



Product Change Notification / SYST-27IUUQ353

Date:

04-Oct-2023

Product Category:

32-bit Microcontrollers

PCN Type:

Silicon Die Revision

Notification Subject:

ERRATA - SAM D5x/E5x Family Silicon Errata and Data Sheet Clarification

Affected CPNs:

[SYST-27IUUQ353_Affected_CPN_10042023.pdf](#)

[SYST-27IUUQ353_Affected_CPN_10042023.csv](#)

Notification Text:

SYST-27IUUQ353

Microchip has released a new Errata for the SAM D5x/E5x Family Silicon Errata and Data Sheet Clarification of devices. If you are using one of these devices please read the document located at [SAM D5x/E5x Family Silicon Errata and Data Sheet Clarification](#).

ERRATA - SAM D5x/E5x Family Silicon Errata and Data Sheet Clarification

Notification Status: Final

Description of Change:

- 1) Added Silicon Revision G
- 2) Updated errata document to reflect silicon die revision G throughout the document.

Impacts to Data Sheet: None

Reason for Change: To Improve Productivity

Change Implementation Status: Complete

Date Document Changes Effective: 04 Oct 2023

NOTE: Please be advised that this is a change to the document only the product has not been changed.

Markings to Distinguish Revised from Unrevised Devices: N/A

Attachments:

[SAM D5x/E5x Family Silicon Errata and Data Sheet Clarification](#)

Please contact your local [Microchip sales office](#) with questions or concerns regarding this notification.

Terms and Conditions:

If you wish to receive Microchip PCNs via email please register for our PCN email service at our [PCN home page](#) select register then fill in the required fields. You will find instructions about registering for Microchips PCN email service in the [PCN FAQ](#) section.

If you wish to change your PCN profile, including opt out, please go to the [PCN home page](#) select login and sign into your myMicrochip account. Select a profile option from the left navigation bar and make the applicable selections.

Affected Catalog Part Numbers (CPN)

ATSAME53J19A-AU
ATSAME51J20A-AU
ATSAMD51J18A-AU-EFP
ATSAMD51J19A-AU-EFP
ATSAMD51J20A-AU-EFP
ATSAME51J18A-AU-EFP
ATSAME51J19A-AU-EFP
ATSAME51J20A-AU-EFP
ATSAME53J18A-AU-EFP
ATSAME53J19A-AU-EFP
ATSAME53J20A-AU-EFP
ATSAMD51P19A-AU
ATSAMD51P20A-AU
ATSAME54P19A-AU
ATSAME54P20A-AU
ATSAMD51P19A-AU-EFP
ATSAMD51P20A-AU-EFP
ATSAME54P19A-AU-EFP
ATSAME54P20A-AU-EFP
ATSAMD51J19A-UNT
ATSAMD51J20A-UNT
ATSAMD51P19A-CTUT
ATSAMD51P20A-CTUT
ATSAME54P19A-CTUT
ATSAME54P20A-CTUT
ATSAMD51P19A-CTUT-EFP
ATSAMD51P20A-CTUT-EFP
ATSAME54P19A-CTUT-EFP
ATSAME54P20A-CTUT-EFP
ATSAME51N19A-AUT
ATSAME51N20A-AUT
ATSAMD51N19A-AUT
ATSAMD51N20A-AUT
ATSAME53N19A-AUT
ATSAME53N20A-AUT
ATSAME54N19A-AUT
ATSAME54N20A-AUT
ATSAMD51N19A-AUT-EFP
ATSAMD51N20A-AUT-EFP
ATSAME51N19A-AUT-EFP
ATSAME51N20A-AUT-EFP
ATSAME53N19A-AUT-EFP
ATSAME53N20A-AUT-EFP
ATSAME54N19A-AUT-EFP
ATSAME54N20A-AUT-EFP
ATSAMD51J19A-UUT

ATSAMD51J20A-UUT
ATSAMD51J19A-UUT-EFP
ATSAMD51J20A-UUT-EFP
ATSAMD51G18A-MUT
ATSAMD51G19A-MUT
ATSAME51G19A-MUT
ATSAME51G18A-MUT
ATSAME51J20A-MZV01
ATSAME51J19A-MZV17
HA5420
ATSAMD51N20A-AUN02
ATSAMD51J19A-MUN01
ATSAME53J18A-MUN02
ATSAMD51J19B-AUN01
ATSAMD51J19A-AUN02
ATSAME53J20A-AUN03
ATSAMD51P19A-AUN01
ATSAMD51N20A-AUTN01
ATSAMD51J20C-UUTN01
ATSAMD51J19A-MUTN01
ATSAMD51J19B-AUTN01
ATSAME51N20A-AZTV14
ATSAME54N20A-AZTV15
ATSAME51J20A-AF
ATSAME51N20A-AF
ATSAMD51J19B-AF
ATSAMD51J18A-AZ
ATSAMD51J19A-AZ
ATSAMD51J20A-AZ
ATSAME53J18A-AZ
ATSAME53J19A-AZ
ATSAME53J20A-AZ
ATSAME51J18A-AZ
ATSAME51J19A-AZ
ATSAME51J20A-AZ
ATSAME54P20A-AF
ATSAME54P19A-AF
ATSAMD51P19A-AF
ATSAMD51P20A-AF
ATSAME54P19A-AZ
ATSAME54P20A-AZ
ATSAMD51P19A-AZ
ATSAMD51P20A-AZ
ATSAME54P20A-AF-SL1
ATSAME54P20A-AF-SL2
ATSAME54P20A-AF-SL3
ATSAME51N19A-AU
ATSAME51N20A-AU
ATSAMD51N19A-AU

ATSAMD51N20A-AU
ATSAME53N19A-AU
ATSAME53N20A-AU
ATSAME54N19A-AU
ATSAME54N20A-AU
ATSAMD51N19A-AU-EFP
ATSAMD51N20A-AU-EFP
ATSAME51N19A-AU-EFP
ATSAME51N20A-AU-EFP
ATSAME53N19A-AU-EFP
ATSAME53N20A-AU-EFP
ATSAME54N19A-AU-EFP
ATSAME54N20A-AU-EFP
ATSAMD51G18A-MU
ATSAMD51G19A-MU
ATSAME51G19A-MU
ATSAME51G18A-MU
ATSAMD51G18A-MU-EFP
ATSAMD51G19A-MU-EFP
ATSAME51G19A-MU-EFP
ATSAME51G18A-MU-EFP
ATSAME51J19A-MU
ATSAME51J18A-MU
ATSAMD51J18A-MU
ATSAMD51J19A-MU
ATSAMD51J20A-MU
ATSAME53J18A-MU
ATSAME53J19A-MU
ATSAME53J20A-MU
ATSAME51J20A-MU
ATSAMD51G18A-MUT-EFP
ATSAMD51G19A-MUT-EFP
ATSAME51G19A-MUT-EFP
ATSAME51G18A-MUT-EFP
ATSAME51J19A-MUT
ATSAME51J18A-MUT
ATSAMD51J18A-MUT
ATSAMD51J19A-MUT
ATSAMD51J20A-MUT
ATSAME53J18A-MUT
ATSAME53J19A-MUT
ATSAME53J20A-MUT
ATSAME51J20A-MUT
ATSAMD51J18A-MUT-EFP
ATSAMD51J19A-MUT-EFP
ATSAMD51J20A-MUT-EFP
ATSAME51J18A-MUT-EFP
ATSAME51J19A-MUT-EFP
ATSAME51J20A-MUT-EFP

ATSAME53J18A-MUT-EFP
ATSAME53J19A-MUT-EFP
ATSAME53J20A-MUT-EFP
ATSAME51J19A-AUT
ATSAME51J18A-AUT
ATSAMD51J18A-AUT
ATSAMD51J19A-AUT
ATSAMD51J20A-AUT
ATSAME53J18A-AUT
ATSAME53J19A-AUT
ATSAME53J20A-AUT
ATSAME51J20A-AUT
ATSAMD51J18A-AUT-EFP
ATSAMD51J19A-AUT-EFP
ATSAMD51J20A-AUT-EFP
ATSAME51J18A-AUT-EFP
ATSAME51J19A-AUT-EFP
ATSAME51J20A-AUT-EFP
ATSAME53J18A-AUT-EFP
ATSAME53J19A-AUT-EFP
ATSAME53J20A-AUT-EFP
ATSAMD51P19A-AUT
ATSAMD51P20A-AUT
ATSAME54P19A-AUT
ATSAME54P20A-AUT
ATSAMD51P19A-AUT-EFP
ATSAMD51P20A-AUT-EFP
ATSAME54P19A-AUT-EFP
ATSAME54P20A-AUT-EFP
ATSAME54P20A-AUTEK1
ATSAMD51P19A-CTFT
ATSAMD51P20A-CTFT
ATSAME54P19A-CTFT
ATSAME54P20A-CTFT
ATSAME51N19A-AFT
ATSAME51N20A-AFT
ATSAMD51N19A-AFT
ATSAMD51N20A-AFT
ATSAME54N19A-AFT
ATSAME54N20A-AFT
ATSAME53N19A-AFT
ATSAME53N20A-AFT
ATSAME54N20A-AZT
ATSAME54N19A-AZT
ATSAMD51J18A-MU-EFP
ATSAMD51J19A-MU-EFP
ATSAMD51J20A-MU-EFP
ATSAME51J18A-MU-EFP
ATSAME51J19A-MU-EFP

ATSAME51J20A-MU-EFP
ATSAME53J18A-MU-EFP
ATSAME53J19A-MU-EFP
ATSAME53J20A-MU-EFP
ATSAME51J19A-AU
ATSAME51J18A-AU
ATSAMD51J18A-AU
ATSAMD51J19A-AU
ATSAMD51J20A-AU
ATSAME53J18A-AU
ATSAME54P19A-CTZTV06
ATSAME51G19A-MZTV12
ATSAME51J18A-MZTV02
ATSAME51J20A-MZTV11
ATSAME51J20A-MZTV16
ATSAME51J19A-MZTV18
ATSAME51J20A-AZTV10
ATSAME54P20A-AZTV13
ATSAME51N19A-AZ510
ATSAME51N20A-AZVAO
ATSAME54N20A-AZVAO
ATSAMD51N19A-AZVAO
ATSAME51G18A-MZVAO
ATSAME51G19A-MZVAO
ATSAMD51G18A-MZVAO
ATSAME51J20A-MZVAO
ATSAME51J18A-MZVAO
ATSAME51J19A-MZVAO
ATSAME51J19A-AZVAO
ATSAME51J18A-AZVAO
ATSAME51J20A-AZVAO
ATSAME54P20A-AZ510
ATSAME54P19A-AZVAO
ATSAME54P20A-AZVAO
ATSAME51N19A-AZT510
ATSAME51N20A-AZTVAO
ATSAME51N19A-AZTVAO
ATSAMD51N19A-AZTVAO
ATSAMD51P20A-CTZTV08
ATSAME54P20A-CTZTV09
ATSAME51G18A-MZTVAO
ATSAME51G19A-MZTVAO
ATSAMD51G18A-MZTVAO
ATSAME51J20A-MZTVAO
ATSAME51J18A-MZTVAO
ATSAME51J19A-MZTVAO
ATSAME51J19A-AZTVAO
ATSAME51J18A-AZTVAO
ATSAME51J20A-AZTVAO

ATSAME54P20A-AZT510
ATSAME54P19A-AZTVAO
ATSAME54P20A-AZTVAO
ATSAME54P20A-AZTV13-MB
ATSAME51N19A-AF
ATSAME53J20A-AU
ATSAME53N19A-AZT
ATSAME53N20A-AZT
ATSAME51N19A-AZT
ATSAME51N20A-AZT
ATSAMD51N20A-AZT
ATSAMD51N19A-AZT
ATSAME54N20A-AFT-SL1
ATSAME54N20A-AFT-SL2
ATSAME54N20A-AFT-SL3
ATSAME54P20A-CTZT
ATSAME54P19A-CTZT
ATSAMD51P20A-CTZT
ATSAMD51P19A-CTZT
ATSAMD51G18A-MFT
ATSAMD51G19A-MFT
ATSAME51G19A-MFT
ATSAME51G18A-MFT
ATSAMD51J20A-MFT
ATSAME51J19A-MFT
ATSAMD51J18A-MFT
ATSAMD51J19A-MFT
ATSAME51J18A-MFT
ATSAME53J18A-MFT
ATSAME53J19A-MFT
ATSAME53J20A-MFT
ATSAME51J20A-MFT
ATSAMD51G19A-MZT
ATSAMD51G18A-MZT
ATSAME51G19A-MZT
ATSAME51G18A-MZT
ATSAME51J20A-MZT
ATSAME51J18A-MZT
ATSAMD51J18A-MZT
ATSAMD51J19A-MZT
ATSAMD51J20A-MZT
ATSAME53J18A-MZT
ATSAME53J19A-MZT
ATSAME53J20A-MZT
ATSAME51J19A-MZT
ATSAME51J18A-AFT
ATSAME51J19A-AFT
ATSAMD51J18A-AFT
ATSAMD51J19A-AFT

ATSAMD51J20A-AFT
ATSAME53J18A-AFT
ATSAME53J19A-AFT
ATSAME53J20A-AFT
ATSAME51J20A-AFT
ATSAMD51J19B-AFT
ATSAME51J20A-AZT
ATSAMD51J20A-AZT
ATSAMD51J18A-AZT
ATSAMD51J19A-AZT
ATSAME53J18A-AZT
ATSAME53J19A-AZT
ATSAME53J20A-AZT
ATSAME51J18A-AZT
ATSAME51J19A-AZT
ATSAME54P20A-AFT
ATSAME54P19A-AFT
ATSAMD51P19A-AFT
ATSAMD51P20A-AFT
ATSAME54P20A-AZT
ATSAME54P19A-AZT
ATSAMD51P19A-AZT
ATSAMD51P20A-AZT
ATSAME54P20A-AFT-SL1
ATSAME54P20A-AFT-SL2
ATSAME54P20A-AFT-SL3
ATSAMD51N19A-AF
ATSAMD51N20A-AF
ATSAME54N19A-AF
ATSAME54N20A-AF
ATSAME53N19A-AF
ATSAME53N20A-AF
ATSAME54N19A-AZ
ATSAME54N20A-AZ
ATSAME53N19A-AZ
ATSAME53N20A-AZ
ATSAME51N19A-AZ
ATSAME51N20A-AZ
ATSAMD51N19A-AZ
ATSAMD51N20A-AZ
ATSAME54N20A-AF-SL1
ATSAME54N20A-AF-SL2
ATSAME54N20A-AF-SL3
ATSAMD51G18A-MF
ATSAMD51G19A-MF
ATSAME51G19A-MF
ATSAME51G18A-MF
ATSAMD51J20A-MF
ATSAME51J19A-MF

ATSAMD51J18A-MF
ATSAMD51J19A-MF
ATSAME51J18A-MF
ATSAME53J18A-MF
ATSAME53J19A-MF
ATSAME53J20A-MF
ATSAME51J20A-MF
ATSAMD51G18A-MZ
ATSAMD51G19A-MZ
ATSAME51G19A-MZ
ATSAME51G18A-MZ
ATSAMD51J18A-MZ
ATSAMD51J19A-MZ
ATSAMD51J20A-MZ
ATSAME53J18A-MZ
ATSAME53J19A-MZ
ATSAME53J20A-MZ
ATSAME51J18A-MZ
ATSAME51J19A-MZ
ATSAME51J20A-MZ
ATSAME51J18A-AF
ATSAME51J19A-AF
ATSAMD51J18A-AF
ATSAMD51J19A-AF
ATSAMD51J20A-AF
ATSAME53J18A-AF
ATSAME53J19A-AF
ATSAME53J20A-AF

SAM D5x/E5x Family Errata

The SAM D5x/E5x family of devices that you have received conform functionally to the current device data sheet (DS60001507), except for the anomalies described in this document.

