# STM32 F0 Value Line

Entry-level MCUs


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# Key Messages



- **STM32 F0**: Is the **Cortex™-M0** core generated with ST's **STM32® DNA**, for cost sensitive designs.
  The **STM32 F0** is benefiting of STM32 DNA, providing the **essential** elements of the STM32 portfolio IPs

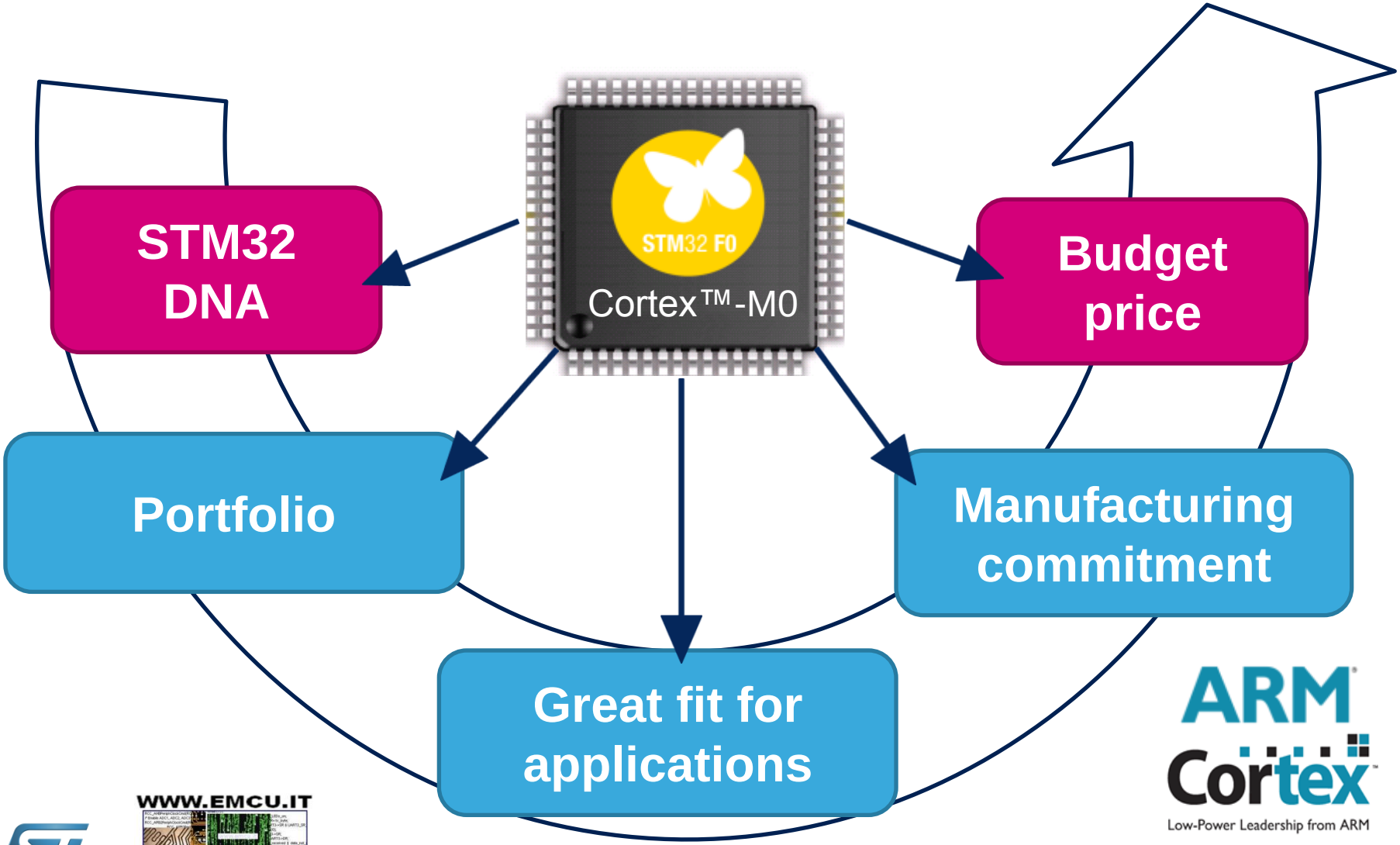
- **STM32 portfolio** offers an extraordinary variety of options, now including **Cortex™-M Cores (M0, M3, M4)** giving developers unparalleled flexibility to find the perfect STM32 for their developments

- Price competitiveness is improved with the introduction of a new low end family.
  The **STM32 F0 Value line.**


**STM32@32 cents**

# STM32 DNA at Budget Price



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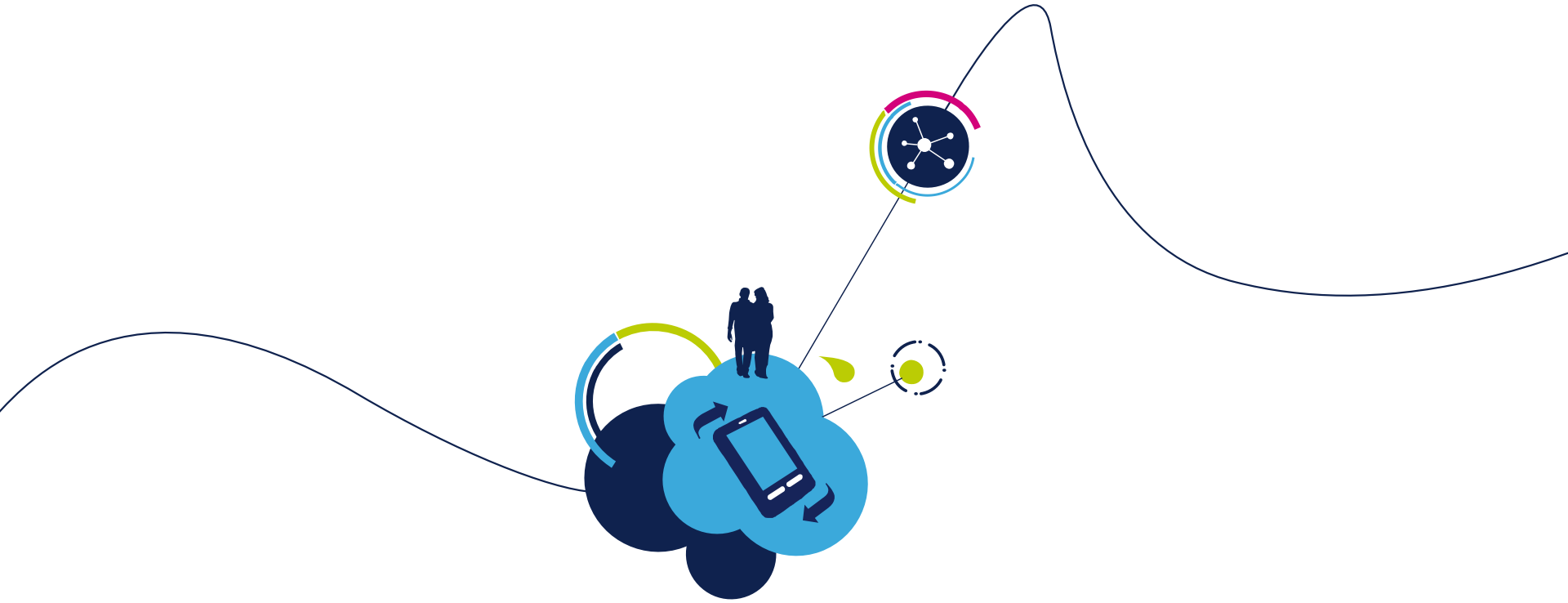
ARM
Cortex
Low-Power Leadership from ARM



# STM32 DNA

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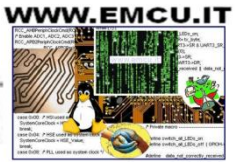
# STM32F030 – Value line



