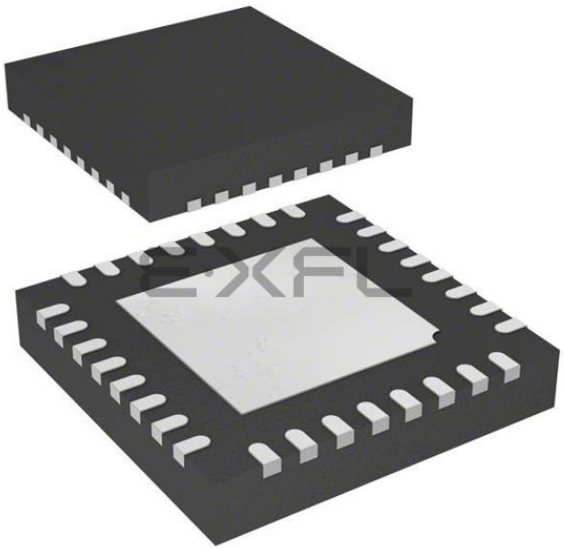

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What is "Embedded - Microcontrollers"?

"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	STM8
Core Size	8-Bit
Speed	16MHz
Connectivity	I²C, IrDA, LINbus, SPI, UART/USART
Peripherals	Brown-out Detect/Reset, POR, PWM, WDT
Number of I/O	28
Program Memory Size	8KB (8K x 8)
Program Memory Type	FLASH
EEPROM Size	640 x 8
RAM Size	1K x 8
Voltage - Supply (Vcc/Vdd)	2.95V ~ 5.5V
Data Converters	A/D 7x10b
Oscillator Type	Internal
Operating Temperature	-40°C ~ 85°C (TA)
Mounting Type	Surface Mount
Package / Case	32-UFQFN Exposed Pad
Supplier Device Package	32-UFQFPN (5x5)
Purchase URL	https://www.e-xfl.com/product-detail/stmicroelectronics/stm8s903k3u6

Contents

List of tables

4.13 Analog-to-digital converter (ADC1)

The STM8S903K3/F3 family products contain a 10-bit successive approximation A/D converter (ADC1) with up to 7 external and 1 internal multiplexed input channels and the following main features:

- Input voltage range: 0 to VDD
- Conversion time: 14 clock cycles
- Single and continuous and buffered continuous conversion modes
- Buffer size (n x 10 bits) where n = number of input channels
- Scan mode for single and continuous conversion of a sequence of channels
- Analog watchdog capability with programmable upper and lower thresholds
- Internal reference voltage on channel AIN7
- Analog watchdog interrupt
- External trigger input
- Trigger from TIM1 TRGO
- End of conversion (EOC) interrupt

Internal bandgap reference voltage

Channel AIN7 is internally connected to the internal bandgap reference voltage. The internal bandgap reference is constant and can be used for example to monitor V_{DD}. It is independent of variations in V_{DD} and ambient temperature T_A.

4.14 Communication interfaces

The following communication interfaces are implemented:

- UART1: Full feature UART, synchronous mode, SPI master mode, Smartcard mode, IrDA mode, single wire mode, LIN2.1 master capability
- SPI: Full and half-duplex, 8 Mbit/s
- I²C: Up to 400 kbit/s

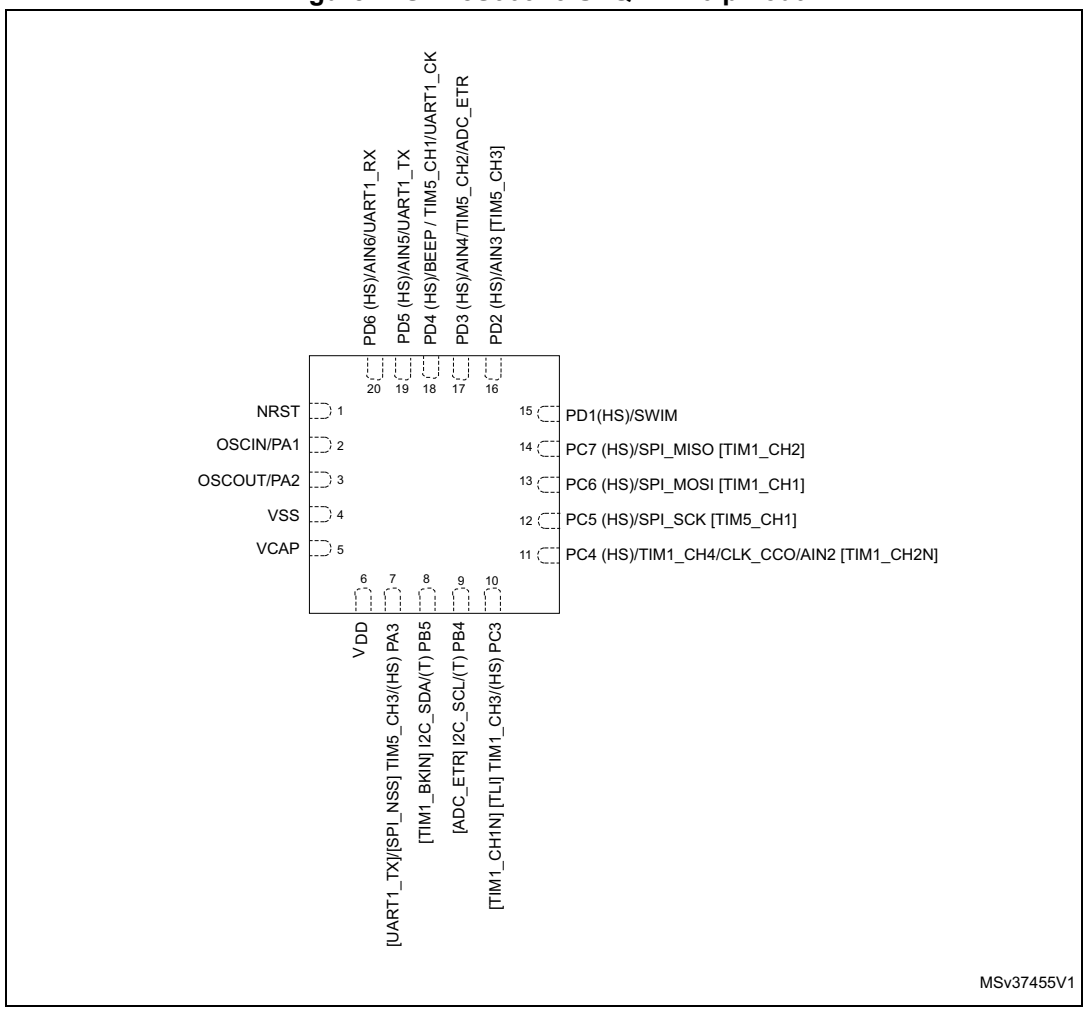
4.14.1 UART1

Main features

- 1 Mbit/s full duplex SCI
- SPI emulation
- High precision baud rate generator
- Smartcard emulation
- IrDA SIR encoder decoder
- LIN master mode
- Single wire half duplex mode

5.2 STM8S903F3 UFQFPN20 pinout

Figure 4. STM8S903F3 UFQFPN20 pinout



1. HS high sink capability.
2. (T) True open drain (P-buffer and protection diode to VDD not implemented).
3. [ ] alternate function remapping option (if the same alternate function is shown twice, it indicates an exclusive choice not a duplication of the function).

