

STM32F401xB and STM32F401xC device limitations

Silicon identification

This errata sheet applies to the STMicroelectronics STM32F401xB/C microcontroller.

The STM32F401xB/C devices 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⁽¹⁾

Order code	Revision code marked on device ⁽²⁾
STM32F401xB, STM32F401xC	"A", "Z"

1. The REV_ID bits in the DBGMCU_IDCODE register show the revision code of the device (see the RM0368 STM32F401xx reference manual for details on how to find the revision code).

2. Refer to datasheet for the device marking.

Table 2. Device summary

Reference	Part number
STM32F401xB	STM32F401VB, STM32F401RB, STM32F401CB
STM32F401xC	STM32F401VC, STM32F401RC, STM32F401CC

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1 ARM 32-bit Cortex-M4 with FPU limitations

An errata notice of the STM32F401xB/C core is available from <http://infocenter.arm.com>.

All the described limitations are minor and related to the revision r0p1-v1 of the Cortex-M4 core. [Table 3](#) summarizes these limitations and their implications on the behavior of STM32F401xB/C devices.

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

ARM ID	ARM category	ARM summary of errata	Impact on STM32F401xB/C
752770	Cat B	Interrupted loads to SP can cause erroneous behavior	Minor
776924	Cat B	VDIV or VSQRT instructions might not complete correctly when very short ISRs are used	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
```

1.2 VDIV or VSQRT instructions might not complete correctly when very short ISRs are used

Description

On Cortex-M4 with FPU core, 14 cycles are required to execute a VDIV or VSQRT instruction.

This limitation is present when the following conditions are met:

- A VDIV or VSQRT is executed
- The destination register for VDIV or VSQRT is one of s0 - s15
- An interrupt occurs and is taken
- The ISR being executed does not contain a floating point instruction
- 14 cycles after the VDIV or VSQRT is executed, an interrupt return is executed

In this case, if there are only one or two instructions inside the interrupt service routine, then the VDIV or VSQRT instruction does not complete correctly and the register bank and FPSCR are not updated, meaning that these registers hold incorrect out-of-date data.

Workaround

Two workarounds are applicable:

- Disable lazy context save of floating point state by clearing LSPEN to 0 (bit 30 of the FPCCR at address 0xE000EF34).
- Ensure that every ISR contains more than 2 instructions in addition to the exception return instruction.

2 STM32F401xB/C 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 and Z
Section 2.1: System limitations	Section 2.1.1: Debugging Stop mode and system tick timer	A
	Section 2.1.2: Debugging Stop mode with WFE entry	A
	Section 2.1.3: Wakeup sequence from Standby mode when using more than one wakeup source	A
	Section 2.1.4: Full JTAG configuration without NJTRST pin cannot be used	A
	Section 2.1.5: MPU attribute to RTC and IWDG registers could be managed incorrectly	A
	Section 2.1.6: Delay after an RCC peripheral clock enabling	A
	Section 2.1.7: PB5 I/O VIN limitation	A
	Section 2.1.8: PA0 I/O VIN limitation in Standby mode	A
	Section 2.1.9: PH1 cannot be used as a GPIO in HSE bypass mode	N
Section 2.2: IWDG peripheral limitation	Section 2.2.1: RVU and PVU flags are not reset in STOP mode	A
Section 2.3: RTC_Tamper limitations	Section 2.3.1: Spurious tamper detection when disabling the tamper channel	A
	Section 2.3.2: Detection of a tamper event occurring before enabling the tamper detection is not supported in edge detection mode	A
Section 2.4: I2C peripheral limitations	Section 2.4.1: SMBus standard not fully supported	A
	Section 2.4.2: Start cannot be generated after a misplaced Stop	A
	Section 2.4.3: Mismatch on the "Setup time for a repeated Start condition" timing parameter	A
	Section 2.4.4: Data valid time ($t_{VD, DAT}$) violated without the OVR flag being set	A
	Section 2.4.5: Both SDA and SCL maximum rise time (t_r) violated when VDD_I2C bus higher than $((VDD+0.3) / 0.7)$ V	A
Section 2.5: I2S peripheral limitation	Section 2.5.1: In I2S slave mode, WS level must be set by the external master when enabling the I2S	A

Table 4. Summary of silicon limitations (continued)

Links to silicon limitations		Revision A and Z
Section 2.6: USART peripheral limitations	Section 2.6.1: Idle frame is not detected if receiver clock speed is deviated	N
	Section 2.6.2: In full duplex mode, the Parity Error (PE) flag can be cleared by writing to the data register	A
	Section 2.6.3: Parity Error (PE) flag is not set when receiving in Mute mode using address mark detection	N
	Section 2.6.4: Break frame is transmitted regardless of nCTS input line status	N
	Section 2.6.5: nRTS signal abnormally driven low after a protocol violation	A
	Section 2.6.6: Start bit detected too soon when sampling for NACK signal from the smartcard	A
	Section 2.6.7: Break request can prevent the Transmission Complete flag (TC) from being set	A
	Section 2.6.8: Guard time is not respected when data are sent on TXE events	A
	Section 2.6.9: nRTS is active while RE or UE = 0	A
Section 2.7: OTG_FS peripheral limitations	Section 2.7.1: Data in RxFIFO is overwritten when all channels are disabled simultaneously	A
	Section 2.7.2: OTG host blocks the receive channel when receiving IN packets and no TxFIFO is configured	A
	Section 2.7.3: Host channel-halted interrupt not generated when the channel is disabled	A
	Section 2.7.4: Error in software-read OTG_FS_DCFG register values	A
Section 2.8: SDIO peripheral limitations	Section 2.8.1: SDIO HW flow control	N
	Section 2.8.2: Wrong CCRCFAIL status after a response without CRC is received	A
	Section 2.8.3: Data corruption in SDIO clock dephasing (NEGEDGE) mode	N
	Section 2.8.4: CE-ATA multiple write command and card busy signal management	A
	Section 2.8.5: No underrun detection with wrong data transmission	A
Section 2.9: ADC peripheral limitations	Section 2.9.1: ADC sequencer modification during conversion	A

2.1 System limitations

2.1.1 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.

2.1.2 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 }
```

