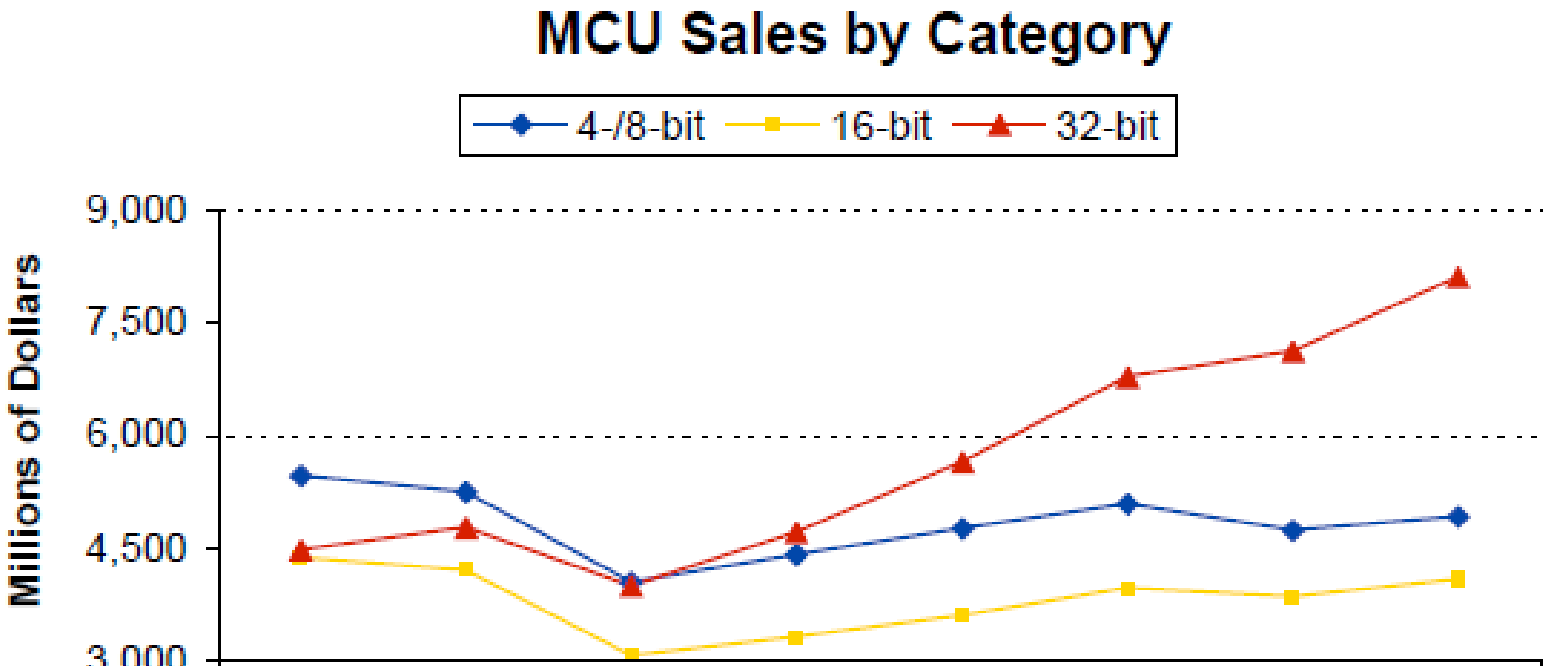
The STM32 microcontrollers

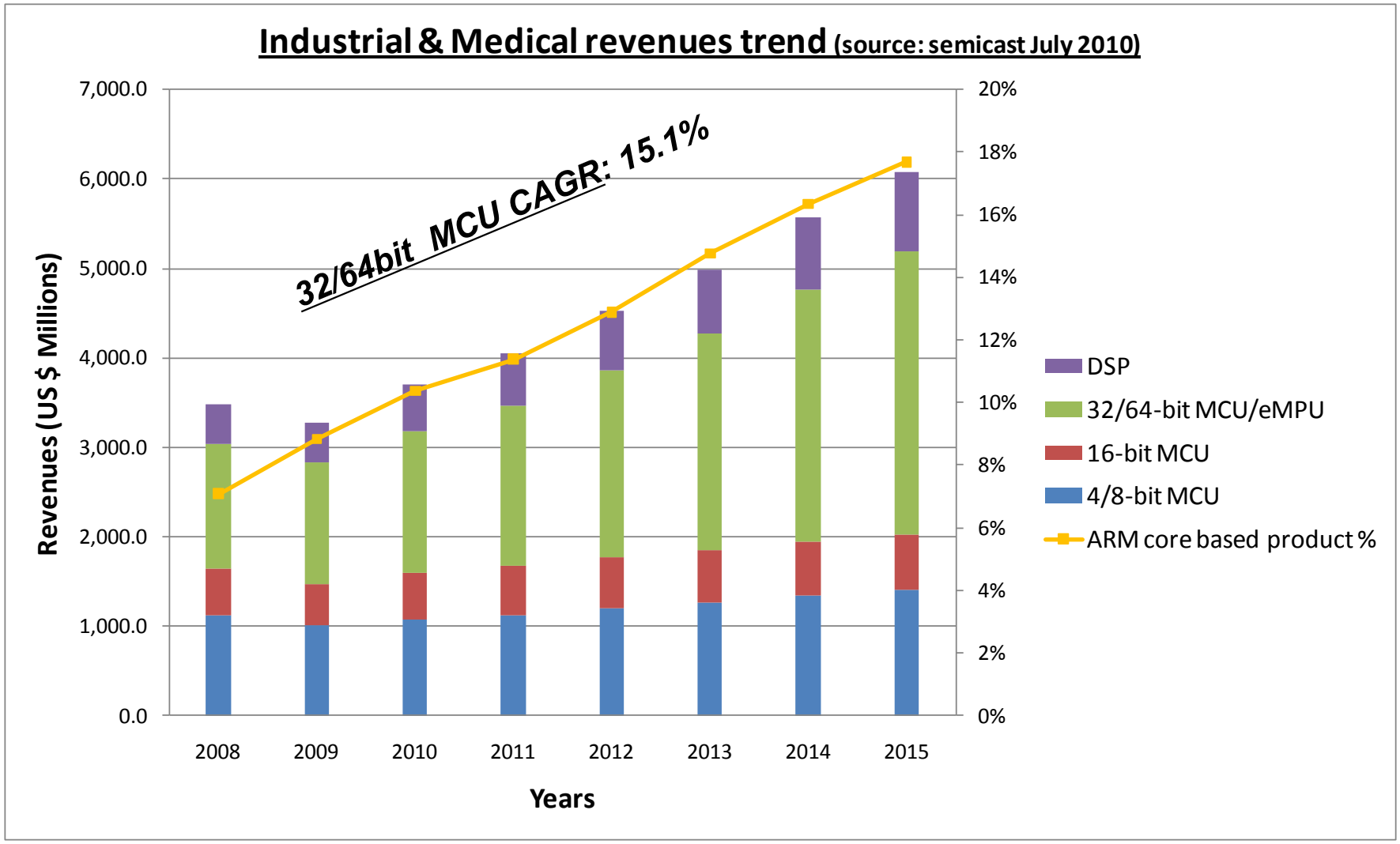
MCU total market trend



	07	08	09	10F	11F	12F	13F	14F
4-/8-bit	5,460	5,242	4,036	4,399	4,751	5,084	4,728	4,917
16-bit	4,370	4,195	3,062	3,307	3,605	3,966	3,847	4,078
32-bit	4,475	4,766	3,984	4,701	5,641	6,769	7,108	8,103

