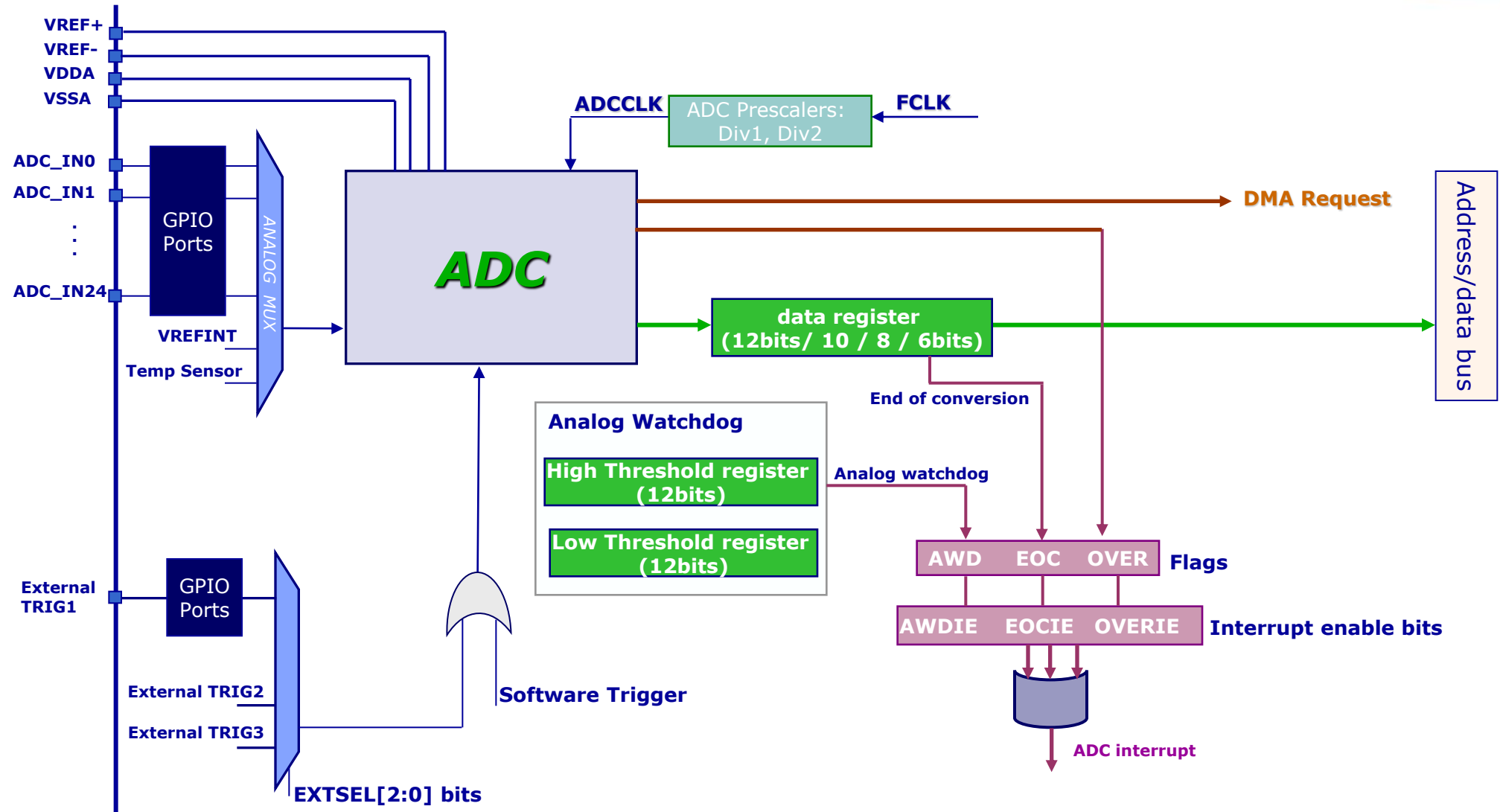
STM8L Training Slides

Analog-to-Digital Converter (ADC)