2.1.3 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.

2.1.4 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.

2.1.5 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.

2.1.6 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-M4 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).

2.1.7 PB5 I/O V_{IN} limitation

Description

If the input voltage (V_{IN}) applied to PB5 exceeds V_{DD} supply voltage, an I/O leakage current, which can impact the product lifetime, is observed.

Workaround

There is no functional limitation on PB5 pad if V_{IN} does not exceed V_{DD} .

2.1.8 PA0 I/O V_{IN} limitation in Standby mode

Description

In Standby mode, if the input voltage (V_{IN}) applied to PA0 exceeds V_{DD} supply voltage, an I/O leakage current, which can impact the product lifetime, is observed.

Workaround

There is no functional limitation on PA0 pad if V_{IN} does not exceed V_{DD} .

If the device does not operate in Standby mode, PA0 is 5 V tolerant (FT) thus allowing an input voltage higher than V_{DD} (according to the datasheet specifications).

2.1.9 PH1 cannot be used as a GPIO in HSE bypass mode

Description

When an external clock is used and the HSE is bypassed, PH1 cannot be used as GPIO.

Work around

None.

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 RTC_Tamper limitations

2.3.1 Spurious tamper detection when disabling the tamper channel

Description

If the tamper detection is configured for detection on falling edge event (TAMPFLT=00 and TAMPxTRG=1) and if the tamper event detection is disabled when the tamper pin is at high level, a false tamper event is detected.

Workaround

None

2.3.2 Detection of a tamper event occurring before enabling the tamper detection is not supported in edge detection mode

Description

When the tamper detection is enabled in edge detection mode (TAMPFLT=00):

- When TAMPxTRG=0 (rising edge detection): if the tamper input is already high before enabling the tamper detection, the tamper event may or may not be detected when enabling the tamper detection. The probability to detect it increases with the APB frequency.
- When TAMPxTRG=1 (falling edge detection): if the tamper input is already low before enabling the tamper detection, the tamper event is not detected when enabling the tamper detection.

Workaround

The I/O state should be checked by software in the GPIO registers, just after enabling the tamper detection and before writing sensitive values in the backup registers, in order to ensure that no active edge occurred before enabling the tamper event detection.

2.4 I2C peripheral limitations

2.4.1 SMBus standard not fully supported

Description

The I²C 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

2.4.2 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 I²C 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 I²C peripheral.

A software workaround consists in asserting the software reset using the SWRST bit in the I2C_CR1 control register.

2.4.3 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 $T_{su;sta}$ in the I²C specification) can be slightly violated when the I²C 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 I²C Fast-mode, if supported by the slave.

2.4.4 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 I²C 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.