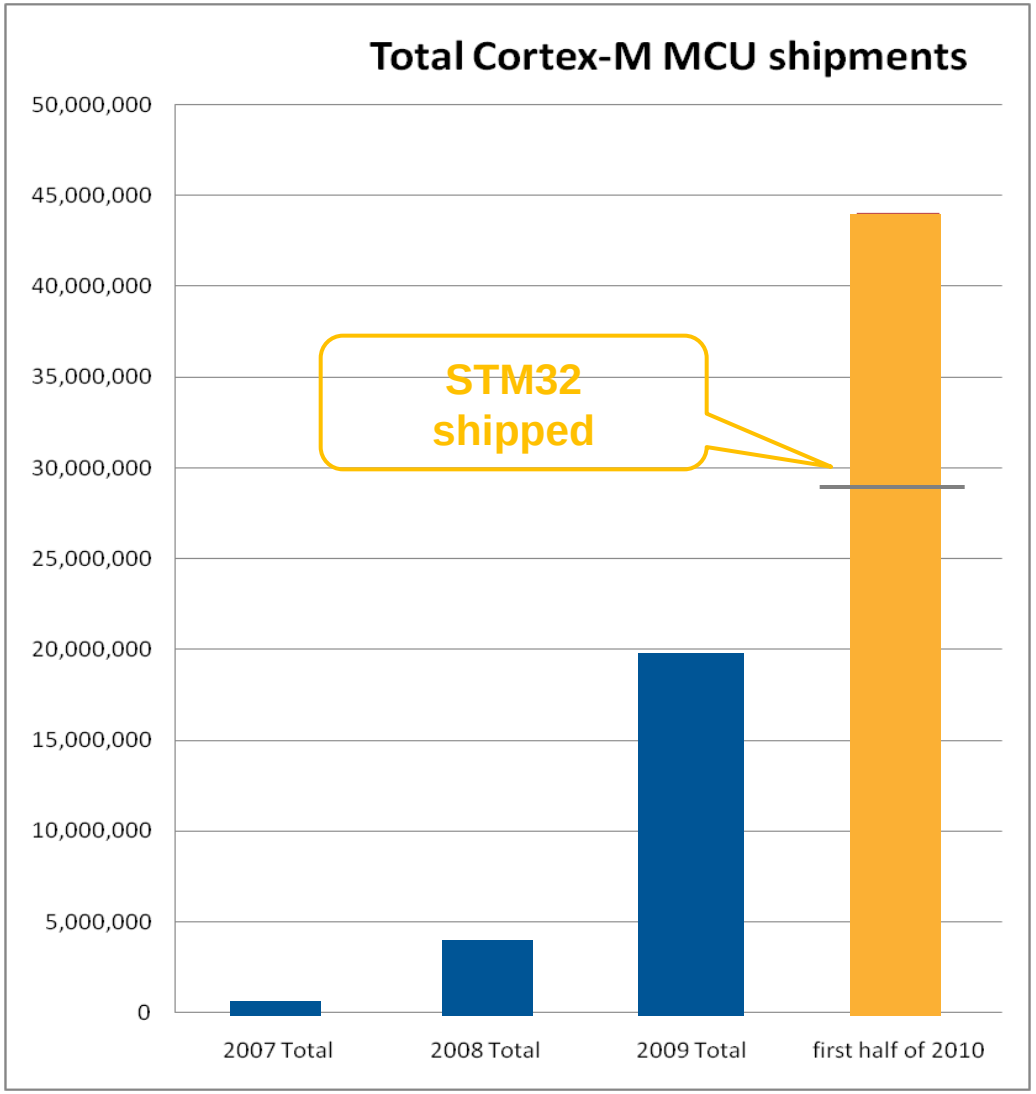
Source: IC Insights

MCU, MPU, DSP revenues trend in Industrial & Medical segments



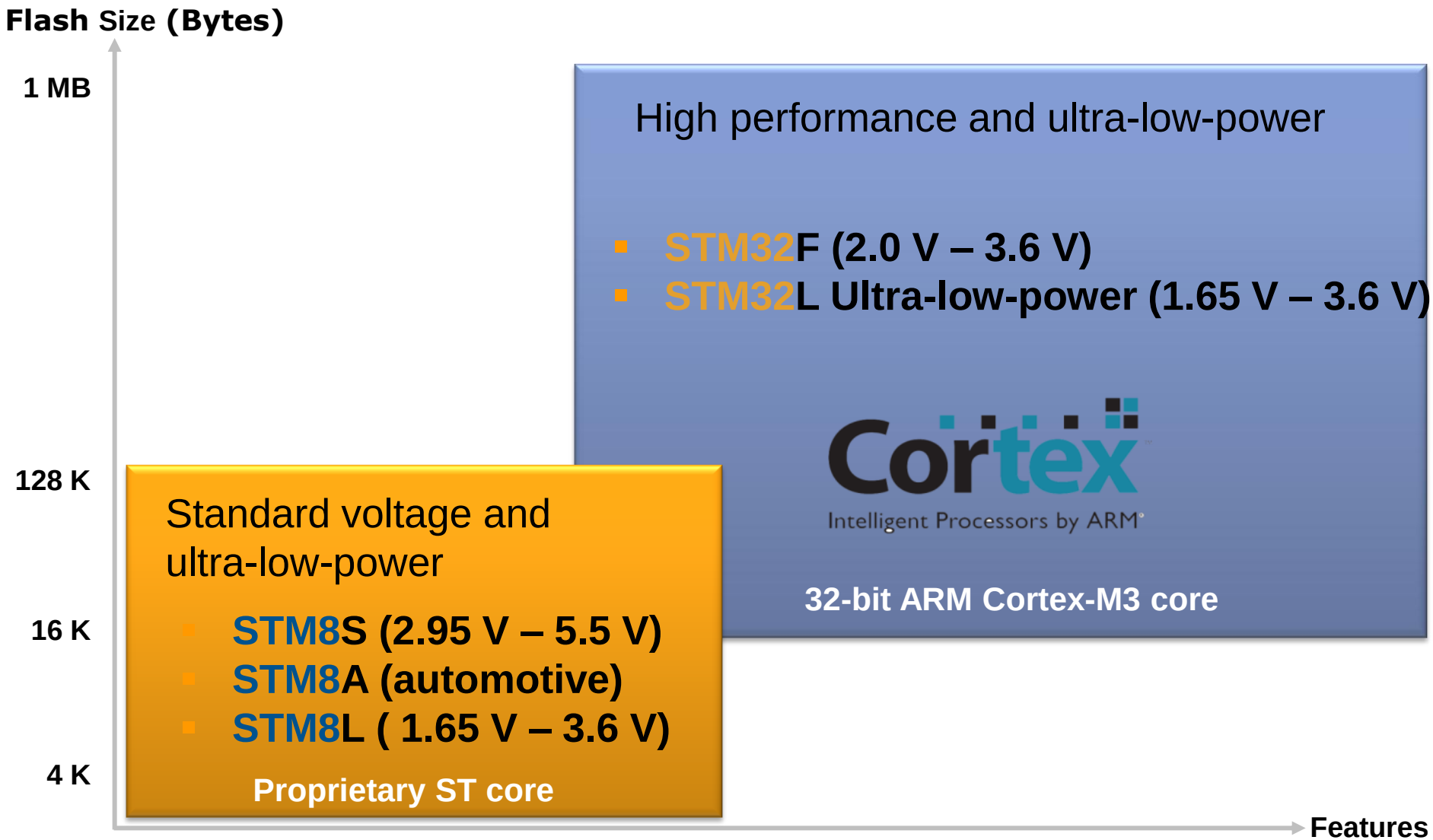
Leader in Cortex-M MCUs

- Cortex is becoming a standard in the microcontroller world
- From the start, ST has lead the Cortex-M market
- The STM32 represents more than 64% of the total Cortex-M MCUs shipped in the first half of 2010



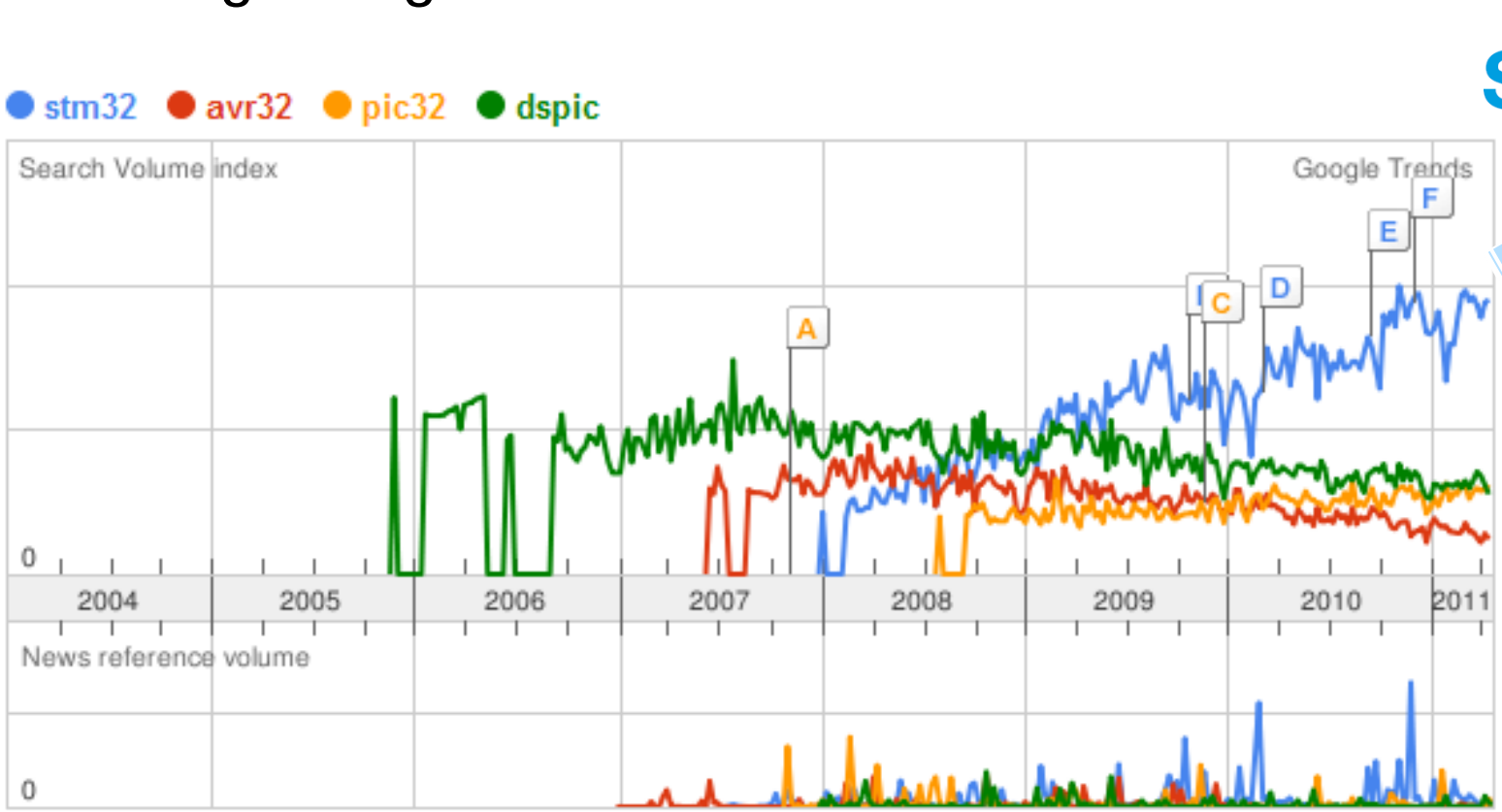
Source: ARM

MCUs – New families development focus



Google Trends

- STM32 most widely searched term among MCUs
- Still growing !