The silicon issues discussed in the following pages are for silicon revisions with the device and revision IDs listed in Table 1. SAM D5x/E5x Family Silicon Device Identification. The silicon issues are summarized in the Table of Contents following this section.

The errata described in this document will be addressed in future revisions of the SAM D5x/E5x family silicon.

Note: This document summarizes all silicon errata issues from all revisions of silicon, previous as well as current.

Data Sheet clarifications and corrections (if applicable) are located in the section [Data Sheet Clarifications](#), following the discussion of silicon issues.

Table 1. SAM D5x/E5x Family Silicon Device Identification

Part Number	Device Identification (DID[31:0])	Revision ID (DID.REVISION[3:0])			
		A	D	F	G
ATSAME54P19A	0x61840x01	0x0	0x3	0x5	0x6
ATSAME54P20A	0x61840x00				
ATSAME54N19A	0x61840x03				
ATSAME54N20A	0x61840x02				
ATSAME53N20A	0x61830x02				
ATSAME53N19A	0x61830x03				
ATSAME53J18A	0x61830x06				
ATSAME53J19A	0x61830x05				
ATSAME53J20A	0x61830x04				
ATSAME51N19A	0x61810x01				
ATSAME51N20A	0x61810x00				
ATSAME51J18A	0x61810x03				
ATSAME51J19A	0x61810x02				
ATSAME51J20A	0x61810x04				
ATSAMD51P20A	0x60060x00				
ATSAMD51P19A	0x60060x01				
ATSAMD51N19A	0x60060x03				
ATSAMD51N20A	0x60060x02				
ATSAMD51J18A	0x60060x06				
ATSAMD51J19A	0x60060x05				
ATSAMD51J20A	0x60060x04				
ATSAMD51G18A	0x60060x08				
ATSAMD51G19A	0x60060x07				
ATSAME51G18A	0x61810306	N/A	0x3	0x5	0x6
ATSAME51G19A	0x61810305				

Note: Refer to the **Device Service Unit** chapter in the current device data sheet (DS60001507) for a detailed information on Device Identification and Revision IDs for your specific device.

Table of Contents

SAM D5x/E5x Family Errata.....	1
1. Silicon Errata Summary.....	5
2. Silicon Errata Issues.....	13
2.1. Analog-to-Digital Converter (ADC).....	13
2.2. Analog Comparator (AC).....	14
2.3. Configurable Custom Logic (CCL).....	15
2.4. Controller Area Network (CAN).....	16
2.5. Clock Failure Detector (CFD).....	25
2.6. Device.....	26
2.7. Device Service Unit (DSU).....	28
2.8. 48 MHz Digital Frequency-Locked Loop (DFLL48M).....	29
2.9. Digital-to-Analog Converter (DAC).....	31
2.10. Direct Memory Access Controller (DMAC).....	32
2.11. Ethernet MAC (GMAC).....	33
2.12. External Interrupt Controller (EIC).....	33
2.13. Fractional Digital Phase-Locked Loop (FDPLL).....	34
2.14. Non-Volatile Memory Controller (NVMCTRL).....	35
2.15. Peripheral Access Controller (PAC).....	35
2.16. I/O Pin Controller (PORT).....	36
2.17. Real-Time Counter (RTC).....	36
2.18. Serial Communication Interface (SERCOM).....	39
2.19. Supply Controller (SUPC).....	45
2.20. Timer/Counter (TC).....	46
2.21. Timer/Counter for Control Applications (TCC).....	47
2.22. Position Decoder (PDEC)	49
2.23. Voltage Reference System (VREF).....	51
2.24. Event System (EVSYS).....	51
2.25. True Random Number Generator (TRNG).....	52
2.26. OSC32KCTRL.....	52
2.27. Oscillator Controller (OSCCTRL).....	52
2.28. Frequency Meter (FREQM).....	52
3. Data Sheet Clarifications.....	54
4. Appendix A: Revision History.....	55
The Microchip Website.....	61
Product Change Notification Service.....	61
Customer Support.....	61
Microchip Devices Code Protection Feature.....	61
Legal Notice.....	61
Trademarks.....	62

Quality Management System..... 63

Worldwide Sales and Service.....64

1. Silicon Errata Summary

Table 1-1. Errata Summary

Module	Feature	Item Number	Issue Summary	Affected Revisions			
				A	D	F	G
Analog -to-Digital Converter(ADC)	ADC SYNCBUSY.SWTRIG	2.1.1	The ADC SYNCBUSY.SWTRIG gets stuck to '1' after wake-up from Standby Sleep mode.	X	X	X	X
Analog -to-Digital Converter(ADC)	ADC TUE/INL/DNL	2.1.2	The ADC TUE/INL/DNL performance is not guaranteed in the following scenarios: <ul style="list-style-type: none"> Sampling frequency is above 500 ksp/s ADC VREF is different from VDDANA 	X			
Analog -to-Digital Converter(ADC)	Reference Buffer Offset Compensation	2.1.3	ADC converted data could be erroneous when using the Reference Buffer (REFCTRL.REFSEL = INTREF, INTVCC0, VREFA or VREB) and when Reference Buffer Offset Compensation is enabled (REFCTRL.REFCOMP = 1).	X	X	X	X
Analog -to-Digital Converter(ADC)	DMA Sequencing	2.1.4	ADC DMA Sequencing with prescaler>8 (ADC->CTRLA.bit.PRESCALER>2), does not produce the expected channel sequence.	X	X	X	X
Analog -to-Digital Converter(ADC)	DMA Sequencing	2.1.5	ADC DMA Sequencing with averaging enabled (AVGCTRL.SAMPLENUM>1) without AVGCTRL bit set (DSEQCTRL.AVGCTRL= 0) in the update sequence does not produce the expected channel sequence.	X	X	X	X
Analog -to-Digital Converter(ADC)	Internal Bandgap Reference	2.1.6	If the internal bandgap voltage reference is selected, ADC conversions may never complete.	X	X	X	X
Analog Comparator (AC)	AC Hysteresis	2.2.1	Enabling Hysteresis (COMPCTRLn.HYSTEN = 0x1) changes the threshold voltage (VTH-), which could result in unexpected behavior of the Analog Comparator.	X	X		
Analog Comparator (AC)	Output	2.2.2	In continuous mode the Comparator output may toggle during startup time before the Ready Status bit is set (STATUSB.READY = 1).	X	X	X	X
Analog Comparator (AC)	Standby Sleep Mode	2.2.3	A comparison in single shot mode will not be completed when entering in Standby Sleep mode with RUNSTDBY = 0.	X	X	X	X
Analog Comparator (AC)	Debug Mode	2.2.4	Continuous comparisons cannot be halted in Debug mode.	X	X	X	X
Configurable Custom Logic (CCL)	Enable Protected Registers	2.3.1	The SEQCTRLx and LUTCTRLx registers are enable-protected by the CTRL.ENABLE bit, whereas they should be enable-protected by the LUTCTRLx.ENABLE bits.	X	X	X	X
Configurable Custom Logic (CCL)	Sequential Logic	2.3.2	When the LUT is disabled to clear the flip-flop/latch output and enabled again, the sequential logic is kept under reset.	X	X	X	X
Controller Area Network (CAN)	CAN Edge Filtering	2.4.1	When edge filtering is activated (CCCR.EFBI = 1) and when the end of the integration phase coincides with a falling edge at the Rx input pin, it may occur that the CAN synchronizes itself incorrectly and does not correctly receive the first bit of the frame. In this case, the CRC will detect the first bit that was received incorrectly, it will rate the received FD frame as faulty, and an error frame will be send.	X	X	X	X
Controller Area Network (CAN)	Dominant Bit of Intermission	2.4.2	When NBTP.NTSEG2 is configured to zero (Phase_Seg2(N) = 1), and when there is a pending transmission request, a dominant third bit of Intermission may cause the CAN to wrongly transmit the first identifier bit dominant instead of recessive, even if this bit was configured as '1' in the Tx Buffer Element of the CAN module.	X	X	X	X
Controller Area Network (CAN)	INTFLAG Status	2.4.3	Message transmitted with wrong arbitration and control fields.	X	X	X	X

.....continued

Module	Feature	Item Number	Issue Summary	Affected Revisions			
				A	D	F	G
Controller Area Network (CAN)	DAR Mode	2.4.4	Retransmission in DAR mode due to lost arbitration.	X	X	X	X
Controller Area Network (CAN)	High Priority Message (HPM) interrupt	2.4.5	Unexpected High Priority Message (HPM) interrupt	X	X	X	X
Controller Area Network (CAN)	TxFIFO	2.4.6	Tx FIFO message sequence inversion	X	X	X	X
Controller Area Network (CAN)	Debug Message	2.4.7	Debug message handling state machine not reset to Idle state when CCCR.INIT is set.	X	X	X	X
Controller Area Network (CAN)	Reserved	2.4.8	Reserved				
Controller Area Network (CAN)	On Demand	2.4.9	The CAN is not compatible with on-demand clock requests.	X	X	X	X
Controller Area Network (CAN)	Debug Mode	2.4.10	ECR.CEL, PSR.PXE, PSR.RFDF, PSR.RBRS, PSR.RESI, PSR.DLEC and PSR.LEC bits can be corrupted by a debug access.	X	X	X	X
Controller Area Network (CAN)	Debug Mode	2.4.11	An expected clear on read of ECR.CEL, PSR.PXE, PSR.RFDF, PSR.RBRS, PSR.RESI, PSR.DLEC and PSR.LEC bits can be unexpectedly filtered-out when the CPU is halted.	X	X	X	X
Controller Area Network (CAN)	Transmit Message Order Inversion	2.4.12	It may happen, depending on the delay between the individual Tx requests, that in the case where multiple Tx Buffers are configured with the same Message ID the Tx Buffers are not transmitted in order of the Tx Buffer number (lowest number first).	X	X	X	X
Controller Area Network (CAN)	Tx (Queue) Buffers	2.4.13	Use of multiple dedicated Tx Buffers or Tx Queue buffers configured with same Message	X	X	X	X
Controller Area Network (CAN)	Transmit Cancellation	2.4.14	Frame transmitted despite confirmed transmit cancellation.	X	X	X	X
Clock Failure Detector (CFD)	CFD with XOSC/XOSC32K Oscillator	2.5.1	When the CFD is enabled for the XOSC/XOSC32K oscillator and the oscillator input signal is stuck at 1, the clock failure detection works correctly but the switch to the safe clock will fail.	X			
Clock Failure Detector (CFD)	XOSC Ready bit not cleared	2.5.2	When the XOSC Clock Failure Detector is enabled and a failure is detected, the XOSC Ready bit is not cleared.	X	X	X	X
Clock Failure Detector (CFD)	False Clock Failure Detection	2.5.3	Re-enabling the Clock Failure Detector when the XOSC is enabled can lead to a false Clock Failure Detection.	X	X	X	X
Clock Failure Detector (CFD)	False Clock Failure Detection	2.5.4	Re-enabling the Clock Failure Detector when the XOSC32K is enabled can lead to a false Clock Failure Detection.	X	X	X	X
Device	Reverse Current in VDDIOB Domain	2.6.1	For the device with 100-pin, 120-pin, and 128-pin counts, when VDDIOB is supplied with the voltage less than VDDIO - 0.7V, reverse current in VDDIOB cluster is observed.	X			
Device	Internal Pull-up on the RESET Pin	2.6.2	The internal pull-up of the RESET pin is not functional.	X			
Device	Detection of a Debugger Probe	2.6.3	The detection of a debugger probe or a user reset (external reset, watchdog reset and system reset request) could fail if the "BOD33 Disable" fuse is cleared (i.e., BOD33 is enabled).	X	X		
Device	VBAT Mode	2.6.4	VBAT mode is not functional.	X			
Device	Internal Reference	2.6.5	When the internal reference is used with the DAC and ADC, their outputs become non-linear when the operating temperature is less than 0°C.	X			
Device	Device Operation for Temperature < -20°C	2.6.6	If the operating temperature is less than -20°C, the device does not start.	X	X	X	X

.....continued							
Module	Feature	Item Number	Issue Summary	Affected Revisions			
				A	D	F	G
Device	Overconsumption in Standby	2.6.7	An overconsumption can happen when entering in standby sleep mode when some peripherals are enabled with run in standby disabled.	X	X	X	X
Device	VDDANA Analog Cluster	2.6.8	Any and all I/O as well as digital alternate functions on VDDANA analog cluster must be confined as inputs only.	X	X	X	X
Device	Standby Mode	2.6.9	STANDBY low power mode is not supported and should not be used in new designs.	X	X		
Device	Power Up	2.6.10	The cache lines 0 (AHB0) and 1 (AHB1), which are enabled by default at reset, may not be reset properly at power-up in some very rare circumstances.	X	X	X	
Device Service Unit	CRC32	2.7.1	DSU CRC32 will not complete when targeting NVM memory space while the NVM cache is disabled.	X	X	X	X
Device Service Unit	Coresight	2.7.2	During Coresight discovery, the TPIU and ETB ROM tables content reads as 0. Debugger may conclude that TPIU and ETB are unavailable and indicate that trace is not available.	X	X	X	X
48 MHz Digital Frequency-Locked Loop (DFLL48M)	COARSE or FINE Calibration Values During the Locking Sequence	2.8.1	If the DFLL48M reaches the maximum or minimum COARSE or FINE calibration values during the locking sequence, an out of bounds interrupt will be generated.	X	X	X	X
48 MHz Digital Frequency-Locked Loop (DFLL48M)	STATUS.DFLLRDY Bit in Close Loop Mode	2.8.2	In Close Loop mode, the STATUS.DFLLRDY bit does not rise before lock fine occurs. Therefore, the information about DFLL ready to start Close Loop mode is not available.	X	X	X	X
48 MHz Digital Frequency-Locked Loop (DFLL48M)	DFLLVAL.FINE Value When DFLL48M Re-enabled	2.8.3	If the DFLL is disabled and then re-enabled, the DFLLVAL.FINE value is ignored by the DFLL module, which will then start its lock fine process at another frequency.	X			
48 MHz Digital Frequency-Locked Loop (DFLL48M)	Lose Lock After Wake (LLAW) Usage	2.8.4	When the Lose Lock After Wake (DFLLCTRLB.LLAW) is set, the DFLL may maintain lock (STATUS.DFLLLOCK = 1) after the DFLL is disabled. If the DFLL lock (STATUS.DFLLLOCK = 1) is maintained when the DFLL is reconfigured and then enabled, some bits may not be properly set.	X	X	X	X
48 MHz Digital Frequency-Locked Loop (DFLL48M)	DFLL48M Status flags	2.8.5	The STATUS.DFLLLOCK and STATUS.DFLLCKC status bits are not automatically cleared when disabling the DFLL while it is running in close loop mode.	X	X	X	X
48 MHz Digital Frequency-Locked Loop (DFLL48M)	DFLL48M Status flags	2.8.6	DFLL48M Status flags may have unexpected values during DFLL48 registers (DFLLCTRLA, DFLLCTRLB, DFLLMUL, DFLLVAL) configuration.	X	X	X	X
48 MHz Digital Frequency-Locked Loop (DFLL48M)	Lose Lock After Wake (LLAW) Usage	2.8.7	Changing Lose Lock After Wake (DFLLCTRLB.LLAW) when the DFLL is not completely stopped can produce a corruption of the closed loop controller and the lock status.	X	X	X	X
Digital-to-Analog Converter (DAC)	RESERVED	2.9.1	RESERVED				
Digital-to-Analog Converter (DAC)	VDDANA as the DAC Reference	2.9.2	The selection of VDDANA as the DAC reference in DAC.CTRLB.REFSEL is non-functional.	X			
Digital-to-Analog Converter (DAC)	DAC on Negative Input AIN3	2.9.3	No analog compare will be done on Comparator 1 (AC1) when using the DAC on negative input AIN3.	X			
Digital-to-Analog Converter (DAC)	Interpolation Mode	2.9.4	If the Interpolation mode is enabled (with filter integrated to the DAC), the last data from the filter is missing, hence the DAC final output value does not correspond to the DAC input value.	X	X	X	X
Digital-to-Analog Converter (DAC)	Reference	2.9.5	The reference select of the DAC (CTRLB.REFSEL) will default to a '0' if the DAC Software Reset (CTRLA.SWRST) is used to reset the module.	X	X	X	X

