

### Silicon identification

This errata sheet applies to the revisions 'A', 'Z' and '1' of STMicroelectronics STM32F405xx/STM32F407xx and STM32F415xx/STM32F417xx microcontroller families. In this document, they will be referred to as STM32F40x and STM32F41x, respectively, unless otherwise specified.

The STM32F40x and STM32F41x families feature an ARM® 32-bit Cortex™-M4 core with FPU, for which an errata notice is also available (see [Section 1](#) for details).

The full list of part numbers is shown in [Table 2](#). The products are identifiable as shown in [Table 1](#):

- by the revision code marked below the order code on the device package
- by the last three digits of the Internal order code printed on the box label

**Table 1. Device identification<sup>(1)</sup>**

Order code	Revision code marked on device <sup>(2)</sup>
STM32F405xx, STM32F407xx	'A', 'Z', '1'
STM32F415xx, STM32F417xx	

1. The REV\_ID bits in the DBGMCU\_IDCODE register show the revision code of the device (see the STM32F40x and STM32F41x reference manual for details on how to find the revision code).
2. Refer to [Appendix A: Revision code on device marking](#) for details on how to identify the revision code and the date code on the different packages.

**Table 2. Device summary**

Reference	Part number
STM32F405xx	STM32F405OG, STM32F405OE, STM32F405RG, STM32F405VG, STM32F405ZG
STM32F407xx	STM32F407IG, STM32F407VG, STM32F407ZG, STM32F407ZE, STM32F407IE, STM32F407VE
STM32F415xx	STM32F415OG, STM32F415RG, STM32F415VG, STM32F415ZG
STM32F417xx	STM32F417VG, STM32F417IG, STM32F417ZG, STM32F417VE, STM32F417ZE, STM32F417IE

# Contents

<b>1</b>	<b>ARM 32-bit Cortex-M4 with FPU limitations</b>	<b>7</b>
1.1	Cortex-M4 interrupted loads to stack pointer can cause erroneous behavior	7
<b>2</b>	<b>STM32F40x and STM32F41x silicon limitations</b>	<b>8</b>
2.1	System limitations	10
2.1.1	ART Accelerator prefetch queue instruction is not supported	10
2.1.2	MCU device ID is incorrect	11
2.1.3	Debugging Stop mode and system tick timer	11
2.1.4	Debugging Stop mode with WFE entry	11
2.1.5	Wakeup sequence from Standby mode when using more than one wakeup source	12
2.1.6	Full JTAG configuration without NJTRST pin cannot be used	12
2.1.7	PDR_ON pin not available on LQFP100 package for revision Z devices	12
2.1.8	Incorrect BOR option byte when consecutively programming BOR option byte	13
2.1.9	Configuration of PH10 and PI10 as external interrupts is erroneous	13
2.1.10	DMA2 data corruption when managing AHB and APB peripherals in a concurrent way	13
2.1.11	Slowing down APB clock during a DMA transfer	14
2.1.12	MPU attribute to RTC and IWDG registers could be managed incorrectly	14
2.1.13	Delay after an RCC peripheral clock enabling	14
2.1.14	Battery charge monitoring lower than 2.4 Volts	15
2.1.15	Internal noise impacting the ADC accuracy	15
2.2	IWDG peripheral limitation	15
2.2.1	RVU and PVU flags are not reset in STOP mode	15
2.3	I2C peripheral limitations	16
2.3.1	SMBus standard not fully supported	16
2.3.2	Start cannot be generated after a misplaced Stop	16
2.3.3	Mismatch on the "Setup time for a repeated Start condition" timing parameter	16
2.3.4	Data valid time ( $t_{VD;DAT}$ ) violated without the OVR flag being set	17
2.3.5	Both SDA and SCL maximum rise time ( $t_r$ ) violated when VDD_I2C bus higher than $((VDD+0.3) / 0.7)$ V	18

2.4	I2S peripheral limitation	18
2.4.1	In I2S slave mode, WS level must be set by the external master when enabling the I2S	18
2.4.2	I2S2 in full-duplex mode may not work properly when SCK and WS signals are mapped on PI1 and PI0 respectively	19
2.5	USART peripheral limitations	19
2.5.1	Idle frame is not detected if receiver clock speed is deviated	19
2.5.2	In full duplex mode, the Parity Error (PE) flag can be cleared by writing to the data register	19
2.5.3	Parity Error (PE) flag is not set when receiving in Mute mode using address mark detection	20
2.5.4	Break frame is transmitted regardless of nCTS input line status	20
2.5.5	nRTS signal abnormally driven low after a protocol violation	20
2.6	OTG_FS peripheral limitations	21
2.6.1	Data in RxFIFO is overwritten when all channels are disabled simultaneously	21
2.6.2	OTG host blocks the receive channel when receiving IN packets and no TxFIFO is configured	21
2.6.3	Host channel-halted interrupt not generated when the channel is disabled	21
2.6.4	Error in software-read OTG_FS_DCFG register values	22
2.7	Ethernet peripheral limitations	22
2.7.1	Incorrect layer 3 (L3) checksum is inserted in transmitted IPv6 packets without TCP, UDP or ICMP payloads	22
2.7.2	The Ethernet MAC processes invalid extension headers in the received IPv6 frames	22
2.7.3	MAC stuck in the Idle state on receiving the TxFIFO flush command exactly 1 clock cycle after a transmission completes	23
2.7.4	Transmit frame data corruption	23
2.7.5	Successive write operations to the same register might not be fully taken into account	24
2.8	FSMC peripheral limitation	26
2.8.1	Dummy read cycles inserted when reading synchronous memories	26
2.8.2	FSMC synchronous mode and NWAIT signal disabled	27
2.8.3	FSMC NOR Flash/PSRAM controller asynchronous access on bank 2 to 4 when bank 1 is in synchronous mode (CBURSTRW bit is set)	27
2.9	SDIO peripheral limitations	27
2.9.1	SDIO HW flow control	27
2.9.2	Wrong CCRCFAIL status after a response without CRC is received	28

---

2.9.3	SDIO clock divider BYPASS mode may not work properly . . . . .	28
2.9.4	Data corruption in SDIO clock dephasing (NEGEDGE) mode . . . . .	28
2.9.5	CE-ATA multiple write command and card busy signal management . .	28
2.9.6	No underrun detection with wrong data transmission . . . . .	29
2.10	ADC peripheral limitations . . . . .	29
2.10.1	ADC sequencer modification during conversion . . . . .	29
2.11	DAC peripheral limitations . . . . .	30
2.11.1	DMA underrun flag management . . . . .	30
2.11.2	DMA request not automatically cleared by DMAEN=0 . . . . .	30
<b>Appendix A Revision code on device marking . . . . .</b>		<b>31</b>
<b>Revision history . . . . .</b>		<b>35</b>

List of tables

Table 1. Device identification . . . . . 1

Table 2. Device summary . . . . . 1

Table 3. Cortex-M4 core limitations and impact on microcontroller behavior . . . . . 7

Table 4. Summary of silicon limitations . . . . . 8

Table 5. Impacted registers and bits. . . . . 24

Table 6. Document revision history . . . . . 35

List of figures

Figure 1. UFBGA176 top package view. . . . . 31

Figure 2. LQFP176 top package view . . . . . 32

Figure 3. LQFP144 top package view . . . . . 32

Figure 4. LQFP100 top package view . . . . . 33

Figure 5. LQFP64 top package view . . . . . 33

Figure 6. WLCSP90 top package view . . . . . 34



# 1 ARM 32-bit Cortex-M4 with FPU limitations

An errata notice of the STM32F40x and STM32F41x core is available from the following web address:

[http://infocenter.arm.com/help/topic/com.arm.doc.ddi0439b\\_errata\\_01/index.html](http://infocenter.arm.com/help/topic/com.arm.doc.ddi0439b_errata_01/index.html).

All the described limitations are minor and related to the revision r0p1-v1 of the CortexM4 core. [Table 3](#) summarizes these limitations and their implications on the behavior of STM32F40x and STM32F41x devices.

**Table 3. Cortex-M4 core limitations and impact on microcontroller behavior**

ARM ID	ARM category	ARM summary of errata	Impact on STM32F40x and STM32F41x
752419	Cat 2	Interrupted loads to SP can cause erroneous behavior	Minor

## 1.1 Cortex-M4 interrupted loads to stack pointer can cause erroneous behavior

### Description

An interrupt occurring during the data-phase of a single word load to the stack pointer (SP/R13) can cause an erroneous behavior of the device. In addition, returning from the interrupt results in the load instruction being executed an additional time.

For all the instructions performing an update of the base register, the base register is erroneously updated on each execution, resulting in the stack pointer being loaded from an incorrect memory location.

