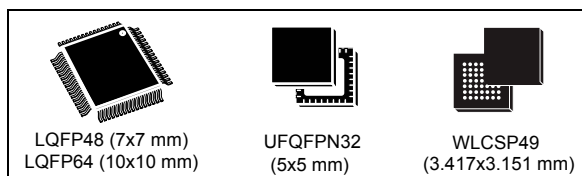


ARM<sup>®</sup> Cortex<sup>®</sup>-M4 32-bit MCU+FPU, up to 64 KB Flash, 16 KB SRAM, ADC, DAC, USB, CAN, COMP, Op-Amp, 2.0 - 3.6 V

Datasheet - production data

## Features

- Core: ARM<sup>®</sup> 32-bit Cortex<sup>®</sup>-M4 CPU with FPU (72 MHz max.), single-cycle multiplication and HW division, DSP instruction
- Memories
  - 32 to 64 Kbytes of Flash memory
  - 16 Kbytes of SRAM on data bus
- CRC calculation unit
- Reset and power management
  - V<sub>DD</sub>, V<sub>DDA</sub> voltage range: 2.0 to 3.6 V
  - Power-on/Power down reset (POR/PDR)
  - Programmable voltage detector (PVD)
  - Low-power: Sleep, Stop, and Standby
  - V<sub>BAT</sub> supply for RTC and backup registers
- Clock management
  - 4 to 32 MHz crystal oscillator
  - 32 kHz oscillator for RTC with calibration
  - Internal 8 MHz RC with x 16 PLL option
  - Internal 40 kHz oscillator
- Up to 51 fast I/O ports, all mappable on external interrupt vectors, several 5 V-tolerant
- Interconnect matrix
- 7-channel DMA controller supporting timers, ADCs, SPIs, I<sup>2</sup>Cs, USARTs and DAC
- 1 × ADC 0.20 μs (up to 15 channels) with selectable resolution of 12/10/8/6 bits, 0 to 3.6 V conversion range, single ended/differential mode, separate analog supply from 2.0 to 3.6 V
- Temperature sensor
- 1 x 12-bit DAC channel with analog supply from 2.4 to 3.6 V
- Three fast rail-to-rail analog comparators with analog supply from 2.0 to 3.6 V
- 1 x operational amplifier that can be used in PGA mode, all terminal accessible with analog supply from 2.4 to 3.6 V



- Up to 18 capacitive sensing channels supporting touchkey, linear and rotary sensors
- Up to 9 timers
  - One 32-bit timer with up to 4 IC/OC/PWM or pulse counter and quadrature (incremental) encoder input
  - One 16-bit 6-channel advanced-control timer, with up to 6 PWM channels, deadtime generation and emergency stop
  - Three 16-bit timers with IC/OC/OCN or PWM, deadtime gen. and emergency stop
  - One 16-bit basic timer to drive the DAC
  - 2 watchdog timers (independent, window)
  - SysTick timer: 24-bit downcounter
- Calendar RTC with alarm, periodic wakeup from Stop/Standby
- Communication interfaces
  - Three I2Cs with 20 mA current sink to support Fast mode plus
  - Up to 3 USARTs, 1 with ISO 7816 I/F, autobaudrate detect and Dual clock domain
  - Up to two SPIs with multiplexed full duplex I2S
  - USB 2.0 full-speed interface
  - 1 x CAN interface (2.0B Active)
  - Infrared transmitter
- Serial wire debug (SWD), JTAG
- 96-bit unique ID

Reference	Part number
STM32F302x6	STM32F302R6, STM32F302C6, STM32F302K6
STM32F302x8	STM32F302R8, STM32F302C8, STM32F302K8

# Contents

<b>1</b>	<b>Introduction</b>	<b>9</b>
<b>2</b>	<b>Description</b>	<b>10</b>
<b>3</b>	<b>Functional overview</b>	<b>13</b>
3.1	ARM® Cortex®-M4 core with FPU, embedded Flash and SRAM	13
3.2	Memories	13
3.2.1	Embedded Flash memory	13
3.2.2	Embedded SRAM	13
3.3	Boot modes	13
3.4	Cyclic redundancy check calculation unit (CRC)	14
3.5	Power management	14
3.5.1	Power supply schemes	14
3.5.2	Power supply supervisor	14
3.5.3	Voltage regulator	15
3.5.4	Low-power modes	15
3.6	Interconnect matrix	15
3.7	Clocks and startup	17
3.8	General-purpose inputs/outputs (GPIOs)	19
3.9	Direct memory access (DMA)	19
3.10	Interrupts and events	19
3.10.1	Nested vectored interrupt controller (NVIC)	19
3.11	Fast analog-to-digital converter (ADC)	20
3.11.1	Temperature sensor	20
3.11.2	Internal voltage reference ( $V_{REFINT}$ )	20
3.11.3	$V_{BAT}$ battery voltage monitoring	21
3.12	Digital-to-analog converter (DAC)	21
3.13	Operational amplifier (OPAMP)	21
3.14	Ultra-fast comparators (COMP)	22
3.15	Timers and watchdogs	22
3.15.1	Advanced timer (TIM1)	23
3.15.2	General-purpose timers (TIM2, TIM15, TIM16, TIM17)	23
3.15.3	Basic timer (TIM6)	24