.....continued							
Module	Feature	Item Number	Issue Summary	Affected Revisions			
				A	D	F	G
Digital-to-Analog Converter (DAC)	First Conversion	2.9.6	When the internal bandgap reference is selected as reference voltage, the DAC Startup Ready bits value is not correct for the first DAC Conversion after device power-up or after wake-up from Standby Low-Power mode.	X	X	X	X
Digital-to-Analog Converter (DAC)	Refresh Mode	2.9.7	The DAC Conversion Refresh mode is not functional.	X	X	X	X
Direct Memory Access Controller (DMAC)	Linked Descriptors	2.10.1	When at least one channel using linked descriptors is already active, a channel Fetch Error (FERR) could occur on enabling a channel with no linked descriptor or the second descriptor (index 1) of the channel being enabled could be fetched by one of the already active channels using linked descriptors.	X	X		
Direct Memory Access Controller (DMAC)	Channel Priority	2.10.2	When using channels with different priority levels, the highest priority channel could stall at the end of its current block.	X			
Direct Memory Access Controller (DMAC)	DMAC in Debug Mode	2.10.3	In debug mode, DMAC does not restart after a debug halt when DBGCTRL.DBGRUN=0.	X			
Ethernet MAC (GMAC)	Ethernet Functionality in 64-pin Packages	2.11.1	Ethernet functionality in 64-pin packages is not available.	X			
External Interrupt Controller (EIC)	Edge Detection	2.12.1	When enabling EIC, SYNCBUSY.ENABLE is released before EIC is fully enabled. Edge detection can be done only after three cycles of the selected GCLK (GCLK_EIC or CLK_ULP32K).	X	X	X	X
External Interrupt Controller (EIC)	Asynchronous Edge Detection	2.12.2	When the asynchronous edge detection is enabled and the system is in Standby mode, only the first edge will be detected. The following edges are ignored until the system wakes up.	X	X	X	X
External Interrupt Controller (EIC)	NMI Interrupt	2.12.3	If the NMI is configured in synchronous edge detection mode, spurious NMI interrupts may occur.	X	X	X	X
Fractional Digital Phase-Locked Loop (FDPLL)	Input Clock on FDPLLn	2.13.1	Several FDPLL unlocks could occur while the output frequency is stable.	X	X		
Fractional Digital Phase-Locked Loop (FDPLL)	FDPLL Ratio in DPLLnRATIO	2.13.2	When changing the FDPLL ratio in DPLLnRATIO register on-the-fly, STATUS.DPLLnLDRT0 will not beset when the ratio update will be completed.	X	X	X	X
Non-Volatile Memory Controller (NVMCTRL)	NVM Read Corruption	2.14.1	NVM reads could be corrupted when mixing NVM reads with Page Buffer writes.	X	X		
Non-Volatile Memory Controller (NVMCTRL)	SmartEEPROM Buffered Mode	2.14.2	SmartEEPROM Buffered mode is not recommended	X	X	X	X
Non-Volatile Memory Controller (NVMCTRL)	Debugger Illegal Accesses	2.14.3	Debugger illegal NVMCTRL address space read transactions return invalid data. Debugger illegal NVMCTRL address space write transactions are silently ignored.	X	X	X	X
Peripheral Access Controller (PAC)	PAC Protection Error in FREQM	2.15.1	FREQM reads on the Control B register (FREQM.CTRLB) generate a PAC protection error.	X	X	X	X
Peripheral Access Controller (PAC)	PAC Protection Error in CCL	2.15.2	Writing the Software Reset bit in the Control A register (CTRLASWRST) will trigger a PAC protection error.	X	X	X	X
I/O Pin Controller (PORT)	PORT Read/Write Attempts on Non-Implemented Registers	2.16.1	PORT read/write attempts on non-implemented registers, including addresses beyond the last implemented register group (PA, PB,...), do not generate a PAC protection error.	X	X	X	X
I/O Pin Controller (PORT)	PORT Pull-Up/Pull-Down Resistor	2.16.2	The pull-down on PA24/PA25 are activated during power-up and when Sleep mode is OFF. On all other pins, except those in the VSWOUT cluster, the pull-up is activated during power-up and when Sleep mode is OFF.	X			

.....continued

Module	Feature	Item Number	Issue Summary	Affected Revisions			
				A	D	F	G
Real-Time Counter (RTC)	Write Corruption	2.17.1	A 8-bit or 16-bit write access for a 32-bit register, or 8-bit write access for a 16-bit register can fail for the following registers: <ul style="list-style-type: none"> The COUNT register in COUNT32 mode The COUNT register in COUNT16 mode The CLOCK register in CLOCK mode 	X	X	X	X
Real-Time Counter (RTC)	Count Read Sync Enable Synchronization Busy	2.17.2	When CTRLA.COUNTSYNC is enabled, the first COUNT value is not correctly synchronized and therefore it is a wrong value.	X	X	X	X
Real-Time Counter (RTC)	Tamper Input Filter	2.17.3	Majority debouncing, as part of RTC tamper detection, does not work, when enabled by setting Debouncer Majority Enable bit CTRLB.DEBMAJ.	X	X	X	X
Real-Time Counter (RTC)	Tamper Detection	2.17.4	Upon enabling the RTC, a false tamper detection could be reported by the RTC.	X	X	X	X
Real-Time Counter (RTC)	Tamper Detection Timestamp	2.17.5	If an external reset occurs during a tamper detection, the TIMESTAMP register will not be updated when next tamper detection is triggered.	X	X	X	X
Real-Time Counter (RTC)	PRESCALER	2.17.6	When the tamper or debouncing features (TAMPCTRL) are enabled, periodic interrupts and events are generated when the prescaler is OFF (CTRLA.PRESCALER=0).	X	X	X	X
Real-Time Counter (RTC)	Tamper Detection Timestamp	2.17.7	When DMA is enabled, the INTFLAG.TAMPER bit is not reset by reading the TIMESTAMP register.	X	X	X	X
Real-Time Counter (RTC)	General Purpose Registers	2.17.8	General Purpose Registers n (GPN) are reset on tamper detection even if GPTRST = 0.	X	X	X	X
Real-Time Counter (RTC)	Battery Backup Mode	2.17.9	Entering Battery Backup mode without waiting for SYNCBUSY.ENABLE and SYNCBUSY.COUNTSYNC synchronization completion may freeze these bits status.	X	X	X	X
Real-Time Counter (RTC)	Active Layer Protection	2.17.10	When the RTC is configured in Active Layer Protection mode (TAMPCTRL.INACT = 0x3) and the RTC CTRLA.ENABLE bit is not set, a tamper can be detected and a timestamp captured. The TAMPID register and INTFLAG.TAMPER bit may not be set.	X	X	X	X
Serial Communication Interface (SERCOM)	SERCOM-USART: USART Auto-Baud Mode	2.18.1	In USART Auto-Baud mode, missing stop bits are not recognized as inconsistent sync (ISF) or framing (FERR) errors.	X	X	X	X
Serial Communication Interface (SERCOM)	SERCOM-USART: Collision Detection	2.18.2	In USART operating mode with Collision Detection enabled (CTRLB.COLDEN=1), the SERCOM will not abort the current transfer as expected if a collision is detected and if the SERCOM APB Clock is lower than the SERCOM Generic Clock.	X	X	X	X
Serial Communication Interface (SERCOM)	SERCOM-USART: Debug Mode	2.18.3	In USART operating mode, if DBGCTRL.DBGSTOP=1, data transmission is not halted after entering Debug mode.	X	X	X	X
Serial Communication Interface (SERCOM)	SERCOM-SPI: 32-bit Extension Mode	2.18.4	When 32-bit Extension mode is enabled and data to be sent is not in multiples of 4 bytes (which means the length counter must be enabled), additional bytes will be sent over the line.	X	X	X	X
Serial Communication Interface (SERCOM)	SERCOM-UART: TXINV and RXINV Bits	2.18.5	The TXINV and RXINV bits in the CTRLA register have inverted functionality.	X	X	X	X
Serial Communication Interface (SERCOM)	SERCOM-I ² C: SDAHOLD Timing	2.18.6	SDAHOLD timing of the SERCOM-I ² C does not match the value shown in the current device data sheet.	X	X	X	X
Serial Communication Interface (SERCOM)	SERCOM-I ² C: Repeated Start in High-Speed Host Write Operation	2.18.7	For High-Speed Host Write operations, writing CTRLB.CMD = 0x1 issues a STOP command instead of a Repeated Start making repeated start not possible in that mode.	X	X	X	X

.....continued

Module	Feature	Item Number	Issue Summary	Affected Revisions			
				A	D	F	G
Serial Communication Interface (SERCOM)	SERCOM-I ² C: Repeated Start in High-Speed Host Read Operation	2.18.8	For High-Speed Host Read operations, sending a NACK (CTRLB.CMD = 0x2) forces a STOP to be issued making repeated start not possible in that mode.	X	X	X	X
Serial Communication Interface (SERCOM)	SERCOM-I ² C: STATUS.CLKHOLD Bit in Host and Client Modes	2.18.9	The STATUS.CLKHOLD bit in host and client modes can be written whereas it is a read-only status bit.	X	X	X	X
Serial Communication Interface (SERCOM)	SERCOM-I ² C: I ² C in Client Mode	2.18.10	In I ² C mode, LENERR, SEXTOUT, LOWTOUT, COLL and BUSERR bits are not cleared when INTFLAG.AMATCH is cleared.	X	X	X	X
Serial Communication Interface (SERCOM)	SERCOM-I ² C: Client Mode with DMA	2.18.11	In I ² C Client Transmitter mode, at the reception of a NACK, if there is still data to be sent in the DMA buffer, the DMA will push a data to the DATA register.	X	X	X	X
Serial Communication Interface (SERCOM)	SERCOM-I ² C: I ² C Client in DATA32B Mode	2.18.12	When SERCOM is configured as an I ² C client in 32-bit Data Mode (DATA32B=1) and the I ² C host reads from the I ² C client (client transmitter) and outputs its NACK (indicating no more data is needed), the I ² C client still receives a DRDY interrupt.	X	X	X	X
Serial Communication Interface (SERCOM)	SERCOM-I ² C: 10-bit Addressing Mode	2.18.13	10-bit addressing in I ² C Client mode is not functional.	X	X	X	X
Serial Communication Interface (SERCOM)	SERCOM-I ² C: Repeated Start	2.18.14	When the Quick command is enabled (CTRLB.QCEN=1), software can issue a repeated Start by writing either CTRLB.CMD or ADDR.ADDR bit fields.	X	X	X	X
Serial Communication Interface (SERCOM)	SERCOM-SPI: Data Preload	2.18.15	In SPI Client mode with Client Data Preload Enabled, the client transmitter may discard some data if the host cannot keep the SPI Select pin low until the end of transmission.	X	X	X	X
Serial Communication Interface (SERCOM)	Repeated Start	2.18.16	For Host Write operations (excluding High-Speed mode), in 10-bit addressing mode, writing CTRLB.CMD = 0x1 does not issue correctly a Repeated Start command.	X	X	X	X
Serial Communication Interface (SERCOM)	SERCOM-USART: Wakeup	2.18.17	The USART does not wake-up the device on Error (INTFLAG.ERROR=1) interrupt.	X	X	X	X
Serial Communication Interface (SERCOM)	SERCOM-USART: LENGTH	2.18.18	When the USART is used in 32-bit mode with hardware handshaking (CTS/RTS) the TXC interrupt flag (INTFLAG.TXC) may be set before transmission has completed. The TXC interrupt flag may incorrectly be set regardless of Data Length Enable (LENGTH.LENEN) is set to '0' or '1'.	X	X	X	X
Serial Communication Interface (SERCOM)	SERCOM-USART: Overconsumption in Standby mode	2.18.19	Unexpected over-consumption in standby mode	X	X	X	X
Serial Communication Interface (SERCOM)	Wake-up Interrupt	2.18.20	The Data Register Empty (DRE) wake-up interrupt is not de-asserted when the register interrupt is cleared (INTFLAG.DRE=0).	X	X	X	X
Serial Communication Interface (SERCOM)	Client Data Preload	2.18.21	Preloading a new SPI data before going into Standby Sleep mode, may lead to extra power consumption.	X	X	X	X
Serial Communication Interface (SERCOM)	Hardware SPI Select Control	2.18.22	When Hardware SPI Select Control is enabled, the SPI Select (SS) pin goes high after each byte transfer.	X	X	X	X
Serial Communication Interface (SERCOM)	SERCOM-I ² C: Automatic Acknowledge	2.18.23	The I ² C Client Automatic Acknowledge feature (CTRLB.AACKEN = 1) is not supported when doing a repeated start.	X	X	X	X
Serial Communication Interface (SERCOM)	SERCOM-I ² C: Wakeup	2.18.24	When an unexpected STOP occurs on the I ² C bus the STATUS.BUSERR & INTFLAG.ERROR bits are set but may not wake the system from sleep mode. An unexpected START will not produce this issue.	X	X	X	X
Serial Communication Interface (SERCOM)	Software Reset	2.18.25	Software Reset (CTRLA.SWRST=1) is not functional when the SERCOM is not enabled (CTRLA.ENABLE=0).	X	X	X	X

.....continued

Module	Feature	Item Number	Issue Summary	Affected Revisions			
				A	D	F	G
Serial Communication Interface (SERCOM)	SERCOM-USART: LIN Host Delays	2.18.26	In SERCOM USART LIN Host mode, in the case where break, sync and identifier fields are automatically transmitted when DATA is written with the identifier, the LIN Host Header delay between the sync and the ID transmission fields is not correct.	X	X	X	X
Serial Communication Interface (SERCOM)	SERCOM-USART: Two Stop Bits Mode in LIN Host	2.18.27	Two stop bits mode is not supported in SERCOM USART LIN Host mode, in the case where break, sync and identifier fields are automatically transmitted when DATA is written with the identifier.	X	X	X	X
Supply Controller (SUPC)	Buck Converter Mode	2.19.1	Digital Phase-Locked Loop (FDPLL200Mx2) and Digital Frequency-Locked Loop (DFLL48M) PLL's cannot be used with main voltage regulator in Buck converter mode.	X	X	X	X
Supply Controller (SUPC)	BOD33 Hysteresis	2.19.2	The hysteresis feature of the 3.3V BOD is not functional while the device is in STANDBY sleep mode.	X	X	X	X
Timer/Counter (TC)	PERBUF/CCBUFx Register	2.20.1	When clearing the STATUS.PERBUFV/STATUS.CCBUFx flag, the SYNCBUSY flag is released before the PERBUF/CCBUFx register is restored to its appropriate value.	X	X	X	X
Timer/Counter (TC)	Retrigger	2.20.2	If a Retrigger event occurs at the Channel Compare Match [n] time, the next Waveform Output [n] is missing or disturbed.	X	X	X	X
Timer/Counter (TC)	PER register (8-bit mode)	2.20.3	In 8-bit Mode, PER register updates using the DMA are not possible in standby mode.	X	X	X	X
Timer/Counter (TC)	MCx Interrupt Flags	2.20.4	In capture operation, MC0/MC1 interrupt status flags are not automatically cleared when CC0/CC1 register are read.	X	X	X	X
Timer/Counter for Control Applications (TCC)	TCC with EVSYS in SYNC/ RESYNC Mode	2.21.1	TCC peripheral is not compatible with an EVSYS channel in SYNC or RESYNC mode.	X	X	X	X
Timer/Counter for Control Applications (TCC)	Dithering Mode with External Retrigger Events	2.21.2	Using TCC in Dithering mode with external retrigger events can lead to an unexpected stretch of right aligned pulses, or shrink of left-aligned pulses.	X	X	X	X
Timer/Counter for Control Applications (TCC)	ALOCK Feature	2.21.3	ALOCK feature is not functional.	X	X	X	X
Timer/Counter for Control Applications (TCC)	LUPD feature in Down-Counting mode	2.21.4	In down-counting mode, the Lock Update bit (CTRLB.LUPD) does not protect against a PER register update from the PERBUF register.	X	X	X	X
Timer/Counter for Control Applications (TCC)	Re-trigger in RAMP2 Operations	2.21.5	Re-trigger in RAMP2 operations is not supported if a prescaler is used and the re-trig of the counter is done on the next GCLK.	X	X	X	X
Timer/Counter for Control Applications (TCC)	Re-trigger	2.21.6	If a Retrigger event occurs at the Channel Compare Match [n] time, the next Waveform Output [n] is missing or disturbed.	X	X	X	X
Timer/Counter for Control Applications (TCC)	RAMP2 operations	2.21.7	Timer/Counter counting down mode (CTRLBCLR.DIR = CTRLBSET.DIR = 1) is not supported in RAMP2 operations.	X	X	X	X
Timer/Counter for Control Applications (TCC)	Dithering Mode	2.21.8	Retrigger in RAMP2 operations is not supported in Dithering Mode.	X	X	X	X
Timer/Counter for Control Applications (TCC)	STATUS Register Access	2.21.9	8-bit or 16-bit writes to the STATUS register are forbidden.	X	X	X	X
Timer/Counter for Control Applications (TCC)	DMA One-Shot Trigger Mode	2.21.10	TCC Counter Overflow (OVF) DMA Trigger in DMA One-Shot Trigger Mode is not functional for Critical RAMP2C and RAMP2CS operation modes.	X	X	X	X

