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"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®-M3
Core Size	32-Bit Single-Core
Speed	32MHz
Connectivity	I²C, IrDA, LINbus, SPI, UART/USART, USB
Peripherals	Brown-out Detect/Reset, Cap Sense, DMA, I²S, LCD, POR, PWM, WDT
Number of I/O	37
Program Memory Size	32KB (32K x 8)
Program Memory Type	FLASH
EEPROM Size	4K x 8
RAM Size	16K x 8
Voltage - Supply (Vcc/Vdd)	1.8V ~ 3.6V
Data Converters	A/D 16x12b; D/A 2x12b
Oscillator Type	Internal
Operating Temperature	-40°C ~ 85°C (TA)
Mounting Type	Surface Mount
Package / Case	48-LQFP
Supplier Device Package	48-LQFP (7x7)
Purchase URL	https://www.e-xfl.com/product-detail/stmicroelectronics/stm32l152c6t6a

2.1 Device overview

Table 2. Ultra-low-power STM32L151x6/8/B-A and STM32L152x6/8/B-A device features and peripheral counts

Peripheral		STM32L15xCxxxA			STM32L15xRxxxA			STM32L15xVxxxA	
Flash (Kbytes)		32	64	128	32	64	128	64	128
Data EEPROM (Kbytes)		4							
RAM (Kbytes)		16	32	32	16	32	32	32	32
Timers	**General-purpose**	6							
	Basic	2							
Communication interfaces	**SPI**	2							
	I^2C	2							
	USART	3							
	USB	1							
GPIOs		37			51/50(1)			83	
12-bit synchronized ADC Number of channels		1 14 channels			1 20/19 channels(1)			1 24 channels	
12-bit DAC Number of channels		2 2							
LCD (STM32L152xxxxA Only) COM x SEG		4x16			4x32/4x31(1) 8x28/8x27(1)			4x44 8x40	
Comparator		2							
Capacitive sensing channels		13			20				
Max. CPU frequency		32 MHz							
Operating voltage		1.8 V to 3.6 V (down to 1.65 V at power-down) with BOR option 1.65 V to 3.6 V without BOR option							
Operating temperatures		Ambient operating temperatures: –40 to +85 °C / –40 to + 105 °C Junction temperature: -40 to +110°C							
Packages		LQFP48, UFQFPN48			LQFP64, TFBGA64			LQFP100, UFBGA100	

1. For TFBGA64 package (instead of PC3 pin there is V_{REF+} pin).

Table 5. Working mode-dependent functionalities (from Run/active down to standby) (continued)

Ips	Run/Active	Sleep	Low-power Run	Low-power Sleep	Stop		Standby	
						Wakeup capability		Wakeup capability
DAC	Y	Y	Y	Y	Y	-	-	-
Temperature sensor	Y	Y	Y	Y	Y	-	-	-
Comparators	Y	Y	Y	Y	Y	Y	-	-
16-bit Timers	Y	Y	Y	Y	-	-	-	-
IWDG	Y	Y	Y	Y	Y	Y	Y	Y
WWDG	Y	Y	Y	Y	-	-	-	-
Touch sensing	Y	-	-	-	-	-	-	-
Systick Timer	Y	Y	Y	Y	-	-	-	-
GPIOs	Y	Y	Y	Y	Y	Y	-	3 pins
Wakeup time to Run mode	0 µs	0.4 µs	3 µs	46 µs	< 8 µs		58 µs	
Consumption V_{DD}=1.8V to 3.6V (Typ)	Down to 185 µA/MHz (from Flash)	Down to 36.9 µA/MHz (from Flash)	Down to 10.9 µA	Down to 5.5 µA	0.43 µA (No RTC) V_{DD}=1.8 V		0.27 µA (No RTC) V_{DD}=1.8 V	
					1.13 µA (with RTC) V_{DD}=1.8 V		0.87 µA (with RTC) V_{DD}=1.8 V	
					0.44 µA (No RTC) V_{DD}=3.0 V		0.28 µA (No RTC) V_{DD}=3.0 V	
					1.38 µA (with RTC) V_{DD}=3.0 V		1.11 µA (with RTC) V_{DD}=3.0 V	

1. The startup on communication line wakes the CPU which was made possible by an EXTI, this induces a delay before entering run mode.

3.2 ARM® Cortex®-M3 core with MPU

The ARM® Cortex®-M3 processor is the industry leading processor for embedded systems. It has been 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 an advanced system response to interrupts.

The ARM® Cortex®-M3 32-bit RISC processor features exceptional code-efficiency, delivering the high-performance expected from an ARM core in the memory size usually associated with 8- and 16-bit devices.

The memory protection unit (MPU) improves system reliability by defining the memory attributes (such as read/write access permissions) for different memory regions. It provides up to eight different regions and an optional predefined background region.

Owing to its embedded ARM core, the STM32L151x6/8/B-A and STM32L152x6/8/B-A devices are compatible with all ARM tools and software.

Nested vectored interrupt controller (NVIC)

The ultra-low-power STM32L151x6/8/B-A and STM32L152x6/8/B-A devices embed a nested vectored interrupt controller able to handle up to 45 maskable interrupt channels (not including the 16 interrupt lines of Cortex-M3) and 16 priority levels.

- Closely coupled NVIC gives low-latency interrupt processing
- Interrupt entry vector table address passed directly to the core
- Closely coupled NVIC core interface
- Allows early processing of interrupts
- Processing of *late arriving*, higher-priority interrupts
- Support for tail-chaining
- Processor state automatically saved
- Interrupt entry restored on interrupt exit with no instruction overhead

This hardware block provides flexible interrupt management features with minimal interrupt latency.

3.3 Reset and supply management

3.3.1 Power supply schemes

- V_{DD} = 1.65 to 3.6 V: external power supply for I/Os and the internal regulator. Provided externally through V_{DD} pins.
- V_{SSA}, V_{DDA} = 1.65 to 3.6 V: external analog power supplies for ADC, reset blocks, RCs and PLL (minimum voltage to be applied to V_{DDA} is 1.8 V when the ADC is used). V_{DDA} and V_{SSA} must be connected to V_{DD} and V_{SS}, respectively.