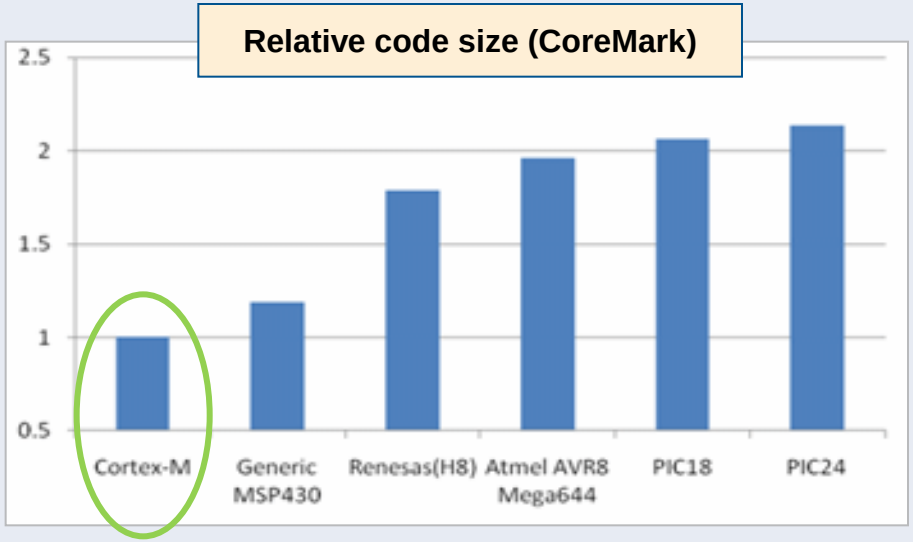


STM32 product family key benefits

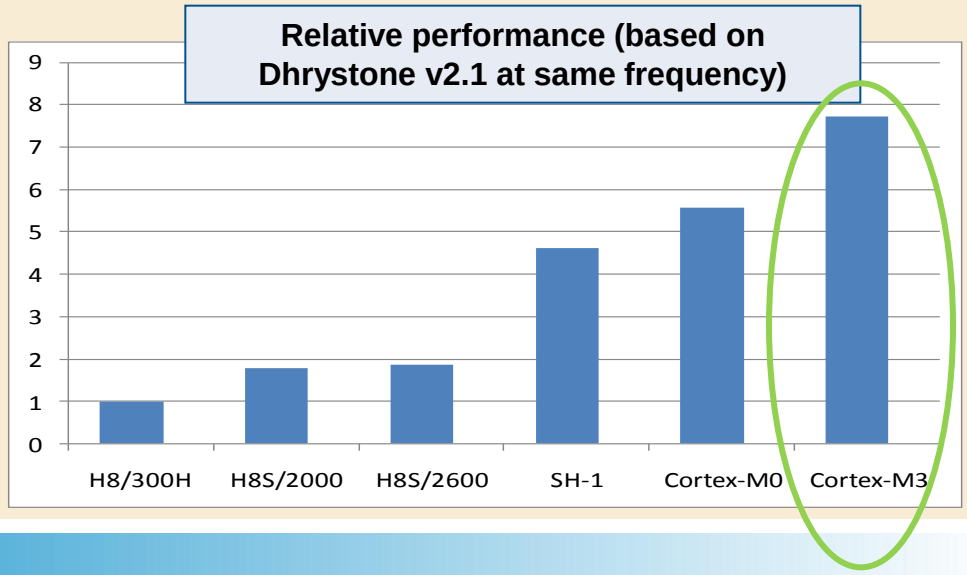
Real-time performance	Outstanding power efficiency	Superior and innovative peripherals	Maximum integration	Extensive tools and software
Cortex Intelligent Processors by ARM				
Leading-edge architecture Excellent real-time behavior	Sub µA RTC, low-voltage low-power modes	USB-OTG high speed, Ethernet, dual CAN, 12-bit ADC, advanced timers	Reset circuitry, clocks, oscillators, PLL regulator, RTC, watchdog	Various IDE, starter kits, libraries, RTOS and stacks
Future-proof design	**Environment friendly, suits low-power operation**	**Address all your needs and beyond**	**Cost and space saving**	**More time for innovation**

Cortex-M advantage

- Cortex-M **smallest code size** of any microcontroller!
- Reducing code → minimum amount of flash



- Cortex-M **better performance** at same or lower clock speeds
  - → Simpler coding, avoiding careful hand optimisations
  - → More features, lower clock speed



Maximum scalability with seven product lines

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)
- Dual 12-bit DAC
- Up to 3x 12-bit ADC (1 µs or 0.5 µs for F-2 series)
- 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 to 3.6 V (L-1 and F-2 series) 5.0 V tolerant I/Os
- Temperature sensor

+

F-2 series - STM32F207/217 and STM32F205/215

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/hash processor and RNG

F-1 series - Connectivity line STM32F105/STM32F107

72 MHz Cortex-M3 CPU	Up to 64-Kbyte SRAM	Up to 256-Kbyte Flash	USB 2.0 OTG FS	3-phase MC timer	2x CAN 2.0B	2x I²S audio	Ethernet IEEE 1588

F-1 series - Performance line STM32F103

72 MHz Cortex-M3 CPU	Up to 96-Kbyte SRAM	Up to 1-Mbyte Flash	USB FS device	3-phase MC timer	CAN 2.0B	SDIO 2x I²S

F-1 series - USB Access line STM32F102

48 MHz Cortex-M3 CPU	Up to 16-Kbyte SRAM	Up to 128-Kbyte Flash	USB FS device

F-1 series - Access line STM32F101

36 MHz Cortex-M3 CPU	Up to 80-Kbyte SRAM	Up to 1-Mbyte Flash

F-1 series - Value line STM32F100

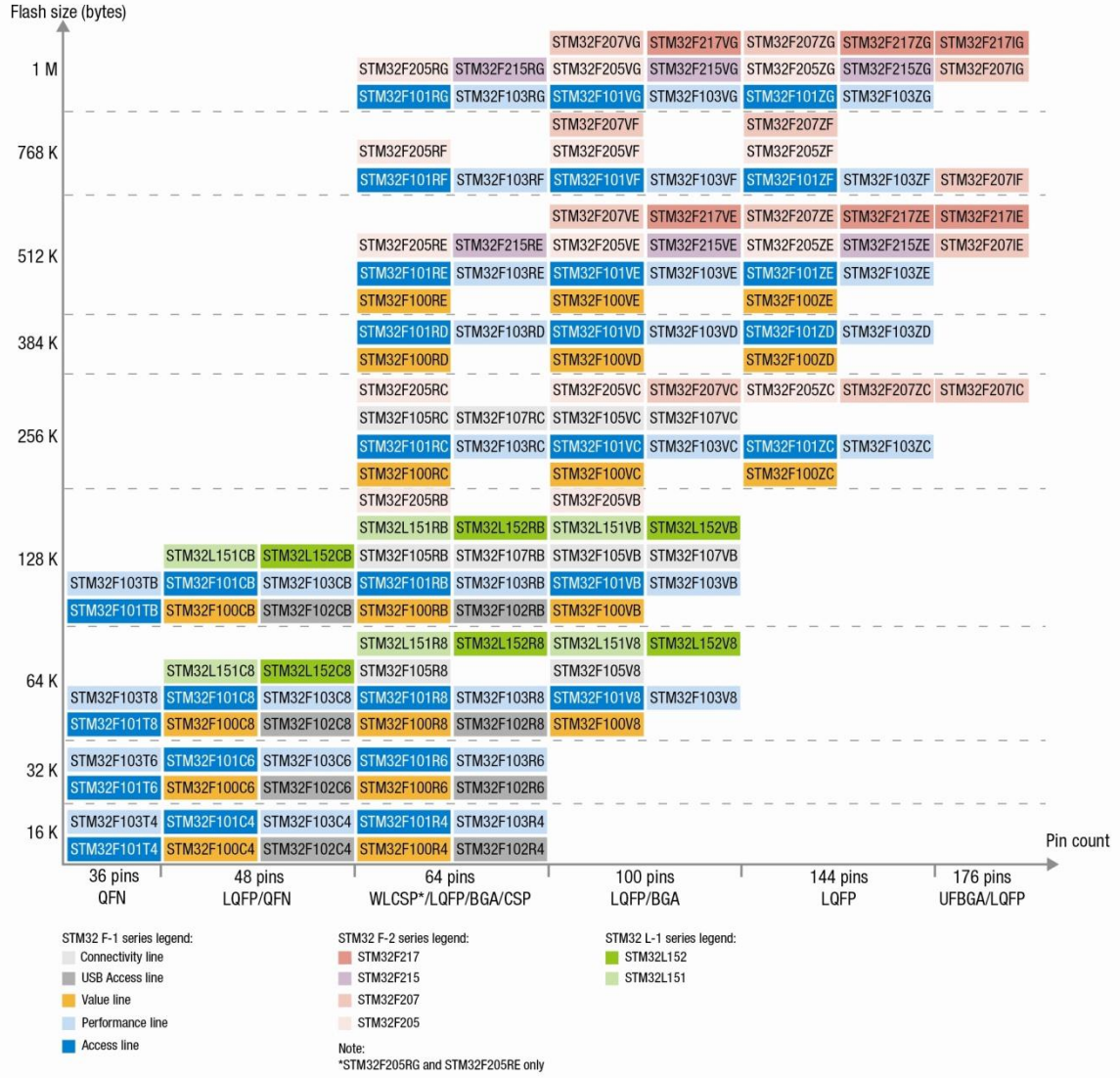
24 MHz Cortex-M3 CPU	Up to 32-Kbyte SRAM	Up to 512-Kbyte Flash	3-phase MC timer	CEC

L-1 series - STM32L151/2

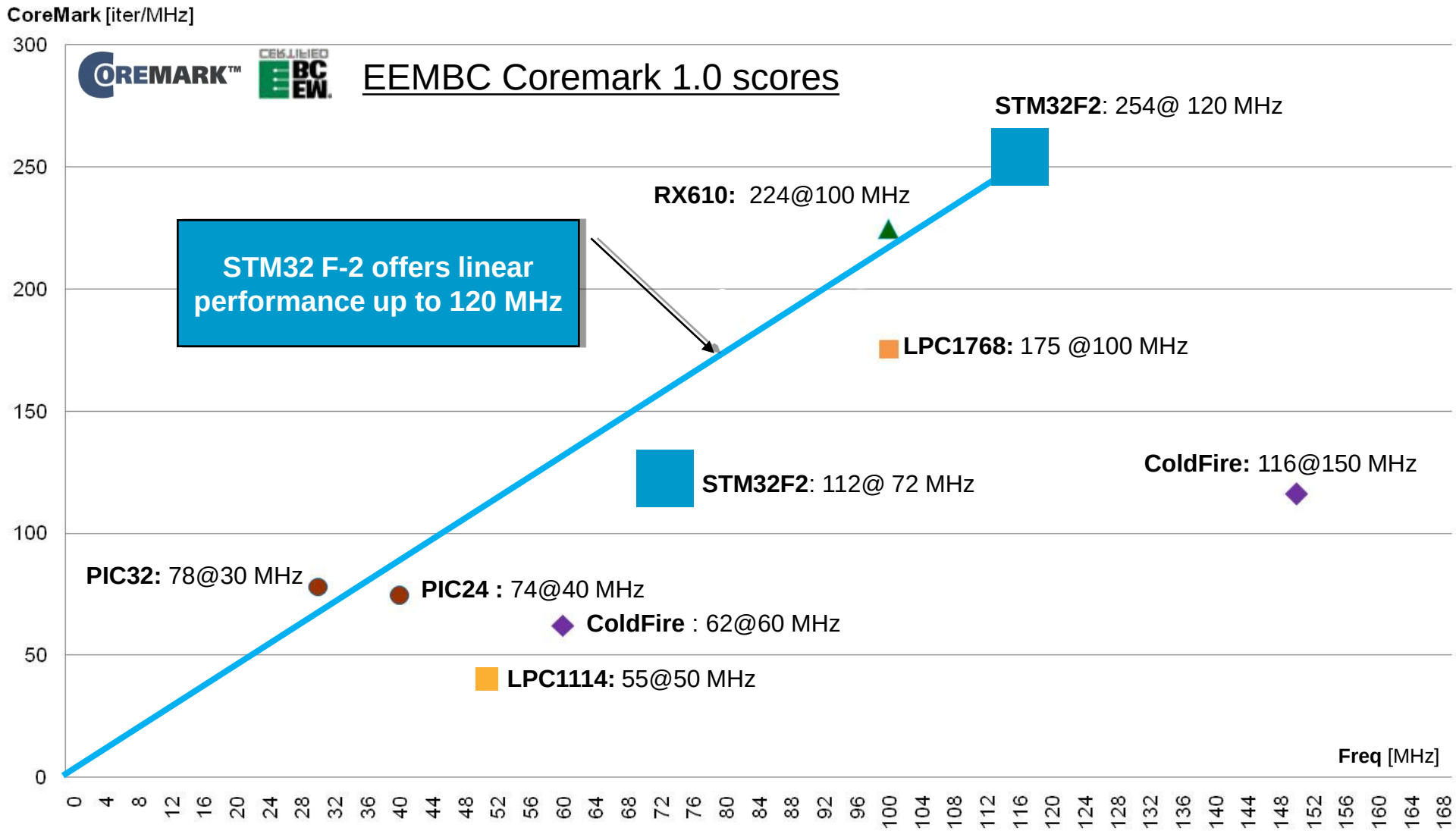
32 MHz Cortex-M3 CPU	Up to 48-Kbyte SRAM	Up to 384-Kbyte Flash	USB FS device	Data EEPROM Up to 12 Kbytes	LCD 8x40 4x44	Comparator	BOR MSI VScal