.....continued

Module	Feature	Item Number	Issue Summary	Affected Revisions			
				A	D	F	G
Timer/Counter for Control Applications (TCC)	MCx Interrupt Flags	2.21.11	In capture operation, MC0/MC1 interrupt status flags are not automatically cleared when CC0/CC1 register are read.	X	X	X	X
PDEC	Reserved	2.22.1	-				
PDEC	Angular and Revolution Counters	2.22.2	With index input enabled i.e., EVCTRL.EVEI[2] and operating in X4/X2 mode, angular and revolution counters are incremented/decremented by two separate and unsynchronized sources.	X	X	X	X
PDEC	Counter Operating Mode	2.22.3	Counting Events is not functional in COUNTER operating mode.	X	X	X	X
PDEC	Counter Operating Mode	2.22.4	Start, restart or retrigger on event is not functional in COUNTER operating mode.	X	X	X	X
PDEC	Direction Change	2.22.5	A direction change detection (INTFLAG.DIR = 1) updates the STATUS.DIR bit with a variable delay.	X	X	X	X
PDEC	Hall Mode	2.22.6	A windows error (WINERR) can be reported after a START command execution, or when leaving standby (with RUNSTDBY = 0).	X	X	X	X
PDEC	Hall Mode	2.22.7	In HALL mode, WINERR Error interrupt (INTFLAG.WINERR = 1) can rise several times on a low-speed window error detection.	X	X	X	X
PDEC	Error Flags	2.22.8	An error detection (INTFLAG.ERR = 1) updates the STATUS Error flags (HERR, WINERR, MPERR, IDXERR, QERR) with a variable delay.	X	X	X	X
Voltage Reference System	Temperature sensor	2.23.1	Temperature sensors are not supported.	X	X	X	X
EVSYS	Synchronous Mode	2.24.1	Spurious Overrun Interrupt when the generic clock for a channel is always on.	X	X	X	X
EVSYS	Software Events	2.24.2	Software Events are not supported in Synchronous and Resynchronized modes.	X	X	X	X
EVSYS	Synchronous/ Resynchronized Modes	2.24.3	In synchronous and resynchronized modes, spurious event detections can be generated when registers in peripherals connected to the AHB-APB bridge on which the EVSYS is connected are accessed.	X	X	X	X
TRNG	Over Consumption	2.25.1	When TRNG is disabled, some internal logic could continue to operate causing an over consumption.	X	X	X	X
OSC32KCTRL	Clock Switch Back Feature Limitation	2.26.1	In the case an application can recover the XOSC32K from a Clock Failure Detection, the application can switch back to the XOSC32K clock (CFDCTRL.SWBACK = 1).	X	X	X	X
OSCCTRL	Clock Switch Back Feature Limitation	2.27.1	In the case an application can recover the XOSC from a Clock Failure Detection, the application can switch back to the XOSC clock using Clock Switch Back feature (XOSCCTRL.SWBEN = 1).	X	X	X	X
FREQM	Lost Interrupt	2.28.1	DONE interrupt may be lost.	X	X	X	X
FREQM	STATUS.BUSY	2.28.2	No timeout period for a FREQM measurement cycle.	X	X	X	X

Notes:

- Cells with 'X' indicates the issue is present in this revision of the silicon.
- Cells with '-' indicates this silicon revision does not exist for this issue.
- The blank cell indicates the issue has been corrected or does not exist in this revision of the silicon.

2. Silicon Errata Issues

The following errata issues apply to the SAM D5x/E5x family of devices.

Note: Cells with an 'X' indicates the issue is present in this revision of the silicon. Cells with a dash '-' indicate this silicon revision does not exist for this issue.

Blank cells indicate the issue has been corrected or does not exist in this revision of the silicon.

2.1 Analog-to-Digital Converter (ADC)

2.1.1 ADC SYNCBUSY.SWTRIG

The ADC SYNCBUSY.SWTRIG gets stuck to '1' after wake-up from Standby Sleep mode.

Workaround

Ignore the ADC SYNCBUSY.SWTRIG status when waking up from Sleep mode.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.1.2 ADC TUE/INL/DNL Performance

The ADC TUE/INL/DNL performance is not guaranteed in the following scenarios:

- Sampling frequency is above 500 ksp/s AND
- ADC V_{REF} is different from VDDANA

Workaround

None.

Affected Silicon Revisions

A	D	F	G				
X							

2.1.3 Reference Buffer Offset Compensation

ADC converted data could be erroneous when using the Reference Buffer (REFCTRL.REFSEL = INTREF, INTVCC0, VREFA or VREB) and when Reference Buffer Offset Compensation is enabled (REFCTRL.REFCOMP = 1).

Workaround

The first five conversions must be ignored. All further ADC module conversions are accurate.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.1.4 DMA Sequencing

ADC DMA Sequencing with prescaler > 8 (ADC->CTRLA.bit.PRESCALER>2) does not produce the expected channel sequence.

Workaround

Keep the prescaler setting to a maximum of 8, and use the GCLK Generator divider if more prescaling is needed.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.1.5 DMA Sequencing

ADC DMA sequencing with averaging enabled (AVGCTRL.SAMPLENUM>1) without the AVGCTRL bit set (DSEQCTRL.AVGCTRL= 0) in the update sequence does not produce the expected channel sequence.

Workaround

Add the AVGCTRL register in the register update list (DSEQCTRL.AVGCTRL= 1) and set the desired value in this list.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.1.6 Internal Bandgap Reference

If the internal bandgap voltage reference is selected (REFCTRL.REFSEL = 0x0), ADC conversions may never complete (INTFLAG.RESRDY = 0).

Workaround

If CTRLA.ONDEMAND = 0: Add a delay of minimum 40 µs between the enable of the ADC (CTRLA.ENABLE) and the start of the first conversion.

If an ADC conversion is triggered by an input event, the delay must be introduced between the enable of the ADC and the enable of the ADC EVSYS channel.

If CTRLA.ONDEMAND = 1: There is no workaround.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.2 Analog Comparator (AC)

2.2.1 AC Hysteresis

Enabling Hysteresis (COMPCTRLn.HYSTEN = 0x1) changes the threshold voltage (VTH-), which could result in unexpected behavior of the Analog Comparator.

Workaround

None.

Affected Silicon Revisions

A	D	F	G				
X	X						

2.2.2 Output

In Continuous mode the comparator output may toggle during startup time before the Ready Status bit is set (STATUSB.READY = 1).

Workaround

None.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.2.3 Standby Sleep Mode

A comparison in single shot mode will not be completed when entering in Standby Sleep mode with RUNSTDBY = 0.

Workaround

Set RUNSTDBY = 1 before entering in Standby mode or wait for Standby exit to start a new comparison.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.2.4 Debug Mode

Continuous comparisons cannot be halted in Debug mode.

Workaround

None.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.3 Configurable Custom Logic (CCL)

2.3.1 Enable Protected Registers

The SEQCTRLx and LUTCTRLx registers are enable-protected by the CTRL.ENABLE bit, whereas they must be enable-protected by the LUTCTRLx.ENABLE bits.

Workaround

None.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.3.2 Sequential Logic Reference

When the LUT is disabled (LUTCTRL0.ENABLE = 0 or LUTCTRL2.ENABLE = 0) to clear the flip-flop/latch output and enabled again, the sequential logic is kept under reset.

Workaround

Write CTRL.ENABLE again after LUT is enabled (LUTCTRL0.ENABLE = 1/LUTCTRL2.ENABLE = 1) back.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.4 Controller Area Network (CAN)

2.4.1 CAN Edge Filtering

When edge filtering is activated (CCCR.EFBI = 1) and when the end of the integration phase coincides with a falling edge at the Rx input pin, it may occur that the CAN synchronizes itself incorrectly and does not correctly receive the first bit of the frame. In this case, the CRC will detect the first bit that was received incorrectly, it will rate the received FD frame as faulty, and an error frame will be send.

The issue only occurs when there is a falling edge at the Rx input pin (CAN_RX) within the last time quantum (tq) before the end of the integration phase. The last time quantum of the integration phase is at the sample point of the 11th recessive bit of the integration phase. When edge filtering is enabled, the bit timing logic of the CAN sees the Rx input signal delayed by the edge filtering. When the integration phase ends, edge filtering is automatically disabled. This affects the reset of the FD CRC registers at the beginning of the frame. The Classical CRC register is not affected, hence this issue does not affect the reception of Classical frames.

In CAN communication, the CAN module may enter an integrating state (either by resetting the CCCR.INIT or by protocol exception event) while a frame is active on the bus. In this case, the 11 recessive bits are counted between the acknowledge bit and the following start of frame. All nodes have synchronized at the beginning of the dominant acknowledge bit. This means that the edge of the following start of frame bit cannot fall on the sample point, therefore the issue does not occur. The issue occurs only when the CAN is by local errors, mis-synchronized with regard to the other nodes.

Glitch filtering as specified in ISO 11898-1:2015 is fully functional.

Edge filtering was introduced for applications where the data bit time is at least 2-tq (of nominal bit time) long. In that case, edge filtering requires at least two consecutive dominant time quanta before the counter counting the 11 recessive bits for idle detection is restarted. This means edge filtering covers the theoretical case of occasional 1-tq long dominant spikes on the CAN bus that would delay idle detection. Repeated dominant spikes on the CAN bus would disturb all CAN communication, so the filtering to speed up idle detection would not help network performance.

When this rare event occurs, the CAN sends an error frame and the sender of the affected frame retransmits the frame. When the retransmitted frame is received, the CAN has left the integration phase and the frame will be received correctly. Edge filtering is only applied during the integration phase and it is never used during normal operation. Because the integration phase is very short with respect to "active communication time", the impact on total error frame rate is negligible. The issue has no impact on data integrity.

The CAN enters the integration phase under the following conditions:

- When CCCR.INIT is set to '0' after start-up
- After a protocol exception event (only when CCCR.PXHD = 0)

Scope:

The erratum is limited to FD frame reception when edge filtering is active (CCCR.EFBI = 1) and when the end of the integration phase coincides with a falling edge at the Rx input pin.

Effects:

The calculated CRC value does not match the CRC value of the received FD frame and the CAN module sends an error frame. After retransmission the frame is received correctly.

Workaround:

Disable edge filtering or wait on retransmission in the event that this rare event occurs.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.4.2 Dominant Bit of Intermission

When NBTP.NTSEG2 is configured to zero (Phase_Seg2(N) = 1), and when there is a pending transmission request, a dominant third bit of intermission may cause the CAN to wrongly transmit the first identifier bit dominant instead of recessive, even if this bit was configured as '1' in the Tx Buffer Element of the CAN module.

Workaround

A phase buffer segment 2 of length '1' (Phase_Seg2(N) = 1) is not sufficient to switch to the first identifier bit after the sample point in intermission where the dominant bit was detected.

The CAN protocol according to ISO 11898-1 defines that a dominant third bit of intermission causes a pending transmission to be started immediately. The received dominant bit is handled as if the CAN has transmitted a Start-of-Frame (SoF) bit.

The ISO 11898-1 specifies the minimum configuration range for Phase_Seg2(N) to be 2..8 tq. Therefore, excluding a Phase_Seg2(N) of '1' will not affect CAN conformance.

Effects:

If NBTP.NTSEG2 = 0, it may occur that the CAN transmits the first identifier bit dominant instead of recessive.

Update configuration range of NBTP.NTSEG2 from 0..127 tq to 1..127 tq in the CAN documentation.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.4.3 Message Transmitted with Wrong Arbitration and Control Fields**Description:**

Under the following conditions a message with wrong ID, format, and DLC is transmitted:

- The CAN is in the "Receiver" (PSR.ACT ≠ 0b10) state, hence no pending transmission
- A new transmission is requested before the third bit of intermission is reached
- The CAN bus is sampled dominant at the third bit of intermission which is treated as SoF (See ISO11898-1:2015, "Section 10.4.2.2")

Under the conditions above, the following might happen:

- The shift register is not loaded with ID, format, and DLC of the requested message
- The CAN will start arbitration with wrong ID, format, and DLC on the next bit
- If the ID wins arbitration, a CAN message with a valid CRC is transmitted
- If this message is acknowledged, the ID stored in the Tx event FIFO is the ID of the requested Tx message and not the ID of the message transmitted on the CAN bus, hence no error is detected by the transmitting CAN

Scope:

The erratum is limited when CAN is in the "Receiver" (PSR.ACT = 0b10) state with no pending transmission (register TXBRP == 0) and a new transmission is requested before the third bit of intermission is reached and this third bit of intermission is seen dominant.

When a transmission is requested by the CPU by writing to TXBAR, the Tx message handler performs an internal arbitration and loads the pending transmit message with the highest priority into its output buffer and then sets the transmission request for the CAN Protocol Controller. The problem occurs only when the transmission request for the CAN Protocol Controller is activated in the critical time window between the sample points of the second and third bit of intermission and if that third bit of intermission is seen dominant.

This dominant level at the third bit of intermission may result from an external disturbance or may be transmitted by another node with a significantly faster clock.

Effects:

In the described case it may happen that the shift register is not loaded with arbitration and control field of the message to be transmitted. The frame is transmitted with wrong ID, format, and DLC but with the data field of the requested message. The message is transmitted in correct CAN (FD) frame format with a valid CRC.

If the message loses arbitration or is disturbed by an error, it is retransmitted with correct arbitration and control fields.