3.3.2 Power supply supervisor

The device has an integrated ZEROPOWER power-on reset (POR)/power-down reset (PDR) that can be coupled with a brownout reset (BOR) circuitry.

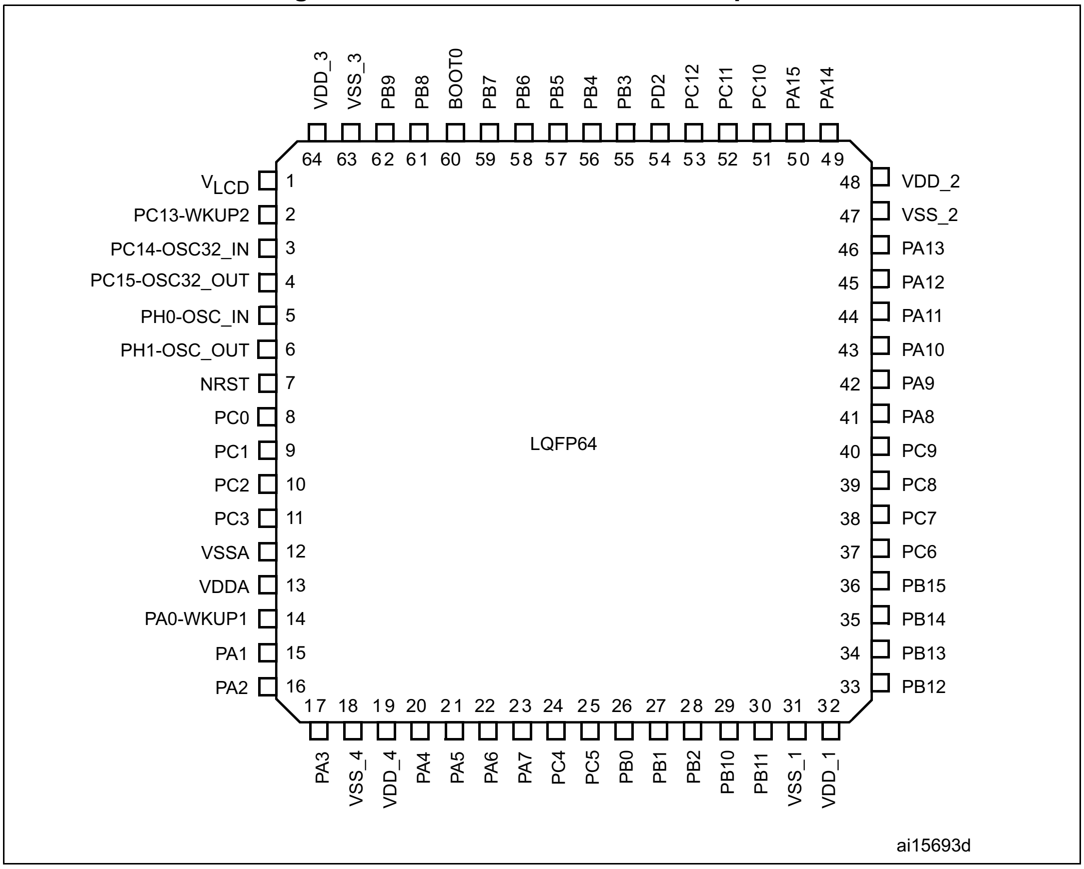
The device exists in two versions:

- The version with BOR activated at power-on operates between 1.8 V and 3.6 V.
- The other version without BOR operates between 1.65 V and 3.6 V.

After the V_{DD} threshold is reached (1.65 V or 1.8 V depending on the BOR which is active or not at power-on), the option byte loading process starts, either to confirm or modify default thresholds, or to disable the BOR permanently: in this case, the V_{DD} min value becomes 1.65 V (whatever the version, BOR active or not, at power-on).

When BOR is active at power-on, it ensures proper operation starting from 1.8 V whatever the power ramp-up phase before it reaches 1.8 V. When BOR is not active at power-up, the power ramp-up should guarantee that 1.65 V is reached on V_{DD} at least 1 ms after it exits the POR area.

Figure 6. STM32L15xRxxxA LQFP64 pinout



1. This figure shows the package top view.

Table 9. STM32L151x6/8/B-A and STM32L152x6/8/B-A pin definitions (continued)

Pins					Pin name	Pin type(1)	I/O structure	Main function(2) (after reset)	Pins functions	
LQFP100	LQFP64	TFBGA64	UFBGA100	LQFP48 or UFQFPN48					Alternate functions	Additional functions
51	33	H8	L12	25	PB12	I/O	FT	PB12	SPI2_NSS/I2C2_SMBA/ USART3_CK/ LCD_SEG12/ TIM10_CH1	ADC_IN18/ COMP1_INP /VLCDRAIL2
52	34	G8	K12	26	PB13	I/O	FT	PB13	SPI2_SCK/ USART3_CTS/ LCD_SEG13/TIM9_CH1	ADC_IN19/ COMP1_INP
53	35	F8	K11	27	PB14	I/O	FT	PB14	SPI2_MISO/ USART3_RTS/ LCD_SEG14/TIM9_CH2	ADC_IN20/ COMP1_INP
54	36	F7	K10	28	PB15	I/O	FT	PB15	SPI2_MOSI/ LCD_SEG15/ TIM11_CH1	ADC_IN21/ COMP1_INP/ RTC_REFIN
55	-	-	K9	-	PD8	I/O	FT	PD8	USART3_TX/ LCD_SEG28	-
56	-	-	K8	-	PD9	I/O	FT	PD9	USART3_RX/ LCD_SEG29	-
57	-	-	J12	-	PD10	I/O	FT	PD10	USART3_CK/ LCD_SEG30	-
58	-	-	J11	-	PD11	I/O	FT	PD11	USART3_CTS/ LCD_SEG31	-
59	-	-	J10	-	PD12	I/O	FT	PD12	TIM4_CH1/ USART3_RTS/ LCD_SEG32	-
60	-	-	H12	-	PD13	I/O	FT	PD13	TIM4_CH2/LCD_SEG33	-
61	-	-	H11	-	PD14	I/O	FT	PD14	TIM4_CH3/LCD_SEG34	-
62	-	-	H10	-	PD15	I/O	FT	PD15	TIM4_CH4/LCD_SEG35	-
63	37	F6	E12	-	PC6	I/O	FT	PC6	TIM3_CH1/LCD_SEG24	-
64	38	E7	E11	-	PC7	I/O	FT	PC7	TIM3_CH2/LCD_SEG25	-
65	39	E8	E10	-	PC8	I/O	FT	PC8	TIM3_CH3/LCD_SEG26	-
66	40	D8	D12	-	PC9	I/O	FT	PC9	TIM3_CH4/LCD_SEG27	-

6.2 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.

