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STM32G4 series

Enabling advanced mixed-signed applications

The STM32 portfolio

Five product categories

- **Wireless MCU** — Short- and long-range connectivity
- **Ultra-low-power MCU**
- **Mainstream MCU**
- **High-performance MCU**

32-bit general-purpose microcontrollers: from 75 to 3,224 CoreMark score

- **Embedded MPU** — 32- and 64-bit microprocessors





Enabling edge AI solutions

Scalable security

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MPU portfolio

MCU portfolio

STM32G4 series

Ideal for applications requiring advanced analog peripherals

Control applications (motor control…)

Industrial equipment

Instrumentation and measurement

Digital power

- Digital SMPS (switch mode power supply)
- PFC (power factor correction)

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STM32G4 series for mixed-signal applications

Performance

170 MHz Arm® Cortex®-M4 combined with three accelerators
213 DMIPS and 569 CoreMark results

Rich integrated analog & digital peripherals

5 x 12-bit ADCs 4 Msps with 16-bit hardware oversampling
CAN-FD (flexible data rate – 8 Msps bit rate)
DACs, op amps, comparators

Safety and security focus

SIL and CLASS-B safety packages, including a self-test library
Arm® PSA Level 1 logical security certification

A wide offering

MCUs with 32 to 512 Kbytes of flash memory
Available in 32- to 128-pin packages
Support from -40 up to 125°C temperature

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Measurement and control

High performance
Arm® Cortex®-M4 + FPU running @ 170MHz
+ 3x accelerators: ART, routine booster (CCM),
Math. accelerator (Cordic and FMAC)

7x comparators
Down to 19 ns propagation delay

5 x ADC
5x12-bit, 16-bit oversampling
4 MSPS (0.25µs)

7 x DAC
12-bit DAC 15 Msps

Motor control timer & high-resolution Timer (D-Power)
12 channels up to 184 ps resolution

STM32G4

Security
Arm PSA Level 1 logical security certification

STM32 Trust

USB Type-C® Power Delivery

High robustness
Highly immune to fast transients
Robust IOs against negative injections

Functional Safety
SIL and CLASSB Safety Packages, including
Self-Test Library

FD CAN
Up to 3 instances
Payload bit rate 8 times bigger than standard CAN

High temperature
from -40°C up to + **125°C**

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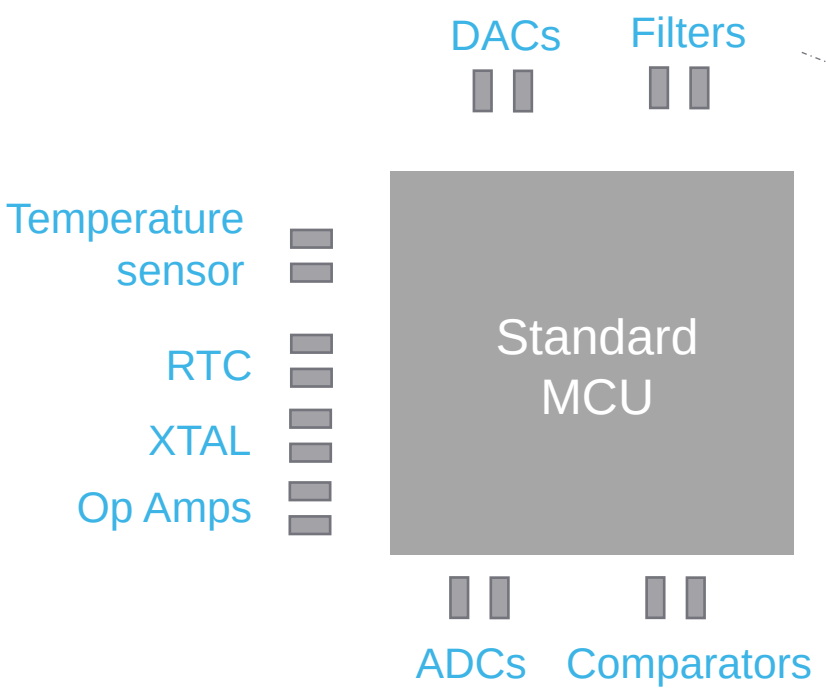
Reducing PCB size and BOM cost



Smaller package
Fewer additional components
All analog peripherals included

STM32**G4**

Project cost $$$

Project cost $

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STM32G4 builds on the STM32F3 MCU series

STM32**F3**

Increased robustness, safety, and security

- EMC (EMI, EMS) → continuous improvement
- **Dual Bank** flash memory with ECC (Live firmware upgrade)
- Hardware encryption AES
- **Securable memory area**

Gain in performance

- **170 MHz** even from internal oscill. (**213 DMIPS**)
  1. ART Accelerator (~dynamic cache)
  2. CCM-SRAM routine booster (~static cache)
  3. **Mathematical accelerator** (Trigo, Filtering)
- Better dynamic power consumption (160µA/Mhz) = ~2.7 times lower than F3 series

Extended peripheral set and architecture

- **1%** RC accuracy [-5°..90°C], 2% full range
- ADC with **hardware oversampling = 16-bit** res.
- Renewed op-amp, DAC, Comparator
- New HR timer features (digital part)
- MC timer improvements (encoder mode…)
- USB Type-C® with Power Delivery incl. PHY
- CAN FD (flexible data-rate)
- Ta: 85° up to **125°C** (limited conditions)

STM32F3 portfolio extension

- D-Power portfolio (STM32F334) extension
- **NEW 80-pin** and **128-pin** packages (LQFP)