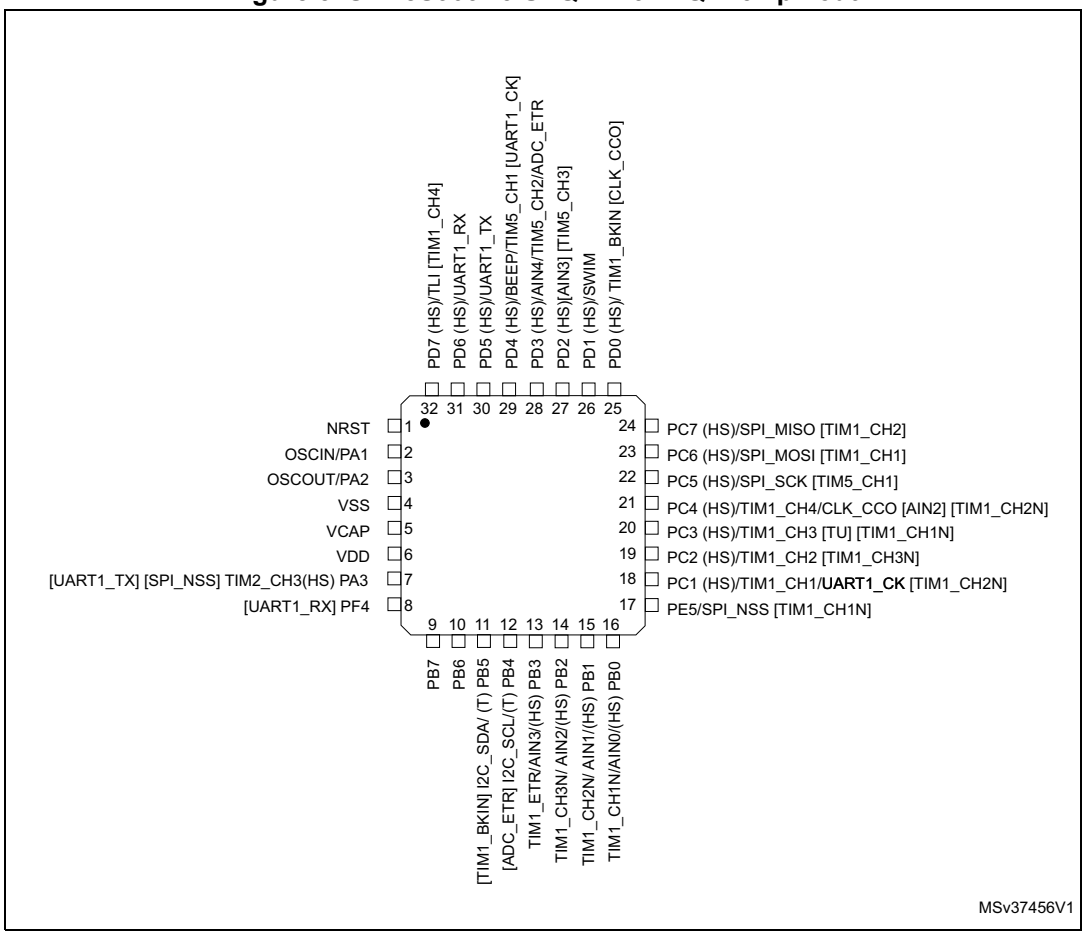
Table 5. TSSOP20/SO20/UFQFPN20 pin descriptions (continued)

TSSOP20	UFQFPN20	Pin name	Type	Input			Output				Main function (after reset)	Default alternate function	Alternate function after remap [option bit]
				floating	wpu	Ext.	High sink(1)	Speed	OD	PP			
19	16	PD2/AIN3/ [TIM5_CH3]	I/O	**X**	X	X	HS	O3	X	X	Port D2	-	Analog input 3 [AFR2] Timer 52 - channel 3 [AFR1]
20	17	PD3/ AIN4/ TIM5_CH2/ ADC_ETR	I/O	**X**	X	X	HS	O3	X	X	Port D3	Analog input 4 Timer 52 - channel 2/ADC external trigger	-
1	18	PD4/ TIM5_CH1/ BEEP [UART1_CK]	I/O	**X**	X	X	HS	O3	X	X	Port D4	Timer 5 - channel 1/BEEP output	UART clock [AFR2]
2	19	PD5/ AIN5/ UART1_TX	I/O	**X**	X	X	HS	O3	X	X	Port D5	Analog input 5/ UART1 data transmit	-
3	20	PD6/ AIN6/ UART1_RX	I/O	**X**	X	X	HS	O3	X	X	Port D6	Analog input 6/ UART1 data receive	-

1. I/O pins used simultaneously for high current source/sink must be uniformly spaced around the package. In addition, the total driven current must respect the absolute maximum ratings (see *Section 10.2: Absolute maximum ratings*).
2. When the MCU is in Halt/Active-halt mode, PA1 is automatically configured in input weak pull-up and cannot be used for waking up the device. In this mode, the output state of PA1 is not driven. It is recommended to use PA1 only in input mode if Halt/Active-halt is used in the application.
3. In the open-drain output column, ‘T’ defines a true open-drain I/O (P-buffer, weak pull-up, and protection diode to VDD are not implemented)
4. The PD1 pin is in input pull-up during the reset phase and after internal reset release.

5.4 STM8S903K3 UFQFPN32/LQFP32 and SDIP32 pinouts

Figure 5. STM8S903K3 UFQFPN32/LQFP32 pinout



1. (HS) high sink capability.
2. (T) True open drain (P-buffer and protection diode to V_{DD} not implemented).
3. [ ] alternate function remapping option (if the same alternate function is shown twice, it indicates an exclusive choice not a duplication of the function).

