

### STM32F7 series

# ARM® Cortex®-M7 powered Releasing your creativity





# STM32® high performance

#### Very high performance 32-bit MCU with DSP and FPU

The STM32F7 with its ARM® Cortex®-M7 core is the smartest MCU and has the best performance of the 32-bit STM32 family.

#### **PERFORMANCE**

The STM32F7 delivers 1082 CoreMark/ 462 DMIPS executing from embedded Flash thanks to the ST ART Accelerator™ at 216 MHz and up to twice the DSP performance, without compromising on power efficiency. External memory can be used with no performance penalty thanks to the L1 cache (up to I/D 16KB+16KB). Fully pin-to-pin and code compatible with the STM32F4 and the STM32 ecosystem.

**Benefits**: Allows creation of more responsive, innovative applications, running on either on-chip or off-chip memories. Easy upgrade for existing designs based on STM32F4.



#### **POWER EFFICIENT**

- Up to 6 CoreMark/mW at 1.8 V
- 130 µA typical in Stop mode with all SRAM saved

**Benefit**: Put more innovation and creativity in power-constrained applications.



LQFP64 10 x 10 x 1.4 mm LQFP100 14 x 14 x 1.4 mm LQFP144 20 x 20 x 1.4 mm LQFP176 24 x 24 x 1.4 mm LQFP208 28 x 28 x 1.4 mm



UFBGA144 7 x 7 x 0.6 mm (pitch 0.5) UFBGA176 10 x 10 x 0.6 mm (pitch 0.65) TFBGA216 3 x 13 x 1.2 mm (pitch 0.8)



WLCSP100 < 4.3 x 4.7 mm WLCSP143 < 5.9 x 4.6 mm WLCSP180 < 6.2 x 5.6 mm

### SMART ARCHITECTURE WITH NEW PERIPHERAL SET

The STM32F7 optimizes the system performance by combining brand-new peripherals around the Cortex-M7, with a superior interconnect architecture with AXI and multi AHB bus matrix, multiple DMA and the Chrom-ART Accelerator™ hardware.

**Benefits**: Concurrent, high-speed data transfers between bus masters and slaves without loading the CPU.

#### Large SRAM with overloading architecture

- Up to 512 Kbytes including 128 Kbytes of Data TCM RAM
- 16 Kbytes of instruction TCM RAM
- 4 Kbytes of backup SRAM

**Benefits**: Support for large data buffers, critical real-time data routines and backup.

#### **New peripheral sets**

- Two SAI (with SPDIF output support), three I<sup>2</sup>S half-duplex and SPDIF input
   Benefit: Multiple audio channel input and output support.
- 2x USB OTG with dedicated power supply Benefit: Enables USB communication even when the MCU is powered at 1.8 V.
- Dual QuadSPI interface:
   Benefit: Connect cost-effective memories with only 1, 4 or 8 data pins.
- On-Chip USB High Speed Phy (on some variants):

