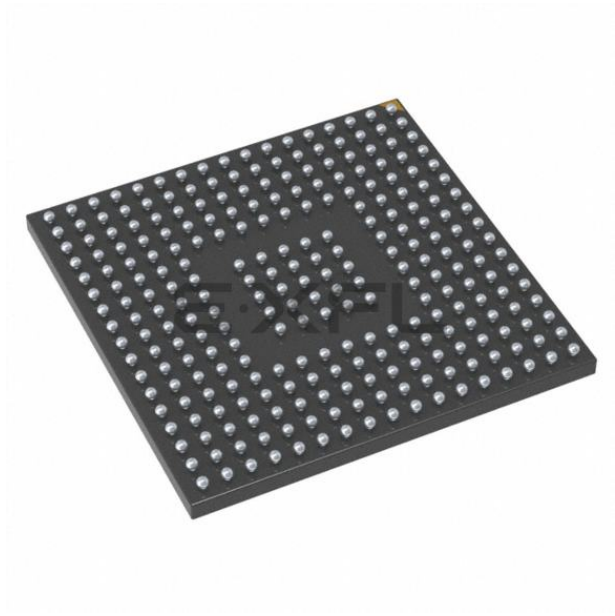

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What is "Embedded - Microcontrollers"?

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Applications of "Embedded - Microcontrollers"

Details	
Product Status	Active
Core Processor	ARM® Cortex®-M4
Core Size	32-Bit Single-Core
Speed	168MHz
Connectivity	CANbus, DCMI, EBI/EMI, Ethernet, I²C, IrDA, LINbus, SPI, UART/USART, USB OTG
Peripherals	Brown-out Detect/Reset, DMA, I²S, LCD, POR, PWM, WDT
Number of I/O	140
Program Memory Size	1MB (1M x 8)
Program Memory Type	FLASH
EEPROM Size	-
RAM Size	192K x 8
Voltage - Supply (Vcc/Vdd)	1.8V ~ 3.6V
Data Converters	A/D 24x12b; D/A 2x12b
Oscillator Type	Internal
Operating Temperature	-40°C ~ 105°C (TA)
Mounting Type	Surface Mount
Package / Case	201-UFBGA
Supplier Device Package	176+25UFBGA (10x10)
Purchase URL	https://www.e-xfl.com/product-detail/stmicroelectronics/stm32f407igh7

List of tables

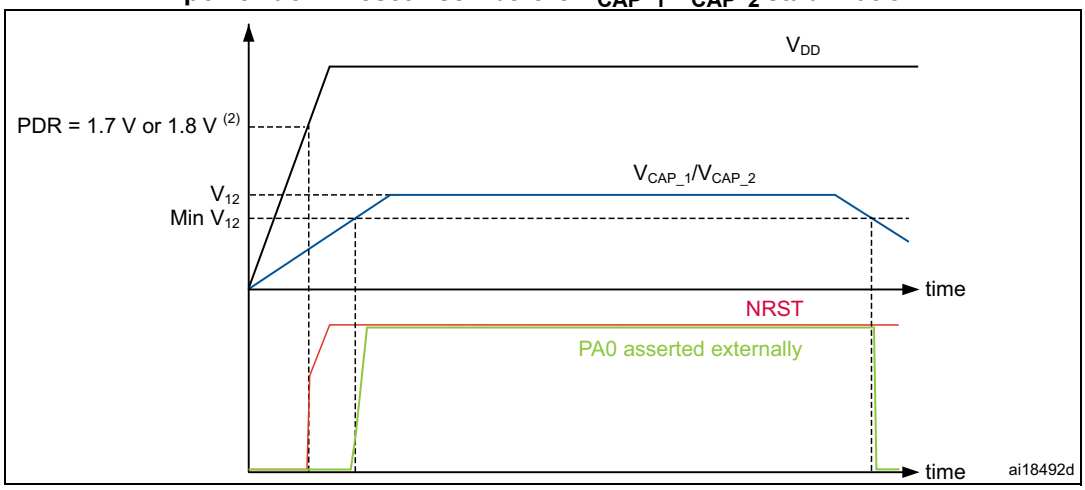
1 Introduction

This datasheet provides the description of the STM32F405xx and STM32F407xx lines of microcontrollers. For more details on the whole STMicroelectronics STM32™ family, please refer to *Section 2.1: Full compatibility throughout the family*.

The STM32F405xx and STM32F407xx datasheet should be read in conjunction with the STM32F4xx reference manual which is available from the STMicroelectronics website *www.st.com*.

For information on the Cortex®-M4 core, please refer to the Cortex®-M4 programming manual (PM0214) available from *www.st.com*.

Figure 11. Startup in regulator OFF mode: fast V_{DD} slope - power-down reset risen before V_{CAP_1}/V_{CAP_2} stabilization



1. This figure is valid both whatever the internal reset mode (ON or OFF).
2. PDR = 1.7 V for a reduced temperature range; PDR = 1.8 V for all temperature ranges.

2.2.17 Regulator ON/OFF and internal reset ON/OFF availability

Table 3. Regulator ON/OFF and internal reset ON/OFF availability

	Regulator ON	Regulator OFF	Internal reset ON	Internal reset OFF
LQFP64 LQFP100	Yes	No	Yes	No
LQFP144			Yes PDR_ON set to V_{DD}	Yes PDR_ON connected to an external power supply supervisor
WLCSP90 UFBGA176 LQFP176	Yes BYPASS_REG set to V_{SS}	Yes BYPASS_REG set to V_{DD}		

2.2.18 Real-time clock (RTC), backup SRAM and backup registers

The backup domain of the STM32F405xx and STM32F407xx includes:

- The real-time clock (RTC)
- 4 Kbytes of backup SRAM
- 20 backup registers

The real-time clock (RTC) is an independent BCD timer/counter. Dedicated registers contain the second, minute, hour (in 12/24 hour), week day, date, month, year, in BCD (binary-coded decimal) format. Correction for 28, 29 (leap year), 30, and 31 day of the month are performed automatically. The RTC provides a programmable alarm and programmable periodic interrupts with wakeup from Stop and Standby modes. The sub-seconds value is also available in binary format.

It is clocked by a 32.768 kHz external crystal, resonator or oscillator, the internal low-power RC oscillator or the high-speed external clock divided by 128. The internal low-speed RC

Standby mode, the SRAM and register contents are lost except for registers in the backup domain and the backup SRAM when selected.

The device exits the Standby mode when an external reset (NRST pin), an IWDG reset, a rising edge on the WKUP pin, or an RTC alarm / wakeup / tamper /time stamp event occurs.

The standby mode is not supported when the embedded voltage regulator is bypassed and the V_{12} domain is controlled by an external power.

2.2.20 V_{BAT} operation

The V_{BAT} pin allows to power the device V_{BAT} domain from an external battery, an external supercapacitor, or from V_{DD} when no external battery and an external supercapacitor are present.

V_{BAT} operation is activated when V_{DD} is not present.

The V_{BAT} pin supplies the RTC, the backup registers and the backup SRAM.