The instructions affected by this limitation are the following:

- LDR SP, [Rn],#imm
- LDR SP, [Rn,#imm]!
- LDR SP, [Rn,#imm]
- LDR SP, [Rn]
- LDR SP, [Rn,Rm]

### Workaround

As of today, no compiler generates these particular instructions. This limitation can only occur with hand-written assembly code.

Both limitations can be solved by replacing the direct load to the stack pointer by an intermediate load to a general-purpose register followed by a move to the stack pointer.

Example:

Replace LDR SP, [R0] by

LDR R2,[R0]

MOV SP,R2

## 2 STM32F40x and STM32F41x silicon limitations

[Table 4](#) gives quick references to all documented limitations.

Legend for [Table 4](#): A = workaround available; N = no workaround available; P = partial workaround available, '-' and grayed = fixed.

**Table 4. Summary of silicon limitations**

Links to silicon limitations		Revision A	Revision Z and 1
Section 2.1: System limitations	<a href="#">Section 2.1.1: ART Accelerator prefetch queue instruction is not supported</a>	N	-
	<a href="#">Section 2.1.2: MCU device ID is incorrect</a>	A	-
	<a href="#">Section 2.1.3: Debugging Stop mode and system tick timer</a>	A	A
	<a href="#">Section 2.1.4: Debugging Stop mode with WFE entry</a>	A	A
	<a href="#">Section 2.1.5: Wakeup sequence from Standby mode when using more than one wakeup source</a>	A	A
	<a href="#">Section 2.1.6: Full JTAG configuration without NJTRST pin cannot be used</a>	A	A
	<a href="#">Section 2.1.7: PDR_ON pin not available on LQFP100 package for revision Z devices</a>	-	N
	<a href="#">Section 2.1.8: Incorrect BOR option byte when consecutively programming BOR option byte</a>	A	A
	<a href="#">Section 2.1.9: Configuration of PH10 and PI10 as external interrupts is erroneous</a>	N	N
	<a href="#">Section 2.1.10: DMA2 data corruption when managing AHB and APB peripherals in a concurrent way</a>	A	A
	<a href="#">Section 2.1.11: Slowing down APB clock during a DMA transfer</a>	A	A
	<a href="#">Section 2.1.12: MPU attribute to RTC and IWDG registers could be managed incorrectly</a>	A	A
	<a href="#">Section 2.1.13: Delay after an RCC peripheral clock enabling</a>	A	A
	<a href="#">Section 2.1.14: Battery charge monitoring lower than 2.4 Volts</a>	P	P
	<a href="#">Section 2.1.15: Internal noise impacting the ADC accuracy</a>	A	A
Section 2.2: IWDG peripheral limitation	<a href="#">Section 2.2.1: RVU and PVU flags are not reset in STOP mode</a>	A	A



Table 4. Summary of silicon limitations (continued)

Links to silicon limitations		Revision A	Revision Z and 1
Section 2.3: I2C peripheral limitations	Section 2.3.1: SMBus standard not fully supported	A	A
	Section 2.3.2: Start cannot be generated after a misplaced Stop	A	A
	Section 2.3.3: Mismatch on the "Setup time for a repeated Start condition" timing parameter	A	A
	Section 2.3.4: Data valid time (tVD;DAT) violated without the OVR flag being set	A	A
	Section 2.3.5: Both SDA and SCL maximum rise time (tr) violated when VDD_I2C bus higher than $((VDD+0.3) / 0.7)$ V	A	A
Section 2.4: I2S peripheral limitation	Section 2.4.1: In I2S slave mode, WS level must be set by the external master when enabling the I2S	A	A
	Section 2.4.2: I2S2 in full-duplex mode may not work properly when SCK and WS signals are mapped on PI1 and PI0 respectively	A	A
Section 2.5: USART peripheral limitations	Section 2.5.1: Idle frame is not detected if receiver clock speed is deviated	N	N
	Section 2.5.2: In full duplex mode, the Parity Error (PE) flag can be cleared by writing to the data register	A	A
	Section 2.5.3: Parity Error (PE) flag is not set when receiving in Mute mode using address mark detection	N	N
	Section 2.5.4: Break frame is transmitted regardless of nCTS input line status	N	N
	Section 2.5.5: nRTS signal abnormally driven low after a protocol violation	A	A
Section 2.6: OTG_FS peripheral limitations	Section 2.6.1: Data in RxFIFO is overwritten when all channels are disabled simultaneously	A	A
	Section 2.6.2: OTG host blocks the receive channel when receiving IN packets and no TxFIFO is configured	A	A
	Section 2.6.3: Host channel-halted interrupt not generated when the channel is disabled	A	A
	Section 2.6.4: Error in software-read OTG_FS_DCFG register values	A	A
Section 2.7: Ethernet peripheral limitations	Section 2.7.1: Incorrect layer 3 (L3) checksum is inserted in transmitted IPv6 packets without TCP, UDP or ICMP payloads	A	A
	Section 2.7.2: The Ethernet MAC processes invalid extension headers in the received IPv6 frames	N	N
	Section 2.7.3: MAC stuck in the Idle state on receiving the TxFIFO flush command exactly 1 clock cycle after a transmission completes	A	A
	Section 2.7.4: Transmit frame data corruption	A	A
	Section 2.7.5: Successive write operations to the same register might not be fully taken into account	A	A

Table 4. Summary of silicon limitations (continued)

Links to silicon limitations		Revision A	Revision Z and 1
Section 2.8: FSMC peripheral limitation	<a href="#">Section 2.8.1: Dummy read cycles inserted when reading synchronous memories</a>	N	N
	<a href="#">Section 2.8.2: FSMC synchronous mode and NWAIT signal disabled</a>	A	A
	<a href="#">Section 2.8.3: FSMC NOR Flash/PSRAM controller asynchronous access on bank 2 to 4 when bank 1 is in synchronous mode (CBURSTRW bit is set)</a>	A	A
Section 2.9: SDIO peripheral limitations	<a href="#">Section 2.9.1: SDIO HW flow control</a>	N	N
	<a href="#">Section 2.9.2: Wrong CCRCFAIL status after a response without CRC is received</a>	A	A
	<a href="#">Section 2.9.3: SDIO clock divider BYPASS mode may not work properly</a>	A	A
	<a href="#">Section 2.9.4: Data corruption in SDIO clock dephasing (NEGEDGE) mode</a>	N	N
	<a href="#">Section 2.9.5: CE-ATA multiple write command and card busy signal management</a>	A	A
	<a href="#">Section 2.9.6: No underrun detection with wrong data transmission</a>	A	A
Section 2.10: ADC peripheral limitations	<a href="#">Section 2.10.1: ADC sequencer modification during conversion</a>	A	A
Section 2.11: DAC peripheral limitations	<a href="#">Section 2.11.1: DMA underrun flag management</a>	A	A
	<a href="#">Section 2.11.2: DMA request not automatically cleared by DMAEN=0</a>	A	A

## 2.1 System limitations

### 2.1.1 ART Accelerator prefetch queue instruction is not supported

#### Description

The ART Accelerator prefetch queue instruction is not supported on revision A devices.

This limitation does not prevent the ART Accelerator from using the cache enable/disable capability and the selection of the number of wait states according to the system frequency.

#### Workaround

- Revision A devices: none
- Revision Z and 1 devices: fixed.

### 2.1.2 MCU device ID is incorrect

#### Description

On revision A devices, the STM32F40x and STM32F41x have the same MCU device ID as the STM32F20x and STM32F21x devices. On revision A devices, when reading the Revision identifier, this will return 0x2000 instead of 0x1000. The device ID and revision ID can be read from address 0xE0042000.

#### Workaround

- Revision A devices  
To differentiate the STM32F4xxx from the STM32F2xxx series, read the MCU device ID and the Core Device.
  - For STM32F2xxx  
MCU device ID = STM32F2xxx device ID  
Core Device = CortexM3
  - For STM32F4xxx  
MCU device ID = STM32F4xxx device ID  
Core Device = CortexM4
- Revision Z and 1 devices: fixed.

### 2.1.3 Debugging Stop mode and system tick timer

#### Description

If the system tick timer interrupt is enabled during the Stop mode debug (DBG\_STOP bit set in the DBGMCU\_CR register), it will wake up the system from Stop mode.

#### Workaround

To debug the Stop mode, disable the system tick timer interrupt.

### 2.1.4 Debugging Stop mode with WFE entry

#### Description

When the Stop debug mode is enabled (DBG\_STOP bit set in the DBGMCU\_CR register), this allows software debugging during Stop mode.

However, if the application software uses the WFE instruction to enter Stop mode, after wakeup some instructions could be missed if the WFE is followed by sequential instructions. This affects only Stop debug mode with WFE entry.

#### Workaround

To debug Stop mode with WFE entry, the WFE instruction must be inside a dedicated function with 1 instruction (NOP) between the execution of the WFE and the Bx LR.