STM32**G4**

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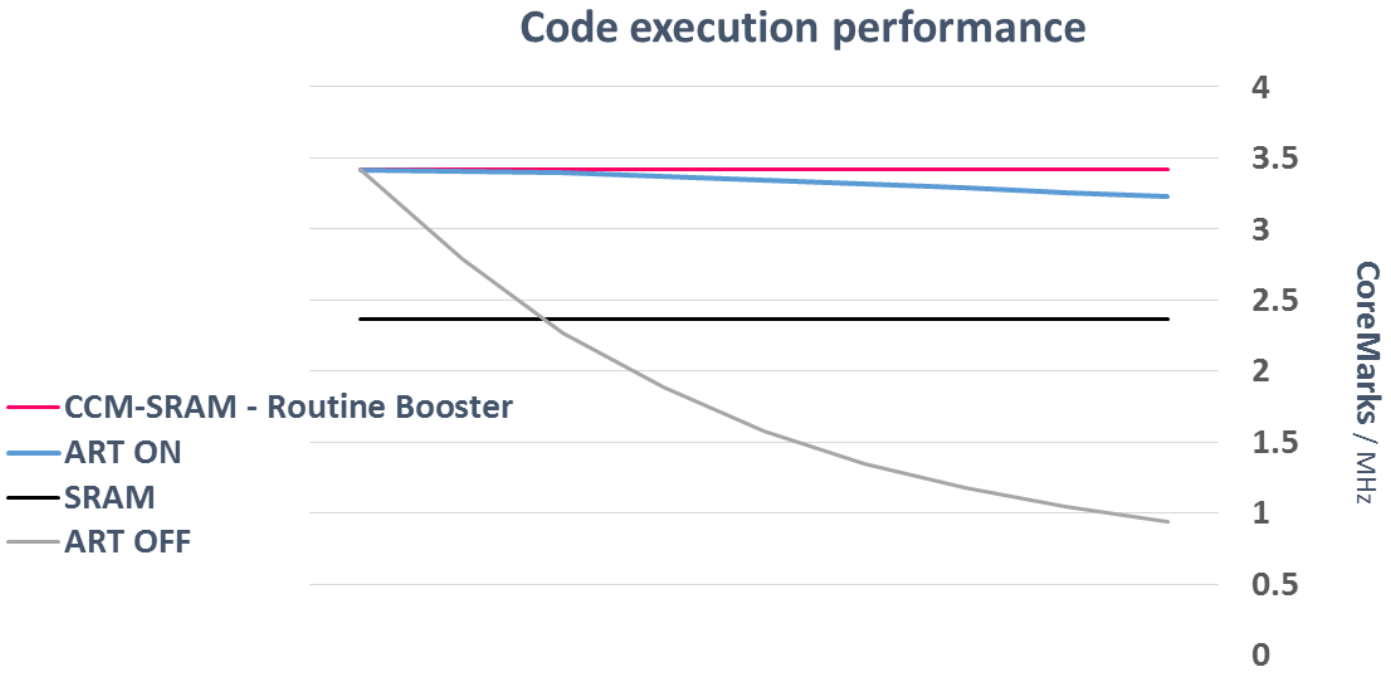
Greater performance

170 MHz CPU performance (Arm® Cortex®-M4) with three accelerators



Number of Wait States	0	1	2	3	4
CPU Clock (MHz)	34	68	102	136	170

Arm® Cortex®-M4 with **FPU**

Up to 170 MHz CPU frequency

Up to 213 DMIPS and 569 CoreMark® results

3 different **hardware accelerators**:

- **ART Accelerator** (~dynamic cache) → full code acceleration (average)
- **Routine booster** CCM-SRAM (~static cache) → determinism preserved
- **Mathematical** (Cordic + FMAC)

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Mathematical accelerators

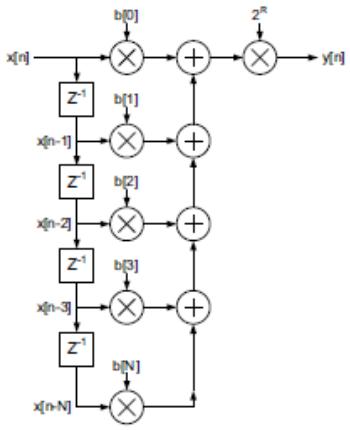
Function acceleration and CPU offload

1. **Cordic (Trigo)**
   - Very helpful for field oriented motor control method (FOC)

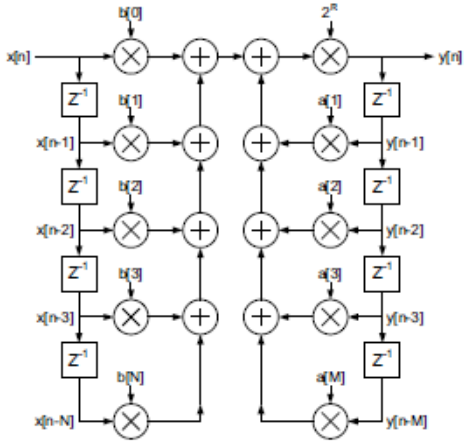
- Vector rotation (polar to rectangular): Sin, Cos
- Vector translation (rectangular to polar): Atan2, modulus
- Sinh, Cosh, Exp
- Atan, Atanh
- Square root
- Ln

2. **Filter math accelerator (FMAC)**
   - Can be used to create
     - 3p3z compensator (→ digital power)
     - Sigma Delta modulator
     - Noise shaper

FIR filter



IIR filter



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Rich, advanced analog peripherals

Mixed-signal SoC for a wide variety of applications

ADC (up to 5)	Values
Topology	**SAR 12-bit** + hardware oversampling → **16-bit**
Sampling rate	Up to **4 Msps**
Input	Single-ended and differential
Offset and Gain compensation	Auto calibration to reduce gain and offset

DAC (up to 7)	Values
Sampling rate	**15 Msps** (internal) 1 Msps (from buffered output)
Settling time	16 ns

Op-Amp (up to 6)	Values
GBW	**13 MHz**
Slew rate	**45 V/µs**
Offset	3 mV over full T° range 1.5 mV @ 25°C
PGA Gain (accuracy)	2, 4, 8, 16, -1, -3, -7, -15 **(1%)** 32, 64, -31, -63 (2%)

Comparator (up to 7)	Values
Power supply	1.62 .. 3.6 V
Propagation delay	**16.7 ns**
Offset	-6 .. +2 mV
Hysteresis	8 steps: 0, 9, 18, 27, 36, 45, 54, 63 mV