Note: When the microcontroller is supplied from V_{BAT}, external interrupts and RTC alarm/events do not exit it from V_{BAT} operation.

When PDR_ON pin is not connected to V_{DD} (internal reset OFF), the V_{BAT} functionality is no more available and V_{BAT} pin should be connected to V_{DD}.

2.2.21 Timers and watchdogs

The STM32F405xx and STM32F407xx devices include two advanced-control timers, eight general-purpose timers, two basic timers and two watchdog timers.

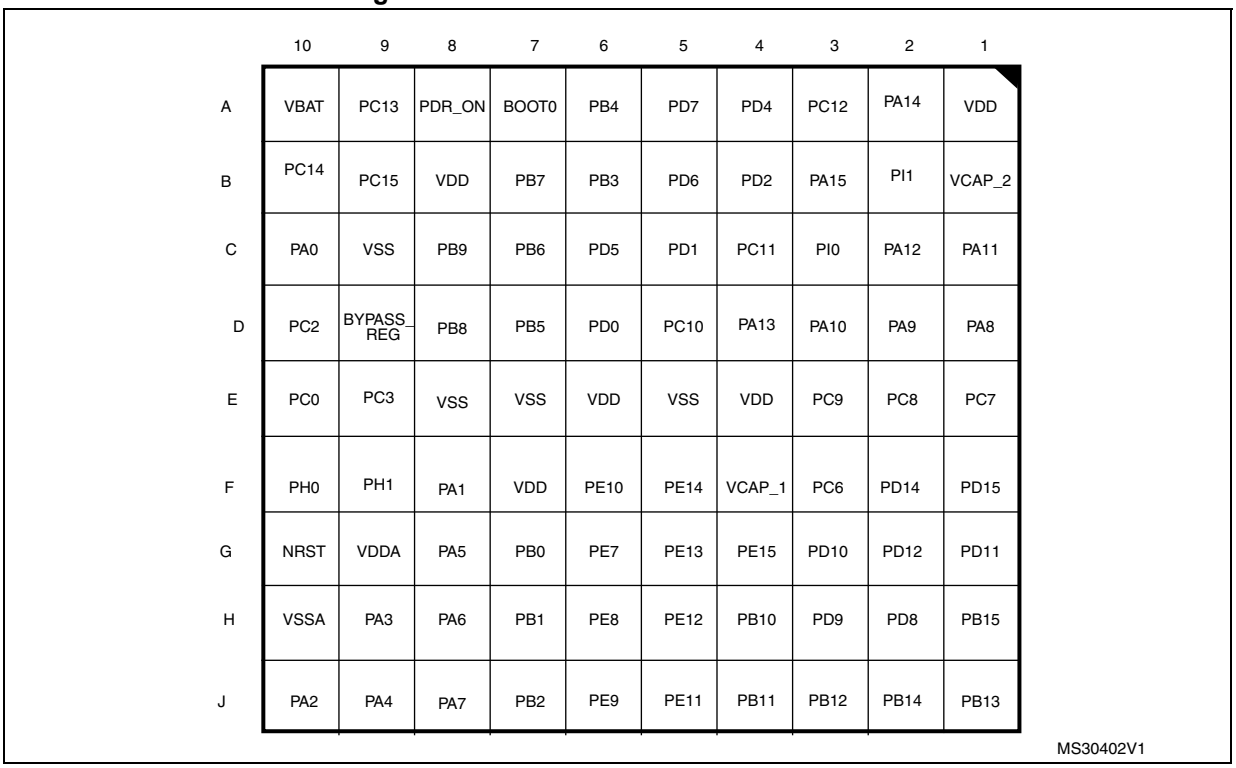
All timer counters can be frozen in debug mode.

Table 4 compares the features of the advanced-control, general-purpose and basic timers.

Table 4. Timer feature comparison

Timer type	Timer	Counter resolution	Counter type	Prescaler factor	DMA request generation	Capture/ compare channels	Complemen-tary output	Max interface clock (MHz)	Max timer clock (MHz)
Advanced -control	TIM1, TIM8	16-bit	Up, Down, Up/down	Any integer between 1 and 65536	Yes	4	Yes	84	168

Figure 17. STM32F40xxx WLCSP90 ballout



1. This figure shows the package bump view.

Table 6. Legend/abbreviations used in the pinout table

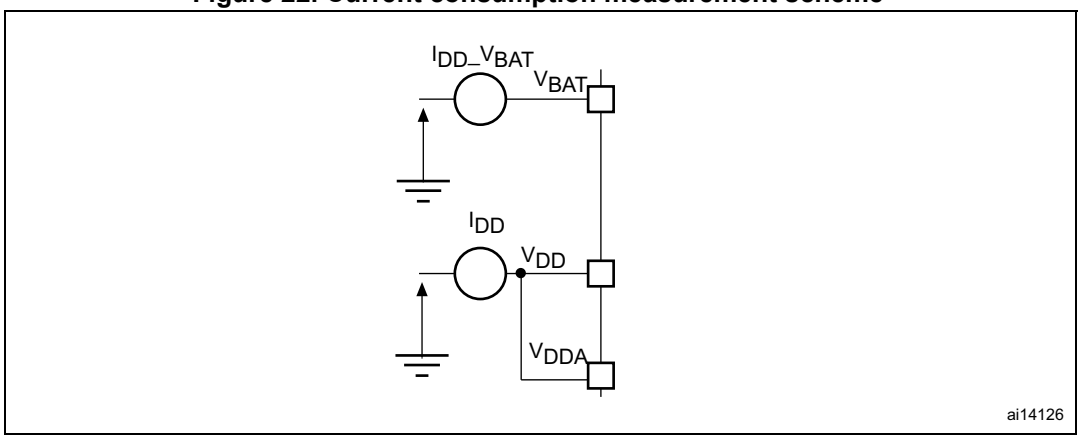
Name	Abbreviation	Definition
Pin name	Unless otherwise specified in brackets below the pin name, the pin function during and after reset is the same as the actual pin name	
Pin type	S	Supply pin
	I	Input only pin
	I/O	Input / output pin
I/O structure	FT	5 V tolerant I/O
	TTa	3.3 V tolerant I/O directly connected to ADC
	B	Dedicated BOOT0 pin
	RST	Bidirectional reset pin with embedded weak pull-up resistor
Notes	Unless otherwise specified by a note, all I/Os are set as floating inputs during and after reset	
Alternate functions	Functions selected through GPIOx_AFR registers	
Additional functions	Functions directly selected/enabled through peripheral registers	

Table 7. STM32F40xxx pin and ball definitions (continued)