Table 8. General hardware register map (continued)

Address	Block	Register label	Register name	Reset status
0x00 5340	TIM6	TIM6_CR1	TIM6 control register 1	0x00
0x00 5341		TIM6_CR2	TIM6 control register 2	0x00
0x00 5342		TIM6_SMCR	TIM6 slave mode control register	0x00
0x00 5343		TIM6_IER	TIM6 interrupt enable register	0x00
0x00 5344		TIM6_SR	TIM6 status register	0x00
0x00 5345		TIM6_EGR	TIM6 event generation register	0x00
0x00 5346		TIM6_CNTR	TIM6 counter	0x00
0x00 5347		TIM6_PSCR	TIM6 prescaler register	0x00
0x00 5348		TIM6_ARR	TIM6 auto-reload register	0xFF
0x00 5349 to 0x00 53DF	Reserved area (153 byte)			
0x00 53E0 to 0x00 53F3	ADC1	ADC_DBxR	ADC data buffer registers	0x00
0x00 53F4 to 0x00 53FF	Reserved area (12 byte)			

7 Interrupt vector mapping

Table 10. Interrupt mapping

IRQ no.	Source block	Description	Wakeup from halt mode	Wakeup from active-halt mode	Vector address
-	RESET	Reset	Yes	Yes	0x00 8000
-	TRAP	Software interrupt	-	-	0x00 8004
0	TLI	External top level interrupt	-	-	0x00 8008
1	AWU	Auto wake up from halt	-	Yes	0x00 800C
2	CLK	Clock controller	-	-	0x00 8010
3	EXTI0	Port A external interrupts	Yes(1)	Yes(1)	0x00 8014
4	EXTI1	Port B external interrupts	Yes	Yes	0x00 8018
5	EXTI2	Port C external interrupts	Yes	Yes	0x00 801C
6	EXTI3	Port D external interrupts	Yes	Yes	0x00 8020
7	EXTI4	Port E external interrupts	Yes	Yes	0x00 8024
8	EXTI5	Port F external interrupts	-	-	0x00 8028
9	Reserved	-	-	-	0x00 802C
10	SPI	End of transfer	Yes	Yes	0x00 8030
11	TIM1	TIM1 update/ overflow/ underflow/ trigger/ break	-	-	0x00 8034
12	TIM1	TIM1 capture/ compare	-	-	0x00 8038
13	TIM5	TIM5 update/ overflow/trigger	-	-	0x00 803C
14	TIM5	TIM5 capture/ compare	-	-	0x00 8040
15	Reserved	-	-	-	0x00 8044
16	Reserved	-	-	-	0x00 8048
17	UART1	Tx complete	-	-	0x00 804C
18	UART1	Receive register DATA FULL	-	-	0x00 8050
19	I2C	I2C interrupt	Yes	Yes	0x00 8054

Table 15. STM8S903K3 alternate function remapping bits [1:0] for 32-pin packages (continued)

AFR1 option bit value	AFR0 option bit value	I/O port	Alternate function mapping
1	1	PD2	TIM5_CH3
		PC5	TIM5_CH1
		PC6	TIM1_CH1
		PC7	TIM1_CH2
		PC2	TIM1_CH3N
		PC1	TIM1_CH2N
		PE5	TIM1_CH1N
		PA3	UART1_TX
		PF4	UART1_RX

1. Refer to STM8S903K3 pin description.

Table 16. STM8S903F3 alternate function remapping bits [1:0] for 20-pin packages

AFR1 option bit value	AFR0 option bit value	I/O port	Alternate function mapping
0	0	AFR1 and AFR0 remapping options inactive: Default alternate functions(1)	
0	1	PC5	TIM5_CH1
		PC6	TIM1_CH1
		PC7	TIM1_CH2
1	0	PA3	SPI_NSS
		PD2	TIM5_CH3
1	1	PD2	TIM5_CH3
		PC5	TIM5_CH1
		PC6	TIM1_CH1
		PC7	TIM1_CH2
		PC2	-
		PC1	-
		PE5	TIM1_CH1N
		PA3	UART1_TX
		PF4	UART1_RX

1. Refer to STM8S903F3 pin descriptions.

Figure 22. Typical V_{IL} and V_{IH} vs V_{DD} @ 4 temperatures

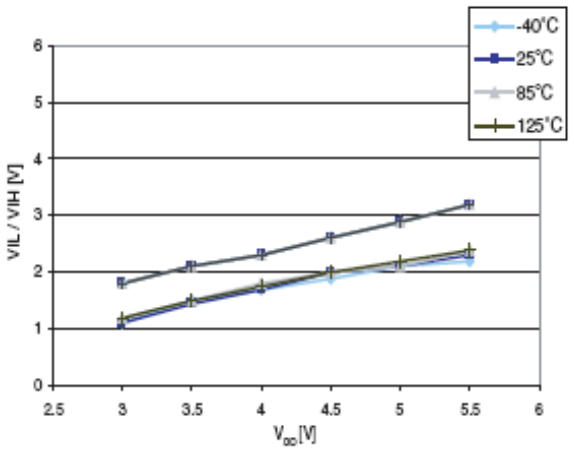


Figure 23. Typical pull-up current vs V_{DD} @ 4 temperatures

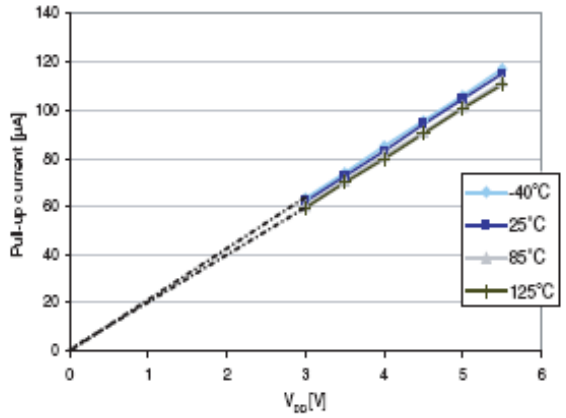


Figure 24. Typical pull-up resistance vs VDD @ 4 temperatures

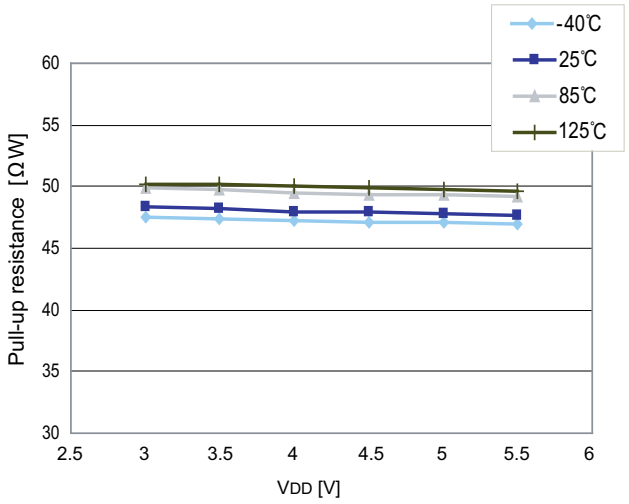


Table 41. Output driving current (standard ports)