- Core
  - Low cost-low powerful ARM® Cortex™-M0 0.9 DMIPS/MHz max @48 MHz
- Architecture
  - No compromises on performance or upward compatibility
  - Robust Reset system
  - 5 channels DMA
  - 48 MHz Clock speed
- Enhanced features for all kinds of applications including consumer or industrial
  - **Numerous PWM 16-bit timers** including **motor control timer**, fast 1.0 µs 12-bit **ADC**, a set of serial communication I/F including, I²C, USART, SPI.
- From 16- to 64-Kbyte embedded Flash
- From 20- to 64-pin TSSOP or LQFP packages

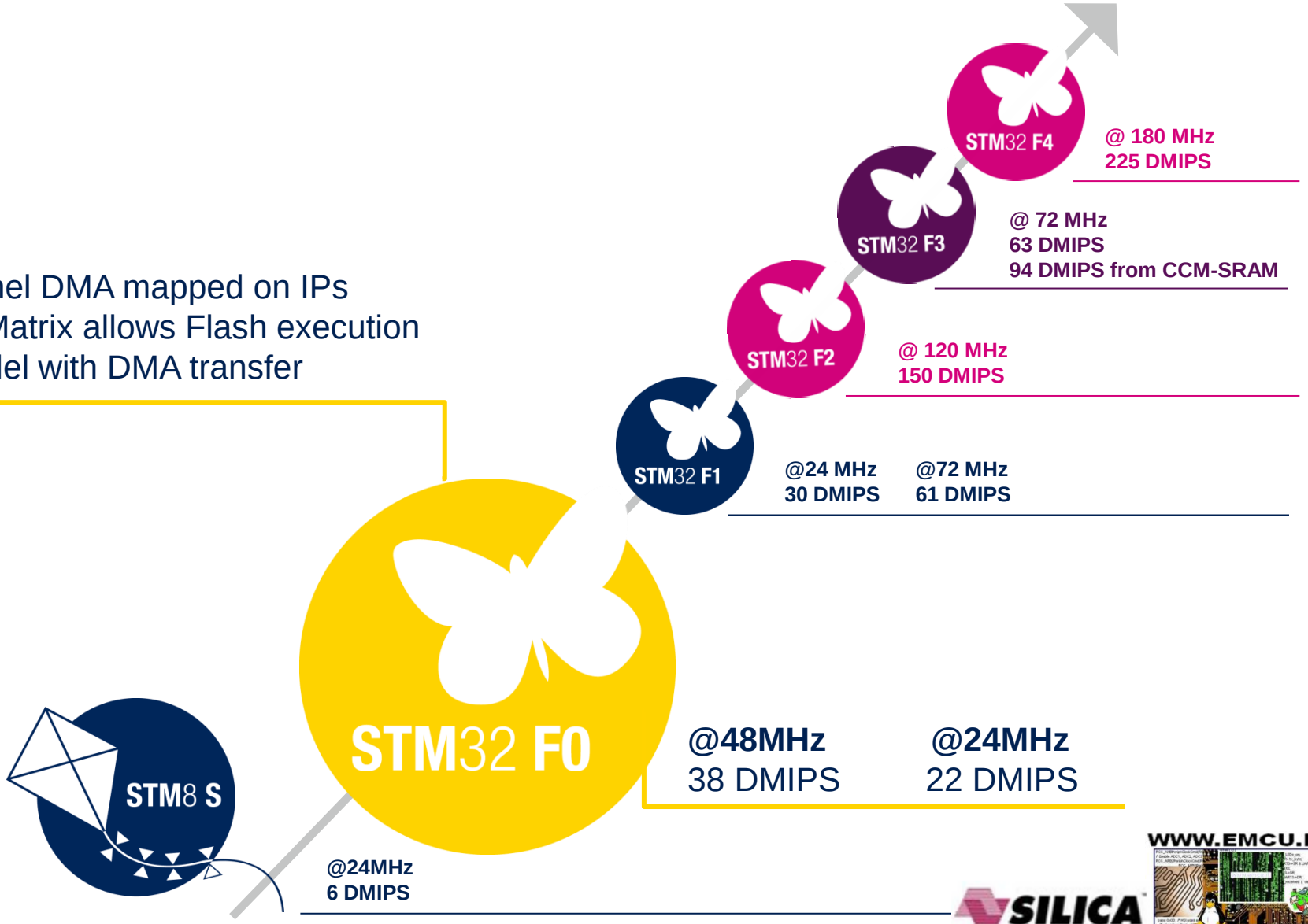




# Real-Time Performance



5 channel DMA mapped on IPs
+ Bus Matrix allows Flash execution
in parallel with DMA transfer



# ST has licensed Cortex-M processors



- **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

| Cortex-M0 | Cortex-M3 | Cortex-M4 |
|---|---|---|
| 8/16-bit applications | 16/32-bit applications | 32-bit/DSC applications |

**Binary and tool compatible**

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# Cortex-M processors binary compatible

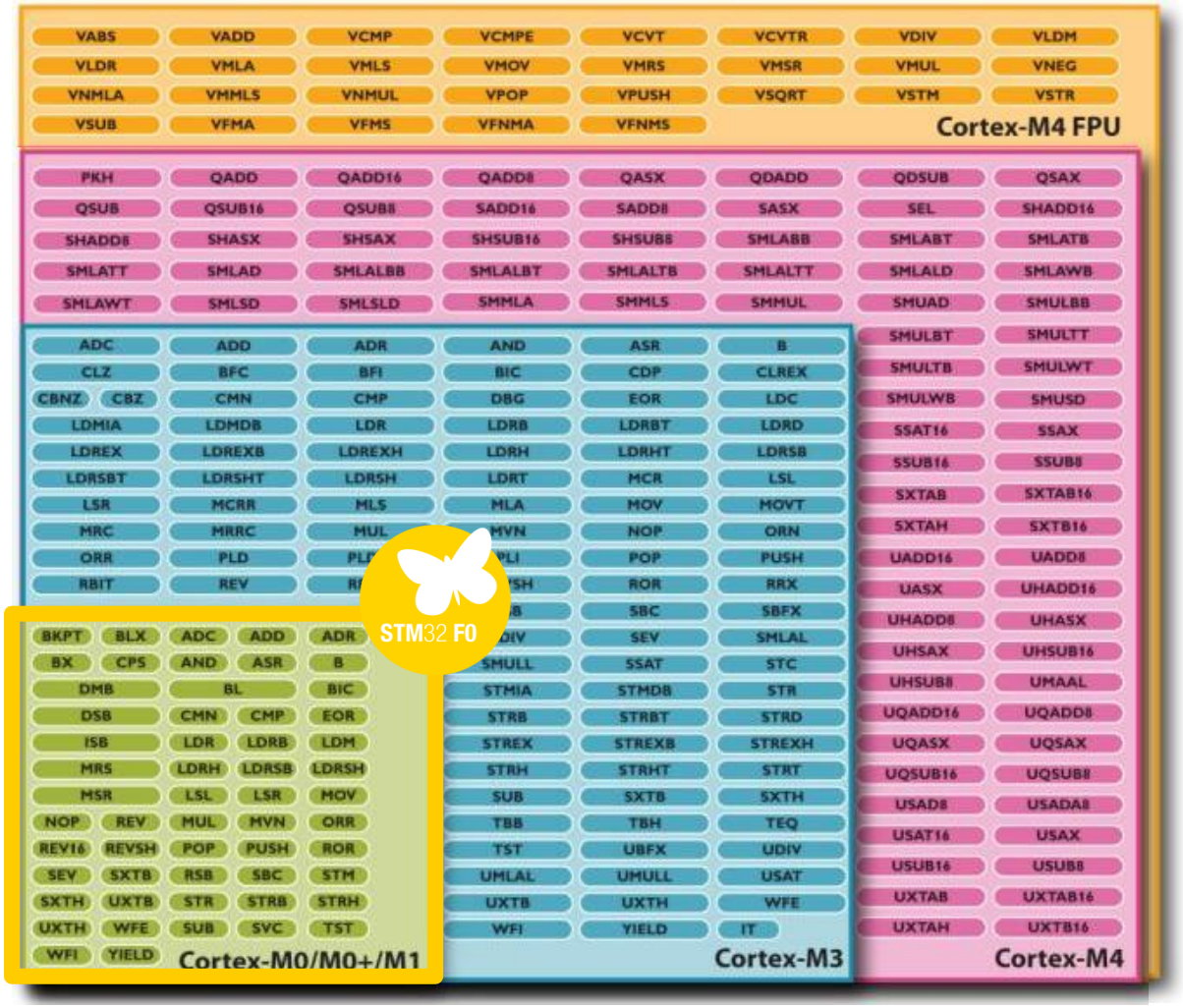


Floating Point Unit (FPU)