Example:

```
__asm void _WFE(void) {  
WFE
```

NOP  
BX lr }

### 2.1.5 Wakeup sequence from Standby mode when using more than one wakeup source

#### Description

The various wakeup sources are logically OR-ed in front of the rising-edge detector which generates the wakeup flag (WUF). The WUF needs to be cleared prior to Standby mode entry, otherwise the MCU wakes up immediately.

If one of the configured wakeup sources is kept high during the clearing of the WUF (by setting the CWUF bit), it may mask further wakeup events on the input of the edge detector. As a consequence, the MCU might not be able to wake up from Standby mode.

#### Workaround

To avoid this problem, the following sequence should be applied before entering Standby mode:

- Disable all used wakeup sources,
- Clear all related wakeup flags,
- Re-enable all used wakeup sources,
- Enter Standby mode

*Note: Be aware that, when applying this workaround, if one of the wakeup sources is still kept high, the MCU enters Standby mode but then it wakes up immediately generating a power reset.*

### 2.1.6 Full JTAG configuration without NJTRST pin cannot be used

#### Description

When using the JTAG debug port in debug mode, the connection with the debugger is lost if the NJTRST pin (PB4) is used as a GPIO. Only the 4-wire JTAG port configuration is impacted.

#### Workaround

Use the SWD debug port instead of the full 4-wire JTAG port.

### 2.1.7 PDR\_ON pin not available on LQFP100 package for revision Z devices

#### Description

On revision Z devices, the PDR\_ON pin (pin 99) available on LQFP100 package is replaced by V<sub>SS</sub>. As a consequence, the POR/PDR feature is always enabled.

**Workaround**

- Applications using on revision A devices with PDR\_ON pin connected to V<sub>DD</sub> (POR/PDR feature enabled)  
Connect the former PDR\_ON pin to V<sub>SS</sub> on revision Z devices.
- Applications using revision A devices with PDR\_ON pin connected to V<sub>SS</sub> (POR/PDR feature disabled)  
No modification is required when migrating to revision Z devices. However, it is no longer possible to supply the product from a 1.7 V V<sub>DD</sub> on LQFP100 package since V<sub>DD</sub> minimum value is 1.8 V when the POR/PDR feature is enabled.

**2.1.8 Incorrect BOR option byte when consecutively programming BOR option byte****Description**

When the AHB prescaler is greater than 2, and consecutive BOR option byte program operations are performed without resetting the device, then an incorrect value might be programmed in the BOR option byte.

**Workaround**

To program consecutive BOR option byte values, either configure the AHB prescaler to 1 or 2, or perform a system reset between each BOR option byte program operation.

**2.1.9 Configuration of PH10 and PI10 as external interrupts is erroneous****Description**

PH10 or PI10 is selected as the source for the EXTI10 external interrupt by setting bits EXTI10[3:0] of SYSCFG\_EXTICR3 register to 0x0111 or 0x1000, respectively. However, this erroneous operation enables PH2 and PI2 as external interrupt inputs.

As a result, it is not possible to use PH10/PI10 as interrupt sources if PH2/PI2 are not selected as the interrupt source, as well. This means that bits EXTI10[3:0] of SYSCFG\_EXTICR3 register and bits EXTI2[3:0] of SYSCFG\_EXTICR1 should be programmed to the same value:

- 0x0111 to select PH10/PH2
- 0x1000 to select PI10/PI2

**Workaround**

None.

**2.1.10 DMA2 data corruption when managing AHB and APB peripherals in a concurrent way****Description**

When the DMA2 is managing AHB Peripherals (only peripherals embedding FIFOs) and also APB transfers in a concurrent way, this generates a data corruption (multiple DMA access).

When this condition occurs:

- The data transferred by the DMA to the AHB peripherals could be corrupted in case of a FIFO target.
- For memories, it will result in multiple access (not visible by the Software) and the data is not corrupted.
- For the DCMI, a multiple unacknowledged request could be generated, which implies an unknown behavior of the DMA.

AHB peripherals embedding FIFO are DCMI, CRYPTO, and HASH. On sales types without CRYPTO, only the DCMI is impacted. External FIFO controlled by the FSMC is also impacted.

### **Workaround**

Avoid concurrent AHB (DCMI, CRYPTO, HASH, FSMC with external FIFO) and APB transfer management using the DMA2.

## **2.1.11 Slowing down APB clock during a DMA transfer**

### **Description**

When the CPU modifies the APB clock (slows down the clock: changes AHB/APB prescaler from 1 to 2, 1 to 4, 1 to 8 or 1 to 16) while the DMA is performing a write access to the same APB peripherals, the current DMA transfer will be blocked. Only system reset will recover.

### **Workaround**

Before slowing down the APB clock, wait until the end of the DMA transfer on this APB.

## **2.1.12 MPU attribute to RTC and IWDG registers could be managed incorrectly**

### **Description**

If the MPU is used and the non bufferable attribute is set to the RTC or IWDG memory map region, the CPU access to the RTC or IWDG registers could be treated as bufferable, provided that there is no APB prescaler configured (AHB/APB prescaler is equal to 1).

### **Workaround**

If the non bufferable attribute is required for these registers, the software could perform a read after the write to guaranty the completion of the write access.

## **2.1.13 Delay after an RCC peripheral clock enabling**

### **Description**

A delay between an RCC peripheral clock enable and the effective peripheral enabling should be taken into account in order to manage the peripheral read/write to registers.

This delay depends on the peripheral's mapping:

- If the peripheral is mapped on AHB: the delay should be equal to 2 AHB cycles.
- If the peripheral is mapped on APB: the delay should be equal to 1 + (AHB/APB prescaler) cycles.

**Workarounds**

1. Use the DSB instruction to stall the Cortex-M CPU pipeline until the instruction is completed.
2. Insert “n” NOPs between the RCC enable bit write and the peripheral register writes (n = 2 for AHB peripherals, n = 1 + AHB/APB prescaler in case of APB peripherals).

**2.1.14 Battery charge monitoring lower than 2.4 Volts****Description**

If ( $V_{DD} = V_{DDA}$ ) is lower than or equal to 2.4 V, the  $V_{BAT}$  conversion correctness is not guaranteed in full temperature and voltage ranges. When  $V_{BAT}$  is set, the voltage divider bridge is enabled and  $V_{BAT}/2$  is connected to the ADC input. In order to monitor the battery charge correctly, the input of the ADC must not be higher than ( $V_{DDA} - 0.6$  V).

Thus,  $V_{BAT}/2 < V_{DD} - 0.6$  V implies that  $V_{DD} > 2.4$  V.

**Workaround**

None. ( $V_{DD} = V_{DDA}$ ) should be greater than 2.4 V.

**2.1.15 Internal noise impacting the ADC accuracy****Description**

An internal noise generated on  $V_{DD}$  supplies and propagated internally may impact the ADC accuracy.

This noise is always active whatever the power mode of the MCU (RUN or Sleep).

**Workarounds**

Two steps could be followed to adapt the accuracy level to the application requirements:

1. Configure the Flash ART as Prefetch OFF and (Data + Instruction) cache ON.
2. Use averaging and filtering algorithms on ADC output codes.

For more workaround details of this limitation, refer to AN4073.

**2.2 IWDG peripheral limitation****2.2.1 RVU and PVU flags are not reset in STOP mode****Description**

The RVU and PVU flags of the IWDG\_SR register are set by hardware after a write access to the IWDG\_RLR and the IWDG\_PR registers, respectively. If the Stop mode is entered immediately after the write access, the RVU and PVU flags are not reset by hardware.

Before performing a second write operation to the IWDG\_RLR or the IWDG\_PR register, the application software must wait for the RVU or PVU flag to be reset. However, since the RVU/PVU bit is not reset after exiting the Stop mode, the software goes into an infinite loop and the independent watchdog (IWDG) generates a reset after the programmed timeout period.

**Workaround**

Wait until the RVU or PVU flag of the IWDG\_SR register is reset before entering the Stop mode.

## **2.3 I2C peripheral limitations**

### **2.3.1 SMBus standard not fully supported**

**Description**

The I<sup>2</sup>C peripheral is not fully compliant with the SMBus v2.0 standard since It does not support the capability to NACK an invalid byte/command.

**Workarounds**

A higher-level mechanism should be used to verify that a write operation is being performed correctly at the target device, such as:

1. Using the SMBAL pin if supported by the host
2. the alert response address (ARA) protocol
3. the Host notify protocol

### **2.3.2 Start cannot be generated after a misplaced Stop**

**Description**

If a master generates a misplaced Stop on the bus (bus error), the peripheral cannot generate a Start anymore.

**Workaround**

In the I<sup>2</sup>C standard, it is allowed to send a Stop only at the end of the full byte (8 bits + acknowledge), so this scenario is not allowed. Other derived protocols like CBUS allow it, but they are not supported by the I<sup>2</sup>C peripheral.