Pin number						Pin name (function after reset)[1]	Pin type	I / O structure	Notes	Alternate functions	Additional functions
LQFP64	WLCSP90	LQFP100	LQFP144	UFBGA176	LQFP176						
	D9			L4	48	BYPASS_REG	I	FT	-	-	-
19	E4	28	39	K4	49	V_{DD}	S	-	-	-	-
20	J9	29	40	N4	50	PA4	I/O	TTa	(4)	SPI1_NSS / SPI3_NSS / USART2_CK / DCMI_HSYNC / OTG_HS_SOF/ I2S3_WS/ EVENTOUT	ADC12_IN4 /DAC_OUT1
21	G8	30	41	P4	51	PA5	I/O	TTa	(4)	SPI1_SCK/ OTG_HS_ULPI_CK / TIM2_CH1_ETR/ TIM8_CH1N/ EVENTOUT	ADC12_IN5/DAC_ OUT2
22	H8	31	42	P3	52	PA6	I/O	FT	(4)	SPI1_MISO / TIM8_BKIN/TIM13_CH1 / DCMI_PIXCLK / TIM3_CH1 / TIM1_BKIN/ EVENTOUT	ADC12_IN6
23	J8	32	43	R3	53	PA7	I/O	FT	(4)	SPI1_MOSI/ TIM8_CH1N / TIM14_CH1/TIM3_CH2/ ETH_MII_RX_DV / TIM1_CH1N / ETH_RMII_CRS_DV/ EVENTOUT	ADC12_IN7
24	-	33	44	N5	54	PC4	I/O	FT	(4)	ETH_RMII_RX_D0 / ETH_MII_RX_D0/ EVENTOUT	ADC12_IN14
25	-	34	45	P5	55	PC5	I/O	FT	(4)	ETH_RMII_RX_D1 / ETH_MII_RX_D1/ EVENTOUT	ADC12_IN15
26	G7	35	46	R5	56	PB0	I/O	FT	(4)	TIM3_CH3 / TIM8_CH2N/ OTG_HS_ULPI_D1/ ETH_MII_RXD2 / TIM1_CH2N/ EVENTOUT	ADC12_IN8
27	H7	36	47	R4	57	PB1	I/O	FT	(4)	TIM3_CH4 / TIM8_CH3N/ OTG_HS_ULPI_D2/ ETH_MII_RXD3 / TIM1_CH3N/ EVENTOUT	ADC12_IN9
28	J7	37	48	M6	58	PB2/BOOT1 (PB2)	I/O	FT	-	EVENTOUT	-

5.1.7 Current consumption measurement

Figure 22. Current consumption measurement scheme



5.2 Absolute maximum ratings

Stresses above the absolute maximum ratings listed in *Table 11: Voltage characteristics*, *Table 12: Current characteristics*, and *Table 13: Thermal characteristics* may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these conditions is not implied. Exposure to maximum rating conditions for extended periods may affect device reliability. Device mission profile (application conditions) is compliant with JEDEC JESD47 Qualification Standard, extended mission profiles are available on demand.

Table 11. Voltage characteristics

Symbol	Ratings	Min	Max	Unit
V_{DD}–V_{SS}	External main supply voltage (including V_{DDA}, V_{DD})(1)	–0.3	4.0	V
V_{IN}	Input voltage on five-volt tolerant pin(2)	V_{SS}–0.3	V_{DD}+4	
	Input voltage on any other pin	V_{SS}–0.3	4.0	
$\lvert\Delta V_{DDx}\rvert$	Variations between different V_{DD} power pins	-	50	mV
$\lvert V_{SSX} - V_{SS}\rvert$	Variations between all the different ground pins including V_{REF-}	-	50	
$V_{ESD(HBM)}$	Electrostatic discharge voltage (human body model)	see *Section 5.3.14: Absolute maximum ratings (electrical sensitivity)*		

1. All main power (V_{DD}, V_{DDA}) and ground (V_{SS}, V_{SSA}) pins must always be connected to the external power supply, in the permitted range.
2. V_{IN} maximum value must always be respected. Refer to *Table 12* for the values of the maximum allowed injected current.

Figure 26. Typical current consumption versus temperature, Run mode, code with data processing running from Flash (ART accelerator OFF) or RAM, and peripherals OFF

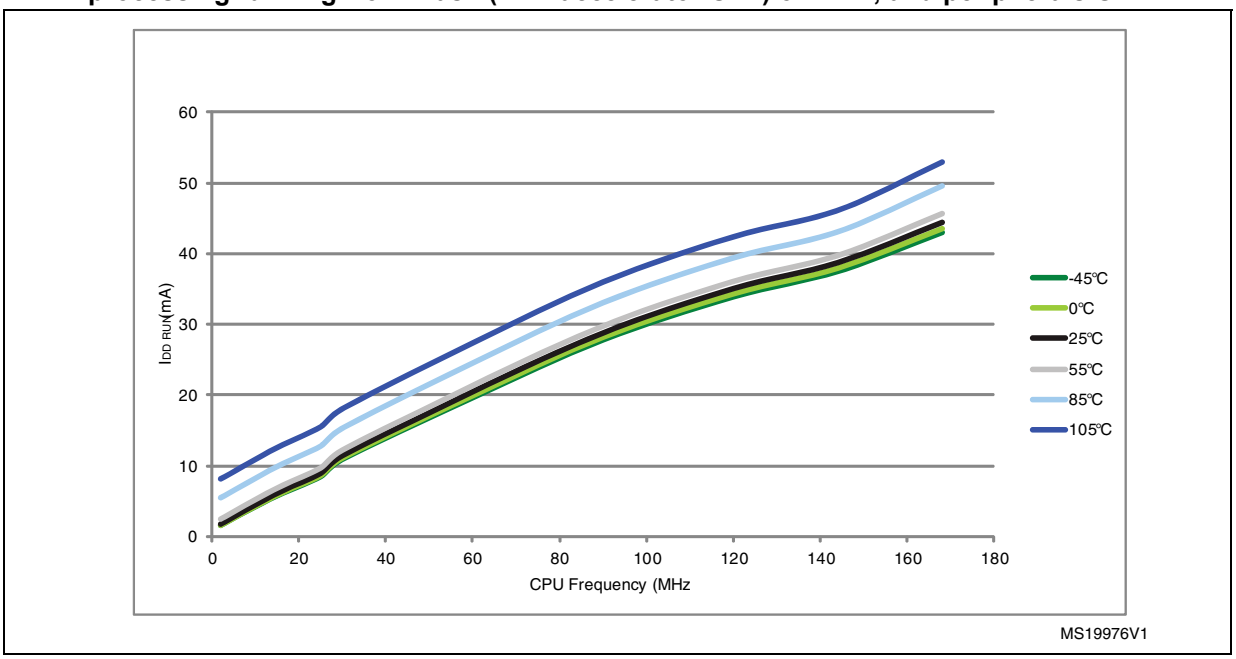
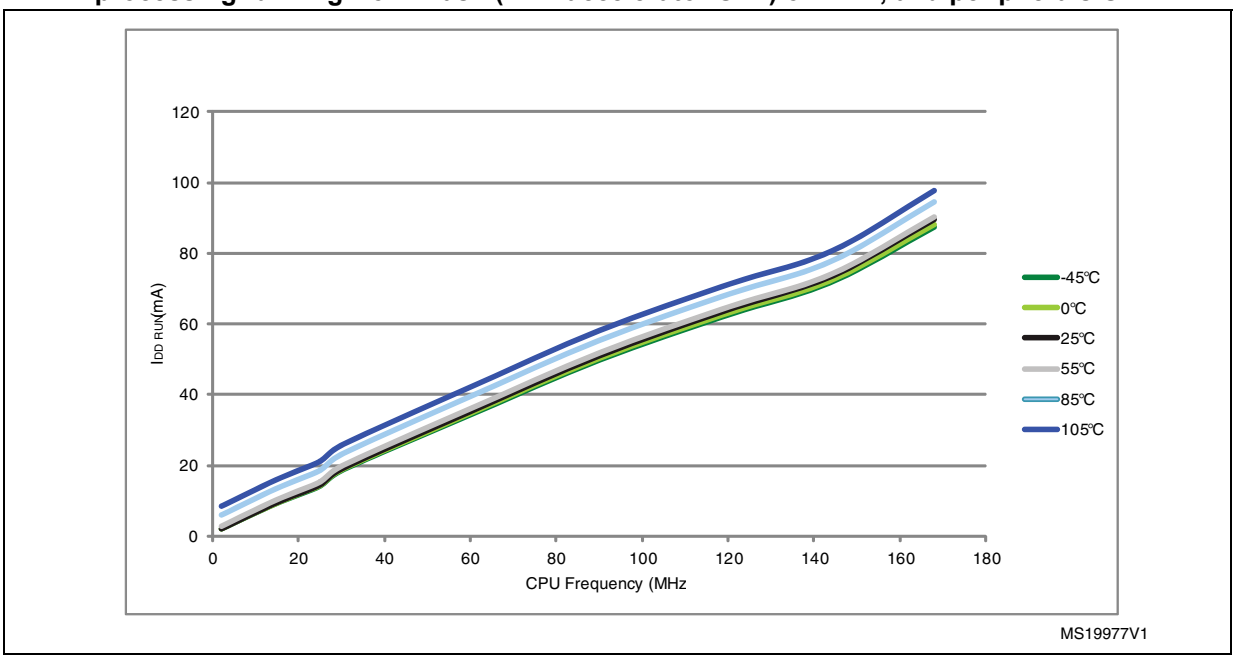


