

# STM32 32-bit MCU Family

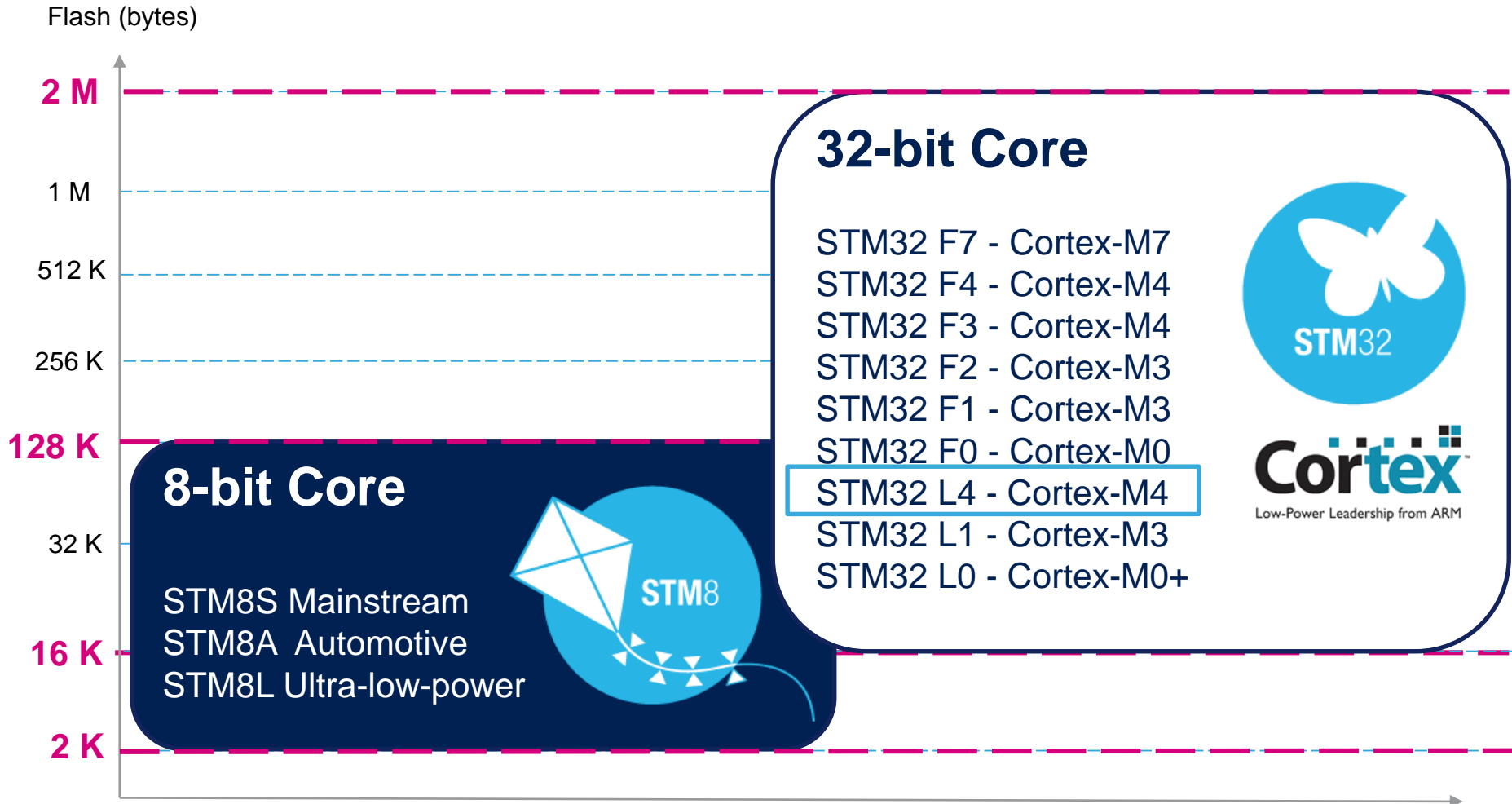
Portfolio and Ecosystem overview – Q2/2015



[WWW.EMCU.IT](http://WWW.EMCU.IT)



## new families development focus



# ST has licensed all Cortex®-M cores

- **Forget traditional 8/16/32-bit classifications and get**
  - Seamless architecture across all applications
  - Every product optimized for ultra-low power and ease of use

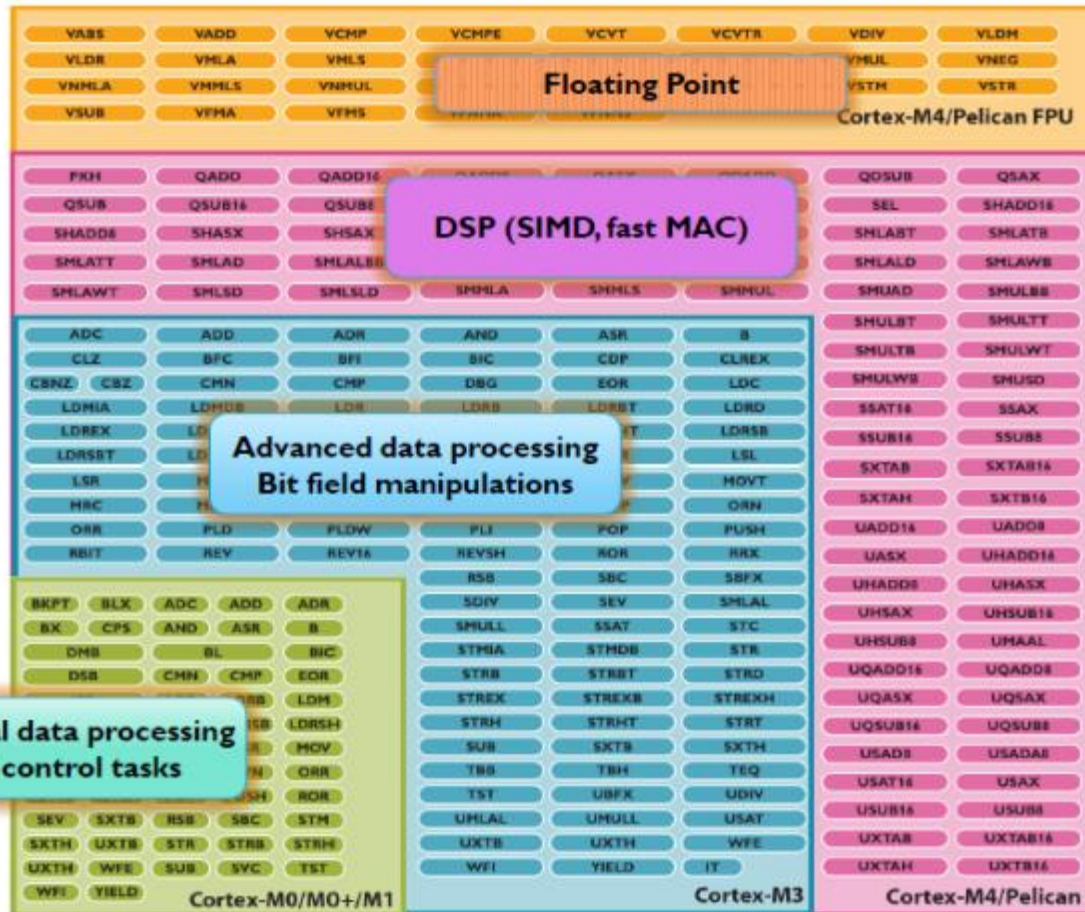


Binary and tool compatible



# Cortex-M processors binary compatible

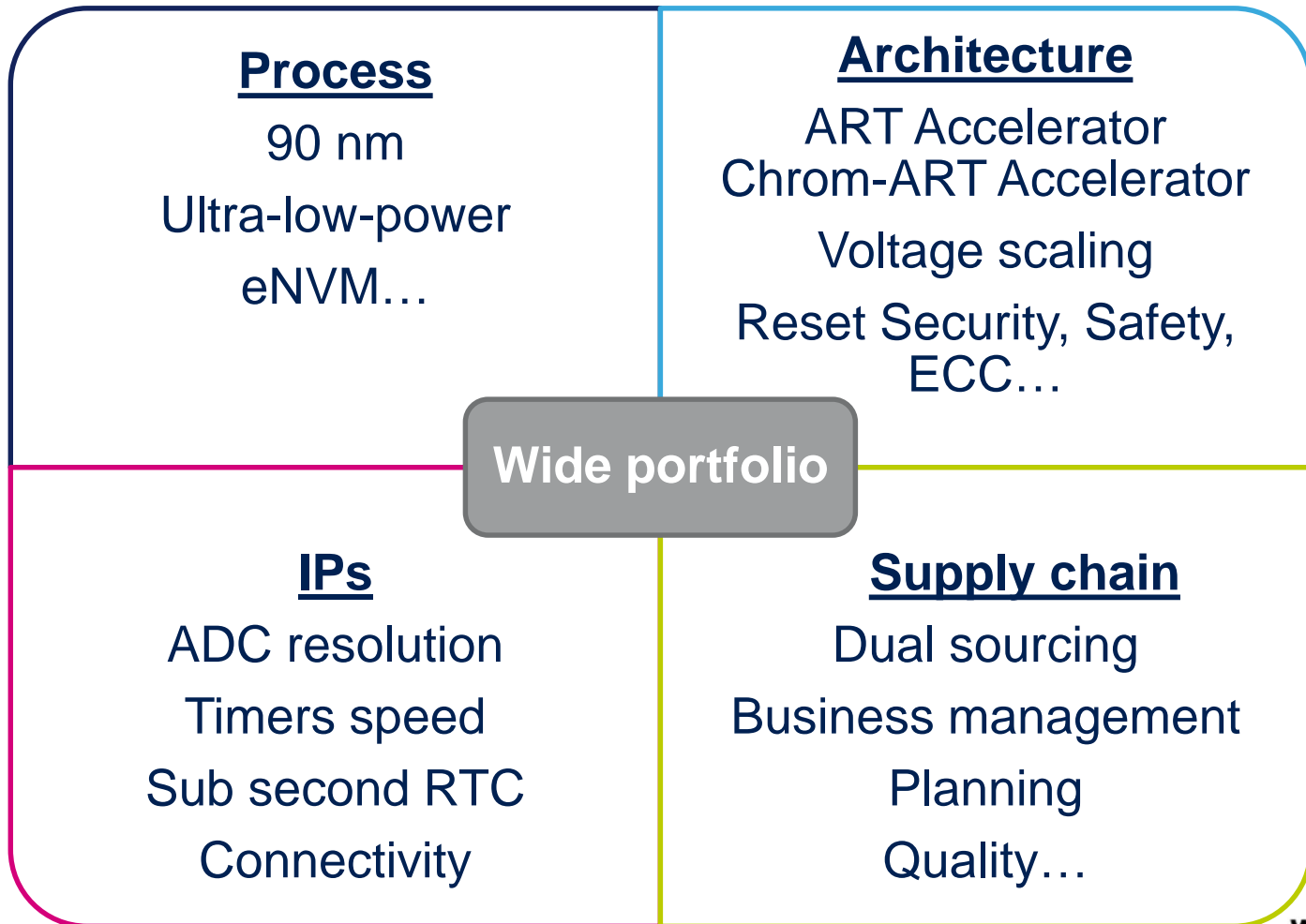
- Cortex-M7 has the same powerful instruction set as Cortex-M4
- MAC instructions are all single cycle
- SIMD instructions can work on 8-/16-bit quantities packed in to a 32-bit word
- Arithmetic can be signed/unsigned, saturating/unsaturating



# Differentiation factors with competition

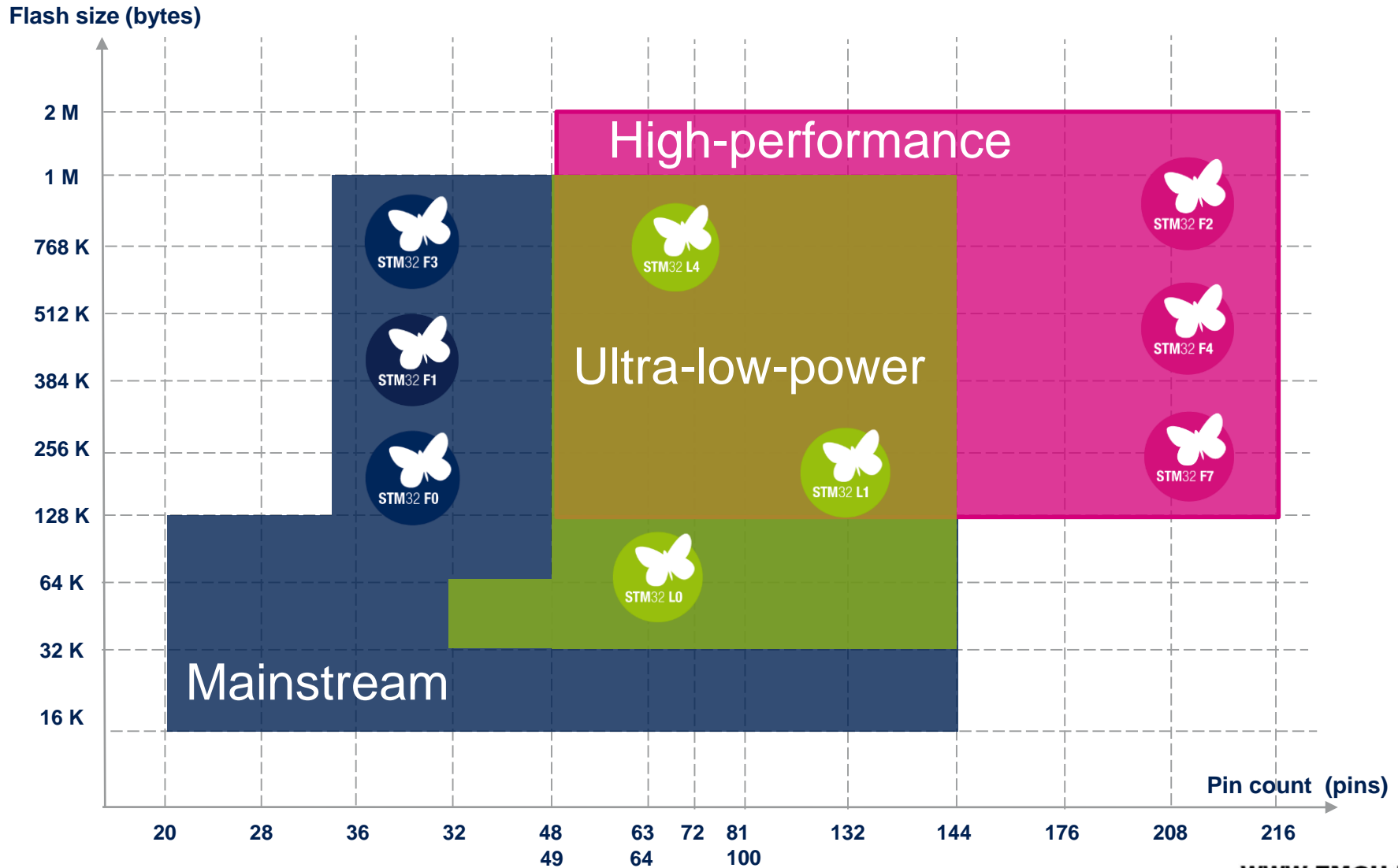
## Same core but.....