A software workaround consists in asserting the software reset using the SWRST bit in the I2C\_CR1 control register.

### **2.3.3 Mismatch on the “Setup time for a repeated Start condition” timing parameter**

**Description**

In case of a repeated Start, the “Setup time for a repeated Start condition” (named Tsu;sta in the I<sup>2</sup>C specification) can be slightly violated when the I<sup>2</sup>C operates in Master Standard mode at a frequency between 88 kHz and 100 kHz.



The limitation can occur only in the following configuration:

- in Master mode
- in Standard mode at a frequency between 88 kHz and 100 kHz (no limitation in Fast-mode)
- SCL rise time:
  - If the slave does not stretch the clock and the SCL rise time is more than 300 ns (if the SCL rise time is less than 300 ns, the limitation cannot occur)
  - If the slave stretches the clock

The setup time can be violated independently of the APB peripheral frequency.

### Workaround

Reduce the frequency down to 88 kHz or use the I<sup>2</sup>C Fast-mode, if supported by the slave.

## 2.3.4 Data valid time ( $t_{VD;DAT}$ ) violated without the OVR flag being set

### Description

The data valid time ( $t_{VD;DAT}$ ,  $t_{VD;ACK}$ ) described by the I<sup>2</sup>C standard can be violated (as well as the maximum data hold time of the current data ( $t_{HD;DAT}$ )) under the conditions described below. This violation cannot be detected because the OVR flag is not set (no transmit buffer underrun is detected).

This limitation can occur only under the following conditions:

- in Slave transmit mode
- with clock stretching disabled (NOSTRETCH=1)
- if the software is late to write the DR data register, but not late enough to set the OVR flag (the data register is written before)

### Workaround

If the master device allows it, use the clock stretching mechanism by programming the bit NOSTRETCH=0 in the I2C\_CR1 register.

If the master device does not allow it, ensure that the software is fast enough when polling the TXE or ADDR flag to immediately write to the DR data register. For instance, use an interrupt on the TXE or ADDR flag and boost its priority to the higher level.

### 2.3.5 Both SDA and SCL maximum rise time ( $t_r$ ) violated when VDD\_I2C bus higher than $((V_{DD}+0.3) / 0.7)$ V

#### Description

When an external legacy I<sup>2</sup>C bus voltage (VDD\_I2C) is set to 5 V while the MCU is powered from V<sub>DD</sub>, the internal 5-Volt tolerant circuitry is activated as soon the input voltage (V<sub>IN</sub>) reaches the V<sub>DD</sub> + diode threshold level. An additional internal large capacitance then prevents the external pull-up resistor (R<sub>P</sub>) from rising the SDA and SCL signals within the maximum timing ( $t_r$ ) which is 300 ns in fast mode and 1000 ns in Standard mode.

The rise time ( $t_r$ ) is measured from V<sub>IL</sub> and V<sub>IH</sub> with levels set at 0.3VDD\_I2C and 0.7VDD\_I2C.

#### Workaround

The external VDD\_I2C bus voltage should be limited to a maximum value of  $((V_{DD}+0.3) / 0.7)$  V. As a result, when the MCU is powered from V<sub>DD</sub>=3.3 V, VDD\_I2C should not exceed 5.14 V to be compliant with I<sup>2</sup>C specifications.

## 2.4 I2S peripheral limitation

### 2.4.1 In I2S slave mode, WS level must be set by the external master when enabling the I2S

#### Description

In slave mode, the WS signal level is used only to start the communication. If the I2S (in slave mode) is enabled while the master is already sending the clock and the WS signal level is low (for I2S protocol) or is high (for the LSB or MSB-justified mode), the slave starts communicating data immediately. In this case, the master and slave will be desynchronized throughout the whole communication.

#### Workaround

The I2S peripheral must be enabled when the external master sets the WS line at:

- High level when the I2S protocol is selected.
- Low level when the LSB or MSB-justified mode is selected.

## 2.4.2 I2S2 in full-duplex mode may not work properly when SCK and WS signals are mapped on PI1 and PI0 respectively

### Description

When SCK and WS signals are used to support I2S full-duplex through GPIO port I: PI1 and PI0 respectively, the I2S2 peripheral cannot be able to provide internally SCK signal and WS signal to I2S2\_ext interface. In this case, I2S2\_ext interface will not be able to send/receive data.

### Workaround

Other mapped pins for SCK and WS signals can be used on GPIO Port B as below:

- I2S2 CK signal: PB10 pin or PB13 pin.
- I2S2 WS signal: PB12 pin or PB9 pin.

## 2.5 USART peripheral limitations

### 2.5.1 Idle frame is not detected if receiver clock speed is deviated

#### Description

If the USART receives an idle frame followed by a character, and the clock of the transmitter device is faster than the USART receiver clock, the USART receive signal falls too early when receiving the character start bit, with the result that the idle frame is not detected (IDLE flag is not set).

#### Workaround

None.

### 2.5.2 In full duplex mode, the Parity Error (PE) flag can be cleared by writing to the data register

#### Description

In full duplex mode, when the Parity Error flag is set by the receiver at the end of a reception, it may be cleared while transmitting by reading the USART\_SR register to check the TXE or TC flags and writing data to the data register.

Consequently, the software receiver can read the PE flag as '0' even if a parity error occurred.

#### Workaround

The Parity Error flag should be checked after the end of reception and before transmission.

### 2.5.3 Parity Error (PE) flag is not set when receiving in Mute mode using address mark detection

#### Description

The USART receiver is in Mute mode and is configured to exit the Mute mode using the address mark detection. When the USART receiver recognizes a valid address with a parity error, it exits the Mute mode without setting the Parity Error flag.

#### Workaround

None.

### 2.5.4 Break frame is transmitted regardless of nCTS input line status

#### Description

When CTS hardware flow control is enabled (CTSE = 1) and the Send Break bit (SBK) is set, the transmitter sends a break frame at the end of the current transmission regardless of nCTS input line status.

Consequently, if an external receiver device is not ready to accept a frame, the transmitted break frame is lost.

#### Workaround

None.

### 2.5.5 nRTS signal abnormally driven low after a protocol violation

#### Description

When RTS hardware flow control is enabled, the nRTS signal goes high when data is received. If this data was not read and new data is sent to the USART (protocol violation), the nRTS signal goes back to low level at the end of this new data.

Consequently, the sender gets the wrong information that the USART is ready to receive further data.

On USART side, an overrun is detected, which indicates that data has been lost.

#### Workaround

Workarounds are required only if the other USART device violates the communication protocol, which is not the case in most applications.

Two workarounds can be used:

- After data reception and before reading the data in the data register, the software takes over the control of the nRTS signal as a GPIO and holds it high as long as needed. If the USART device is not ready, the software holds the nRTS pin high, and releases it when the device is ready to receive new data.
- The time required by the software to read the received data must always be lower than the duration of the second data reception. For example, this can be ensured by treating all the receptions by DMA mode.

## 2.6 OTG\_FS peripheral limitations

### 2.6.1 Data in RxFIFO is overwritten when all channels are disabled simultaneously

#### Description

If the available RxFIFO is just large enough to host 1 packet + its data status, and is currently occupied by the last received data + its status and, at the same time, the application requests that more IN channels be disabled, the OTG\_FS peripheral does not first check for available space before inserting the disabled status of the IN channels. It just inserts them by overwriting the existing data payload.

#### Workaround

Use one of the following recommendations:

1. Configure the RxFIFO to host a *minimum* of  $2 \times \text{MPSIZ} + 2 \times \text{data status entries}$ .
2. The application has to check the RXFLVL bit (RxFIFO non-empty) in the OTG\_FS\_GINTSTS register before disabling each IN channel. If this bit is not set, then the application can disable an IN channel at a time. Each time the application disables an IN channel, however, it first has to check that the RXFLVL bit = 0 condition is true.

### 2.6.2 OTG host blocks the receive channel when receiving IN packets and no TxFIFO is configured

#### Description

When receiving data, the OTG\_FS core erroneously checks for available TxFIFO space when it should only check for RxFIFO space. If the OTG\_FS core cannot see any space allocated for data transmission, it blocks the reception channel and no data is received.

#### Workaround

Set at least one TxFIFO equal to the maximum packet size. In this way, the host application, which intends to support only IN traffic, also has to allocate some space for the TxFIFO.

Since a USB host is expected to support any kind of connected endpoint, it is good practice to always configure enough TxFIFO space for OUT endpoints.

### 2.6.3 Host channel-halted interrupt not generated when the channel is disabled

#### Description

When the application enables, then immediately disables the host channel before the OTG\_FS host has had time to begin the transfer sequence, the OTG\_FS core, as a host, does not generate a channel-halted interrupt. The OTG\_FS core continues to operate normally.

#### Workaround

Do not disable the host channel immediately after enabling it.

