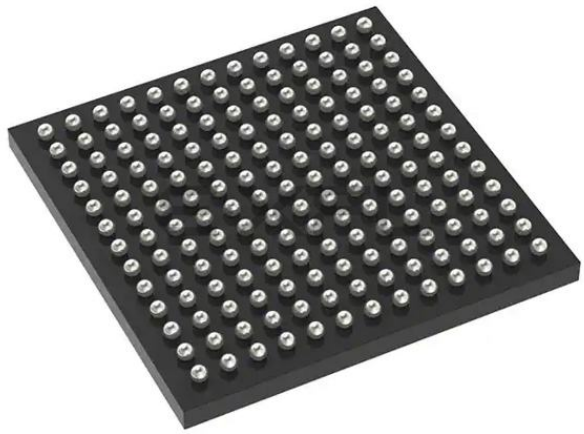

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What is "Embedded - Microcontrollers"?

"Embedded - Microcontrollers" refer to small, integrated circuits designed to perform specific tasks within larger systems. These microcontrollers are essentially compact computers on a single chip, containing a processor core, memory, and programmable input/output peripherals. They are called "embedded" because they are embedded within electronic devices to control various functions, rather than serving as standalone computers. Microcontrollers are crucial in modern electronics, providing the intelligence and control needed for a wide range of applications.

Applications of "Embedded - Microcontrollers"

Details	
Product Status	Active
Core Processor	ARM® Cortex®-M4
Core Size	32-Bit Single-Core
Speed	80MHz
Connectivity	CANbus, EBI/EMI, I²C, IrDA, LINbus, MMC/SD, QSPI, SAI, SPI, SWPMI, UART/USART, USB OTG
Peripherals	Brown-out Detect/Reset, DMA, LCD, PWM, WDT
Number of I/O	136
Program Memory Size	1MB (1M x 8)
Program Memory Type	FLASH
EEPROM Size	-
RAM Size	320K x 8
Voltage - Supply (Vcc/Vdd)	1.71V ~ 3.6V
Data Converters	A/D 24x12b; D/A 2x12b
Oscillator Type	Internal
Operating Temperature	-40°C ~ 125°C (TA)
Mounting Type	Surface Mount
Package / Case	169-UFBGA
Supplier Device Package	169-UFBGA (7x7)
Purchase URL	https://www.e-xfl.com/product-detail/stmicroelectronics/stm32l496agi3

The main features of the touch sensing controller are the following:

- Proven and robust surface charge transfer acquisition principle
- Supports up to 24 capacitive sensing channels
- Up to 3 capacitive sensing channels can be acquired in parallel offering a very good response time
- Spread spectrum feature to improve system robustness in noisy environments
- Full hardware management of the charge transfer acquisition sequence
- Programmable charge transfer frequency
- Programmable sampling capacitor I/O pin
- Programmable channel I/O pin
- Programmable max count value to avoid long acquisition when a channel is faulty
- Dedicated end of acquisition and max count error flags with interrupt capability
- One sampling capacitor for up to 3 capacitive sensing channels to reduce the system components
- Compatible with proximity, touchkey, linear and rotary touch sensor implementation
- Designed to operate with STMTouch touch sensing firmware library

Note: The number of capacitive sensing channels is dependent on the size of the packages and subject to I/O availability.

3.23 Liquid crystal display controller (LCD)

The LCD drives up to 8 common terminals and 44 segment terminals to drive up to 320 pixels.

- Internal step-up converter to guarantee functionality and contrast control irrespective of V_{DD}. This converter can be deactivated, in which case the VLCD pin is used to provide the voltage to the LCD
- Supports static, 1/2, 1/3, 1/4 and 1/8 duty
- Supports static, 1/2, 1/3 and 1/4 bias
- Phase inversion to reduce power consumption and EMI
- Integrated voltage output buffers for higher LCD driving capability
- Up to 8 pixels can be programmed to blink
- Unneeded segments and common pins can be used as general I/O pins
- LCD RAM can be updated at any time owing to a double-buffer
- The LCD controller can operate in Stop mode

3.24 Digital filter for Sigma-Delta Modulators (DFSDM)

The device embeds one DFSDM with 4 digital filters modules and 8 external input serial channels (transceivers) or alternately 8 internal parallel inputs support.

The DFSDM peripheral is dedicated to interface the external ΣΔ modulators to microcontroller and then to perform digital filtering of the received data streams (which represent analog value on ΣΔ modulators inputs). DFSDM can also interface PDM (Pulse Density Modulation) microphones and perform PDM to PCM conversion and filtering in

This low-power timer supports the following features:

- 16-bit up counter with 16-bit autoreload register
- 16-bit compare register
- Configurable output: pulse, PWM
- Continuous/ one shot mode
- Selectable software/hardware input trigger
- Selectable clock source
  - Internal clock sources: LSE, LSI, HSI16 or APB clock
  - External clock source over LPTIM input (working even with no internal clock source running, used by pulse counter application).
- Programmable digital glitch filter
- Encoder mode (LPTIM1 only)

3.27.5 Infrared interface (IRTIM)

The STM32L496xx includes one infrared interface (IRTIM). It can be used with an infrared LED to perform remote control functions. It uses TIM16 and TIM17 output channels to generate output signal waveforms on IR_OUT pin.

3.27.6 Independent watchdog (IWDG)

The independent watchdog is based on a 12-bit downcounter and 8-bit prescaler. It is clocked from an independent 32 kHz internal RC (LSI) and as it operates independently from the main clock, it can operate in Stop and Standby modes. It can be used either as a watchdog to reset the device when a problem occurs, or as a free running timer for application timeout management. It is hardware or software configurable through the option bytes. The counter can be frozen in debug mode.

3.27.7 System window watchdog (WWDG)

The window watchdog is based on a 7-bit downcounter that can be set as free running. It can be used as a watchdog to reset the device when a problem occurs. It is clocked from the main clock. It has an early warning interrupt capability and the counter can be frozen in debug mode.