Table 11. Voltage characteristics

Symbol	Ratings	Min	Max	Unit
$V_{DD}–V_{SS}$	External main supply voltage (including V_{DDA} and V_{DD})(1)	–0.3	4.0	V
V_{IN}(2)	Input voltage on five-volt tolerant pin	V_{SS} –0.3	V_{DD}+4.0	
	Input voltage on any other pin	V_{SS} –0.3	4.0	
$\|\Delta V_{DDx}\|$	Variations between different V_{DD} power pins	-	50	mV
$\|V_{SSX} – V_{SS}\|$	Variations between all different ground pins(3)	-	50	
$V_{REF+} – V_{DDA}$	Allowed voltage difference for $V_{REF+} > V_{DDA}$	-	0.4	V
$V_{ESD(HBM)}$	Electrostatic discharge voltage (human body model)	see *Section 6.3.11*		-

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 must always be respected. Refer to *Table 12* for maximum allowed injected current values.
3. Include V_{REF-} pin.

Table 12. Current characteristics

Symbol	Ratings	Max.	Unit
ΣI_{VDD}	Total current into sum of all V_{DD_x} power lines (source)(1)	100	mA
ΣI_{VSS}(2)	Total current out of sum of all V_{SS_x} ground lines (sink)(1)	100	
$I_{VDD(PIN)}$	Maximum current into each V_{DD_x} power pin (source)(1)	70	
$I_{VSS(PIN)}$	Maximum current out of each V_{SS_x} ground pin (sink)(1)	-70	
I_{IO}	Output current sunk by any I/O and control pin	25	
	Output current sourced by any I/O and control pin	- 25	
$\Sigma I_{IO(PIN)}$	Total output current sunk by sum of all IOs and control pins(2)	60	
	Total output current sourced by sum of all IOs and control pins(2)	-60	
$I_{INJ(PIN)}$ (3)	Injected current on five-volt tolerant I/O(4) RST and B pins	-5/+0	
	Injected current on any other pin(5)	± 5	
$\Sigma I_{INJ(PIN)}$	Total injected current (sum of all I/O and control pins)(6)	± 25	

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. This current consumption must be correctly distributed over all I/Os and control pins. The total output current must not be sunk/sourced between two consecutive power supply pins referring to high pin count LQFP packages.

Table 14. General operating conditions (continued)

Symbol	Parameter	Conditions	Min	Max	Unit
P_D	Power dissipation at TA = 85 °C for suffix 6 or TA = 105 °C for suffix 7(4)	UFBGA100 package	-	339	mW
		LQFP100 package	-	435	
		TFBGA64 package	-	308	
		LQFP64 package	-	444	
		LQFP48 package	-	364	
		UFQFPN48 package	-	606	
T_A	Ambient temperature for 6 suffix version	Maximum power dissipation(5)	–40	85	°C
	Ambient temperature for 7 suffix version	Maximum power dissipation	–40	105	
T_J	Junction temperature range	6 suffix version	–40	105	°C
	Junction temperature range	7 suffix version	–40	110	

1. When the ADC is used, refer to *Table 55: ADC characteristics*.
2. It is recommended to power V_{DD} and V_{DDA} from the same source. A maximum difference of 300 mV between V_{DD} and V_{DDA} can be tolerated during power-up and operation.
3. To sustain a voltage higher than V_{DD}+0.3 V, the internal pull-up/pull-down resistors must be disabled.
4. If T_A is lower, higher P_D values are allowed as long as T_J does not exceed T_J max (see *Table 13: Thermal characteristics on page 56*).
5. In low-power dissipation state, T_A can be extended to -40°C to 105°C temperature range as long as T_J does not exceed T_J max (see *Table 13: Thermal characteristics on page 56*).

6.3.2 Embedded reset and power control block characteristics

The parameters given in the following table are derived from the tests performed under the ambient temperature condition summarized in the following table.

Table 15. Embedded reset and power control block characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
t_{VDD}(1)	V_{DD} rise time rate	BOR detector enabled	0	-	∞	µs/V
		BOR detector disabled	0	-	1000	
	V_{DD} fall time rate	BOR detector enabled	20	-	∞	
		BOR detector disabled	0	-	1000	
$T_{RSTTEMPO}$(1)	Reset temporization	V_{DD} rising, BOR enabled	-	2	3.3	ms
		V_{DD} rising, BOR disabled(2)	0.4	0.7	1.6	
$V_{POR/PDR}$	Power on/power down reset threshold	Falling edge	1	1.5	1.65	V
		Rising edge	1.3	1.5	1.65	

Table 22. Current consumption in Low-power sleep mode

Symbol	Parameter	Conditions			Typ	Max(1)	Unit
I_{DD} (LP Sleep)	Supply current in Low-power sleep mode	All peripherals OFF, V_{DD} from 1.65 V to 3.6 V	MSI clock, 65 kHz f_{HCLK} = 32 kHz Flash OFF	T_A = -40 °C to 25 °C	5.5	-	µA
			MSI clock, 65 kHz f_{HCLK} = 32 kHz Flash ON	T_A = -40 °C to 25 °C	15	16	
				T_A = 85 °C	20	23	
				T_A = 105 °C	24	26	
			MSI clock, 65 kHz f_{HCLK} = 65 kHz, Flash ON	T_A = -40 °C to 25 °C	15	16	
				T_A = 85 °C	20.5	23	
				T_A = 105 °C	25.4	27	
			MSI clock, 131 kHz f_{HCLK} = 131 kHz, Flash ON	T_A = -40 °C to 25 °C	18	20	
				T_A = 55 °C	21	22	
				T_A = 85 °C	23	27	
				T_A = 105 °C	28	31	
		TIM9 and USART1 enabled, Flash ON, V_{DD} from 1.65 V to 3.6 V	MSI clock, 65 kHz f_{HCLK} = 32 kHz	T_A = -40 °C to 25 °C	15	16	
				T_A = 85 °C	20	22	
				T_A = 105 °C	24	26	
			MSI clock, 65 kHz f_{HCLK} = 65 kHz	T_A = -40 °C to 25 °C	15	16	
				T_A = 85 °C	20.5	23	
				T_A = 105 °C	25.4	27	
			MSI clock, 131 kHz f_{HCLK} = 131 kHz	T_A = -40 °C to 25 °C	18	20	
				T_A = 55 °C	21	22	
				T_A = 85 °C	23	27	
				T_A = 105 °C	28	30	
I_{DD} Max (LP Sleep)	Max allowed current in Low-power Sleep mode	V_{DD} from 1.65 V to 3.6 V	-	-	-	200	