Workarounds

- **Workaround 1:** Request a new transmission only if another transmission is already pending (that is, register TXBRP \neq 0) or when the CAN is not in the "Receiver" (when PSR.ACT \neq 0b10) state. To avoid activating the transmission request in the critical time window between the sample points of the second and third bit of intermission, the application software can evaluate the Rx interrupt flags, such as IR.DRX, IR.RF0N, and IR.RF1N, which are set at the last bit of EoF when a received and accepted message becomes valid. The last bit of EoF is followed by third bits of intermission. Therefore the critical time window has safely terminated three bit times after the Rx interrupt. Now a transmission may be requested by writing to TXBAR. After the interrupt, the application has to take care that the transmission request for the CAN Protocol Controller is activated before the critical window of the following reception is reached.
- **Workaround 2:** If a transmission is to be requested while no other transmission request is already pending and the CAN bus is not idle, set the CCCR.INIT bit (which stops the CAN protocol controller), set the transmission request and clear the CCCR.INIT bit. The message currently being received when the CCCR.INIT bit is set will be lost, but no errors (or error frames) will be generated and the CAN protocol controller will re-integrate into the CAN communication immediately at the 11 recessive bits of the next End-of-Frame including intermission.
- **Workaround 3:** It is also possible to keep the number of pending transmissions always at > 0 by frequently requesting a message, then the condition "no pending transmission" is never met. The frequently requested message may be given a low priority, losing arbitration to all other messages.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.4.4 DAR Mode

When the CAN is configured in DAR mode (CCCR.DAR = 1) the automatic retransmission for transmitted messages that have been disturbed by an error or have lost arbitration is disabled. When the transmission attempt is not successful, the Tx Buffer's Transmission Request bit (TXBRP.TRPn) will be cleared and the Tx Buffer's Cancellation Finished bit (TXBCF.CFn) will be set.

When the transmitted message loses arbitration at one of the first two identifier bits, chances are that instead of the bits of the actually transmitted Tx Buffer, the TXBRP.TRPn and TXBCF.CFn bits of the previously started Tx Buffer (or Tx Buffer 0 if there is no previous transmission attempt) are written (TXBRP.TRPn = 0, TXBCF.CFn = 1).

If in this case the TXBRP.TRPn bit of the Tx Buffer that lost arbitration at the first two identifier bits are not cleared, retransmission is attempted. When the CAN loses arbitration again at the immediately following retransmission, then actually and previously transmitted Tx Buffer are the same and this Tx Buffer's TXBRP.TRPn bit is cleared and its TXBCF.CFn bit is set.

Scope:

The erratum is limited to the case when the CAN loses arbitration at one of the first two transmitted identifier bits while in DAR mode. The problem does not occur when the transmitted message is disturbed by an error.

Effects:

In this case, it might happen that the TXBRP.TRPn bit is cleared after the second transmission attempt instead of the first. Additionally it may happen that the TXBRP.TRPn bit of the previously started Tx Buffer is cleared, if it has been set again. As in this case the previously started Tx Buffer has lost CAN internal arbitration against the active Tx Buffer, its message has a lower identifier priority. It would also have lost arbitration on the CAN bus at the same position.

Workaround

None.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.4.5 High-Priority Message (HPM) interrupt

There are two configurations where the issue occurs:

Configuration A:

- At least one Standard Message ID Filter Element is configured with priority flag set (S0.SFEC = 0b100/0b101/0b110)
- No Extended Message ID Filter Element configured
- Non-matching extended frames are accepted (GFC.ANFE = 0b00/0b01)

The HPM interrupt flag IR.HPM is set erroneously on reception of a non-high-priority extended message under the following conditions:

1. A standard HPM frame is received and accepted by a filter with priority flag set (that is, Interrupt flag IR.HPM is set as expected).
2. An extended frame is received and accepted because of the GFC.ANFE configuration (that is, Interrupt flag IR.HPM is set erroneously).

Configuration B:

- At least one Extended Message ID filter element is configured with priority flag set (F0.EFEC = 0b100/0b101/0b110)
- No Standard Message ID filter element is configured
- Non matching standard frames are accepted (GFC.ANFS = 0b00/0b01)

The HPM interrupt flag IR.HPM is set erroneously on reception of a non high-priority standard message under the following conditions:

1. An extended HPM frame is received and accepted by a filter with priority flag set (that is, Interrupt flag IR.HPM is set as expected).
2. A standard frame is received and accepted because of the GFC.ANFS configuration (that is, Interrupt flag IR.HPM is set erroneously).

Scope:

The erratum is limited to the following configurations:

Configuration A:

No Extended Message ID filter element is configured and non matching extended frames are accepted due to Global Filter Configuration (GFC.ANFE = 0b00/0b01).

Configuration B:

No Standard Message ID Filter Element configured and non-matching standard frames are accepted due to Global Filter Configuration (GFC.ANFS = 0b00/0b01).

Effects:

Interrupt flag IR.HPM is set erroneously at the reception of a frame with:

- Configuration A: Extended Message ID
- Configuration B: Standard Message ID

Workaround

Configuration A:

Setup an Extended Message ID filter element with the following configuration:

- F0.EFEC = 001/010: Select Rx FIFO for storage of extended frames
- F0.EFID1 = any value: The value is not relevant as all ID bits are masked out by F1.EFID2
- F1.EFT = 10: Classic filter, F0.EFID1 = filter, F1.EFID2 = mask
- F1.EFID2 = 0: All bits of the received extended ID are masked out

Now all extended frames are stored in Rx FIFO '0' or Rx FIFO '1' depending on the configuration of F0.EFEC.

Configuration B:

Setup an Standard Message ID filter element with the following configuration:

- S0.SFEC = 001/010: Select Rx FIFO for storage of standard frames
- S0.SFID1 = any value: The value is not relevant as all ID bits are masked out by S0.SFID2
- S0.SFT = 10: Classic filter, S0.SFID1 = filter, S0.SFID2 = mask
- S0.SFID2 = 0: All bits of the received standard ID are masked out

Now all standard frames are stored in Rx FIFO '0' or Rx FIFO '1' depending on the configuration of S0.SFEC.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.4.6 Tx FIFO message sequence inversion

Assuming that there are two Tx FIFO messages in the output pipeline of the Tx Message Handler. Transmission of Tx FIFO message 1 is started:

Position 1: Tx FIFO message 1 (transmission ongoing)

Position 2: Tx FIFO message 2

Position 3: Free FIFO bugger

During the transmission of Tx FIFO message 1, a non Tx FIFO message with a higher CAN priority is requested. Due to its priority it will be inserted into the output pipeline. The TxMH performs

"message scans" to keep the output pipeline up to date with the highest priority messages from the message RAM.

After the following two message scans, the output pipeline has the following content:

Position 1: Tx FIFO message 1 (transmission ongoing)

Position 2: non Tx FIFO message with higher CAN priority

Position 3: Tx FIFO message 2

If the transmission of Tx FIFO message 1 is not successful (lost arbitration or CAN bus error) it is pushed from the output pipeline by the non Tx FIFO message with higher CAN priority. The following scan again inserts Tx FIFO message 1 into the output pipeline at position 3:

Position 1: non Tx FIFO message with higher CAN priority (transmission ongoing)

Position 2: Tx FIFO message 2

Position 3: Tx FIFO message 1

This results in Tx FIFO message 2 being in the output pipeline in front of Tx FIFO message 1 and they are transmitted in that order, resulting in a message sequence inversion.

Scope:

The erratum describes the case when the CAN uses both, dedicated Tx Buffers and a Tx FIFO (TXBC.TFQM = 0) and the messages in the Tx FIFO do not have the highest internal CAN priority. The described sequence inversion may also happen between two non Tx FIFO messages (Tx Queue or dedicated Tx Buffers) that have the same CAN identifier and that should be transmitted in the order of their buffer numbers (not the intended use).

Effects:

In the described case it may happen that two consecutive messages from the Tx FIFO exchange their positions in the transmit sequence.

Workarounds

When transmitting messages from a dedicated Tx Buffer with higher priority than the messages in the Tx FIFO, choose one of the following workarounds:

Workaround 1

Use two dedicated Tx Buffers, for example, use Tx Buffers 4 and 5 instead of the Tx FIFO.

The Transmit Loop below replaces the function that fills the Tx FIFO.

Write the message to Tx Buffer 4

Transmit Loop:

- Request Tx Buffer 4 - write TXBAR.A4
- Write message to Tx Buffer 5
- Wait until transmission of Tx Buffer 4 completed - IR.TC, read TXBTO.TO4
- Request Tx Buffer 5 - write TXBAR.A5
- Write message to Tx Buffer 4
- Wait until transmission of Tx Buffer 5 completed - IR.TC, read TXBTO.TO5

Workaround 2

Ensure that only one Tx FIFO element is pending for transmission at any time.

The Tx FIFO elements may be filled at any time with messages to be transmitted, but their transmission requests are handled separately. Each time a Tx FIFO transmission has completed and the Tx FIFO becomes empty (IR.TFE = 1), the next Tx FIFO element is requested.

Workaround 3

Use only a Tx FIFO. Send the message with the higher priority also from Tx FIFO.

Drawback: The higher priority message has to wait until the preceding messages in the Tx FIFO are sent.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.4.7 Debug Message

In case the CCCR.INIT bit is set by the Host by writing to the CCCR register or when the M_CAN enters BusOff state, the debug message handling state machine stays in its current state instead of being reset to Idle state. Setting CCCR.CCE does not change RXF1S.DMS.

Scope:

The erratum is limited to the case when the Debug on CAN Support feature is active. Regular operation is not affected. In regular operation the debug message handling state machine always remains in Idle state.

Effects:

In the described case the debug message handling state machine is stopped and remains in the current state signaled by RXF1S.DMS. In case the RXF1S.DMS = 11, the output `m_can_dma_req` remains active.

Workaround

In case the debug message handling state machine has stopped while RXF1S.DMS = 01 or RXF1S.DMS = 10, it can be reset to Idle state by hardware reset or by reception of debug messages after CCCR.INIT is reset to '0'.

In case the debug message handling state machine has stopped while RXF1S.DMS = 11 with `m_can_dma_req` active, it can be reset to Idle state by hardware reset or by activating input `m_can_dma_ack`.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.4.8 Reserved

2.4.9 On Demand

The CAN is not compatible with on-demand clock requests.

Workaround

Clear the ONDEMAND bit to zero for the oscillator source that provides the GCLK to the CAN.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.4.10 Debug Mode

The ECR.CEL, PSR.PXE, PSR.RFDF, PSR.RBRS, PSR.RESI, PSR.DLEC and PSR.LEC bits can be corrupted by a debug access.

Workaround

Do not read the ECR, PSR registers with a debugger when the CPU is not halted in debug, otherwise debug access will clear those bits.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.4.11 Debug Mode

An expected clear on read of the ECR.CEL, PSR.PXE, PSR.RFDF, PSR.RBRS, PSR.RESI, PSR.DLEC and PSR.LEC bits can be unexpectedly filtered-out when the CPU is halted.

Workaround

Do not halt the CPU if other hosts in the application are accessing the ECR or PSR registers.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.4.12 Transmit Message Order Inversion

It may happen, depending on the delay between the individual Tx requests, that in the case where multiple Tx Buffers are configured with the same message ID, the Tx Buffers are not transmitted in order of the Tx Buffer number (lowest number first).

Scope:

The erratum is limited to the case when multiple Tx Buffers are configured with the same message ID.

Effects:

In the case described it may happen that Tx Buffers configured with the same message ID and pending Tx request are not transmitted with lowest Tx Buffer number first (message order inversion).

Workaround

First write the group of Tx messages with same message ID to the message RAM and then afterwards request transmission of all these messages concurrently by a single write access to TXBAR.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.4.13 Tx (Queue) Buffers

Scope:

Use of multiple dedicated Tx Buffers or Tx Queue buffers configured with same message ID.

Effects:

If the dedicated Tx buffers with the same message ID are not requested in ascending order or at the same time or in case of multiple Tx Queue buffers with the same message ID, it cannot be

guaranteed, that these messages are transmitted in ascending order with lowest buffer number first.

Workaround

In case a defined order of transmission is required the Tx FIFO will be used for transmission of messages with the same message ID. Alternatively dedicated Tx buffers with same message ID will be requested in ascending order with lowest buffer number first or by a single write access to TXBAR. Alternatively a single Tx Buffer can be used to transmit those messages one after the other.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.4.14 Transmit Cancellation

If all of the following events have occurred:

- Transmission of the TX Buffer nn was not successful.
- The automatic retransmission mechanism has started to resend the TX Buffer nn and is currently sending the first four identifier bits.
- The user attempts to cancel the transaction by setting the TXBCR.CRnn bit.

The hardware will send a signal stating that the transaction or transmission was successfully canceled even when it has not been TXBCF.CFnn = 1 and TXBRP.TRPnn = 0. The hardware also states that frame was not transmitted on the bus TXBTO.TOnn = 0.

Other than what is signaled by TXBCF.CFnn and TXBTO.TOnn, the transmission continues until the complete frame has been sent on the CAN bus.

If the transmission is successful, the TXBTO.TOnn bit will be set. In this case new data is written to the TX Buffer nn while the transmission is still ongoing. A frame with inconsistent data may appear on the bus.

Scope:

This problem is limited to the case of transmit cancellation of CAN FD messages with more than eight data bytes, while automatic retransmission is enabled (CCCR.DAR = '0'). Transmit cancellation of Classical CAN messages and CAN FD messages with up to eight data bytes is not affected.

Effects:

When the TXBRP.TRPnn bit of the TX Buffer nn is reset by an incomplete transmit cancellation, this TX Buffer is reported to be free. If the software now writes new data to this TX Buffer while a transmission is still ongoing, this new data may be loaded into the protocol controller, leading to a data inconsistency of the transmitted frame. This means that the transmitted frame consists partly of the data available at start of frame, and data written to the TX Buffer during the ongoing transmission.

Workaround

Do not use transmit cancellation for CAN FD messages with more than eight data bytes.

Alternatively wait for the duration of the expected transmission time of the canceled TX Buffer before writing new data to that TX Buffer.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.5 Clock Failure Detector (CFD)

2.5.1 CFD with XOSC/XOSC32K Oscillator

When the CFD is enabled for the XOSC/XOSC32K oscillator and the oscillator input signal is stuck at 1, the clock failure detection works correctly but the switch to the safe clock will fail.

Workarounds

Two possible workarounds are as follows:

1. If the main clock source comes from the XOSC/XOSC32K oscillator, the only workaround is indirect (i.e., using the WDT in firmware and switch to safe clock source in firmware at WDT reset).
2. Because the clock failure detection is functional, once the STATUS.CLKFAIL is set, and if the STATUS.CLKSW is not set, manually switch to safe clock from firmware by changing the configurations of the Generic Clock Generators that use the XOSC/XOSC32K oscillator as a clock source to use another source clock instead.

Affected Silicon Revisions

A	D	F	G				
X							

2.5.2 XOSC Ready Bit not Cleared

When the XOSC Clock Failure Detector is enabled (XOSCCTRL.CFDEN = 1) and a failure is detected (STATUS.XOSCFAIL = 1), the XOSC Ready bit is not cleared (STATUS.XOSCRDY = 1).

Workaround

STATUS.XOSCFAIL must always be checked before STATUS.XOSCRDY, and STATUS.XOSCRDY must always be ignored when STATUS.XOSCFAIL = 1.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.5.3 False Clock Failure Detection

Disabling the Clock Failure Detector (XOSCCTRL.CFDEN = 0) and re-enabling it (XOSCCTRL.CFDEN = 1) when the XOSC is enabled (XOSCCTRL.ENABLE = 1), can lead to a false Clock Failure Detection.

Workaround

Follow these steps to re-enable the Clock Failure Detector:

1. Disable the XOSC (XOSCCTRL.ENABLE = 0).
2. Disable the Clock Failure Detector (XOSCCTRL.CFDEN = 0).
3. Re-enable the Clock Failure Detector (XOSCCTRL.CFDEN = 1).
4. Re-enable the XOSC (XOSCCTRL.ENABLE = 1).

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.5.4 False Clock Failure Detection

Disabling the Clock Failure Detector (CFDCTRL.CFDEN = 0) and re-enabling it (CFDCTRL.CFDEN = 1) when the XOSC32K is enabled (XOSC32K.ENABLE = 1), can lead to a false Clock Failure Detection.

Workaround

Follow these steps to re-enable the Clock Failure Detector:

1. Disable the XOSC32K (XOSC32K.ENABLE = 0).
2. Disable the Clock Failure Detector (CFDCTRL.CFDEN = 0).
3. Re-enable the Clock Failure Detector (CFDCTRL.CFDEN = 1).
4. Re-enable the XOSC32K (XOSC32K.ENABLE = 1).