3.15.4	Independent watchdog (IWDG)	24
3.15.5	Window watchdog (WWDG)	24
3.15.6	SysTick timer	24
3.16	Real-time clock (RTC) and backup registers	24
3.17	Inter-integrated circuit interfaces (I <sup>2</sup> C)	26
3.18	Universal synchronous/asynchronous receiver transmitter (USART)	27
3.19	Serial peripheral interfaces (SPI)/Inter-integrated sound interfaces (I2S)	27
3.20	Controller area network (CAN)	28
3.21	Universal serial bus (USB)	28
3.22	Touch sensing controller (TSC)	28
3.23	Infrared transmitter	30
3.24	Development support	31
3.24.1	Serial wire JTAG debug port (SWJ-DP)	31
<b>4</b>	<b>Pinouts and pin description</b>	<b>32</b>
<b>5</b>	<b>Memory mapping</b>	<b>49</b>
<b>6</b>	<b>Electrical characteristics</b>	<b>53</b>
6.1	Parameter conditions	53
6.1.1	Minimum and maximum values	53
6.1.2	Typical values	53
6.1.3	Typical curves	53
6.1.4	Loading capacitor	53
6.1.5	Pin input voltage	53
6.1.6	Power supply scheme	54
6.1.7	Current consumption measurement	55
6.2	Absolute maximum ratings	56
6.3	Operating conditions	58
6.3.1	General operating conditions	58
6.3.2	Operating conditions at power-up / power-down	59
6.3.3	Embedded reset and power control block characteristics	59
6.3.4	Embedded reference voltage	61
6.3.5	Supply current characteristics	61
6.3.6	Wakeup time from low-power mode	73

6.3.7	External clock source characteristics	74
6.3.8	Internal clock source characteristics	80
6.3.9	PLL characteristics	81
6.3.10	Memory characteristics	82
6.3.11	EMC characteristics	83
6.3.12	Electrical sensitivity characteristics	84
6.3.13	I/O current injection characteristics	85
6.3.14	I/O port characteristics	86
6.3.15	NRST pin characteristics	91
6.3.16	Timer characteristics	92
6.3.17	Communications interfaces	94
6.3.18	ADC characteristics	102
6.3.19	DAC electrical specifications	111
6.3.20	Comparator characteristics	112
6.3.21	Operational amplifier characteristics	114
6.3.22	Temperature sensor characteristics	117
6.3.23	V <sub>BAT</sub> monitoring characteristics	117
<b>7</b>	<b>Package information</b>	<b>118</b>
7.1	WLCSP49 package information	119
7.2	LQFP64 package information	122
7.3	LQFP48 package information	125
7.4	UFQFPN32 package information	129
7.5	Thermal characteristics	132
7.5.1	Reference document	132
7.5.2	Selecting the product temperature range	133
<b>8</b>	<b>Ordering information</b>	<b>135</b>
<b>9</b>	<b>Revision history</b>	<b>136</b>

## List of tables

Table 1.	STM32F302x6/8 device features and peripheral counts	11
Table 2.	External analog supply values for analog peripherals	14
Table 3.	STM32F302x6/8 peripheral interconnect matrix	16
Table 4.	Timer feature comparison	22
Table 5.	Comparison of I2C analog and digital filters	26
Table 6.	STM32F302x6/8 I <sup>2</sup> C implementation	26
Table 7.	USART features	27
Table 8.	STM32F302x6/8 SPI/I2S implementation	28
Table 9.	Capacitive sensing GPIOs available on STM32F302x6/8 devices	29
Table 10.	No. of capacitive sensing channels available on STM32F302x6/8 devices	29
Table 11.	Legend/abbreviations used in the pinout table	35
Table 12.	STM32F302x6/8 pin definitions	36
Table 13.	Alternate functions for Port A	43
Table 14.	Alternate functions for Port B	45
Table 15.	Alternate functions for Port C	47
Table 16.	Alternate functions for Port D	48
Table 17.	Alternate functions for Port F	48
Table 18.	STM32F302x6 STM32F302x8 peripheral register boundary addresses	50
Table 19.	Voltage characteristics	56
Table 20.	Current characteristics	57
Table 21.	Thermal characteristics	57
Table 22.	General operating conditions	58
Table 23.	Operating conditions at power-up / power-down	59
Table 24.	Embedded reset and power control block characteristics	59
Table 25.	Programmable voltage detector characteristics	60
Table 26.	Embedded internal reference voltage	61
Table 27.	Internal reference voltage calibration values	61
Table 28.	Typical and maximum current consumption from VDD supply at VDD = 3.6V	62
Table 29.	Typical and maximum current consumption from the VDDA supply	64
Table 30.	Typical and maximum VDD consumption in Stop and Standby modes	64
Table 31.	Typical and maximum VDDA consumption in Stop and Standby modes	65
Table 32.	Typical and maximum current consumption from VBAT supply	65
Table 33.	Typical current consumption in Run mode, code with data processing running from Flash	67
Table 34.	Typical current consumption in Sleep mode, code running from Flash or RAM	68
Table 35.	Switching output I/O current consumption	70
Table 36.	Peripheral current consumption	72
Table 37.	Low-power mode wakeup timings	73
Table 38.	Wakeup time using USART	73
Table 39.	High-speed external user clock characteristics	74
Table 40.	Low-speed external user clock characteristics	75
Table 41.	HSE oscillator characteristics	76
Table 42.	LSE oscillator characteristics (f <sub>LSE</sub> = 32.768 kHz)	78
Table 43.	HSI oscillator characteristics	80
Table 44.	LSI oscillator characteristics	81
Table 45.	PLL characteristics	81
Table 46.	Flash memory characteristics	82