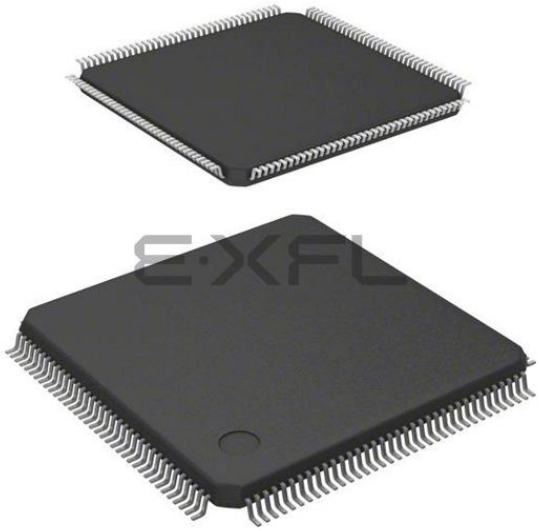

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Applications of "Embedded - Microcontrollers"

Details	
Product Status	Active
Core Processor	ARM® Cortex®-M7
Core Size	32-Bit Single-Core
Speed	216MHz
Connectivity	CANbus, EBI/EMI, I²C, IrDA, LINbus, MMC/SD, QSPI, SAI, SPI, UART/USART, USB
Peripherals	Brown-out Detect/Reset, DMA, I²S, POR, PWM, WDT
Number of I/O	114
Program Memory Size	256KB (256K x 8)
Program Memory Type	FLASH
EEPROM Size	-
RAM Size	256K x 8
Voltage - Supply (Vcc/Vdd)	1.7V ~ 3.6V
Data Converters	A/D 24x12b; D/A 2x12b
Oscillator Type	Internal
Operating Temperature	-40°C ~ 85°C (TA)
Mounting Type	Surface Mount
Package / Case	144-LQFP
Supplier Device Package	144-LQFP (20x20)
Purchase URL	https://www.e-xfl.com/product-detail/stmicroelectronics/stm32f722zct6

Table 2. STM32F722xx and STM32F723xx features and peripheral counts (continued)

Peripherals	STM32F72xRx	STM32F72xVx	STM32F72xZx	STM32F72xIx
Operating voltage	1.7 to 3.6 V(8)			
Operating temperatures	Ambient temperatures: –40 to +85 °C /–40 to +105 °C			
	Junction temperature: –40 to + 125 °C			
Package	LQFP64(9)	LQFP100(9) WLCSP100(10)	LQFP144 UFBGA144(10)	UFBGA176 LQFP176

1. For the LQFP100 package, only FMC Bank1 is available. Bank1 can only support a multiplexed NOR/PSRAM memory using the NE1 Chip Select.
2. On the STM32F723xx device packages, except the 176-pin ones, the TIM12 is not available, so there are 9 general-purpose timers.
3. The SPI1, SPI2 and SPI3 interfaces give the flexibility to work in an exclusive way in either the SPI mode or the I^2S audio mode.
4. USB OTG HS with the ULPI on the STM32F722xx devices and with integrated HS PHY on the STM32F723xx devices.
5. The SDMMC2 supports a dedicated power rail for clock, command and data 0..4 lines, feature available starting from 144 pin package.
6. The SDMMC2 is not available on the STM32F723Vx devices.
7. 216 MHz maximum frequency for - 40°C to + 85°C ambient temperature range (200 MHz maximum frequency for - 40°C to + 105°C ambient temperature range).
8. V_{DD}/V_{DDA} minimum value of 1.7 V is obtained when the internal reset is OFF (refer to *Section 2.15.2: Internal reset OFF*).
9. Available only on the STM32F722xx devices.
10. Available only on the STM32F723xx devices.

1.2 STM32F723xx versus STM32F722xx LQFP144/LQFP176 packages:

Figure 3. Compatible board design for LQFP144 package

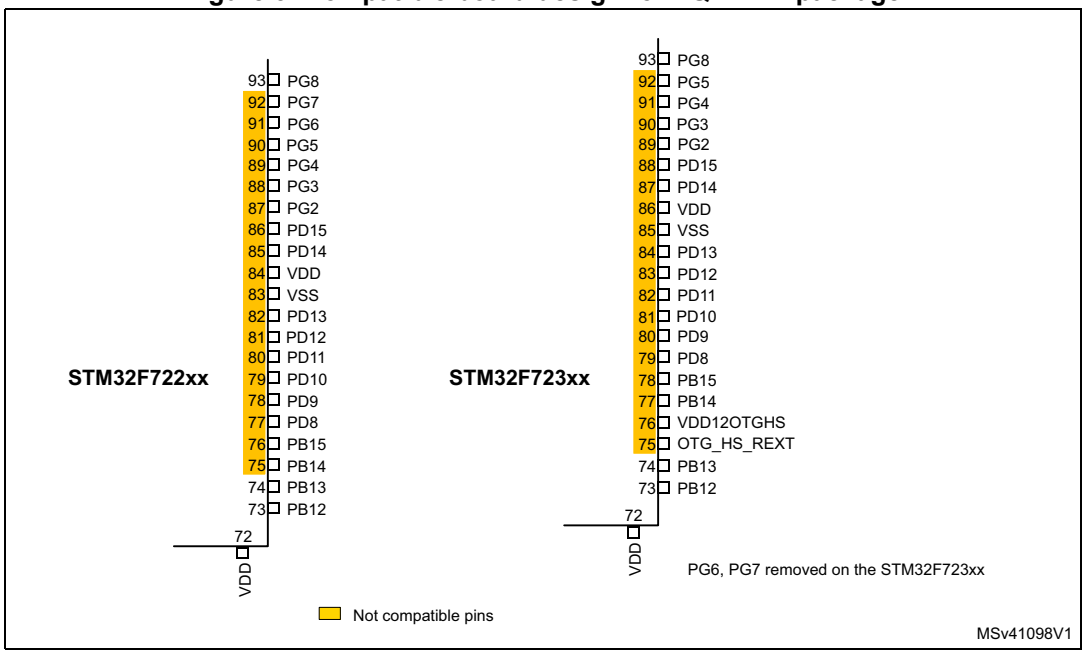
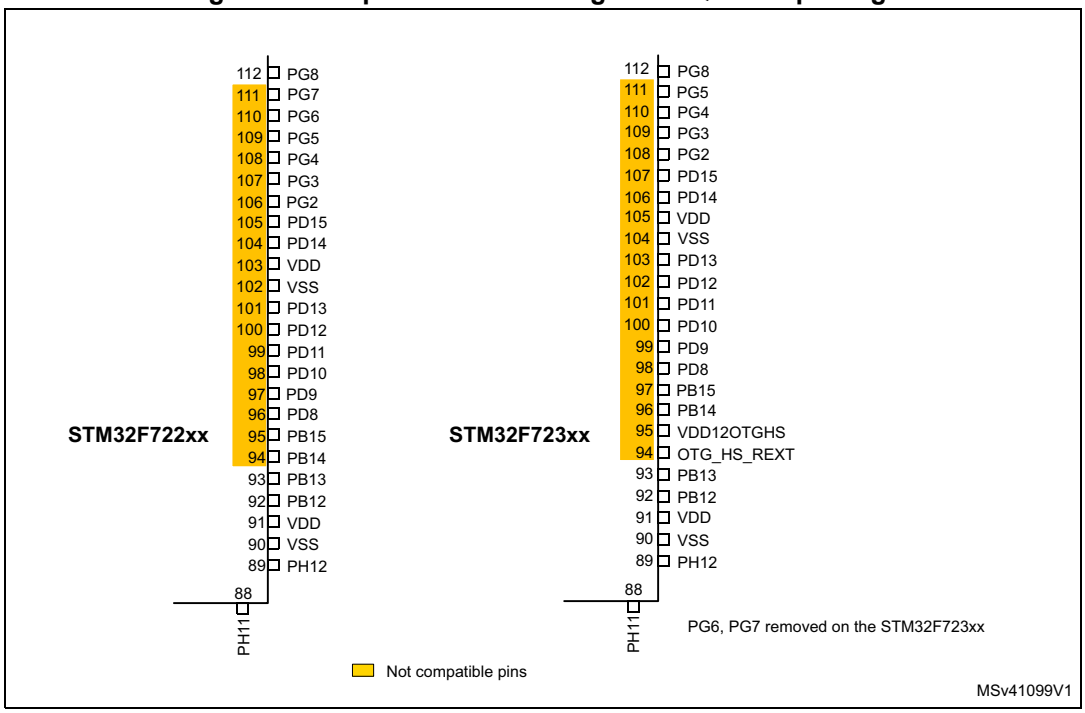