1. Guaranteed by characterization results, unless otherwise specified.

Low-speed external user clock generated from an external source

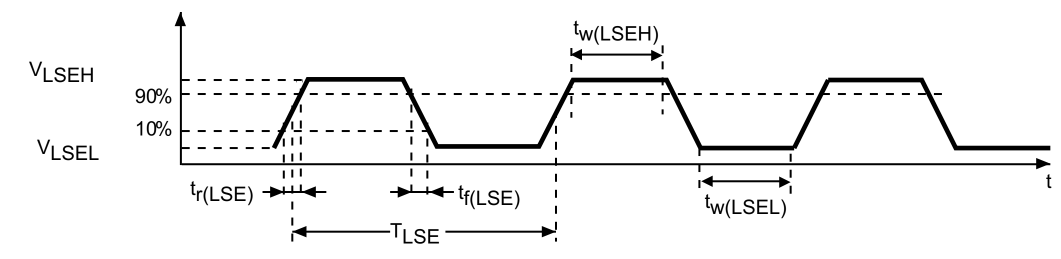
The characteristics given in the following table result from tests performed using a low-speed external clock source, and under ambient temperature and supply voltage conditions summarized in *Table 14*.

Table 28. Low-speed external user clock characteristics[1]

Symbol	Parameter	Min	Typ	Max	Unit
f_{LSE_ext}	User external clock source frequency	1	32.768	1000	kHz
V_{LSEH}	OSC32_IN input pin high level voltage	$0.7V_{DD}$	-	V_{DD}	-
V_{LSEL}	OSC32_IN input pin low level voltage	V_{SS}	-	$0.3V_{DD}$	-
$t_{w(LSEH)}$ $t_{w(LSEL)}$	OSC32_IN high or low time	465	-	-	ns
$t_{r(LSE)}$ $t_{f(LSE)}$	OSC32_IN rise or fall time	-	-	10	ns
$C_{IN(LSE)}$	OSC32_IN input capacitance	-	0.6	-	pF

1. Guaranteed by design.

Figure 16. Low-speed external clock source AC timing diagram



High-speed external clock generated from a crystal/ceramic resonator

The high-speed external (HSE) clock can be supplied with a 1 to 24 MHz crystal/ceramic resonator oscillator. All the information given in this paragraph are based on characterization results obtained with typical external components specified in *Table 29*. In the application, the resonator and the load capacitors have to be placed as close as possible to the oscillator pins in order to minimize output distortion and startup stabilization time. Refer to the crystal resonator manufacturer for more details on the resonator characteristics (frequency, package, accuracy).

Table 29. HSE oscillator characteristics[1][2]

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
f_{OSC_IN}	Oscillator frequency	-	1		24	MHz
R_F	Feedback resistor	-		200	-	kΩ

Multi-speed internal (MSI) RC oscillator

Table 33. MSI oscillator characteristics

Symbol	Parameter	Condition	Typ	Max	Unit
f_{MSI}	Frequency after factory calibration, done at V_{DD}= 3.3 V and T_A = 25 °C	MSI range 0	65.5	-	kHz
		MSI range 1	131	-	
		MSI range 2	262	-	
		MSI range 3	524	-	
		MSI range 4	1.05	-	MHz
		MSI range 5	2.1	-	
		MSI range 6	4.2	-	
ACC_{MSI}	Frequency error after factory calibration	-	±0.5	-	%
$D_{TEMP(MSI)}$(1)	MSI oscillator frequency drift 0 °C ≤T_A ≤105 °C	-	±3	-	%
$D_{VOLT(MSI)}$(1)	MSI oscillator frequency drift 1.65 V ≤V_{DD} ≤3.6 V, T_A = 25 °C	-	-	2.5	%/V
$I_{DD(MSI)}$(2)	MSI oscillator power consumption	MSI range 0	0.75	-	µA
		MSI range 1	1	-	
		MSI range 2	1.5	-	
		MSI range 3	2.5	-	
		MSI range 4	4.5	-	
		MSI range 5	8	-	
		MSI range 6	15	-	
$t_{SU(MSI)}$	MSI oscillator startup time	MSI range 0	30	-	µs
		MSI range 1	20	-	
		MSI range 2	15	-	
		MSI range 3	10	-	
		MSI range 4	6	-	
		MSI range 5	5	-	
		MSI range 6, Voltage range 1 and 2	3.5	-	
		MSI range 6, Voltage range 3	5	-	

6.3.9 Memory characteristics

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

RAM memory

Table 35. RAM and hardware registers

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
VRM	Data retention mode(1)	STOP mode (or RESET)	1.65	-	-	V

1. Minimum supply voltage without losing data stored in RAM (in Stop mode or under Reset) or in hardware registers (only in Stop mode).