Figure 27. Typical current consumption versus temperature, Run mode, code with data processing running from Flash (ART accelerator OFF) or RAM, and peripherals ON



On-chip peripheral current consumption

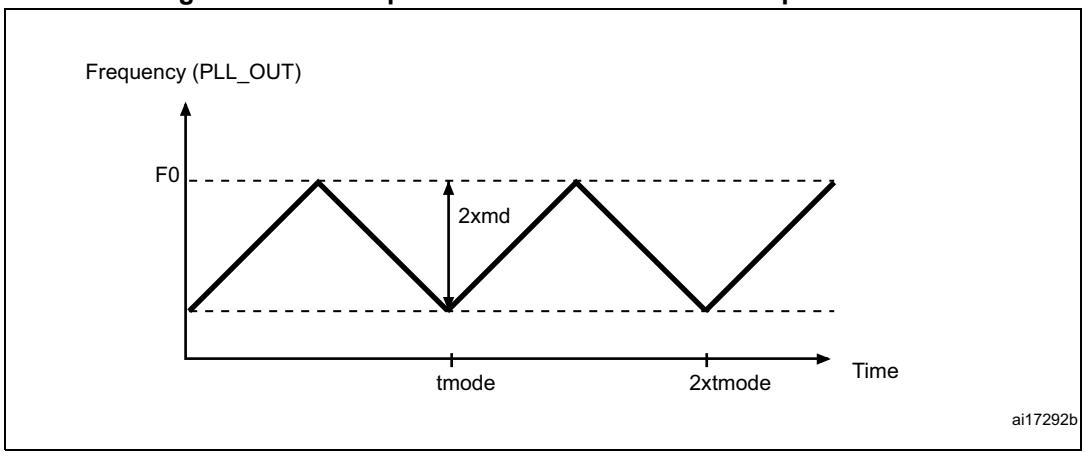
The current consumption of the on-chip peripherals is given in *Table 28*. The MCU is placed under the following conditions:

- At startup, all I/O pins are configured as analog pins by firmware.
- All peripherals are disabled unless otherwise mentioned
- The code is running from Flash memory and the Flash memory access time is equal to 5 wait states at 168 MHz.
- The code is running from Flash memory and the Flash memory access time is equal to 4 wait states at 144 MHz, and the power scale mode is set to 2.
- The ART accelerator is ON.
- The given value is calculated by measuring the difference of current consumption
  - with all peripherals clocked off
  - with one peripheral clocked on (with only the clock applied)
- When the peripherals are enabled: HCLK is the system clock, $f_{PCLK1} = f_{HCLK}/4$, and $f_{PCLK2} = f_{HCLK}/2$.
- The typical values are obtained for V_{DD} = 3.3 V and T_A= 25 °C, unless otherwise specified.

Table 28. Peripheral current consumption

Peripheral		I_{DD}(Typ)(1)		Unit
		Scale1 (up t 168 MHz)	Scale2 (up to 144 MHz)	
AHB1 (up to 168 MHz)	GPIOA	2.70	2.40	µA/MHz
	GPIOB	2.50	2.22	
	GPIOC	2.54	2.28	
	GPIOD	2.55	2.28	
	GPIOE	2.68	2.40	
	GPIOF	2.53	2.28	
	GPIOG	2.51	2.22	
	GPIOH	2.51	2.22	
	GPIOI	2.50	2.22	
	OTG_HS+ULPI	28.33	25.38	
	CRC	0.41	0.40	
	BKPSRAM	0.63	0.58	
	DMA1	37.44	33.58	
	DMA2	37.69	33.93	
	ETH_MAC ETH_MAC_TX ETH_MAC_RX ETH_MAC_PTP	20.43	18.39	

Figure 36. PLL output clock waveforms in down spread mode



5.3.12 Memory characteristics

Flash memory

The characteristics are given at T_A = –40 to 105 °C unless otherwise specified.

The devices are shipped to customers with the Flash memory erased.

Table 39. Flash memory characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I_{DD}	Supply current	Write / Erase 8-bit mode, V_{DD} = 1.8 V	-	5	-	mA
		Write / Erase 16-bit mode, V_{DD} = 2.1 V	-	8	-	
		Write / Erase 32-bit mode, V_{DD} = 3.3 V	-	12	-	

Table 40. Flash memory programming

Symbol	Parameter	Conditions	Min(1)	Typ	Max(1)	Unit
t_{prog}	Word programming time	Program/erase parallelism (PSIZE) = x 8/16/32	-	16	100(2)	µs
$t_{ERASE16KB}$	Sector (16 KB) erase time	Program/erase parallelism (PSIZE) = x 8	-	400	800	ms
		Program/erase parallelism (PSIZE) = x 16	-	300	600	
		Program/erase parallelism (PSIZE) = x 32	-	250	500	
$t_{ERASE64KB}$	Sector (64 KB) erase time	Program/erase parallelism (PSIZE) = x 8	-	1200	2400	ms
		Program/erase parallelism (PSIZE) = x 16	-	700	1400	
		Program/erase parallelism (PSIZE) = x 32	-	550	1100	

USB OTG FS characteristics

This interface is present in both the USB OTG HS and USB OTG FS controllers.