5

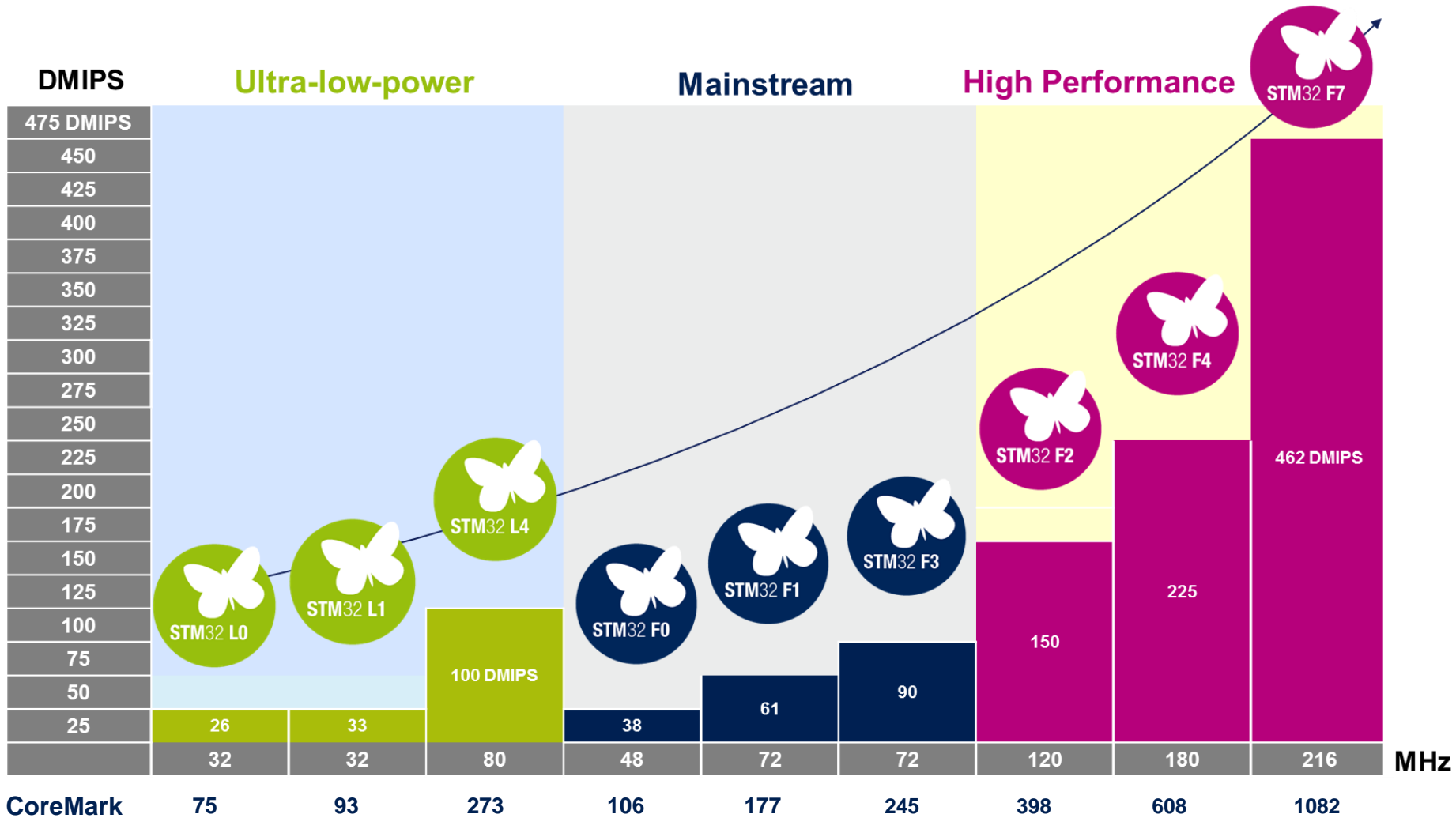


# STM32 today – platform effect

Select your fit product inside a wide, compatible portfolio



# Broadest 32-bit MCU product portfolio



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# 5 reasons to choose an STM32

## Real-time performance



STM32 Dynamic Efficiency™, ART Accelerator™, Chrom-ART Accelerator™, CCM-SRAM, L1-Cache Multi-AHB bus matrix, Excellent real-time up to 200 MHz/ 428 DMIPS Zero-wait state execution performance from Flash

## Outstanding power efficiency



< 1  $\mu\text{A}$  RTC in  $V_{\text{BAT}}$  mode, ultra-low dynamic power consumption 90  $\mu\text{A}/\text{MHz}$ , with lowest dynamic consumption. 1.65 to 3.6 V  $V_{\text{DD}}$ , 0.45  $\mu\text{A}$  Stop mode and 0.3  $\mu\text{A}$  Standby mode

## Superior and innovative peripherals



USB-OTG High speed, Ethernet, CAN, DFSDM, HR timer, LCD-TFT controller, SRAM interface, crypto/hash processor, true RNG\*, PGA, 16-bit  $\Sigma\Delta$  ADC and 12-bit ADC (up to 5 MSPS), external memory interface, CEC, SAI, BAM

## Maximum integration



Reset circuitry, voltage regulator, internal RC oscillator, PLL, WLCSP packages

## Extensive ecosystem



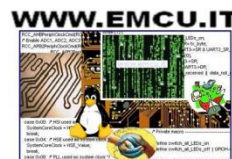
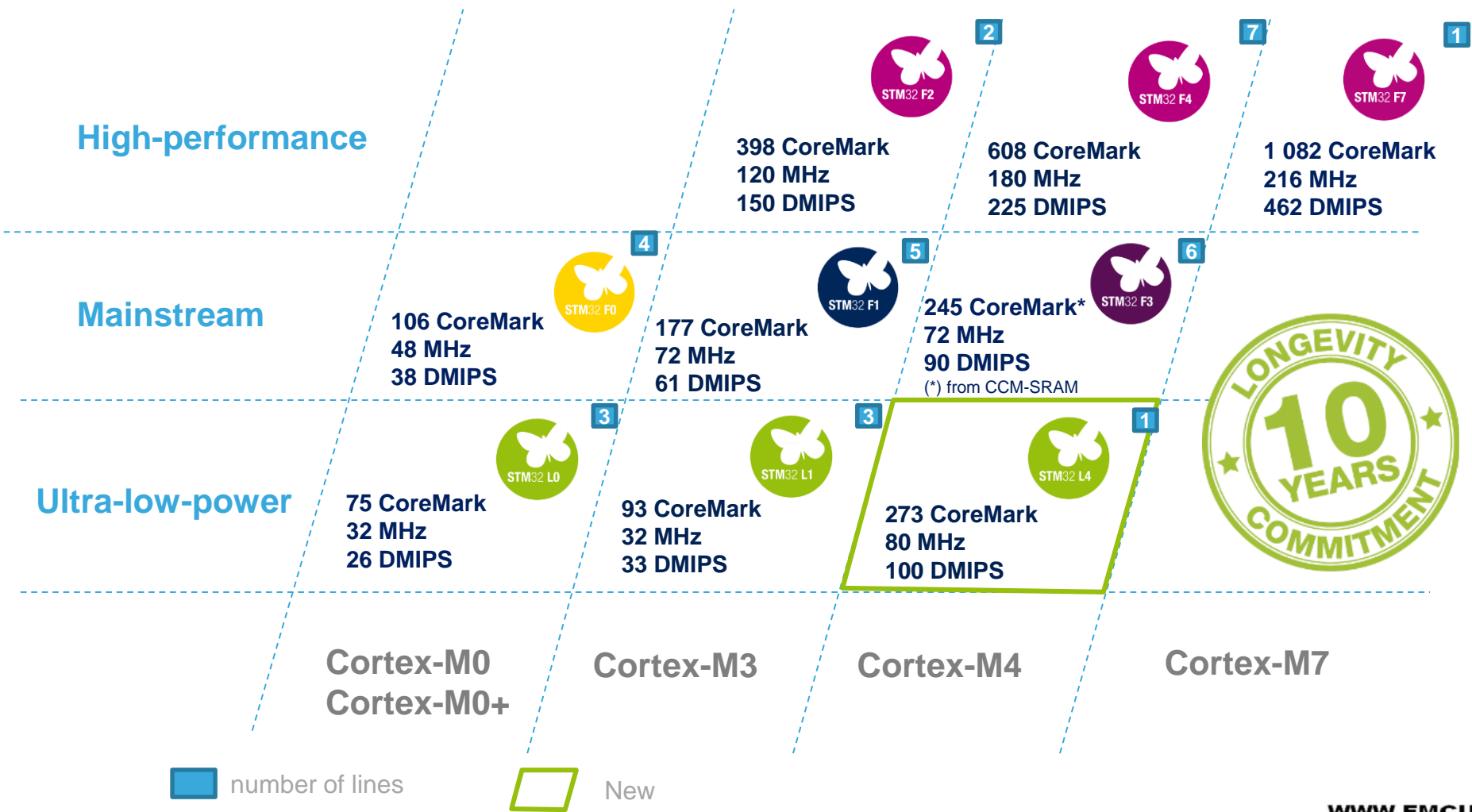
ARM + ST ecosystem (eval. boards, discovery kits, STM32 Nucleo evaluation board (mbed enabled), STM32Cube™ and software libraries, RTOS)

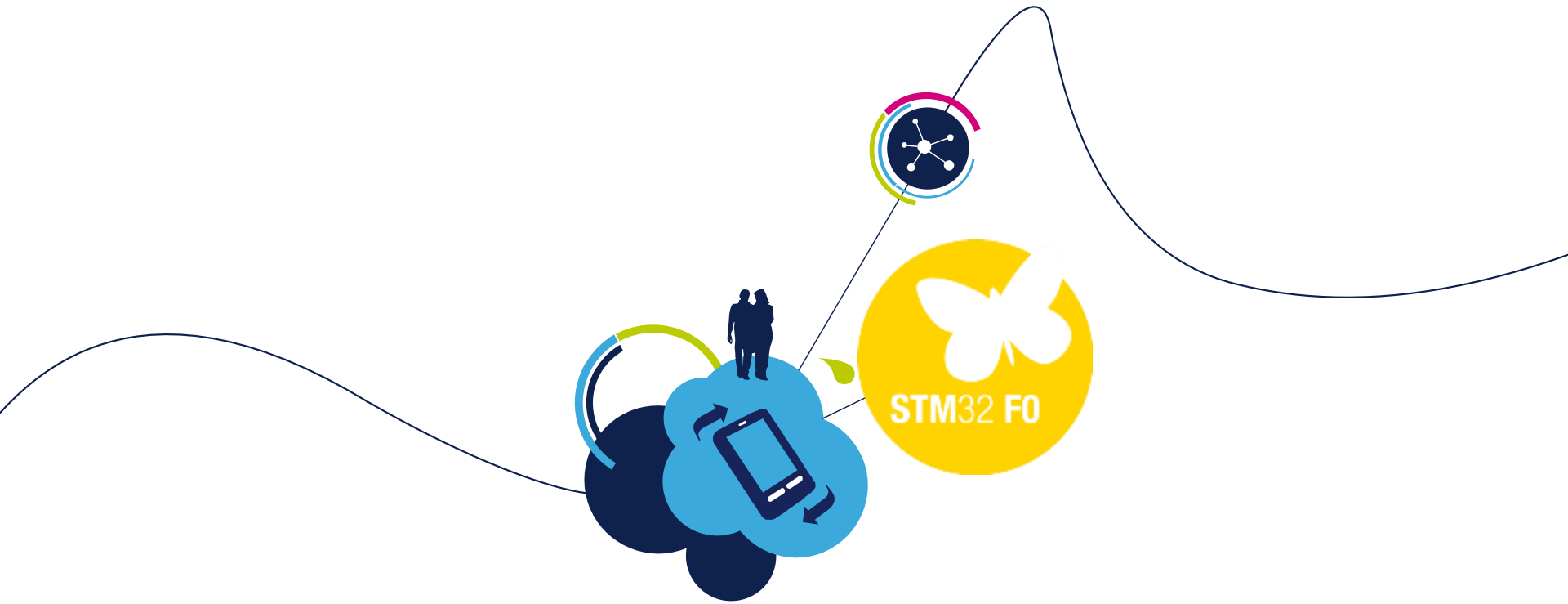
More than **600 compatible devices**  
Releasing your creativity



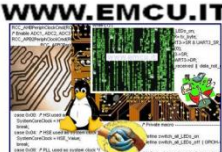
# Today - STM32 portfolio positioning

9 product series / 32 product lines

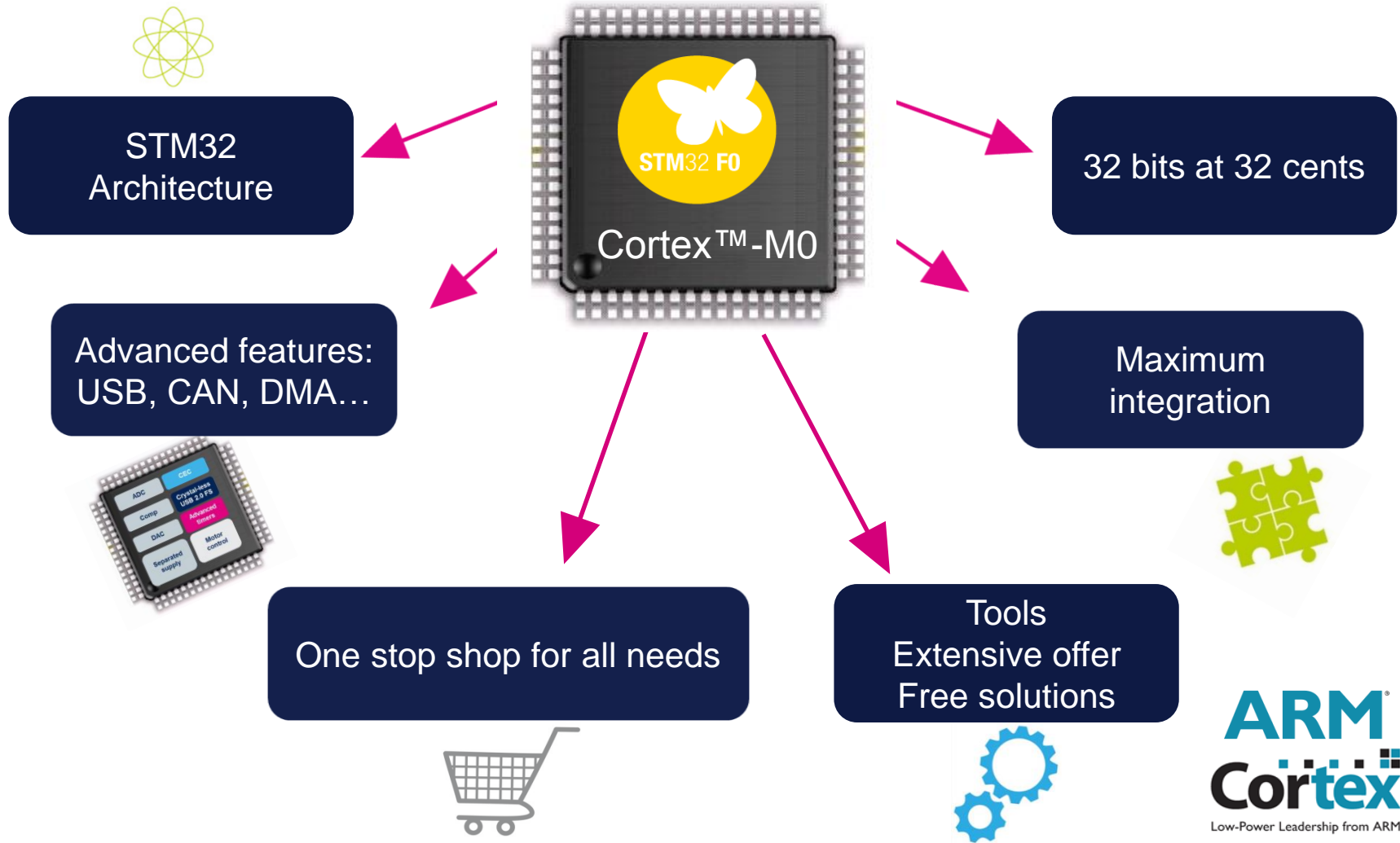




# STM32 F0 Series



# STM32 F0 at a glance



**ARM**  
**Cortex**  
Low-Power Leadership from ARM

- **STM32F0** is the STM32 entry series
  - From 16kB to 256kB
  - From TSSOP20 to QFP100
- Lowering portfolio STM32 to high-end **8-bit and 16-bit market**
  - Brings Cortex-M0 performance on top of cost consideration
  - Speeds up cost-constrained decisions
- **Cost-sensitive** applications
  - With New STM32F0 Value line : **32 bits at 32 cents**
- Maximum **integration**
  - Battery backed-up registers, RTC, separate analog supply
- **Power efficiency**
  - 250 $\mu$ A/MHz, 2 $\mu$ A in stand-by mode