Flash memory and data EEPROM

Table 36. Flash memory and data EEPROM characteristics

Symbol	Parameter	Conditions	Min	Typ	Max(1)	Unit
V_{DD}	Operating voltage Read / Write / Erase	-	1.65	-	3.6	V
t_{prog}	Programming / erasing time for byte / word / double word / half-page	Erasing	-	3.28	3.94	ms
		Programming	-	3.28	3.94	
I_{DD}	Average current during whole program/erase operation	T_A = 25 °C, V_{DD} = 3.6 V	-	300	-	µA
	Maximum current (peak) during program/erase operation		-	1.5	2.5	mA

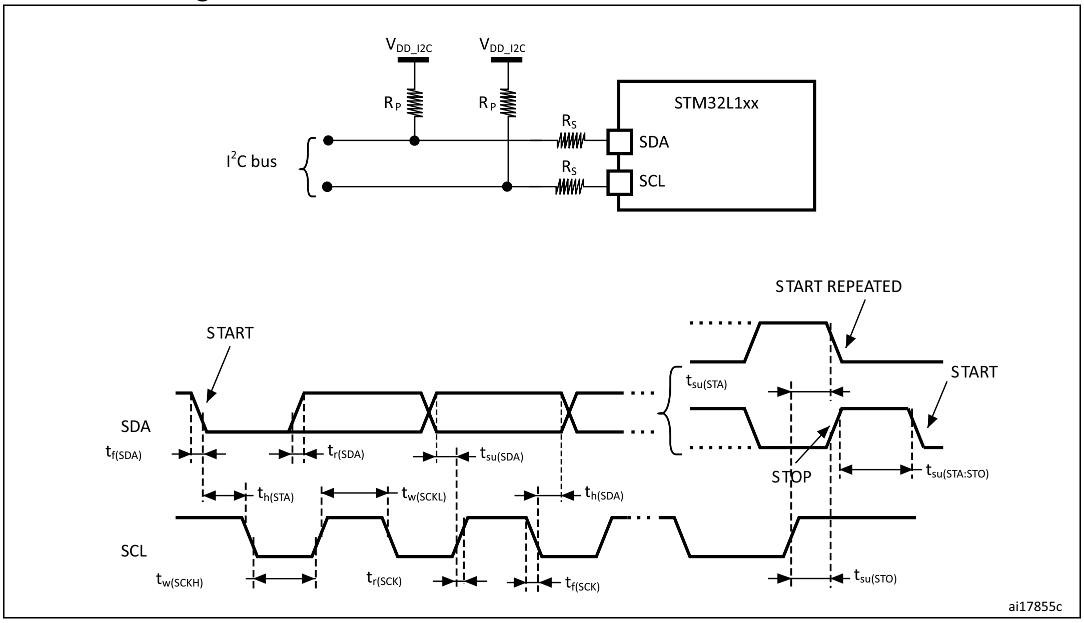
1. Guaranteed by design.

Table 37. Flash memory, data EEPROM endurance and data retention

Symbol	Parameter	Conditions	Value			Unit
			Min(1)	Typ	Max	
NCYC(2)	Cycling (erase / write) Program memory	T_A = -40°C to 105 °C	10	-	-	kcycles
	Cycling (erase / write) EEPROM data memory		300	-	-	
t_{RET}(2)	Data retention (program memory) after 10 kcycles at T_A = 85 °C	TRET = +85 °C	30	-	-	years
	Data retention (EEPROM data memory) after 300 kcycles at T_A = 85 °C		30	-	-	
	Data retention (program memory) after 10 kcycles at T_A = 105 °C	TRET = +105 °C	10	-	-	
	Data retention (EEPROM data memory) after 300 kcycles at T_A = 105 °C		10	-	-	

1. Guaranteed by characterization results.
2. Characterization is done according to JEDEC JESD22-A117.

Figure 21. I^2C bus AC waveforms and measurement circuit



1. R_S = series protection resistors
2. R_P = pull-up resistors
3. V_{DD_I2C} = I2C bus supply
4. Measurement points are done at CMOS levels: $0.3V_{DD}$ and $0.7V_{DD}$.

Table 49. SCL frequency (f_{PCLK1}= 32 MHz, $V_{DD} = V_{DD\_I2C}$ = 3.3 V)(1)(2)

f_{SCL} (kHz)	I2C_CCR value
	R_P = 4.7 kΩ
400	0x801B
300	0x8024
200	0x8035
100	0x00A0
50	0x0140
20	0x0320

1. R_P = External pull-up resistance, f_{SCL} = I^2C speed.
2. For speeds around 200 kHz, the tolerance on the achieved speed is of ±5%. For other speed ranges, the tolerance on the achieved speed is ±2%. These variations depend on the accuracy of the external components used to design the application.

Table 62. Comparator 2 characteristics

Symbol	Parameter	Conditions	Min	Typ	Max[1]	Unit
V_{DDA}	Analog supply voltage	-	1.65	-	3.6	V
V_{IN}	Comparator 2 input voltage range	-	0	-	V_{DDA}	V
t_{START}	Comparator startup time	Fast mode	-	15	20	µs
		Slow mode	-	20	25	
$t_{d\ slow}$	Propagation delay[2] in slow mode	1.65 V ≤ V_{DDA} ≤ 2.7 V	-	1.8	3.5	
		2.7 V ≤ V_{DDA} ≤ 3.6 V	-	2.5	6	
$t_{d\ fast}$	Propagation delay[2] in fast mode	1.65 V ≤ V_{DDA} ≤ 2.7 V	-	0.8	2	
		2.7 V ≤ V_{DDA} ≤ 3.6 V	-	1.2	4	
V_{offset}	Comparator offset error	-	-	±4	±20	mV
dThreshold/dt	Threshold voltage temperature coefficient	V_{DDA} = 3.3V T_A = 0 to 50 °C V- = V_{REFINT}, 3/4 V_{REFINT}, 1/2 V_{REFINT}, 1/4 V_{REFINT}	-	15	100	ppm/°C
I_{COMP2}	Current consumption[3]	Fast mode	-	3.5	5	µA
		Slow mode	-	0.5	2	

1. Guaranteed by characterization results.
2. The delay is characterized for 100 mV input step with 10 mV overdrive on the inverting input, the non-inverting input set to the reference.
3. Comparator consumption only. Internal reference voltage (necessary for comparator operation) is not included.

6.3.21 LCD controller (STM32L152x6/8/B-A devices only)

The STM32L152xx-A devices embed a built-in step-up converter to provide a constant LCD reference voltage independently from the V_{DD} voltage. An external capacitor C_{ext} must be connected to the V_{LCD} pin to decouple this converter.

