STM32H7 Dual Core
World Most Powerful MCU

Marketing Presentation – Jun 2019
Continuing the STM32 Success Story

Leader in Arm Cortex-M 32-bit General Purpose MCU

World 1st Cortex-M MCU
World 1st Cortex-M Ultra-low-power
1st High Perf. 120 MHz, 90nm
1st High Perf. Cortex-M4 168 MHz
1st Mixed Signal DSP + Analog STM32F3 Cortex-M4
Entry Cost STM32F0 Cortex-M0
Entry Cost Ultra-low-power
World 1st Cortex-M7
Leadership Ultra-low-power Cortex-M4
#1 ULP 273 ULPBench™
#1 Performance 2020 CoreMark
Ultra-low-power Excellence
Mainstream Cortex-M0+ MCUs Efficiency at its best!
Introduction of M33 Excellence in ULP with more security
Mainstream Cortex-M4 MCUs

Dual-core, multiprotocol and open radio
Dual-core Microprocessor among the STM32

STM32H7 Series

New Dual core product lines expanding the STM32 portfolio

New Performance Record
2424 + 800 CoreMark (Cortex®-M7 @480Mhz + Cortex®-M4 @240Mhz)

Dual-core flexible architecture for industrial, security or AI applications
Accelerated graphics, fast data transfer, advanced peripherals

Advanced security features
Crypto Hash, Cortex®-M7 Security services

Rich eco-system to speed-up your design
SW tools, HW boards, community and partners
Performance Record
High Performance Range

Arm® Cortex® -M7 @480MHz
Most powerful Cortex core with double precision FPU, MPU, advanced DSP and L1 cache

Arm® Cortex® -M4 @240MHz
Best in class core for real-time with single precision FPU, DSP, MPU and ART Accelerator™
Extend the STM32H7 Experience

Dual core lines for concurrent-thread-applications

Single core lines for single-thread-application
Powerful Cores
Supported by a Powerful Architecture

Display nice graphic
The Chrom-ART Accelerator and MJPEG codec offload the CPU by more than 90%

Manage security
Use dedicated cryptography and Hashing HW acceleration to offload the CPU by more than 90%

Transfer data efficiently across peripherals
The Main DMA takes care of the most complex schemes between memories and peripherals with up to 16 channels to offload the CPU

Generate complex wave forms
High-Resolution timer (2.1ns) can generate complex wave forms synchronized on multiple events, with no CPU assist
Dual-core Architecture Approach

2 Simple Examples

Industrial tool machine

Cortex-M7 = HMI
Cortex-M4 = Com/Gateway + Motor Control
  + Sensor pre-processing (AI)

Home automation & security

Cortex-M7 = AI NN (Pattern recognition, ASR)
Cortex-M4 = Com/Gateway + Real-time I/F
Build Complex Applications
Mixing AI and Real-time Control

Connected Kitchen Aid with advanced HMI (Large display and Voice recognition)

- Display Interface
- Memory Interface
- Display
- Memory
- NOR Quad-SPI
- eMMC
- SDRAM
- SD card
- arm Cortex-M7
- Chrom-ART JPEG codec accelerator
- Crypto Hash
- arm Cortex-M4
- RAM
- FLASH
- Main DMA
- Hi-res timer
- Motor control
- Sensing
- Communication
Benefits of Dual-core Architecture

Increase system performance
• 2x processing units working in parallel (2 applications or run time safety check by 1 core)
• Reduces computation time and average power consumption

Reduce development time
Reduce development time
• Reduce dependencies between dev. Teams (one team per core)
• Less components on the PCB to ease and shorten PCB design and validation

Increase system efficiency
Workload balance between 3 power domains
• Cortex-M7 (more powerful): GUI, DSP, security
• Cortex-M4 (real-time): Connectivity, RTOS, Motor control or process control task
• Batch Acquisition Mode domain: sensors acquisition, GPIO and low power management

Reduce system cost
Reduce BOM cost by transferring more tasks to STM32H7
• Remove external devices (by integrating secondary functions)
• 1 MCU instead of 2
• Extends connectivity
• Enhance user interfaces
• Integrated SMPS (few ext. components needed)
Secure Your Production Flow with Secure Firmware Install (SFI*)

Manage STM32 authentication, firmware decryption and installation

Customer premises

- FW
- Encrypted FW
- ST Hardware Secure Module (HSM)
- Store encryption key into HSM