Symbol	Parameter	Conditions	Min	Max	Unit
V_{OL}	Output low level with 8 pins sunk	I_{IO}= 10 mA, V_{DD} = 5 V	-	2.0	V
	Output low level with 4 pins sunk	I_{IO}= 4 mA, V_{DD} = 3.3 V	-	1.0(1)	
V_{OH}	Output high level with 8 pins sourced	I_{IO}= 10 mA, V_{DD} = 5 V	2.8	-	
	Output high level with 4 pins sourced	I_{IO}= 4 mA, V_{DD} = 3.3 V	2.1(1)	-	

1. Guaranteed by characterization results

Figure 31. Typ. V_{DD} - V_{OH} @ V_{DD} = 3.3 V (standard ports)

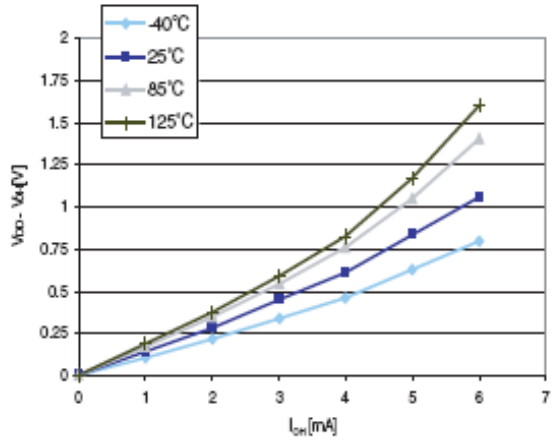


Figure 32. Typ. V_{DD} - V_{OH} @ V_{DD} = 5.0 V (standard ports)

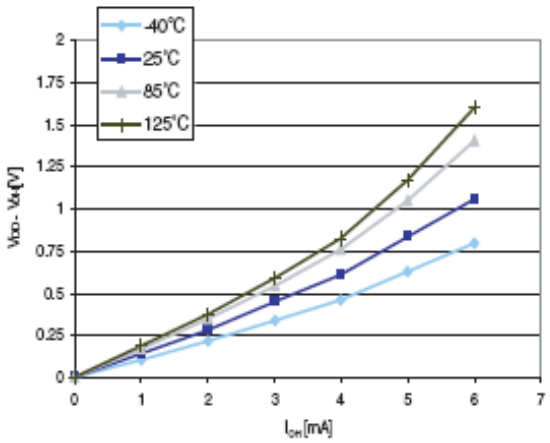


Figure 33. Typ. V_{DD} - V_{OH} @ V_{DD} = 3.3 V (high sink ports)

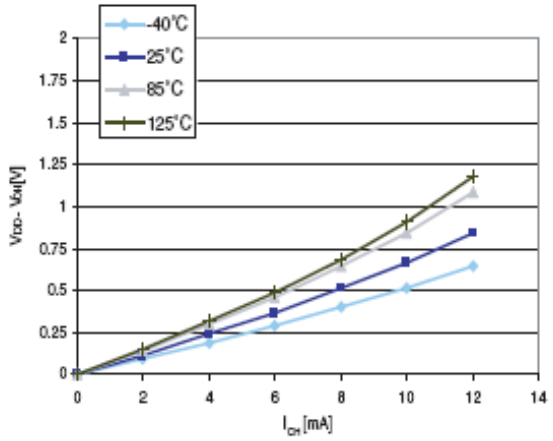
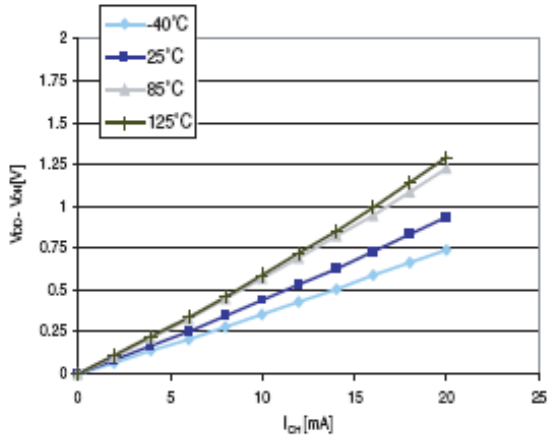


Figure 34. Typ. V_{DD} - V_{OH} @ V_{DD} = 5.0 V (high sink ports)



10.3.7 Reset pin characteristics

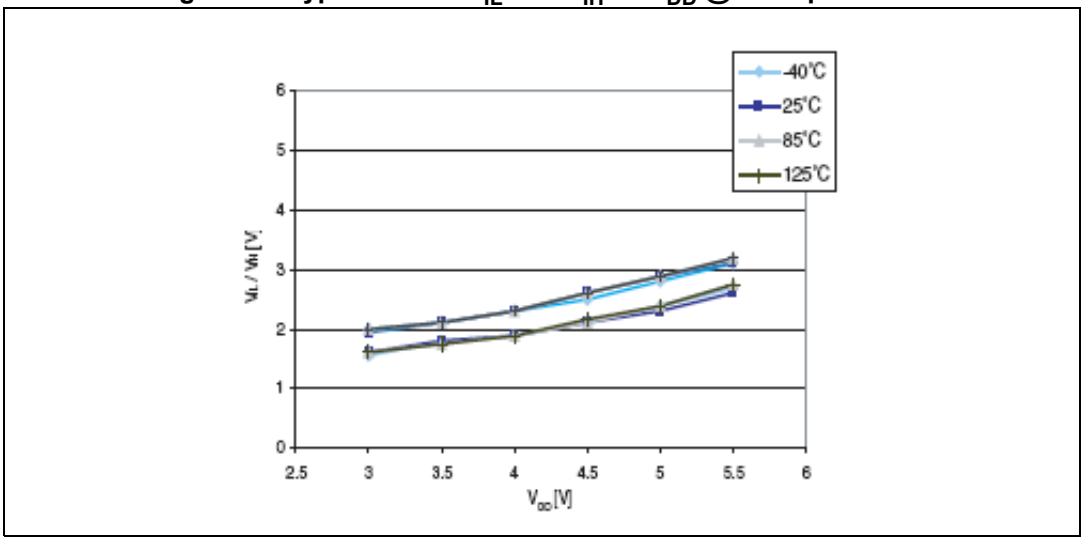
Subject to general operating conditions for V_{DD} and T_A unless otherwise specified.