DSP (SIMD, fast MAC)

Advanced data processing
Bit field manipulations

General data processing
I/O control tasks




Source: ARM

# Cortex-M feature set comparison



| Cortex<br>Low-Power Leadership from ARM | Cortex-M0 | Cortex-M3 | Cortex-M4 |
|---|---|---|---|
| **Architecture Version** | V6M | v7M | v7ME |
| **Instruction set architecture** | Thumb, Thumb-2 System Instructions | Thumb + Thumb-2 | Thumb + Thumb-2, DSP, SIMD, FP |
| **DMIPS/MHz** | 0.9 | 1.25 | 1.25 |
| **Bus interfaces** | 1 | 3 | 3 |
| **Integrated NVIC** | Yes | Yes | Yes |
| **Number interrupts** | 1-32 + NMI | 1-240 + NMI | 1-240 + NMI |
| **Interrupt priorities** | 4 | 8-256 | 8-256 |
| **Breakpoints, Watchpoints** | 4/2/0, 2/1/0 | 8/4/0, 2/1/0 | 8/4/0, 2/1/0 |
| **Memory Protection Unit (MPU)** | No | Yes (Option) | Yes (Option) |
| **Integrated trace option (ETM)** | No | Yes (Option) | Yes (Option) |
| **Fault Robust Interface** | No | Yes (Option) | No |
| **Single Cycle Multiply** | **Yes** (Option) | Yes | Yes |
| **Hardware Divide** | No | Yes | Yes |
| **WIC Support** | Yes | Yes | Yes |
| **Bit banding support** | No | Yes | Yes |
| **Single cycle DSP/SIMD** | No | No | Yes |
| **Floating point hardware** | No | No | Yes |
| **Bus protocol** | AHB Lite | AHB Lite, APB | AHB Lite, APB |
| **CMSIS Support** | Yes | Yes | Yes |

# No compromise on robustness



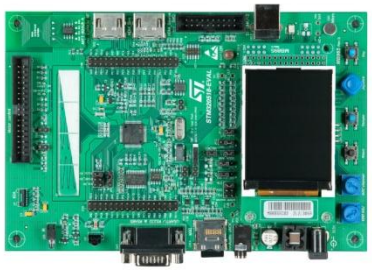
## Meets industry safety specifications

- Hardware **RAM** parity check
- **Clock Security System** (CSS) for switching to back-up internal RC in case of external clock failure
- **2x Watchdogs (2x WDG)** capable of real-time code execution monitoring and ensuring the application integrity independently from system clock
- **Cyclic Redundancy Check** (CRC) with DMA support for embedded Flash-memory content-integrity checking


# Extensive Tools and SW



- STM32F0 Evaluation board for full product feature evaluation
  - Hardware evaluation platform for all interfaces
  - Possible connection to all I/Os and all peripherals



**STM320518-EVAL**
**$199**

- Compatible Discovery-Kit


**STM32F0DISCOVERY**
**$7.99**

- Large choice of development IDE solutions from the STM32 and ARM ecosystem

| Free IDE | Lead partners | 3rd Parties |
|---|---|---|
| CooCox | IAR SYSTEMS | aiji SYSTEM, hitex DEVELOPMENT TOOLS, atollic, i SYSTEM, Green Hills SOFTWARE, INC. |
| KEIL Tools by ARM | KEIL Tools by ARM | LAUTERBACH, SIGNUM SYSTEMS, TASKING, expresslogic, CMX SYSTEMS |

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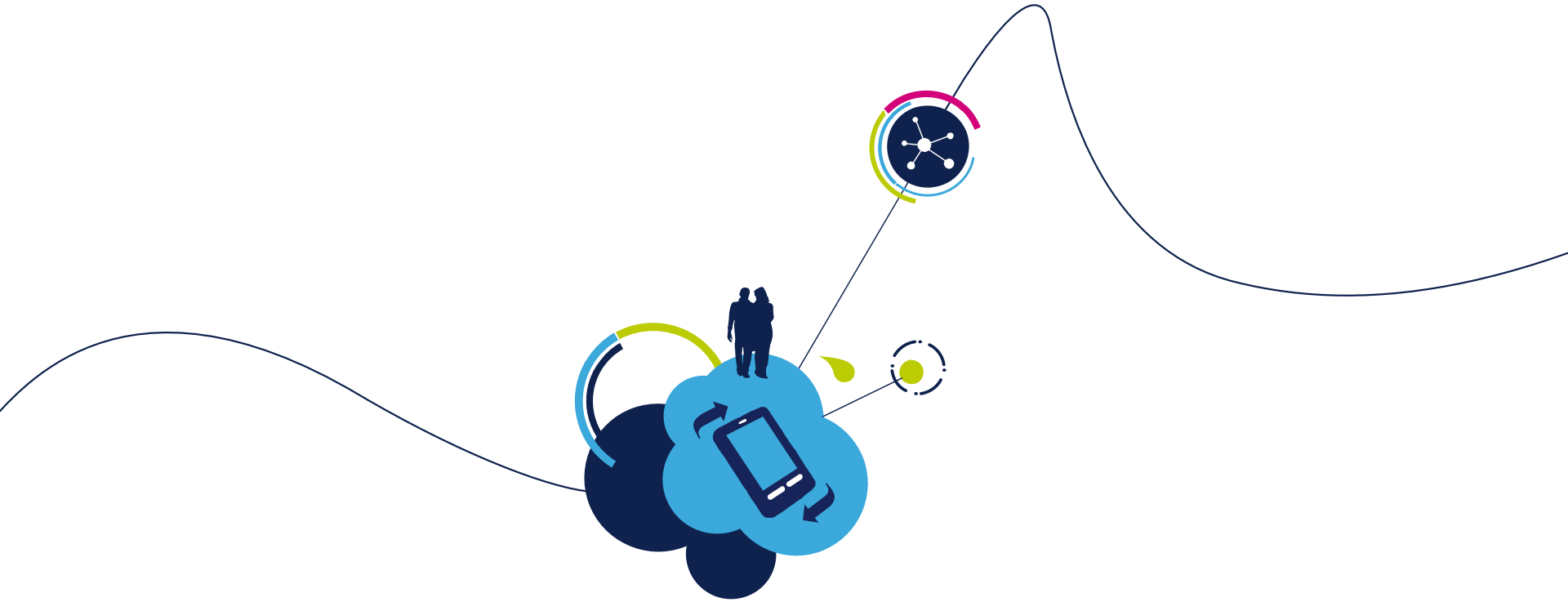

# STM32 Portfolio

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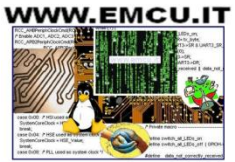