Figure 4. Compatible board design for LQFP176 package



2. Available only on the STM32F723xx devices.

2 Functional overview

2.1 ARM® Cortex®-M7 with FPU

The ARM® Cortex®-M7 with FPU processor is the latest generation of ARM processors for embedded systems. It was developed to provide a low-cost platform that meets the needs of MCU implementation, with a reduced pin count and low-power consumption, while delivering outstanding computational performance and low interrupt latency.

The Cortex®-M7 processor is a highly efficient high-performance featuring:

- Six-stage dual-issue pipeline
- Dynamic branch prediction
- Harvard caches (8 Kbytes of I-cache and 8 Kbytes of D-cache)
- 64-bit AXI4 interface
- 64-bit ITCM interface
- 2x32-bit DTCM interfaces

The processor supports the following memory interfaces:

- Tightly Coupled Memory (TCM) interface.
- Harvard instruction and data caches and AXI master (AXIM) interface.
- Dedicated low-latency AHB-Lite peripheral (AHBP) interface.

The processor supports a set of DSP instructions which allow efficient signal processing and complex algorithm execution.

It supports single precision FPU (floating point unit), speeds up software development by using metalanguage development tools, while avoiding saturation.

Figure 5 shows the general block diagram of the STM32F722xx and STM32F723xx family.

Note: Cortex®-M7 with FPU core is binary compatible with the Cortex®-M4 core.

2.2 Memory protection unit

The memory protection unit (MPU) is used to manage the CPU accesses to memory to prevent one task to accidentally corrupt the memory or resources used by any other active task. This memory area is organized into up to 8 protected areas that can in turn be divided up into 8 subareas. The protection area sizes are between 32 bytes and the whole 4 gigabytes of addressable memory.

The MPU is especially helpful for applications where some critical or certified code has to be protected against the misbehavior of other tasks. It is usually managed by an RTOS (real-time operating system). If a program accesses a memory location that is prohibited by the MPU, the RTOS can detect it and take action. In an RTOS environment, the kernel can dynamically update the MPU area setting, based on the process to be executed.

The MPU is optional and can be bypassed for applications that do not need it.

– The V_{DDUSB} rising and falling time rate specifications must be respected
– In the operating mode phase, V_{DDUSB} could be lower or higher than V_{DD}:
  - If the USB (USB OTG_HS/OTG_FS) is used, the associated GPIOs powered by V_{DDUSB} are operating between V_{DDUSB_MIN} and V_{DDUSB_MAX}.
  - The V_{DDUSB} supplies both USB transceiver (USB OTG_HS and USB OTG_FS). If only one USB transceiver is used in the application, the GPIOs associated to the other USB transceiver are still supplied by V_{DDUSB}.
  - If the USB (USB OTG_HS/OTG_FS) is not used, the associated GPIOs powered by V_{DDUSB} are operating between V_{DD_MIN} and V_{DD_MAX}.

Figure 7. V_{DDUSB} connected to V_{DD} power supply

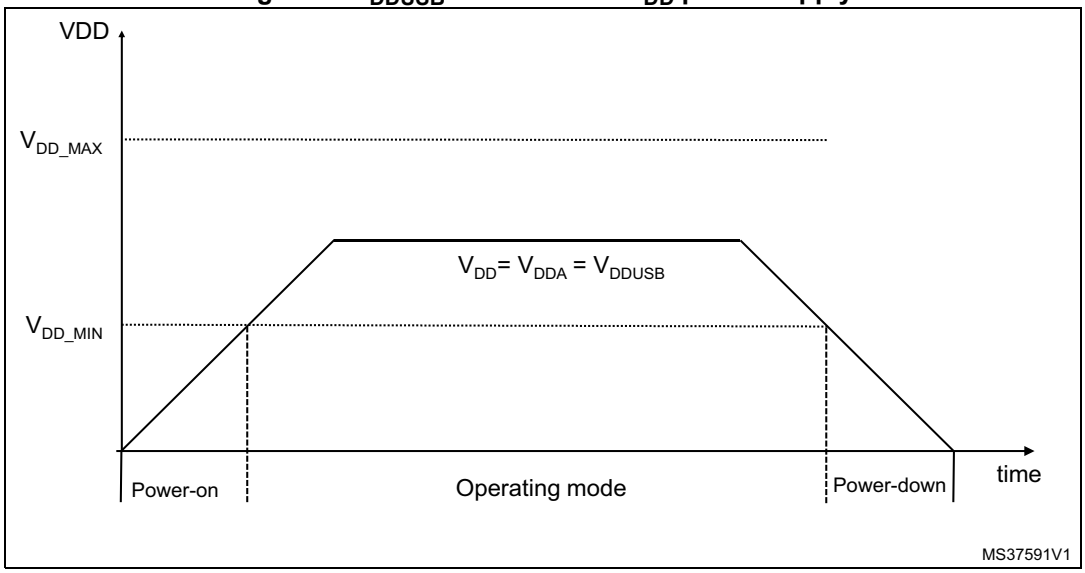
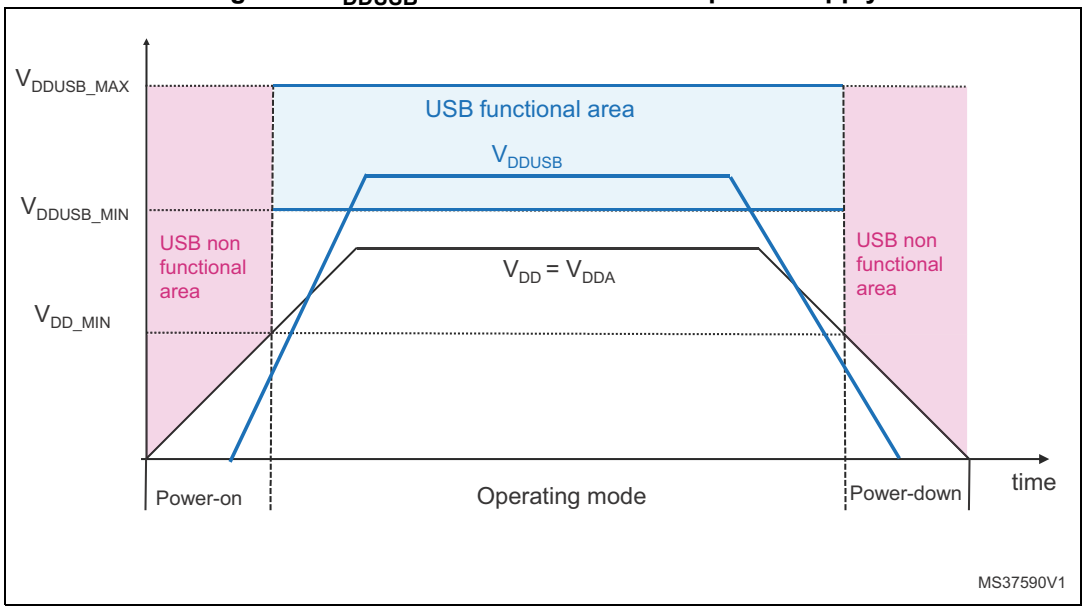