Table 44. NRST pin characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{IL(NRST)}$	NRST input low level voltage(1)	-	-0.3	-	0.3 x V_{DD}	V
$V_{IH(NRST)}$	NRST input high level voltage(1)	I_{OL}= 2 mA	0.7 x V_{DD}	-	V_{DD}+ 0.3	
$V_{OL(NRST)}$	NRST output low level voltage(1)	I_{OL}= 3 mA	-	-	0.5	
$R_{PU(NRST)}$	NRST pull-up resistor(2)	-	30	55	80	kΩ
$t_{IFP(NRST)}$	NRST input filtered pulse(3)	-	-	-	75	ns
$t_{INFP(NRST)}$	NRST Input not filtered pulse(3)	-	500	-	-	
$t_{OP(NRST)}$	NRST output pulse(3)	-	20	-	-	µs

1. Guaranteed by characterization results.
2. The R_{PU} pull-up equivalent resistor is based on a resistive transistor.
3. Guaranteed by design.

Figure 35. Typical NRST V_{IL} and V_{IH} vs V_{DD} @ 4 temperatures

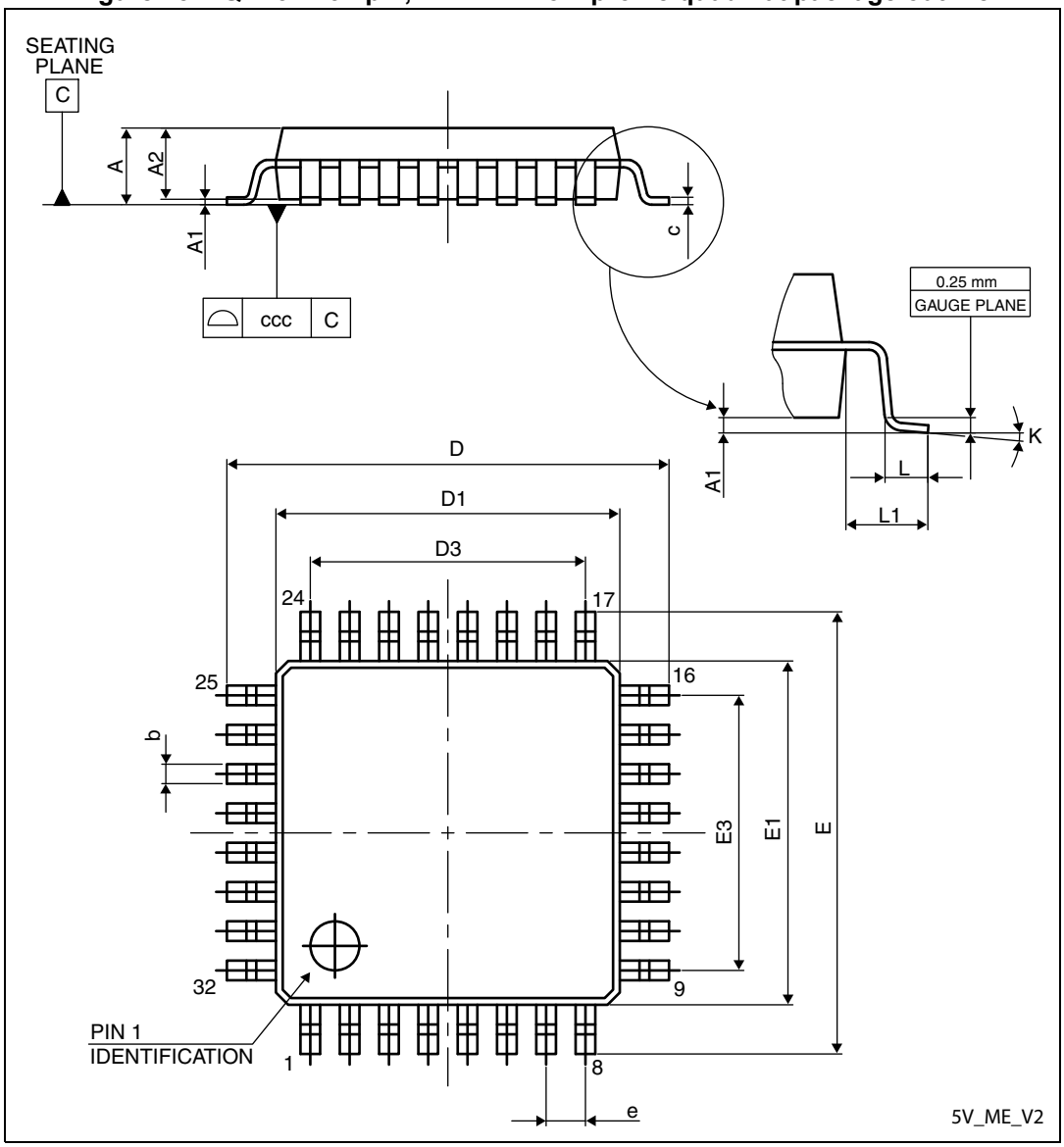


11 Package information

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.