STM32 – largest Cortex-M3 portfolio

- 16-Kbyte to 1-Mbyte embedded Flash
- 36-pin to 176-pin packages
- Compatibility across more than 185 devices
- Full coverage of all application needs



Best in class performance
proven by Coremark



STM32's I/O peripherals

- High-performance analog
  - 12-bit ADC with 1 µs or 0.5µs conversion
  - 12-bit DAC
- General-purpose I/O
  - Fully configurable
  - 18 MHz to 60MHz max toggle rate
  - LCD 8x40
- Advanced timers
  - Multi-mode 16-bit timers
  - Motor control timers
  - Watchdog and SysTick timers
  - Real-time clock with battery backup

STM32's connectivity and system peripherals

- Connectivity
  - 4.5 Mbit/s to 7.5 Mbit/s USARTs
  - 18 Mbit/s to 30 Mbit/s SPI
  - SDIO support
  - 400 kHz I²C
  - USB device FS
  - CAN
  - I²S Audio
  - USB OTG FS and HS
  - Ethernet
  - Camera interface, 8- to 14-bit parallel, up to 48 Mb
- System peripherals
  - 12-channel DMA controller
  - Flexible system memory controller (FSMC) up to 60MHz
  - Crypto/hash processor: 3DES, AES256/SHA-1, MD5, HMAC

STM32 maximum integration

- Clocks
  - Advanced PLLs for single Xtal operation or core and peripherals
  - Accurate RC oscillator with trimming register
- Reset circuitry
  - Power-on reset
  - Low-voltage detect (brown-out)
  - Watchdog timers
- System security
  - Tamper detect
  - Up to 528 bytes of OTP
- Power management
  - Integrated low-voltage regulator for single 2.0 V to 3.6 V operation (1.65V to 3.6V with STM32L)
  - Clock enable/disable for each peripheral
  - Backup SRAM 4KB

STM32 – leading the pack

- Cost-sensitive
  - STM32 Value line down to $0.85
  - Based on Cortex-M3 running at 48 MHz
  - Large peripheral set

- High-performance
  - STM32F-2 series with150 DMIPS at 120 MHz
  - ART Accelerator™ and 7-layer bus matrix
  - Extremely low dynamic consumption: 180 µA/MHz
  - HS USB, IEEE 1588 – Ethernet, camera interface

- Ultra-low power
  - STM32L – EnergyLite™ platform
  - 186 µA/DMIPS MCU based on Cortex-M3
  - Low voltage down to 1.65 V

STM32 VALUE Line: Greater choice for cost-sensitive applications

- High-performance core
  - ARM® Cortex™-M3 zero wait state 1.25 DMIPS/MHz
    - up to 30 DMIPS at 24 MHz max

- Essential features for appliances, consumer and industrial
  - **Seven PWM 16-bit timers** including **motor control timer**,
  - fast 1.2 µs 12-bit **ADC** & dual 12-bit **DAC**
  - Consumer Electronic Control **(CEC)** hardware function
  - Flexible Static Memory Controller **(FSMC)** addressing SRAM, PSRAM, NOR external memories
  - **LCD** parallel **interface** support

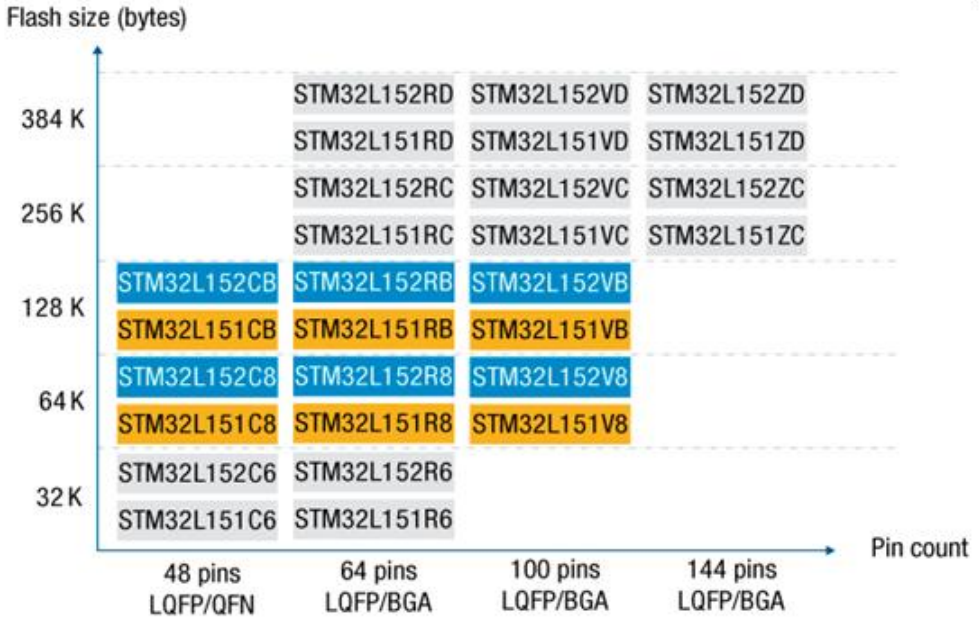
Devices >=256 KB Flash only

- From 16-Kbyte up to 512-Kbyte Flash
- From 48-pin to 144-pin packages

- Under $1 most accessible STM32
  - From $0.85 (resale 10 Ku) for 16-Kbyte devices in LQFP48 package

STM32L - Ultra-low power STM32

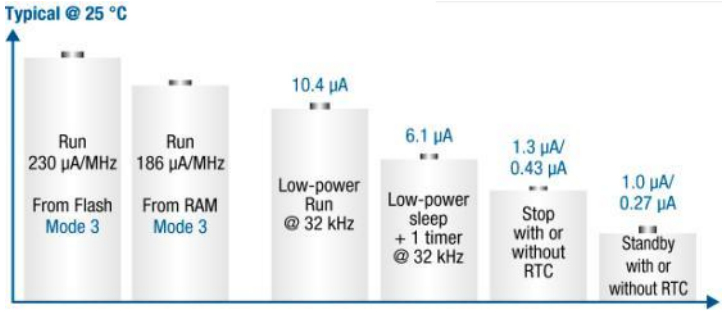
- Energy saving
  - 32-bit ARM Cortex-M3 performance
  - Ultra-low power in dynamic and static modes
- Power supply:
  - 1.65 to 3.6V without BOR
  - 1.8 to 3.6V with BOR
- Special features
  - Segment LCD 8x40
  - 4KBytes EEPROM
  - Comparator
- Pin-to-pin compatible with STM32 family



Legend:

STM32L151 without LCD

STM32L152 with LCD



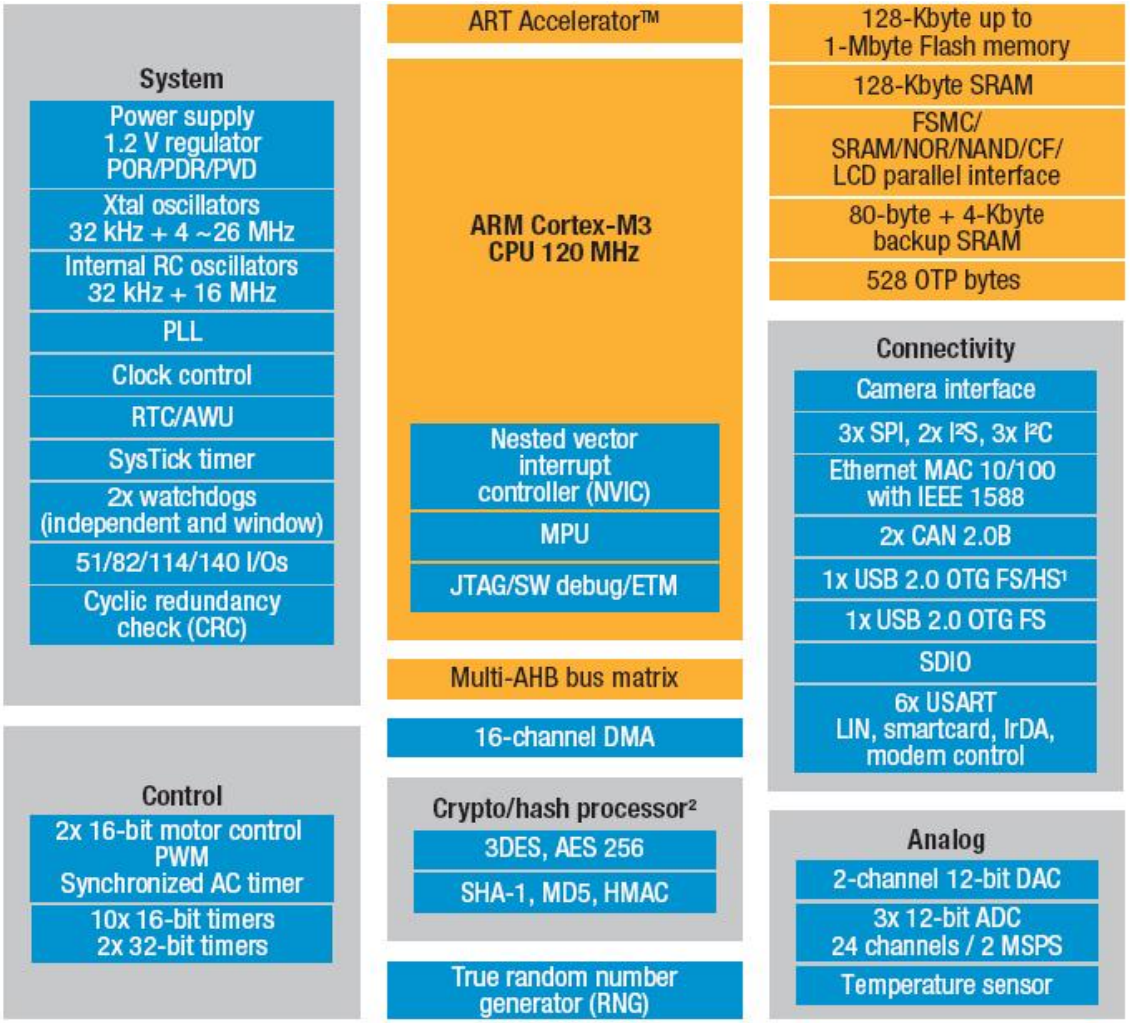
STM32 F-2 Series

- F-2 Series is a complement to existing F-1 with more Performance/Memory/New features.
  - Demands for such higher performance does exist in application using USB stack, Ethernet TCP-IP or graphic libraries.
  - current F-1 user can extend use of STM32 to higher-end products.
- With new peripherals, F-2 can address new application fields.
  - New peripherals: Camera IF, Crypto engine, HS USB
- New 90nm embedded Flash technology
  - Feature rich, more memory/ function product with minimal cost overhead compared to existing F-1 series.