Figure 8. V_{DDUSB} connected to external power supply



On the STM32F7x3xx devices, the USB OTG HS sub-system uses an additional power supply pin:

- The VDD12OTGHS pin is the output of PHY HS regulator (1.2V). An external capacitor of 2.2 µF must be connected on the VDD12OTGHS pin.

2.15 Power supply supervisor

2.15.1 Internal reset ON

On packages embedding the PDR_ON pin, the power supply supervisor is enabled by holding PDR_ON high. On the other packages, the power supply supervisor is always enabled.

The device has an integrated power-on reset (POR)/ power-down reset (PDR) circuitry coupled with a Brownout reset (BOR) circuitry. At power-on, POR/PDR is always active and ensures proper operation starting from 1.8 V. After the 1.8 V POR threshold level is reached, the option byte loading process starts, either to confirm or modify default BOR thresholds, or to disable BOR permanently. Three BOR thresholds are available through option bytes. The device remains in reset mode when V_{DD} is below a specified threshold, $V_{POR/PDR}$ or V_{BOR}, without the need for an external reset circuit.

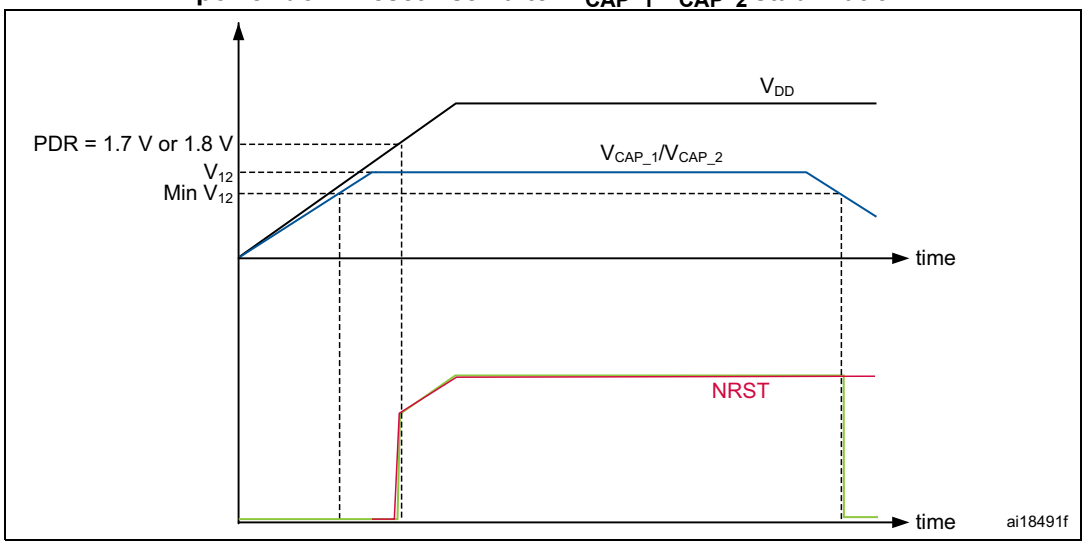
The device also features an embedded programmable voltage detector (PVD) that monitors the V_{DD}/V_{DDA} power supply and compares it to the V_{PVD} threshold. An interrupt can be generated when V_{DD}/V_{DDA} drops below the V_{PVD} threshold and/or when V_{DD}/V_{DDA} is higher than the V_{PVD} threshold. The interrupt service routine can then generate a warning message and/or put the MCU into a safe state. The PVD is enabled by software.

2.15.2 Internal reset OFF

This feature is available only on packages featuring the PDR_ON pin. The internal power-on reset (POR) / power-down reset (PDR) circuitry is disabled through the PDR_ON pin.

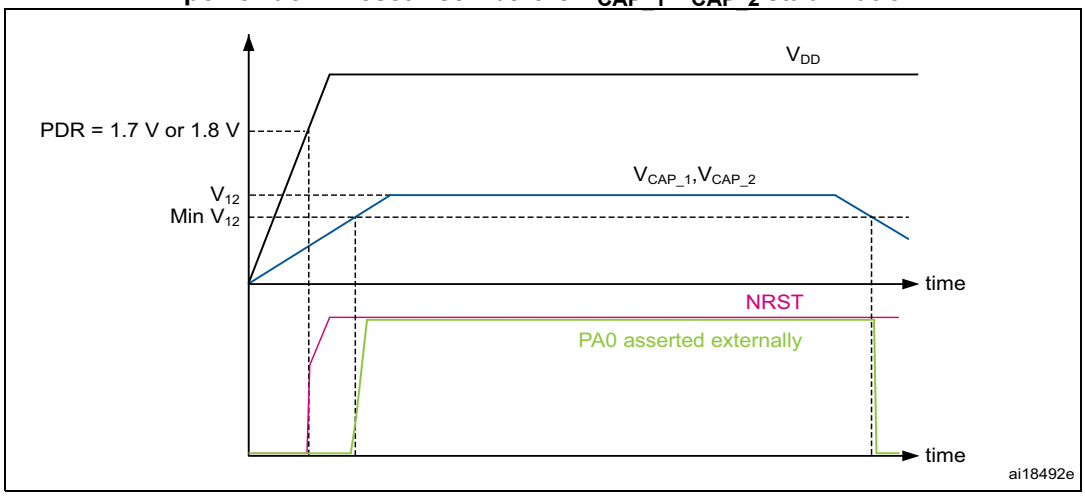
An external power supply supervisor should monitor V_{DD} and NRST and should maintain the device in reset mode as long as V_{DD} is below a specified threshold. PDR_ON should be connected to V_{SS}. Refer to *Figure 9: Power supply supervisor interconnection with internal reset OFF*.

Figure 12. Startup in regulator OFF: slow V_{DD} slope - power-down reset risen after V_{CAP_1}/V_{CAP_2} stabilization



1. This figure is valid whatever the internal reset mode (ON or OFF).

Figure 13. 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 whatever the internal reset mode (ON or OFF).