11.1 LQFP32 package information

Figure 45. LQFP32 - 32-pin, 7 x 7 mm low-profile quad flat package outline



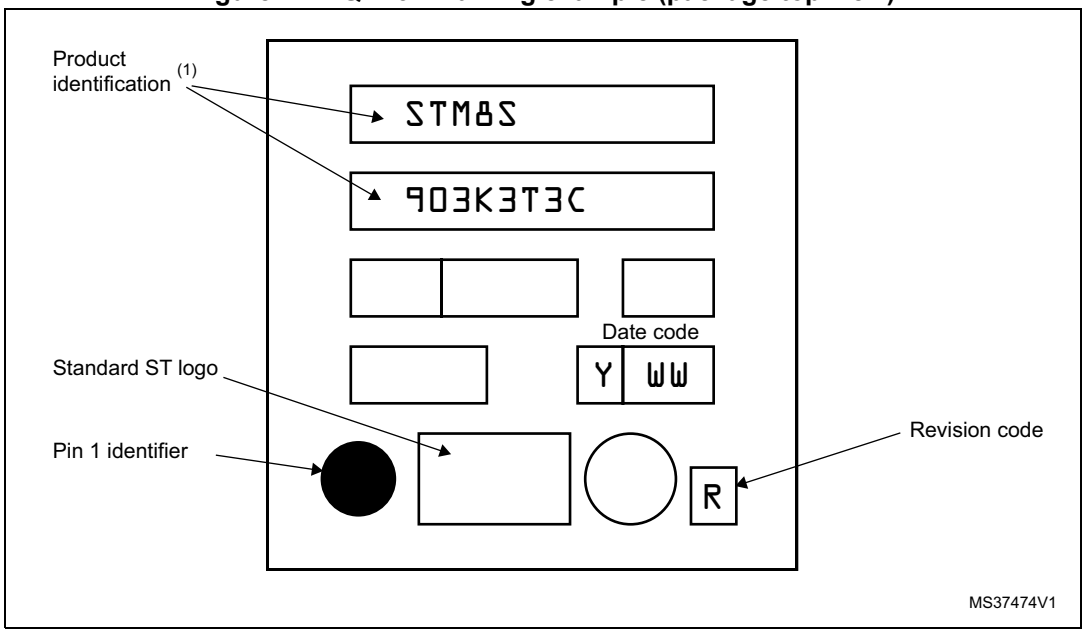
1. Drawing is not to scale.

Device marking

The following figure gives an example of topside marking orientation versus pin 1 identifier location.

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

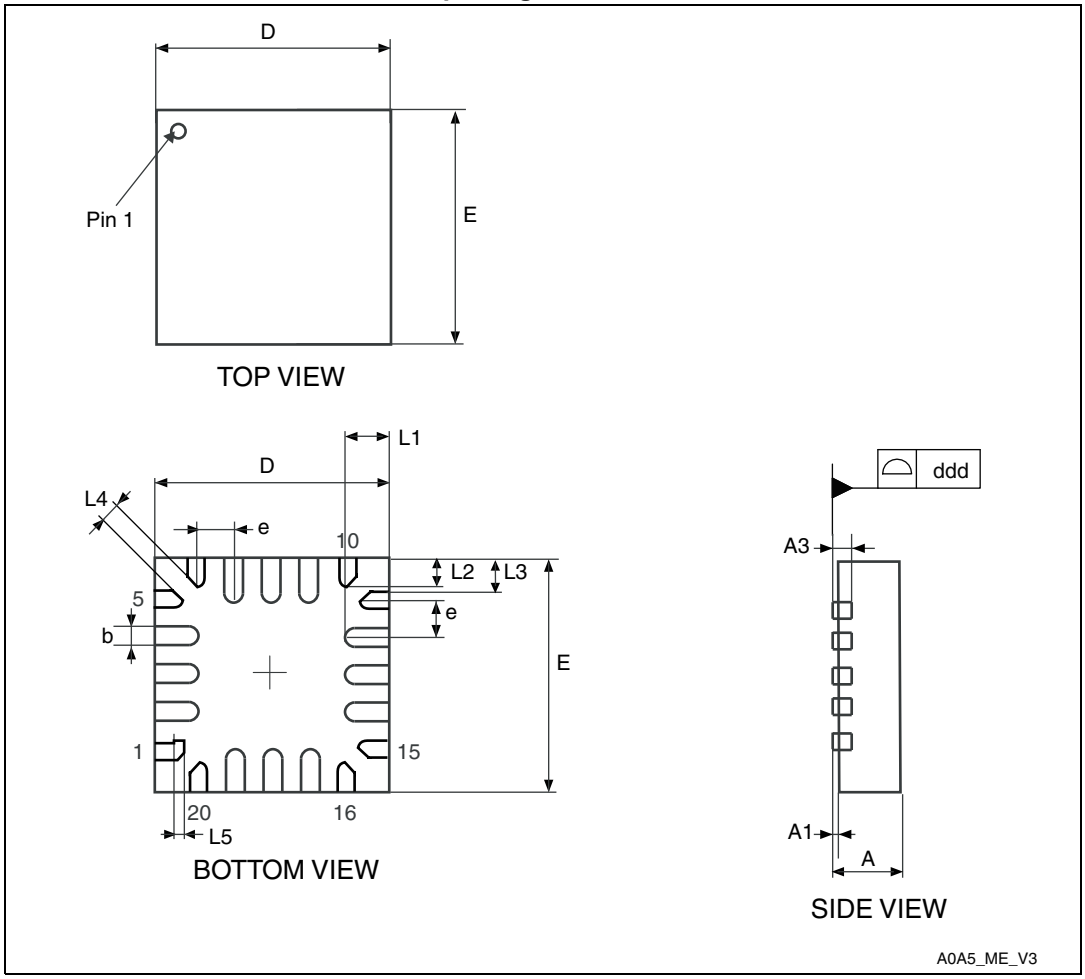
Figure 47. LQFP32 marking example (package top view)



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.

11.3 UFQFPN20 package information

Figure 51. UFQFPN20 - 20-lead, 3x3 mm, 0.5 mm pitch, ultra thin fine pitch quad flat package outline



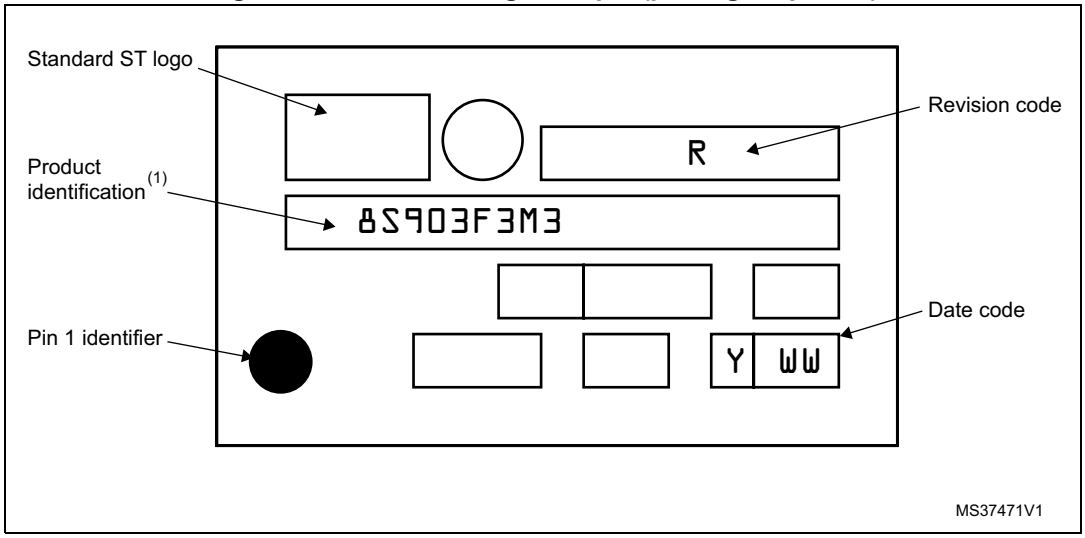
1. Drawing is not to scale.