# STM32 F0 Product lines

## Main common features

**Cortex™-M0  
@ 48 MHz**

Reset POR/PDR  
2x Watchdogs  
Hardware CRC

2x Internal RC  
Crystal oscillators  
PLL  
Calendar RTC

1x12-bit ADC  
T°C sensor

Multiple Channel DMA  
USART/SPI/I2C  
Single Wire Debug  
Unique ID

### STM32F0x8 Low Voltage line 1.8V +/- 8%

16KB to 256KB Flash 4-32KB SRAM (Parity check) 20-byte backup data	16&32 -bit timers	DAC Comp (*)	Touch Sense	8xUSART 2xSPI 2xI2C CEC	USB Clock free (*)
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### STM32F0x2 USB line 2.0 to 3.6V

16KB to 128KB Flash 4-16KB SRAM (Parity check) 20-byte backup data	16&32 -bit timers	DAC & Comp	Touch Sense	4xUSART 2xSPI 2xI2C CEC	USB Clock free	CAN
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### STM32F0x1 Access line 2.0 to 3.6V

16KB to 256KB Flash 4-32KB SRAM (Parity check) 20-byte backup data	16&32 -bit timers	DAC & Comp	Touch Sense	8xUSART 2xSPI 2xI2C CEC
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### STM32F0x0 Value line - 2.4V to 3.6V

16KB to 256KB Flash 4-32KB SRAM (Parity check)	16&32 -bit timers	USB	6xUSART 2xSPI 2xI2C
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# STM32F0 Portfolio



## STM32F0x0 Value Line



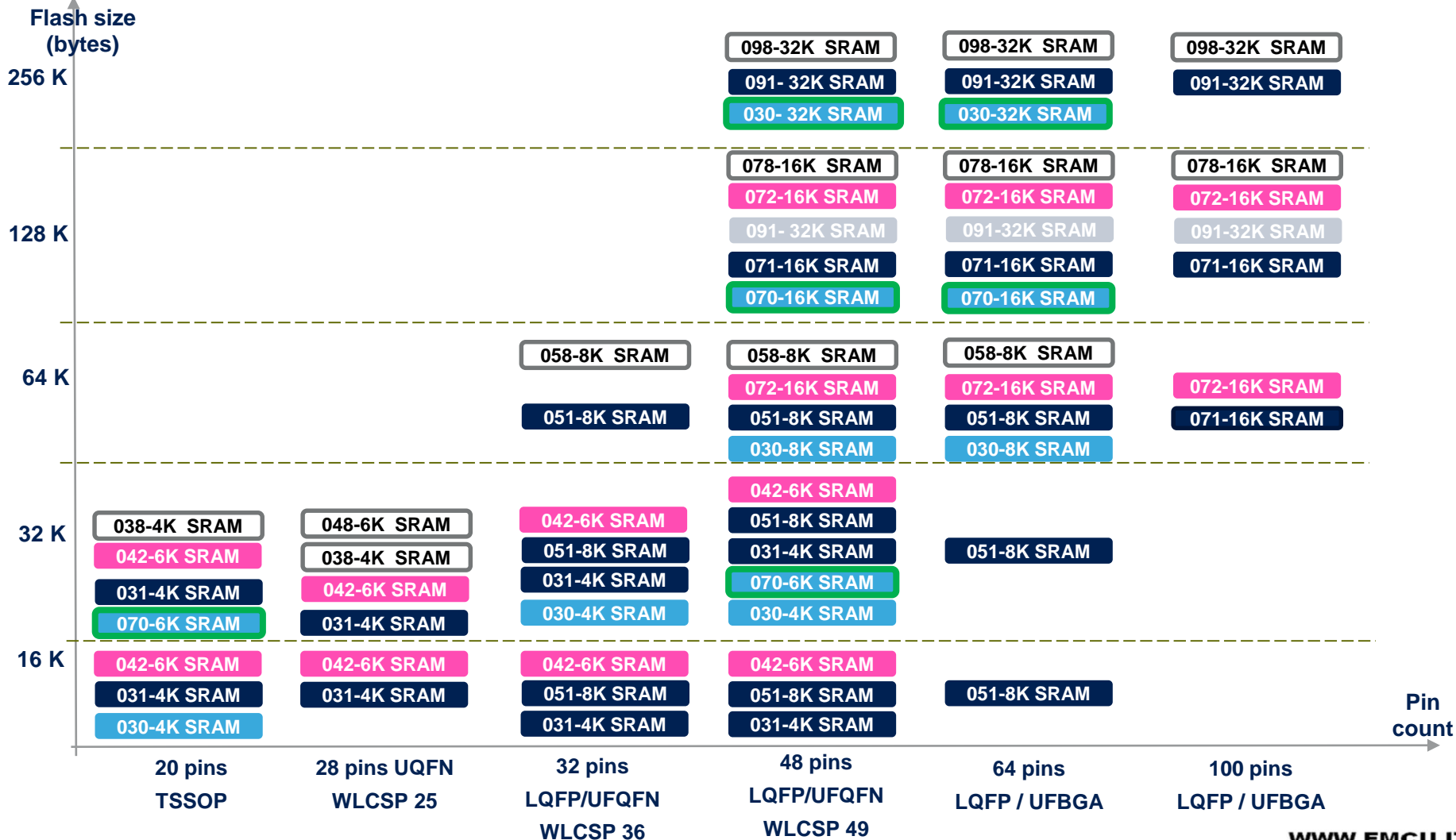
## STM32F0x1 Access Line



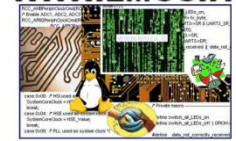
## STM32F0x2 USB Line



## STM32F0x8 1.8V

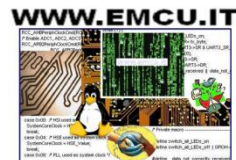


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# STM32 F3 series Mixed-Signal & DSP





# STM32 F3 product lines

All product lines include:

- Cortex-M4 + FPU  
Fmax = 72 MHz
- MPU\*
- PLL
- ETM\*
- FSMC\*
- Reset + BOR PVD
- Low and high speed internal oscillators
- 2x watchdogs + RTC (real-time clock)
- HW CRC
- Reset circuitry POR/PDR
- Multiple DMA
- Communication peripherals USART, SPI, I<sup>2</sup>C
- IR transmitter
- Multiple 16-bit timers
- 1x 32-bit timer
- Temperature sensor
- Backup registers
- Touch-sensing controller

## General Purpose applications

### STM32F301/302/303 lines

Up to 512-Kbyte Flash	Up to 64-Kbyte SRAM	Up to 16-Kbyte CCM-SRAM	2x DAC 12-bit	7x comparator	4x 12-bit ADC 5 MSPS SAR	4x PGA	CAN 2.0B	USB 2.0 FS	3x16-bit AMC timer
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### STM32F373 Precision line- 16-bit Sigma Delta ADC

Up to 256-Kbyte Flash	Up to 32-Kbyte SRAM	3x 16-bit $\Sigma\Delta$ ADC	3x DAC 12-bit	2x comparator	1x 12-bit ADC 1 MSPS SAR	CEC	CAN 2.0B	USB 2.0 FS
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### STM32F334 Digital power line - High-resolution timer

Up to 64-Kbyte Flash	Up to 12-Kbyte SRAM	Up to 4-Kbyte CCM-SRAM	3x DAC 12-bit	3x comparator	2x 12-bit ADC 5 MSPS SAR	2x PGA	CAN 2.0B	High resolution timer < 300 ps	1x16-bit AMC timer
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## Application Specific

Other part number available: STM32F3x8 (Power supply = 1.8v +/-8%)

Note: \* Product dedicated



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Upgrade your applications!

## 512 Kbytes STM32F3 MCUs Raise the Bar in System Integration

Newsbite [here](#)



512 Kbytes Flash  
80 Kbytes SRAM

- + NUCLEO-F303RE
- + STM32303E-EVAL



Note: \* Available in Q2/2015



● 1.8V version available

[www.st.com/stm32f3](http://www.st.com/stm32f3)

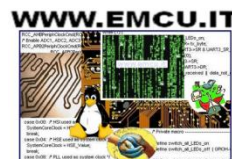
# STM32F373 line overview

Both product lines include:

Cortex-M4 + FPU Fmax = 72 MHz
MPU
PLL
ETM
Reset + BOR PVD
Low and high speed internal oscillators
2x watchdogs + RTC Real-time clock
HW CRC
Reset circuitry POR/PDR
Multiple DMA
Communication peripherals USART, SPI, I2C
Multiple 16-bit timers
1x 32-bit timer
Temperature sensor
Backup registers

STM32F373 line

+	Up to 256-Kbyte Flash	Up to 32-Kbyte SRAM	3x 16-bit ADC $\Sigma\Delta$	3x DAC 12-bit	2x comparators	1x 12-bit ADC 1 MspS SAR	CEC	CAN 2.0B	USB 2.0 FS
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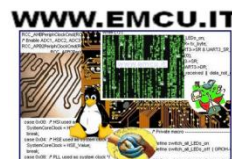
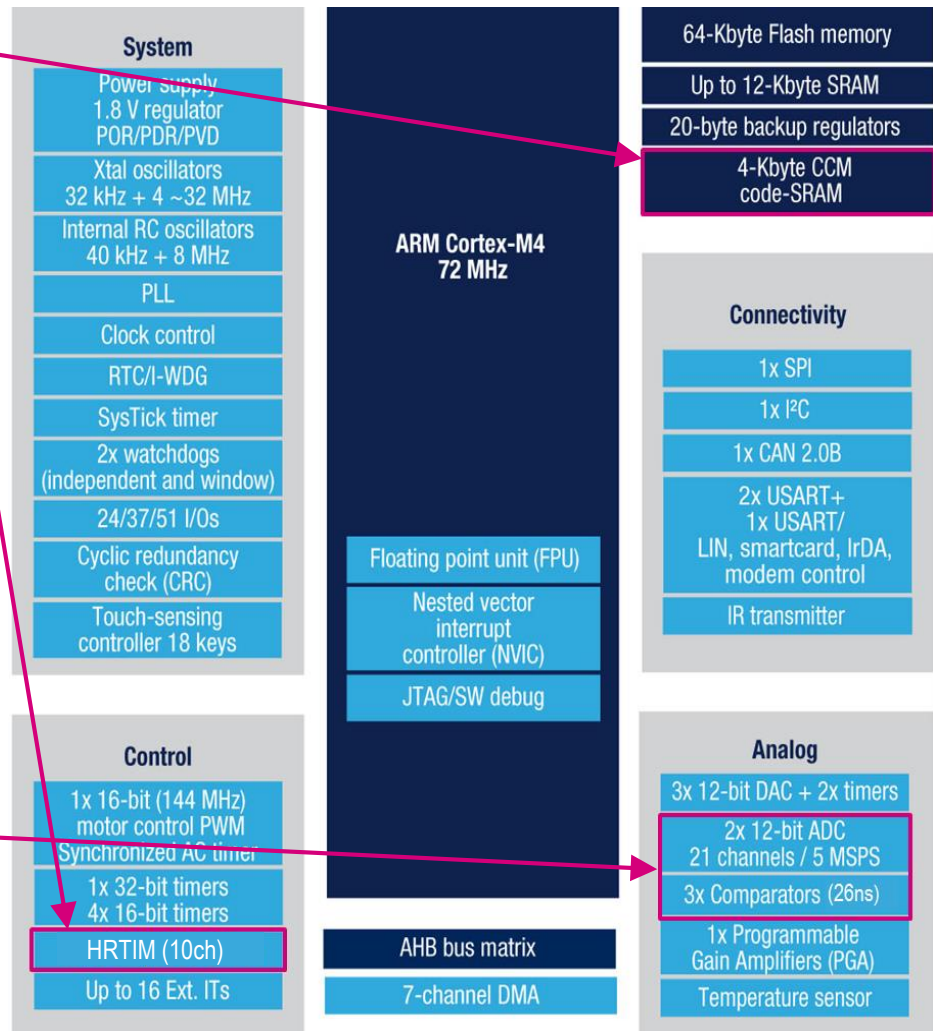


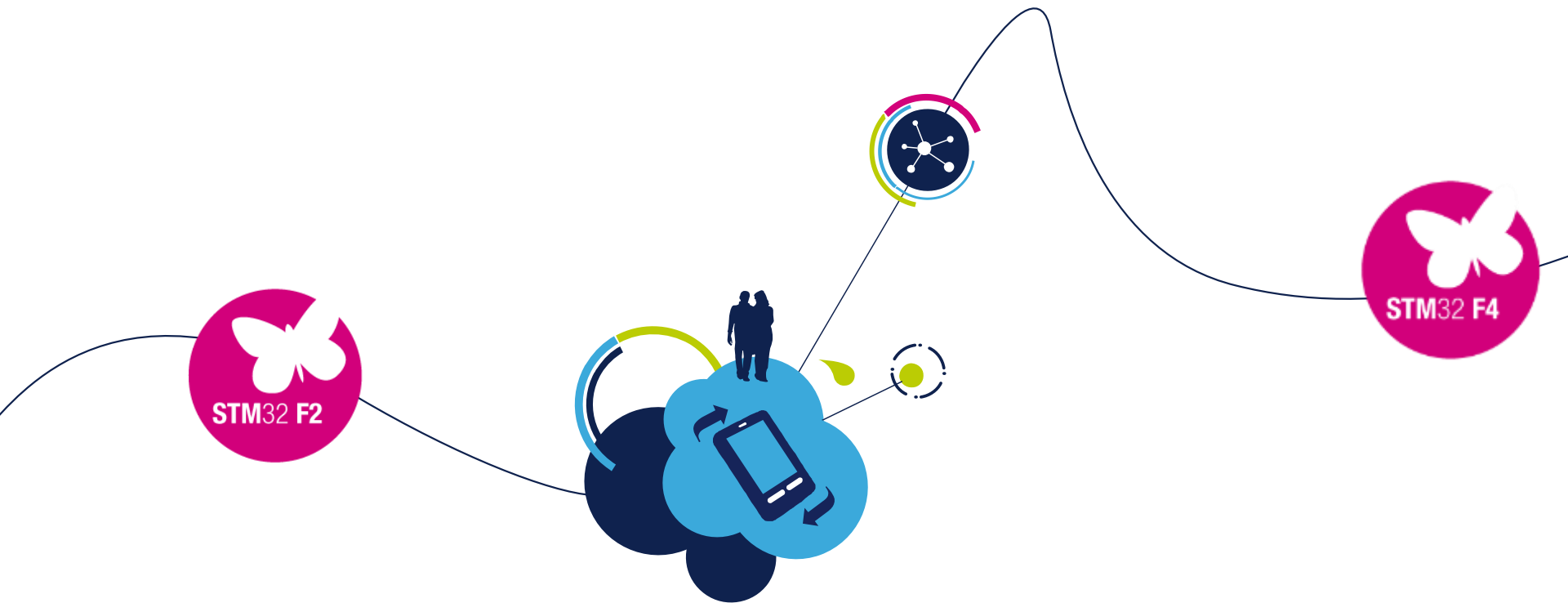
In Production

# F3 series STM32F334 – 64KB

- Cortex-M4 at 72MHz (90DMIPS)
- LQFP 32/48/64, T° -40..105°C
- **HRTIM** timer is made of Hi-Resolution + Waveform Builder & Event Handler :
  - 217ps (4.6GHz eq.) high resolution guaranteed on all channels vs voltage, temperature or manufacturing deviation
    - High Resolution on all channels and any timing
    - 10-channels timer made of 6 timings units that can be cross-coupled or work independently
  - Advanced PWM waveforms generation with SW minimized
    - Smart functions, such as a HW burst mode controller
    - One DMA channel per timer
    - One parameter modification can change multiple events (timer chaining)
  - Complex event management
    - 10 external events inputs and 5 Fault inputs
  - Numerous interconnect
- High-speed ADCs for precise and accurate control
  - 12-bit SAR – 5MSps, single-ended and diff. inputs
  - Down to 21ns sampling time
  - Multiple triggers for PWM
- Built-in analog for protection and signal conditioning
  - Ultra Fast comparators (26ns)
  - Op-Amp with built in Gain (PGA)