Table 57. USB OTG FS startup time

Symbol	Parameter	Max	Unit
$t_{STARTUP}$(1)	USB OTG FS transceiver startup time	1	µs

1. Guaranteed by design.

Table 58. USB OTG FS DC electrical characteristics

Symbol		Parameter	Conditions	Min.(1)	Typ.	Max.(1)	Unit
Input levels	V_{DD}	USB OTG FS operating voltage	-	3.0(2)	-	3.6	V
	V_{DI}(3)	Differential input sensitivity	I(USB_FS_DP/DM, USB_HS_DP/DM)	0.2	-	-	V
	V_{CM}(3)	Differential common mode range	Includes V_{DI} range	0.8	-	2.5	
	V_{SE}(3)	Single ended receiver threshold	-	1.3	-	2.0	
Output levels	V_{OL}	Static output level low	R_L of 1.5 kΩ to 3.6 V(4)	-	-	0.3	V
	V_{OH}	Static output level high	R_L of 15 kΩ to V_{SS}(4)	2.8	-	3.6	
R_{PD}		PA11, PA12, PB14, PB15 (USB_FS_DP/DM, USB_HS_DP/DM)	$V_{IN} = V_{DD}$	17	21	24	kΩ
		PA9, PB13 (OTG_FS_VBUS, OTG_HS_VBUS)		0.65	1.1	2.0	
R_{PU}		PA12, PB15 (USB_FS_DP, USB_HS_DP)	$V_{IN} = V_{SS}$	1.5	1.8	2.1	
		PA9, PB13 (OTG_FS_VBUS, OTG_HS_VBUS)	$V_{IN} = V_{SS}$	0.25	0.37	0.55	

1. All the voltages are measured from the local ground potential.
2. The STM32F405xx and STM32F407xx USB OTG FS functionality is ensured down to 2.7 V but not the full USB OTG FS electrical characteristics which are degraded in the 2.7-to-3.0 V V_{DD} voltage range.
3. Guaranteed by design.
4. R_L is the load connected on the USB OTG FS drivers

Table 67. ADC characteristics (continued)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
t_{lat}(4)	Injection trigger conversion latency	f_{ADC} = 30 MHz	-	-	0.100	µs
			-	-	3(7)	$1/f_{ADC}$
t_{latr}(4)	Regular trigger conversion latency	f_{ADC} = 30 MHz	-	-	0.067	µs
			-	-	2(7)	$1/f_{ADC}$
t_S(4)	Sampling time	f_{ADC} = 30 MHz	0.100	-	16	µs
		-	3	-	480	$1/f_{ADC}$
t_{STAB}(4)	Power-up time	-	-	2	3	µs
t_{CONV}(4)	Total conversion time (including sampling time)	f_{ADC} = 30 MHz 12-bit resolution	0.50	-	16.40	µs
		f_{ADC} = 30 MHz 10-bit resolution	0.43	-	16.34	µs
		f_{ADC} = 30 MHz 8-bit resolution	0.37	-	16.27	µs
		f_{ADC} = 30 MHz 6-bit resolution	0.30	-	16.20	µs
		9 to 492 (t_S for sampling +n-bit resolution for successive approximation)				$1/f_{ADC}$
f_S(4)	Sampling rate (f_{ADC} = 30 MHz, and t_S = 3 ADC cycles)	12-bit resolution Single ADC	-	-	2	Msps
		12-bit resolution Interleave Dual ADC mode	-	-	3.75	Msps
		12-bit resolution Interleave Triple ADC mode	-	-	6	Msps
I_{VREF+}(4)	ADC V_{REF} DC current consumption in conversion mode	-	-	300	500	µA
I_{VDDA}(4)	ADC V_{DDA} DC current consumption in conversion mode	-	-	1.6	1.8	mA

1. V_{DD}/V_{DDA} minimum value of 1.7 V is obtained when the device operates in reduced temperature range, and with the use of an external power supply supervisor (refer to *Section : Internal reset OFF*).
2. It is recommended to maintain the voltage difference between V_{REF+} and V_{DDA} below 1.8 V.
3. V_{DDA} -V_{REF+} < 1.2 V.
4. Guaranteed by characterization.
5. V_{REF+} is internally connected to V_{DDA} and V_{REF-} is internally connected to V_{SSA}.
6. R_{ADC} maximum value is given for V_{DD}=1.8 V, and minimum value for V_{DD}=3.3 V.
7. For external triggers, a delay of $1/f_{PCLK2}$ must be added to the latency specified in *Table 67*.

Table 81. Synchronous non-multiplexed NOR/PSRAM read timings(1)(2)

Symbol	Parameter	Min	Max	Unit
$t_{w(CLK)}$	FSMC_CLK period	$2T_{HCLK}$ –0.5	-	ns
$t_{d(CLKL-NExL)}$	FSMC_CLK low to FSMC_NEx low (x=0..2)	-	0.5	ns
$t_{d(CLKL-NExH)}$	FSMC_CLK low to FSMC_NEx high (x= 0…2)	0	-	ns
$t_{d(CLKL-NADVL)}$	FSMC_CLK low to FSMC_NADV low	-	2	ns
$t_{d(CLKL-NADVH)}$	FSMC_CLK low to FSMC_NADV high	3	-	ns
$t_{d(CLKL-AV)}$	FSMC_CLK low to FSMC_Ax valid (x=16…25)	-	0	ns
$t_{d(CLKL-AIV)}$	FSMC_CLK low to FSMC_Ax invalid (x=16…25)	2	-	ns
$t_{d(CLKL-NOEL)}$	FSMC_CLK low to FSMC_NOE low	-	0.5	ns
$t_{d(CLKL-NOEH)}$	FSMC_CLK low to FSMC_NOE high	1.5	-	ns
$t_{su(DV-CLKH)}$	FSMC_D[15:0] valid data before FSMC_CLK high	6	-	ns
$t_{h(CLKH-DV)}$	FSMC_D[15:0] valid data after FSMC_CLK high	3	-	ns
$t_{su(NWAIT-CLKH)}$	FSMC_NWAIT valid before FSMC_CLK high	4	-	ns
$t_{h(CLKH-NWAIT)}$	FSMC_NWAIT valid after FSMC_CLK high	0	-	ns