Table 56. UFQFPN20 - 20-lead, 3x3 mm, 0.5 mm pitch, ultra thin fine pitch quad flat package mechanical data

Dim.	mm			inches(1)		
	Min	Typ	Max	Min	Typ	Max
A	0.500	0.550	0.600	0.0197	0.0217	0.0236
A1	0.000	0.020	0.050	0.0000	0.0008	0.0020
A3	-	0.152	-	-	0.060	-
D	2.900	3.000	3.100	0.1142	0.1181	0.1220
E	2.900	3.000	3.100	0.1142	0.1181	0.1220
L1	0.500	0.550	0.600	0.0197	0.0217	0.0236
L2	0.300	0.350	0.400	0.0118	0.0138	0.0157

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

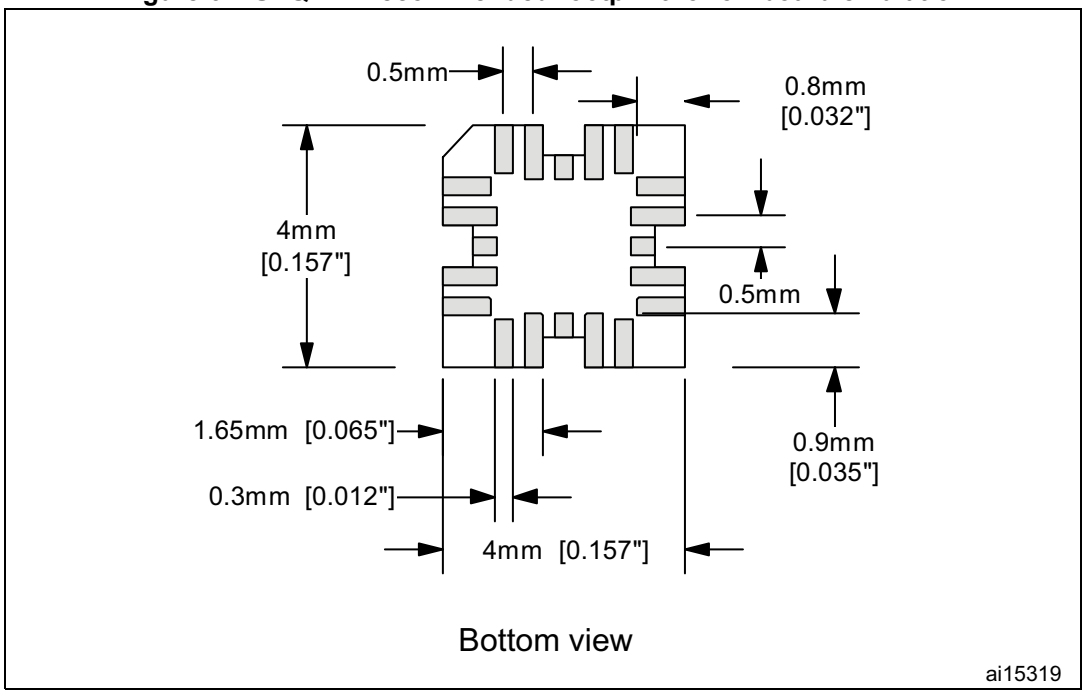
Figure 60. SO20 marking example (package top view)



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.