## 2.6.4 Error in software-read OTG\_FS\_DCFG register values

### Description

When the application writes to the DAD and PFIVL bitfields in the OTG\_FS\_DCFG register, and then reads the newly written bitfield values, the read values may not be correct.

The values written by the application, however, are correctly retained by the core, and the normal operation of the device is not affected.

### Workaround

Do not read from the OTG\_FS\_DCFG register's DAD and PFIVL bitfields just after programming them.

## 2.7 Ethernet peripheral limitations

### 2.7.1 Incorrect layer 3 (L3) checksum is inserted in transmitted IPv6 packets without TCP, UDP or ICMP payloads

#### Description

The application provides the per-frame control to instruct the MAC to insert the L3 checksums for TCP, UDP and ICMP packets. When automatic checksum insertion is enabled and the input packet is an IPv6 packet without the TCP, UDP or ICMP payload, then the MAC may incorrectly insert a checksum into the packet. For IPv6 packets without a TCP, UDP or ICMP payload, the MAC core considers the next header (NH) field as the extension header and continues to parse the extension header. Sometimes, the payload data in such packets matches the NH field for TCP, UDP or ICMP and, as a result, the MAC core inserts a checksum.

#### Workaround

When the IPv6 packets have a TCP, UDP or ICMP payload, enable checksum insertion for transmit frames, or bypass checksum insertion by using the CIC (checksum insertion control) bits in TDES0 (bits 23:22).

### 2.7.2 The Ethernet MAC processes invalid extension headers in the received IPv6 frames

#### Description

In IPv6 frames, there can be zero or some extension headers preceding the actual IP payload. The Ethernet MAC processes the following extension headers defined in the IPv6 protocol: Hop-by-Hop Options header, Routing header and Destination Options header. All extension headers, except the Hop-by-Hop extension header, can be present multiple times and in any order before the actual IP payload. The Hop-by-Hop extension header, if present, has to come immediately after the IPv6's main header.

The Ethernet MAC processes all (valid or invalid) extension headers including the Hop-by-Hop extension headers that are present after the first extension header. For this reason, the GMAC core will accept IPv6 frames with invalid Hop-by-Hop extension headers. As a

consequence, it will accept any IP payload as valid IPv6 frames with TCP, UDP or ICMP payload, and then incorrectly update the Receive status of the corresponding frame.

#### **Workaround**

None.

### **2.7.3 MAC stuck in the Idle state on receiving the TxFIFO flush command exactly 1 clock cycle after a transmission completes**

#### **Description**

When the software issues a TxFIFO flush command, the transfer of frame data stops (even in the middle of a frame transfer). The TxFIFO read controller goes into the Idle state (TFRS=00 in ETH\_MACDBGR) and then resumes its normal operation.

However, if the TxFIFO read controller receives the TxFIFO flush command exactly one clock cycle after receiving the status from the MAC, the controller remains stuck in the Idle state and stops transmitting frames from the TxFIFO. The system can recover from this state only with a reset (e.g. a soft reset).

#### **Workaround**

Do not use the TxFIFO flush feature.

If TxFIFO flush is really needed, wait until the TxFIFO is empty prior to using the TxFIFO flush command.

### **2.7.4 Transmit frame data corruption**

Frame data corrupted when the TxFIFO is repeatedly transitioning from non-empty to empty and then back to non-empty.

#### **Description**

Frame data may get corrupted when the TxFIFO is repeatedly transitioning from non-empty to empty for a very short period, and then from empty to non-empty, without causing an underflow.

This transitioning from non-empty to empty and back to non-empty happens when the rate at which the data is being written to the TxFIFO is almost equal to or a little less than the rate at which the data is being read.

This corruption cannot be detected by the receiver when the CRC is inserted by the MAC, as the corrupted data is used for the CRC computation.

#### **Workaround**

Use the Store-and-Forward mode: TSF=1 (bit 21 in ETH\_DMAOMR). In this mode, the data is transmitted only when the whole packet is available in the TxFIFO.

## 2.7.5 Successive write operations to the same register might not be fully taken into account

### Description

A write to a register might not be fully taken into account if a previous write to the same register is performed within a time period of four TX\_CLK/RX\_CLK clock cycles. When this error occurs, reading the register returns the most recently written value, but the Ethernet MAC continues to operate as if the latest write operation never occurred.

See [Table 5: Impacted registers and bits](#) for the registers and bits impacted by this limitation.

**Table 5. Impacted registers and bits**

Register name	Bit number	Bit name
DMA registers		
ETH_DMABMR	7	EDFE
ETH_DMAOMR	26	DTCEFD
	25	RSF
	20	FTF
	7	FEF
	6	FUGF
	4:3	RTC
GMAC registers		
ETH_MACCR	25	CSTF
	23	WD
	22	JD
	19:17	IFG
	16	CSD
	14	FES
	13	ROD
	12	LM
	11	DM
	10	IPCO
	9	RD
	7	APCS
	6:5	BL
	4	DC
	3	TE
	2	RE
ETH_MACFFR		MAC frame filter register
ETH_MACHTHR	31:0	Hash Table High Register



Table 5. Impacted registers and bits (continued)

Register name	Bit number	Bit name
ETH_MACHTLR	31:0	Hash Table Low Register
ETH_MACFCR	31:16	PT
	7	ZQPD
	5:4	PLT
	3	UPFD
	2	RFCE
	1	TFCE
	0	FCB/BPA
ETH_MACVLANTR	16	VLANTC
	15:0	VLANTI
ETH_MACRWUFR		all remote wakeup registers
ETH_MACPMTCSR	31	WFFRPR
	9	GU
	2	WFE
	1	MPE
	0	PD
ETH_MACA0HR		MAC address 0 high register
ETH_MACA0LR		MAC address 0 low register
ETH_MACA1HR		MAC address 1 high register
ETH_MACA1LR		MAC address 1 low register
ETH_MACA2HR		MAC address 2 high register
ETH_MACA2LR		MAC address 2 low register
ETH_MACA3HR		MAC address 3 high register
ETH_MACA3LR		MAC address 3 low register
IEEE 1588 time stamp registers		

Table 5. Impacted registers and bits (continued)

Register name	Bit number	Bit name
ETH_PTPTSCR	18	TSPFFMAE
	17:16	TSCNT
	15	TSSMRME
	14	TSSEME
	13	TSSIPV4FE
	12	TSSIPV6FE
	11	TSSPTPOEFE
	10	TSPTPPSV2E
	9	TSSSR
	8	TSSARFE
	5	TSARU
	3	TSSTU
	2	TSSTI
	1	TSFCU
	0	TSE

### Workaround

Two workarounds could be applicable:

- Ensure a delay of four TX\_CLK/RX\_CLK clock cycles between the successive write operations to the same register.
- Make several successive write operations without delay, then read the register when all the operations are complete, and finally reprogram it after a delay of four TX\_CLK/RX\_CLK clock cycles.

## 2.8 FSMC peripheral limitation

### 2.8.1 Dummy read cycles inserted when reading synchronous memories

#### Description

When performing a burst read access to a synchronous memory, two dummy read accesses are performed at the end of the burst cycle whatever the type of AHB burst access. However, the extra data values which are read are not used by the FSMC and there is no functional failure.

#### Workaround

None.

## 2.8.2 FSMC synchronous mode and NWAIT signal disabled

### Description

When the FSMC synchronous mode operates with the NWAIT signal disabled, if the polarity (WAITPOL in the FSMC\_BCRx register) of the NWAIT signal is identical to that of the NWAIT input signal level, the system hangs and no fault is generated.

### Workaround

PD6 (NWAIT signal) must not be connected to AF12 and the NWAIT polarity must be configured to active high (set WAITPOL bit to 1 in FSMC\_BCRx register).

## 2.8.3 FSMC NOR Flash/PSRAM controller asynchronous access on bank 2 to 4 when bank 1 is in synchronous mode (CBURSTRW bit is set)

### Description

If bank 1 of NOR/PSRAM controller is enabled in synchronous write mode (CBURSTRW bit set), while any other NOR/PSRAM banks (2 to 4) are enabled in asynchronous mode, two limitations occur:

- The byte lane NBL[1:0] are not active( kept at '1') for the first write access to the asynchronous memory.
- The system hangs without any fault generation when a write access is performed to an asynchronous memory with the extended feature enabled.

These two limitations occur only when the NOR/PSRAM bank 1 is configured in synchronous write mode (CBURSTRW bit set).

### Workaround

If multiple banks are enabled with mixed asynchronous and synchronous write modes, use any NOR/PSRAM bank for synchronous write access, except for bank 1.