3.27.8 SysTick timer

This timer is dedicated to real-time operating systems, but could also be used as a standard down counter. It features:

- A 24-bit down counter
- Autoreload capability
- Maskable system interrupt generation when the counter reaches 0.
- Programmable clock source

Table 13. SAI implementation

SAI features(1)	SAI1	SAI2
I2S, LSB or MSB-justified, PCM/DSP, TDM, AC'97	X	X
Mute mode	X	X
Stereo/Mono audio frame capability.	X	X
16 slots	X	X
Data size configurable: 8-, 10-, 16-, 20-, 24-, 32-bit	X	X
FIFO Size	X (8 Word)	X (8 Word)
SPDIF	X	X

1. X: supported

3.34 Single wire protocol master interface (SWPMI)

The Single wire protocol master interface (SWPMI) is the master interface corresponding to the Contactless Frontend (CLF) defined in the ETSI TS 102 613 technical specification. The main features are:

- full-duplex communication mode
- automatic SWP bus state management (active, suspend, resume)
- configurable bitrate up to 2 Mbit/s
- automatic SOF, EOF and CRC handling

SWPMI can be served by the DMA controller.

3.35 Controller area network (CAN)

The two CANs are compliant with the 2.0A and B (active) specifications with a bit rate up to 1Mbit/s. They can receive and transmit standard frames with 11-bit identifiers as well as extended frames with 29-bit identifiers. Each CAN has three transmit mailboxes, two receive FIFOS with 3 stages and 28 shared scalable filter banks (all of them can be used even if one CAN is used). 256 bytes of SRAM are allocated for each CAN.

The synchronization for this oscillator can also be taken from the USB data stream itself (SOF signalization) which allows crystal less operation.

The major features are:

- Combined Rx and Tx FIFO size of 1.25 KB with dynamic FIFO sizing
- Supports the session request protocol (SRP) and host negotiation protocol (HNP)
- 1 bidirectional control endpoint + 5 IN endpoints + 5 OUT endpoints
- 8 host channels with periodic OUT support
- HNP/SNP/IP inside (no need for any external resistor)
- Software configurable to OTG 1.3 and OTG 2.0 modes of operation
- OTG 2.0 Supports ADP (Attach detection Protocol)
- USB 2.0 LPM (Link Power Management) support
- Battery Charging Specification Revision 1.2 support
- Internal FS OTG PHY support

For OTG/Host modes, a power switch is needed in case bus-powered devices are connected.

3.38 Clock recovery system (CRS)

The STM32L496xx devices embed a special block which allows automatic trimming of the internal 48 MHz oscillator to guarantee its optimal accuracy over the whole device operational range. This automatic trimming is based on the external synchronization signal, which could be either derived from USB SOF signalization, from LSE oscillator, from an external signal on CRS_SYNC pin or generated by user software. For faster lock-in during startup it is also possible to combine automatic trimming with manual trimming action.

3.39 Flexible static memory controller (FSMC)

The Flexible static memory controller (FSMC) includes two memory controllers:

- The NOR/PSRAM memory controller
- The NAND/memory controller

This memory controller is also named Flexible memory controller (FMC).

The main features of the FMC controller are the following:

- Interface with static-memory mapped devices including:
  - Static random access memory (SRAM)
  - NOR Flash memory/OneNAND Flash memory
  - PSRAM (4 memory banks)
  - NAND Flash memory with ECC hardware to check up to 8 Kbyte of data
- 8-,16- bit data bus width
- Independent Chip Select control for each memory bank
- Independent configuration for each memory bank
- Write FIFO
- The Maximum FMC_CLK frequency for synchronous accesses is HCLK/2.

Table 15. STM32L496xx pin definitions

Pin Number									Pin name (function after reset)	Pin type	I/O structure	Notes	Pin functions	
LQFP64	WLCSP100	WLCSP100_SMPS	LQFP100	UFBGA132	LQFP144	LQFP144_SMPS	UFBGA169	UFBGA169_SMPS					Alternate functions	Additional functions
-	-	-	-	-	-	-	C3	C3	PI11	I/O	FT	-	EVENTOUT	-
-	B9	C8	1	B2	1	1	D3	D3	PE2	I/O	FT_l	-	TRACECK, TIM3_ETR, TSC_G7_IO1, LCD_SEG38, FMC_A23, SAI1_MCLK_A, EVENTOUT	-
-	B10	B10	2	A1	2	2	D2	D2	PE3	I/O	FT_l	-	TRACED0, TIM3_CH1, TSC_G7_IO2, LCD_SEG39, FMC_A19, SAI1_SD_B, EVENTOUT	-
-	C8	E7	3	B1	3	3	D1	D1	PE4	I/O	FT	-	TRACED1, TIM3_CH2, DFSDM1_DATIN3, TSC_G7_IO3, DCMI_D4, FMC_A20, SAI1_FS_A, EVENTOUT	-
-	D8	E8	4	C2	4	4	E4	E4	PE5	I/O	FT	-	TRACED2, TIM3_CH3, DFSDM1_CKIN3, TSC_G7_IO4, DCMI_D6, FMC_A21, SAI1_SCK_A, EVENTOUT	-
-	E7	D8	5	D2	5	5	E3	E3	PE6	I/O	FT	-	TRACED3, TIM3_CH4, DCMI_D7, FMC_A22, SAI1_SD_A, EVENTOUT	RTC_TAMP3/WKUP3
1	C10	C10	6	E2	6	6	E2	E2	VBAT	S	-	-	-	-
2	C9	C9	7	C1	7	7	E1	E1	PC13	I/O	FT	-	EVENTOUT	RTC_TAMP1/RTC_TS/ RTC_OUT/WKUP2
3	D10	D10	8	D1	8	8	F1	F1	PC14-OSC32_IN (PC14)	I/O	FT	-	EVENTOUT	OSC32_IN
4	E10	D9	9	E1	9	9	G1	G1	PC15-OSC32_OUT (PC15)	I/O	FT	-	EVENTOUT	OSC32_OUT

Table 15. STM32L496xx pin definitions (continued)