1. C_L = 30 pF.
2. Guaranteed by characterization.

Figure 68. NAND controller waveforms for read access

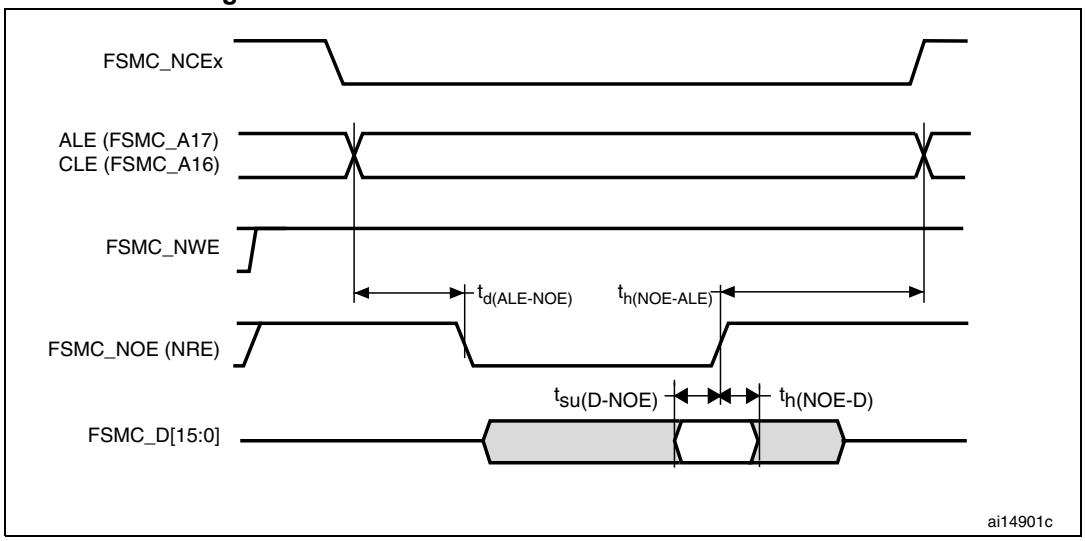
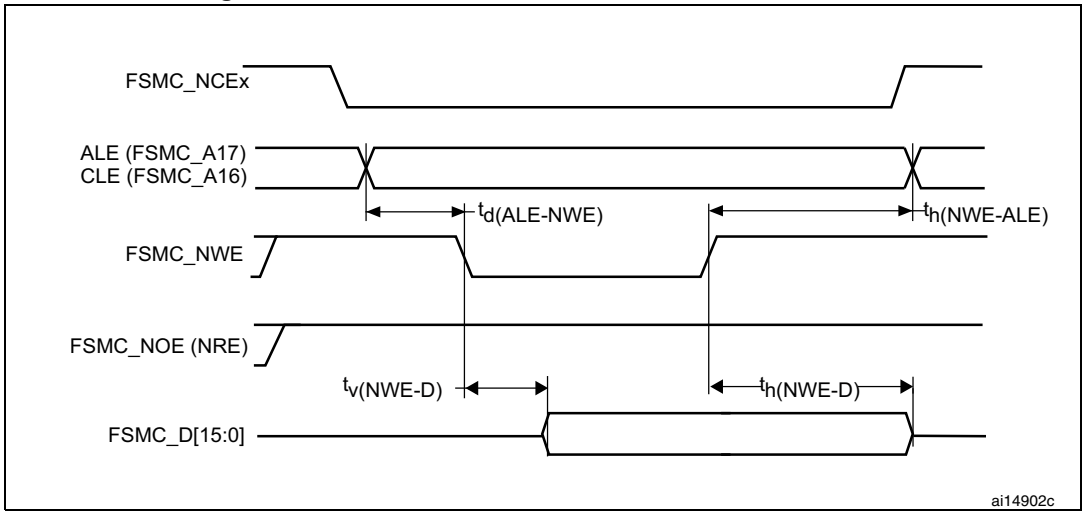


Figure 69. NAND controller waveforms for write access

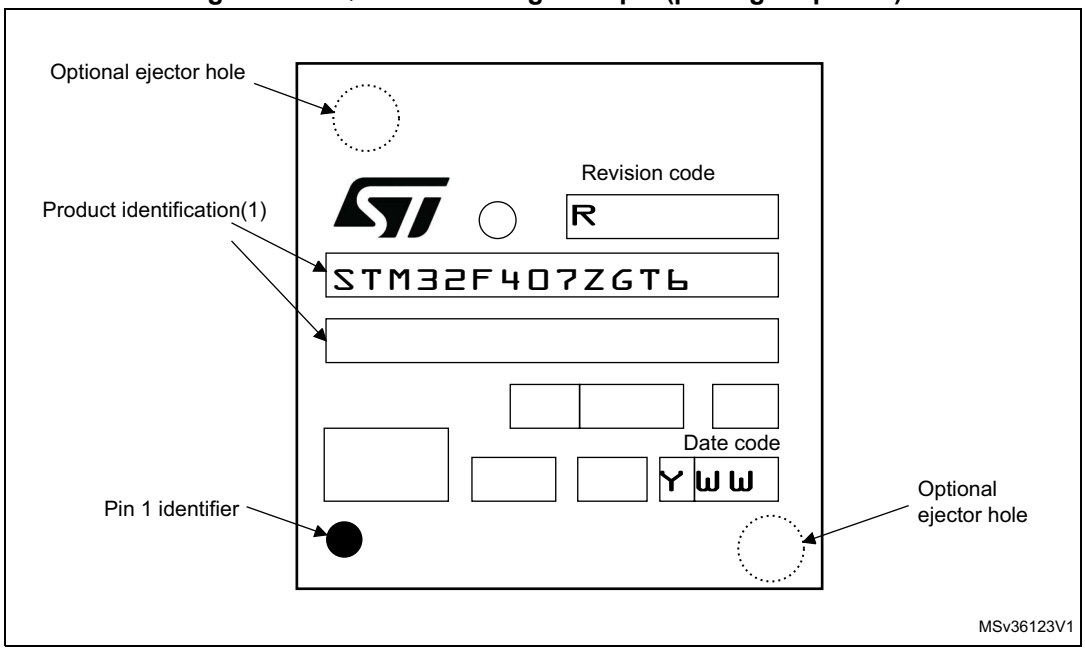


Device marking for LQPF144

The following figure gives an example of topside marking and pin 1 position identifier location.