Untrusted environment

- Encrypted FW transfer
- HSM physical transfer
- Authenticate target STM32
- Generate installation license

ST32H7 SFI

(*) : optional – SFI service available on specific part numbers
A Full Set of Security

- AES-128/256 Encryption
- SHA-256 Authentication
- Certified Crypto library
- True Random Number Generator
- Unique ID
- Key provisioning for STM32 authentication

- Anti-tamper detection
- Memory Protection Unit (MPU)
- Secure Boot
- Read and Write Protection
- Secure User Area (Hide Protect)
- PC-ROP
- JTAG fuse

Some of the above features are optional and require to procure dedicated part numbers. Please refer to product specification.
Detailed use-cases
Performance and smart architecture
are yours to innovate
Create a Rich Human Machine Interface

Cortex-M7 - handling audio and rich HMI, Cortex-M4 running Real Time control tasks

- Display: High Resolution, MIP-DSI display interface
- Memory: NOR Quad-SPI, eMMC, SDRAM, SD card
- Audio decoding and output
- Chrom-ART JPEG codec accelerator
- Crypto Hash
- Hi-res timer
- Main DMA
- RAM
- FLASH
- Cortex-M7
- Cortex-M4

STM32 H7
Life augmented
Seamlessly Move and Format Data

Main DMA - Flexible and high speed data transfers schemes without CPU load

Display

Memory
- NOR Quad-SPI
- eMMC
- SDRAM
- SD card

ARM Cortex-M7

Display Interface

Chrom-ART JPEG codec accelerator

Crypto Hash

ARM Cortex-M4

RAM

RAM

FLASH

Hi-res timer

Main DMA
Reinforce the Security in your Solution

Authenticate your chip and securely install your code in memory

Cryptography and Hashing hardware assist

Display Interface

Display Interface

Memory Interface

Memory Interface

ARM Cortex-M7

ARM Cortex-M4

RAM

RAM

FLASH

Main DMA

Hi-res timer

Cryptography and Hashing hardware assist

Authenticate your chip and securely install your code in memory

Display

Memory

NOR Quad-SPI

eMMC

SDRAM

SD card

Chrom-ART JPEG codec accelerator

Crypto Hash

Security services
Control Real-time Applications

High resolution timer: advanced wave forms generation

- Display Interface
  - Display
  - Memory Interface
  - NOR Quad-SPI
  - eMMC
  - SDRAM
  - SD card

- arm Cortex-M7
  - Chrom-ART JPEG codec accelerator
  - Crypto Hash

- RAM
- Main DMA

- arm Cortex-M4
- Hi-res timer
  - Timing defined in multiple timers
Industrial and Health & Wellness DNA

Industrial
- Error Code Correction on all Flash and RAM and dual core for safety
- Large choice of packages
- Advanced digital and analog
  (High resolution timer, 16-bit ADC, OpAmp, Ethernet, CANFD…)
- High temperature -40°C up to 140°C junction temperature (avail. Q4-2019)
### Industrial and Health & Wellness DNA

#### Industrial
- **Inverters**
  Advanced timers and analog peripherals
- **Communication gateway**
  Rich connectivity and optional dual core
- **Human Machine Interface**
  Chrom-ART Accelerator and display interfaces for TFT and MIPI-DSI

#### Health & Wellness
- **Health and wellness**
  Chrom-ART Accelerator and display interfaces for TFT and MIPI-DSI
- **Individual assistance** (hearing, respiratory)
  Advanced timers and analog
- **Measurements and Data logger**
  Advanced Analog
Consumer DNA

Consumer

- Small packages
- Power efficiency and high performance
- Advanced audio and graphic
- High-speed peripherals
- Large expandable memories to support ever increasing communication protocols
Consumer DNA

Consumer DNA

- **IoT gateway**
  Large memory and rich communication peripherals
- **Access control**
  Chrom-ART Accelerator and display interfaces for TFT and MIPI-DSI
- **Drones**
  High processing architecture with dual core option, advanced timers and analog peripherals, small packages
Dual-core ready ecosystem
Supported by the STM32 Ecosystem
Software Tools for Dual-core Architecture