Pin Number									Pin name (function after reset)	Pin type	I/O structure	Notes	Pin functions	
LQFP64	WLCSP100	WLCSP100_SMPS	LQFP100	UFBGA132	LQFP144	LQFP144_SMPS	UFBGA169	UFBGA169_SMPS					Alternate functions	Additional functions
-	-	-	-	J7	50	50	N6	N6	PF12	I/O	FT	-	FMC_A6, EVENTOUT	-
-	-	-	-	-	51	51	-	-	VSS	S	-	-	-	-
-	-	-	-	-	52	52	A8	A8	VDD	S	-	-	-	-
-	-	-	-	K7	53	53	M6	M6	PF13	I/O	FT	-	I2C4_SMBA, DFSDM1_DATIN6, FMC_A7, EVENTOUT	-
-	-	-	-	J8	54	54	L6	L6	PF14	I/O	FT_fa	-	I2C4_SCL, DFSDM1_CKIN6, TSC_G8_IO1, FMC_A8, EVENTOUT	-
-	-	-	-	J9	55	55	K6	K6	PF15	I/O	FT_fa	-	I2C4_SDA, TSC_G8_IO2, FMC_A9, EVENTOUT	-
-	-	-	-	H9	56	56	J6	J6	PG0	I/O	FT	-	TSC_G8_IO3, FMC_A10, EVENTOUT	-
-	-	-	-	G9	57	57	H6	H6	PG1	I/O	FT	-	TSC_G8_IO4, FMC_A11, EVENTOUT	-
-	K6	K6	38	M7	58	58	L7	L7	PE7	I/O	FT	-	TIM1_ETR, DFSDM1_DATIN2, FMC_D4, SAI1_SD_B, EVENTOUT	-
-	K5	K5	39	L7	59	59	K7	K7	PE8	I/O	FT	-	TIM1_CH1N, DFSDM1_CKIN2, FMC_D5, SAI1_SCK_B, EVENTOUT	-
-	J5	J5	40	M8	60	60	J7	J7	PE9	I/O	FT	-	TIM1_CH1, DFSDM1_CKOUT, FMC_D6, SAI1_FS_B, EVENTOUT	-
-	-	-	-	F6	61	61	M7	M7	VSS	S	-	-	-	-
-	-	-	-	G6	62	62	N7	N7	VDD	S	-	-	-	-

Table 16. Alternate function AF0 to AF7 (for AF8 to AF15 see *Table 17*) (continued)

Port		AF0	AF1	AF2	AF3	AF4	AF5	AF6	AF7
		SYS_AF	TIM1/2/5/8/ LPTIM1	TIM1/2/3/4/5	SPI2/USART2/ CAN2/TIM8/ QUADSPI	I2C1/2/3/4/ DCMI	SPI1/2/DCMI/ QUADSPI	SPI3/I2C3/ DFSDM/ COMP1/ QUADSPI	USART1/2/3
Port F	PF0	-	-	-	-	I2C2_SDA	-	-	-
	PF1	-	-	-	-	I2C2_SCL	-	-	-
	PF2	-	-	-	-	I2C2_SMBA	-	-	-
	PF3	-	-	-	-	-	-	-	-
	PF4	-	-	-	-	-	-	-	-
	PF5	-	-	-	-	-	-	-	-
	PF6	-	TIM5_ETR	TIM5_CH1	-	-	-	-	-
	PF7	-	-	TIM5_CH2	-	-	-	-	-
	PF8	-	-	TIM5_CH3	-	-	-	-	-
	PF9	-	-	TIM5_CH4	-	-	-	-	-
	PF10	-	-	-	QUADSPI_CLK	-	-	-	-
	PF11	-	-	-	-	-	-	-	-
	PF12	-	-	-	-	-	-	-	-
	PF13	-	-	-	-	I2C4_SMBA	-	DFSDM1_ DATIN6	-
	PF14	-	-	-	-	I2C4_SCL	-	DFSDM1_CKIN6	-
	PF15	-	-	-	-	I2C4_SDA	-	-	-

Table 17. Alternate function AF8 to AF15 (for AF0 to AF7 see *Table 16*) (continued)

Port		AF8	AF9	AF10	AF11	AF12	AF13	AF14	AF15
		UART4/5/ LPUART1/ CAN2	CAN1/TSC	CAN2/ OTG_FS/DCMI/ QUADSPI	LCD	SDMMC/ COMP1/2/FMC/SWPMI1	SAI1/2	TIM2/15/16/17/ LPTIM2	EVENOUT
Port E	PE0	-	-	DCMI_D2	LCD_SEG36	FMC_NBL0	-	TIM16_CH1	EVENTOUT
	PE1	-	-	DCMI_D3	LCD_SEG37	FMC_NBL1	-	TIM17_CH1	EVENTOUT
	PE2	-	TSC_G7_IO1	-	LCD_SEG38	FMC_A23	SAI1_MCLK_A	-	EVENTOUT
	PE3	-	TSC_G7_IO2	-	LCD_SEG39	FMC_A19	SAI1_SD_B	-	EVENTOUT
	PE4	-	TSC_G7_IO3	DCMI_D4	-	FMC_A20	SAI1_FS_A	-	EVENTOUT
	PE5	-	TSC_G7_IO4	DCMI_D6	-	FMC_A21	SAI1_SCK_A	-	EVENTOUT
	PE6	-	-	DCMI_D7	-	FMC_A22	SAI1_SD_A	-	EVENTOUT
	PE7	-	-	-	-	FMC_D4	SAI1_SD_B	-	EVENTOUT
	PE8	-	-	-	-	FMC_D5	SAI1_SCK_B	-	EVENTOUT
	PE9	-	-	-	-	FMC_D6	SAI1_FS_B	-	EVENTOUT
	PE10	-	TSC_G5_IO1	QUADSPI_CLK	-	FMC_D7	SAI1_MCLK_B	-	EVENTOUT
	PE11	-	TSC_G5_IO2	QUADSPI_BK1_NCS	-	FMC_D8	-	-	EVENTOUT
	PE12	-	TSC_G5_IO3	QUADSPI_BK1_IO0	-	FMC_D9	-	-	EVENTOUT
	PE13	-	TSC_G5_IO4	QUADSPI_BK1_IO1	-	FMC_D10	-	-	EVENTOUT
	PE14	-	-	QUADSPI_BK1_IO2	-	FMC_D11	-	-	EVENTOUT
	PE15	-	-	QUADSPI_BK1_IO3	-	FMC_D12	-	-	EVENTOUT