2.4.5 Both SDA and SCL maximum rise time (t_r) violated when VDD_I2C bus higher than $((VDD+0.3) / 0.7)$ V

Description

When an external legacy I²C bus voltage (VDD_I2C) is set to 5 V while the MCU is powered from V_{DD}, the internal 5-Volt tolerant circuitry is activated as soon the input voltage (V_{IN}) reaches the $V_{DD} +$ diode threshold level. An additional internal large capacitance then prevents the external pull-up resistor (R_P) 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_{IL} and V_{IH} with levels set at $0.3V_{DD_I2C}$ and $0.7V_{DD_I2C}$.

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 $V_{DD}=3.3$ V, VDD_I2C should not exceed 5.14 V to be compliant with I²C specifications.

2.5 I2S peripheral limitation

2.5.1 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.

2.6 USART peripheral limitations

2.6.1 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.

2.6.2 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.

2.6.3 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.

2.6.4 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.

2.6.5 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.

2.6.6 Start bit detected too soon when sampling for NACK signal from the smartcard

Description

According to ISO/IEC 7816-3 standard, when a character parity error is detected, the receiver shall transmit a NACK error signal 10.5 ± 0.2 ETUs after the character START bit falling edge. In this case, the transmitter should be able to detect correctly the NACK signal until 11 ± 0.2 ETUs after the character START bit falling edge.

In Smartcard mode, the USART peripheral monitors the NACK signal during the receiver time frame (10.5 ± 0.2 ETUs), while it should wait for it during the transmitter one (11 ± 0.2 ETUs). In real cases, this would not be a problem as the card itself needs to respect a 10.7

ETU period when sending the NACK signal. However this may be an issue to undertake a certification.

Workaround

None

2.6.7 Break request can prevent the Transmission Complete flag (TC) from being set

Description

After the end of transmission of a data (D1), the Transmission Complete (TC) flag will not be set if the following conditions are met:

- CTS hardware flow control is enabled.
- D1 is being transmitted.
- A break transfer is requested before the end of D1 transfer.
- nCTS is de-asserted before the end of D1 data transfer.

Workaround

If the application needs to detect the end of a data transfer, the break request should be issued after checking that the TC flag is set.

2.6.8 Guard time is not respected when data are sent on TXE events

Description

In smartcard mode, when sending a data on TXE event, the programmed guard time is not respected i.e. the data written in the data register is transferred on the bus without waiting the completion of the guardtime duration corresponding to the previous transmitted data.

Workaround

Write the data after TC is set because in smartcard mode, the TC flag is set at the end of the guard time duration.

2.6.9 nRTS is active while RE or UE = 0

Description

The nRTS line is driven low as soon as RTSE bit is set even if the USART is disabled (UE = 0) or if the receiver is disabled (RE=0) i.e. not ready to receive data.

Workaround

Configure the I/O used for nRTS as an alternate function after setting the UE and RE bits.

2.7 OTG_FS peripheral limitations

2.7.1 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.

2.7.2 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.

2.7.3 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.

2.7.4 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.

2.8 SDIO peripheral limitations

2.8.1 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.

2.8.2 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.

2.8.3 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.

2.8.4 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.

2.8.5 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

2.9 ADC peripheral limitations

2.9.1 ADC sequencer modification during conversion

Description

If an ADC conversion is started by software (writing the SWSTART bit), and if the ADC_SQRx or ADC_JSQRx registers are modified during the conversion, the current conversion is reset and the ADC does not restart a new conversion sequence automatically.

If an ADC conversion is started by hardware trigger, this limitation does not apply. The ADC restarts a new conversion sequence automatically.

Workaround

When an ADC conversion sequence is started by software, a new conversion sequence can be restarted only by setting the SWSTART bit in the ADC_CR2 register.

3 Revision history

Table 5. Document revision history

Date	Revision	Changes
20-Sep-2013	1	Initial release.
19-Dec-2013	2	Added STM32F401xD and STM32F401xE part numbers. Changed STM32F401xx reference manual name to RM0368.
23-Mar-2015	3	Added: <ul style="list-style-type: none"> – rev “Z” on Table 1: Device identification and in Table 4: Summary of silicon limitations – Section 1.2: VDIV or VSQRT instructions might not complete correctly when very short ISRs are used. – Section 2.1.7: PB5 I/O VIN limitation – Section 2.1.8: PA0 I/O VIN limitation in Standby mode – Section 2.1.9: PH1 cannot be used as a GPIO in HSE bypass mode – Section 2.3: RTC_Tamper limitations – From Section 2.6.6 to Section 2.6.9 Removed reference in all document to Root Part Numbers STM32F401D/E Updated: <ul style="list-style-type: none"> – Section Table 4.: Summary of silicon limitations

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