Complete support of Arm Dual Cortex-M architecture

- **STM32CubeMX**
  - STM32CubeMX enhanced for Dual-core
  - Configure and generate Code
  - Multi-core resources allocation
  - Peripherals configuration

- **IDEs**
  - Compile and Debug
  - Multi-Core Solutions
  - Partners IDE
  - Free IDE based on Eclipse
  - Multi-core debugging

- **STM32 Programming Tool**
  - Program the application into the chip
  - Device information and readout
  - Signing tool & license generation
STM32H7 Hardware Solutions

Speed-up evaluation, prototyping and design

Evaluation Boards
- Full feature STM32H7 evaluation
  - STM32H743I-EVAL2
  - STM32H753I-EVAL2
  - STM32H747I-EVAL
  - STM32H757I-EVAL

Discovery Kits
- Flexible prototyping & demo
  - STM32H745I-DISCO
  - STM32H747I-DISCO
  - STM32H747I-DISC1
  - STM32H750B-DK

Nucleo Boards
- Affordable and quick prototyping
  - NUCLEO-H743ZI2
  - NUCLEO-H753ZI
  - NUCLEO-H745ZI-Q / H755ZI-Q

Starting at $318
Starting at $87
Starting at $69
Starting at $27
Software, Tools and Services
a Broad Ecosystem to Support Development

Large selection of partners already engaged for:

- Embedded software
- Software tools
- Graphics UI
- Security
- Training and services
STM32H7 Line-up
CORE, MEMORIES AND ACCELERATION
- Single core Cortex-M7 480 MHz
- Dual core Cortex-N7 460 MHz and Cortex-M7 240 MHz (STM32H767 and STM32H757 only)
- Flash on RAM acceleration
- SPI-FPU and DP-FPU
- 4 x DMA

CONNECTIVITY
- 2 x USB 2.0 OTG FS/HS
- 2 x USBMC
- UART, SPI, PC
- 2 x CAN (1 x FD and 1 x TD)
- CAN FD
- FMC, Dual O-SPI
- Ethernet MAC, IEEE1588
- USB
- Analog (comp. A/D)

AUDIO
- 3 x PS + audio PLL
- 4 x SAW
- 2 x 12-bit DAC
- EOPIC-EX

GRAPHIC
- Chrom-AIT Accelerator™

OTHER
- Crypto/Hash (except H742)
- Security services (except H742)
- TRNG
- ESMC
- 16- and 32-bit timers
- 3 x 16-bit A/D (up to 5.6 Msps)
- Voltage range 1.62 to 3.6 V
- Multi-power domains

<table>
<thead>
<tr>
<th>Product line</th>
<th>Fcpu (MHz)</th>
<th>UB Flash (bytes)</th>
<th>RAM (bytes)</th>
<th>Graphic</th>
<th>Power supply</th>
<th>T° range</th>
</tr>
</thead>
<tbody>
<tr>
<td>STM32H7x7</td>
<td>400 ± 240</td>
<td>Up to 2MB</td>
<td>1 MB (incl. 128 K DTCM) + 64 K ITCM + 54 KB bckup + 4 K bckup2</td>
<td>TFF-LCD JPEG code</td>
<td>DQG + LDO</td>
<td>Standard 95 °C</td>
</tr>
<tr>
<td>STM32H7x5</td>
<td>400 ± 240</td>
<td>Up to 2MB</td>
<td>1 MB (incl. 128 K DTCM) + 64 K ITCM + 54 KB bckup + 4 K bckup2</td>
<td>TFF-LCD JPEG code</td>
<td>DQG + LDO</td>
<td>Standard 95 °C</td>
</tr>
<tr>
<td>STM32H7x3</td>
<td>400</td>
<td>Up to 2MB</td>
<td>1 MB (incl. 128 K DTCM) + 64 K ITCM + 54 KB bckup + 4 K bckup2</td>
<td>TFF-LCD JPEG code</td>
<td>LDO</td>
<td>Standard 95 °C</td>
</tr>
<tr>
<td>STM32H742</td>
<td>400</td>
<td>Up to 2MB</td>
<td>692 K (incl. 128 K DTCM) + 64 K ITCM + 16 KB bckup + 4 K bckup2</td>
<td>no</td>
<td>LDO</td>
<td>Standard 95 °C</td>
</tr>
<tr>
<td>STM32H750</td>
<td>400</td>
<td>120K</td>
<td>1 MB (incl. 128 K DTCM) + 64 K ITCM + 54 KB bckup + 4 K bckup2</td>
<td>TFF-LCD JPEG code</td>
<td>LDO</td>
<td>Standard 95 °C</td>
</tr>
</tbody>
</table>