Table 18. STM32L496xx memory map and peripheral register boundary addresses(1)

Bus	Boundary address	Size (bytes)	Peripheral
AHB4	0xA000 1000 - 0xA000 13FF	1 KB	QUADSPI
AHB3	0xA000 0400 - 0xA000 0FFF	3 KB	Reserved
	0xA000 0000 - 0xA000 03FF	1 KB	FMC
-	0x5006 0C00 - 0x5FFF FFFF	~260 MB	Reserved
AHB2	0x5006 0800 - 0x5006 0BFF	1 KB	RNG
	0x5005 0400 - 0x5005 FFFF	62 KB	Reserved
	0x5005 0000 - 0x5005 03FF	1 KB	DCMI
	0x5004 0400 - 0x5004 FFFF	62 KB	Reserved
	0x5004 0000 - 0x5004 03FF	1 KB	ADC
	0x5000 0000 - 0x5003 FFFF	16 KB	OTG_FS
	0x4800 2400 - 0x4FFF FFFF	~127 MB	Reserved
	0x4800 2000 - 0x4800 23FF	1 KB	GPIOI
	0x4800 1C00 - 0x4800 1FFF	1 KB	GPIOH
	0x4800 1800 - 0x4800 1BFF	1 KB	GPIOG
	0x4800 1400 - 0x4800 17FF	1 KB	GPIOF
	0x4800 1000 - 0x4800 13FF	1 KB	GPIOE
	0x4800 0C00 - 0x4800 0FFF	1 KB	GPIOD
	0x4800 0800 - 0x4800 0BFF	1 KB	GPIOC
	0x4800 0400 - 0x4800 07FF	1 KB	GPIOB
	0x4800 0000 - 0x4800 03FF	1 KB	GPIOA
-	0x4002 BC00 - 0x47FF FFFF	~127 MB	Reserved
AHB1	0x4002 B000 - 0x4002 BBFF	3 KB	DMA2D
	0x4002 4400 - 0x4002 AFFF	26 KB	Reserved
	0x4002 4000 - 0x4002 43FF	1 KB	TSC
	0x4002 3400 - 0x4002 3FFF	1 KB	Reserved
	0x4002 3000 - 0x4002 33FF	1 KB	CRC
	0x4002 2400 - 0x4002 2FFF	3 KB	Reserved
	0x4002 2000 - 0x4002 23FF	1 KB	FLASH registers
	0x4002 1400 - 0x4002 1FFF	3 KB	Reserved
	0x4002 1000 - 0x4002 13FF	1 KB	RCC
	0x4002 0800 - 0x4002 0FFF	2 KB	Reserved
	0x4002 0400 - 0x4002 07FF	1 KB	DMA2
	0x4002 0000 - 0x4002 03FF	1 KB	DMA1

Table 18. STM32L496xx memory map and peripheral register boundary addresses(1) (continued)

Bus	Boundary address	Size (bytes)	Peripheral
APB1	0x4000 4800 - 0x4000 4BFF	1 KB	USART3
	0x4000 4400 - 0x4000 47FF	1 KB	USART2
	0x4000 4000 - 0x4000 43FF	1 KB	Reserved
	0x4000 3C00 - 0x4000 3FFF	1 KB	SPI3
	0x4000 3800 - 0x4000 3BFF	1 KB	SPI2
	0x4000 3400 - 0x4000 37FF	1 KB	Reserved
	0x4000 3000 - 0x4000 33FF	1 KB	IWDG
	0x4000 2C00 - 0x4000 2FFF	1 KB	WWDG
	0x4000 2800 - 0x4000 2BFF	1 KB	RTC
	0x4000 2400 - 0x4000 27FF	1 KB	LCD
	0x4000 1800 - 0x4000 23FF	3 KB	Reserved
	0x4000 1400 - 0x4000 17FF	1 KB	TIM7
	0x4000 1000 - 0x4000 13FF	1 KB	TIM6
	0x4000 0C00- 0x4000 0FFF	1 KB	TIM5
	0x4000 0800 - 0x4000 0BFF	1 KB	TIM4
	0x4000 0400 - 0x4000 07FF	1 KB	TIM3
	0x4000 0000 - 0x4000 03FF	1 KB	TIM2

1. The gray color is used for reserved boundary addresses.

6 Electrical characteristics

6.1 Parameter conditions

Unless otherwise specified, all voltages are referenced to V_{SS}.

6.1.1 Minimum and maximum values

Unless otherwise specified, the minimum and maximum values are guaranteed in the worst conditions of ambient temperature, supply voltage and frequencies by tests in production on 100% of the devices with an ambient temperature at T_A = 25 °C and T_A = $T_A$max (given by the selected temperature range).

Data based on characterization results, design simulation and/or technology characteristics are indicated in the table footnotes and are not tested in production. Based on characterization, the minimum and maximum values refer to sample tests and represent the mean value plus or minus three times the standard deviation (mean ±3σ).

6.1.2 Typical values

Unless otherwise specified, typical data are based on T_A = 25 °C, V_{DD} = V_{DDA} = 3 V. They are given only as design guidelines and are not tested.

Typical ADC accuracy values are determined by characterization of a batch of samples from a standard diffusion lot over the full temperature range, where 95% of the devices have an error less than or equal to the value indicated (mean ±2σ).

6.1.3 Typical curves

Unless otherwise specified, all typical curves are given only as design guidelines and are not tested.

6.1.4 Loading capacitor

The loading conditions used for pin parameter measurement are shown in *Figure 16*.

6.1.5 Pin input voltage

The input voltage measurement on a pin of the device is described in *Figure 17*.