Table 10. STM32F722xx and STM32F723xx pin and ball definition (continued)

Pin Number										Pin name (function after reset)[1]	Pin type	I/O structure	Notes	Alternate functions	Additional functions
STM32F722xx					STM32F723xx										
LQFP64	LQFP100	LQFP144	UFBGA176	LQFP176	WLCSP100	UFBGA176	UFBGA144	LQFP144	LQFP176						
15	23	35	N2	41	J8	N2	K2	35	41	PA1	I/O	FT	(5)	TIM2_CH2, TIM5_CH2, USART2_RTS, UART4_RX, QUADSPI_BK1_IO3, SAI2_MCK_B, EVENTOUT	ADC1_IN1, ADC2_IN1, ADC3_IN1
16	24	36	P2	42	H8	P2	L2	36	42	PA2	I/O	FT	(5)	TIM2_CH3, TIM5_CH3, TIM9_CH1, USART2_TX, SAI2_SCK_B, EVENTOUT	ADC1_IN2, ADC2_IN2, ADC3_IN2, WKUP2
-	-	-	F4	43	-	F4	-	-	43	PH2	I/O	FT		LPTIM1_IN2, QUADSPI_BK2_IO0, SAI2_SCK_B, FMC_SDCKE0, EVENTOUT	-
-	-	-	G4	44	-	G4	-	-	44	PH3	I/O	FT	-	QUADSPI_BK2_IO1, SAI2_MCK_B, FMC_SDNE0, EVENTOUT	-
-	-	-	H4	45	-	H4	-	-	45	PH4	I/O	FTf	(4)	I2C2_SCL, OTG_HS_ULPI_NXT, EVENTOUT	-
-	-	-	J4	46	-	J4	-	-	46	PH5	I/O	FTf	-	I2C2_SDA, SPI5_NSS, FMC_SDNWE, EVENTOUT	-
17	25	37	R2	47	H7	R2	M2	37	47	PA3	I/O	FT	(4) (5)	TIM2_CH4, TIM5_CH4, TIM9_CH2, USART2_RX, OTG_HS_ULPI_D0, EVENTOUT	ADC1_IN3, ADC2_IN3, ADC3_IN3
18	26	38	-	-	K8	-	G4	38	-	VSS	S	-	-	-	-
-	-	-	L4	48	-	L4	H5	-	48	BYPASS_REG	I	FT	-	-	-

Table 10. STM32F722xx and STM32F723xx pin and ball definition (continued)

Pin Number										Pin name (function after reset)[1]	Pin type	I/O structure	Notes	Alternate functions	Additional functions
STM32F722xx					STM32F723xx										
LQFP64	LQFP100	LQFP144	UFBGA176	LQFP176	WLCSP100	UFBGA176	UFBGA144	LQFP144	LQFP176						
-	-	-	C9	136	-	C9	-	-	136	VDD	S	-	-	-	-
49	76	109	A14	137	C4	A14	A11	109	137	PA14(JTCK-SWCLK)	I/O	FT	-	JTCK-SWCLK, EVENTOUT	-
50	77	110	A13	138	B4	A13	A10	110	138	PA15(JTDI)	I/O	FT	-	JTDI, TIM2_CH1/TIM2_ETR, SPI1_NSS/I2S1_WS, SPI3_NSS/I2S3_WS, UART4_RTS, EVENTOUT	-
51	78	111	B14	139	A3	B14	B11	111	139	PC10	I/O	FT	-	SPI3_SCK/I2S3_CK, USART3_TX, UART4_TX, QUADSPI_BK1_IO1, SDMMC1_D2, EVENTOUT	-
52	79	112	B13	140	C5	B13	B10	112	140	PC11	I/O	FT	-	SPI3_MISO, USART3_RX, UART4_RX, QUADSPI_BK2_NCS, SDMMC1_D3, EVENTOUT	-
53	80	113	A12	141	D5	A12	C10	113	141	PC12	I/O	FT	-	TRACED3, SPI3_MOSI/I2S3_SD, USART3_CK, UART5_TX, SDMMC1_CK, EVENTOUT	-
-	81	114	B12	142	B5	B12	E10	114	142	PD0	I/O	FT	-	CAN1_RX, FMC_D2, EVENTOUT	-
-	82	115	C12	143	A4	C12	D10	115	143	PD1	I/O	FT	-	CAN1_TX, FMC_D3, EVENTOUT	-

Table 12. STM32F722xx and STM32F723xx alternate function mapping (continued)

Port		AF0	AF1	AF2	AF3	AF4	AF5	AF6	AF7	AF8	AF9	AF10	AF11	AF12	AF15
		SYS	TIM1/2	TIM3/4/5	TIM8/9/10/11/LPTIM1	I2C1/2/3/USART1	SPI1/I2S1/SPI2/I2S2/SPI3/I2S3/SPI4/5	SPI2/I2S2/SPI3/I2S3/SPI3/I2S3/SAI1/UART4	SPI2/I2S2/SPI3/I2S3/USART1/2/3/UART5	SAI2/USART6/UART4/5/7/8/OTG1_FS	CAN1/TIM12/13/14/QUADSPI/FMC/OTG2_HS	SAI2/QUADSPI/SDMMC2/OTG2_HS/OTG1_FS	SDMMC2	UART7/FMC/SDMMC1/OTG2_FS	SYS
Port I	PI7	-	-	-	TIM8_CH3	-	-	-	-	-	-	SAI2_FS_A	-	FMC_D29	EVENTOUT
	PI8	-	-	-	-	-	-	-	-	-	-	-	-	-	EVENTOUT
	PI9	-	-	-	-	-	-	-	-	UART4_RX	CAN1_RX	-	-	FMC_D30	EVENTOUT
	PI10	-	-	-	-	-	-	-	-	-	-	-	-	FMC_D31	EVENTOUT
	PI11	-	-	-	-	-	-	-	-	-	-	OTG_HS_ULPI_DIR	-	-	EVENTOUT
	PI12	-	-	-	-	-	-	-	-	-	-	-	-	-	EVENTOUT
	PI13	-	-	-	-	-	-	-	-	-	-	-	-	-	EVENTOUT
	PI14	-	-	-	-	-	-	-	-	-	-	-	-	-	EVENTOUT
	PI15	-	-	-	-	-	-	-	-	-	-	-	-	-	EVENTOUT

5.3.13 USB OTG HS PHY PLLs characteristics (on STM32F723xx devices)

The parameters given in *Table 49* are derived from tests performed under temperature and V_{DD} supply voltage conditions summarized in *Table 17*.

Table 49. USB OTG HS PLL1 characteristics(1)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
f_{PLL1_IN}	PLL1 input clock	-	12, 12.5, 16, 24, 25			MHz
f_{PLL1_OUT}	PLL1 output clock(2)	-	-	60	-	
f_{VCO_OUT}	PLL1 VCO output	-	600	-	720	
t_{LOCK}	PLL1 lock time(2)	-	-	-	22	µs
$I_{DD(PLL1)}$	PLL1 digital power consumption	-	-	-	1.8	mA
$I_{DDA(PLL1)}$	PLL1 analog power consumption	-	-	-	2.75	

1. Guaranteed by design.
2. Based on test during characterization.

Table 50. USB OTG HS PLL2 characteristics(1)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
f_{PLL2_IN}	PLL2 input clock	-	-	60	-	MHz
f_{PLL2_OUT}	PLL2 output clock(2)	-	-	480	-	
f_{VCO_OUT}	PLL2 VCO output	-	-	480	-	
t_{LOCK}	PLL2 lock time(2)	-	-	-	91	µs
$I_{DD(PLL2)}$	PLL2 digital power consumption	-	-	-	2.1	mA
$I_{DDA(PLL2)}$	PLL2 analog power consumption	-	-	-	1.5	

1. Guaranteed by design.
2. Based on test during characterization.

5.3.14 USB OTG HS PHY regulator characteristics (on STM32F723xx devices)

The parameters given in *Table 51* are derived from tests performed under temperature and V_{DD} supply voltage conditions summarized in *Table 17*.