## 2.9 SDIO peripheral limitations

### 2.9.1 SDIO HW flow control

#### Description

When enabling the HW flow control by setting bit 14 of the SDIO\_CLKCR register to '1', glitches can occur on the SDIOCLK output clock resulting in wrong data to be written into the SD/MMC card or into the SDIO device. As a consequence, a CRC error will be reported to the SD/SDIO MMC host interface (DCRCFAIL bit set to '1' in SDIO\_STA register).

#### Workaround

None.

*Note: Do not use the HW flow control. Overrun errors (Rx mode) and FIFO underrun (Tx mode) should be managed by the application software.*

## 2.9.2 Wrong CCRCFAIL status after a response without CRC is received

### Description

The CRC is calculated even if the response to a command does not contain any CRC field. As a consequence, after the SDIO command IO\_SEND\_OP\_COND (CMD5) is sent, the CCRCFAIL bit of the SDIO\_STA register is set.

### Workaround

The CCRCFAIL bit in the SDIO\_STA register shall be ignored by the software. CCRCFAIL must be cleared by setting CCRCFAILC bit of the SDIO\_ICR register after reception of the response to the CMD5 command.

## 2.9.3 SDIO clock divider BYPASS mode may not work properly

### Description

In high speed communication mode, when SDIO\_CK is equal to 48 MHz (PLL48\_output = 48 MHz), the BYPASS bit is equal to '1' and the NEGEDGE bit is equal to '0' (respectively bit 10 and bit 13 in the SDIO\_CLKCR register), the hold timing at the I/O pin is not aligned with the SD/MMC 2.0 specifications.

### Workaround

When not using USB nor RNG, PLL48\_output (SDIOCLK) frequency can be raised up to 75 MHz, allowing to reach 37.5 MHz on SDIO\_CK in high speed mode. The BYPASS bit, the CLKDIV bit and the NEGEDGE bit are equal to '0'.

## 2.9.4 Data corruption in SDIO clock dephasing (NEGEDGE) mode

### Description

When NEGEDGE bit is set to '1', it may lead to invalid data and command response read.

### Workaround

None. A configuration with the NEGEDGE bit equal to '1' should not be used.

## 2.9.5 CE-ATA multiple write command and card busy signal management

### Description

The CE-ATA card may inform the host that it is busy by driving the SDIO\_D0 line low, two cycles after the transfer of a write command (RW\_MULTIPLE\_REGISTER or RW\_MULTIPLE\_BLOCK). When the card is in a busy state, the host must not send any data until the BUSY signal is de-asserted (SDIO\_D0 released by the card).

This condition is not respected if the data state machine leaves the IDLE state (Write operation programmed and started, DTEN = 1, DTDIR = 0 in SDIO\_DCTRL register and TXFIFOE = 0 in SDIO\_STA register).

As a consequence, the write transfer fails and the data lines are corrupted.

**Workaround**

After sending the write command (RW\_MULTIPLE\_REGISTER or RW\_MULTIPLE\_BLOCK), the application must check that the card is not busy by polling the BSY bit of the ATA status register using the FAST\_IO (CMD39) command before enabling the data state machine.

**2.9.6 No underrun detection with wrong data transmission****Description**

In case there is an ongoing data transfer from the SDIO host to the SD card and the hardware flow control is disabled (bit 14 of the SDIO\_CLKCR is not set), if an underrun condition occurs, the controller may transmit a corrupted data block (with wrong data word) without detecting the underrun condition when the clock frequencies have the following relationship:

$$[3 \times \text{period}(\text{PCLK2}) + 3 \times \text{period}(\text{SDIOCLK})] \geq (32 / (\text{BusWidth})) \times \text{period}(\text{SDIO\_CK})$$

**Workaround**

Avoid the above-mentioned clock frequency relationship, by:

- Incrementing the APB frequency
- or decreasing the transfer bandwidth
- or reducing SDIO\_CK frequency

**2.10 ADC peripheral limitations****2.10.1 ADC sequencer modification during conversion****Description**

When a software start of conversion is used as an ADC trigger, and if the ADC\_SQRx or ADC\_JSQRx registers are modified during the conversion, the current conversion is reset and the ADC does not automatically restart the new conversion sequence. The hardware start of conversion trigger is not impacted and the ADC automatically restarts the new sequence when the next hardware trigger occurs.

**Workaround**

When a software start of conversion is used, the user application must first set the SWSART bit in the ADC\_CR2 register, and then restart the new conversion sequence.

## 2.11 DAC peripheral limitations

### 2.11.1 DMA underrun flag management

#### Description

If the DMA is not fast enough to input the next digital data to the DAC, as a consequence, the same digital data is converted twice. In these conditions, the DMAUDR flag is set, which usually leads to disable the DMA data transfers. This is not the case: the DMA is not disabled by DMAUDR=1, and it keeps servicing the DAC.

#### Workaround

To disable the DAC DMA stream, reset the EN bit (corresponding to the DAC DMA stream) in the DMA\_SxCR register.

### 2.11.2 DMA request not automatically cleared by DMAEN=0

#### Description

if the application wants to stop the current DMA-to-DAC transfer, the DMA request is not automatically cleared by DMAEN=0, or by DACEN=0.

If the application stops the DAC operation while the DMA request is high, the DMA request will be pending while the DAC is reinitialized and restarted; with the risk that a spurious unwanted DMA request is serviced as soon as the DAC is re-enabled.

#### Workaround

To stop the current DMA-to-DAC transfer and restart, the following sequence should be applied:

1. Check if DMAUDR is set.
2. Clear the DAC/DMAEN bit.
3. Clear the EN bit of the DAC DMA/Stream
4. Reconfigure by software the DAC, DMA, triggers etc.
5. Restart the application.

## Appendix A Revision code on device marking

[Figure 1](#), [Figure 2](#), [Figure 3](#), [Figure 4](#), [Figure 5](#) and [Figure 6](#) show the marking compositions for the UFBGA176, LQFP176, LQFP144, LQFP100, LQFP64 and WLCSP90 packages, respectively. The only fields shown are the Additional field containing the revision code and the Year and Week fields making up the date code.