Figure 16. Pin loading conditions

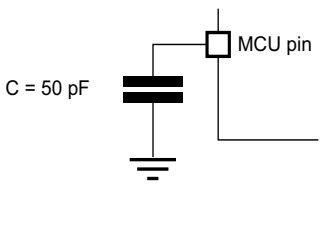


Figure 17. Pin input voltage

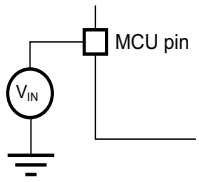


Table 38. Typical current consumption in Run and Low-power run modes, with different codes running from SRAM1

Symbol	Parameter	Conditions			TYP	Unit	TYP	Unit
		-	Voltage scaling	Code	25 °C		25 °C	
I_{DD_ALL} (Run)	Supply current in Run mode	$f_{HCLK} = f_{HSE}$ up to 48 MHz included, bypass mode PLL ON above 48 MHz all peripherals disable	Range 2 f_{HCLK} = 26 MHz	Reduced code(1)	2.72	mA	105	µA/MHz
				Coremark	2.72		105	
				Dhrystone 2.1	2.65		102	
				Fibonacci	2.47		95	
				While(1)	2.37		91	
			Range 1 f_{HCLK} = 80 MHz	Reduced code(1)	9.71	mA	121	µA/MHz
				Coremark	9.7		121	
				Dhrystone 2.1	9.48		119	
				Fibonacci	8.79		110	
				While(1)	8.45		106	
I_{DD_ALL} (LPRun)	Supply current in Low-power run	$f_{HCLK} = f_{MSI}$ = 2 MHz all peripherals disable		Reduced code(1)	258	µA	129	µA/MHz
				Coremark	268		134	
				Dhrystone 2.1	240		120	
				Fibonacci	230		115	
				While(1)	255		128	

1. Reduced code used for characterization results provided in *Table 26*, *Table 28*, *Table 30*.

Table 39. Typical current consumption in Run, with different codesrunning from SRAM1 and power supplied by external SMPS (VDD12 = 1.10 V)

Symbol	Parameter	Conditions(1)			TYP	Unit	TYP	Unit
		-	Voltage scaling	Code	25 °C		25 °C	
I_{DD_ALL} (Run)	Supply current in Run mode	$f_{HCLK} = f_{HSE}$ up to 48 MHz included, bypass mode PLL ON above 48 MHz all peripherals disable	f_{HCLK} = 26 MHz	Reduced code(2)	1.17	mA	45	µA/MHz
				Coremark	1.17		45	
				Dhrystone 2.1	1.14		44	
				Fibonacci	1.07		41	
				While(1)	1.02		39	
			f_{HCLK} = 80 MHz	Reduced code(1)	3.49		44	
				Coremark	3.49		44	
				Dhrystone 2.1	3.41		43	
				Fibonacci	3.16		39	
				While(1)	3.04		38	

1. All values are obtained by calculation based on measurements done without SMPS and using following parameters: SMPS input = 3.3 V, SMPS efficiency = 85%, VDD12 = 1.10 V
2. Reduced code used for characterization results provided in *Table 26*, *Table 28*, *Table 30*.

Table 45. Current consumption in Stop 1 mode

Symbol	Parameter	Conditions			TYP					MAX(1)					Unit
		-	-	V_{DD}	25 °C	55 °C	85 °C	105 °C	125 °C	25 °C	55 °C	85 °C	105 °C	125 °C	
I_{DD_ALL} (Stop 1)	Supply current in Stop 1 mode, RTC disabled	-	LCD disabled	1.8 V	11.2	30.7	107	243	523	25.4	79.6	287	651	1395	µA
				2.4 V	11.3	30.8	108	244	526	25.5	79.8	288	655	1403	
				3 V	11.6	31	108	245	530	25.9	80.5	290	659	1413	
				3.6 V	11.9	31.5	109	248	536	28.6	81.4	293	665	1428	
		-	LCD enabled(2) clocked by LSI	1.8 V	11.7	29.7	102	234	504	27.1	81.1	288.5	653	1397	
				2.4 V	11.7	29.9	102	234	506	27.2	81.0	289	656	1405	
				3 V	12.1	29.9	103	234	508	27.4	81.6	291	660	1415	
				3.6 V	12.2	30.1	103	235	510	28.8	82.4	294	667	1429	
I_{DD_ALL} (Stop 1 with RTC)	Supply current in stop 1 mode, RTC enabled	RTC clocked by LSI	LCD disabled	1.8 V	11.9	31.1	108	243	523	26.6	80.5	288	652	1396	µA
				2.4 V	12.1	31.4	108	244	528	26.7	80.9	289	656	1404	
				3 V	12.4	31.7	109	246	531	27.7	81.6	291	660	1415	
				3.6 V	12.6	32.3	110	249	537	28.9	82.8	295	667	1429	
			LCD enabled(2)	1.8 V	11.7	30.1	104	235	510	26.7	80.6	288	653	1397	
				2.4 V	11.8	30.2	104	238	511	26.7	81.1	290	657	1406	
				3 V	11.8	30.5	104	238	515	28.3	81.8	2912	661	1416	
				3.6 V	12.3	31	105	239	519	30.9	83.0	295	668	1430	
		RTC clocked by LSE bypassed at 32768 Hz	LCD disabled	1.8 V	11.8	31.3	108	243	523	-	-	-	-	-	
				2.4 V	11.9	31.6	108	244	527	-	-	-	-	-	
				3 V	12.7	31.9	109	246	531	-	-	-	-	-	
				3.6 V	12.7	32.5	111	249	537	-	-	-	-	-	
		RTC clocked by LSE quartz(3) in low drive mode	LCD disabled	1.8 V	11.5	29	100	268	-	-	-	-	-	-	
				2.4 V	11.5	29.2	101	268	-	-	-	-	-	-	
				3 V	12	29.4	102	270	-	-	-	-	-	-	
				3.6 V	12.1	31.7	103	272	-	-	-	-	-	-	

Table 50. Peripheral current consumption (continued)

Peripheral		Range 1	Range 2	Low-power run and sleep	Unit
APB2	All APB2 on	55.40	41.33	46.00	µA/MHz
ALL		234.98	195.83	235.70	

1. The BusMatrix is automatically active when at least one master is ON (CPU, DMA).
2. The GPIOx (x= A…I) dynamic current consumption is approximately divided by a factor two versus this table values when the GPIO port is locked thanks to LCKK and LCKy bits in the GPIOx_LCKR register. In order to save the full GPIOx current consumption, the GPIOx clock should be disabled in the RCC when all port I/Os are used in alternate function or analog mode (clock is only required to read or write into GPIO registers, and is not used in AF or analog modes).
3. The AHB to APB1 Bridge is automatically active when at least one peripheral is ON on the APB1.
4. The AHB to APB2 Bridge is automatically active when at least one peripheral is ON on the APB2.