Table 51. USB OTG HS PHY regulator characteristics(1)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{DD12OTGHS}$	1.2 V internal voltage on $V_{DD12OTGHS}$	-	1.18	1.2	1.24	V
CEXT	External capacitor on $V_{DD12OTGHS}$	-	1.1	2.2	3.3	µF
$I_{DDPHYHSREG}$	Regulator power consumption	-	100	120	125	µA

1. Based on test during characterization.

5.3.15 USB HS PHY external resistor characteristics (on STM32F723xx devices)

Table 52. USB HS PHY external resistor characteristics (on STM32F723xx devices)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
REXT	External calibration resistor connected (to GND) from OTG_HS_REXT	Required if using USB HS PHY	2.97	3.00	3.03	kΩ

5.3.16 Memory characteristics

Flash memory

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

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

Table 53. Flash memory characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I_{DD}	Supply current	Write / Erase 8-bit mode, V_{DD} = 1.7 V	-	6.7	-	mA
		Write / Erase 16-bit mode, V_{DD} = 2.1 V	-	9.2	-	
		Write / Erase 32-bit mode, V_{DD} = 3.3 V	-	12.6	-	

Table 54. 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	-	346	418	ms
		Program/erase parallelism (PSIZE) = x 16	-	252	312	
		Program/erase parallelism (PSIZE) = x 32	-	208	265	
$t_{ERASE128KB}$	Sector (128 KB) erase time	Program/erase parallelism (PSIZE) = x 8	-	1953	2500	ms
		Program/erase parallelism (PSIZE) = x 16	-	1252	1639	
		Program/erase parallelism (PSIZE) = x 32	-	927	1322	
$t_{ERASE64KB}$	Sector (64 KB) erase time	Program/erase parallelism (PSIZE) = x 8	-	1027	1298	ms
		Program/erase parallelism (PSIZE) = x 16	-	675	840	
		Program/erase parallelism (PSIZE) = x 32	-	505	682	

Static latchup

Two complementary static tests are required on six parts to assess the latchup performance:

- A supply overvoltage is applied to each power supply pin
- A current injection is applied to each input, output and configurable I/O pin

These tests are compliant with EIA/JESD 78A IC latchup standard.

Table 60. Electrical sensitivities

Symbol	Parameter	Conditions	Class
LU	Static latch-up class	T_A = +105 °C conforming to JESD78A	II level A

5.3.19 I/O current injection characteristics

As a general rule, current injection to the I/O pins, due to external voltage below V_{SS} or above V_{DD} (for standard, 3 V-capable I/O pins) should be avoided during normal product operation. However, in order to give an indication of the robustness of the microcontroller in cases when abnormal injection accidentally happens, susceptibility tests are performed on a sample basis during device characterization.

Functional susceptibilty to I/O current injection

While a simple application is executed on the device, the device is stressed by injecting current into the I/O pins programmed in floating input mode. While current is injected into the I/O pin, one at a time, the device is checked for functional failures.

The failure is indicated by an out of range parameter: ADC error above a certain limit (>5 LSB TUE), out of conventional limits of induced leakage current on adjacent pins (out of –5 µA/+0 µA range), or other functional failure (for example reset, oscillator frequency deviation).

Negative induced leakage current is caused by negative injection and positive induced leakage current by positive injection.

The test results are given in *Table 61*.

Table 61. I/O current injection susceptibility(1)

Symbol	Description	Functional susceptibility		Unit
		Negative injection	Positive injection	
I_{INJ}	Injected current on BOOT0, PDR_ON, BYPASS_REG, OTG_HS_REXT	-0	0	mA
	Injected current on NRST	-0	NA	
	Injected current on PF9, PF10, PH0_OSCIN, PH1_OSCOUT, PC0, PC1, PC2, PC3, PB14(2), PB15(2)	-0	NA	
	Injected current on any other FT or FTf pins	-5	NA	
	Injected current on any other pins	-5	+5	

1. NA = not applicable.

Table 63. Output voltage characteristics

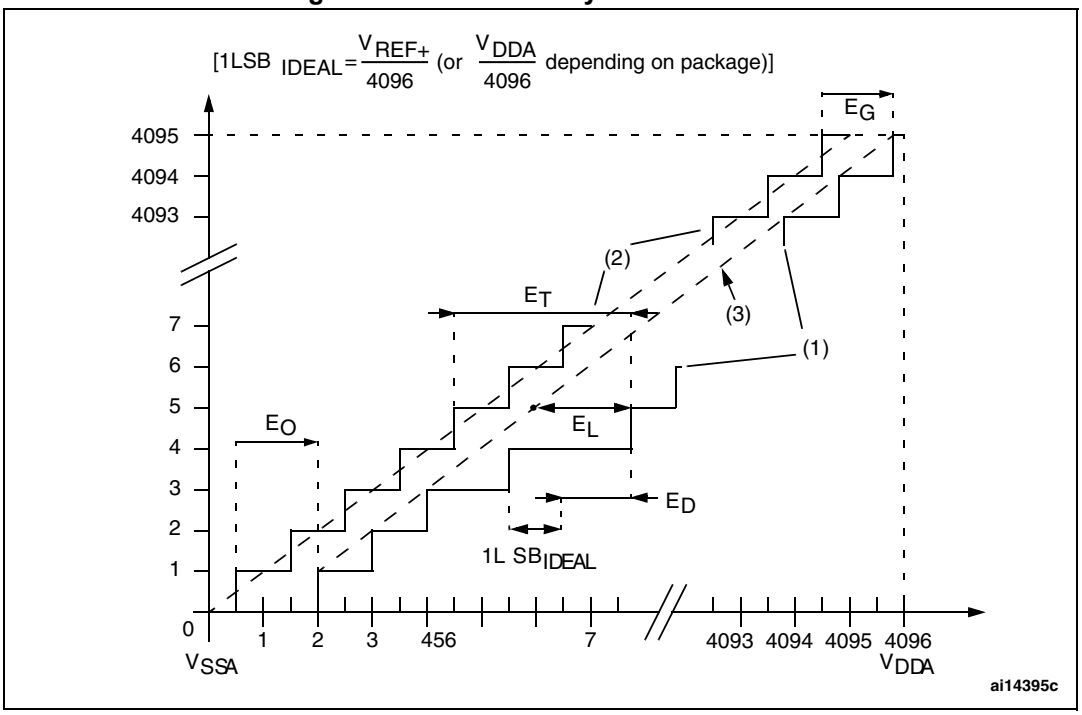
Symbol	Parameter	Conditions	Min	Max	Unit
V_{OL}(1)	Output low level voltage for an I/O pin	CMOS port(2) I_{IO} = +8 mA 2.7 V ≤V_{DD} ≤3.6 V	-	0.4	V
V_{OH}(3)	Output high level voltage for an I/O pin except PC14	CMOS port(2) I_{IO} = -8 mA 2.7 V ≤V_{DD} ≤3.6 V	V_{DD} − 0.4	-	
V_{OH}(3)	Output high level voltage for PC14	CMOS port(2) I_{IO} = -2 mA 2.7 V ≤V_{DD} ≤3.6 V	V_{DD} − 0.4	-	
V_{OL} (1)	Output low level voltage for an I/O pin	TTL port(2) I_{IO} =+8mA 2.7 V ≤V_{DD} ≤3.6 V	-	0.4	V
V_{OH} (3)	Output high level voltage for an I/O pin except PC14	TTL port(2) I_{IO} =-8mA 2.7 V ≤V_{DD} ≤3.6 V	2.4	-	
V_{OL}(1)	Output low level voltage for an I/O pin	I_{IO} = +20 mA 2.7 V ≤V_{DD} ≤3.6 V	-	1.3(4)	V
V_{OH}(3)	Output high level voltage for an I/O pin except PC14	I_{IO} = -20 mA 2.7 V ≤V_{DD} ≤3.6 V	V_{DD}−1.3(4)	-	
V_{OL}(1)	Output low level voltage for an I/O pin	I_{IO} = +6 mA 1.8 V ≤V_{DD} ≤3.6 V	-	0.4(4)	V
V_{OH}(3)	Output high level voltage for an I/O pin except PC14	I_{IO} = -6 mA 1.8 V ≤V_{DD} ≤3.6 V	V_{DD}−0.4(4)	-	
V_{OL}(1)	Output low level voltage for an I/O pin	I_{IO} = +4 mA 1.7 V ≤V_{DD} ≤3.6V	-	0.4(5)	V
V_{OH}(3)	Output high level voltage for an I/O pin except PC14	I_{IO} = -4 mA 1.7 V ≤V_{DD} ≤3.6V	V_{DD}−0.4(5)	-	
V_{OH}(3)	Output high level voltage for PC14	I_{IO} = -1 mA 1.7 V ≤V_{DD} ≤3.6V	V_{DD}−0.4(5)	-	