**Figure 1. UFBGA176 top package view**

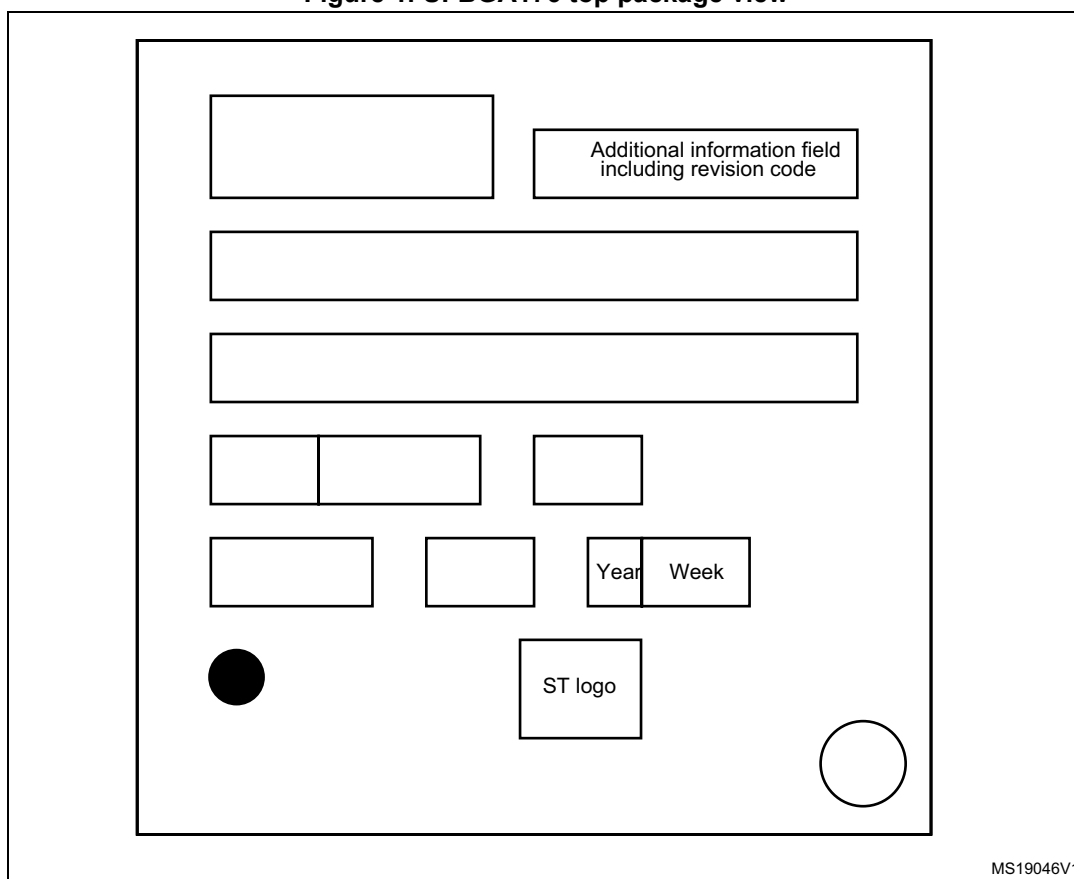


Figure 2. LQFP176 top package view

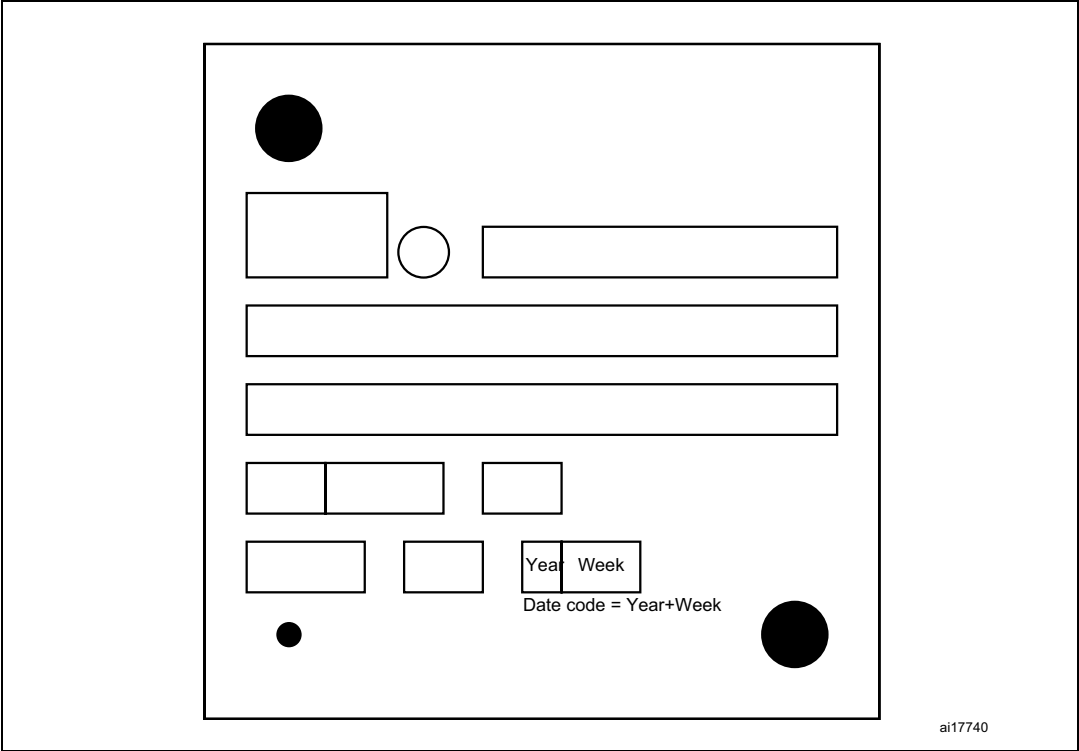


Figure 3. LQFP144 top package view

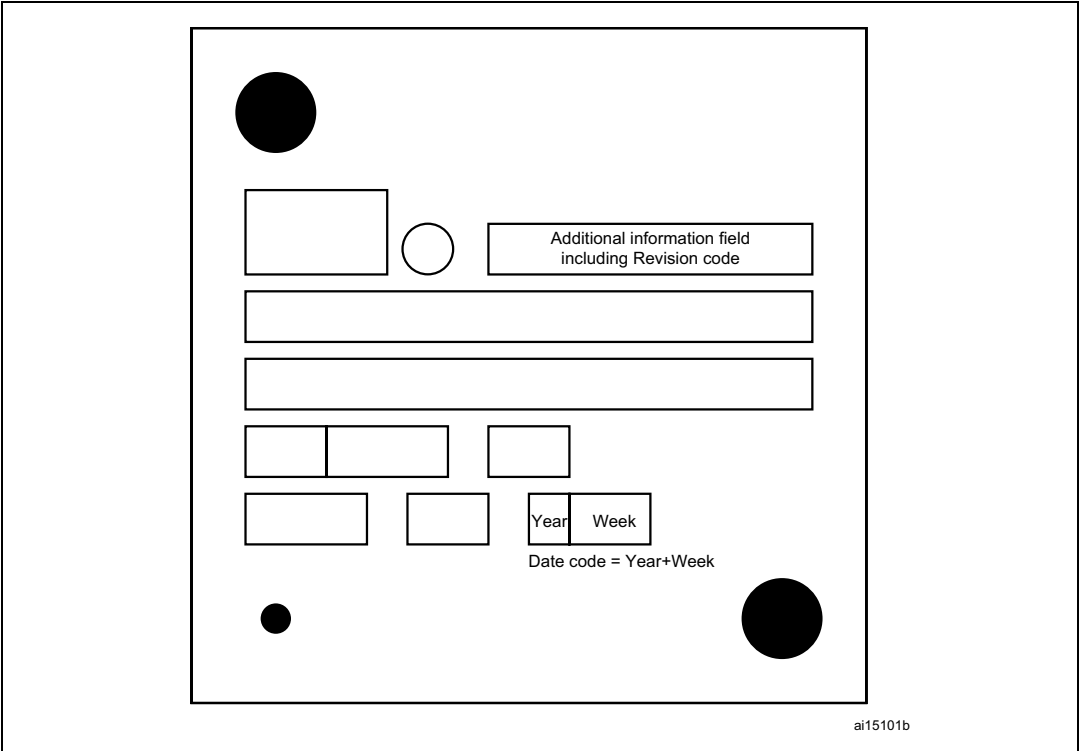




Figure 4. LQFP100 top package view

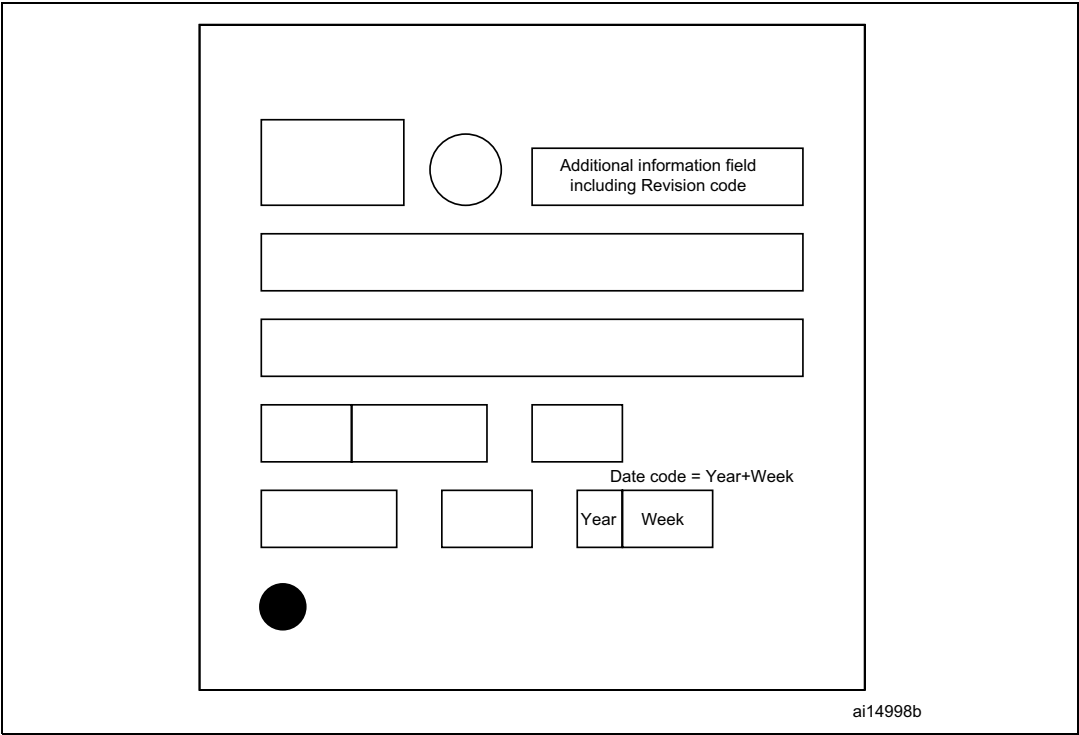


Figure 5. LQFP64 top package view

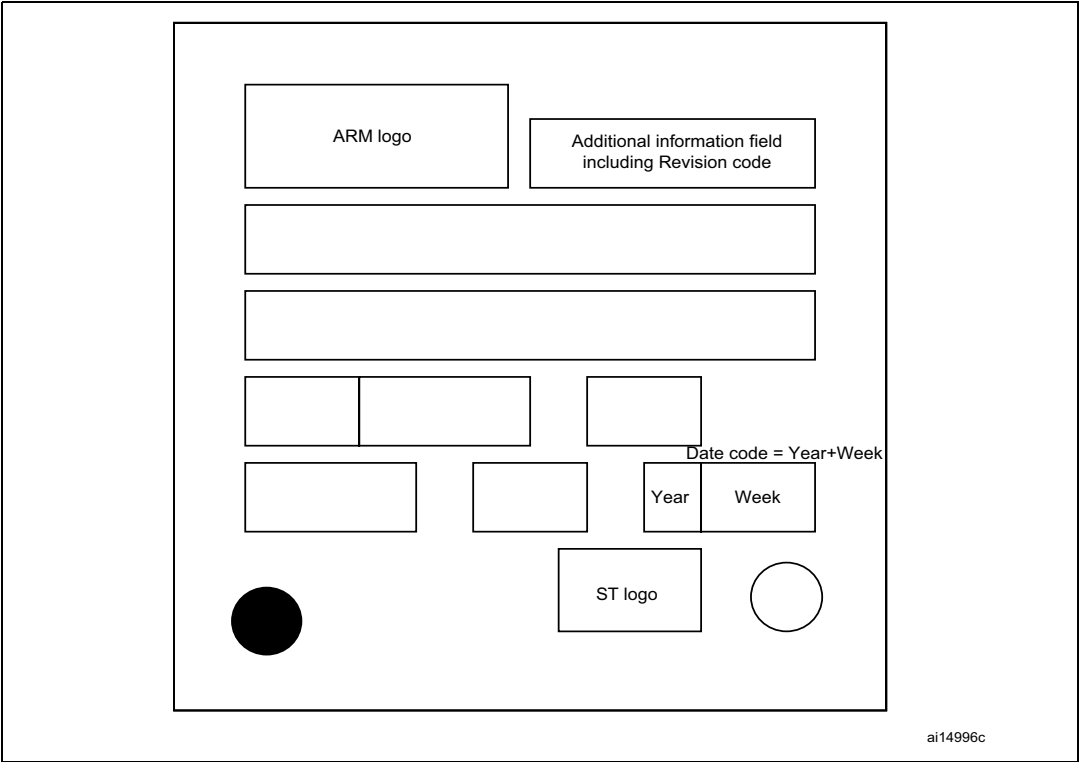
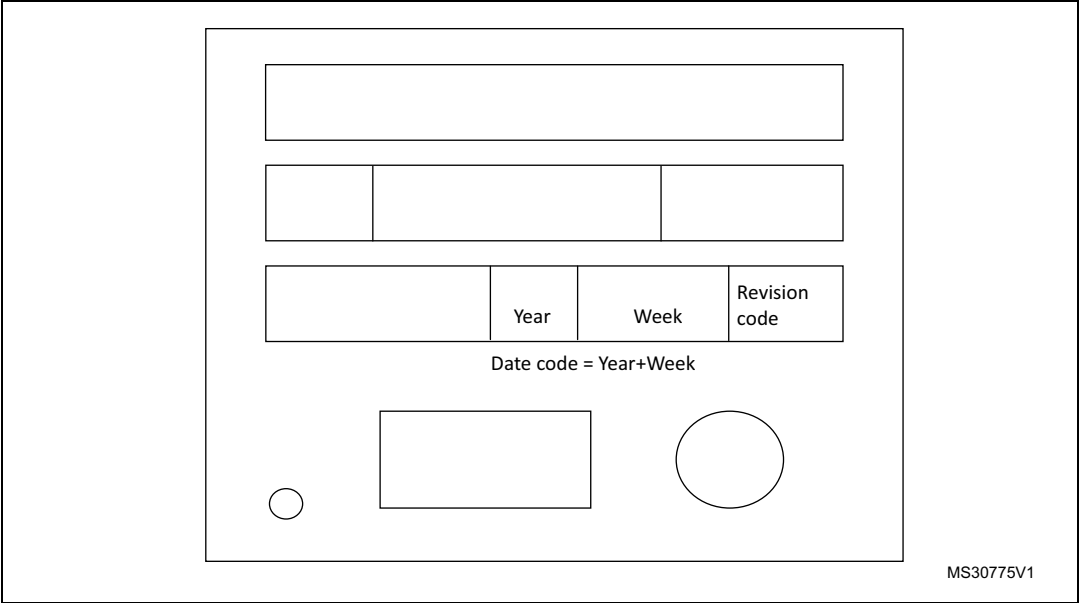


Figure 6. WLCSP90 top package view



## Revision history

**Table 6. Document revision history**

Date	Revision	Changes
19-Sep-2011	1	Initial release.
12-Dec-2011	2	<p>Replaced STM42F4xx by STM32F4xx on cover page.</p> <p>Added silicon revision Z.</p> <p>Modified link to ARM 32-bit Cortex-M4F errata notice in <a href="#">Section 1: ARM 32-bit Cortex-M4 with FPU limitations</a>.</p> <p>Updated status of ART Accelerator prefetch queue and MCU device ID limitations for revision Z in <a href="#">Table 4: Summary of silicon limitations</a></p> <p>Updated <a href="#">Section 2.1.1: ART Accelerator prefetch queue instruction is not supported</a> and <a href="#">Section 2.1.2: MCU device ID is incorrect</a> to make differentiate between revision A and revision Z devices.</p> <p>Added <a href="#">Section 2.1.6: Full JTAG configuration without NJTRST pin cannot be used</a>, <a href="#">Section 2.1.7: PDR_ON pin not available on LQFP100 package for revision Z devices</a>, <a href="#">Section 2.1.8: Incorrect BOR option byte when consecutively programming BOR option byte</a>, and <a href="#">Section 2.1.9: Configuration of PH10 and PI10 as external interrupts is erroneous</a>.</p> <p>Updated workaround for <a href="#">Section 2.5.5: nRTS signal abnormally driven low after a protocol violation</a>.</p> <p>Added <a href="#">Section 2.9.2: Wrong CCRCFAIL status after a response without CRC is received</a> and <a href="#">Section 2.2.1: RVU and PVU flags are not reset in STOP mode</a>.</p>