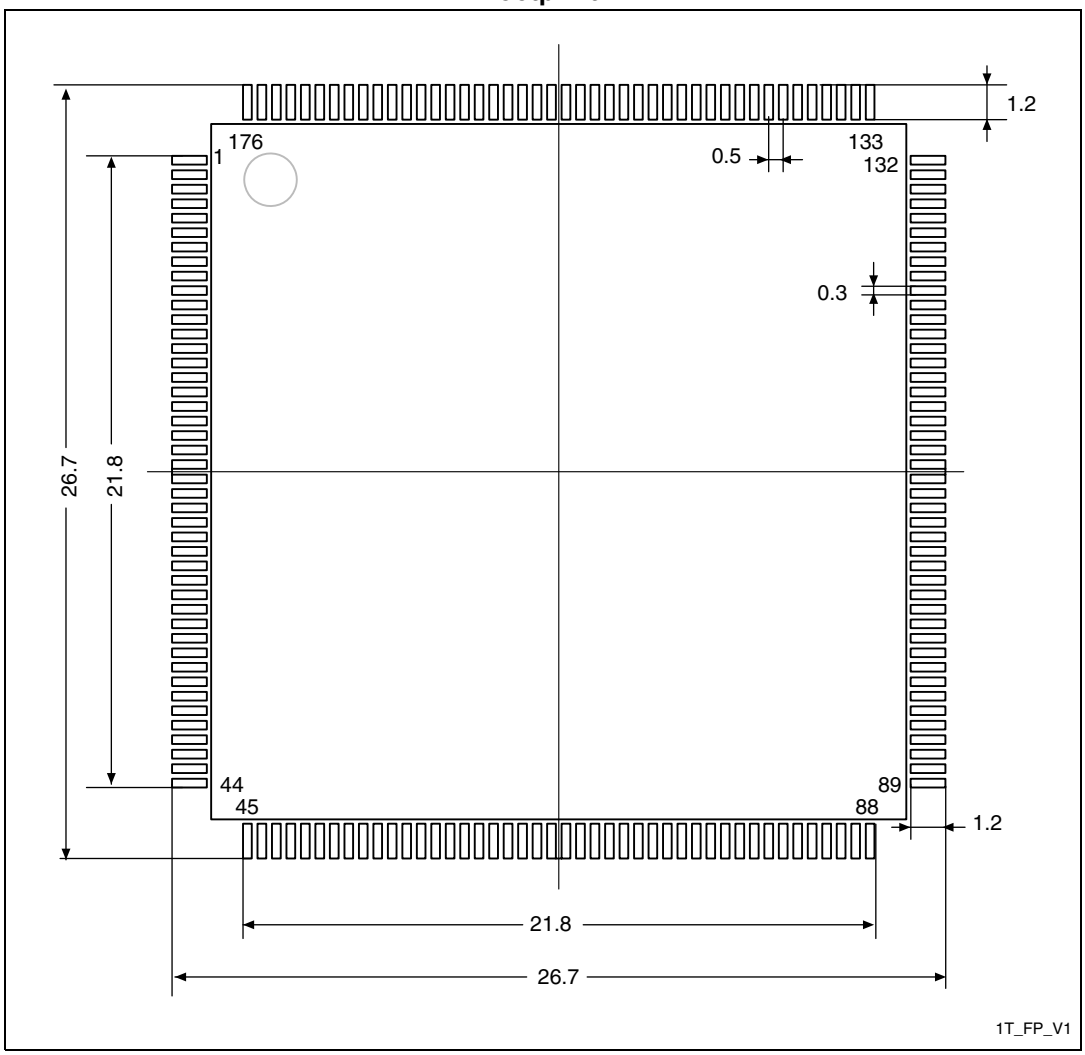
Other optional marking or inset/upset marks, which depend on supply chain operations, are not indicated below.

Figure 86. LQFP144 marking example (package top view)



1. Parts marked as “ES”, “E” or accompanied by an Engineering Sample notification letter, are not yet qualified and therefore not yet ready to be used in production and any consequences deriving from such usage will not be at ST charge. In no event, ST will be liable for any customer usage of these engineering samples in production. ST Quality has to be contacted prior to any decision to use these Engineering Samples to run qualification activity.

Figure 91. LQFP176 - 176-pin, 24 x 24 mm low profile quad flat recommended footprint



1. Dimensions are expressed in millimeters.

7 Part numbering

Table 99. Ordering information scheme

Example: STM32 F 405 R E T 6 xxx

Device family

STM32 = ARM-based 32-bit microcontroller

Product type

F = general-purpose

Device subfamily

405 = STM32F40xxx, connectivity

407= STM32F40xxx, connectivity, camera interface, Ethernet

Pin count

R = 64 pins

O = 90 pins

V = 100 pins

Z = 144 pins

I = 176 pins

Flash memory size

E = 512 Kbytes of Flash memory

G = 1024 Kbytes of Flash memory

Package

T = LQFP

H = UFBGA

Y = WLCSP

Temperature range

6 = Industrial temperature range, –40 to 85 °C.

7 = Industrial temperature range, –40 to 105 °C.

Options

xxx = programmed parts

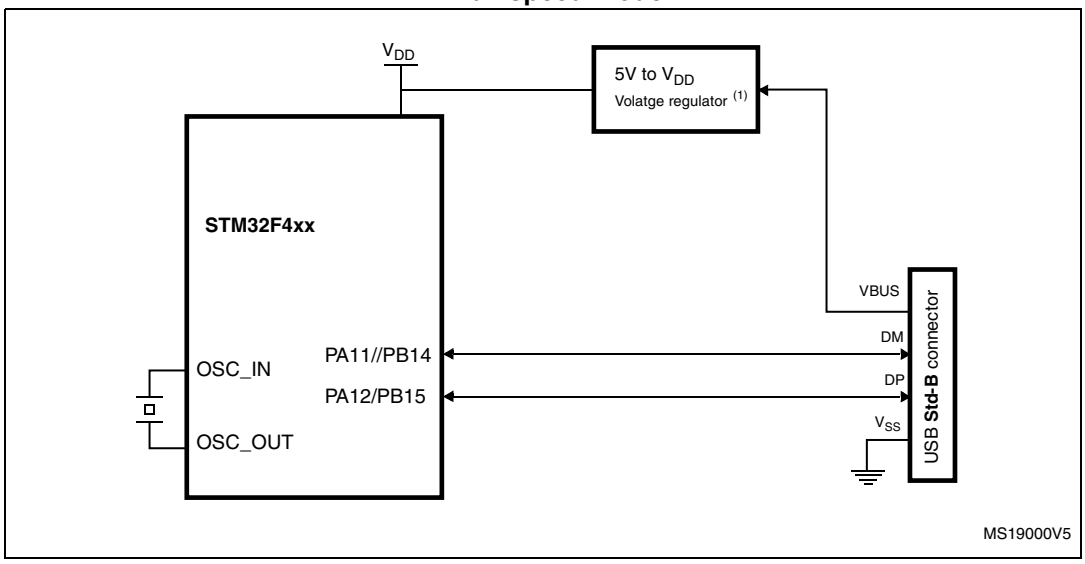
TR = tape and reel

For a list of available options (speed, package, etc.) or for further information on any aspect of this device, please contact your nearest ST sales office.