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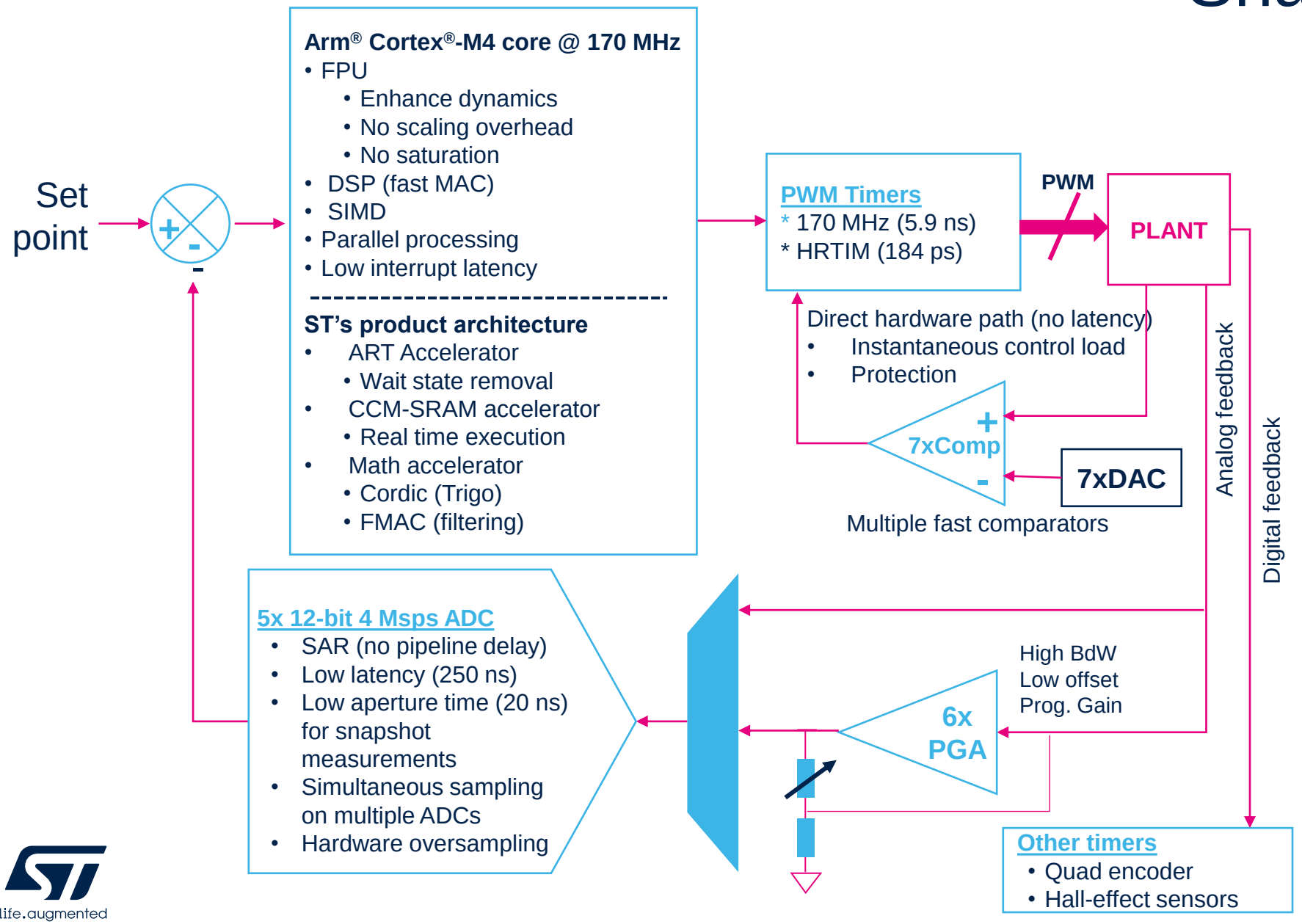
Shaped for control



Easy use of the analog and digital resources thanks to high peripheral interconnect and flexible bus matrix

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Key features for targeted applications

- Fast CPU 170 MHz
- Mathematical accelerator (Cordic)
- Advanced Motor Control timers
- Fast comparators
- 4 Msps ADC-12bit + hardware oversampling
- Op-Amp with built-in gain (PGA)
- DAC-12bit
- 1% RC accuracy (UART communication w/o external Xtal)

Motor Control

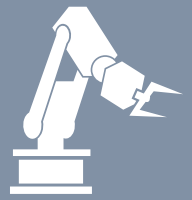
Home appliances, e-bikes, air conditioning

High-end consumer

Rechargeable devices, drones, toys

- Low-thickness, small form-factor
- Low consumption in run mode ~ 160 µA/MHz
- Embedded analog
- SAI (Serial Audio Interface)
- USB Type-C® Power Delivery 3.0

- Fast CPU 170 MHz
- Mathematical accelerator (Cordic)
- High temperature 125°C
- CAN FD support
- SPI, USART, I²C
- Advanced timers
- Real-time clock with backup registers
- Dual bank flash for live upgrade
- AES & security



Industrial devices

Industrial equipment

Digital power

Servers, telecom, EV charging stations

- Fast CPU 170 MHz
- Mathematical accelerator (Filtering)
- 12ch high-resolution timer (184 ps)
- 4 Msps ADC-12bit + hardware oversampling
- Fast comparators (17 ns)
- Embedded analog
- Dual bank flash for live upgrade
- AES & security
- FMAC (for type II / III compensator)

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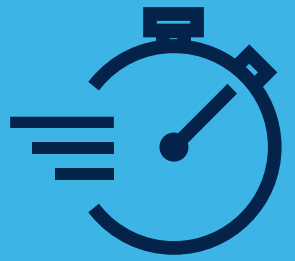
Simplifying digital power conversion

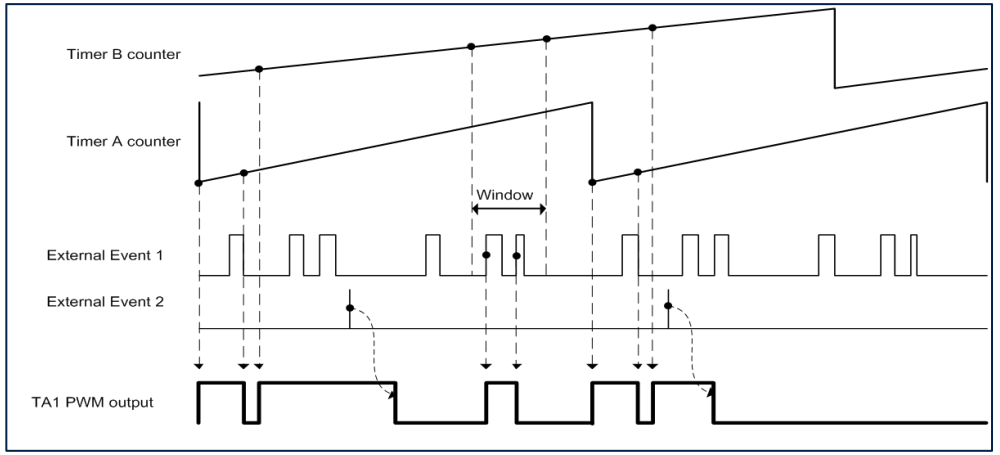
Enhance your digital power solutions using the STM32G4 **high-resolution timer (HRTIM)**



HRTimer – High resolution and much more

High resolution PWM

- 12 channels with 184 ps resolution on frequency and duty cycle
- 184 ps is equivalent to a 5.4GHz timer clock



Flexible PWM generation

- 7 x independent time base to create various shape of PWM
- 6 x complementary pair PWM outputs
- Up to 32 set/reset transitions per PWM period thanks to the built-in crossbar
- Controller/target configuration for multi phase converter

Multiple Event handlers

- 6 x digital and analog fault input
- 10 x events cycle to cycle current control or PWM restart (constant Ton/Toff)
- Blanking, windowing, and digital filter

12 independent channels

- Any topology supported from 1x 12 PWM (triple interleaved LLC (server application) up to 12 x 1 PWM (multiple independent buck converters (lighting))