Hi-Resolution  
Waveform Builder & Event Handler



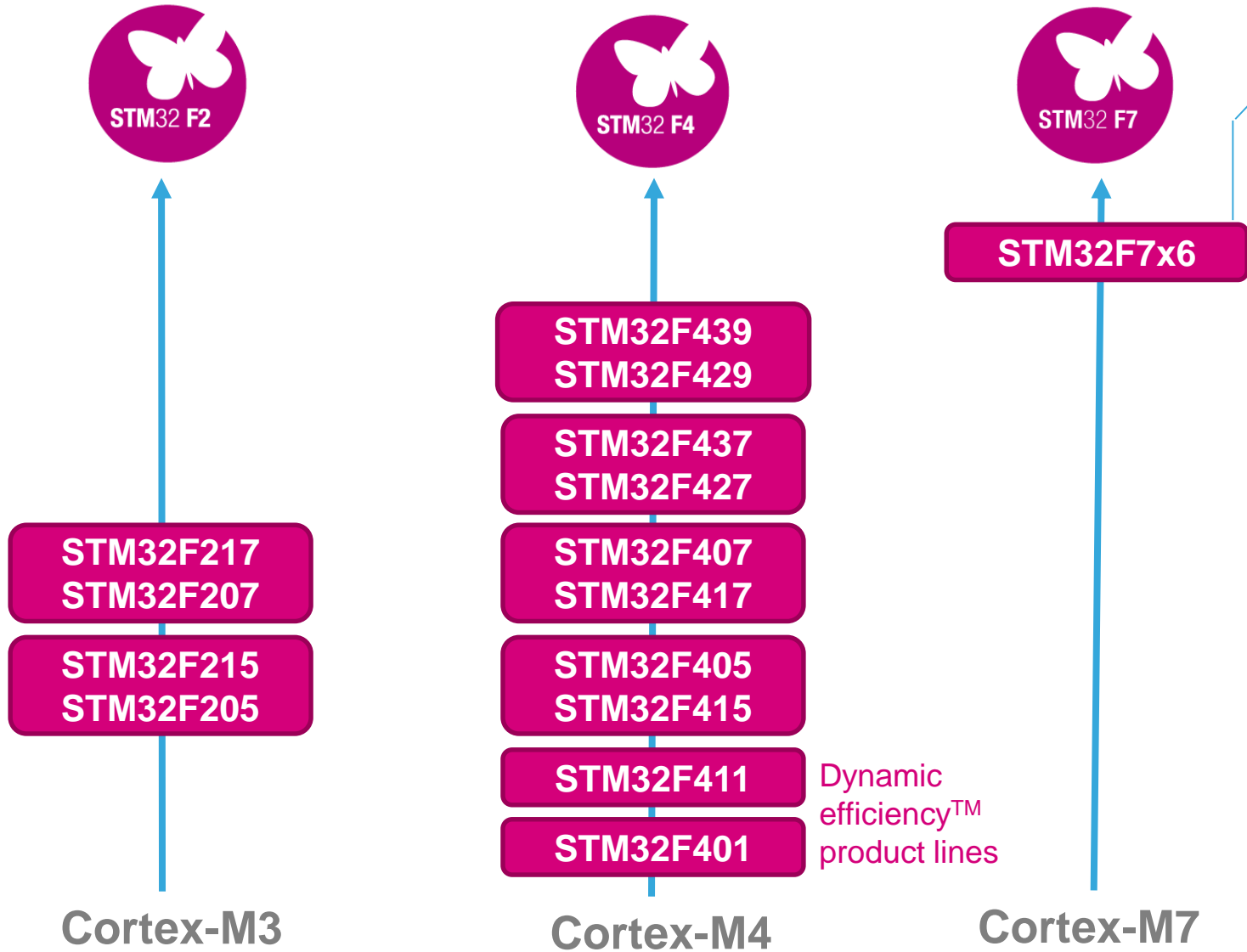


# STM32 High-performance

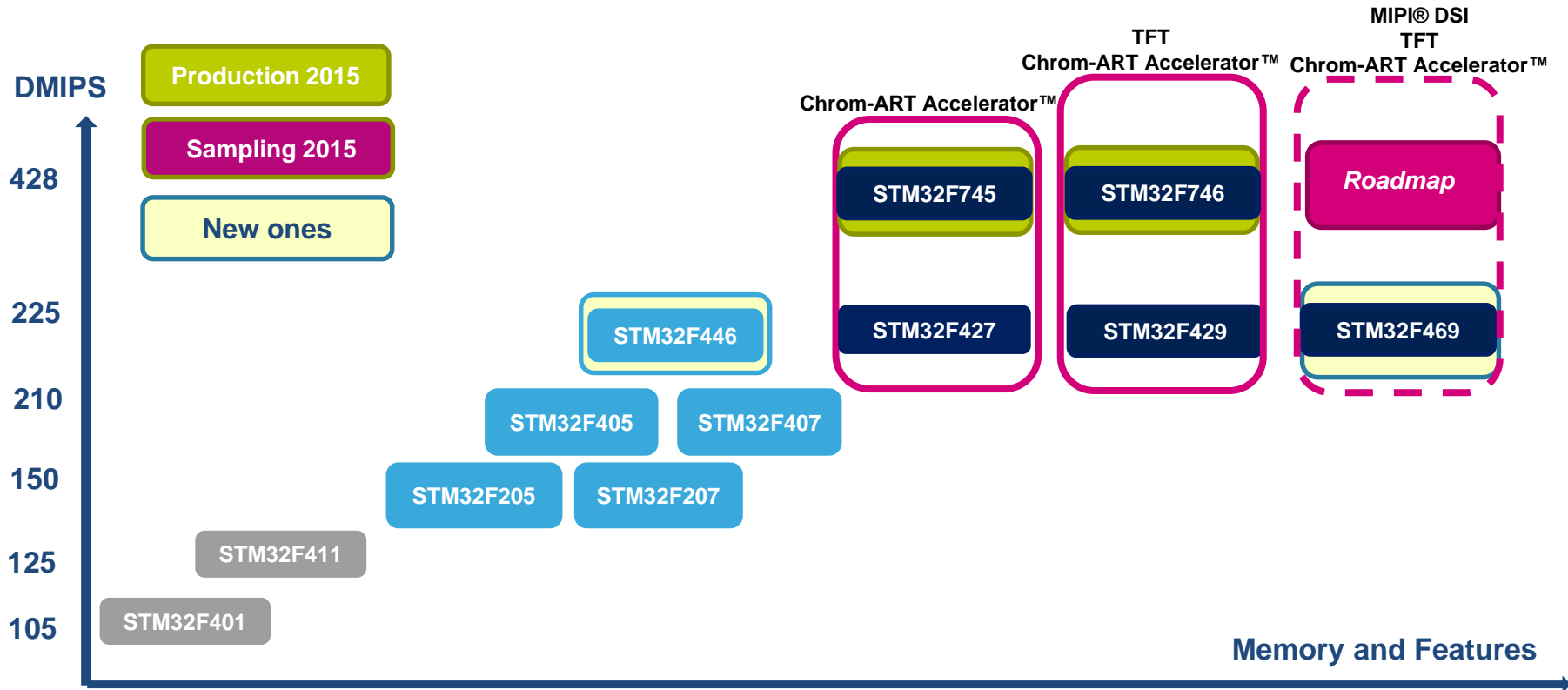


# High-performance offer

NEW



# STM32 - High-performance platform

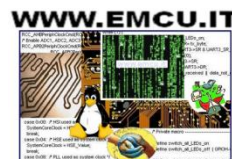


**Access** | **Foundation** | **Advanced**

Dynamic efficiency  
Access to high performance with light cost

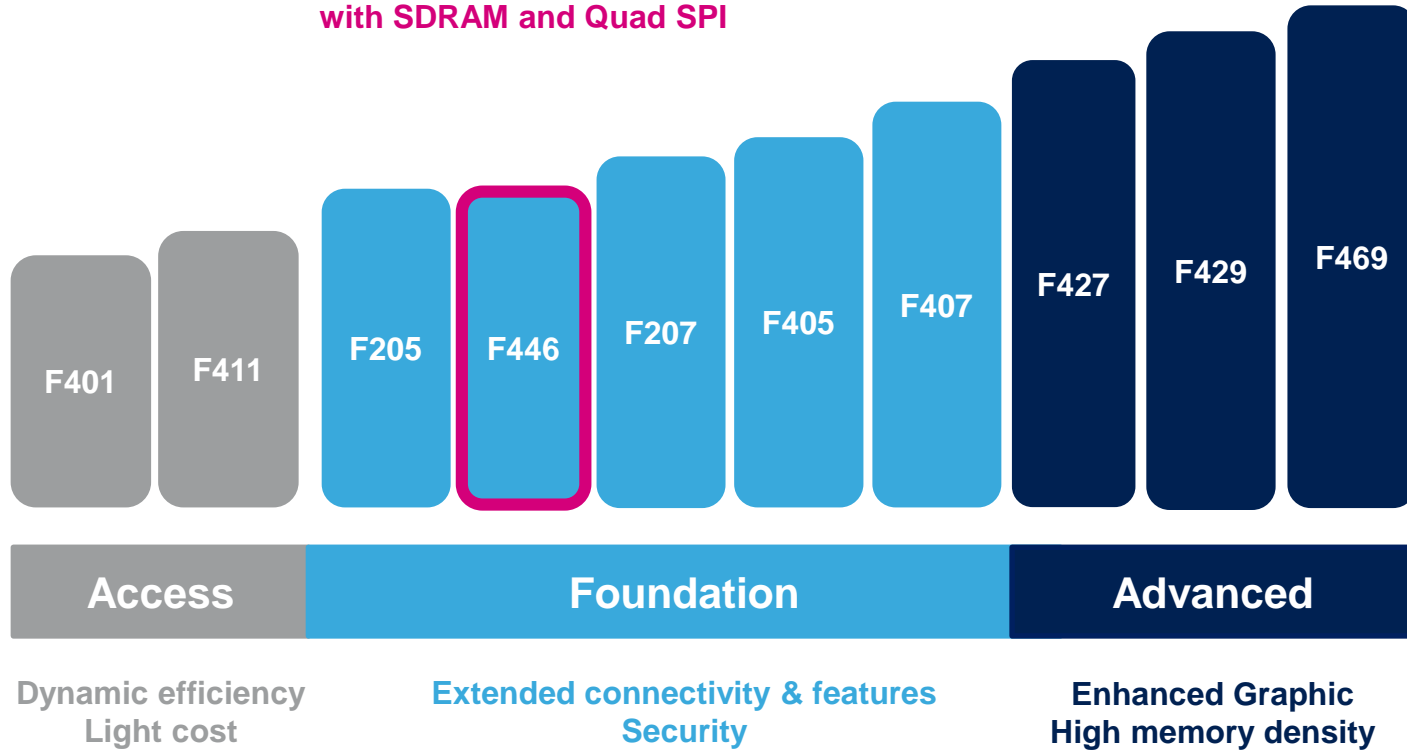
Connectivity  
Features  
Security

Enhanced Graphic  
High memory density

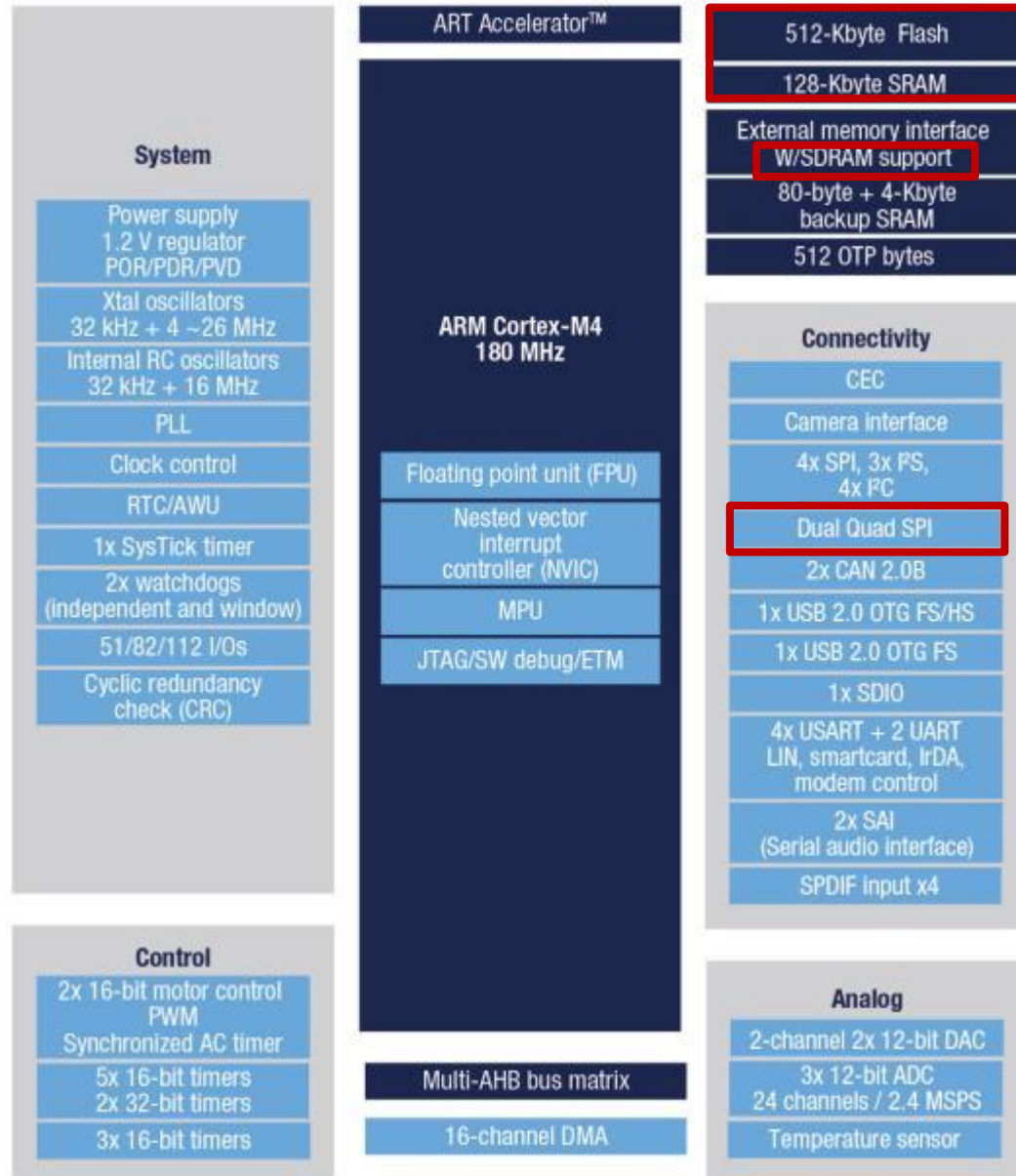


# F446 - Price positioning

Cost effective high performance MCU  
with SDRAM and Quad SPI



# STM32F446 – Block diagram





# STM32F469/479 block diagram

- Packages :

