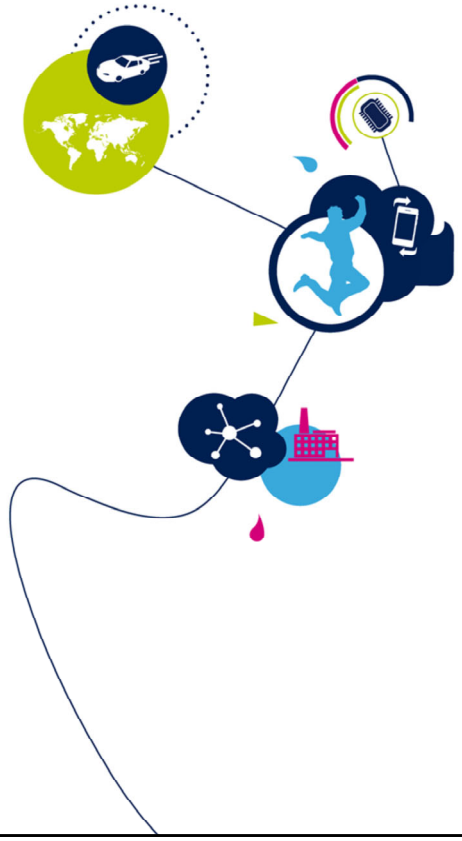
STM32WB - VREFBUF

Voltage Reference Buffer

Revision 1.0



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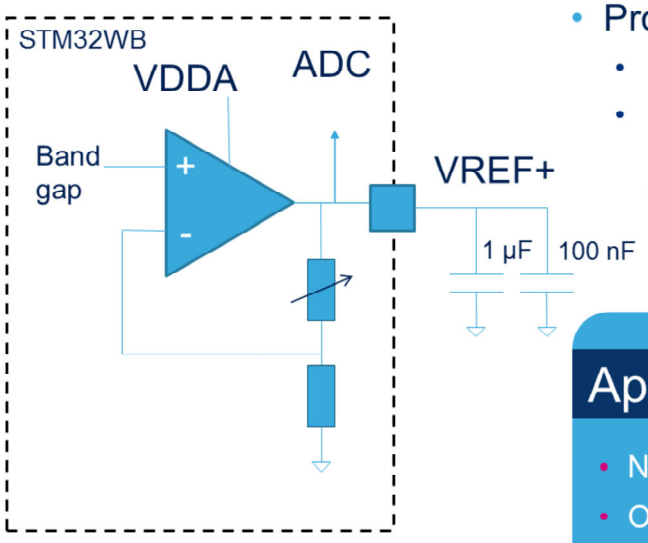
Hello, and welcome to this presentation of the STM32 Voltage Reference buffer. It covers the main features of this block, which creates an on-chip reference voltage.

Overview



- Provides an analog reference voltage
  - 2.5 / 2.048 V reference voltage for ADC
  - Can provide reference voltage and support external load up to 4 mA with low quiescent current.

Application benefits

- Not necessary to have external reference voltage IC.
- On-chip VREF generator provides VDDA-independent reference voltage.

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The VREF buffer embedded into STM32WB microcontrollers provides a stable voltage based on an internal bandgap reference for use by the analog-to-digital converter. Its output voltage is programmable to 2.5 or 2.048 V. This output voltage can also support external loads up to 4 mA. External bulk and bypass capacitors are required when the internal VREF buffer is used.
Applications can benefit from this on-chip voltage reference as it eliminates the need for an expensive, external standalone reference voltage IC. For space-constrained systems, it is common to use the analog supply as the reference voltage. By using this VREF buffer instead, it can create a stable voltage even if the analog supply is changing, for example when the VDDA supply comes from a battery output.

Low-power modes

Mode	Description
Run	Active.
Sleep	Active
Low-power run	Active.
Low-power sleep	Active.
Stop 0/Stop 1	Active.
Stop 2	Not available. Peripheral registers content is kept.
Standby	Powered-down. The peripheral must be reinitialized after exiting Standby mode.
Shutdown	Powered-down. The peripheral must be reinitialized after exiting Shutdown mode.

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The VREF Buffer is active in the following power modes: Run, Sleep, Low-power run, Low-power sleep, STOP 0 and STOP 1 modes.
In Stop 2 mode, the VREF Buffer is not available, but the contents of its registers are preserved. In Standby and Shutdown modes, the VREF buffer is powered-down and it must be reinitialized after waking up from these modes.

Performance

Symbol	Condition	Typical	Unit
V_{DDA}	V_{REF} = 2.048	2.4~3.6	V
	V_{REF} = 2.5	2.8~3.6	V
$V_{REF\_OUT\_ERROR}$	V_{REF} = 2.048	-2 / +1	mV
	V_{REF} = 2.5	-2 / +2	mV
I_{load}	Max. load current	4	mA
I_{VDDA}	I_{LOAD} = 0 µA	16	µA
	I_{LOAD} = 50 µA	18	µA
	I_{LOAD} = 4 mA	35	µA
PSRR	DC	60	dB
t_{start_up}	C_{LOAD} = 1 µF	500	µs

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This table shows some performance parameters for the VREF buffer. The VREF buffer can work from 2.4 to 3.6 V for a 2.048 V output, and 2.8 to 3.6 V for a 2.5 V output. The quiescent current is very small even with a 4 mA output current. It is possible to disable the VREF buffer when it is not being used. It can be available again 500 micro seconds after it is re-enabled.

Related peripherals

- Refer to these trainings linked to this peripheral, for more information
  - Analog-to-digital converter (ADC)

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The STM32WB's analog-to-digital converter uses this VREF Buffer output. Please refer to training modules for these peripheral for additional information.