STM32 F2 : Block Diagram

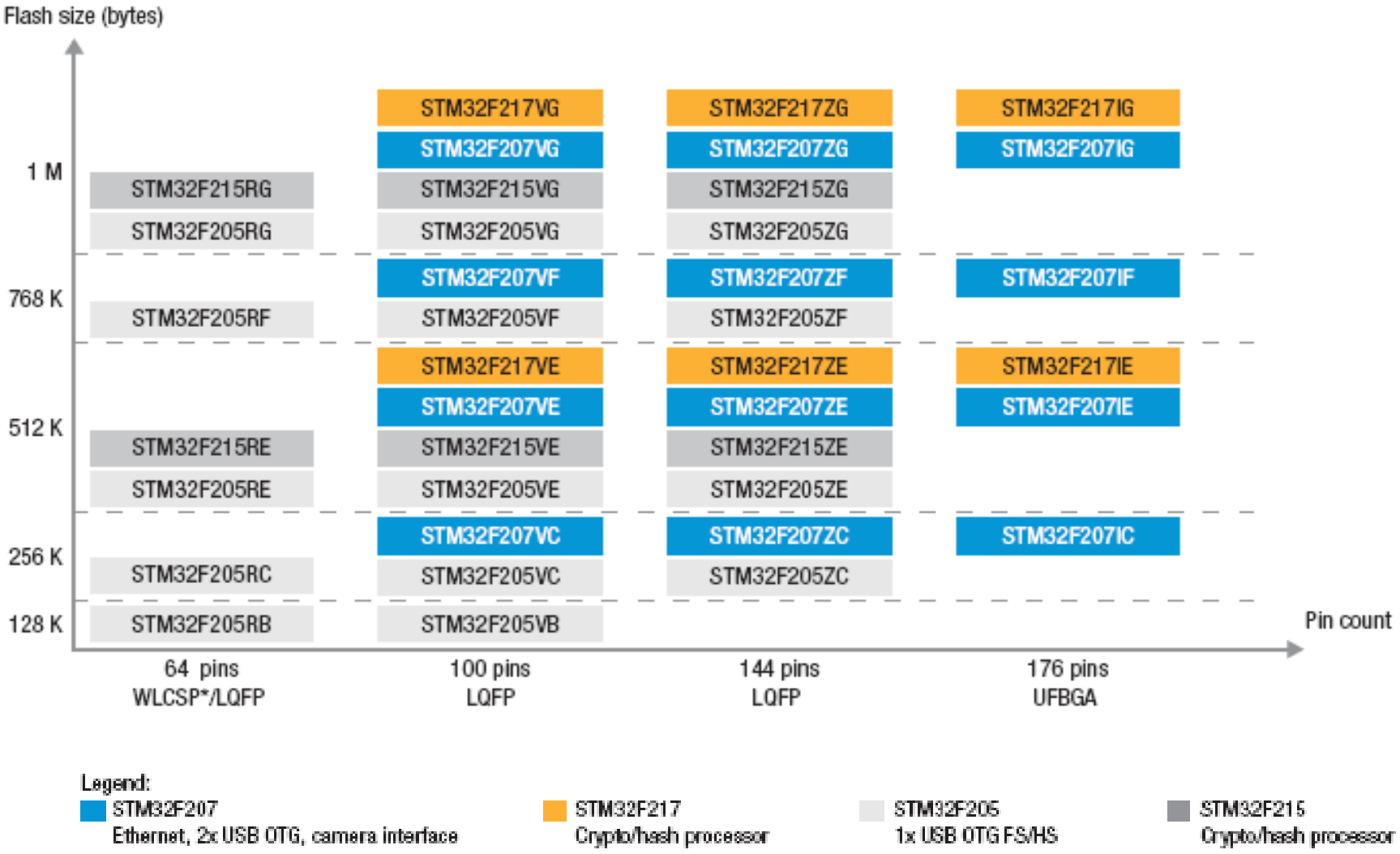
New Features

- 120 MHz running CPU with ART Accelerator ™ and multi-level AHB Bus Matrix
- 1.65 to 3.6V Supply
- 1-MByte Flash, 128-KByte SRAM
- 4 Kbytes back up SRAM
- Ethernet, 2xUSB OTG with High Speed support, camera interface
- Crypto/Hash processor
- True random number generator
- Fast ADC 2MSPS
- 32bit timers



Notes:
1. HS requires an external PHY connected to ULPI interface
2. Crypto/hash processor on STM32F217x and STM32F215x

STM32 F-2 Series Portfolio



Outstanding Performance and Power

- Cortex-M3 core's maximum processing performance with 0-wait state execution from Flash up to 120MHz
- 150 DMips at 120MHz

- 188µA/MHz, 22.5mA at 120MHz
  - ST's 90nm process,1.2V core
  - ST ART Accelerator™ reducing accesses to Flash

- Adaptive Real Time (ART memory accelerator™)
  - 128-bits wide Flash with Prefetch
  - Intelligent Branch management

- Advanced low-power modes and features
  - Backup SRAM and RTC
  - <1µA with RTC on
  - <1uA with 4-Kbyte backed up SRAM
  - <2uA with both on

- 32-bit 7 layers AHB bus matrix interconnects

- VDD min down to 1.65V

Peripherals and integration

High Speed USB OTG

- Audio PLL, I²S and USB synchronization
- Camera interface, 8- to 14-bit parallel, up to 48Mbyte/s at 48MHz
- Flexible static memory interface up to 60MHz
- Crypto/hash processor: 3DES, AES256/SHA-1, MD5, HMAC
- 3 SPIs running at up to 30Mbit/s,
- 6 USARTs running at up to 7.5Mbit/s
- 3x 12-bit ADC, 2 MSPS, up to 6MSPS in interleaved mode
- True random-number generator
- Fast GPIO (60 MHz toggling)

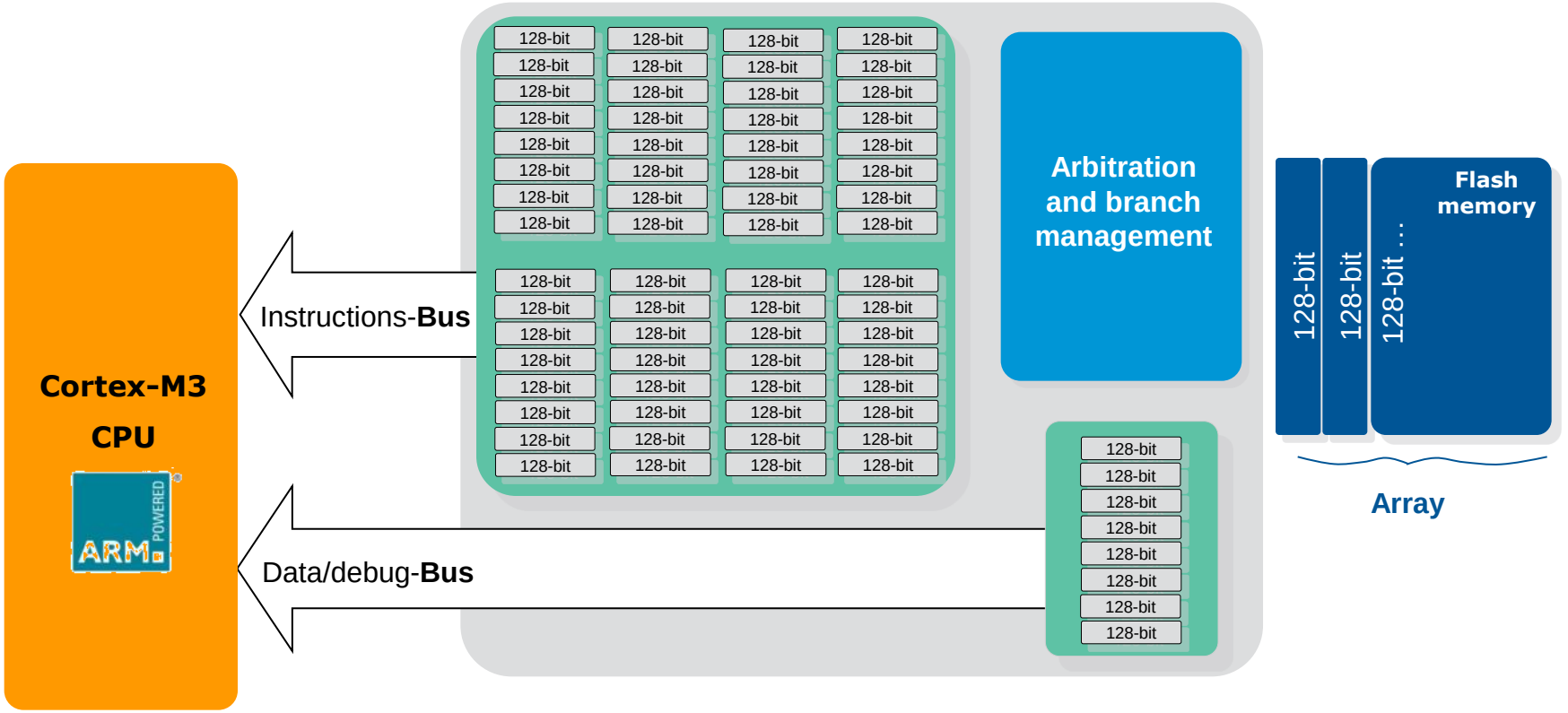
1-MByte Flash and 128-Kbyte

- 4-Kbytes back up SRAM: used as EEPROM to save application state, calibration data,
- 528 bytes of OTP memory to store critical user data such as Ethernet MAC addresses or cryptographic keys.