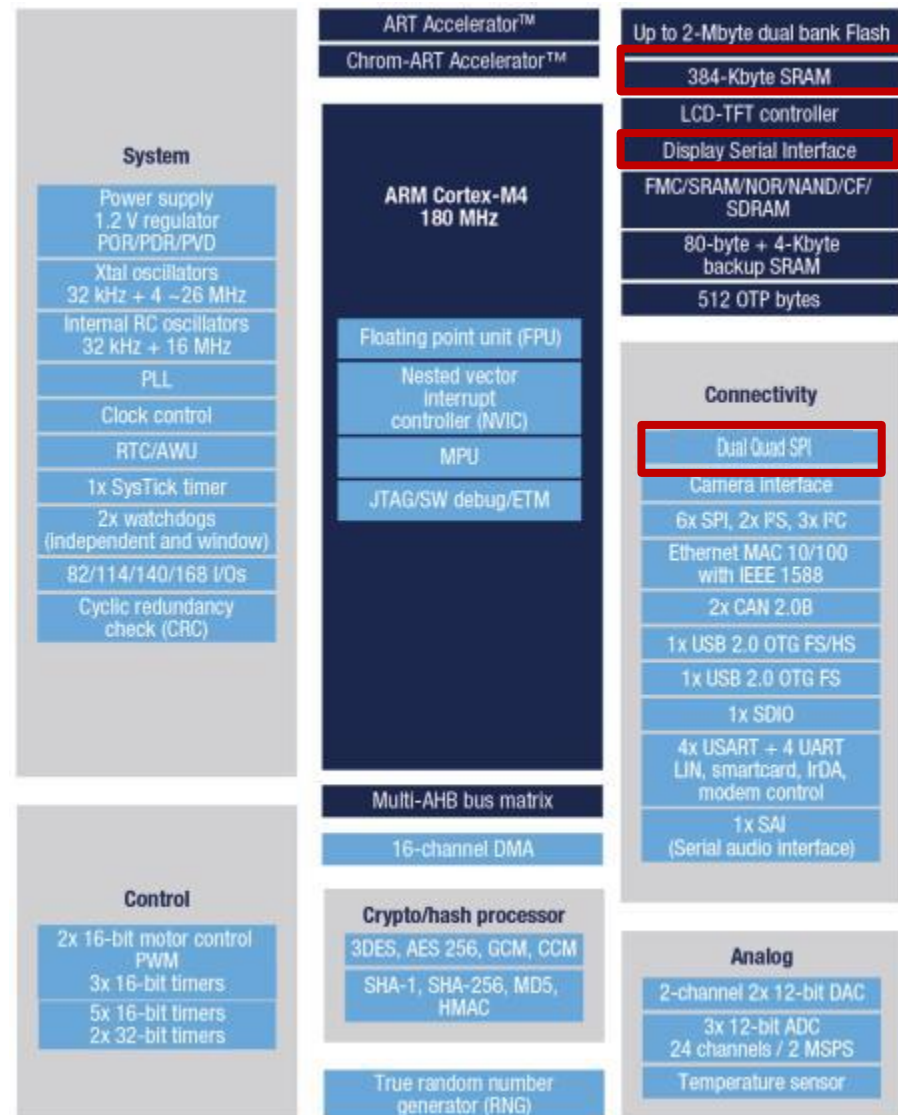
- WLCSP168
- BGA168
- LQFP208
- BGA216
- LQFP 176

- Memory sizes

- 2MB Flash, 384KB RAM
- 1MB Flash, 384KB RAM
- 512KB Flash, 384KB RAM

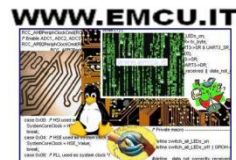
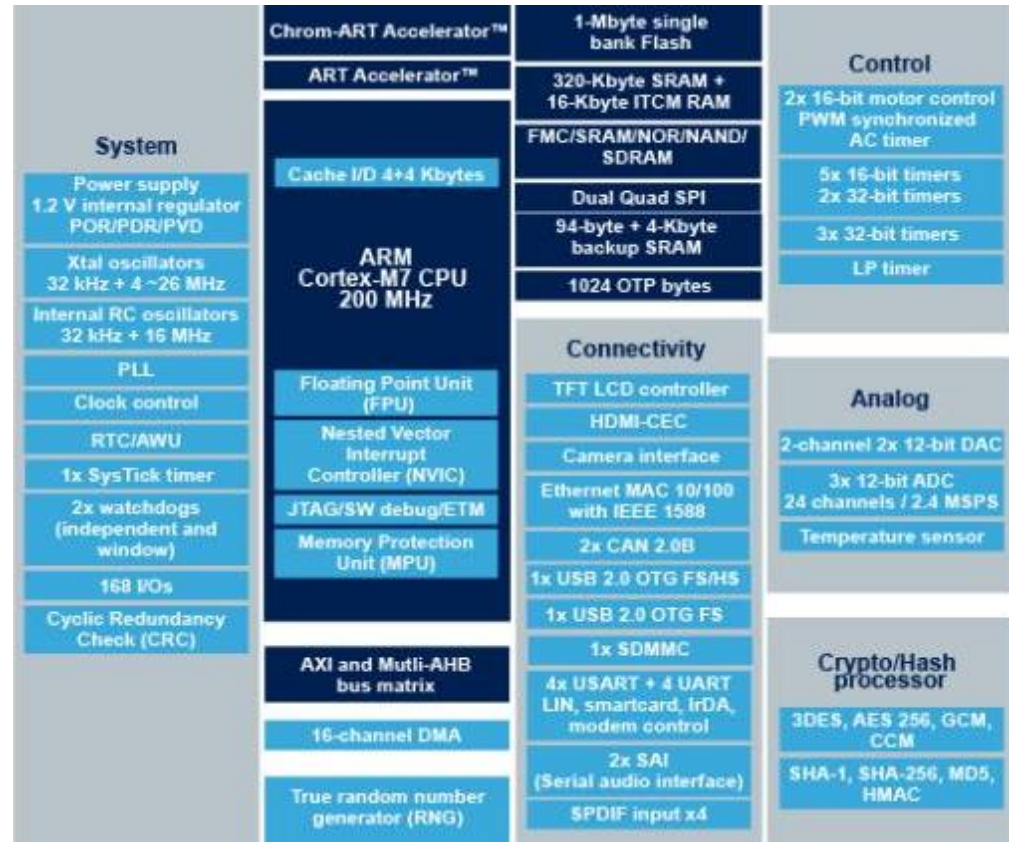
- Cryptography

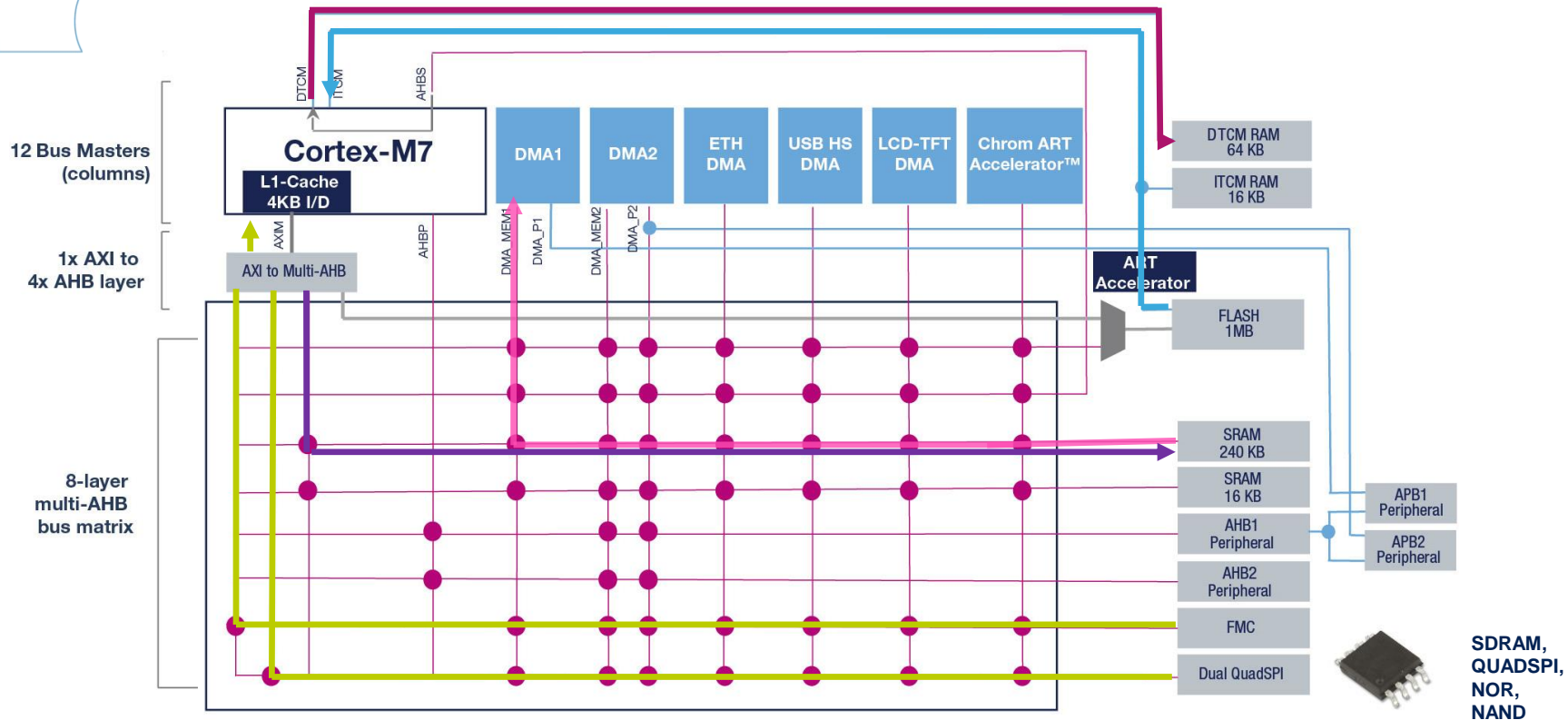
- F479 embeds a HW Crypto processor



# STM32 F756 block diagram

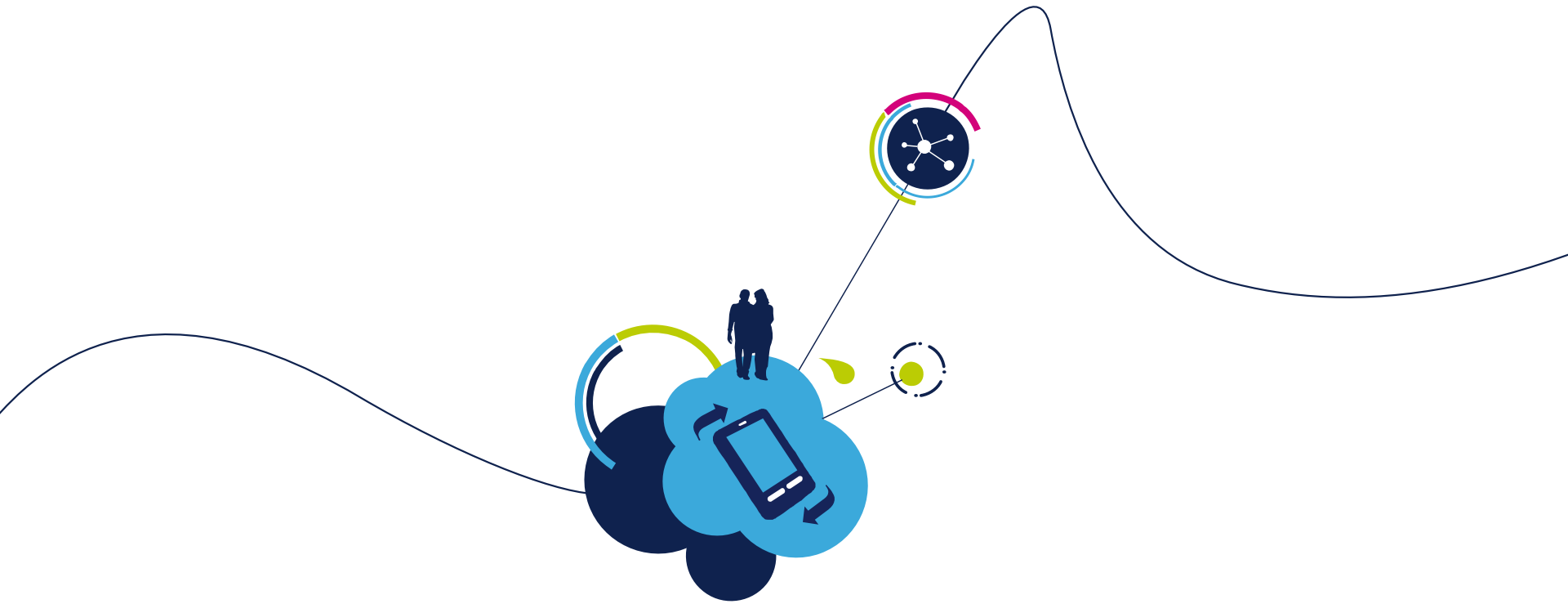
- NEW core: ARM Cortex-M7
- Up to 200 MHz, 428 DMIPS/1000 CoreMark
- Twice more DSP performance vs Cortex-M4 core
- New generation of Peripherals
- 2xSAI, 3xI2S half duplex, USB dedicated supply for 1.8 V operation, CEC, Quad SPI, SPDIF input, 4xI2C.
- Same packages as F429
  - WLCSP143
  - LQFP100,144,176,208
  - BGA 176, 216



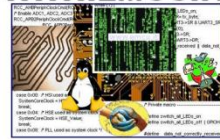


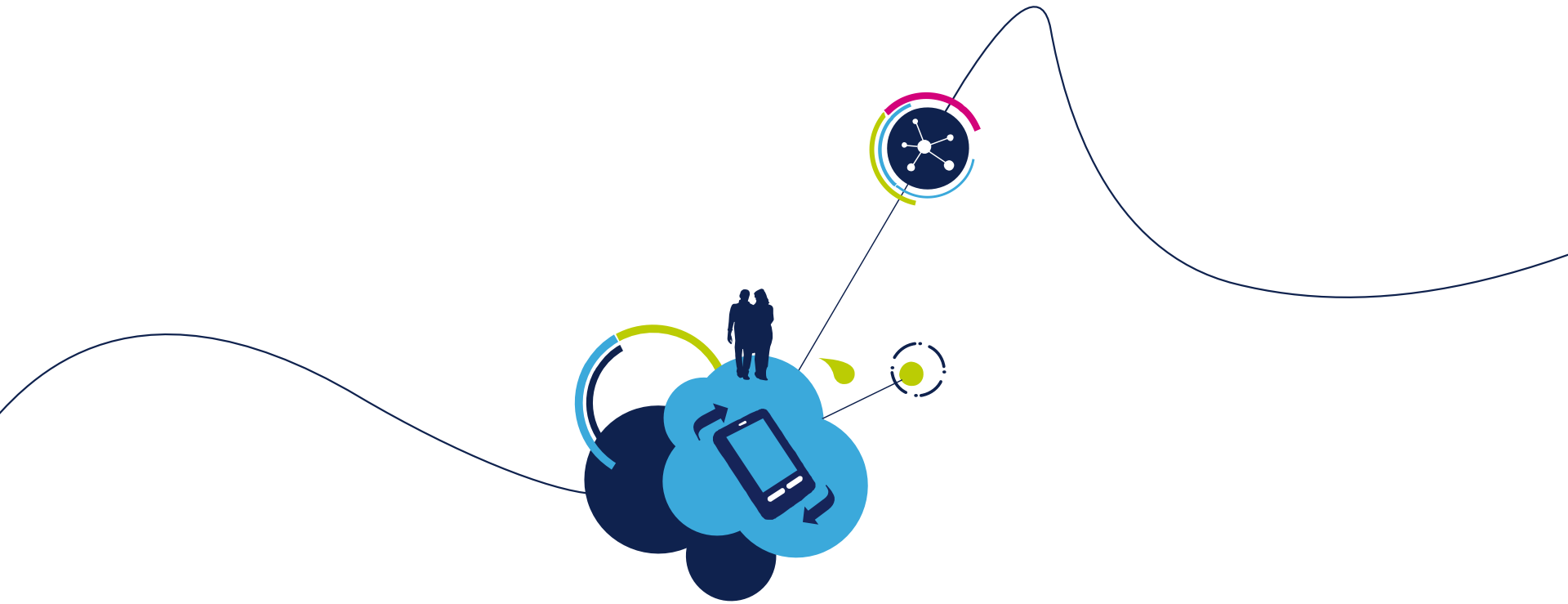
**Legend:**

- ITCM:** Critical Code with deterministic execution
- DTCM RAM:** Critical real time data ( Stack, heap ..)
- System SRAM:** Concurrent data transfer CPU or DMA
- External Memories:** Quad SPI, and FMC for data manipulation or code execution