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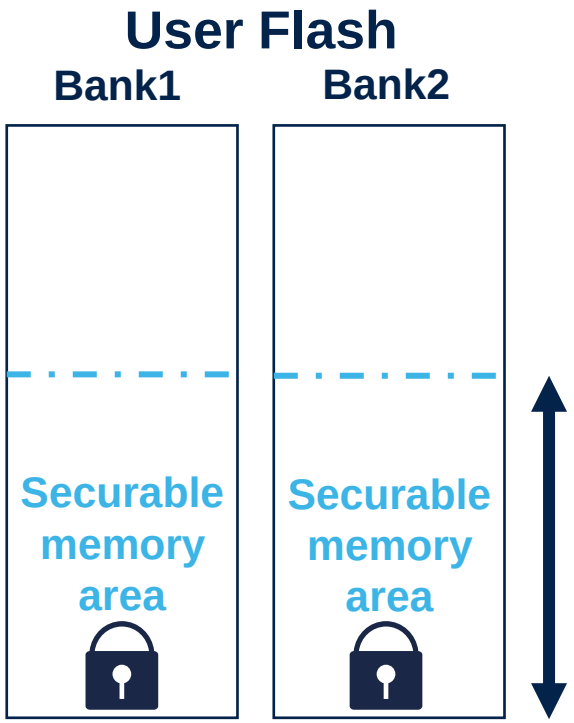
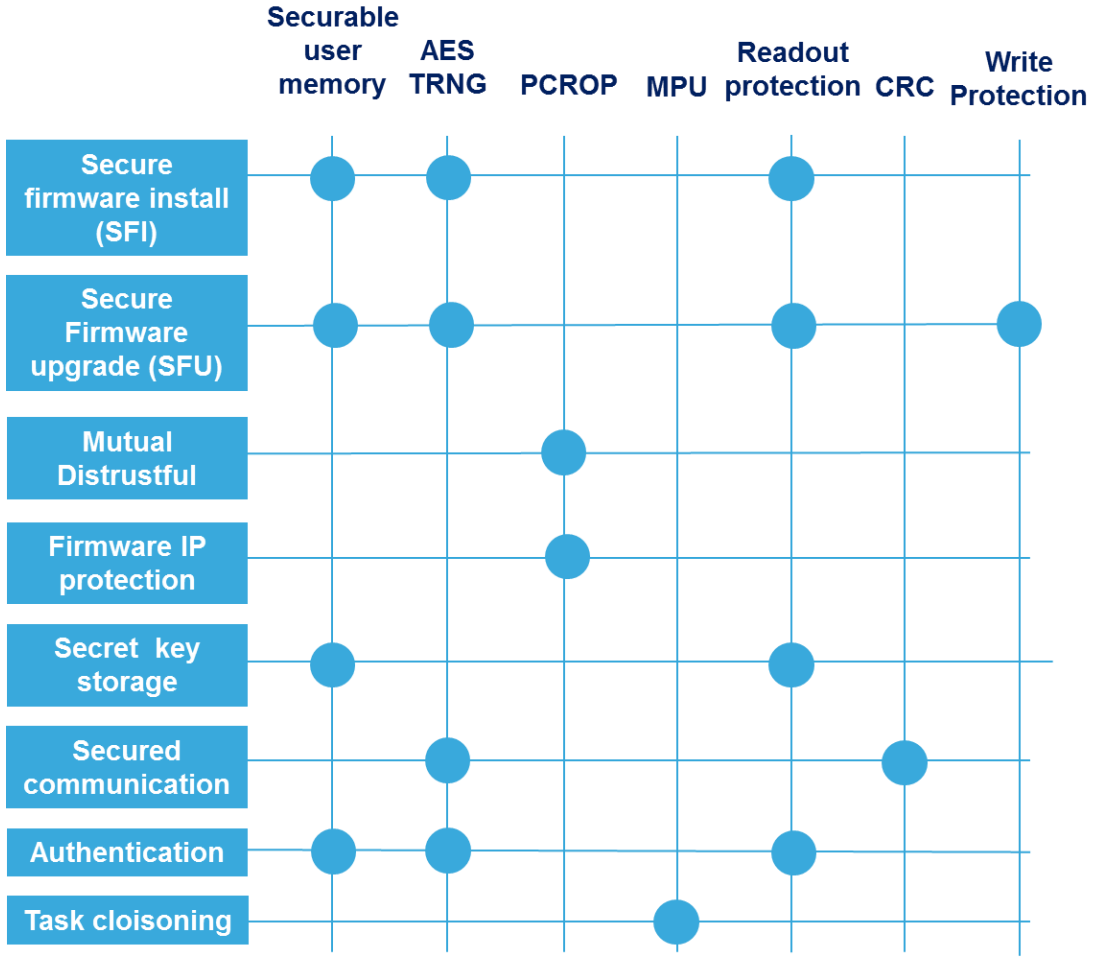
Integrated security features

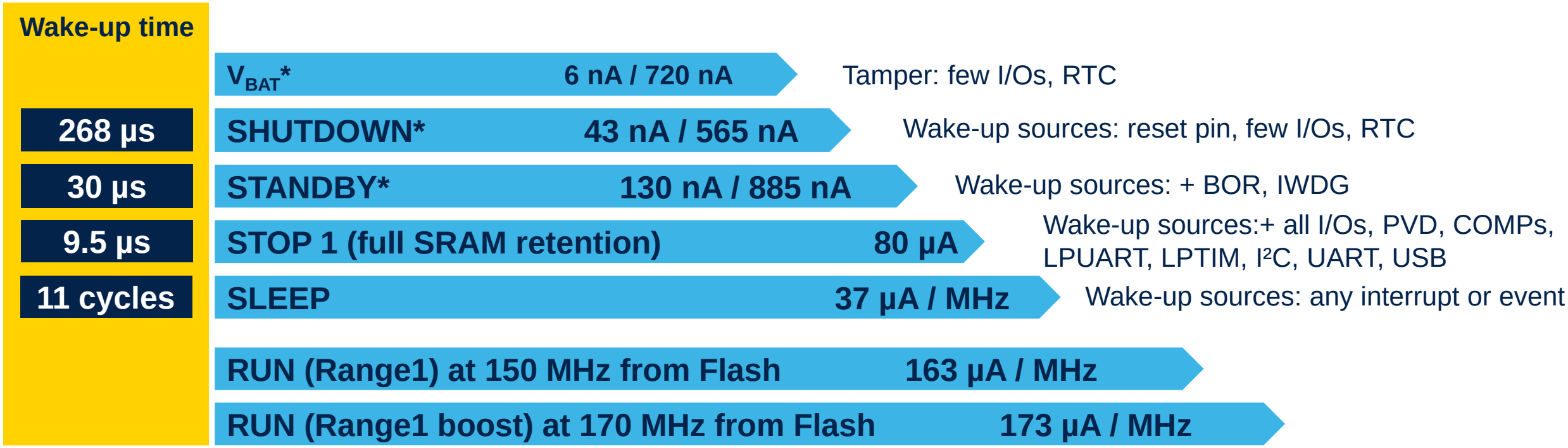


Securable memory area:

- Configurable size
- Can be secured once exiting
  - No more access nor debugging possible
- Good fit to store critical data
  - Critical routines
  - Keys