Notes:
1: optional - dedicated CPn, STM32H765, STM32H767, STM32H755, STM32H757 for the Crypto Variants
2: SPI and CS-GPIO - Available Mid-2018
3: available Q4-2019 - Extended temp range Max 125C Ambient/110C junction, Dedicated Part numbers

Tailored for Your Needs
- 40nm Embedded Flash Process
- Single and Dual core versions
- High performance up to 480MHz
- 2MB Flash Dual Bank with ECC
- 1MB RAM with ECC
- More security features (Boot, Tamper …) and security services (optional)
- 35 communication peripherals
- New generation of peripherals including fast 16-bit ADC up to 3.6Mmps, up to 5MSPS in 12-bit, Comparators, Op Amp
- New connectivity (TT-CAN and FD-CAN)
- High-Resolution timer (2.1ns)
- Several Low-Power Timers
- SMPS on Dual core variants
- Up to 140C junction temperature (optional, avail Q4-2019)
**STM32H742**

**Single Core Entry Level**

- An entry level version of the STM32H7 series
- Easy migration from the F7 and F4 series due to the pin for pin compatibility on common packages
- A wide choice of packages and form factors
STM32H753/H743
Single Core General Purpose

- Easy migration from the F7 and F4 series due to the pin for pin compatibility on common packages
- A wide choice of packages and form factors
- Optional crypto variants offering the security services (SFI and SB-SFU) support
STM32H750 Value Line

- A STM32H7 with Flash reduced to the essential to implement user bootloader and focus on external memories usage
- Lowest price point for the STM32H7 series
- Come natively in Crypto variants only
STM32H755/H745
Dual Core Industrial

- A STM32H7 Dual core version
- LDO and SMPS for optimized current consumption
- A wide choice of packages and form factors suitable for industrial or appliance applications
- Optional crypto variants offering security services (SFI & SB-SFU) support
- Optional support of extended Temperature range (avail. Q4-2019) on specific part numbers
STM32H757/H747
Dual Core Graphic

- A STM32H7 Dual core version for advanced graphic thanks to the MIPI-DSI Phy allowing to connect high resolution displays
- LDO and SMPS for optimized current consumption
- A wide choice of packages and form factors suitable for highly integrated applications
- Optional crypto variants offering the security services (SFI and SB-SFU) support
Block Diagram by Power Domain

Multi-power domain architecture for maximum flexibility and minimum power consumption

• **Three power domains for maximum flexibility**: To allow the shutdown of unused domains and minimize current consumption

• **Power efficiency in RUN mode**
  Thanks to 40nm process, dynamic voltage scaling and SMPS

• **Batch Acquisition Mode Domain**
  For always ON tasks, Including Vbat subdomain with RTC and backup RAM
Flexible Architecture for Power Efficiency

Only 60% of the dynamic power of the STM32H7 Single core thanks to the SMPS

- CM7/CM4 RUN (VOS1) at 400/200 MHz - PERIPH OFF
- CM7 RUN (VOS1) at 400 MHz - PERIPH OFF, CM4 idle
- STOP Mode (D3 STOP, D1 and D2 STDBY)
- STANDBY + 4 KB RAM
- STANDBY
- V_{BAT} = 30 nA / 0.75 µA****

Typ @ V_{DD} = 3.3 V, @ 25 °C

Notes:
* from Flash (Cache ON and Reg. ON)
*** VOS5; Flash OFF, no IWDG
**** with RTC, at 3V
More details available in product Sheet available at www.st.com
New STMicroelectronics’ STM32H7 Microcontrollers Combine Dual-Core Performance with Rich Feature Integration

- System integration
- Advanced connectivity and control
- Security services

► STM32H7x5 here
► STM32H7x7 here
► ST blog article here
STM32H7 Series - Key Take Away

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- **New Performance Record**
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  Accelerated graphics, fast data transfer, advanced peripherals

- **Advanced security features**
  Crypto Hash, Cortex®-M7 Security services

- **Rich eco-system to speed-up your design**
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Releasing Your Creativity

STM32 H7

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