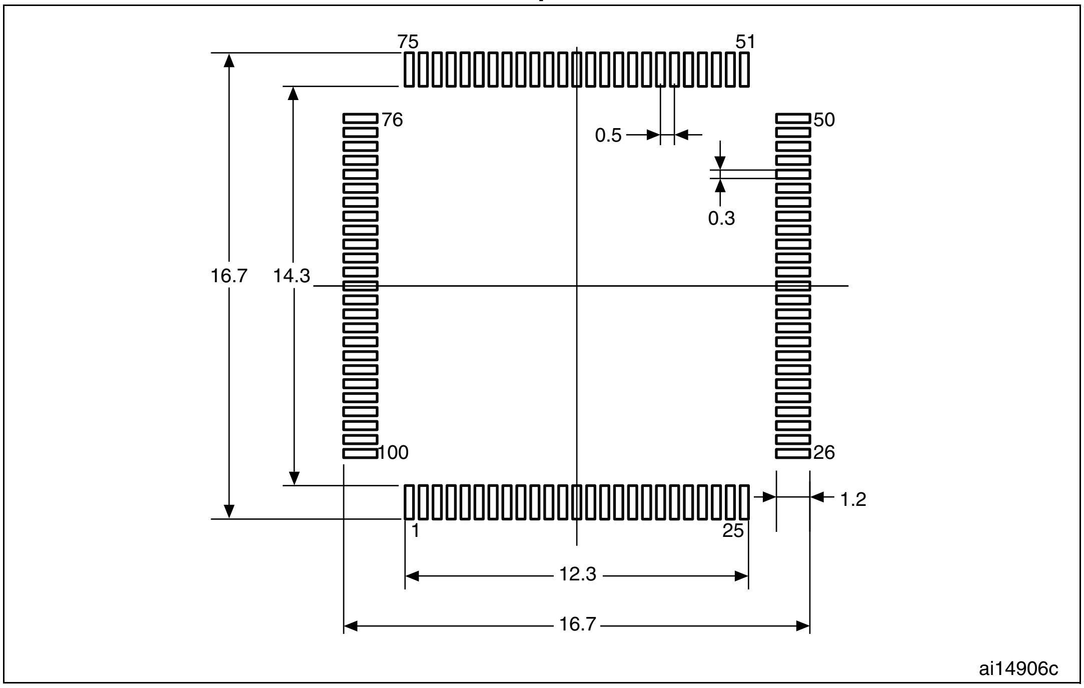
Table 63. LCD controller characteristics

Symbol	Parameter	Min	Typ	Max	Unit
V_{LCD}	LCD external voltage	-	-	3.6	V
V_{LCD0}	LCD internal reference voltage 0	-	2.6	-	V
V_{LCD1}	LCD internal reference voltage 1	-	2.73	-	V
V_{LCD2}	LCD internal reference voltage 2	-	2.86	-	V
V_{LCD3}	LCD internal reference voltage 3	-	2.98	-	V
V_{LCD4}	LCD internal reference voltage 4	-	3.12	-	V
V_{LCD5}	LCD internal reference voltage 5	-	3.26	-	V
V_{LCD6}	LCD internal reference voltage 6	-	3.4	-	V
V_{LCD7}	LCD internal reference voltage 7	-	3.55	-	V
C_{ext}	V_{LCD} external capacitance	0.1	-	2	μF
I_{LCD}(1)	Supply current at V_{DD} = 2.2 V	-	3.3	-	μA
	Supply current at V_{DD} = 3.0 V	-	3.1	-	μA
R_{Htot}(2)	Low drive resistive network overall value	5.28	6.6	7.92	MΩ
R_L(2)	High drive resistive network total value	192	240	288	kΩ
V_{44}	Segment/Common highest level voltage	-	-	V_{LCD}	V
V_{34}	Segment/Common 3/4 level voltage	-	3/4 V_{LCD}	-	V
V_{23}	Segment/Common 2/3 level voltage	-	2/3 V_{LCD}	-	V
V_{12}	Segment/Common 1/2 level voltage	-	1/2 V_{LCD}	-	V
V_{13}	Segment/Common 1/3 level voltage	-	1/3 V_{LCD}	-	V
V_{14}	Segment/Common 1/4 level voltage	-	1/4 V_{LCD}	-	V
V_0	Segment/Common lowest level voltage	0	-	-	V
ΔVxx(2)	Segment/Common level voltage error T_A = -40 to 105 °C	-	-	±50	mV

1. LCD enabled with 3 V internal step-up active, 1/8 duty, 1/4 bias, division ratio= 64, all pixels active, no LCD connected

2. Guaranteed by characterization results.

Figure 31. LQPF100 14 x 14 mm, 100-pin low-profile quad flat package recommended footprint