1. The I_{IO} current sunk by the device must always respect the absolute maximum rating specified in *Table 15*. and the sum of I_{IO} (I/O ports and control pins) must not exceed I_{VSS}.
2. TTL and CMOS outputs are compatible with JEDEC standards JESD36 and JESD52.
3. The I_{IO} current sourced by the device must always respect the absolute maximum rating specified in *Table 15* and the sum of I_{IO} (I/O ports and control pins) must not exceed I_{VDD}.
4. Based on characterization data.
5. Guaranteed by design.

Input/output AC characteristics

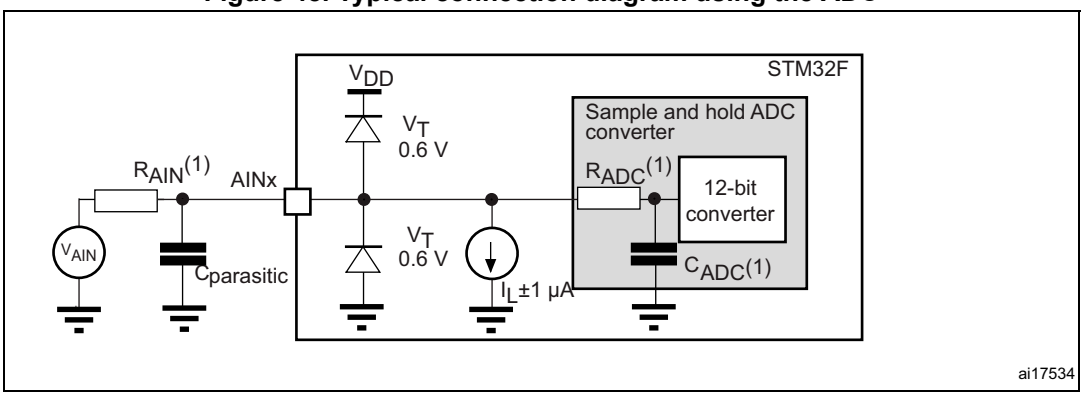
The definition and values of input/output AC characteristics are given in *Figure 45* and *Table 64*, respectively.

Figure 47. ADC accuracy characteristics



1. See also *Table 70*.
2. Example of an actual transfer curve.
3. Ideal transfer curve.
4. End point correlation line.
5. E_T = Total Unadjusted Error: maximum deviation between the actual and the ideal transfer curves.
   EO = Offset Error: deviation between the first actual transition and the first ideal one.
   EG = Gain Error: deviation between the last ideal transition and the last actual one.
   ED = Differential Linearity Error: maximum deviation between actual steps and the ideal one.
   EL = Integral Linearity Error: maximum deviation between any actual transition and the end point correlation line.

Figure 48. Typical connection diagram using the ADC



1. Refer to *Table 68* for the values of R_{AIN}, R_{ADC} and C_{ADC}.
2. $C_{parasitic}$ represents the capacitance of the PCB (dependent on soldering and PCB layout quality) plus the pad capacitance (roughly 5 pF). A high $C_{parasitic}$ value downgrades conversion accuracy. To remedy this, f_{ADC} should be reduced.

Table 94. Asynchronous non-multiplexed SRAM/PSRAM/NOR read timings(1)

Symbol	Parameter	Min	Max	Unit
$t_{w(NE)}$	FMC_NE low time	2Thclk -1	2Thclk +1	ns
$t_{v(NOE\_NE)}$	FMC_NEx low to FMC_NOE low	0	0.5	
$t_{w(NOE)}$	FMC_NOE low time	2Thclk -1	2Thclk +1	
$t_{h(NE\_NOE)}$	FMC_NOE high to FMC_NE high hold time	0	-	
$t_{v(A\_NE)}$	FMC_NEx low to FMC_A valid	-	0.5	
$t_{h(A\_NOE)}$	Address hold time after FMC_NOE high	0	-	
$t_{v(BL\_NE)}$	FMC_NEx low to FMC_BL valid	-	0.5	
$t_{h(BL\_NOE)}$	FMC_BL hold time after FMC_NOE high	0	-	
$t_{su(Data\_NE)}$	Data to FMC_NEx high setup time	Thclk -1.5	-	
$t_{su(Data\_NOE)}$	Data to FMC_NOEx high setup time	Thclk -1.5	-	
$t_{h(Data\_NOE)}$	Data hold time after FMC_NOE high	0	-	
$t_{h(Data\_NE)}$	Data hold time after FMC_NEx high	0	-	
$t_{v(NADV\_NE)}$	FMC_NEx low to FMC_NADV low	-	0	
$t_{w(NADV)}$	FMC_NADV low time	-	Thclk -0.5	