Real-time performance

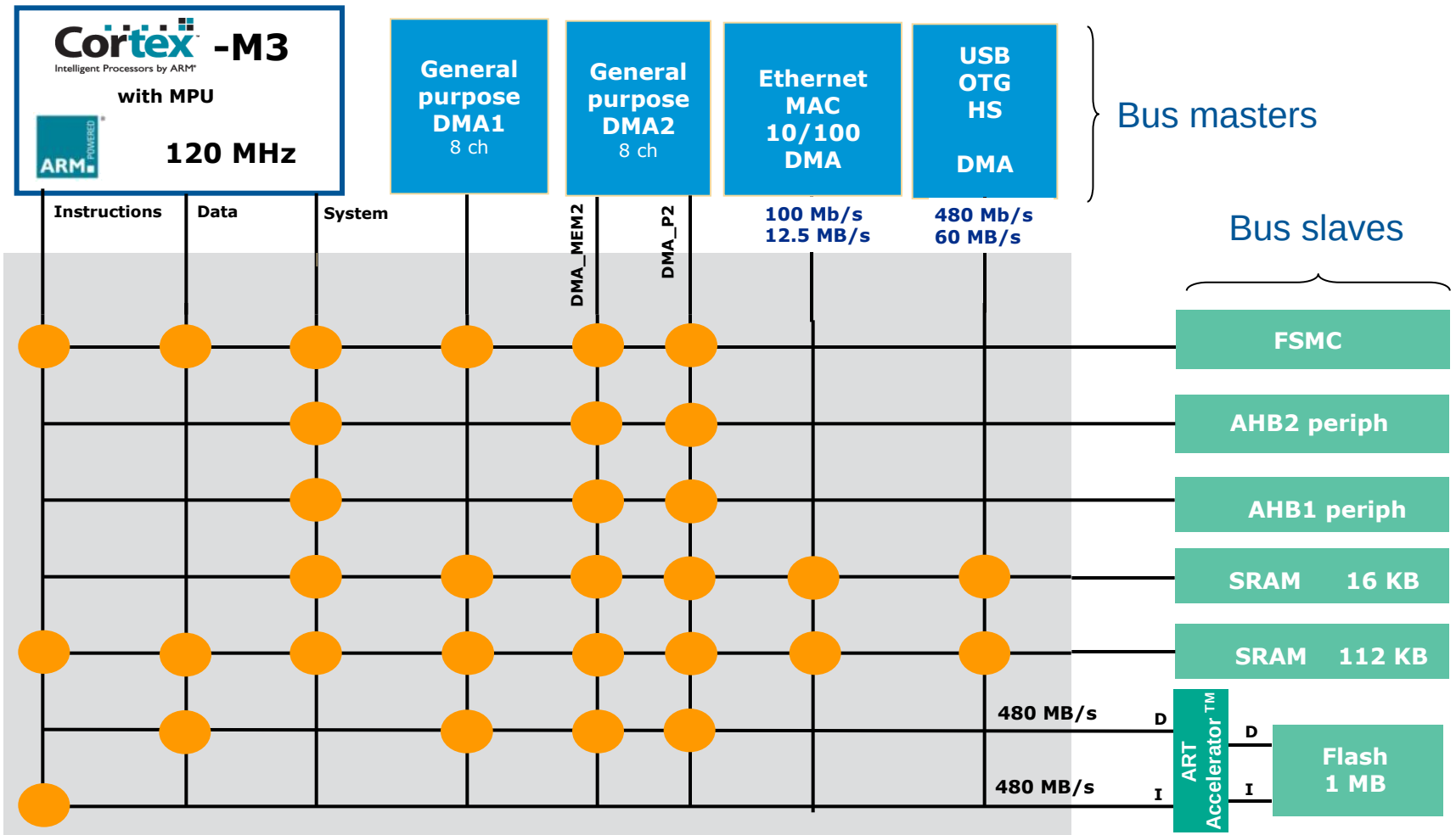
ART Accelerator™

- The adaptive real-time memory accelerator unleashes the Cortex-M3 core's maximum processing performance equivalent to 0-wait state execution Flash up to 120 MHz.



Real-time performance

32-bit multi-AHB bus matrix



F-2 series Tools & Software

- **Evaluation board for full product feature evaluation**
  - **Hardware evaluation platform for all interfaces: External memories, Ethernet and 2 USB OTG connectors, touch-screen TFT display, CMOS camera, audio output…**
  - **Possible connection to all I/Os and all peripherals**
- **Many options of development IDE solutions and Firmware**

STM3220G-EVAL

mbest, IAR SYSTEMS, SIGNUM SYSTEMS, LAUTERBACH, RAISONANCE, TASKING, aiji SYSTEM, KEIL An ARM® Company, hitex DEVELOPMENT TOOLS, Green Hills SOFTWARE, INC., RA, Altium, atollic, i SYSTEM, GNU

eCosCentric, µd Micro Digital, Green Hills SOFTWARE, INC., CMX SYSTEMS, Micrium, SEGGER, Open Source, Quadros Systems Inc., expresslogic, interniche technologies, inc., KEIL An ARM® Company, freeRTOS, MiSPO 株式会社ミスポ, eForce, Computex, insight インサイトインターナショナル, GRAPE SYSTEMS, 横河ディジタルコンピュータ株式会社 Yokogawa Digital Computer Corporation

One architecture – multiple applications

- **Point of sales**
  - Bank-card readers
  - Cash registers, thermal printers
  - Bill validation, package tracking
  - Vending
  - Scanners

- **USB devices**
  - Security and biometrics
  - Card readers

- **Industrial automation**
  - Circuit breakers
  - Programmable logic controll
  - Industrial networking

- **Consumer**
  - PC peripherals, gaming
  - Digital cameras, GPS platforms
  - Remote control, satellite radio

- **Building security/fire/HVAC**
  - Metering
  - Alarm systems, security cameras
  - Fingerprint security systems

- **Medical**
  - Cardio monitors
  - Portable test equipment
  - Glucose meters

- **Appliances**
  - Major appliances
  - User interfaces and vector control drive

- **Other**
  - Measurement, battery-operated applications, toys…

STM32 various applications

Medical

BIOMET

Hybrid Card Reader

KICC KOREA INFORMATION & COMMUNICATIONS CO., LTD.

Cryptography
(WIFI device)

chumby

Signal treatment
(Music instrument)

Tronical®
You play. We tune.

Power Meter

深圳长城开发科技股份有限公司
SHENZHEN KAIFA TECHNOLOGY CO., LTD.

GPS Car tracker

CalAmp

Point Of Sale

LANDI 联迪

Flight Instruments

RENSCHLER

Tools and Software

STM32 Releasing your creativity

STM32 tools

4 starter kits suppliers
Numerous boards



STM32 promotion kits


EvoPrimer


STM32-ComStick


STM32VLDISCOVERY

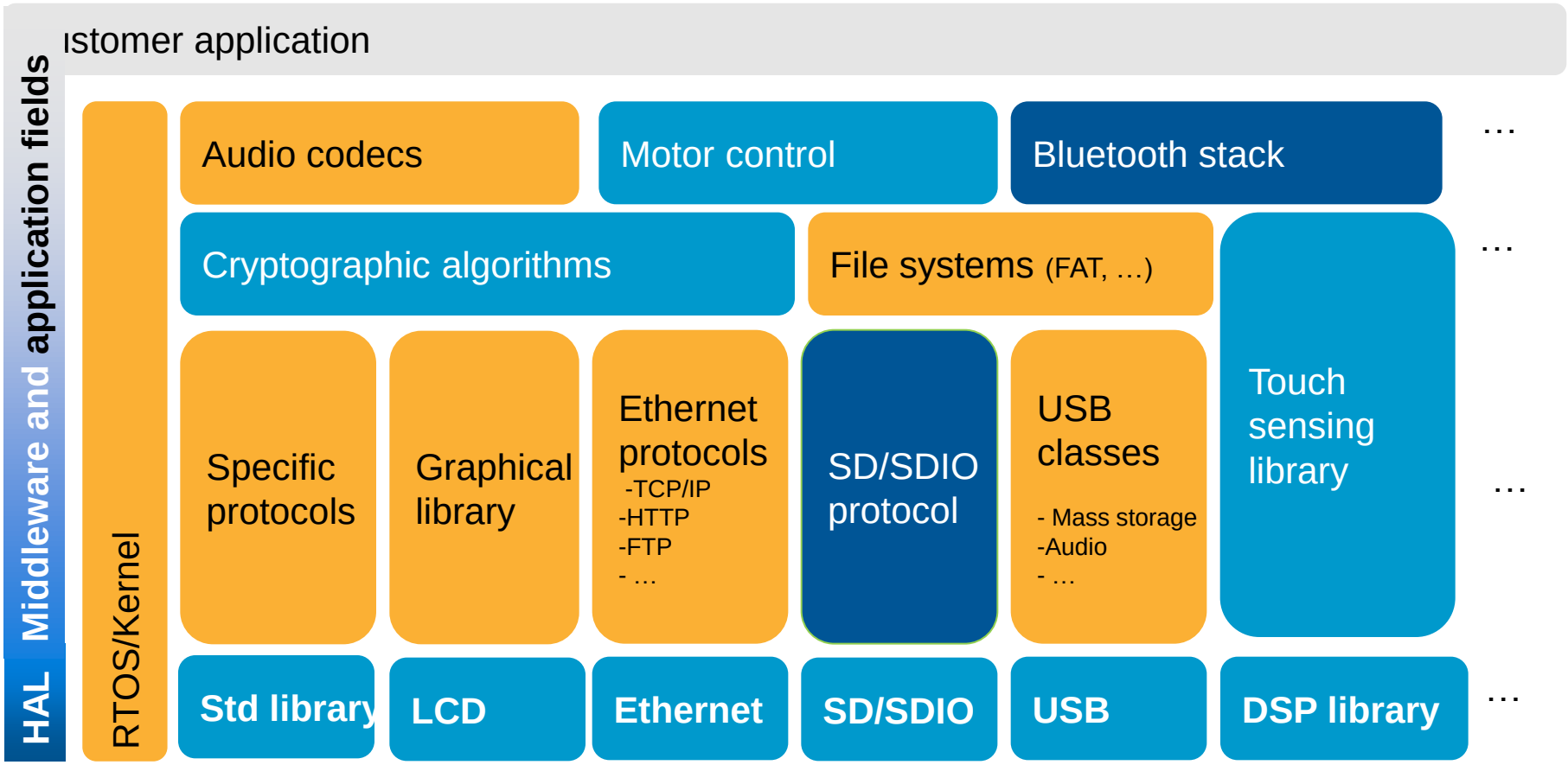
More than **15** different development IDE solutions

mbest · IAR SYSTEMS · SIGNUM SYSTEMS · LAUTERBACH · RAISONANCE · TASKING · aiji SYSTEM · KEIL An ARM® Company · hitex DEVELOPMENT TOOLS · Green Hills SOFTWARE, INC. · RA · Altium · atollic · iSYSTEM · GNU