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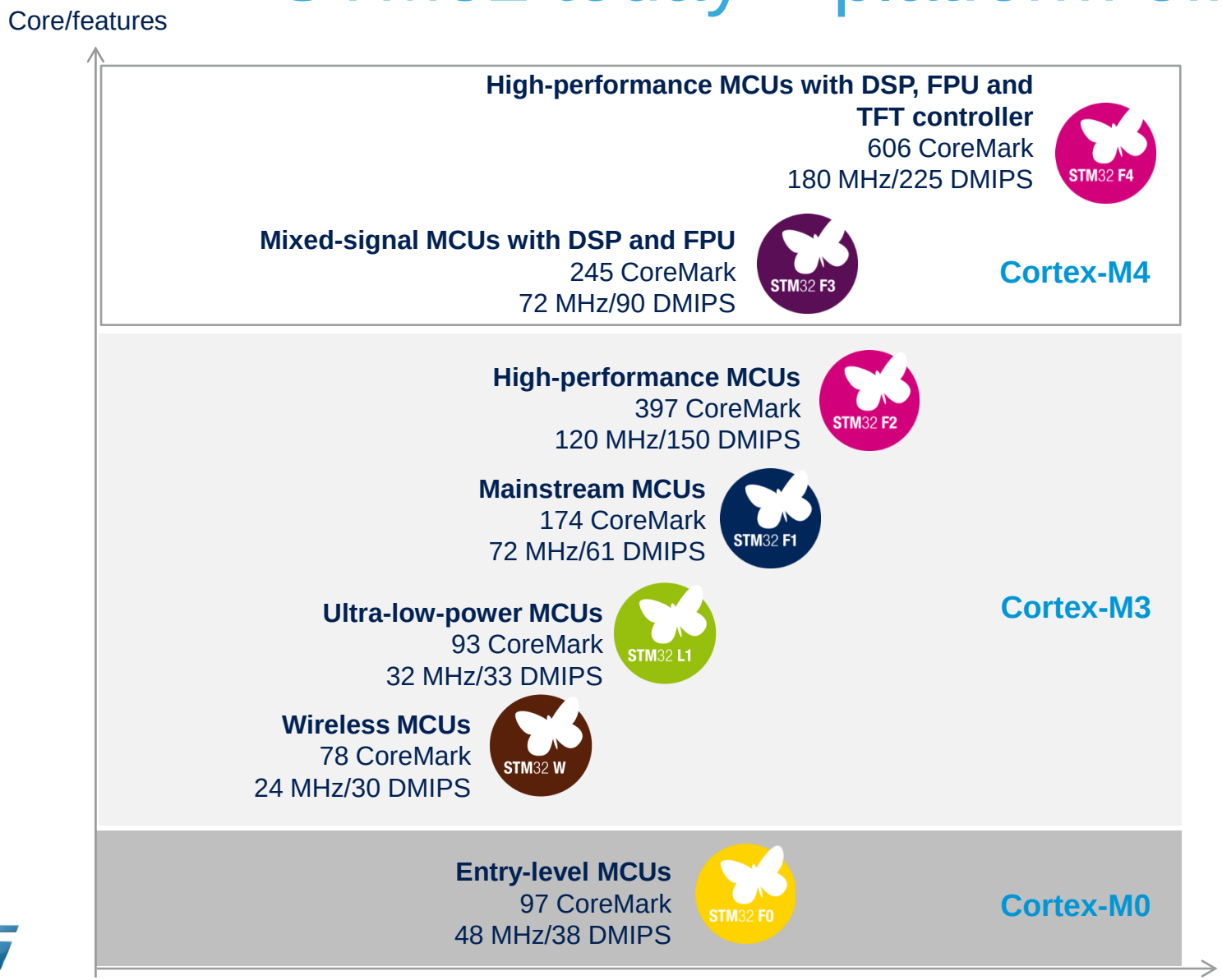
# STM32 today – platform effect



# STM32 – 7 product series



**Common core peripherals and architecture:**

- Communication peripherals: USART, SPI, I²C
- Multiple general-purpose timers
- Integrated reset and brown-out warning
- Multiple DMA
- 2x watchdogs Real-time clock
- Integrated regulator PLL and clock circuit
- External memory interface (FSMC)
- Up to 3x 12-bit DAC
- Up to 4x 12-bit ADC (Up to 5 MSPS)
- Main oscillator and 32 kHz oscillator
- Low-speed and high-speed internal RC oscillators
- -40 to +85 °C and up to 105 °C operating temperature range
- Low voltage 2.0 to 3.6 V or 1.65/1.7 to 3.6 V (depending on series)
- Temperature sensor

**STM32 F4 series - High performance with DSP (STM32F401/405/415/407/417/427/437/429/439)**

| 180 MHz Cortex-M4 with DSP and FPU | Up to 256-Kbyte SRAM | Up to 2-Mbyte Flash | 2x USB 2.0 OTG FS/HS | 3-phase MC timer | 2x CAN 2.0B | SDIO 2x I²S audio Camera IF | Ethernet IEEE 1588 | Crypto TFT LCD + SDRAM |
|---|---|---|---|---|---|---|---|---|

**STM32 F3 series - Mixed-signal with DSP (STM32F302/303/313/372/373/383)**

| 72 MHz Cortex-M4 with DSP and FPU | Up to 48-Kbyte SRAM & CCM-SRAM | Up to 256-Kbyte Flash | USB 2.0 FS | 2x 3-phase MC timer (144 MHz) | CAN 2.0B | Up to 7x comparator | 3x 16-bit ΣΔ ADC | 4x PGA |
|---|---|---|---|---|---|---|---|---|

**STM32 F2 series - High performance (STM32F205/215/207/217)**

| 120 MHz Cortex-M3 CPU | Up to 128-Kbyte SRAM | Up to 1-Mbyte Flash | 2x USB 2.0 OTG FS/HS | 3-phase MC timer | 2x CAN 2.0B | SDIO 2x I²S audio Camera IF | Ethernet IEEE 1588 | Crypto |
|---|---|---|---|---|---|---|---|---|

**STM32 F1 series - Mainstream - 5 product lines (STM32F100/101/102/103 and 105/107)**

| Up to 72 MHz Cortex-M3 CPU | Up to 96-Kbyte SRAM | Up to 1-Mbyte Flash | USB 2.0 OTG FS | 3-phase MC timer | Up to 2x CAN 2.0B | SDIO 2x I²S audio | Ethernet IEEE 1588 |
|---|---|---|---|---|---|---|---|

**STM32 F0 series – Entry level (STM32F030/50/051)**

| 48 MHz Cortex-M0 CPU | Up to 8-Kbyte SRAM | Up to 64-Kbyte Flash | 3-phase MC timer | Comparator | CEC |
|---|---|---|---|---|---|

**STM32 L1 series - Ultra-low-power (STM32L100/151/152/162)**

| 32 MHz Cortex-M3 CPU | Up to 48-Kbyte SRAM | Up to 384-Kbyte Flash | USB FS device | Up to 12-Kbyte EEPROM | LCD 8x40 4x44 | Comparator | BOR MSI VScal | AES 128-bit |
|---|---|---|---|---|---|---|---|---|

**STM32 W series - Wireless (STM32W108)**

| 24 MHz Cortex-M3 CPU | Up to 16-Kbyte SRAM | Up to 256-Kbyte Flash | 2.4 GHz IEEE 802.15.4 Transceiver | Lower MAC Digital baseband | AES 128-bit |
|---|---|---|---|---|---|

# STM32F Complete offer



| STM32 F0 Entry | STM32 F1 Mainstream | STM32 F3 Extended | STM32 F2 Hi Perf | STM32 F4 Hi Perf / DSP |
|---|---|---|---|---|
| Cortex-**M0**<br>48 MHz<br>1.65 to 3.6V<br>8- /16-bit application | Cortex-**M3**<br>24 to 72 MHz<br>2.0 to 3.6V<br>widest portfolio | Cortex-**M4**<br>72 MHz<br>1.65 or 2.0 to 3.6 V<br>DSP & Analog | Cortex-**M3**<br>120 MHz<br>1.7 to 3.6V<br>High performance | Cortex-**M4**<br>180 MHz<br>1.7 to 3.6V<br>High performance & DSP |
| Pinout compatibility | | | Pinout compatibility | |
| Platform optimized for cost effectiveness<br>16 – 64 Kbytes | 5 lines<br>Foundation of STM32<br>Best mix Features / Perf<br>16KB -1MB | 5 lines<br>ADC 5Msps, 16-bit ADC ΣΔ, PGA, Compar., Hi-resol. timer,<br>64 – 256 Kbytes | 2 lines<br>Advanced connectivity<br>Encryption<br>128KB -1MB<br>128kB SRAM | 2 lines<br>Advanced connectivity<br>Encryption<br>128KB -2MB<br>128kB SRAM |
| **Cost Smart** | **Broad Range** | **Advanced & SoC solution** | **High Performance** | **High Performance w/ DSP** |