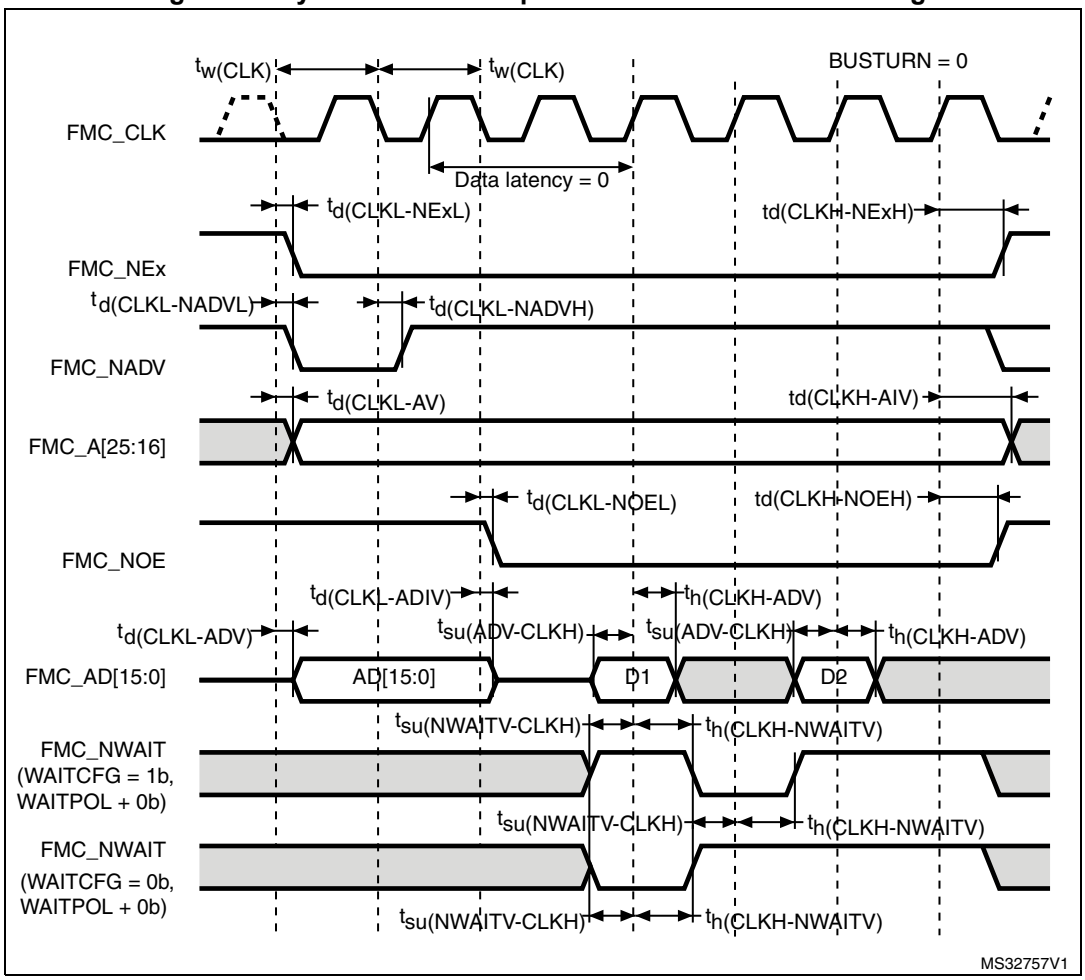
1. C_L = 30 pF.

Table 95. Asynchronous non-multiplexed SRAM/PSRAM/NOR read - NWAIT timings(1)

Symbol	Parameter	Min	Max	Unit
$t_{w(NE)}$	FMC_NE low time	7Thclk +1	7Thclk +1	ns
$t_{w(NOE)}$	FMC_NWE low time	5Thclk -1	5Thclk +1	
$t_{w(NWAIT)}$	FMC_NWAIT low time	Thclk -0.5	-	
$t_{su(NWAIT\_NE)}$	FMC_NWAIT valid before FMC_NEx high	5Thclk +1.5	-	
$t_{h(NE\_NWAIT)}$	FMC_NEx hold time after FMC_NWAIT invalid	4Thclk +1	-	

1. Guaranteed by characterization results.

Figure 65. Synchronous multiplexed NOR/PSRAM read timings

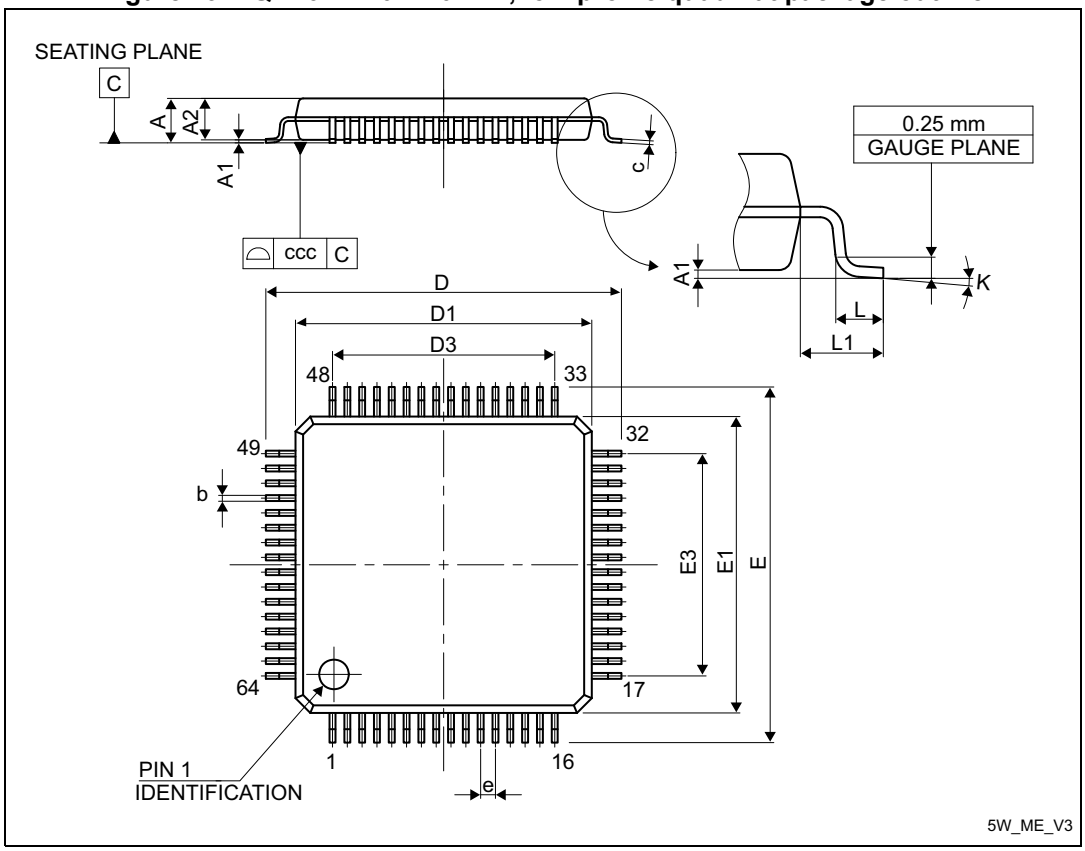


6 Package information

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: *www.st.com*. ECOPACK® is an ST trademark.