**Benefit**: More integration on high-speed USB communication

#### **UP TO SIX LINES FOR MORE PERFORMANCE**

ARM® Cortex®-M7 – 216 MHz	ACCELERATION  • ART Accelerator™  • L1 cache: data and instruction cache  • Chrom-ART Accelerator™	STM32 F7 Product		F <sub>CPU</sub> (MHz)	L1 cache (I/D)	FPU	Flash (bytes)	RAM (KB) + 16K ITCM + 4K backup	JPEG codec	CAN	DF SDM	TFT LCD controller	MIPI®-DSI
	(except. STM32F7x3/F7x2)	Advanced lines											
	<ul> <li>Floating Point Unit</li> <li>CONNECTIVITY</li> <li>2 x USB2.0 OTG FS/HS</li> <li>SDIO (x2 on F76x &amp; F779)</li> <li>USART, UART, SPI, I<sup>2</sup>C</li> <li>CAN2.0</li> <li>HDMI-CEC</li> <li>Ethernet IEEE 1588 (except. STM32F7x3/F7x2)</li> <li>FMC</li> <li>MDIO slave (on F76x and F77x)</li> <li>Camera I/F (except. STM32F7x3/F7x2)</li> <li>Dual mode Quad-SPI</li> </ul>	STM32F7x9 <sup>2</sup> STM32F7x8 <sup>1</sup>		216	16K+16K	Double Precision	1M to 2M (RWW)	512K - (incl.128K DTCM)	•	3	•	•	•
		STM32F7x7 <sup>2</sup>		216	16K+16K	Double Precision	1M to 2M (RWW)		•	3	•	•	
		STM32F7x6 <sup>2</sup>		216	4K+4K	Single Precision	512K to 1M	320K (incl.64K DTCM)		2		•	
		STM32F7x5	765	216	16K+16K	Double Precision	1M to 2M (RWW)	512K (incl.128K DTCM)		3	•		
	AUDIO  1/2S + audio PLL  2 x SAI  2 x 12-bit DAC		745	216	4K+4K	Single Precision	512K to 1M	320K (incl.64K DTCM)		2			
	SPDIF-RX	Foundation lines											
	<ul> <li>OTHER</li> <li>16- and 32-bit timers</li> <li>3 x 12-bit ADC 2.4 MSPS</li> <li>Low voltage supply: 1.7 to 3.6 V</li> <li>85 °C and 105 °C ranges</li> </ul>	Product lines F <sub>CPU</sub> (MHz)		F <sub>CPU</sub> (MHz)	L1 cache (I/D)	FPU	Flash (bytes)	RAM (KB) + 16K ITCM + 4K backup	JPEG codec	CAN	DF SDM	PC-ROP (protected code execution)	USB HS PHY
		STM32F7x3 <sup>2</sup>		216	8K+8K	Single	256K to	256K		1		•	٠
		STM32F7x2°		216	8K+8K	Precision Single Precision	512K 256K to 512K	(incl.64K DTCM)		1		•	

Notes: 1 Voltage Regulator Off mode available for WLCSP180 package (STM32F778AIY6TR)

<sup>&</sup>lt;sup>2</sup> Only STM32F332, STM32F333, STM32F756, STM32F777 and STM32F779 include HW crypto/hash functions



#### STM32F733 BLOCK DIAGRAM

# System Power supply 1.2 V regulator POR/PDR/PVD Xtal oscillators 32 kHz + 4 ~26 MHz Internal RC oscillators 32 kHz + 16 MHz PLL Clock control RTC/AWU 1x SysTick timer 2x watchdogs

# Control 2x 16-bit motor control PWM synchronized AC timer 10x 16-bit timers 2x 32-bit timers

LP timer

(independent and

window)

50/79/112/138 I/Os

Cyclic redundancy

check (CRC)

Crypto AES-256

# ART Accelerator™

Cache I/D 8+8 Kbytes

ARM Cortex-M7 216 MHz

# Floating point unit (FPU) Nested vector interrupt controller (NVIC) JTAG/SW debug/ETM Memory Protection Unit (MPU)

AXI and Multi-AHB bus matrix

PC-ROP

16-channel DMA True random number generator (RNG)

#### 512-Kbyte Flash

256-Kbyte SRAM + 16-Kbyte ITCM RAM FMC/SRAM/NOR/NAND/ SDRAM

Dual Quad-SPI

1024-byte + 4-Kbyte backup SRAM 528-byte OTP

#### Connectivity

5x SPI, 3x I<sup>2</sup>S, 3x I<sup>2</sup>C

Camera interface

1x CAN 2.0B

1x USB 2.0 OTG FS/HS

**USB HS Phy** 

1x USB 2.0 OTG FS

2x SDMMC

4x USART + 4 UART LIN, smartcard, IrDA, modem control

2x SAI

(Serial audio interface)

#### Analog

2x 12-bit, 2-channel DACs 3x 12-bit ADC 24 channels / 2.4 MSPS Temperature sensor