Over **18** different RTOS and stack solution providers

eCosCentric · µd Micro Digital · Green Hills SOFTWARE, INC. · CMX SYSTEMS · Micrium · Quadros Systems Inc. · Open Source · expresslogic · interniche technologies, inc. · KEIL An ARM® Company · freeRTOS · MiSPO 株式会社ミスポ · eForce · Computex · 横河ディジタルコンピュータ株式会社 Yokogawa Digital Computer Corporation · insight インサイトインターナショナル · GRAPE SYSTEMS

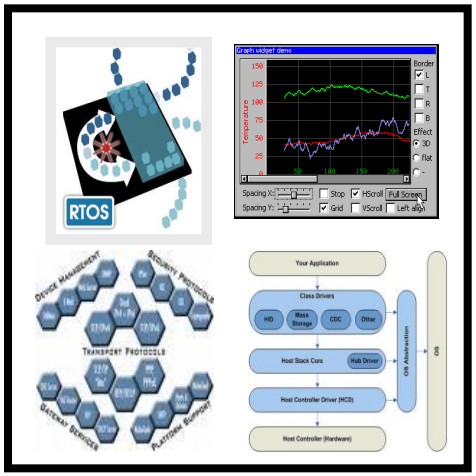
STM32 – firmware solutions



→ We provide more than just silicon

Third Party Software stacks and RTOS

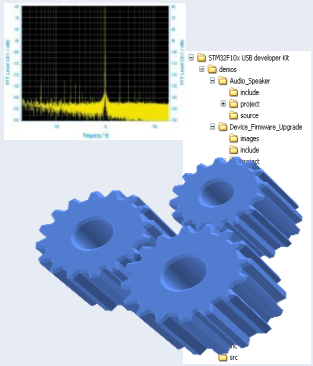
eCosCentric
Micro Digital
Green Hills SOFTWARE, INC.
CMX SYSTEMS
Micrium
freeRTOS
Quadros Systems Inc.
interniche technologies, inc.
KEIL An ARM® Company
expresslogic
Open Source
MiSPO 株式会社ミスポ
横河ディジタルコンピュータ株式会社
Yokogawa Digital Computer Corporation
eForce
Computex
insight インサイトインターナショナル株式会社
GRAPE SYSTEMS



Choice of complete software solutions

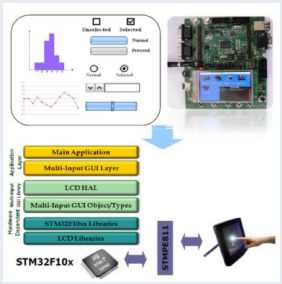
- Real Time Operating Systems
- USB Host/OTG stacks, File systems
- Ethernet stacks
- Graphics libraries

Free software solutions from ST

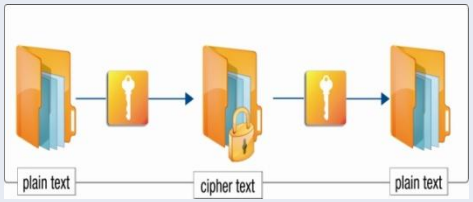


Standard Peripheral Library & DSP Library

USB OTG library



Graphic Library

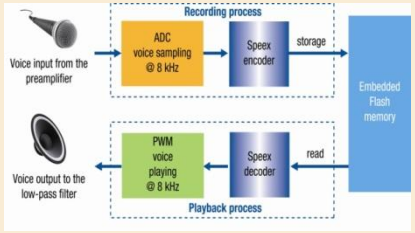


Encryption Library

Motor Control Library

Self-test routines for EN/IEC 60335-1 Class B

CMSIS COMPLIANT
ARM® Cortex™ Microcontroller Software Interface Standard



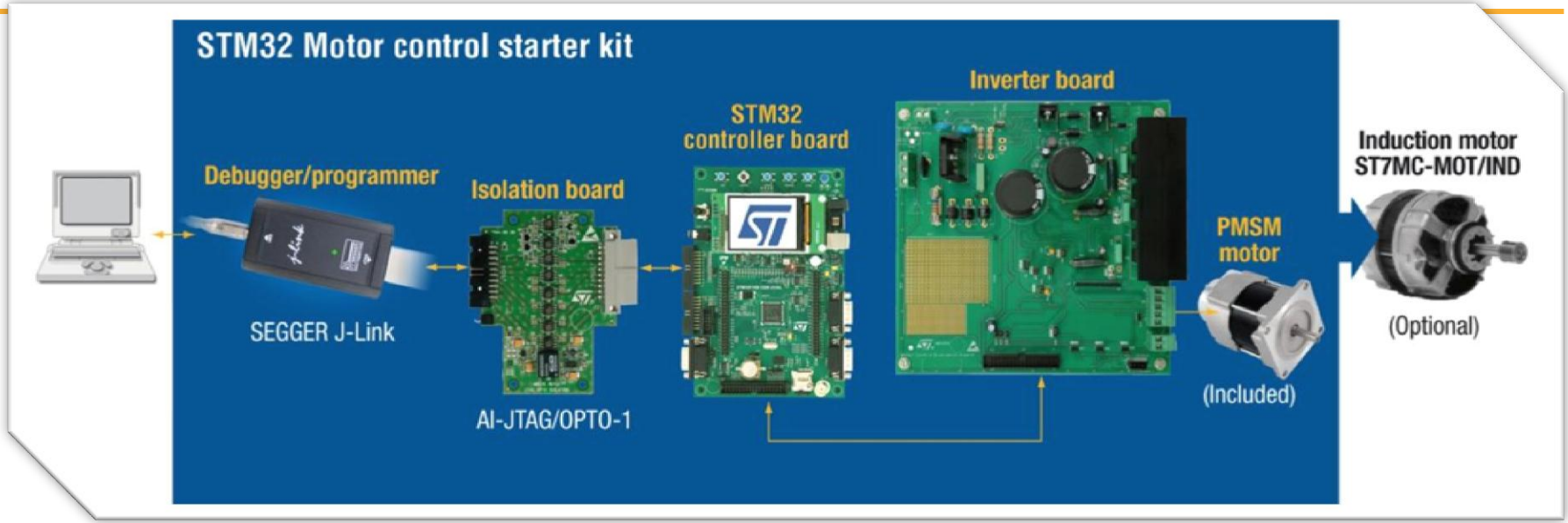
SPEEX Codec

STM32 Audio Engine
iPod iAP software

New Software in 2011

- Third party, refer to PDF description on internet: http://www.st.com/internet/com/SOFTWARE_RESOURCES/SW_COMPONENT/FIRMWARE/3rd_pty_fw.pdf
- Motor control
  - MC Kit with Value line: June 2011
  - MC Lib for STM32 F-2: June 2011
  - MC Lib for STM32 F-4: Nov 2011
  - MC lib for F-0: Dec 2011
  - TCP/IP extended - Beta version (on demand)
  - Polar SSL, Ethernet IAP, Ethernet IP CAM, Ethernet to Usart bridge
- ARM DSP library for M3 & M4: Now
- Crypto
  - Extended Crypto (SW): Beta version (on demand)
  - Extended Crypto (HW support): June 2011
- Audio
  - IPOD protocol (IAP): Beta on demand on F105
- RF
  - Bluetooth - Alpwise iAnywhere stack with STLC2690: June 2011
  - Wifi with Roving Networks: Now
  - Wifi with Gainspan: Now
- Touch sensing (charge transfer with HW assist)
  - STM32 F-0: Q4 2011
  - STM32 F-3: Q1 2012

STM32 motor control kit and libraries



- STM3210B-MCKIT
- Kit includes
  - STM32 controller board
  - Inverter board
  - Motors
  - JTAG adapter and isolation board
- Free motor control libraries for
  - PMSM and AC induction motors
  - Field-oriented control
  - Sensor and sensor less

- Dedicated kit for dual motor control and PFC support
  - STEVAL-IHM022V1 for dual motor control demonstration
  - STEVAL-ISF002V1 for PFC driver
- Value Line Support available in June 2010

Start Today with the STM32

- **STM32 Discovery kit**
  - Includes everything for a quick start with the STM32 Value line for less than $10
  - Ideal for evaluation, learning or prototyping
  - Development toolchain support
    - TrueSTUDIO® lite unlimited free version
    - EWARM
    - MDK-ARM

atollic

KEIL An ARM® Company

IAR SYSTEMS

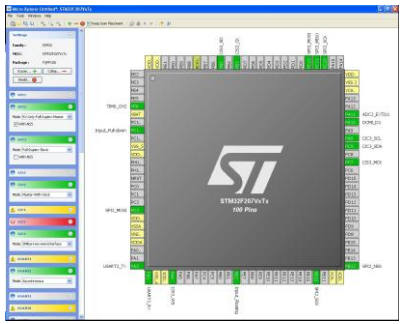
  - Can be used to debug/program any STM32 application
  - Dedicated web site: www.st.com/stm32-discovery with examples and documents

Order code: STM32VLDISCOVERY

Making life easier

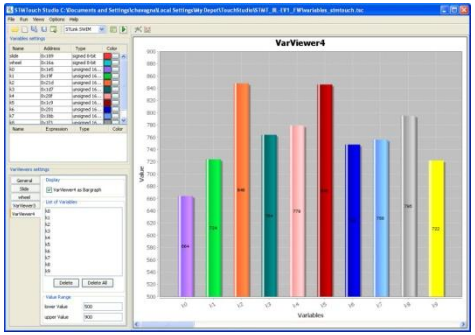
Start with the right STM32 and get the optimum pinout configuration

- **MicroXplorer tools**
  - MCU product selector
    - Identify the best STM32 to fit your application needs (performance, memory, peripherals, I/Os, etc.)
  - MCU configuration tool
    - Configure the STM32 pinout to fit your application needs



Optimize application performance

- **STM Studio tool**
  - Monitor any variable selected in your code to optimize application performance (motor control, touch sense, etc.)
    - Several display modes
    - On-the-fly acquisition modes
    - Log to/replay from file
    - Variables read/write capability



STM32 EvoPrimer
latest STM32 Primer

- Unique, versatile solution for exploring a variety of new STMicroelectronics' 8 and 32-bit microcontrollers.
- Finely finished, with color LCD and sound support
- The Raisonance **EvoPrimer** is a fun universal development platform supporting a range of STM8 8-bit and STM32 32-bit microcontrollers.
  - Complete toolset including Raisonance debugger/programmer, C compiler and IDE
  - Interchangeable target boards make it possible to try out many ST MCUs from the same platform.
- **EvoPrimer** with target boards at **RRP: $99**
  - **STM3210EPRIMER**: with STM32F103VE
  - **STM3210CPRIMER**: with STM32F107VC
  - **STM3220GPRIMER**: with STM32F205VG (RRP $174)
- Additional target boards available at **RRP:$24**

STM32-comStick compact dev kit

- STM32-comStick
  - Everything included
  - Firmware, user's guide, CD
  - USB-bus powered
- Demonstrate and evaluate Ethernet, USB, connectivity
  - Web server demo
  - USB host demo
- *Full tool-chain* from Hitex*
  - Code size limit
  - Full capability: editing, GNU compiling, Flash programming, and debugging with HiTop environment

* For use on one STM32-comStick dongle

Order from ST or Hitex

Micrium Books: µC-OS/III and TCP-IP with STM32F107 evaluation board

- Micrium's newest RTOS µC-OS/III bundle
  - A two-part book accompanied by an ST STM32F107 evaluation board.
  - Available at Amazon, and through ST: RRP $199.95 (DCPL $159)
- Order code: **STM32CMICOS-EVAL**

- Micrium's newest TCP-IP bundle
  - Understand how a TCP/IP stack works using Micrium's µC/TCP-IP as a reference with the book µC/TCP-IP: The Embedded Protocol Stack for the STM32F107, Connectivity line. Examples run on the STM32F107 evaluation board available with the book µC/OS-III.
- Order code: **STM32CMICTCP-BK**

STM32 STLINK and Atollic True studio

- The ST-LINK debug probe
  - From ST and distributors
  - resale price of $21.