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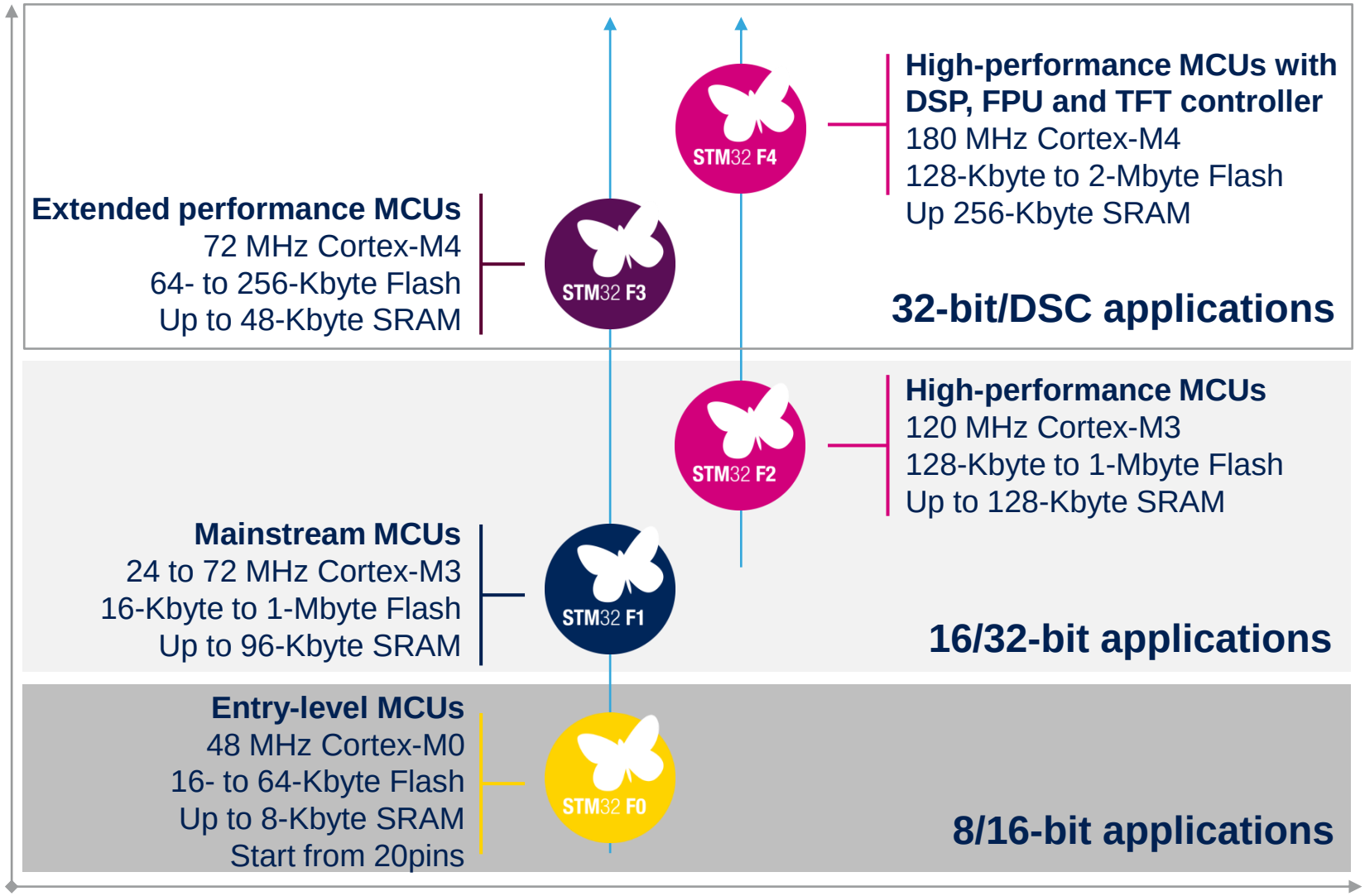
# STM32F – Family by core





# STM32 Mainstreams

# STM32 F0 Product lines (present and future)



## Main common features

**Cortex™-M0 @ 48 MHz**

- PLL
- Reset + BOR
- Low and high speed oscillators
- RTC
- 2x Watchdogs
- Hardware CRC
- Reset circuitry POR/PDR
- Multiple Channel DMA
- USART, SPI and I²C
- Single Wire Debug
- Temp. sensor

### STM32F051 – 2.0 to 3.6V

| | | | | | | |
|---|---|---|---|---|---|---|
| 16- to 64-KB Flash<br>8-KB SRAM<br>(parity check)<br>20-byte backup data | 2x Comp.<br>VBat | 12-bit ADC<br>1 MSPS SAR | 16-bit MC timer | 1x 12-bit DAC | CEC<br>I²S<br>(I²C,USART wake-up) | Up to 18 Cap. Touch-sensing |

### STM32F050 – 2.0 to 3.6V

| | | | | |
|---|---|---|---|---|
| 16- to 32-KB Flash<br>4-KB SRAM<br>(parity check)<br>20-byte backup data | VBat | 12-bit ADC<br>1 MSPS SAR | 16-bit MC timer | I²S<br>(I²C,USART wake-up) |

### STM32F030 Value line – 2.4 to 3.6V

| | | |
|---|---|---|
| 16- to 64-KB Flash<br>Up to 8-KB SRAM<br>(parity check) | 12-bit ADC<br>1 MSPS SAR | 16-bit MC timer |

STM32 F0

New

# STM32F050/051 Current Portfolio

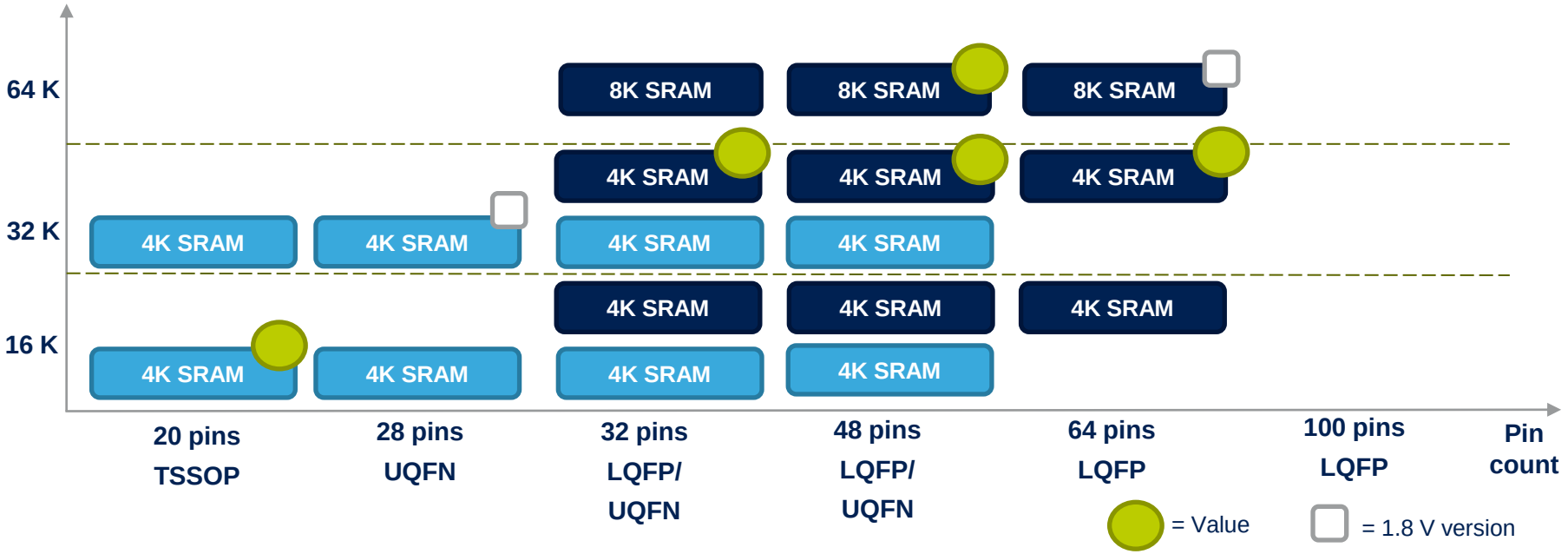


**STM32F050**

16KB-32KB Flash
4KB SRAM
5x 16-bit timer including MC timer
1x 32-bit timer
1x SPI, 1x I2C,1x USART
12-bit ADC