#### STM32F779 BLOCK DIAGRAM

**Power supply** 

1.2 V regulator

POR/PDR/PVD Xtal oscillators 32 kHz + 4 ~26 MHz

Internal RC oscillators

32 kHz + 16 MHz PLL Clock control RTC/AWU

1x SysTick timer

2x watchdogs (independent and

window)

50/79/112/138 I/Os

Cyclic redundancy

check (CRC)

#### **STM32F7 ON-LINE TRAINING**

www.st.com/stm32f7-online-training



## ART Accelerator™ System

Cache I/D 8+8 Kbytes

ARM

512-Kbyte Flash
256-Kbyte SRAM +
16-Kbyte ITCM RAM
FMC/SRAM/NOR/NAND/
SDRAM

Dual Quad-SPI 1024-byte + 4-Kbyte

backup SRAM 528-byte OTP

ARM Cortex-M7 216 MHz

Connectivity

5x SPI, 3x I<sup>2</sup>S, 3x I<sup>2</sup>C

Camera interface 1x CAN 2.0B

1x USB 2.0 OTG FS/HS USB HS Phy

1x USB 2.0 OTG FS 2x SDMMC

4x USART + 4 UART LIN, smartcard, IrDA, modem control

2x SAI (Serial audio interface)

#### **Control**

2x 16-bit motor control PWM synchronized AC timer 10x 16-bit timers 2x 32-bit timers LP timer

> Crypto AES-256

AXI and Multi-AHB bus matrix

Floating point unit

(FPU)
Nested vector
interrupt

controller (NVIC)

JTAG/SW debug/ETM

**Memory Protection Unit** 

(MPU) PC-ROP

16-channel DMA True random number

generator (RNG)

Analog

2x 12-bit, 2-channel DACs 3x 12-bit ADC 24 channels / 2.4 MSPS Temperature sensor

#### **ST MCU FINDER**

Free Android application to find the right STM32 MCU. www.st.com/stmcufinder



#### STM32F7 ECOSYSTEM

#### **Hardware tools**

www.st.com/stm32hardwaretools

#### STM32 Nucleo board



#### Flexible prototyping

NUCLEO-F746ZG NUCLEO-F767ZI NUCLEO-F722ZE\*

Note: \* Available in Q1/2017

#### **Evaluation board**





**TASKING** 

**ARM** KEIL

#### Discovery kit



#### Creative demos

STM32F746G-DISCO STM32F723E-DISCO\* STM32F769I-DISCO STM32F769I-DISC1

#### **Full-feature evaluation**

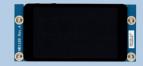
STM32746G-EVAL2 STM32F769I-EVAL

#### Hardware Crypto/Hash devices

STM32756G-EVAL2 STM32F779I-EVAL

#### STM32F769 Discovery Kit

**Accessories** 



#### B-LCD40-DSI1\*

4" WVGA TFT LCD with MIPI-DSI interface and capacitive touch

Notes: \* for STM32F769I-DISC1 only



#### **B-LCDAD-RPI1**

15-pin single-row flexible printed circuit DSI adapter board



**B-LCDAD-HDMI1 DSI to HDMI adapter** 

Note: on STM32F769 Discovery kits use the dualrow 8-way connector to host a 3rd-party Wi-Fi module available on the market

#### **Software tools**

www.st.com/stm32softwaretools









**Partner IDEs** 

KEELABS EMPROG

ARM'mbed

atollic 8C6









Free **IDE** 

### Touch GFX 🕟

#### **Embedded** Wizard

**GUI** solutions

**STemWin** 

#### **STMStudio**



Configure and generate code Compile and debug

Monitor

#### **Embedded Software**

www.st.com/stm32embeddedsoftware







STM32Cube LL\* (Low Layer)

STM32Cube HAL and middleware **Std Libraries** 

**CMSIS** and Mbed SDK

Virtual machines and models

**High optimization** low portability

Average optimization STM32 portability

Low optimization **ARM** portability

Low optimization large portability

Note: \* Available in Q1/2017



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