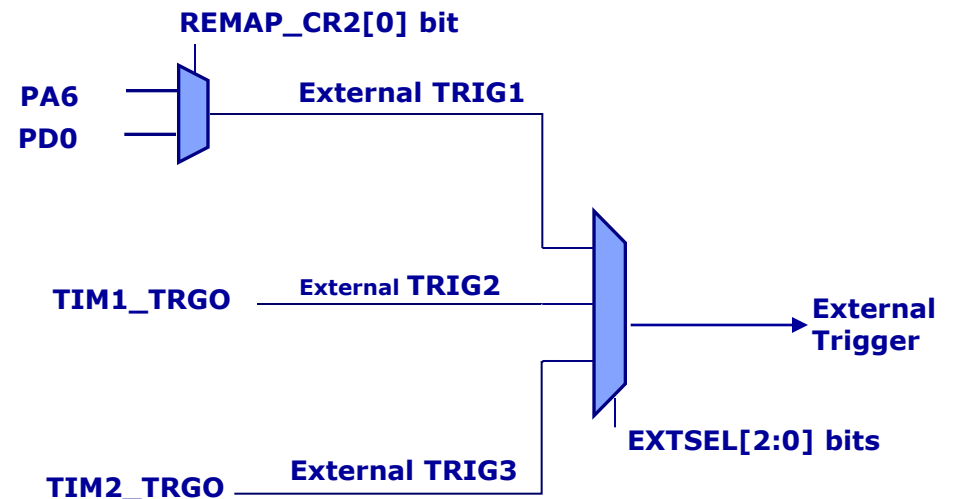
- ADC conversion time up to $1\mu\text{s}$ (@ SYSCLK 16MHz) with up to 12-bit resolution
- Voltage range: 1.8 V to 3.6 V
 - Maximum conversion rate obtained from 2.4 V to 3.6 V
 - ADC at a lower speed between 1.8 V and 2.4 V
 - ADC functionality not guaranteed below 1.8 V
- ADC input range: $V_{\text{REF-}} \leq V_{\text{IN}} \leq V_{\text{REF+}}$
- Up to 27 multiplexed channels:
 - 25 external channels: from Channel 0 to Channel 24 (connected from pads ADC1_IN0 to ADC1_IN24)
 - 2 internal channels:
 - Internal Reference Voltage (V_{REFINT})
 - Temperature sensor (TS) output
- 2 Channels conversion groups :
 - 24 slow channels: Channel 0 to Channel 23
 - 3 fast channels: channel 24, Channel V_{REFINT} and Channel TS

- DMA capability
- Single and continuous conversion modes
- Multiple channel conversion (scan mode using DMA)
- External trigger option for conversion (ext. pins, timers)
- Programmable sampling time – independently for fast group and slow group
- Right data alignment with inbuilt data coherency
- Analog watchdog – high and low thresholds
- Interrupt generation on:
 - End of Conversion
 - Analog watchdog

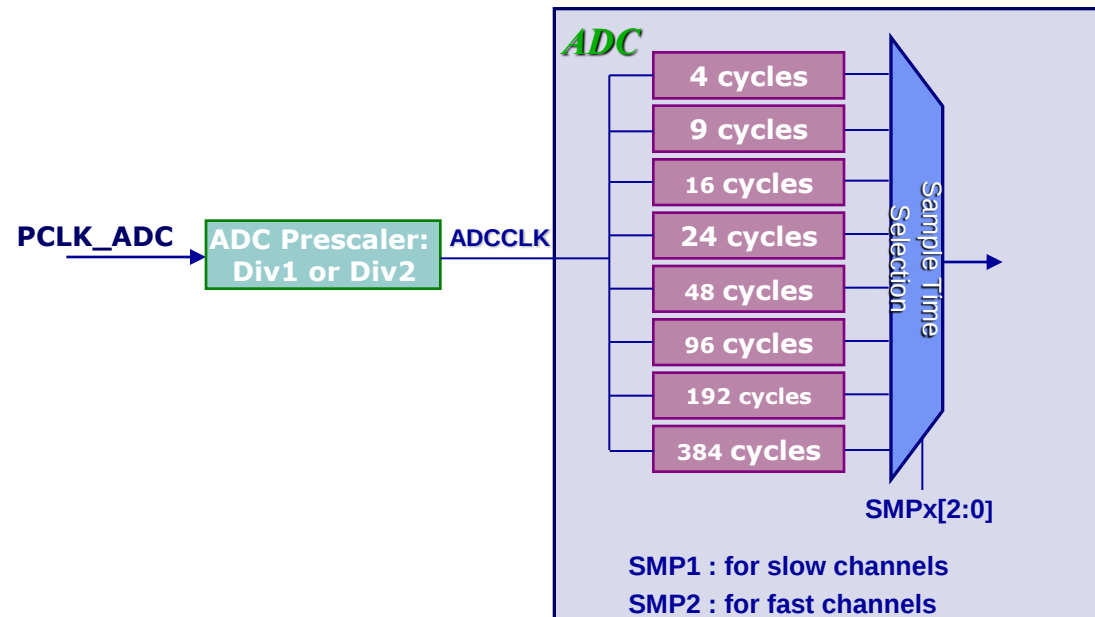
ADC Block Diagram



- Programmable number of channels: Up to 27 channels
- Programmable sample time and conversion sequence
- Conversion started by:
 - Software through start bit
 - External trigger generated by:
 - TIM 1 TRGO
 - TIM 2 TRGO
 - PD0 or PA6 pins