**STM32F051**

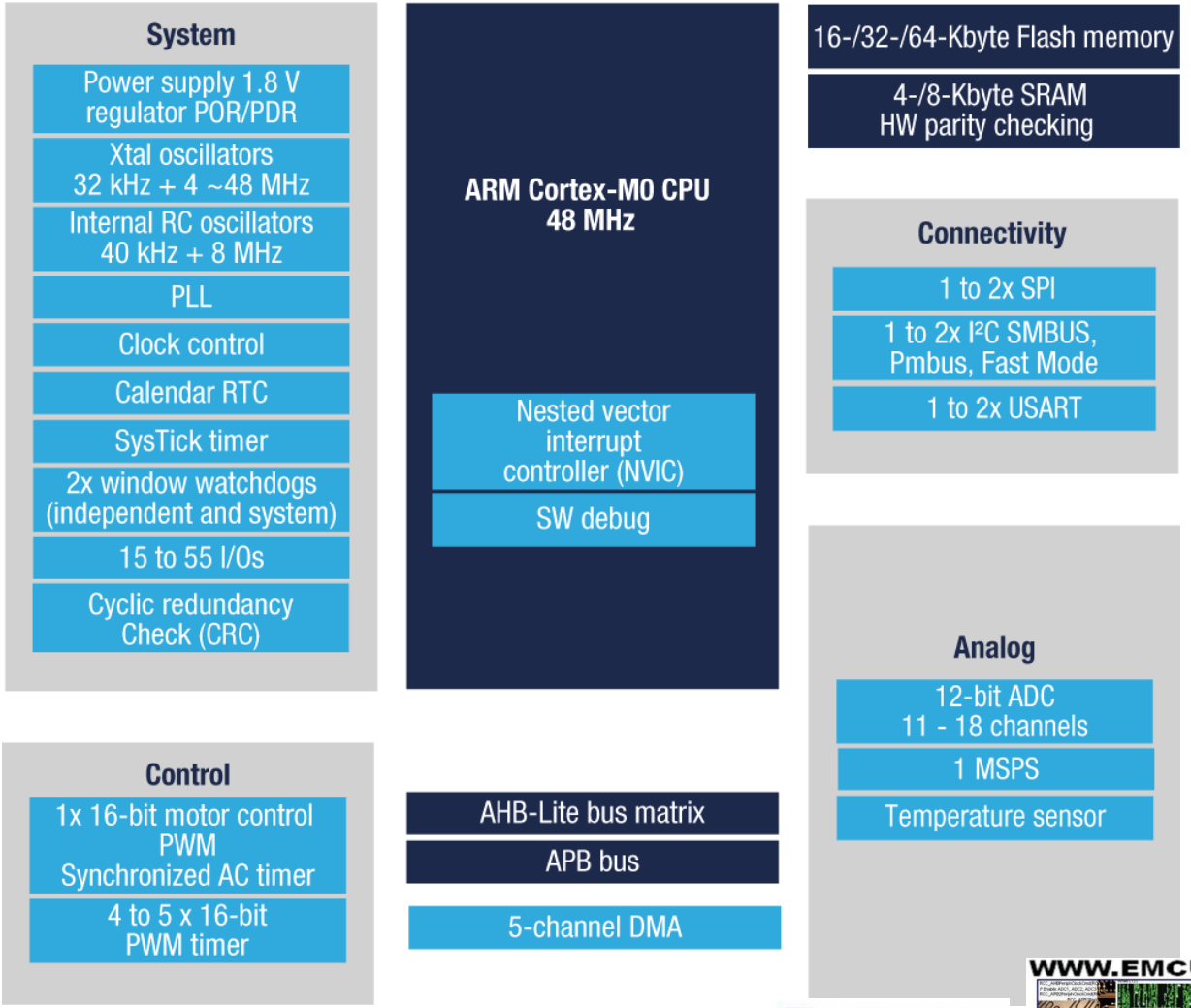
16KB-64KB Flash
4KB-8KB SRAM
6x 16-bit timer including MC timer
1x 32-bit timer
2x SPI, 2x I2C, 2x USART, CEC,
12-bit DAC, 12-bit ADC, 2x Analog Comp



# STM32F030 block diagram



- Description
  - 2.4 to 3.6V
  - 48 MHz/38 DMIPS
  - Int. RC 8 MHz + PLL
  - Trim-able 1% RC
  - 5 channels DMA
  - Up 55 I/Os
- Packages
  - TSSOP20
  - LQFP32,48 and 64



# STM32F03x : 8-, 32- and 64-Kbyte fact sheet



- **ARM 32-bit Cortex-M0 core**
  - 48 MHz max CPU frequency
- **2.4 to 3.6V power supply**
- **5 x channels DMA**
- **Safety features**
  - RAM Hardware parity check, CRC, 2x watchdogs, clock security system..
- **Communication peripherals**
  - 1x USART, 1x SPI, 1x $I^2C$
    - $I^2C$ fast mode + (20 mA drive capability)
    - SPI (18 Mbit/s) with 4-16 bit programmable bit frame
    - USART auto baud rate detection
  - Additional USART, SPI and I2C on 64KB versions
- **Timers**
  - 1x 16-bit PWM motor control AC timer
  - Up to 5 x 16-bit timer with up to 8xIC/OC/PWM
- **Real Time Clock**
  - H/W calendar, alarm functions and two tamper inputs
- **I/O ports**
- **Analog features**
  - 1x 12-bit ADC 1.0µS with separate analog supply and independent clock.
  - 1x Temperature Sensor
  - 1x voltage reference 1.2V
- **Debug mode**
  - Serial wire debug (SWD)
- **TSSOP20, LQFP32 5x5, LQFP48 7x7 packages and LQFP64 10x10 packages,**

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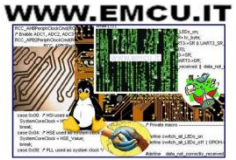