Dynamic efficiency modes



Conditions: 25°C, V_{DD} = 3 V

Note: * without RTC / with RTC

Extensive peripheral set

Unit parameters	STM32G4x1 Access line	STM32G474 Hi-Resolution line	STM32G473 Performance line
Core, frequency	Arm® Cortex®-M4, 170 MHz		
Flash (max)	Up to 512 Kbytes single bank	512 Kbytes (2x256 KB dual bank)	
RAM (up to)	Up to 96 Kbytes	96 Kbytes	
CCM –SRAM (code-SRAM)	Up to 16 Kbytes	32 Kbytes	
12-bit ADC SAR	Up to 3x 12-bit 4 MSPS	5x 12-bit 4 MSPS	
Comparator	4	7	
Op Amp with 4 built-in gain values with 1% accuracy	Up to 4	6	
12-bit DAC	4	7	
Motor Control timer	Up to 3x (170 MHz)	3x (170 MHz)	
CAN-FD	Up to 2x	3x	
12 channel hi-resolution timer	-	1x	-
Power supply	1.72 to 3.6 V		

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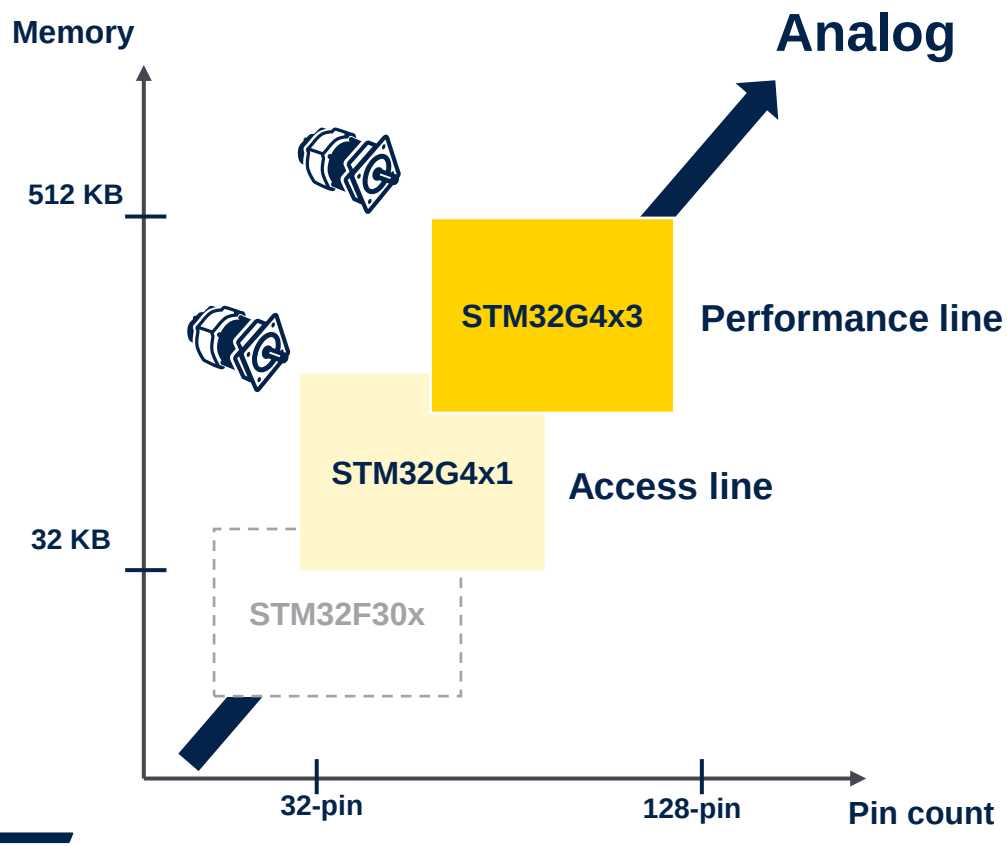
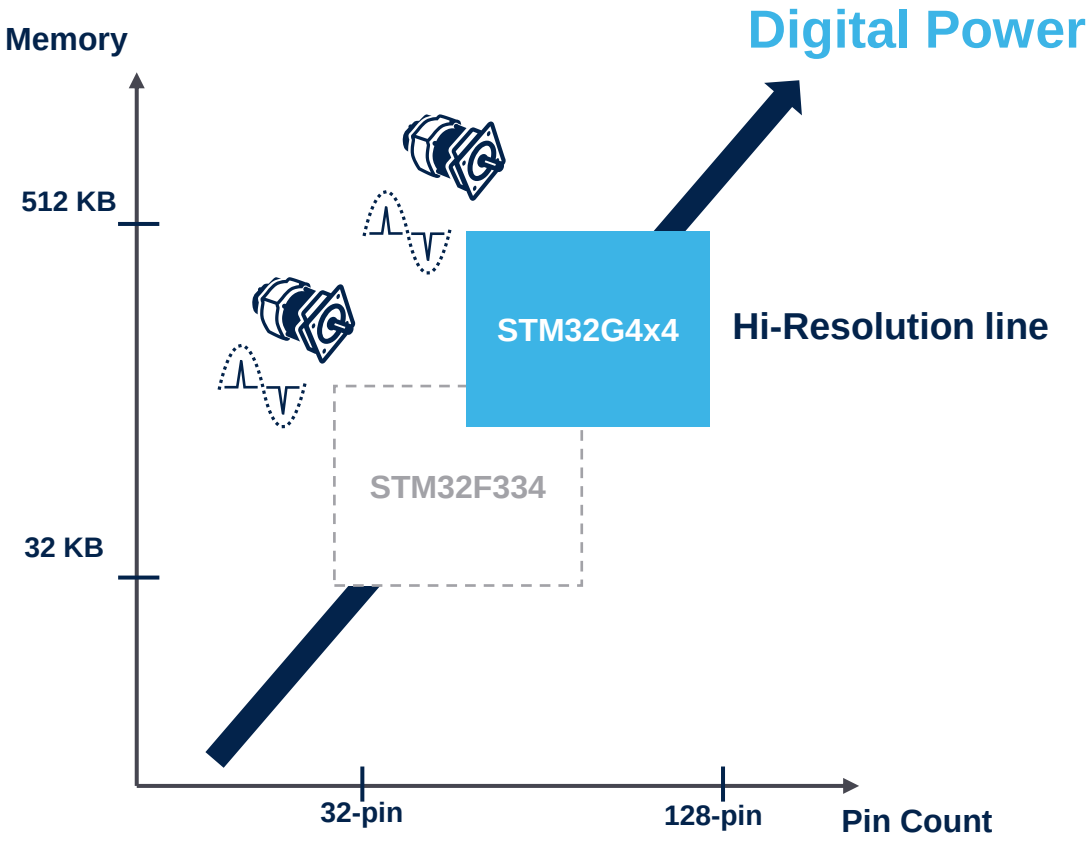
STM32G4 products lines