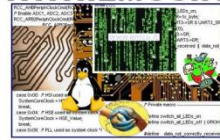


# STM32 Ultra Low Power



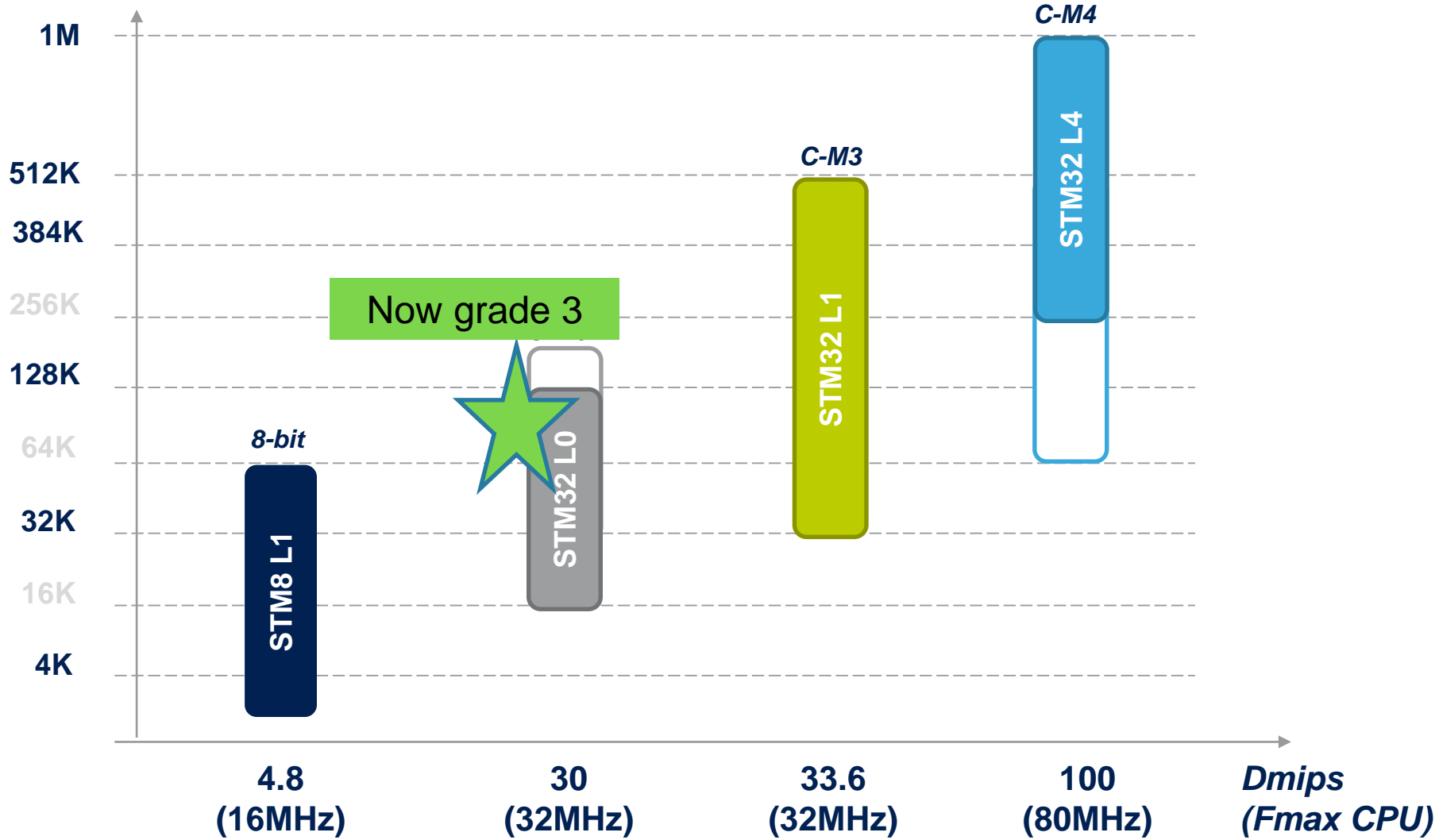


# STM32 Ultra Low Power



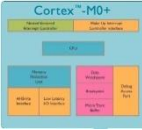
# Full Ultra-low-power Family

Memory size (Bytes)





# Meet the STM32L0x Series



## • STM32<sup>®</sup> ultra-low-power DNA is now built with ARM Cortex-M0+

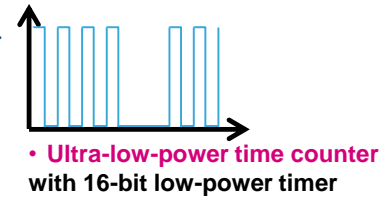
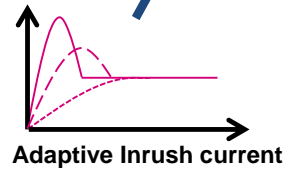
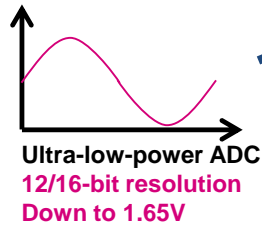
- 1.71V to 3.6V 32MHz operation
- 139µA/MHz (Run 32MHz)
- 87µA/MHz (Run Optimized)
- 400nA Stop mode + Full Ram
- 3.5 µs wakeup to Run
- -40°C to +125°C range



- Full Flash Protection
- Sector Flash Protection
- Hardware encryption - AES
- True RNG<sup>2</sup>
- Unique ID (96-bit)
- Class B
- Built-in ECC



USB 2.0 FS Certified  
Crystal-less / BCD<sup>1</sup>



• Ultra-low-power UART  
Up to 9600b in stop mode

1. Battery Charger Detection
2. True Random Number Generator



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Common features	
Cortex™-M0+ 32 MHz speed with MPU and MUL	
AES 128-bit	
Firewall protection <sup>2</sup> (Flash and RAM)	
Built-in 16 MHz, 4,2MHz and 38 kHz RC oscillators	
Multiple USART, SPI, I2C Low-power UART	
Multiple 16-bit timers Low-power 16-bit timer	
2x watchdogs	
Reset circuitry POR/PDR	
Brown Out Reset Program Voltage Detector	
2x comparators	
Dynamic Voltage Scaling	

## STM32L0x3 – USB & LCD line – 32-K to 192-Kbyte Flash

Up to 192-KB Flash <sup>1</sup>	Up to 20-KB SRAM	Up to 6-KB EEPROM	Main osc. input 1-24 MHz	RTC with 32 kHz osc.	7 ch DMA	ADC 12-bit 1Msps 16-ch	DAC Up to 2x 12-bit	USB2.0 Crystal Less, LPM, BCD	Touch Sense	True RNG	LCD 8x48 4x52
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## STM32L0x2 – USB line - 32 to 192-Kbyte Flash

Up to 192-KB Flash <sup>1</sup>	Up to 20-KB SRAM	Up to 6-KB EEPROM	Main osc. input 1-24 MHz	RTC with 32 kHz osc.	7 ch DMA	12-bit ADC 1Msps 16-ch	2xDAC 12-bit	USB2.0 Crystal Less, LPM, BCD	Touch Sense	True RNG
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## STM32L0x1 – Access line - 16-K to 192-Kbyte Flash

Up to 192-KB Flash <sup>1</sup>	Up to 20-KB SRAM	Up to 6-KB EEPROM	Main osc. input 1-24 MHz	RTC with 32 kHz osc.	4 ch DMA	12-bit ADC 1Msps 16-ch
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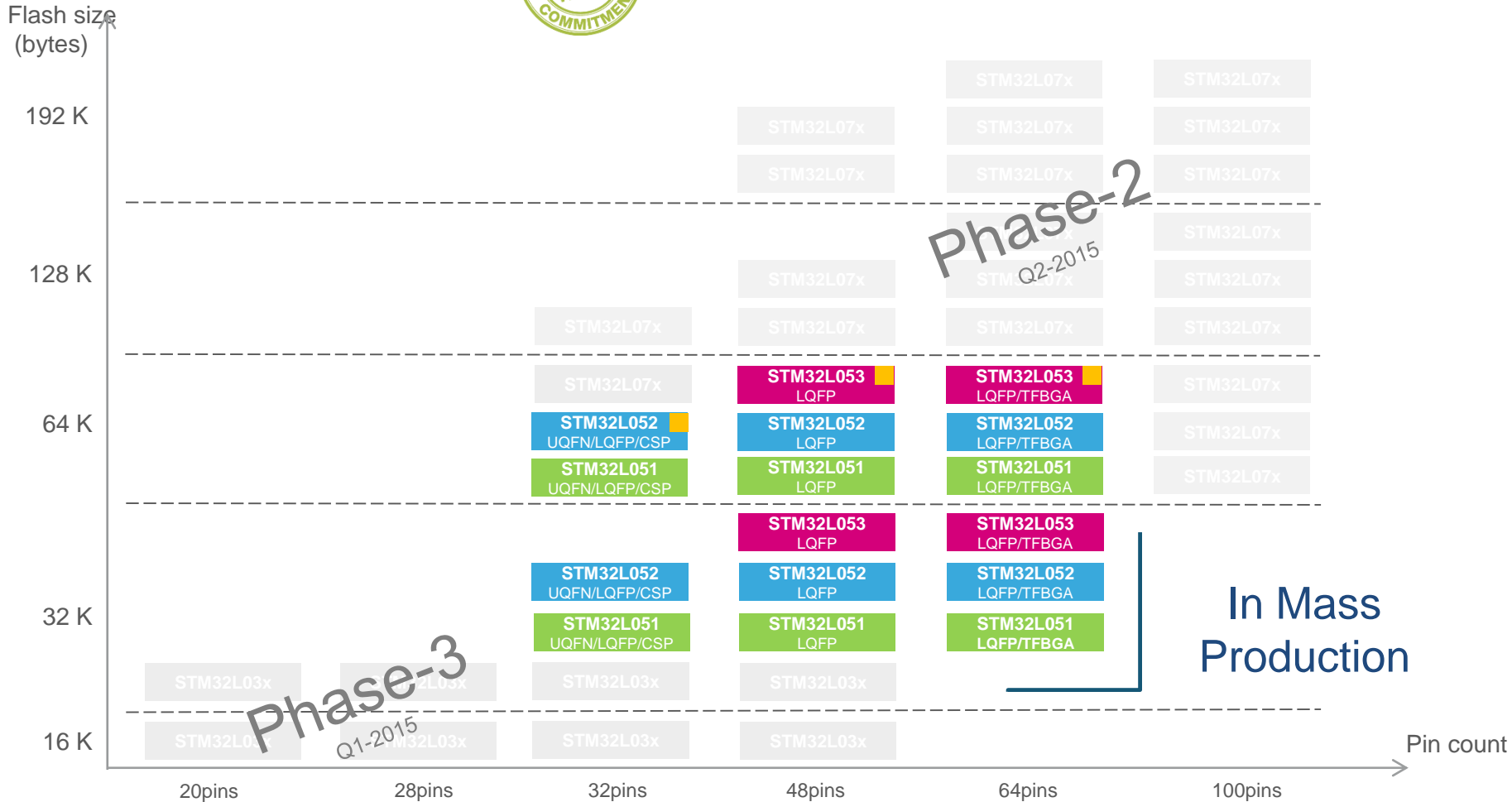
1. Dual bank flash with Rww feature from Flash to EEPROM (on part number STM32L07x/08x))
2. Only on STM32L0x2 and L0x3 line





# STM32L0x – portfolio

Cortex™-M0+ @ 32MHz – H2-2014



### Package size

UQFN: 20pins in 3x3mm / 28pins in 4x4mm / 32pins in 5x5mm  
 LQFP: 32-to 48pins in 7x7mm / 64pins in 10x10mm / 100pins in 14x14mm  
 BGA: 64pins in 5x5mm / 100pins in 7x7mm

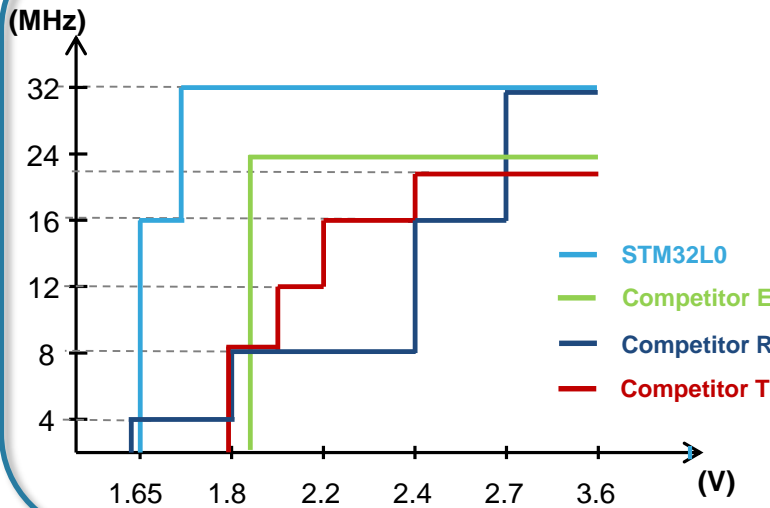
- STM32L0x1 - Access Line
- STM32L0x2 - USB Line
- STM32L0x3 - USB & LCD Line
- AES option



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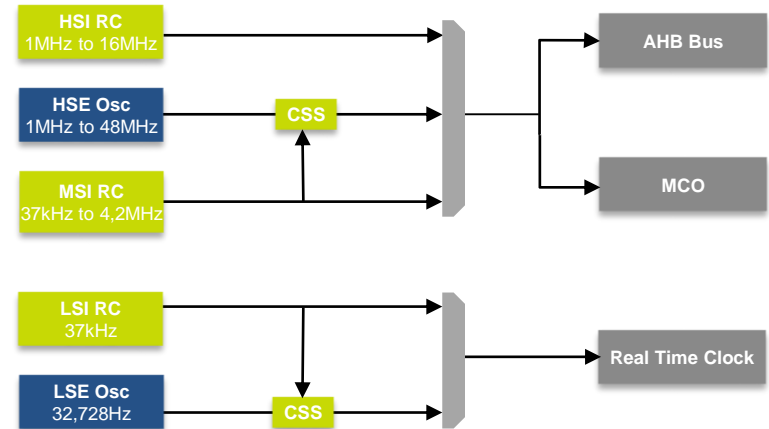
- A wide range operation



## Low voltage and High speed platform

Why to compromise CPU speed vs. power supply ?

- Clock Security System (CSS)  
Automatic clock switch to internal RC



## Design robustness is our concern

Clock Security System will ensure a very fast switch (couple of clock pulse) between external oscillator and internal one in case of malfunction detection.