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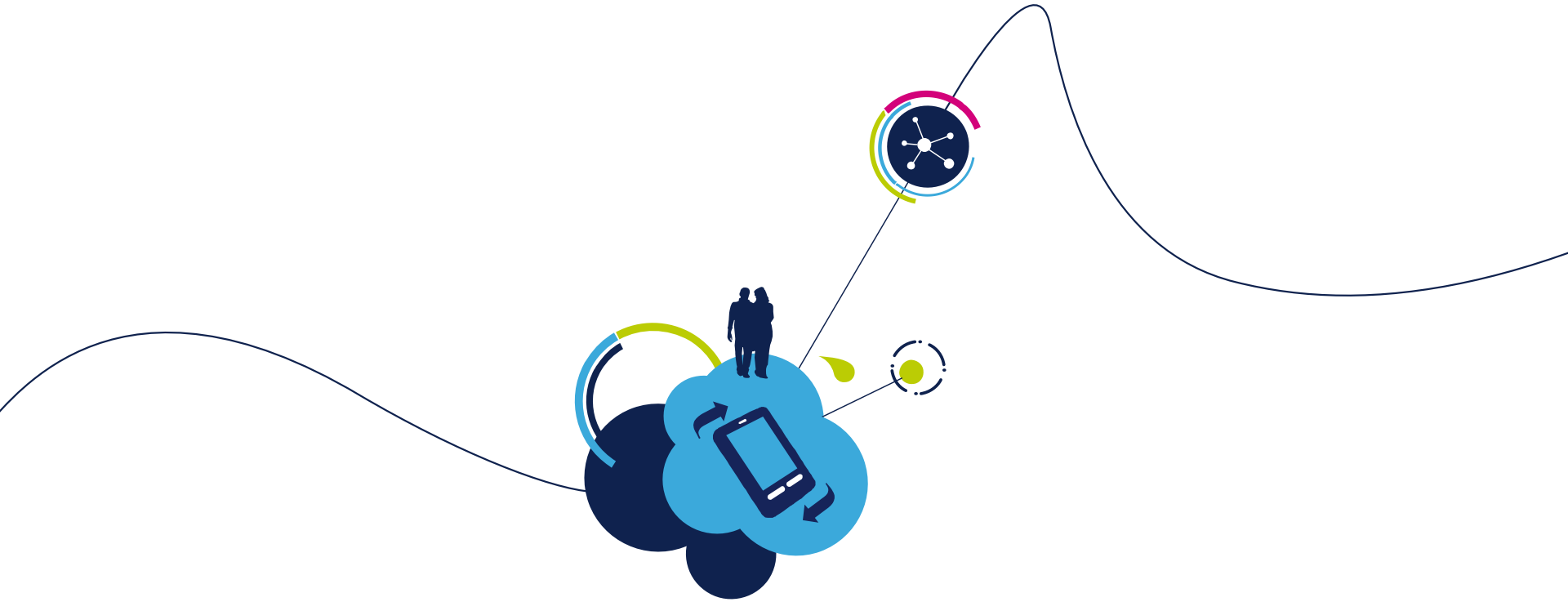


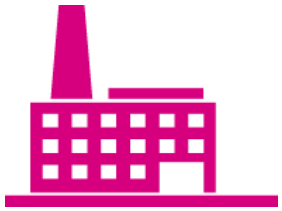
# Great fit for applications

# STM32F030 targeted applications



## Industrial

Timers
All communication
Peripherals



- Industry Std. comm
- RTC @ 0.95 ppm

Basic MCU for basic functions

## Consumer appliances

ADC 12b, timers,
I²C FM+, RTC

- High sink & Fast I/OS
- Suitable timers
- U/I friendly
- Stable & reliable Analog

Home appliances, motor control, power tools..

## Consumer devices

Simplified portfolio
Price driven

- Value line proven concept on STM8
- HDMI - CEC (Software)

A/V receivers, TVs, Blue-ray disk players, Printers, Gaming… What else? A Lot.

# Great Fit for small consumer appliances



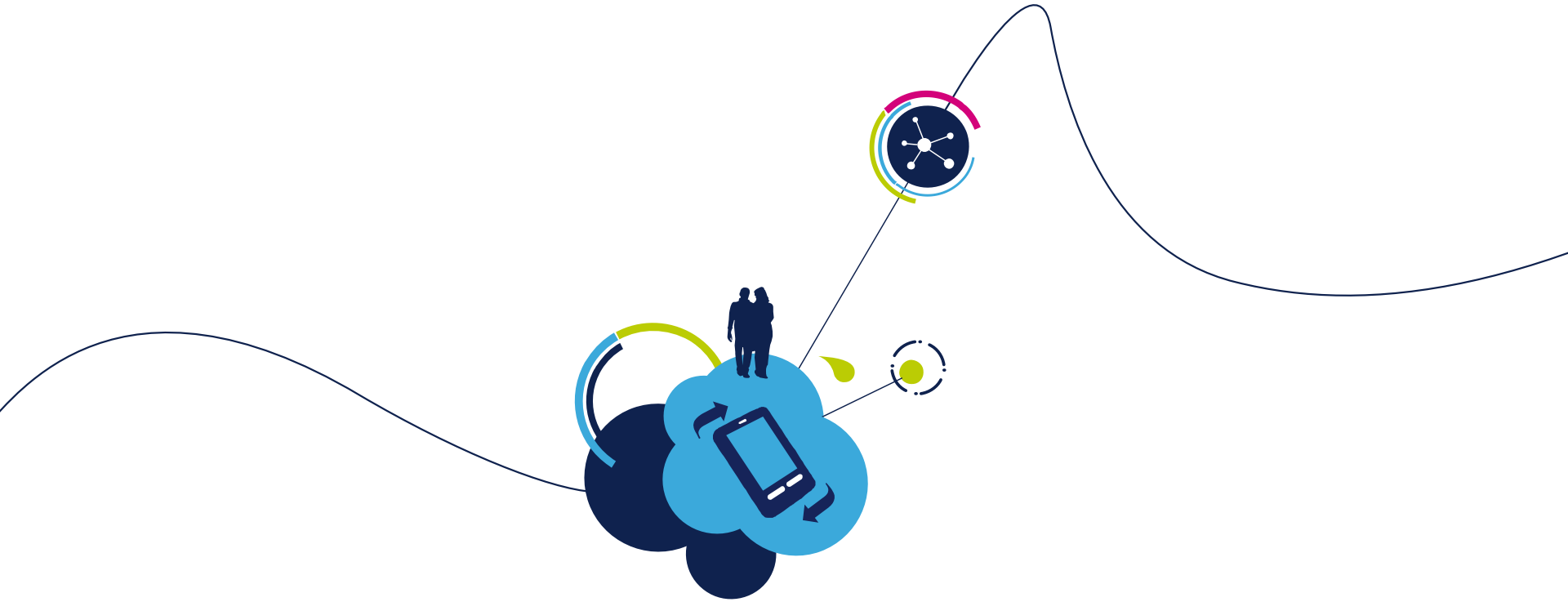
**Easy communication** between front panel and power components with robust **I²C FM+ with 20mA sink** capability and **fast IO toggling** capability (25% faster than STM32F1 @ same frequency)

**Advanced DIGITAL & ANALOG IPs**

- 3 timers suit **inducted element control**
- 1 timer for **motor control** (complete reference designs avail)
- 1µs, 12-bit ADC with 12 channels for **efficient sensors**

**Safety ready:**

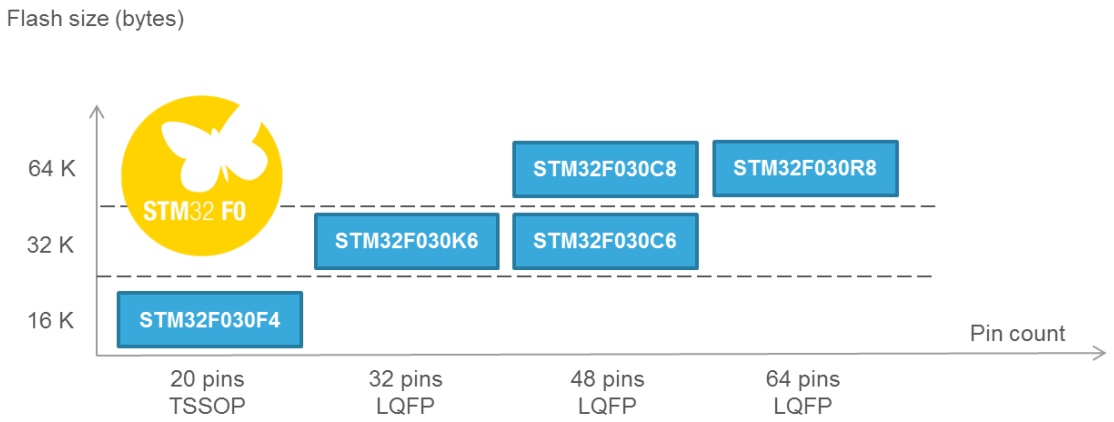
- Real-time hardware **RAM parity check** and 16-bit **CRC** for FLASH-memory integrity checks
- Extended **double watchdog system** with autonomous clock, windowing and **clock security system**