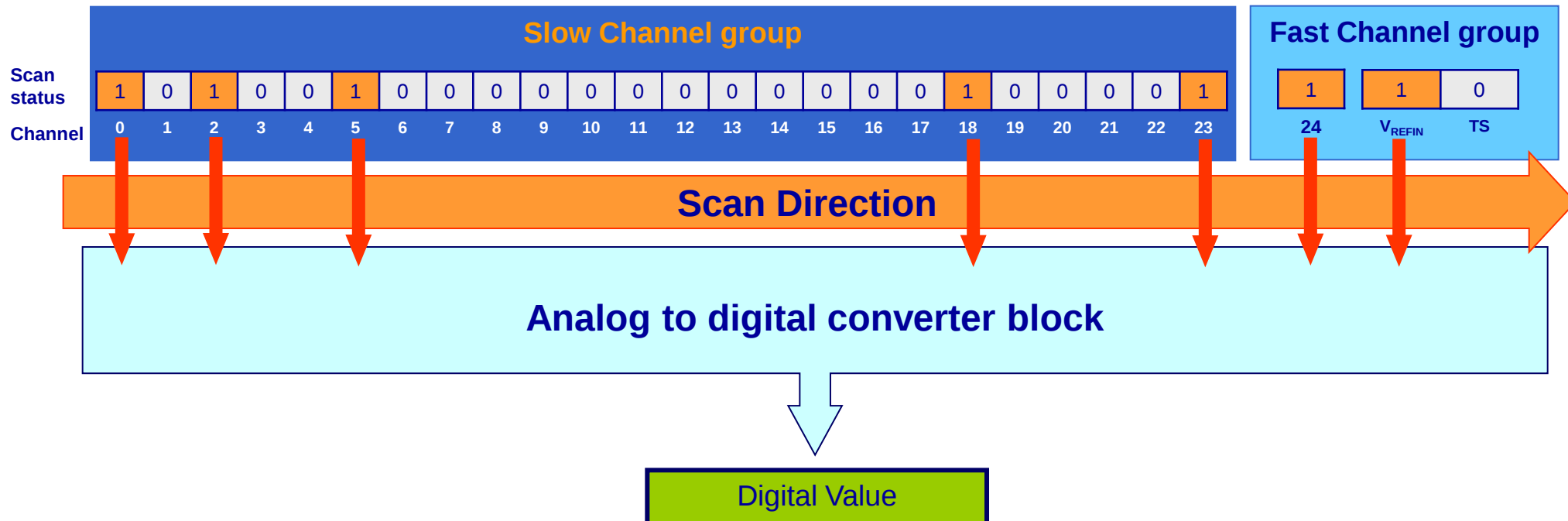


- PADC_CLK, up to 16MHz, taken from SYSCLK through a prescaler (/1, /2, /4, /8, /16, /32, /64 or /128)
- ADCCLK taken from PADC_CLK through a prescaler (/1 or /2)
- Programmable sample time cycles for each Group of channels:

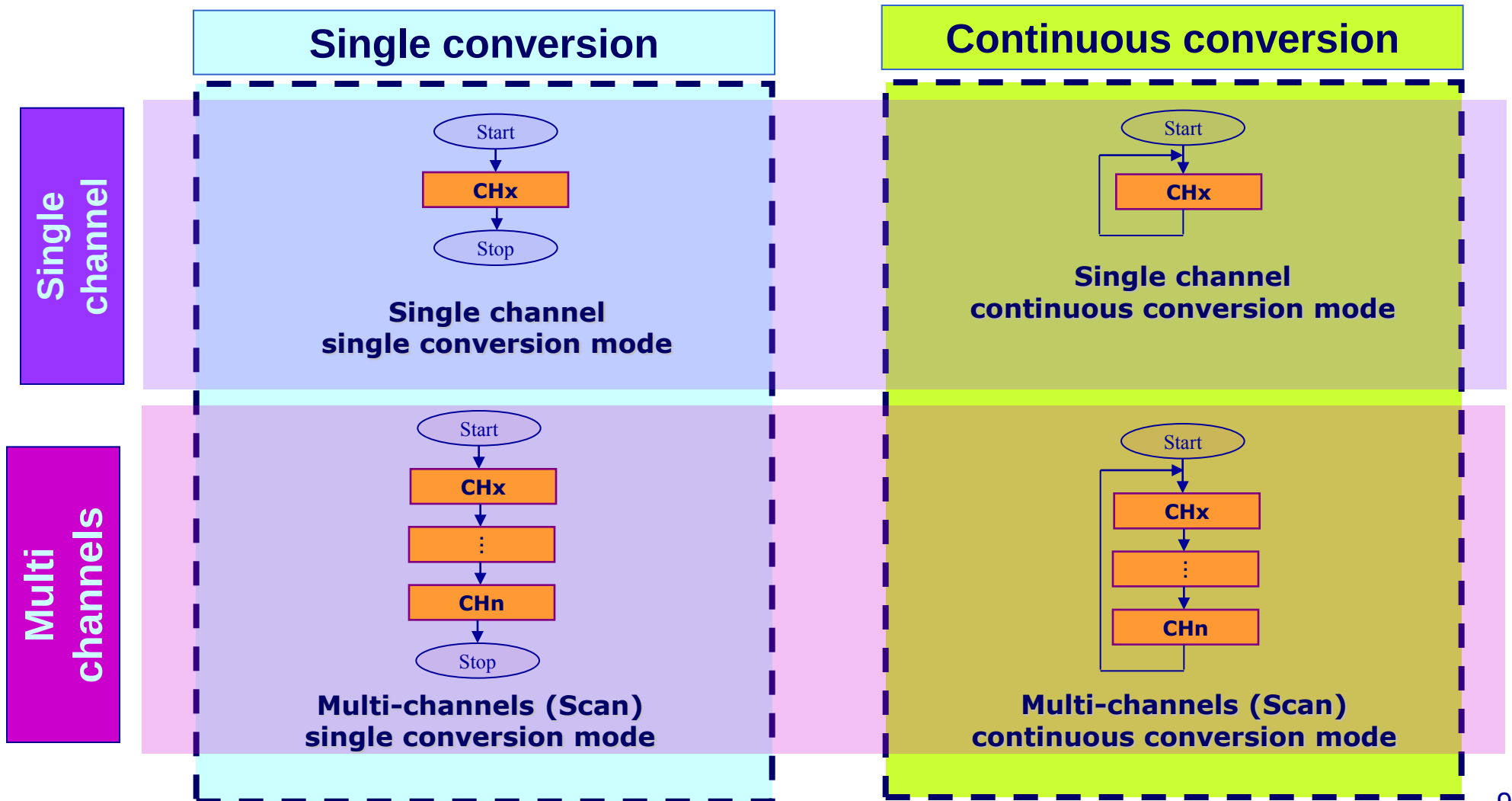


- Up to 27 conversions (with different sampling time - group by group).

Example: - Conversion of channels: 0; 2; 5; 18; 23; 24; V_{REFINT} .

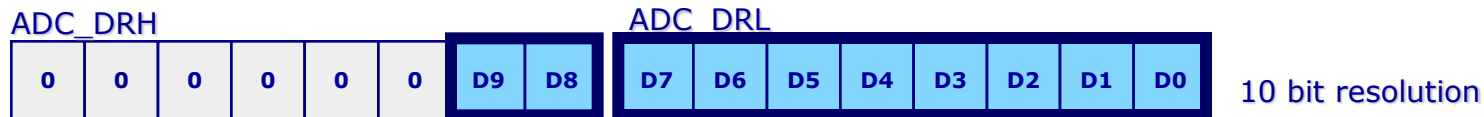
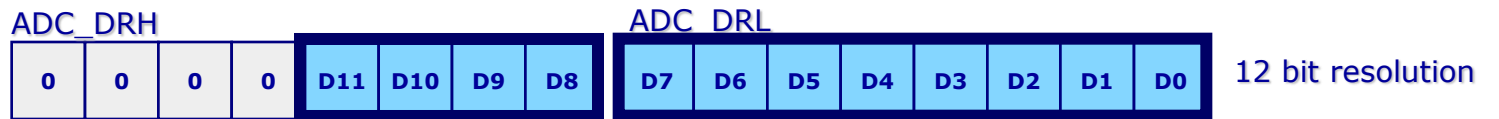