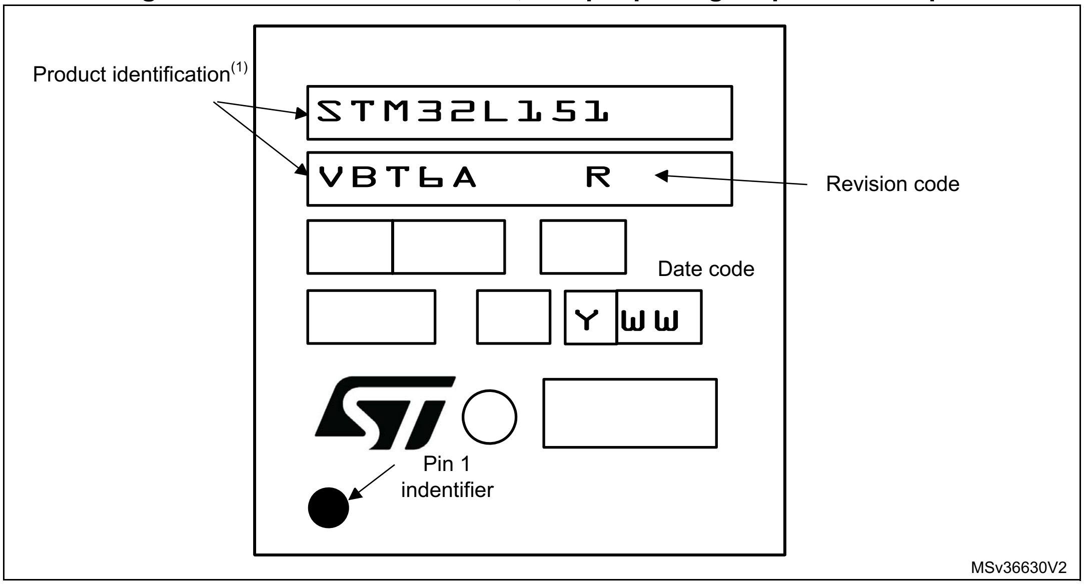


1. Dimensions are in millimeters.

LQFP100 device Marking

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

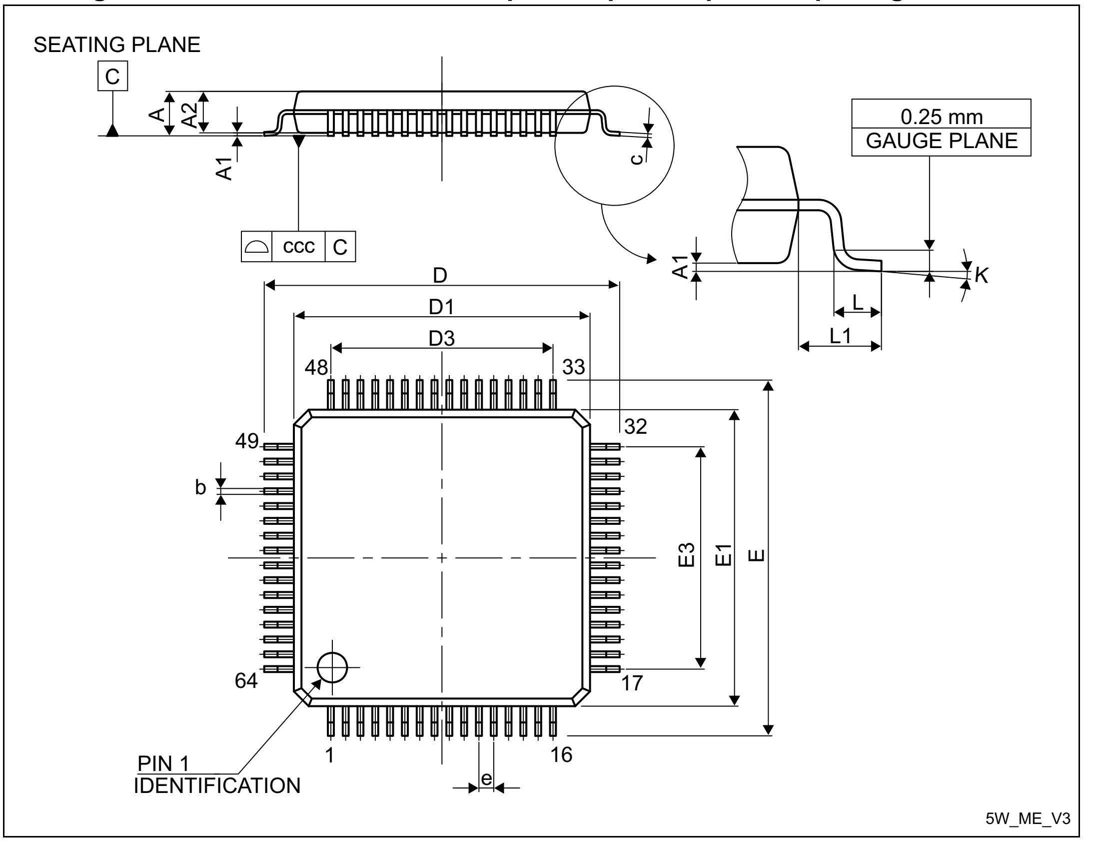
Figure 32. LQFP100 14 x 14 mm, 100-pin package top view example



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.

7.2 LQFP64 10 x 10 mm, 64-pin low-profile quad flat package information

Figure 33. LQFP64 10 x 10 mm, 64-pin low-profile quad flat package outline



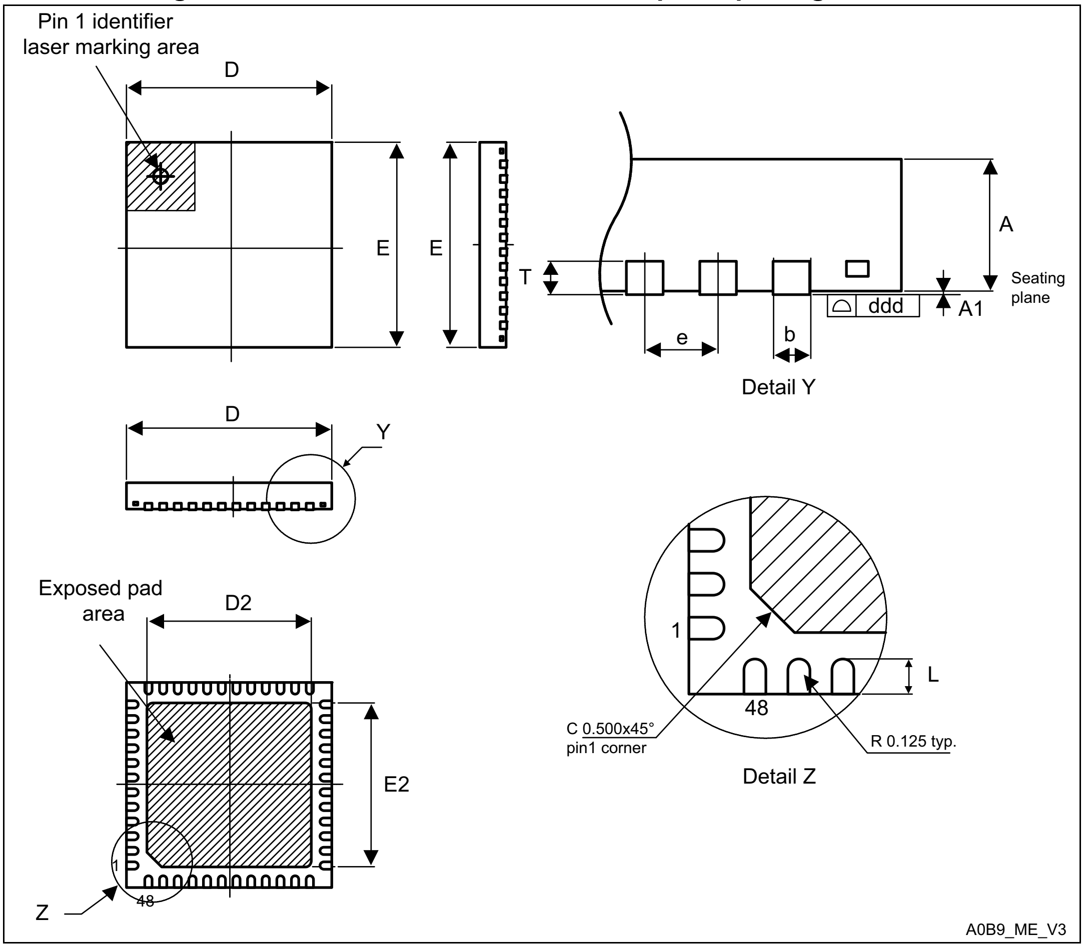
1. Drawing is not to scale.