- Atollic TrueSTUDIO
  - downloaded from http://www.atollic.com/index.php/download
  - €995 for TrueSTUDIO/STM32 Pro,
  - Free of charge for TrueSTUDIO/STM32 Lite.

LITE/PRO VERSION FEATURE COMPARISION

FEATURE	LITE	PRO
Price	Free	Low-cost
Supported languages	Assembler, C	Assembler, C and C++
ARM build & debug tools	✔	✔
PC build & debug tools	–	✔
GUI configuration of command line tool options	–	✔
Extensive IDE	✔	✔
Additional IDE features	–	✔
Graphical UML editors	–	✔
Integrated version control system client	–	✔
Integrated bug/task management system client	–	✔
Runtime libraries	Precompiled	Adaptable
JTAG dongle support	ST ST-LINK	Extensive
Technical support	–	Available
Unlimited code size	✔	✔
Unlimited usage time	✔	✔

STM32 Roadmap

MMS – MCD
Marketing Team

ST has licenced all Cortex-M processors

- **Forget traditional 8/16/32-bit classifications**
  - Seamless architecture across all applications
  - Every product optimised 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

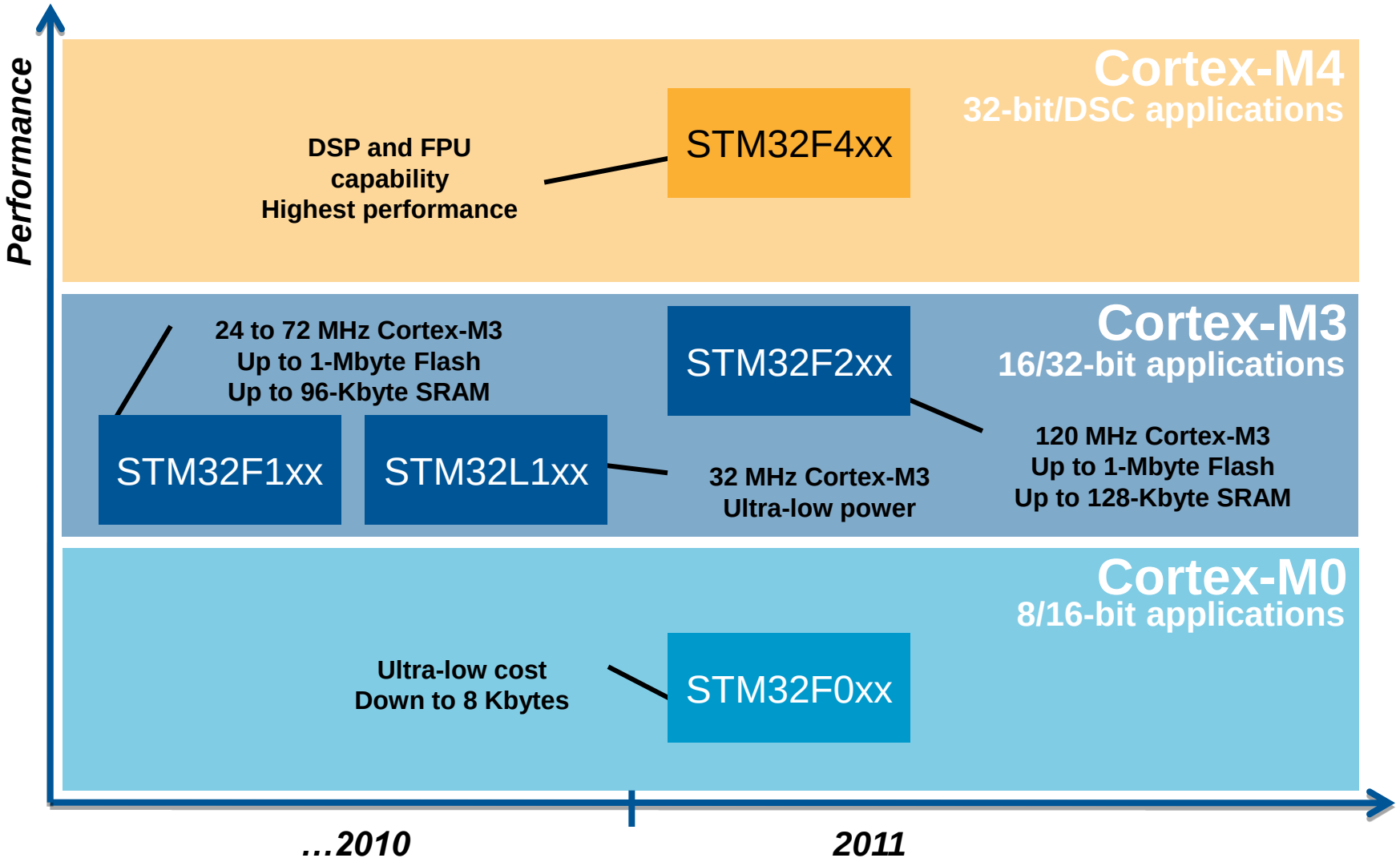








STM32 Releasing your creativity - further



STM32 Releasing your creativity

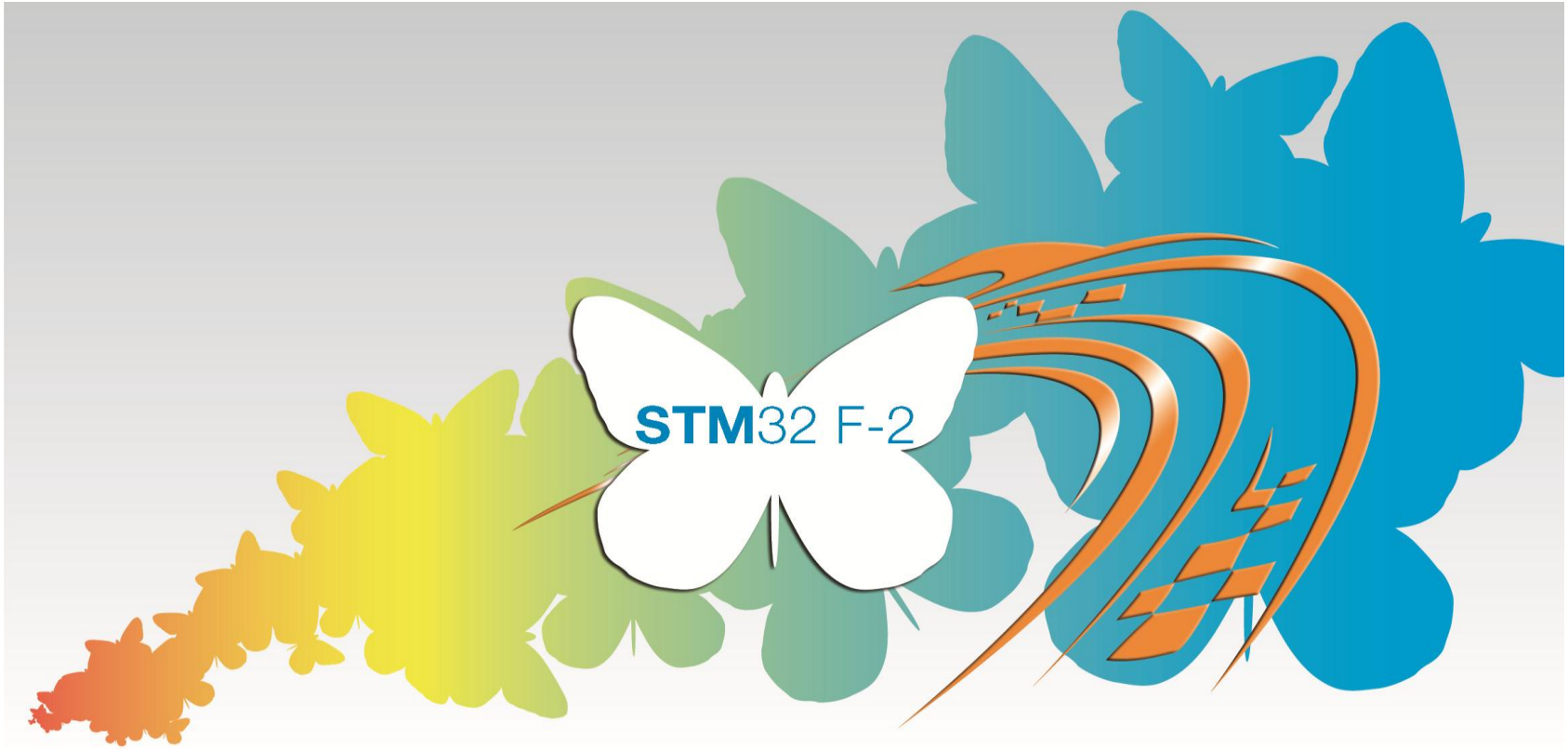
- Building on leading-edge ARM-based architecture in production at hundreds of customers

- New STM32 F-2 series, STM32L and STM32 Value line devices increase STM32 offer scalability
  - STM32 is the industry's largest portfolio of Cortex-M based MCU
  - More than185 part numbers across 7 product lines, rich and diverse peripheral set
  - Addresses the 3 dimensions of MCU: Performance, Cost effectiveness, Low power

- The STM32 family brings new degrees of freedom to MCUs by combining**:**
  - 32-bit processing (ARM Cortex™-M3 core) with leading performance and excellent real-time behavior
  - Outstanding power efficiency
  - First-class peripherals
  - Maximum integration
  - An excellent tools and software ecosystem

- STMicroelectronics committed to continue reshaping the MCU market

Thank you



Find all STM32 documentation on www.st.com/stm32