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.6 Device

2.6.1 Reverse Current in VDDIOB Domain

For the device with 100-pin, 120-pin, and 128-pin counts when VDDIOB is supplied with the voltage less than VDDIO - 0.7V, reverse current in VDDIOB cluster is observed.

Workaround

None. The PB13 pin must be tied to ground.

Affected Silicon Revisions

A	D	F	G				
X							

2.6.2 Internal Pull-up on the RESET Pin

The internal pull-up of the RESET pin is not functional.

Workaround

An external 100K pull-up must be added on the RESET pin.

Affected Silicon Revisions

A	D	F	G				
X							

2.6.3 Detection of a Debugger Probe

The detection of a debugger probe or a user reset (external reset, watchdog reset and system reset request) could fail if the "BOD33 Disable" fuse is cleared (i.e., BOD33 is enabled).

Workaround

To secure the detection of debugger probes or a user reset, enable BOD33 using the SUPC.BOD33 register instead of the "BOD33 Disable" fuse. The "BOD33 Disable" fuse must be kept set.

Affected Silicon Revisions

A	D	F	G				
X	X						

2.6.4 VBAT Mode

V_{BAT} mode is not functional.

Workaround

None.

Affected Silicon Revisions

A	D	F	G				
X							

2.6.5 Internal Reference

When the internal reference is used with the DAC and ADC, their outputs become non-linear when the operating temperature is less than 0°C.

Workaround

The internal reference must be used only for positive temperatures (i.e., above 0°C).

Affected Silicon Revisions

A	D	F	G				
X							

2.6.6 Device Operation for Temperature < -20°C

If the operating temperature is less than -20°C, the device does not start.

Workaround

Apply an external reset pulse at power-up when V_{DD} is higher than 2V, or keep reset line low while V_{DD} is lower than 2V.

Affected Silicon Revisions

Device	A	D	F	G			
Package Grade U with EFP	-						
Package Grade U without EFP	X	X	X	X			
Other Package Grades	X						

Note: EFP refers to Extended Flash Performance and is only available for package grade U = -40°C to +85°C Matte Sn Plating (Industrial). For additional information, refer to the device data sheet.

2.6.7 Overconsumption in Standby

An overconsumption can happen when entering in Standby Sleep mode when the following peripherals are enabled (CTRLA.ENABLE = 1) with run in Standby disabled (CTRLA.RUNSTDBY = 0):

- DFLL48M
- RTC
- TC
- TCC
- ADC
- PDEC
- SERCOM

Workaround

Disable the concerned peripherals when entering in Standby Sleep mode.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.6.8 VDDANA Analog Cluster

Any and all I/O as well as digital alternate functions on VDDANA analog cluster must be confined as inputs only. Refer to the "Table 6-34. GPIO Clusters" for the list per package of pins powered by VDDANA.

Note: The IOSET configurations for the concerned digital alternate output functions must be considered (refer to "6.2.8 IOSET Configurations").

Workaround

None.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.6.9 Standby Low-Power Mode

Standby Low-Power mode is not supported and should not be used in new designs.

Workaround

The Idle Low-Power mode must be considered if Hibernate or Backup Sleep modes are not an option.

Idle Sleep mode must be tuned by applying low-power techniques like waiting for any peripheral pending transactions to complete and switching on a slow clock source before entering the Low-Power mode.

Affected Silicon Revisions

A	D	F	G				
X	X						

2.6.10 Power Up

The cache lines 0 (AHB0) and 1 (AHB1), which are enabled by default at reset, may not be reset properly at power-up under extremely rare circumstances.

In such rare situations, different types of data corruption may happen on the two different cache lines:

- **Cache line 0 (AHB0):** A CPU fetch of the reset vector could be corrupted, preventing the application from booting correctly.
- **Cache line 1 (AHB1):** Access from one of the following Hosts (DSU, ICM, DMA) could be corrupted.

Workaround

- **Cache line 0 (AHB0):** Enable the Watchdog timer at power on with the lowest period possible by programming the WDT Enable and WDT Period bit fields from the NVM USER ROW (UROW) as follows:
 - WDT Enable = 0x1
 - WDT Period = 0x0
- **Cache line 1 (AHB1):** Clean up the Cache line 1 by toggling the NVMCTRL CTRLA.CACHEDIS1 bit before any Host (DSU, ICM, DMA) accesses as follows:
 - CACHEDIS1 = 0x1
 - CACHEDIS1 = 0x0

Affected Silicon Revisions

A	D	F	G				
X	X	X					

2.7 Device Service Unit (DSU)**2.7.1 CRC32**

The DSU CRC32 will not complete when targeting NVM memory space while the NVM cache is disabled.

Workaround

Be sure to always enable the NVM cache when performing a DSU CRC32 request targeting the NVM memory space.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.7.2 Coresight

During Coresight discovery (that allows a debugger to identify the available on-chip debug resources), the TPIU and ETB ROM table content (containing component and device IDs) read as 0. Debugger may conclude that TPIU and ETB are unavailable and indicate that trace is not available.

Workaround

None.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.8 48 MHz Digital Frequency-Locked Loop (DFLL48M)

2.8.1 COARSE or FINE Calibration Values During the Locking Sequence

If the DFLL48M reaches the maximum or minimum COARSE or FINE calibration values during the locking sequence, an out of bounds interrupt will be generated. These interrupts will be generated even if the final calibration values at DFLL48M lock are not at maximum or minimum, and might therefore be false out of bounds interrupts.

Workaround

Check that lock bits, DFLLCKC and DFLLCKF, in the OSCCTRL Interrupt Flag Status and Clear register (INTFLAG) are both set before enabling the DFLL00B interrupt.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.8.2 STATUS.DFLLRDY Bit in Close Loop Mode

In Close Loop mode, the STATUS.DFLLRDY bit does not rise before lock fine occurs. Therefore, the information about DFLL ready to start Close Loop mode is not available.

Workaround

None.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.8.3 DFLLVAL.FINE Value When DFLL48M Re-enabled

If the DFLL is disabled and then re-enabled, the DFLLVAL.FINE value is ignored by the DFLL module, which will then start its lock fine process at another frequency.

Workaround

Before writing the final configuration in the DFLLCTRLB register, the DFLL module must be re-enabled in Open Loop mode to read and rewrite the DFLLVAL register.

1. OSCCTRL->DFLLMUL.reg = X; // Write new DFLLMUL configuration
2. OSCCTRL.DFLLCTRLB.reg = 0; // Select Open loop configuration
3. OSCCTRL.DFLLCTRLA.bit.ENABLE = 1; // Enable DFLL
4. OSCCTRL.DFLLVAL.reg = OSCCTRL->DFLLVAL.reg; // Reload DFLLVAL register
5. OSCCTRL.DFLLCTRLB.reg = X; // Write final DFLL configuration

Affected Silicon Revisions

A	D	F	G				
X							

2.8.4 Lose Lock After Wake (LLAW) Usage

When the Lose Lock After Wake (DFLLCTRLB.LLAW) is set, the DFLL may maintain lock (STATUS.DFLLLOCK = 1) after the DFLL is disabled. If the DFLL lock (STATUS.DFLLLOCK = 1) is maintained when the DFLL is reconfigured and then enabled, some bits may not be properly set.

Workaround

When reconfiguring the DFLL wait for the lock status to set to '0' (STATUS.DFLLLOCK = 0) after disabling the DFLL (DFLLCTRLA.ENABLE = 0).

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.8.5 DFLL48M Status Flags

The STATUS.DFLLLOCKF and STATUS.DFLLLOCKC status bits are not automatically cleared when disabling the DFLL while it is running in Close Loop mode.

Workaround

Once the DFLL is disabled, clear the OSCCTRL.DFLLCTRLB.MODE bit to reset the lock bits of the DFLLSTATUS register.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.8.6 DFLL48M Status Flags

DFLL48M Status flags may have unexpected values during the DFLL48 registers (DFLLCTRLA, DFLLCTRLB, DFLLMUL, DFLLVAL) configuration.

Workaround

Clear DFLL48M Status before and after enabling the DFLL48M (DFLLCTRLA.ENABLE = 1).

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.8.7 Lose Lock After Wake (LLAW) Usage

Changing Lose Lock After Wake (DFLLCTRLB.LLAW) when the DFLL is not completely stopped can produce a corruption of the closed loop controller and its lock status.

Workaround

The DFLLCTRLB.LLAW bit update must be done as follows:

1. Disable the DFLL (DFLLCTRLA.ENABLE = 0).
2. Wait for synchronization (DFLLSYNC.ENABLE = 0).
3. Wait for STATUS.DFLLRDY = 0.
4. Update the DFLLCTRLB.LLAW bit.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.9 Digital-to-Analog Converter (DAC)

2.9.1 RESERVED

2.9.2 VDDANA as the DAC Reference

The selection of VDDANA as the DAC reference in DAC.CTRLB.REFSEL is non-functional.

Workaround

The VDDANA must be connected externally to a V_{REF} pin and DAC.CTRLB.VREFAU must be selected.

Affected Silicon Revisions

A	D	F	G				
X							

2.9.3 DAC on Negative Input AIN3

No analog compare will be done on Comparator 1 (AC1) when using the DAC on negative input AIN3.

Workaround

Use the internal VDD scaler.

Affected Silicon Revisions

A	D	F	G				
X							

2.9.4 Interpolation Mode

If the Interpolation mode is enabled (with filter integrated to the DAC), the last data from the filter is missing, and therefore, the DAC final output value does not correspond to the DAC input value.

Although interrupt events are generated at the end of conversion (EOC), the EOC occurs before the final value from the filter and is of no use in the application.

Workaround

None.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.9.5 Reference

The reference select of the DAC (CTRLB.REFSEL) will default to a '0' if the DAC Software Reset (CTRLA.SWRST) is used to reset the module.

Workaround

None.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.9.6 First Conversion

When the internal bandgap reference (INTREF) is selected as reference voltage (CTRLB.REFSEL = 0x3), the DAC Startup Ready bits value (STATUS.READY0, STATUS.READY1) is not correct for the first DAC Conversion after device power-up or after wake-up from Standby Low-Power mode.

Workaround

Disregard STATUS.READY0 and STATUS.READY1 bits for the first DAC conversion and check instead that the Data Buffer 0/1 Empty bits are set (INTFLAG.EMPTY0 = 1, INTFLAG.EMPTY1 = 1), as this process also checks the DAC readiness exhaustively. It will ensure the DAC is ready for the first conversion after device power-up or after wake-up from Standby Low-Power mode.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.9.7 Refresh Mode

The DAC Conversion Refresh mode is not functional.

Workaround

A conversion must be started at least every 10 μ s to guarantee DAC performances specification.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.10 Direct Memory Access Controller (DMAC)**2.10.1 Linked Descriptors**

When at least one channel using linked descriptors is already active, a channel Fetch Error (FERR) could occur on enabling a channel with no linked descriptor or the second descriptor (index 1) of the channel being enabled could be fetched by one of the already active channels using linked descriptors. These errors can occur when a channel is being enabled during the link request of another channel and if the channel number of the channel being enabled is lower than the channel already active.

Workaround

When enabling a channel while other channels using linked descriptors are already active, the channel number of the new channel to enable must be greater than the other channel numbers.

Affected Silicon Revisions

A	D	F	G				
X	X						

2.10.2 Channel Priority

When using channels with different priority levels, the highest priority channel could stall at the end of its current block.

When this occurs, the channel is seen as active with BTCNT = 0 in the ACTIVE register with Busy and Pending flag set in the CHSTATUSn register. This condition also prevents the other channels from executing.

Workaround

None.

Affected Silicon Revisions

A	D	F	G				
X							

2.10.3 DMAC in Debug Mode

In Debug mode, DMAC does not restart after a debug halt when DBGCTRL.DBGRUN = 0.

Workaround

Set DBGCTRL.DBGRUN to 1 so that the DMAC continues normal operation when the CPU is halted by an external debugger.

Affected Silicon Revisions

A	D	F	G				
X							

2.11 Ethernet MAC (GMAC)

2.11.1 Ethernet Functionality in 64-pin Packages

Ethernet functionality in 64-pin packages is not available.

Workaround

None.

Affected Silicon Revisions

A	D	F	G				
X							

2.12 External Interrupt Controller (EIC)

2.12.1 Edge Detection

When enabling EIC, SYNCBUSY.ENABLE is released before EIC is fully enabled. Edge detection can be done only after three cycles of the selected GCLK (GCLK_EIC or CLK_ULP32K).

Workaround

None.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.12.2 Asynchronous Edge Detection

When the asynchronous edge detection is enabled and the system is in Standby mode, only the first edge will be detected. The following edges are ignored until the system wakes up.

Workaround

Use the asynchronous edge detection with debouncer enabled. It is recommended to set the DPRESALER.PRESCALER and DPRESALER.TICKON to have the lowest frequency possible. To reduce the power consumption, set the EIC GCLK frequency as low as possible or select the ULP32K clock (EIC CTRLA.CKSEL set).

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.12.3 NMI Interrupt

If the NMI is configured in synchronous edge detection mode (NMICTRL.NMISENSE = 1, 2 or 3; NMICTRL.NMIASYNCH = 0), spurious NMI interrupts may occur if, after a software reset (CTRLA.SWRST = 1), another EIC external interrupt x (EXTINTx) than the NMI is also configured in edge detection mode.

Workaround

- Configure the EIC external interrupt x (EXTINTx) in edge detection mode.
- Enable the EIC: CTRLA.ENABLE = 1.
- Wait till the synchronization is complete (SYNCBUSY.ENABLE = 0).
- Configure the NMI in edge detection mode.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.13 Fractional Digital Phase-Locked Loop (FDPLL)**2.13.1 Input Clock on FDPLLn**

FDPLL unlocks could occur while the output frequency is stable.

Workaround

Enable the lock bypass (OSCCTRL.DPLLCTRLB.LBYPASS = 1) and wake up fast (OSCCTRL.DPLLCTRLB.WUF = 1) to avoid losing FDPLL clock output during a false unlock status. The workaround does not avoid false unlock indications but it disables the gating of the FDPLL clock output by the lock status. Therefore, the clock is issued even if the FDPLL status shows unlocked. The Clock Ready bit (OSCCTRL.DPLLSTATUS.CLKRDY) can be monitored by the application to ensure activity is present on the FDPLLn output, but clock ready does not provide any indication of FDPLLn Lock nor frequency. A 10 ms delay is also suggested after the clock ready bit is set to allow the DPLL to achieve the target frequency.

Pseudo Code

Set OSCCTRL.DPLLCTRLB.WUF = 1 and OSCCTRL.DPLLCTRLB.LBYPASS = 1

Set DPLLCTRLA.ENABLE = 1

Wait (OSCCTRL.DPLLSTATUS.CLKRDY == 1)

Delay (10 ms)

Set Source for GCLK with DPLL

Affected Silicon Revisions

A	D	F	G				
X	X						

2.13.2 FDPLL Ratio in DPLLnRATIO

When changing the FDPLL ratio in DPLLnRATIO register on-the-fly, STATUS.DPLLnLDRTO will not be set when the ratio update will be completed.

Workaround

Wait for the interruption flag INTFLAG.DPLNLDRT0 instead.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.14 Non-Volatile Memory Controller (NVMCTRL)

2.14.1 NVM Read Corruption

NVM reads could be corrupted when mixing NVM reads with Page Buffer writes.

Workaround

Disable cache lines before writing to the Page Buffer when executing from NVM or reading data from NVM while writing to the Page Buffer. Cache lines are disabled by writing a one to CTRLA.CACHEDIS0 and CTRLA.CACHEDIS1.