Table 65. LQFP64 10 x 10 mm, 64-pin low-profile quad flat package mechanical data

Symbol	millimeters			inches(1)		
	Min	Typ	Max	Typ	Min	Max
A	-	-	1.600	-	-	0.0630
A1	0.050	-	0.150	0.0020	-	0.0059
A2	1.350	1.400	1.450	0.0531	0.0551	0.0571
b	0.170	0.220	0.270	0.0067	0.0087	0.0106
c	0.090	-	0.200	0.0035	-	0.0079
D	-	12.000	-	-	0.4724	-
D1	-	10.000	-	-	0.3937	-
D3	-	7.500	-	-	0.2953	-
E	-	12.000	-	-	0.4724	-
E1	-	10.000	-	-	0.3937	-

7.4 UFQFPN48 7 x 7 mm, 0.5 mm pitch, package information

Figure 39. UFQFPN48 7 x 7 mm, 0.5 mm pitch, package outline

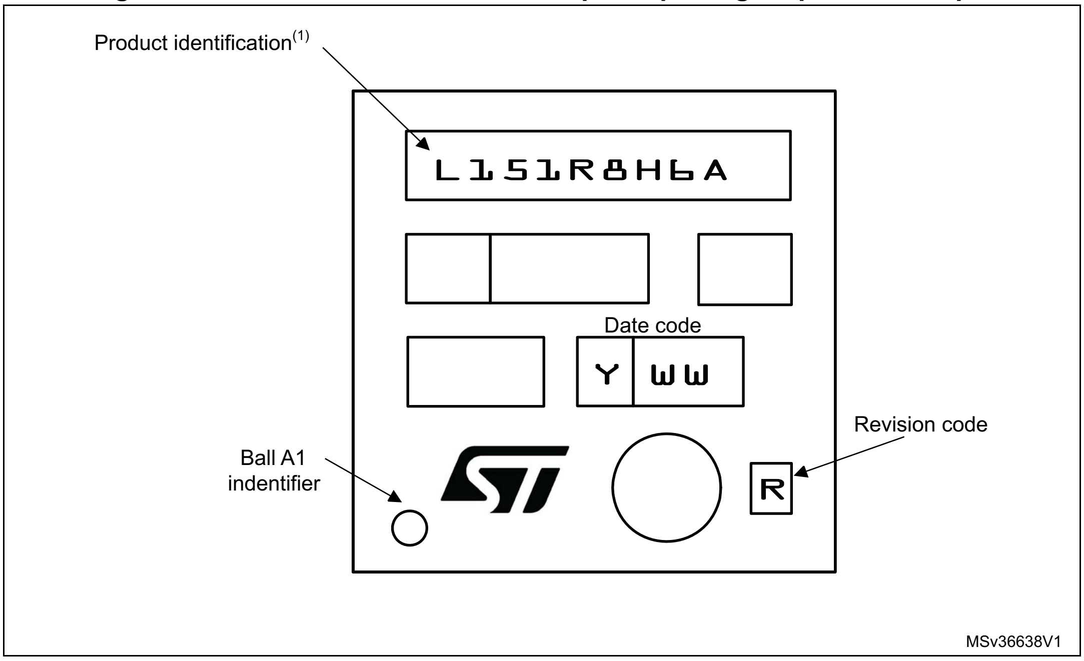


1. Drawing is not to scale.
2. All leads/pads should also be soldered to the PCB to improve the lead/pad solder joint life.
3. There is an exposed die pad on the underside of the UFQFPN package. It is recommended to connect and solder this back-side pad to PCB ground.

TFBGA64 device marking

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

Figure 47. TFBGA64 5 x 5 mm, 0.5 mm pitch, 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.

9 Revision history

Table 74. Document revision history

Date	Revision	Changes
04-Feb-2014	1	Initial release.
12-Mar-2014	2	Updated *Section 3.5: Low-power real-time clock and backup registers*, *Section 6.1.2: Typical values* and *Section 6.3.4: Supply current characteristics*. Updated *General PCB design guidelines*. Updated *Table 5: Working mode-dependent functionalities (from Run/active down to standby)*, *Table 14: General operating conditions*, *Table 21: Current consumption in Low-power run mode*, *Table 22: Current consumption in Low-power sleep mode*, *Table 23: Typical and maximum current consumptions in Stop mode*, *Table 24: Typical and maximum current consumptions in Standby mode*, *Table 25: Peripheral current consumption*, *Table 42: I/O current injection susceptibility*, *Table 66: I/O static characteristics* and *Table 46: NRST pin characteristics*. Updated *Figure 14: Current consumption measurement scheme*.
04-Feb-2015	3	Updated DMIPS features in cover page and *Section 2: Description*. Updated max temperature at 105°C instead of 85°C in the whole datasheet. Updated current consumption in *Table 20: Current consumption in Sleep mode*. Updated *Table 25: Peripheral current consumption* with new measured values. Updated *Table 57: Maximum source impedance RAIN max* adding note 2. Updated *Section 7: Package information* with new package device marking. Updated *Figure 9: Memory map*.