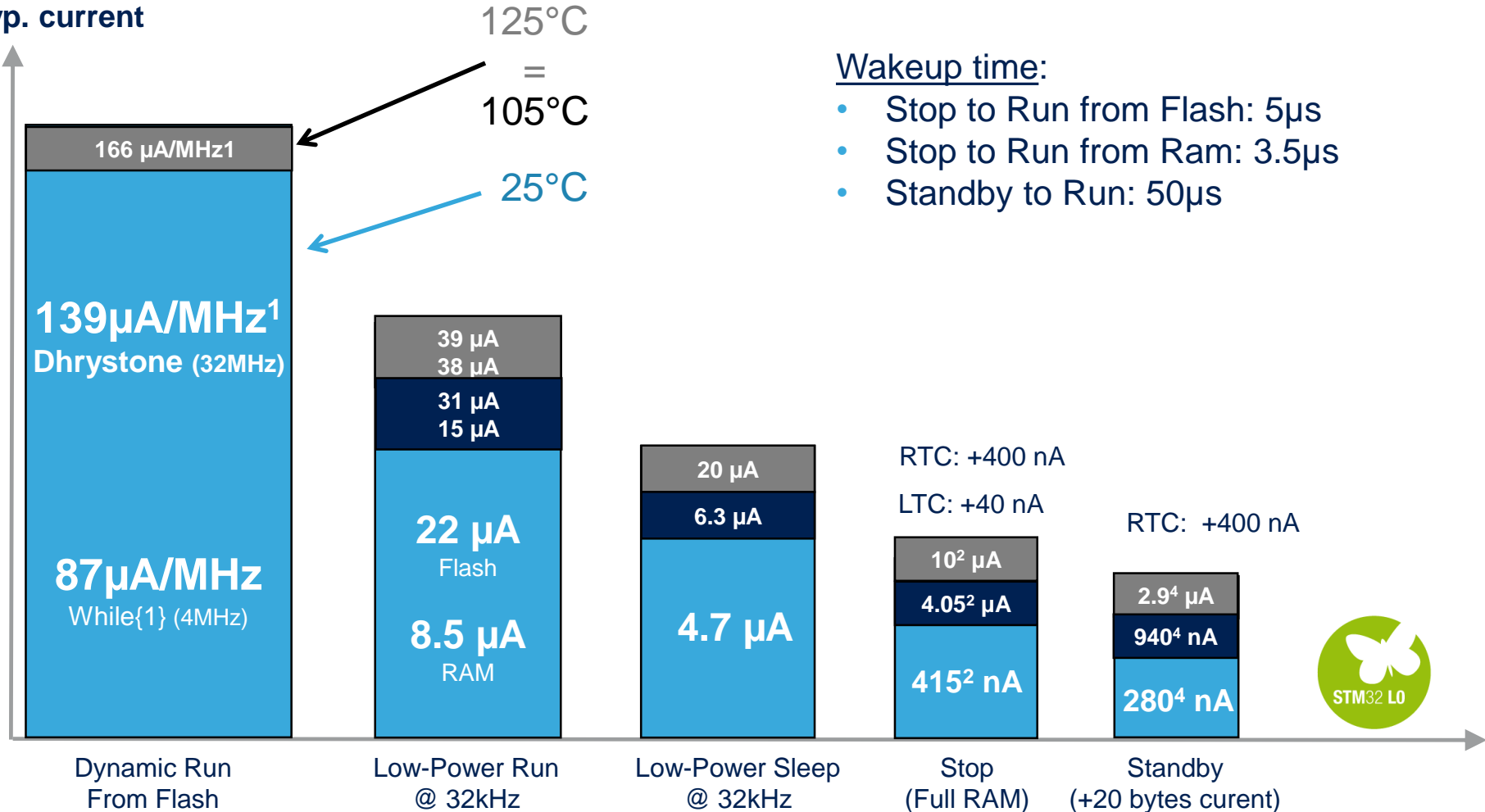
This unique feature will allow your application working were other MCUs will let you down.



# STM32L05x - power consumption

From 25°C to 125°C (typical)

Typ. current



### Wakeup time:

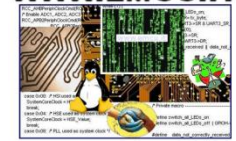
- Stop to Run from Flash: 5 $\mu$ s
- Stop to Run from Ram: 3.5 $\mu$ s
- Standby to Run: 50 $\mu$ s



1. Dhrystone power consumption value executed from Flash (Prefetch off) with VDD=3.3V
2. STOP mode consumption with **Full Ram data retention** (RTC value given with LSE low-drive using 32,768kHz crystal)
3. LTC: Low-power Time Counter @ 100Hz with external oscillator (LSE)
4. STANDBY mode consumption with **20Byte of backup register and Power supply monitoring**

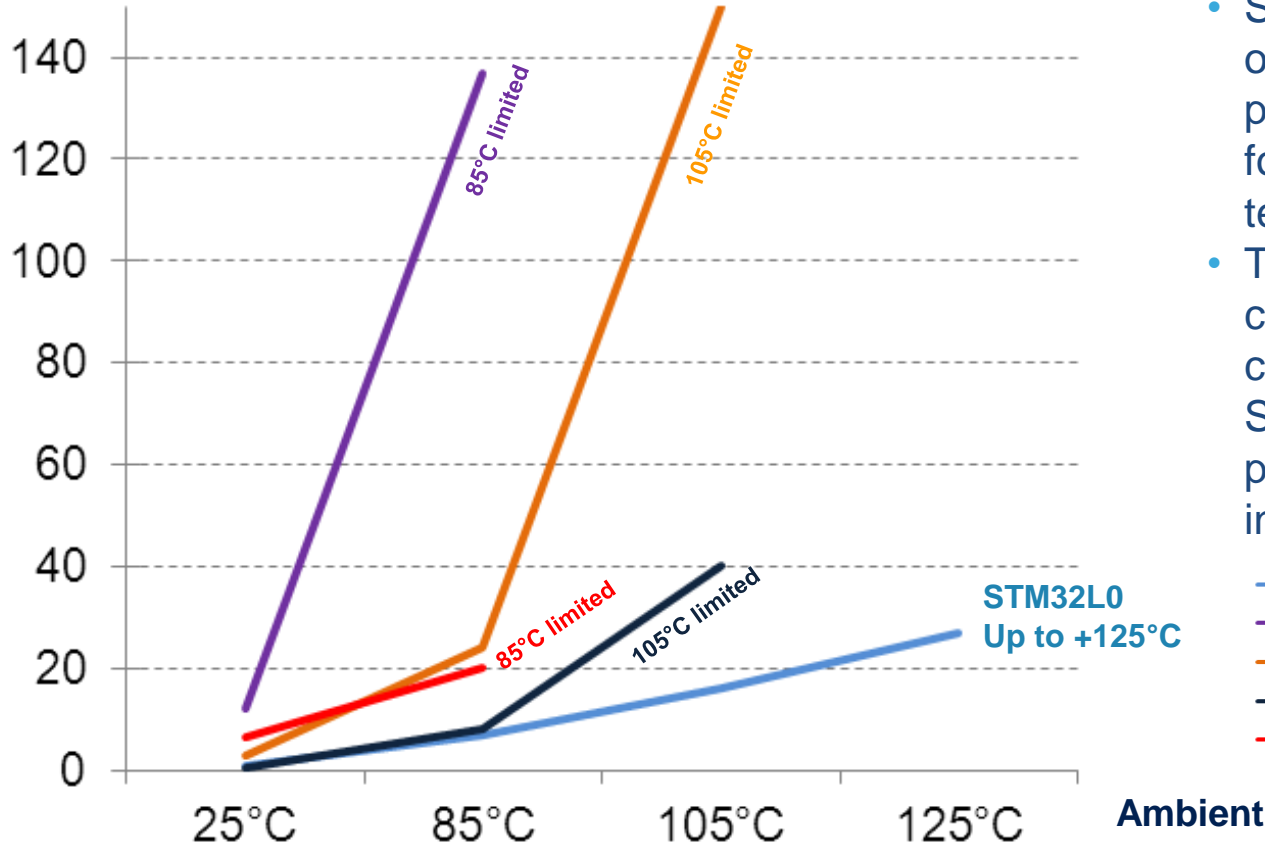


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- Max. current value at lowest power mode vs. temperature capability

IDD ( $\mu\text{A}$ )



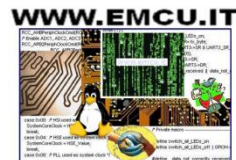
- STM32L0 platform offers the lowest power consumption for the highest temperature range.
- This capability to control leakage current makes STM32L0 the premium choice for industrial application,

- STM32L0
- Competitor A
- Competitor F
- Competitor R
- Competitor T

Note: Value based on competition datasheet, looking at lowest power mode with full RAM retention at VDD 3.0V. All datasheet give same value for -40°C/+25°C temperature range.

# STM32L4 MCU series

Excellence in **ultra-low-power** with **performance**

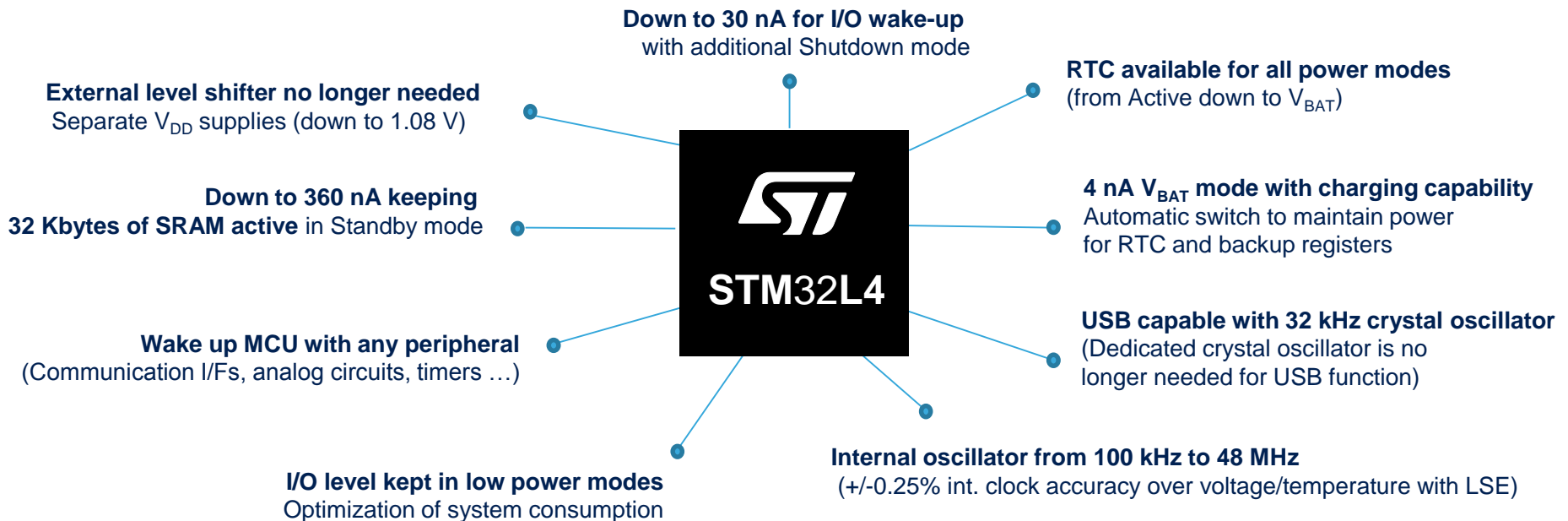


# Ultra-Low-Power and Flexibility



## FlexPowerControl

STM32L4 is based on a new platform optimized to reduce power consumption and increase flexibility

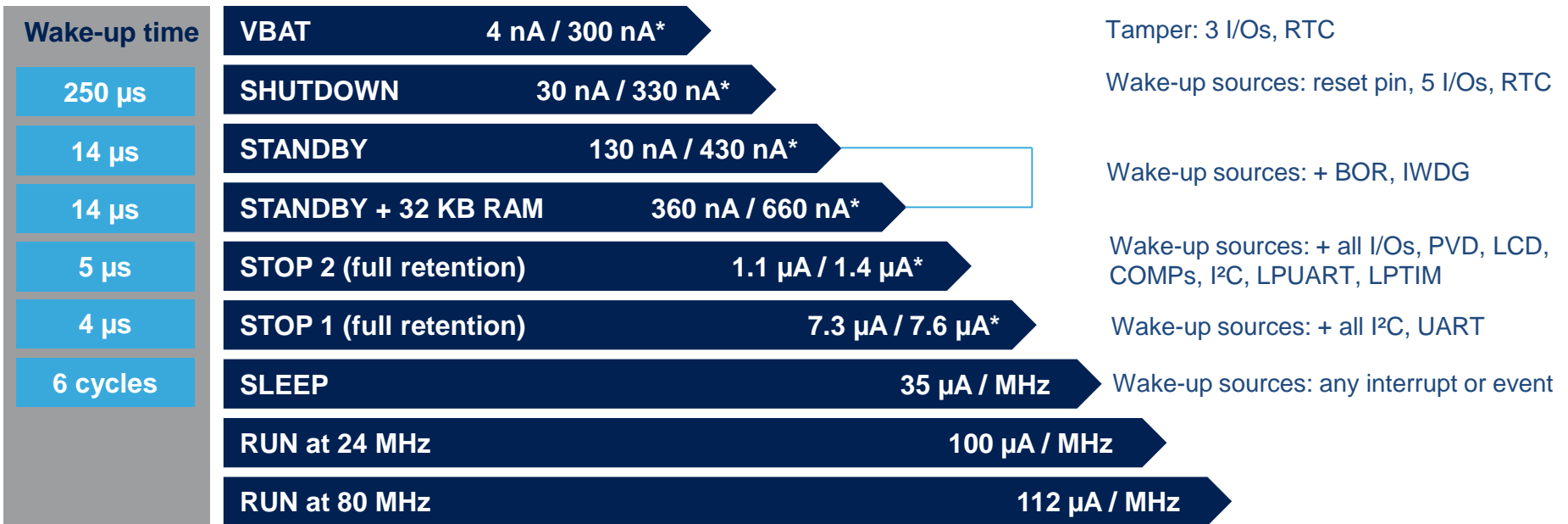


**1 ULP leader and performance booster**

# Ultra-low-power modes

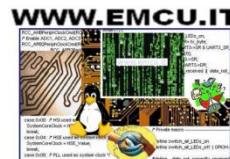


## Best power consumption numbers with full flexibility



Note : \* without RTC / with RTC

1 ULP leader and performance booster

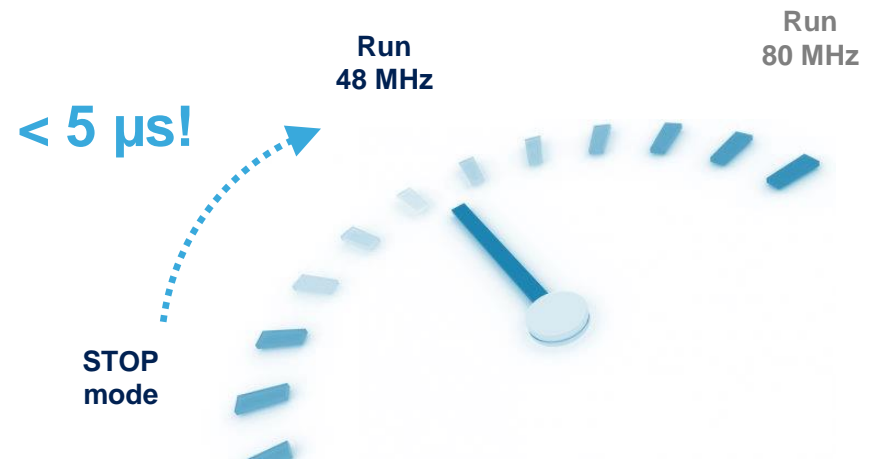


# Efficient run and fast wake-up



Ready for Launch Control ? From 0 to 48 MHz in less than 5  $\mu$ s

- Thanks to our internal oscillator (MSI) used at start-up (programmable from 100 kHz to 48 MHz)
- PLL wake-up time < 15  $\mu$ s (needed to reach  $f_{MAX}$ )