Affected Silicon Revisions

A	D	F	G				
X	X						

2.14.2 SmartEEPROM Buffered Mode is not Recommended

SmartEEPROM Buffered write mode benefits in terms of wear leveling and timings come with strong restrictions. The SmartEEPROM address space must be written linearly, and no read must be issued to the SmartEEPROM Page (SEEP) under modification. As those restrictions are difficult to implement (because they heavily depends on application: for instance, the application must ensure that no host in the system accesses this space) and effects on wear leveling and timings are difficult to measure and are not predictable, it is recommended not to use the SmartEEPROM buffered write mode.

Workaround

None.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.14.3 Debugger Illegal Accesses

Debugger illegal NVMCTRL address space read transactions return invalid data.

Debugger illegal NVMCTRL address space write transactions are silently ignored.

Workaround

None.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.15 Peripheral Access Controller (PAC)

2.15.1 PAC Protection Error in FREQM

FREQM reads on the Control B register (FREQM.CTRLB) generate a PAC protection error.

Workaround

None.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.15.2 PAC Protection Error in CCL

Writing the Software Reset bit in the Control A register (CTRLASWRST) will trigger a PAC protection error.

Workaround

Clear the CCL PAC error each time a CCL software reset is executed.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.16 I/O Pin Controller (PORT)**2.16.1 PORT Read/Write Attempts on Non-Implemented Registers**

PORT read/write attempts on non-implemented registers, including addresses beyond the last implemented register group (PA, PB,...), do not generate a PAC protection error.

Workaround

None.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.16.2 PORT Pull-Up/Pull-Down Resistor

The pull-down on PA24/PA25 are activated during power-up and when Sleep mode is OFF. On all other pins, except those in the VSWOUT cluster, the pull-up is activated during power-up and when Sleep mode is OFF.

Workaround

None.

Affected Silicon Revisions

A	D	F	G				
X							

2.17 Real-Time Counter (RTC)**2.17.1 Write Corruption**

A 8-bit or 16-bit write access for a 32-bit register, or 8-bit write access for a 16-bit register can fail for the following registers:

- COUNT register in COUNT32 mode
- COUNT register in COUNT16 mode
- CLOCK register in CLOCK mode

Workaround

Write the registers with:

- A 32-bit write access for COUNT register in COUNT32 mode, CLOCK register in CLOCK mode

- A 16-bit write access for the COUNT register in COUNT16 mode

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.17.2 COUNTSYNC

When CTRLA.COUNTSYNC is enabled, the first COUNT value is not correctly synchronized and thus it is a wrong value.

Workaround

After enabling COUNTSYNC, read the COUNT register until its value is changed when compared to its first value read. After this, all consequent value read from the COUNT register is valid.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.17.3 Tamper Input Filter

Majority debouncing, as part of RTC tamper detection, does not work when enabled by setting the Debouncer Majority Enable bit, CTRLB.DEBMAJ.

Workaround

None.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.17.4 Tamper Detection

Upon enabling the RTC tamper detection feature, a false tamper detection can be reported by the RTC.

Workarounds

Use any one of the following workarounds:

- **Workaround 1:** Configure TAMPER detection as ONLY falling edge.
- **Workaround 2:** If the user software has to use TAMPER detection as rising edge, it must ignore the tamper interrupts generated after enabling the RTC tamper detection, and until 10 RTC clock periods.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.17.5 Tamper Detection Timestamp

If an external reset occurs during a tamper detection, the TIMESTAMP register will not be updated when next tamper detection is triggered.

Workarounds

Enable RTC tamper interrupt and copy the timestamp from the RTC CLOCK register to one of the following destinations:

- SRAM

- GPx registers in RTC
- BKUPx registers in RTC

Note: This workaround does not apply for battery backup mode. In battery backup mode, the RTC Timestamp capture feature is not functional.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.17.6 Prescaler

When the tamper or debouncing features (TAMPCTRL) are enabled, periodic interrupts and events are generated when the prescaler is OFF (CTRLA.PRESCALER = 0).

Workaround

When the prescaler is OFF (CTRLA.PRESCALER = 0), clear the Periodic Interval n Event Output Enable bits (EVCTRL.PEREOn = 0 [n = 7...0]) and respective Periodic Interval n Interrupt Enable (INTENCLR.PERn = 1 [n = 7...0]) bits.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.17.7 Tamper Detection Timestamp

When DMA is enabled (CTRLB.DMAEN = 1), the INTFLAG.TAMPER bit is not reset by reading the TIMESTAMP register.

Workaround

Clear the INTFLAG.TAMPER bit by writing a '1' to this bit when the Timestamp value has been read by the DMA.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.17.8 General Purpose Registers

General Purpose Registers n (GPn) are reset on tamper detection even if GPTRST = 0.

Workaround

None.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.17.9 Battery Backup Mode

Entering Battery Backup mode without waiting for SYNCBUSY.ENABLE and SYNCBUSY.COUNTSYNC synchronization completion may freeze the status of these bits.

Workaround

Ensure that both SYNCBUSY.ENABLE and SYNCBUSY.COUNTSYNC synchronization is completed (SYNCBUSY.ENABLE = 0 and SYNCBUSY.COUNTSYNC = 0) before enabling Battery Backup mode (refer to the section "Entering Battery Backup Mode" in the product data sheet).

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.17.10 Active Layer Protection

When the RTC is configured in Active Layer Protection mode (TAMPCTRL.INACT = 0x3), and the RTC CTRLA.ENABLE bit is not set, a tamper can be detected and a timestamp captured. The TAMPID register and the INTFLAG.TAMPER bit may not be set.

Workaround

When the RTC is configured in Active Layer Protection mode, after setting the CTRLA.ENABLE control bit, the user must wait for 10 RTC clock periods. Then the user must clear the TAMPID register, clear the INTFLAG.TAMPER bit and do a dummy read of the TIMESTAMP register to remove the lock condition on the TIMESTAMP register.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.18 Serial Communication Interface (SERCOM)**2.18.1 SERCOM-USART: Auto-Baud Mode**

In USART Auto-Baud mode, missing stop bits are not recognized as inconsistent sync (ISF) or framing (FERR) errors.

Workaround

None.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.18.2 SERCOM-USART: Collision Detection

In USART operating mode with Collision Detection enabled (CTRLB.COLDEN = 1), the SERCOM will not abort the current transfer as expected if a collision is detected and if the SERCOM APB clock is lower than the SERCOM generic clock.

Workaround

The SERCOM APB clock must always be higher than the SERCOM generic clock to support collision detection.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.18.3 SERCOM-USART: Debug Mode

In USART operating mode, if DBGCTRL.DBGSTOP = 1, data transmission is not halted after entering Debug mode.

Workaround

None.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.18.4 SERCOM-SPI: 32-bit Extension Mode

When 32-bit Extension mode is enabled and data to be sent is not in multiples of 4 bytes, which means the length counter must be enabled, and additional bytes will be sent over the line.

Workarounds

Use any one of the following workarounds:

1. Write the Inter-Character Spacing bits (CTRLC.ICSPACE) to a non-zero-value.
2. Do not use length counter in firmware by keeping the data to be sent is in multiples of 4 bytes.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.18.5 SERCOM-UART: TXINV and RXINV Bits

The TXINV and RXINV bits in the CTRLA register have inverted functionality.

Workaround

In software interpret the TXINV bit as a functionality of RXINV, and conversely, interpret the RXINV bit as a functionality of TXINV.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.18.6 SERCOM-I²C: SDAHOLD Timing

SDAHOLD timing of the SERCOM-I²C does not match the value shown in the current device data sheet. The following table shows the specified and real values of SDA Hold timing.

Table 2-1. SDA Hold Timing

SDA Hold Time Value	Specified SDA Hold Time	Real SDA Hold Time
0x0	Disabled	Disabled
0x1	50 ns to 100 ns	20 ns to 40 ns
0x2	300 ns to 600 ns	100 ns to 250 ns
0x3	400 ns to 800 ns	150 ns to 350 ns

Workaround

None.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.18.7 SERCOM-I²C: Repeated Start in High-Speed Host Write Operation

For High-Speed Host Write operations, writing CTRLB.CMD = 0x1 issues a STOP command instead of a Repeated Start making repeated start not possible in that mode.

Workaround

None.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.18.8 SERCOM-I²C: Repeated Start in High-Speed Host Read Operation

For High-Speed Host Read operations, sending a NACK (CTRLB.CMD = 0x2) forces a STOP to be issued making repeated start not possible in that mode.

Workaround

None.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.18.9 SERCOM-I²C: STATUS.CLKHOLD Bit in Host and Client Modes

The STATUS.CLKHOLD bit in host and client modes can be written whereas it is a read-only status bit.

Workaround

Do not clear STATUS.CLKHOLD bit to preserve the current clock hold state.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.18.10 SERCOM-I²C: I²C in Client Mode

In I²C mode, LENERR, SEXTOUT, LOWTOUT, COLL and BUSERR bits are not cleared when INTFLAG.AMATCH is cleared.

Workaround

Manually clear status bits LENERR, SEXTOUT, LOWTOUT, COLL and BUSERR by writing these bits to 1 when set.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.18.11 SERCOM-I²C: Client Mode with DMA

In I²C Client Transmitter mode, at the reception of a NACK, if there is still data to be sent in the DMA buffer, the DMA will push a data to the DATA register. Because a NACK was received, the transfer on the I²C bus will not occur causing the loss of this data.

Workaround

Configure the DMA transfer size to the number of data to be received by the I²C host. DMA cannot be used if the number of data to be received by the host is not known.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.18.12 SERCOM-I²C: I²C Client in DATA32B Mode

When SERCOM is configured as an I²C client in 32-bit Data Mode (DATA32B = 1) and the I²C host reads from the I²C client (client transmitter) and outputs its NACK (indicating no more data is needed), the I²C client still receives a DRDY interrupt.

If the CPU does not write a new data to the I²C client DATA register, I²C client will pull SDA line, which will result in stalling the bus permanently.

Workarounds

1. Write a dummy data to data register when a NACK is received from the host.
2. Use command #2 (SERCOMx->I2CS.CTRLB.bit.CMD = 2) when a NACK is received from the host.



Important: Because STATUS.RXNACK always indicates the last received ACK, to determine when a NACK is received from the I²C host, the I²C client software needs to consider I2CS.STATUS.RXNACK only on the second DRDY interrupt after receiving the AMATCH interrupt.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.18.13 SERCOM-I²C: 10-bit Addressing Mode

10-bit addressing in I²C Client mode is not functional.

Workaround

None.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.18.14 SERCOM-I²C: Repeated Start

When the Quick command is enabled (CTRLB.QCEN = 1), software can issue a repeated Start by writing either CTRLB.CMD or ADDR.ADDR bit fields. If in these conditions, SCL Stretch Mode is CTRLA.SCLSM = 1, a bus error will be generated.

Workaround

Use Quick Command mode (CTRLB.QCEN = 1) only if SCL Stretch Mode is CTRLA.SCLSM = 0.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.18.15 SERCOM-SPI: Data Preload

In SPI Client mode with Client Data Preload Enabled (CTRLB.PLOADEN = 1), the client transmitter may discard some data if the host cannot keep the SPI Select pin low until the end of transmission.

Workaround

In SPI Client mode, the SPI Select pin (\overline{SS}) must be kept low by the host until the end of the transmission if the Client Data Preload feature is used (CTRLB.PLOADEN = 1).

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.18.16 SERCOM I²C: Repeated Start

For Host Write operations (excluding High-Speed mode), in 10-bit addressing mode, writing CTRLB.CMD = 0x1 does not issue a Repeated Start command correctly.

Workaround

Write the same 10-bit address with the same direction bit to the ADDR.ADDR register to generate properly a Repeated Start.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.18.17 SERCOM-USART: Wakeup

The USART does not wake-up the device on Error Interrupt (INTFLAG.ERROR = 1).

Workaround

Configure the USART to wake-up the device on the RX Complete Interrupt (INTENSET.RXC = 1) in order to check the PERR/FERR status (STATUS.PERR = 1 or STATUS.FERR = 1).

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.18.18 SERCOM-USART: LENGTH

When the USART is used in 32-bit mode with hardware handshaking (CTS/RTS), the TXC interrupt flag (INTFLAG.TXC) may be set before transmission has completed. The TXC interrupt flag may incorrectly be set regardless of Data Length Enable (LENGTH.LENEN) is set to '0' or '1'.

Workaround

None.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.18.19 SERCOM-USART: Overconsumption in Standby mode

When SERCOM USART CTRLA.RUNSTDBY= 0 and the Receiver is disabled (CTRLB.RXEN= 0), the clock request to the GCLK generator feeding the SERCOM will stay asserted during Standby mode, leading to unexpected over-consumption.

Workaround

Configure CTRLA.RXPO and CTRLA.TXPO in order to use the same SERCOM PAD for RX and TX or add an external pull-up on the RX pin.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.18.20 SERCOM-USART, SERCOM-SPI: Wake-up Interrupt

The Data Register Empty (DRE) wake-up interrupt is not de-asserted when the register interrupt is cleared (INTFLAG.DRE = 0).

The issue occurs if the DRE interrupt is enabled (INTSET.DRE = 1) when the device enters in Standby Sleep mode.

Workaround

Do not enable DRE interrupt (INTSET.DRE = 1) before entering in Standby Sleep mode.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.18.21 SERCOM-SPI: SPI Data Preload

Preloading a new SPI data (CTRLB.PLOADEN = 1) before going into Standby Sleep mode, may lead to extra power consumption.

Workaround

None.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.18.22 SERCOM-SPI: Hardware SPI Select Control

When Hardware SPI Select Control is enabled (CTRLB.MSSEN = 1), the SPI Select (\overline{SS}) pin goes high after each byte transfer even if a new data is ready to be sent.

Workaround

Set CTRLB.MSSEN = 0 and handle the SPI Select (\overline{SS}) pin by software.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.18.23 SERCOM-I2C: Automatic Acknowledge

The I²C Client Automatic Acknowledge feature (CTRLB.AACKEN = 1) is not supported when doing a repeated start.

Workaround

Do not use the AACKEN feature, implement a AMATCH handler instead.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.18.24 SERCOM-I2C: No Wakeup upon Unexpected STOP

When an unexpected STOP occurs on the I²C bus, the STATUS.BUSERR and INTFLAG.ERROR bits are set but may not wake the system from Sleep mode. An unexpected START will not produce this issue.

Workaround

None.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.18.25 Software Reset

Software Reset (CTRLA.SWRST = 1) is not functional when the SERCOM is not enabled (CTRLA.ENABLE = 0).

Workaround

None.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.18.26 LIN Host Delays

In SERCOM USART LIN Host mode (CTRLA.FORM = 0x2), in the case where break, sync, and identifier fields are automatically transmitted when data is written with the identifier (CTRLB.LINCMD = 0x2), the LIN Host Header delay between the sync and the ID transmission fields is not correct for the following cases:

- CTRLC.HDRDLY = 0x2, where the delay between sync and ID transmission fields is 8-bit time instead of 4-bit time.
- CTRLC.HDRDLY = 0x3, where the delay between sync and ID transmission fields is 14-bit time instead of 4-bit time.

Workaround

None.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.18.27 Two Stop Bits Mode in LIN Host

Two stop bits mode (CTRLB.SBMODE = 0x1) is not supported in SERCOM USART LIN Host mode (CTRLA.FORM = 0x2) in the case where break, sync, and identifier fields are automatically transmitted when data is written with the identifier (CTRLB.LINCMD = 0x2). Only one Stop bit mode is supported.

Workaround

None.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.19 Supply Controller (SUPC)

2.19.1 Buck Converter Mode

Buck Converter mode is not supported when using PLLs. As a result, the information given in Tables "Current Consumption - Active and Idle Mode" data for Buck Converter mode with FDPLL and DFLL configurations is not valid and must be disregarded.

Workaround

Use the LDO Regulator mode when using FDPLL and DFLL configurations.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.19.2 BOD33 Hysteresis

The hysteresis feature of the 3.3V BOD is not functional while the device is in Standby Sleep mode.