Appendix A Application block diagrams

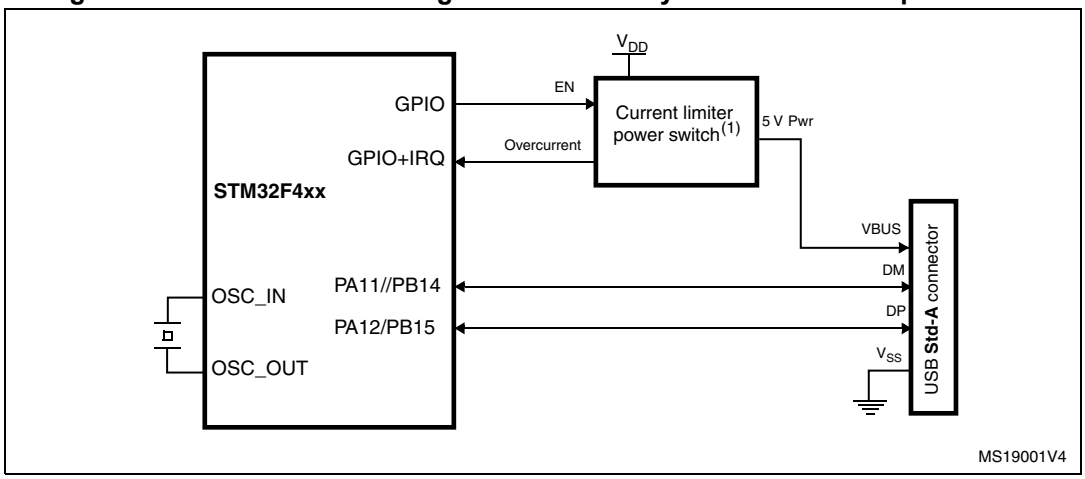
A.1 USB OTG full speed (FS) interface solutions

Figure 93. USB controller configured as peripheral-only and used in Full speed mode



1. External voltage regulator only needed when building a V_{BUS} powered device.
2. The same application can be developed using the OTG HS in FS mode to achieve enhanced performance thanks to the large Rx/Tx FIFO and to a dedicated DMA controller.

Figure 94. USB controller configured as host-only and used in full speed mode



1. The current limiter is required only if the application has to support a V_{BUS} powered device. A basic power switch can be used if 5 V are available on the application board.
2. The same application can be developed using the OTG HS in FS mode to achieve enhanced performance thanks to the large Rx/Tx FIFO and to a dedicated DMA controller.

Table 100. Document revision history (continued)

Date	Revision	Changes
04-Jun-2013	4	Modified *Note 1* below *Table 2: STM32F405xx and STM32F407xx: features and peripheral counts*. Updated *Figure 4* title. Updated *Note 3* below *Figure 21: Power supply scheme*. Changed simplex mode into half-duplex mode in *Section 2.2.25: Inter-integrated sound (I2S)*. Replaced DAC1_OUT and DAC2_OUT by DAC_OUT1 and DAC_OUT2, respectively. Updated pin 36 signal in *Figure 15: STM32F40xxx LQFP176 pinout*. Changed pin number from F8 to D4 for PA13 pin in *Table 7: STM32F40xxx pin and ball definitions*. Replaced TIM2_CH1/TIM2_ETR by TIM2_CH1_ETR for PA0 and PA5 pins in *Table 9: Alternate function mapping*. Changed system memory into System memory + OTP in *Figure 18: STM32F40xxx memory map*. Added *Note 1* below *Table 16: VCAP_1/VCAP_2 operating conditions*. Updated I_{DDA} description in *Table 74: DAC characteristics*. Removed PA9/PB13 connection to VBUS in *Figure 93: USB controller configured as peripheral-only and used in Full speed mode* and *Figure 94: USB controller configured as host-only and used in full speed mode*. Updated SPI throughput on front page and *Section 2.2.24: Serial peripheral interface (SPI)* Updated operating voltages in *Table 2: STM32F405xx and STM32F407xx: features and peripheral counts* Updated note in *Section 2.2.14: Power supply schemes* Updated *Section 2.2.15: Power supply supervisor* Updated “Regulator ON” paragraph in *Section 2.2.16: Voltage regulator* Removed note in *Section 2.2.19: Low-power modes* Corrected wrong reference manual in *Section 2.2.28: Ethernet MAC interface with dedicated DMA and IEEE 1588 support* Updated *Table 15: Limitations depending on the operating power supply range* Updated *Table 24: Typical and maximum current consumptions in Standby mode* Updated *Table 25: Typical and maximum current consumptions in VBAT mode* Updated *Table 37: PLLI2S (audio PLL) characteristics* Updated *Table 44: EMI characteristics* Updated *Table 49: Output voltage characteristics* Updated *Table 51: NRST pin characteristics* Updated *Table 55: SPI dynamic characteristics* Updated *Table 56: I2S dynamic characteristics* Deleted Table 59 Updated *Table 62: ULPI timing* Updated *Figure 46: Ethernet SMI timing diagram*

Table 100. Document revision history (continued)

Date	Revision	Changes
04-Jun-2013	4 (continued)	Updated *Figure 87: UFBGA176+25 ball, 10 x 10 mm, 0.65 mm pitch, ultra fine pitch ball grid array package outline* Updated *Table 95: UFBGA176+25 ball, 10 × 10 × 0.65 mm pitch, ultra thin fine pitch ball grid array mechanical data* Updated *Figure 5: STM32F40xxx block diagram* Updated *Section 2: Description* Updated footnote (3) in *Table 2: STM32F405xx and STM32F407xx: features and peripheral counts* Updated *Figure 3: Compatible board design between STM32F10xx/STM32F2/STM32F40xxx for LQFP144 package* Updated *Figure 4: Compatible board design between STM32F2 and STM32F40xxx for LQFP176 and BGA176 packages* Updated *Section 2.2.14: Power supply schemes* Updated *Section 2.2.15: Power supply supervisor* Updated *Section 2.2.16: Voltage regulator*, including figures. Updated *Table 14: General operating conditions*, including footnote (2). Updated *Table 15: Limitations depending on the operating power supply range*, including footnote (3). Updated footnote (1) in *Table 67: ADC characteristics*. Updated footnote (2) in *Table 68: ADC accuracy at fADC = 30 MHz*. Updated footnote (1) in *Table 74: DAC characteristics*. Updated *Figure 9: Regulator OFF*. Updated *Figure 7: Power supply supervisor interconnection with internal reset OFF*. Added *Section 2.2.17: Regulator ON/OFF and internal reset ON/OFF availability*. Updated footnote (2) of *Figure 21: Power supply scheme*. Replaced respectively “I2S3S_WS" by "I2S3_WS”, “I2S3S_CK” by “I2S3_CK” and “FSMC_BLN1” by “FSMC_NBL1” in *Table 9: Alternate function mapping*. Added “EVENTOUT” as alternate function “AF15” for pin PC13, PC14, PC15, PH0, PH1, PI8 in *Table 9: Alternate function mapping* Replaced “DCMI_12” by “DCMI_D12” in *Table 7: STM32F40xxx pin and ball definitions*. Removed the following sentence from *Section : I2C interface characteristics*: ”Unless otherwise specified, the parameters given in *Table 56* are derived from tests performed under the ambient temperature, f_{PCLK1} frequency and V_{DD} supply voltage conditions summarized in *Table 14*.”. In *Table 7: STM32F40xxx pin and ball definitions on page 47*: – For pin PC13, replaced “RTC_AF1” by “RTC_OUT, RTC_TAMP1, RTC_TS” – for pin PI8, replaced “RTC_AF2” by “RTC_TAMP1, RTC_TAMP2, RTC_TS”. – for pin PB15, added RTC_REFIN in Alternate functions column. In *Table 9: Alternate function mapping on page 62*, for port PB15, replaced “RTC_50Hz” by “RTC_REFIN”.