The consumption for the peripherals when using SMPS can be found using STM32CubeMX PCC tool.

6.3.6 Wakeup time from low-power modes and voltage scaling transition times

The wakeup times given in *Table 51* are the latency between the event and the execution of the first user instruction.

The device goes in low-power mode after the WFE (Wait For Event) instruction.

Table 51. Low-power mode wakeup timings(1)

Symbol	Parameter	Conditions		Typ	Max	Unit
$t_{WUSLEEP}$	Wakeup time from Sleep mode to Run mode	-		6	6	Nb of CPU cycles
$t_{WULPSLEEP}$	Wakeup time from Low-power sleep mode to Low-power run mode	Wakeup in Flash with Flash in power-down during low-power sleep mode (SLEEP_PD=1 in FLASH_ACR) and with clock MSI = 2 MHz		6.6	8.3	
$t_{WUSTOP0}$	Wake up time from Stop 0 mode to Run mode in Flash	Range 1	Wakeup clock MSI = 48 MHz	7.0	11.6	µs
			Wakeup clock HSI16 = 16 MHz	6.2	10.7	
		Range 2	Wakeup clock MSI = 24 MHz	7.3	11.7	
			Wakeup clock HSI16 = 16 MHz	6.2	10.7	
			Wakeup clock MSI = 4 MHz	7.6	13.2	
	Wake up time from Stop 0 mode to Run mode in SRAM1	Range 1	Wakeup clock MSI = 48 MHz	2.5	2.9	
			Wakeup clock HSI16 = 16 MHz	2.7	2.9	
		Range 2	Wakeup clock MSI = 24 MHz	3.2	3.6	
			Wakeup clock HSI16 = 16 MHz	2.7	2.9	
			Wakeup clock MSI = 4 MHz	5.7	13.2	

Table 77. ADC accuracy - limited test conditions 1(1)(2)(3)

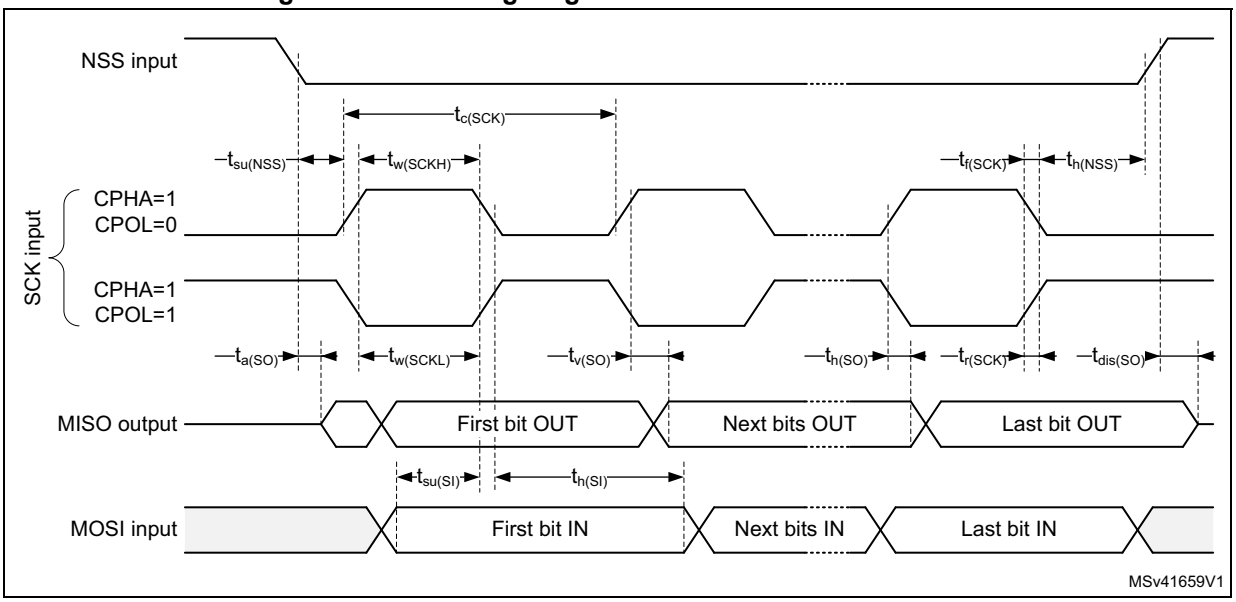
Sym-bol	Parameter	Conditions(4)			Min	Typ	Max	Unit
ET	Total unadjusted error	ADC clock frequency ≤ 80 MHz, Sampling rate ≤ 5.33 Msps, V_{DDA} = VREF+ = 3 V, TA = 25 °C	Single ended	Fast channel (max speed)	-	4	5	LSB
				Slow channel (max speed)	-	4	5	
			Differential	Fast channel (max speed)	-	3.5	4.5	
				Slow channel (max speed)	-	3.5	4.5	
EO	Offset error		Single ended	Fast channel (max speed)	-	1	2.5	
				Slow channel (max speed)	-	1	2.5	
			Differential	Fast channel (max speed)	-	1.5	2.5	
				Slow channel (max speed)	-	1.5	2.5	
EG	Gain error		Single ended	Fast channel (max speed)	-	2.5	4.5	
				Slow channel (max speed)	-	2.5	4.5	
			Differential	Fast channel (max speed)	-	2.5	3.5	
				Slow channel (max speed)	-	2.5	3.5	
ED	Differential linearity error		Single ended	Fast channel (max speed)	-	1	1.5	
				Slow channel (max speed)	-	1	1.5	
			Differential	Fast channel (max speed)	-	1	1.2	
				Slow channel (max speed)	-	1	1.2	
EL	Integral linearity error		Single ended	Fast channel (max speed)	-	1.5	2.5	
				Slow channel (max speed)	-	1.5	2.5	
			Differential	Fast channel (max speed)	-	1	2	
				Slow channel (max speed)	-	1	2	
ENOB	Effective number of bits		Single ended	Fast channel (max speed)	10.4	10.5	-	bits
				Slow channel (max speed)	10.4	10.5	-	
			Differential	Fast channel (max speed)	10.8	10.9	-	
				Slow channel (max speed)	10.8	10.9	-	
SINAD	Signal-to-noise and distortion ratio		Single ended	Fast channel (max speed)	64.4	65	-	dB
				Slow channel (max speed)	64.4	65	-	
			Differential	Fast channel (max speed)	66.8	67.4	-	
				Slow channel (max speed)	66.8	67.4	-	
SNR	Signal-to-noise ratio		Single ended	Fast channel (max speed)	65	66	-	
				Slow channel (max speed)	65	66	-	
			Differential	Fast channel (max speed)	67	68	-	
				Slow channel (max speed)	67	68	-	