# Manufacturing Commitment

# Value line: the economy of scale

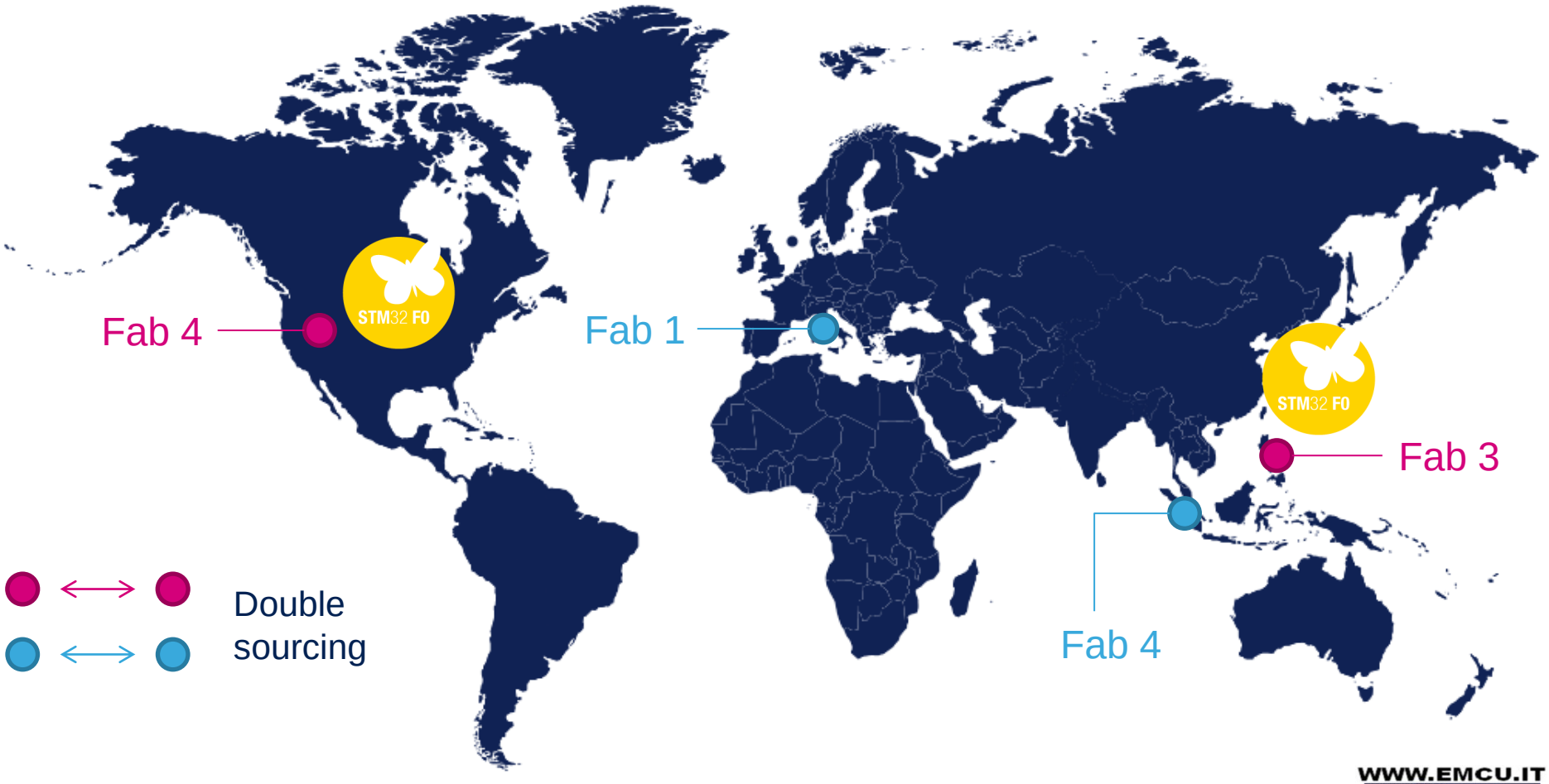


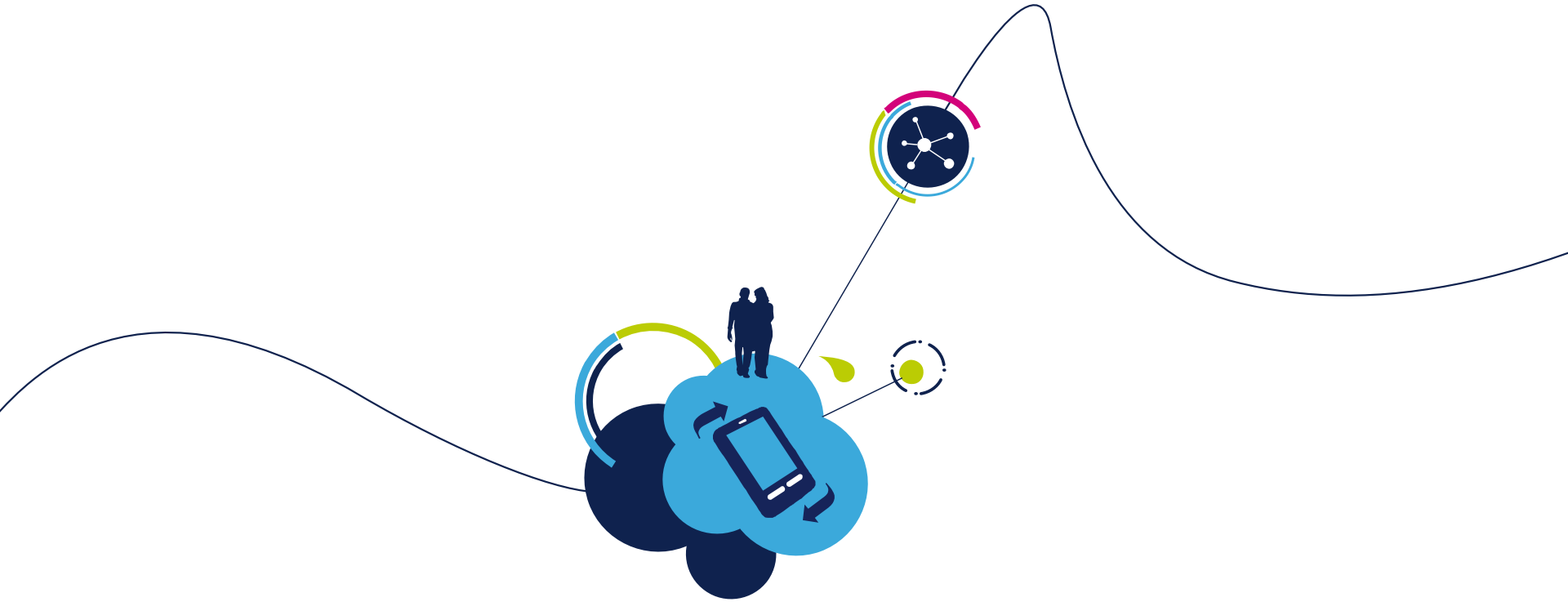



- Only few part numbers, simplifying dramatically the operations.
- A **full test flow** (100% test) with an extreme efficiency and short cycle time
- The frozen specification is optimizing the inventory management and is reducing the cost of ownership.
- STM32F0 reengineered for **the benefits of our customers**

# STM32 / STM32F0 Manufacturing Commitment







# Budget Price

# Speeds Up Cost-Constrained Decisions



Cutting cost often implies performance or platform headaches


- Save decision time:
  - No compromise on product performance
  - Wide STM32 platform benefit
    - Developers can re-use STM32F0 investment for future applications

# STM32F030 – Value line summary



- In the same vein of the STM32F0 product family. Concatenation of features into few part numbers.
- **Ultra optimized** operation and manufacturing for the benefits of our customers.
- **Pin for pin compatible** with STM32F0,F1 and F3 to ease the migration across the portfolio.
- With the first **STM32@32 cents** ST is penetrating “for real” the 8-bit arena with an inexpensive Cortex™ product solution.

# Thank you

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