Performance and access lines



High resolution line



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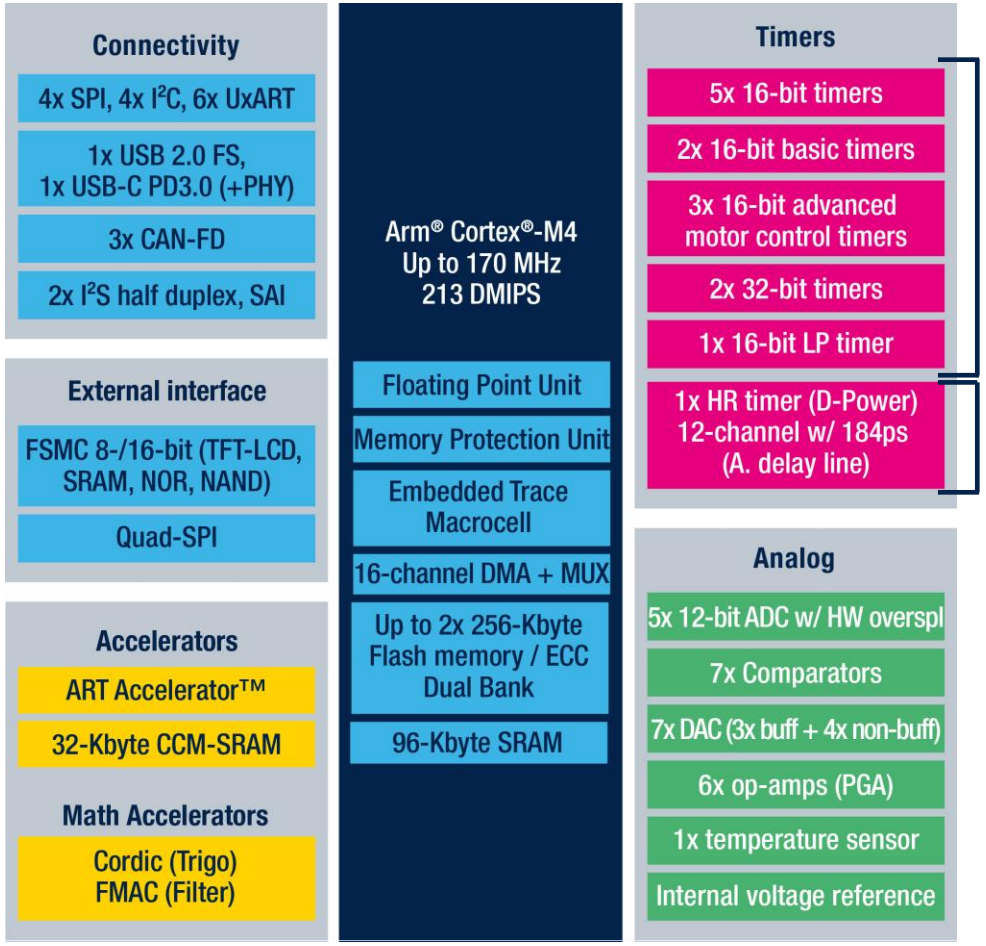
STM32G474/3 block diagram

High-resolution and high-performance lines (128 to 512 Kbytes)



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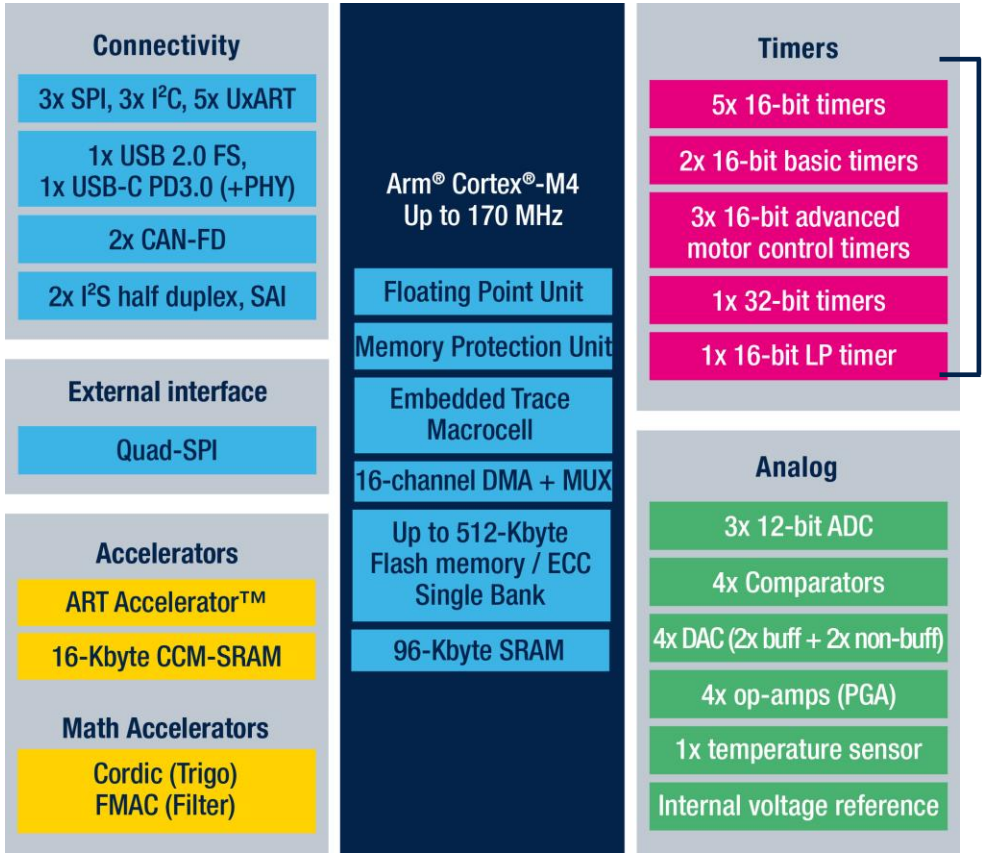
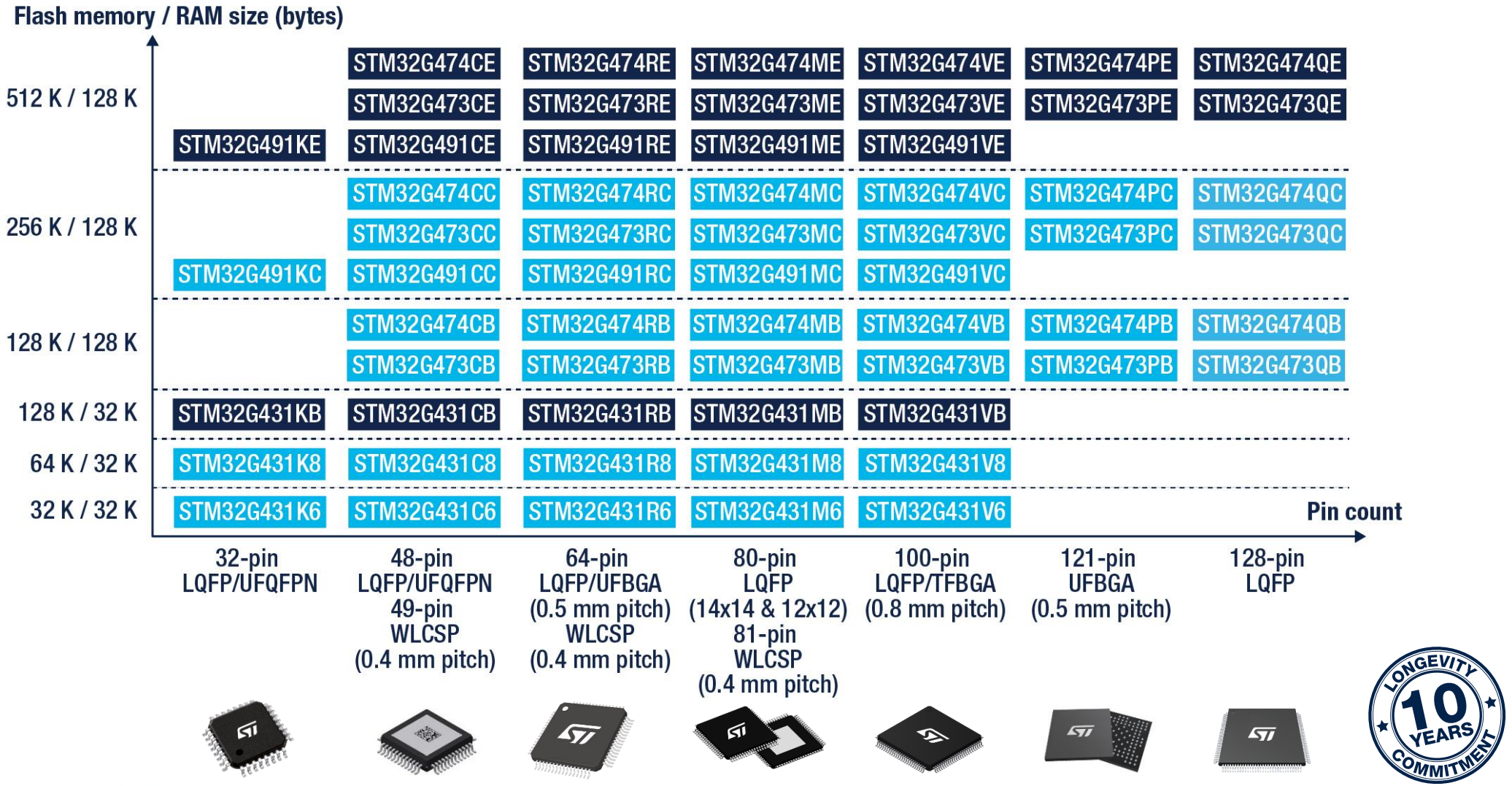
STM32G491 block diagram