Table 83. VREFBUF characteristics(1) (continued)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I_{DDA}(VREFBUF)	VREFBUF consumption from V_{DDA}	I_{load} = 0 µA	-	16	25	µA
		I_{load} = 500 µA	-	18	30	
		I_{load} = 4 mA	-	35	50	

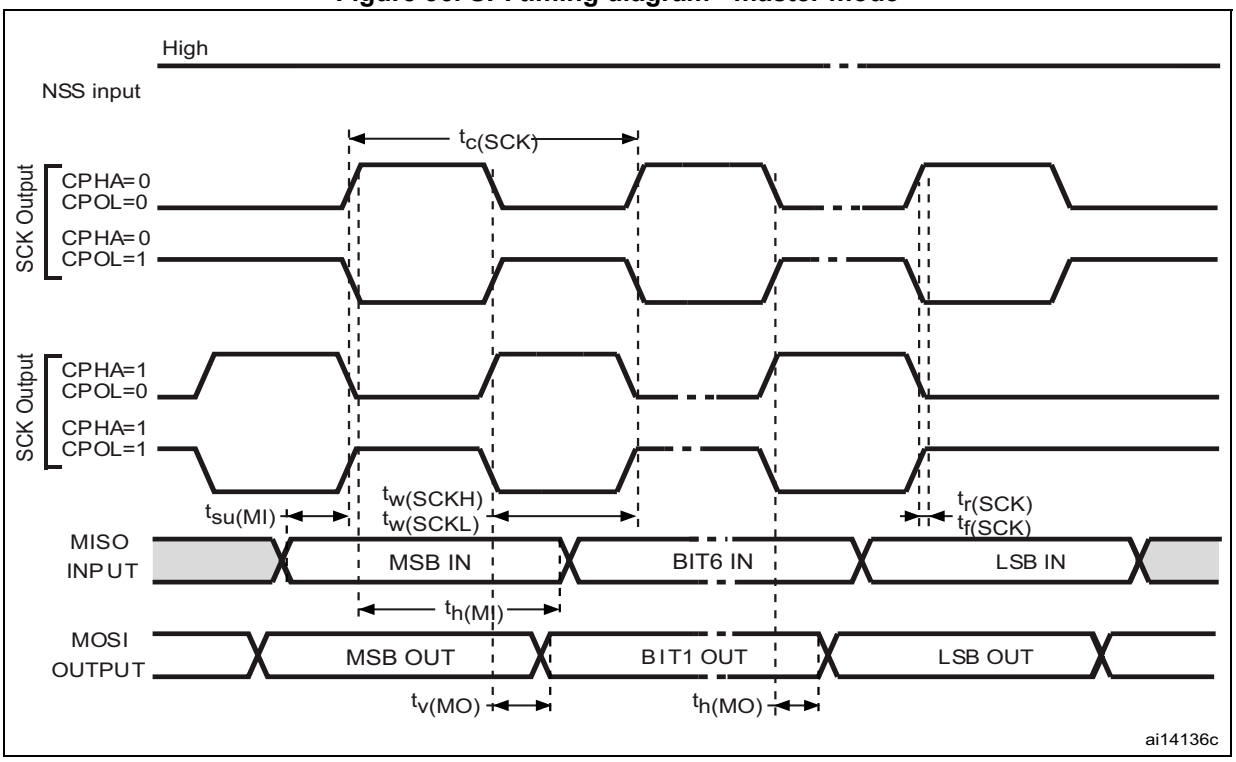
1. Guaranteed by design, unless otherwise specified.
2. In degraded mode, the voltage reference buffer can not maintain accurately the output voltage which will follow (V_{DDA} - drop voltage).
3. Guaranteed by test in production.
4. The capacitive load must include a 100 nF capacitor in order to cut-off the high frequency noise.
5. To correctly control the VREFBUF inrush current during start-up phase and scaling change, the V_{DDA} voltage should be in the range [2.4 V to 3.6 V] and [2.8 V to 3.6 V] respectively for V_{RS} = 0 and V_{RS} = 1.