6.1 LQFP64 – 10 x 10 mm, low-profile quad flat package information

Figure 79. LQFP64 – 10 x 10 mm, low-profile quad flat package outline

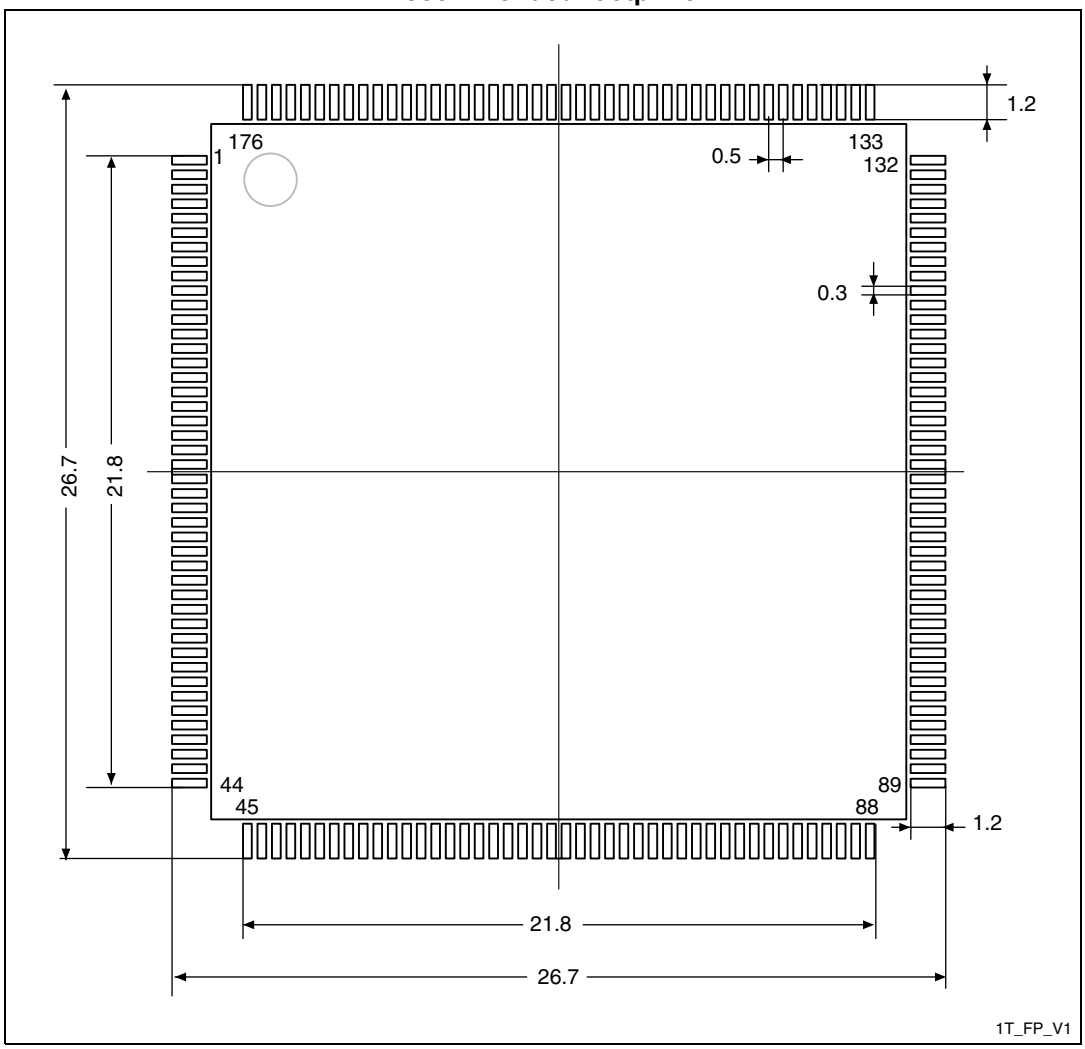


1. Drawing is not to scale.

Table 116. LQFP64 – 10 x 10 mm, low-profile quad flat package mechanical data

Symbol	millimeters			inches(1)		
	Min	Typ	Max	Min	Typ	Max
A	-	-	1.60	-	-	0.0630
A1	0.05	-	0.15	0.0020	-	0.0059
A2	1.350	1.40	1.45	0.0531	0.0551	0.0571
b	0.17	0.22	0.27	0.0067	0.0087	0.0106

Figure 89. LQFP176, 24 x 24 mm, 176-pin low-profile quad flat package recommended footprint



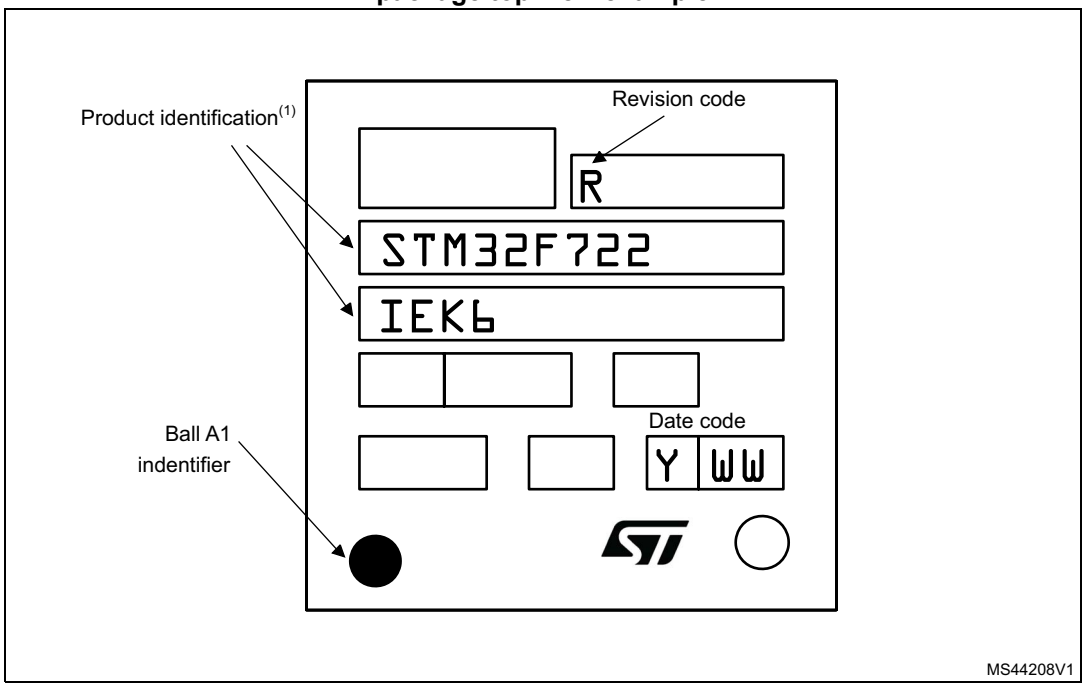
1. Dimensions are expressed in millimeters.

UFBGA176+25 device marking

The following figure gives an example of topside marking orientation versus ball A1 identifier location.

Other optional marking or inset/upset marks, which identify the parts throughout supply chain operations, are not indicated below.

Figure 96. UFBGA176+25, 10 × 10 × 0.6 mm ultra thin fine-pitch ball grid array package top view example



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.

Revision history

Table 129. Document revision history

Date	Revision	Changes
03-Feb-2017	1	Initial release.
30-Mar-2017	2	Updated cover with the maximum SPI speed at 54 Mbit/s. Updated *Figure 14: STM32F722xx LQFP64 pinout*.