- Four conversion modes are available:

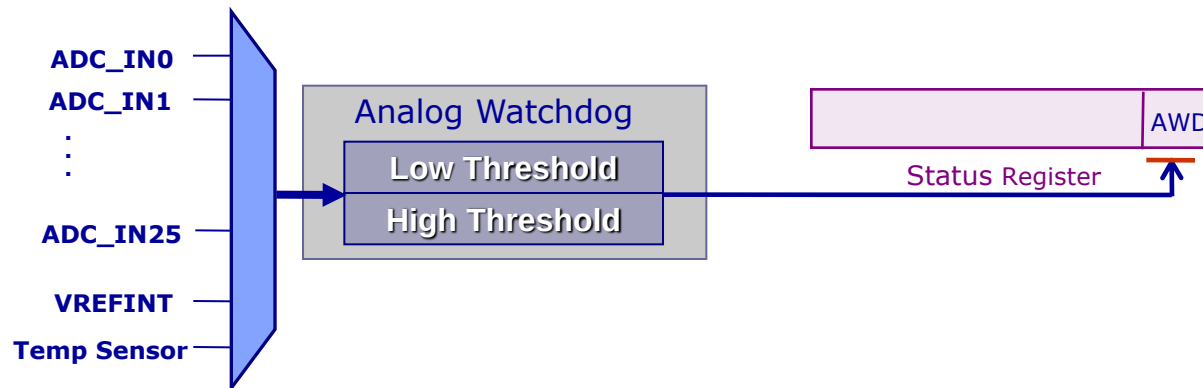


- selectable resolution to 6, 8, 10 or 12 bits
 - by reducing the resolution, the time conversion is also reduced

Right alignment

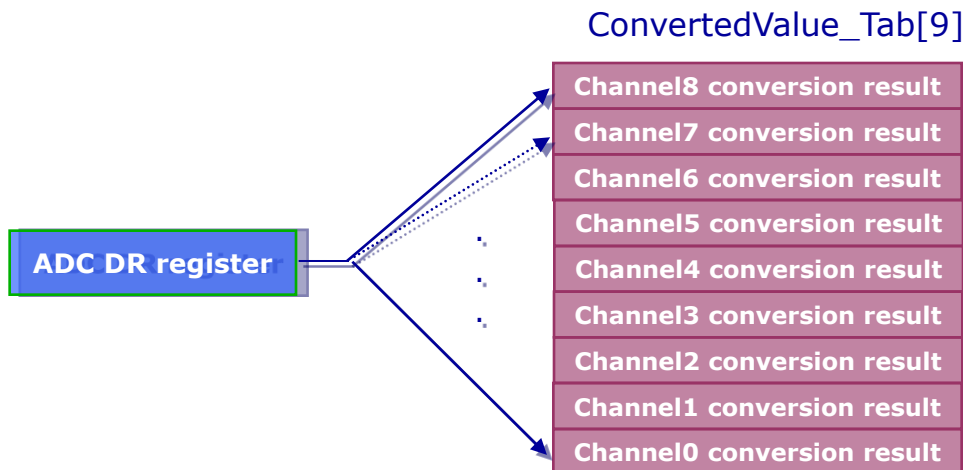


- 12-bit programmable analog watchdog low and high thresholds
- Selectable channel controlled by the analog watchdog
- Interrupt generation on low or high thresholds detection



- **Schmitt trigger disabling feature**
- Schmitt trigger can be disabled to reduce the consumption of some pins used as analog inputs
- As there are 2 internal channels, only 25 Schmitt triggers can be disabled.

- When a scan conversion is performed, as soon as an end of conversion is detected, the DMA ADC request is sent, informing that there is a data ready to be transferred.
- If a new conversion is completed and the DMA has not complete the transfer of previous conversion data, the overrun flag is risen and an interrupt is generated (if enabled).



Example:

- Conversion of channels: 0, 1, 2, 3, 4, 5, 6, 7 and 8
- Convert data stored in ConvertedValue_Tab[9]
- DMA transfer enabled (destination address auto incremented)

Note: EOC flag cleared at end of channels conversion due to DMA access to ADC DR register

- How many ADC channels are in the STM8L15x microcontroller ?

- How many channels groups are in the STM8L15x microcontroller ?

- How many channels could be guarded by the analog watchdog?

- What are the different conversion modes supported by the ADC?

- What are the interrupts requests of the ADC?

- How can we reduce ADC consumption?

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