Figure 35. SPI timing diagram - slave mode and CPHA = 1



1. Measurement points are done at CMOS levels: 0.3 V_{DD} and 0.7 V_{DD}.

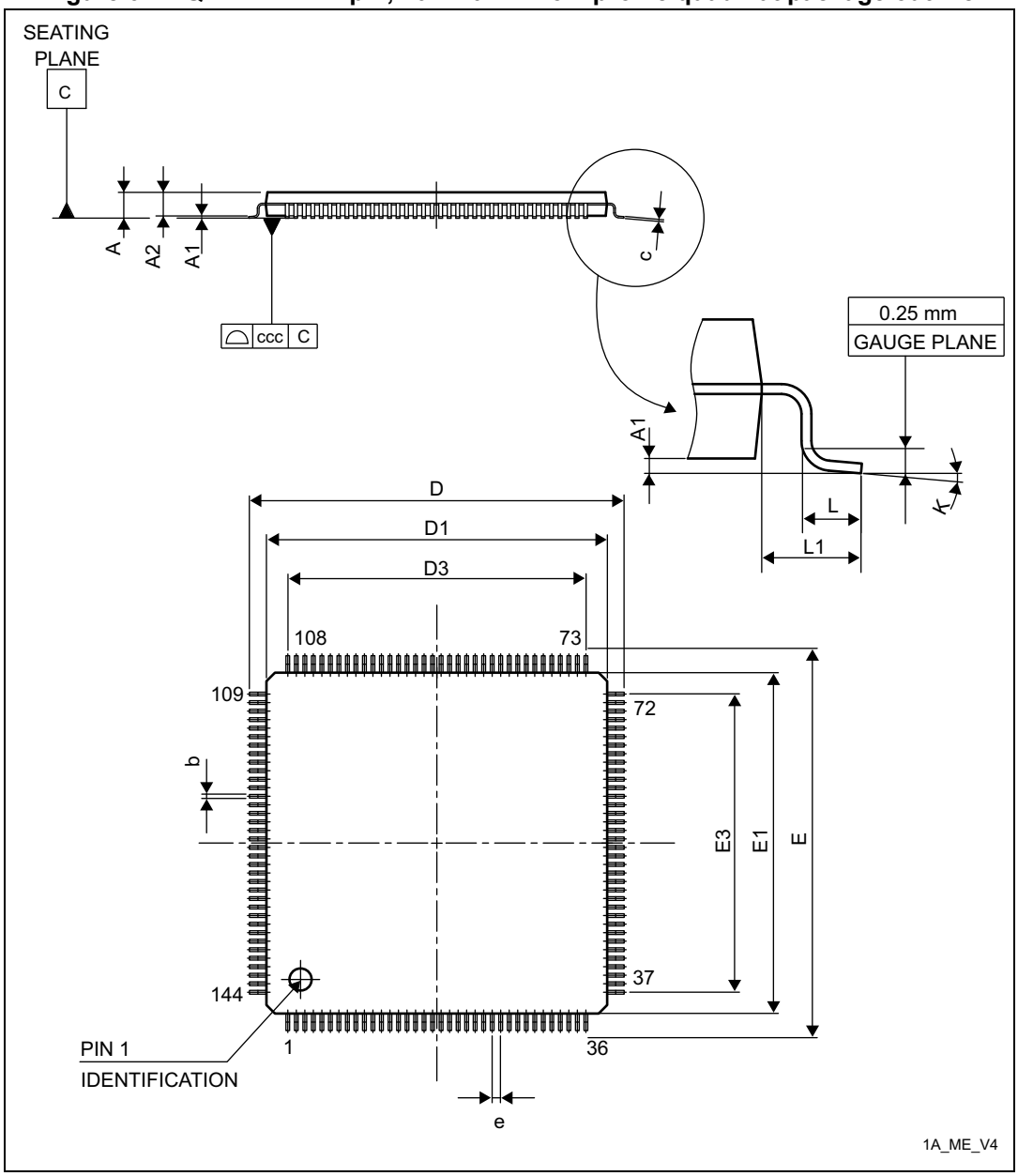
Figure 36. SPI timing diagram - master mode



1. Measurement points are done at CMOS levels: 0.3 V_{DD} and 0.7 V_{DD}.

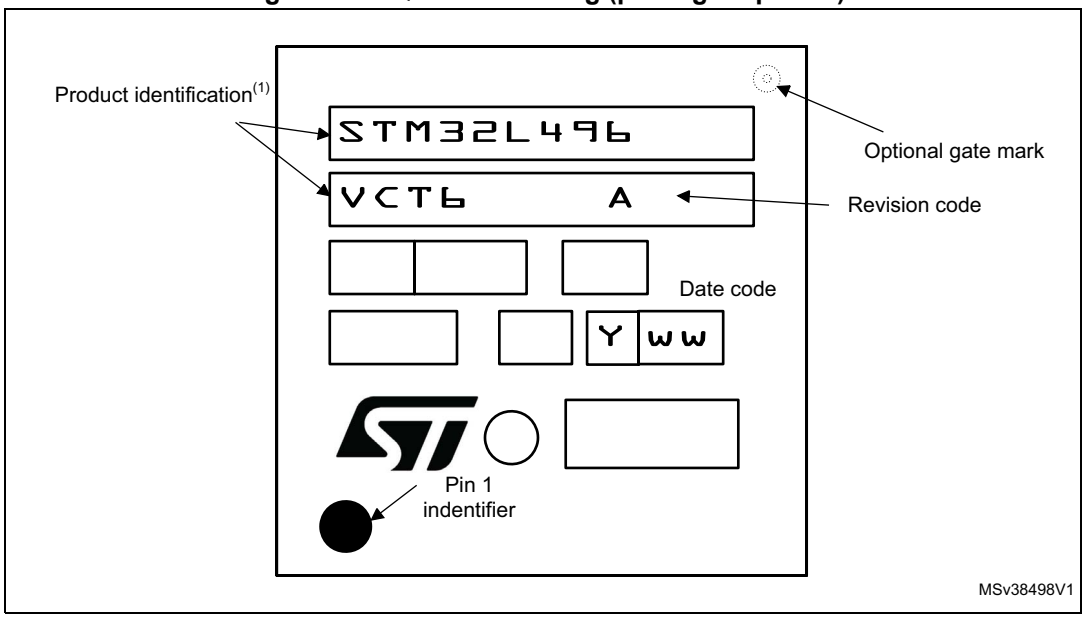
7.2 LQFP144 package information

Figure 62. LQFP144 - 144-pin, 20 x 20 mm low-profile quad flat package outline



1. Drawing is not to scale.

Figure 71. LQFP100 marking (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.

8 Part numbering

Table 130. STM32L496xx ordering information scheme

Example: STM32 L 496 V G T 6 P TR

Device family

STM32 = ARM® based 32-bit microcontroller

Product type

L = ultra-low-power

Device subfamily

496: STM32L496xG

Pin count

R = 64 pins
V = 100 pins
Q = 132 pins
Z = 144 pins
A = 169 pins

Flash memory size

G = 1 MB of Flash memory
E = 512 KByte of Flash memory

Package

T = LQFP ECOPACK®2
I = UFBGA ECOPACK®2
Y = CSP ECOPACK®2

Temperature range

6 = Industrial temperature range, -40 to 85 °C (105 °C junction)
7 = Industrial temperature range, -40 to 105 °C (125 °C junction)
3 = Industrial temperature range, -40 to 125 °C (130 °C junction)

Option

Blank = Standard production with integrated LDO
P = Dedicated pinout supporting external SMPS

Packing

TR = tape and reel
xxx = programmed parts