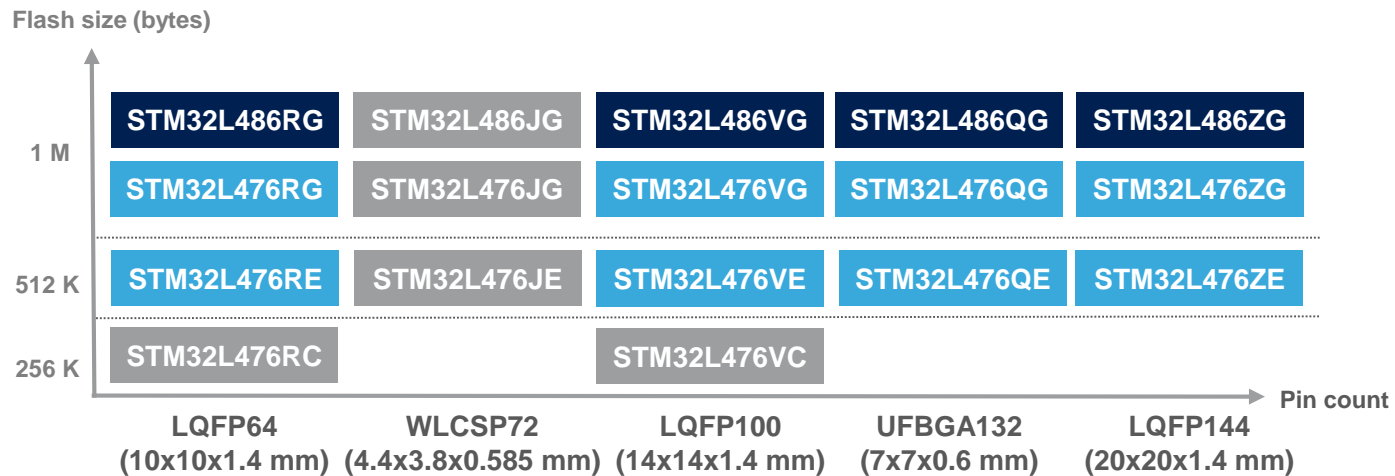


1 ULP leader and performance booster





# STM32L4 portfolio

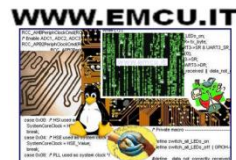
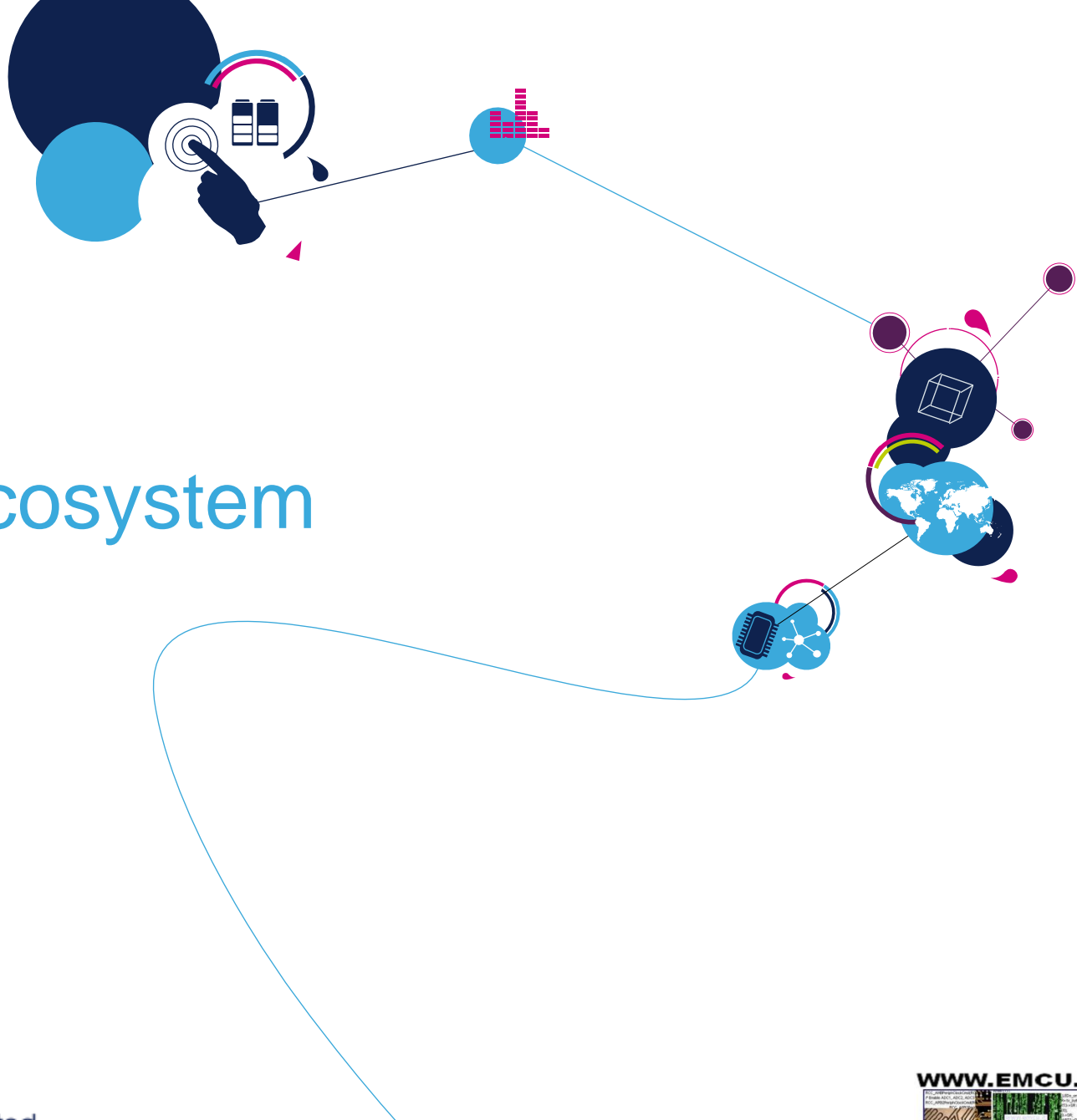


#### Legend:

- With 128/256-bit AES Hardware Encryption
- Without 128/256-bit AES Hardware Encryption
- Available in Q2/2015

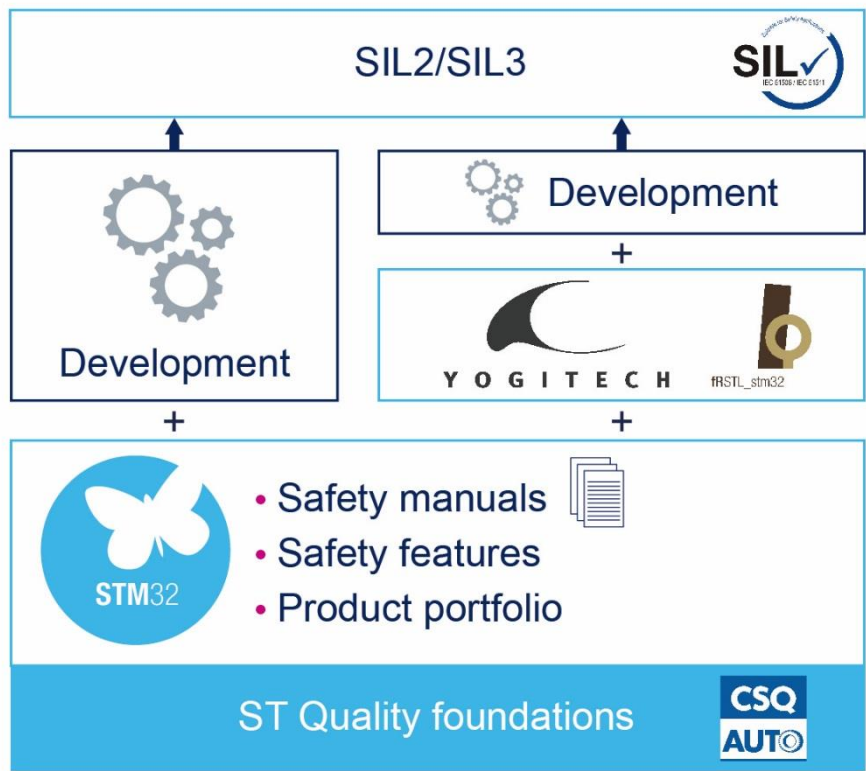
4 Great investment

# STM32 Ecosystem



## Safety design package for STM32 MCUs

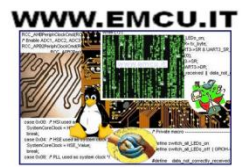
**Dramatically reduce time and cost to build STM32 based systems certified to IEC 61508 Functional Safety Standard**



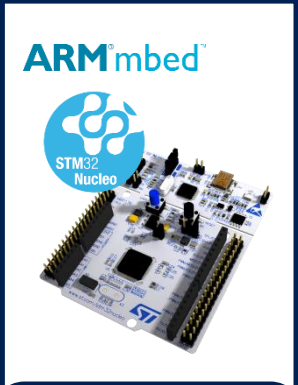



Press release [here](#)



[www.st.com/stm32safety](http://www.st.com/stm32safety)



# Hardware Development Tools

				
	STM32 Nucleo	Discovery kits	Evaluation boards	3 <sup>rd</sup> parties
Typical use case	Flexible prototyping, Community	Prototyping, Creative demos	Full feature evaluation	From full evaluation to open hardware
Extension possibilities	+++	++	+++	
Connectivity	Arduino™ ST Morpho	ST	ST	



# STM32 Nucleo features

Flexible board power supply  
Through USB or external source

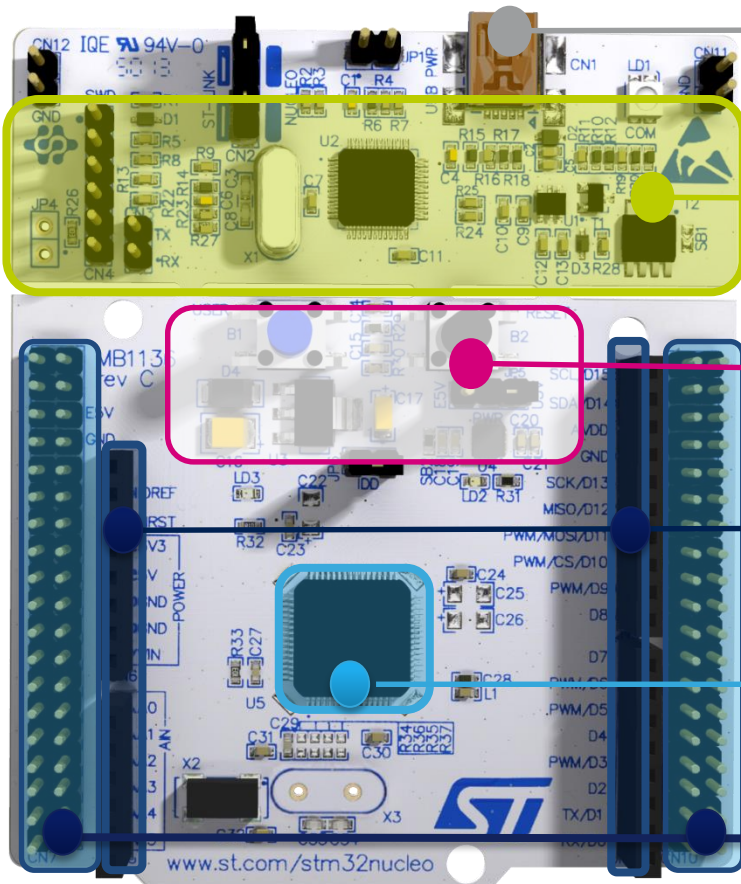
Integrated ST-Link/V2-1  
Mass storage device flash programming

2 push buttons, 2 color LEDs

Arduino™ extension connectors  
Easy access for add-ons

One STM32 MCU flavor with 64 pins

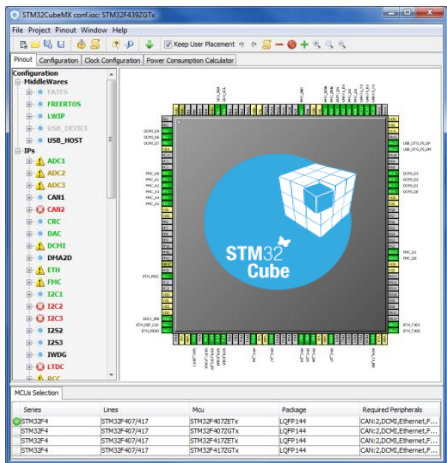
Morpho extension headers  
direct access to all MCU I/Os



[www.st.com/stm32nucleo](http://www.st.com/stm32nucleo)

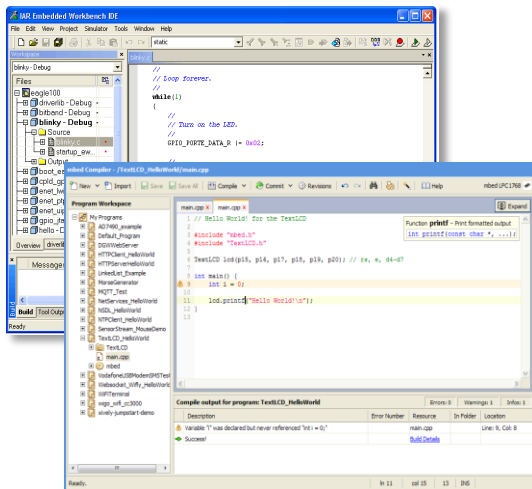


# Comprehensive choice of free IDEs



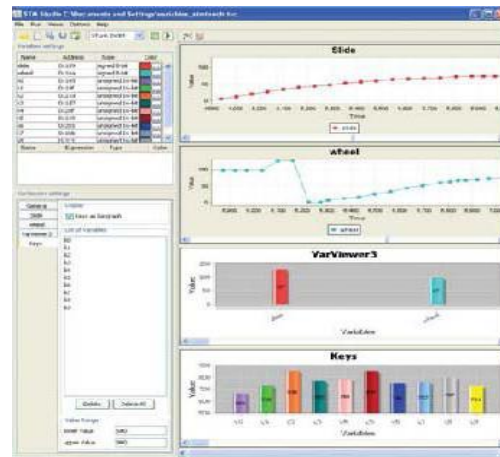
STM32CubeMX

Generate Code



Partners IDEs

Compile & Debug



STMStudio

Monitor

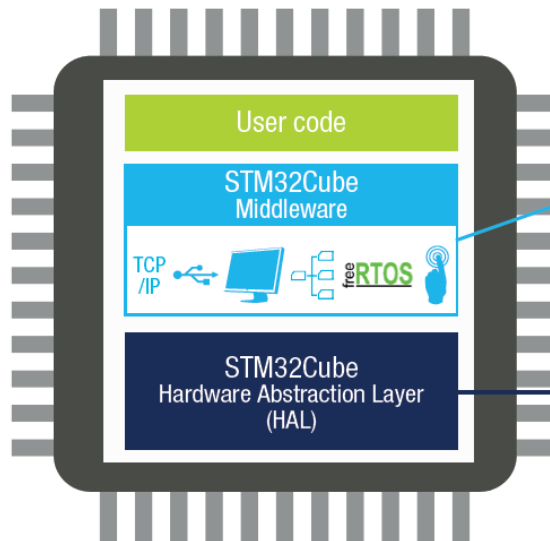


Free IDE



## Supporting all STM32 MCUs

- Get configuration code generated\* from a tool with STM32Cube and focus on your added-value software !
  - 4 configuration wizards: pinout, clock, peripherals & middleware, power consumption
  - Portable Hardware Abstraction layer, from series to others
  - Middleware with RTOS, USB, TCP/IP, File System, Graphics , Touch sensing...



- Open-source TCP/IP stack (lwIP)
- USB Host and Device library from ST
- STemWin graphical stack library from ST and SEGGER
- Open-source FAT file system (FatFs)
- Open-source real-time OS (FreeRTOS)
- Dozens of examples

- Abstraction of STM32 MCU through portable APIs
- High coverage for most STM32 peripherals
- Production-ready using CodeSonar® static analysis tool
- Hundreds of examples
- Open-source BSD license

# New ST MCU Finder Application

48



- Quickly find the right ST MCU
- Easy access to technical materials
- Latest news from ST MCU world



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Tell your colleagues and customers

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-> Be ready for new exiting features coming this summer...



[www.st.com/stm32](http://www.st.com/stm32)

# Releasing your creativity with the new STM32



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