Access lines (32 to 512 Kbytes)



STM32G4 portfolio



Legend: Crypto AES-256 version is available on this package

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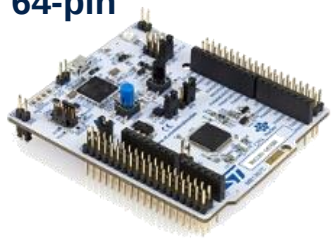
STM32G4 hardware solutions

Accelerate evaluation, prototyping, and design

$15

64-pin



32-pin*

$12*

STM32 Nucleo

Flexible prototyping

- NUCLEO-G431RB
- NUCLEO-G474RE
- NUCLEO-G431KB*
- NUCLEO-G491RE

$333

Evaluation boards

Full feature STM32G4 evaluation

- STM32G474E-EVAL1

$70

Motor control pack

Feature for motor control and analog

- P-NUCLEO-IHM03

$59**

$18

$36

Discovery kits

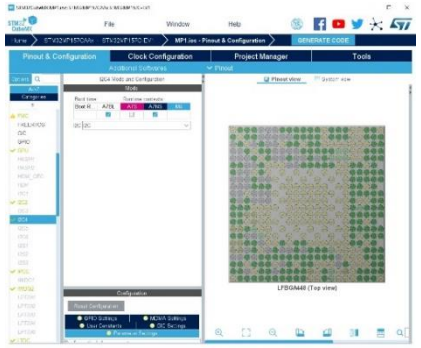
Key feature prototyping

- B-G474E-DPOW1 **
- B-G431B-ESC1
- B-G473E-ZEST1S

Recommended resell price

STM32G4 software tools to accelerate your development

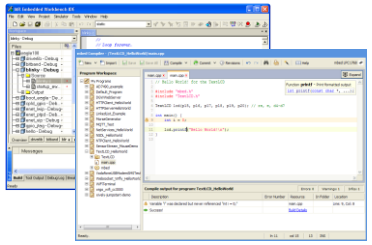
STM32 CubeMX

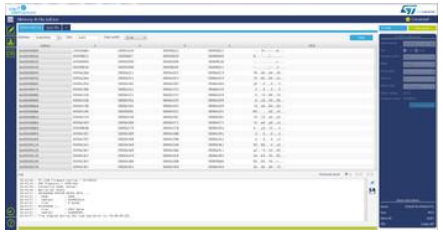


arm KEIL iar

eclipse

STM32 CubeIDE





STM32 CubeProgrammer

STM32CubeMX

Graphical tool for easy configuration

- Configure and generate code
- Peripherals and middleware configuration

IDEs compile and debug