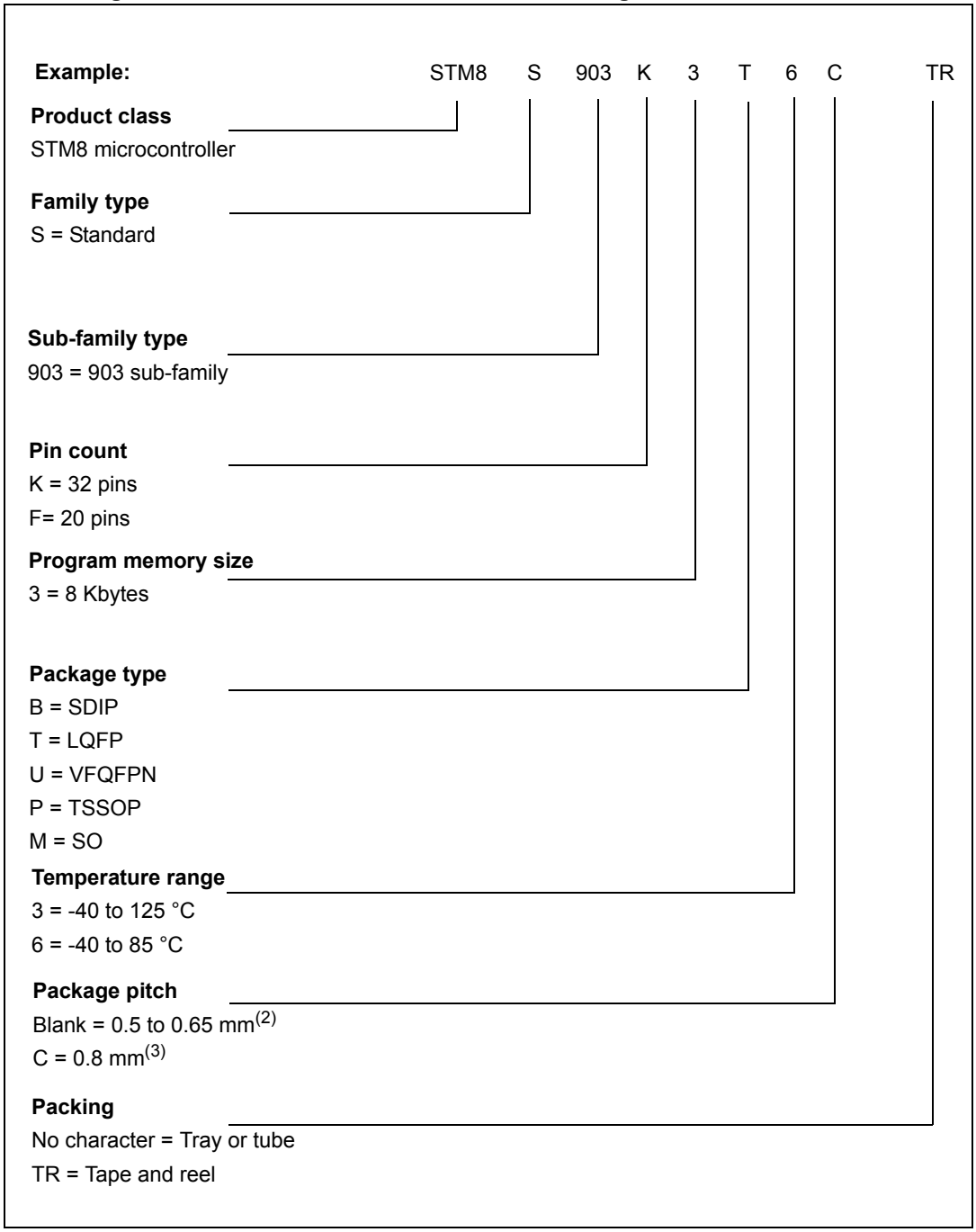
11.7 UFQFPN recommended footprint

Figure 61. UFQFPN recommended footprint for on-board emulation



13 Ordering information

Figure 63. STM8S903K3/F3 access line ordering information scheme(1)



1. A dedicated ordering information scheme will be released if, in the future, memory programming service (FastROM) is required The letter “P” will be added after STM8S. Three unique letters identifying the customer application code will also be visible in the codification. Example: STM8SP903K3MACTR.
2. UFQFPN, TSSOP, and SO packages.
3. LQFP package.

OPT4 watchdog

PRSC (check only one option)	[ ] for 16 MHz to 128 kHz prescaler [ ] for 8 MHz to 128 kHz prescaler [ ] for 4 MHz to 128 kHz prescaler
CKAWUSEL (check only one option)	[ ] LSI clock source selected for AWU [ ] HSE clock with prescaler selected as clock source for AWU
EXTCLK (check only one option)	[ ] External crystal connected to OSCIN/OSCOUT [ ] External signal on OSCIN

OPT5 crystal oscillator stabilization HSECNT (check only one option)

[ ] 2048 HSE cycles

[ ] 128 HSE cycles

[ ] 8 HSE cycles

[ ] 0.5 HSE cycles

OTP6 is reserved

Comments:	.....
Supply operating range in the application:	.....
Notes:	.....

14 STM8 development tools

Development tools for the STM8 microcontrollers include the full-featured STice emulation system supported by a complete software tool package including C compiler, assembler and integrated development environment with high-level language debugger. In addition, the STM8 is to be supported by a complete range of tools including starter kits, evaluation boards and a low-cost in-circuit debugger/programmer.

14.1 Emulation and in-circuit debugging tools

The STice emulation system offers a complete range of emulation and in-circuit debugging features on a platform that is designed for versatility and cost-effectiveness. In addition, STM8 application development is supported by a low-cost in-circuit debugger/programmer.

The STice is the fourth generation of full featured emulators from STMicroelectronics. It offers new advanced debugging capabilities including profiling and coverage to help detect and eliminate bottlenecks in application execution and dead code when fine tuning an application.

In addition, STice offers in-circuit debugging and programming of STM8 microcontrollers via the STM8 single wire interface module (SWIM), which allows non-intrusive debugging of an application while it runs on the target microcontroller.

For improved cost effectiveness, STice is based on a modular design that allows you to order exactly what you need to meet your development requirements and to adapt your emulation system to support existing and future ST microcontrollers.

14.1.1 STice key features

- Occurrence and time profiling and code coverage (new features),
- Advanced breakpoints with up to 4 levels of conditions,
- Data breakpoints,
- Program and data trace recording up to 128 KB records,
- Read/write on the fly of memory during emulation,
- In-circuit debugging/programming via SWIM protocol,
- 8-bit probe analyzer,
- 1 input and 2 output triggers,
- Power supply follower managing application voltages between 1.62 to 5.5 V,
- Modularity that allows you to specify the components you need to meet your development requirements and adapt to future requirements.
- Supported by free software tools that include integrated development environment (IDE), programming software interface and assembler for STM8.

Table 61. Document revision history (continued)

Date	Revision	Changes
28-Jul-2011	6	Added note for OPT1 option list. Updated OPT2 option list for STM8S903K3 and created OPT2 option list for STM8S903F3 in *Section 13.1: STM8S903K3/F3 FASTROM microcontroller option list*. Updated UART1 interrupt vector addresses in *Table 10: Interrupt mapping*. Updated note related to true open-drain outputs in *Table 6: STM8S903K3 UFQFPN32/LQFP32/SDIP32 pin descriptions* and *Table 5: TSSOP20/SO20/UFQFPN20 pin descriptions*. Added UFQFPN20 package. Removed CLK_CANCCR register from *Table 8: General hardware register map*. Added note for Px_IDR registers in *Table 7: I/O port hardware register map*. Updated the caption of *Figure 63: STM8S903K3/F3 access line ordering information scheme(1)*. Removed Typical HSI accuracy curve in *High speed internal RC oscillator (HSI)* Updated the value of recommended external capacitor to 100 nF in *Table 44: NRST pin characteristics*. Updated the disclaimer.
04-Apr-2012	7	Renamed internal reference voltage as internal bandgap reference voltage. Updated notes related to VCAP in *Table 21: General operating conditions*. Added values of t_R/t_F for 50 pF load capacitance, and updated note in *Table 40: I/O static characteristics*. Updated typical and maximum values of RPU in *Table 40: I/O static characteristics* and *Table 44: NRST pin characteristics*. Changed SCK input to SCK output in *Table 45: SPI characteristics*. Modified *Figure 51: UFQFPN20 - 20-lead, 3x3 mm, 0.5 mm pitch, ultra thin fine pitch quad flat package outline*.
13-Jun-2012	8	Restored *Figure 44: Typical application with ADC*. Modified *Figure 51: UFQFPN20 - 20-lead, 3x3 mm, 0.5 mm pitch, ultra thin fine pitch quad flat package outline*.