03-Aug-2012	3	<p>Added <a href="#">Section 2.1.10: DMA2 data corruption when managing AHB and APB peripherals in a concurrent way</a>, <a href="#">Section 2.1.11: Slowing down APB clock during a DMA transfer</a>, <a href="#">Section 2.1.12: MPU attribute to RTC and IWDG registers could be managed incorrectly</a>, <a href="#">Section 2.1.13: Delay after an RCC peripheral clock enabling</a>, <a href="#">Section 2.1.14: Battery charge monitoring lower than 2.4 Volts</a> and <a href="#">Appendix A: Revision code on device marking</a>.</p> <p>Added <a href="#">Section 2.8.2: FSMC synchronous mode and NWAIT signal disabled</a>.</p> <p>Added <a href="#">Section 2.9.3: SDIO clock divider BYPASS mode may not work properly</a>, <a href="#">Section 2.9.4: Data corruption in SDIO clock dephasing (NEGEDGE) mode</a> and <a href="#">Section 2.9.5: CE-ATA multiple write command and card busy signal management</a>.</p> <p>Added <a href="#">Section 2.11: DAC peripheral limitations</a> with <a href="#">Section 2.11.1: DMA underrun flag management</a> and <a href="#">Section 2.11.2: DMA request not automatically cleared by DMAEN=0</a>.</p>

Table 6. Document revision history (continued)

Date	Revision	Changes
25-Apr-2013	4	<p>Removed the reference to 'Cortex-M4F' in the whole document.</p> <p>Updated <a href="#">Table 2: Device summary</a>, <a href="#">Section 2.1.2: MCU device ID is incorrect</a>. Added <a href="#">Section 2.1.5: Wakeup sequence from Standby mode when using more than one wakeup source</a>.</p> <p>Updated <a href="#">Section 2.8.1: Dummy read cycles inserted when reading synchronous memories</a>.</p> <p>Added <a href="#">Section 2.2: IWDG peripheral limitation</a>, <a href="#">Section 2.4.2: I2S2 in full-duplex mode may not work properly when SCK and WS signals are mapped on PI1 and PI0 respectively</a>, <a href="#">Section 2.7.5: Successive write operations to the same register might not be fully taken into account</a> and <a href="#">Section 2.8.3: FSMC NOR Flash/PSRAM controller asynchronous access on bank 2 to 4 when bank 1 is in synchronous mode (CBURSTRW bit is set)</a>, <a href="#">Section 2.9.6: No underrun detection with wrong data transmission</a> and <a href="#">Section 2.10.1: ADC sequencer modification during conversion</a>.</p> <p>Added <a href="#">Figure 6: WLCSP90 top package view</a>.</p>
11-Oct-2013	5	<p>Added silicon revision 1.</p> <p>Added <a href="#">Section 2.3.5: Both SDA and SCL maximum rise time (tr) violated when VDD_I2C bus higher than ((VDD+0.3) / 0.7) V</a>.</p>

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