Simple, powerful solutions

- Partners IDE (Arm® Keil®) FREE
- IDE based on Eclipse FREE
- RTOS aware debug

STM32 programming tool

STM32CubeProgrammer

- Flash and/or system memory
- GUI or command-line interface

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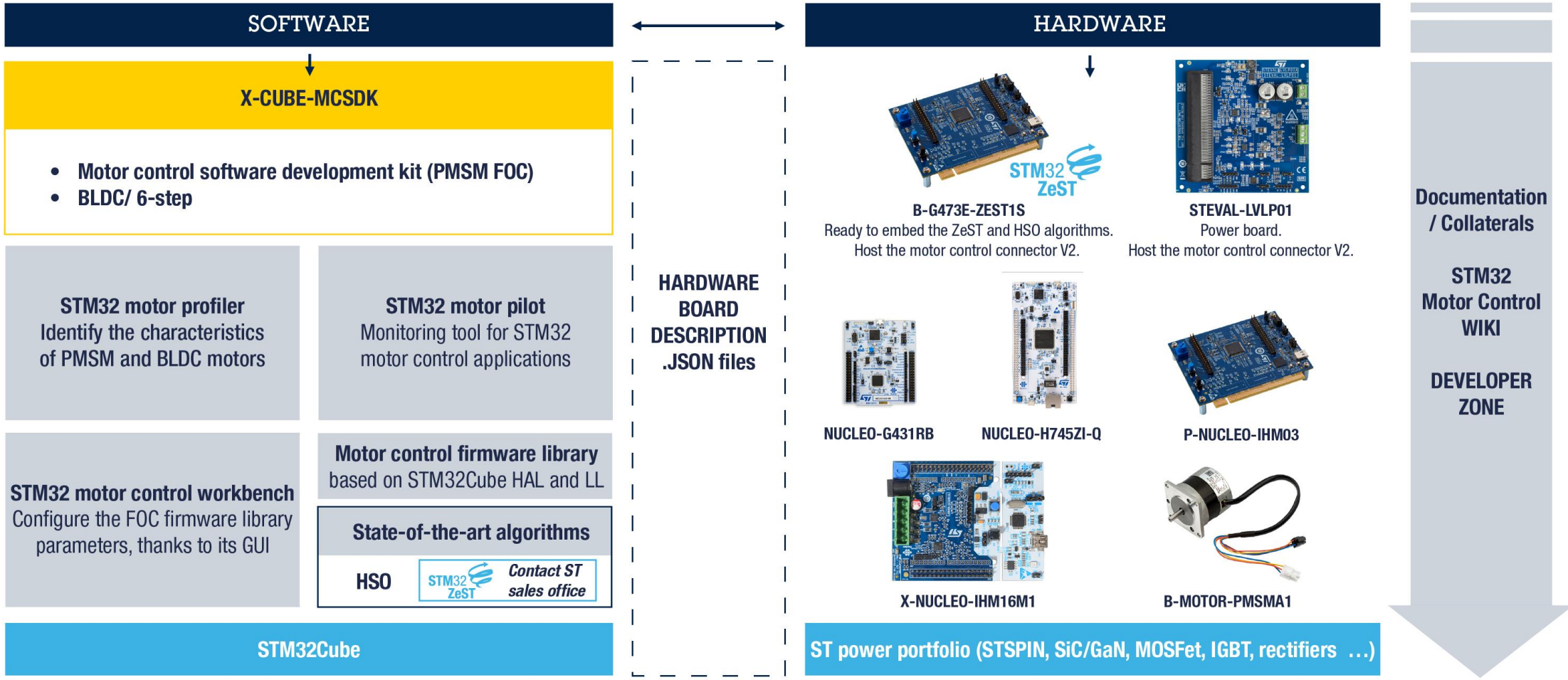
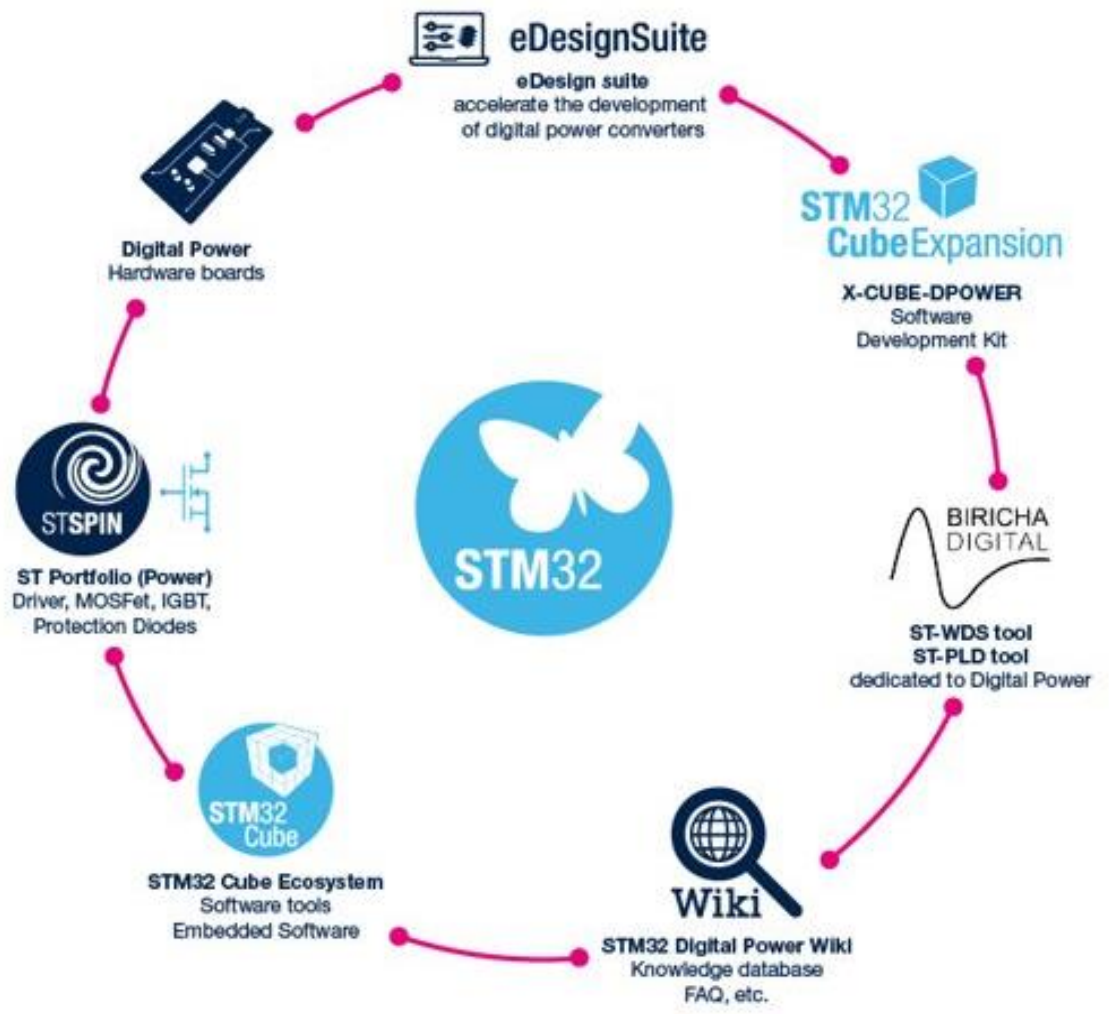
Motor control ecosystem for the STM32 family



http://www.st.com/stm32-motor-control

STM32 ecosystem for digital power



- **Full ecosystem** (hardware boards, firmware examples, software tools, documentation and training)
- **Dedicated HRTIM Cookbook - AN4539:** How to operate the hi-resolution timer in different topologies
- **Digital power training** (PSU and PFC) – based on the STM32G4 series in collaboration with Biricha

www.st.com/stm32-digital-power

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- STM32G4 online training
- wiki.st.com/stm32mcu
- github.com/stm32-hotspot
- STM32G4 blog articles

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Our technology starts with You

Find out more at www.st.com/STM32G4

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