Workaround

None.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.20 Timer/Counter (TC)

2.20.1 PERBUF/CCBUFx Register

When clearing the STATUS.PERBUFV/STATUS.CCBUFx flag, the SYNCBUSY flag is released before the PERBUF/CCBUFx register is restored to its appropriate value.

Workaround

Successively clear the STATUS.PERBUFV/STATUS.CCBUFx flag twice to ensure that the PERBUF/CCBUFx register value is restored before updating it.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.20.2 Retrigger

If a Retrigger event (EVCTRL.EVACTn = 0x1, RETRIGGER) occurs at the Channel Compare Match [n] time, the next Waveform Output [n] is corrupted.

Workaround

Use two channels to store their two successive (n and n+1) CC register values and combine their related waveform outputs to make signal redundancy.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.20.3 PER register (8-bit mode)

In 8-bit mode, the PER register updates using the DMA are not possible in Standby mode.

Workaround

None.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.20.4 MCx Interrupt Flags

In capture operation, MC0/MC1 interrupt status flags (INTFLAG.MC0/INTFLAG.MC1) are not automatically cleared when the CC0/CC1 register is read.

Workaround

MC0/MC1 interrupt status flags must be cleared by the software (INTFLAG.MC0 = 1/INTFLAG.MC1 = 1).

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.21 Timer/Counter for Control Applications (TCC)

2.21.1 TCC with EVSYS in SYNC/RESYNC Mode

TCC peripheral is not compatible with an EVSYS channel in SYNC or RESYNC mode.

Workaround

Use TCC with an EVSYS channel in ASYNC mode.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.21.2 Dithering Mode with External Retrigger Events

Using TCC in Dithering mode with external retrigger events can lead to an unexpected stretch of right-aligned pulses, or shrink of left-aligned pulses.

Workaround

Do not use retrigger events or actions when the TCC module is configured in Dithering mode.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.21.3 ALOCK Feature

The ALOCK feature is not functional.

Workaround

None.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.21.4 LUPD feature in Down-Counting Mode

In Down-Counting mode, the Lock Update bit (CTRLB.LUPD) does not protect against a PER register update from the PERBUF register.

Workaround

None.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.21.5 Re-trigger in RAMP2 Operations

Re-trigger in RAMP2 operations (RAMP2, RAMP2A, RAMP2C, RAMP2CS) is not supported if a prescaler is used (CTRLA.PRESCALER != 0) and the re-trigger of the counter is done on the next GCLK (CTRLA.PRESCSYNC = GCLK or CTRLA.PRESCSYNC = RESYNC).

Workaround

Configure the re-trigger of the counter on the next prescaler clock (CTRLA.PRESCSYNC = PRESC).

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.21.6 Re-trigger

If a Re-trigger event (EVCTRL.EVACTn = 0x1, RETRIGGER) occurs at the Channel Compare Match [n] time, the next Waveform Output [n] is corrupted.

Workaround

Use two channels to store their two successive (n and n+1) CC register values and combine their related waveform outputs to make signal redundancy.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.21.7 RAMP2 Operations

Timer/Counter Counting-down mode (CTRLBCLR.DIR = CTRLBSET.DIR = 1) is not supported in RAMP2 operations (RAMP2, RAMP2A, RAMP2C, RAMP2CS).

Workaround

Use Timer/Counter Counting-up mode (CTRLBCLR.DIR = CTRLBSET.DIR = 0).

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.21.8 Dithering Mode

Retrigger in RAMP2 operations is not supported in Dithering mode.

Workaround

None.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.21.9 STATUS Register Access

8-bit or 16-bit writes to the STATUS register are forbidden.

Workaround

None.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.21.10 Sequence State

The TCC Counter Overflow (OVF) DMA Trigger in DMA One-Shot Trigger Mode (CTRLA.DMAOS = 1) is not functional for Critical RAMP2C and RAMP2CS operation modes.

Workaround

None.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.21.11 MCx Interrupt Flags

In capture operation, MC0/MC1 interrupt status flags (INTFLAG.MC0/INTFLAG.MC1) are not automatically cleared when the CC0/CC1 register is read.

Workaround

MC0/MC1 interrupt status flags must be cleared by the software (INTFLAG.MC0 = 1/INTFLAG.MC1 = 1).

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.22 Position Decoder (PDEC)

2.22.1 Reserved

2.22.2 Angular and Revolution Counters

With index input enabled, that is EVCTRL.EVEI[2] and operating in X4/X2 mode, angular and revolution counters are incremented/decremented by two separate and unsynchronized sources (phases and index). This can lead to generating erroneous MC0 and MC1 events.

Workaround

If the application use case permits, operate PDEC in X4S/X2S mode by setting CTRLA.CONF[2:0] = 0b001/ 0b011. In this mode, the revolution counter is incremented/decremented by a single source, that is angular counter overflow/underflow.

If the application use case restricts operation in X4/X2 mode, then disable index input event, that is EVCTRL.EVEI[2] = 0. This ensures that revolution counter is incremented/decremented by a single source, that is angular counter overflow/underflow. First occurrence of the index pulse can be detected using an external interrupt input and angular counter value can be reset in the corresponding interrupt service routine.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.22.3 Counter Operating Mode

Counting Events (EVCTRL.EVACT = 0x2) is not functional in COUNTER operating mode (CTRLA.MODE = 0x2).

Workaround

None.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.22.4 Counter Operating Mode

Start, restart, or retrigger on event (EVCTRL.EVACT = 0x1) is not functional in COUNTER operating mode (CTRLA.MODE = 0x2).

Workaround

None.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.22.5 Direction Change

A direction change detection (INTFLAG.DIR = 1) updates the STATUS.DIR bit with a variable delay.

Workaround

Don't consider the STATUS.DIR bit status when using the INTFLAG.DIR bit.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.22.6 Hall Mode

A Windows Error (WINERR) flag can be reported after a START command execution, or when leaving standby (with RUNSTDBY = 0).

Workaround

Ignore the Windows Error (WINERR) flag in Hall mode after a START command execution, or when leaving standby.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.22.7 Hall Mode

In HALL mode, the WINERR Error interrupt (INTFLAG.WINERR = 1) can rise several times on a low-speed window error detection.

Workaround

Disable the WINERR (INTCLR.WINERR = 1) at first error detection, then re-enable it once the error root cause at the application level is solved.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.22.8 Error Flags

An Error Detection (INTFLAG.ERR=1) updates the STATUS Error flags (HERR, WINERR, MPERR, IDXERR, QERR) with a variable delay.

Workaround

Poll the STATUS Error flags until one of these bits is set.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.23 Voltage Reference System (VREF)

2.23.1 Temperature Sensor

Both internal temperature sensors, TSENSP and TSENSC, are not supported and should not be used.

Workaround

None.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.24 Event System (EVSYS)

2.24.1 Synchronous Mode

In Synchronous mode, spurious overrun interrupts can be generated when the generic clock for a channel is always ON (CHANNEL.ONDEMAND = 0).

Workaround

Set Generic Clock on Demand feature by setting CHANNEL.ONDEMAND = 1.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.24.2 Software

Software Events are not supported in Synchronous and Resynchronized modes.

Workaround

Use software events in Asynchronous mode.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.24.3 Synchronous/Resynchronized Modes

In synchronous mode, including RESYNC mode, spurious event detections can be generated when accessing peripherals used in conjunction with the EVSYS.

Workaround

To avoid spurious EVSYS detections, EVSYS must be write protected by configuring the WRCTRL register in the PAC before being used.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.25 True Random Number Generator (TRNG)

2.25.1 Over Consumption

When TRNG is disabled, some internal logic could continue to operate causing an over consumption.

Workaround

Disable the TRNG module twice:

- CTRLA.ENABLE = 0;
- CTRLA.ENABLE = 0;

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.26 OSC32KCTRL

2.26.1 Clock Switch Back Feature Limitation

If an application can recover the XOSC32K from a Clock Failure Detection, the application can switch back to the XOSC32K clock (CFDCTRL.SWBACK = 1).

Entering Low-Power Sleep mode is not possible if the clock switch back cannot complete due to a persistent failure.

Workaround

Disable the Clock Failure Detector (CFDCTRL.CFDEN = 0).

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.27 Oscillator Controller (OSCCTRL)

2.27.1 Clock Switch Back Feature Limitation

If an application can recover the XOSC from a Clock Failure Detection, the application can switch back to the XOSC clock using Clock Switch Back feature (XOSCCTRL.SWBEN = 1).

Entering Low-Power Sleep mode is not possible if the clock switch back cannot complete due to a persistent failure.

Workaround

Disable the Clock Failure Detector (XOSCCTRL.CFDEN = 0).

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.28 Frequency Meter (FREQM)

2.28.1 Lost Interrupt

The DONE interrupt may be lost when the measurement period (CFG.A.REFNUM * the reference clock period) is less than 4 APB clock periods.

Workaround

The measurement reference period must be longer than 4 APB clock periods.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

2.28.2 STATUS.BUSY

There is no timeout period for a FREQM measurement cycle. If the cycle count does not reach CFGA.REFNUM, the measurement cycle will not end and STATUS.BUSY will never deassert.

Workaround

If the measure signal may be very slow, may stop during the measurement or have a frequency of 0Hz, the application code must monitor the measurement cycle and terminate it in an appropriate period of time.

Affected Silicon Revisions

A	D	F	G				
X	X	X	X				

3. Data Sheet Clarifications

The following typographic corrections and clarifications are to be noted for the device data sheet (DS60001507K), and are showed in **BOLD** type:

There are currently no new data sheet clarifications to report.

4. Appendix A: Revision History

Rev. T (08/2023)

Updated the silicon revision to reflect revision G throughout the document.

Rev. S (05/2023)

Obsolete Data Sheet Clarifications were removed.

The following errata were added in this revision:

- [EIC: 2.12.3 NMI Interrupt](#)
- [TC: 2.20.4 MCx Interrupt Flags](#)
- [TCC: 2.21.11 MCx Interrupt Flags](#)
- [FREQM: 2.28.1 Lost Interrupt](#)
- [FREQM: 2.28.2 STATUS.BUSY](#)

The following errata were updated in this revision:

- Sequential Logic
- Tamper Detection Timestamp
- Tamper Detection Timestamp

Rev. R (02/2023)

The following errata were added in this revision:

- [Device: 2.6.10 Power Up](#)

Rev. Q (12/2022)

The following errata were added in this revision:

- [SERCOM: 2.18.26 SERCOM-USART LIN Host Delays](#)
- [SERCOM: 2.18.27 SERCOM-USART Two Stop Bits in LIN Host](#)

The following errata were updated with new verbiage in this revision:

- [Device: Detection of a Debugger Probe 2.6.3](#)
- [SUPC: Buck Converter Mode 2.19.1](#)

Rev. P (08/2022)

The following updates were implemented in this revision along with numerous typographical corrections:

- Updated the silicon revision throughout the document to F
- Deprecated DAC errata for [Smoothing of the Output Signal in Differential Mode](#)

The following errata were added in this revision:

- [ADC: Internal Bandgap Reference 2.1.6](#)
- [CAN: Transmit Cancellation 2.4.14](#)
- [Device: Standby Mode 2.6.9](#)
- [DAC: Refresh Mode 2.9.7](#)
- [NVMCTRL: Debugger Illegal Accesses 2.14.3](#)
- [TCC: STATUS Register Access 2.21.9](#)
- [TCC: Sequence State 2.21.10](#)
- [EVSYS: Synchronous/Resynchronized Modes 2.24.3](#)

- [OSC32CTRL: Clock Switch Back Feature Limitation 2.26.1](#)
- [OSCCTRL: Clock Switch Back Feature Limitation 2.27.1](#)

The following Data Sheet Clarifications were added in this revision:

- I/O Pins Maximum Output Current Table 54-13

Rev. N (02/2022)

The following updates were implemented in this revision along with numerous typographical corrections:

- Updated the silicon revision throughout the document to E.

The following errata were added in this revision:

- [CAN: Tx \(Queue\) Buffers 2.4.13](#)
- [Device: VDDANA Analog Cluster 2.6.8](#)
- [DSU: Coresight 2.7.2](#)
- [NVMCTRL: SMARTEEPROM Buffered Mode 2.14.2](#)
- [SERCOM: SERCOM-I2C Wakeup 2.18.24](#)
- [SERCOM: Software Reset 2.18.25](#)

The following errata had wording updated:

- [FDPLL: Low-Frequency Input Clock on FDPLLn 2.13.1](#)

Rev. M (06/2021)

The following updates were implemented in this revision along with numerous typographical corrections:

- [RTC: Tamper Detection 2.17.4](#) was updated with new Workaround information
- Terminology for “Master,” and “Slave,” was updated to “Host,” and “Client” respectively. This change may not be reflected in all associated Microchip Documentation. For more information, contact a Microchip Representative.
- Added the following Errata:
 - CAN: Transmit Message Order Inversion
 - [Device: Overconsumption in Standby 2.6.7](#)
 - [DFLL48M: Lose Lock After Wake Bit 2.8.7](#)
 - [RTC: Battery backup Mode 2.17.9](#)
 - [RTC: Active Layer Protection 2.17.10](#)
 - SERCOM-I2C: Automatic Acknowledge
 - [TC: PER Register \(8-bit mode\) 2.20.3](#)
 - [PDEC: Counter Operating Mode 2.22.3](#)
 - [PDEC: Counter Operating Mode 2.22.4](#)
 - PDEC: Direction Change Different
 - PDEC: Hall Mode
 - PDEC: Hall Mode
 - PDEC: Error Flags

Rev. L (01/2021)

The following errata had updates to their titles for clarification:

- [SERCOM I2C: Repeated Start in High-Speed Master Write Operation](#)
- [SERCOM I2C: Repeated Start in High-Speed Master Write Operation](#)

- [SERCOM I2C: STATUS.CLKHOLD Bit in Master and Slave Modes](#)
- [SERCOM-USART: Wakeup](#)
- [SERCOM-USART: LENGTH](#)
- [SERCOM-USART: Overconsumption in Standby Mode](#)

The following Errata were added in this revision:

- [2.2.3 AC: Standby Sleep Mode](#)
- [2.2.4 AC: Debug Mode](#)
- [2.4.7 CAN: Debug Message](#)
- [2.4.8 CAN: Bus Errors](#)
- [2.4.9 CAN: On Demand](#)
- [2.4.10 CAN: Debug Mode](#)
- [2.4.11 CAN: Debug Mode](#)
- [2.5.2 CFD: Ready Bit Not Cleared](#)
- [2.5.3 CFD: False Clock Failure Detection](#)
- [2.5.4 CFD: False Clock Failure Detection](#)
- [2.8.5 DFLL48M: DFLL48M Status Flags](#)
- [2.8.6 DFLL48M: DFLL48M Status Flags](#)
- [2.9.6 DAC: First Conversion](#)
- [2.17.7 RTC: Tamper Detection Timestamp](#)
- [2.17.8 RTC: General Purpose Registers](#)
- [2.18.20 SERCOM: Wake-up Interrupt](#)
- [2.18.21 SERCOM-SPI: Slave Data Preload](#)
- [2.18.22 SERCOM-SPI: Hardware Slave Select Control](#)
- [2.20.2 TC: Retrigger](#)
- [2.21.5 TCC: Re-trigger in RAMP2 Operations](#)
- [2.21.6 TCC: Re-Trigger](#)
- [2.21.7 TCC: RAMP2 Operations](#)
- [2.21.8 TCC: Dithering Mode](#)
- [2.22.2 PDEC: Angular and Revolution Counters](#)
- [2.24.1 EVSYS: Synchronous Mode](#)
- [2.24.2 EVSYS: Software](#)
- [2.25.1 TRNG: Over consumption](#)

Rev. K (05/2020)

The following Silicon Errata was removed as the issue does not exist:

- [2.22.1 X2 Mode](#)

The following silicon errata were updated:

- [2.6.6 Device Operation for Temperature](#) was updated with a table denoting those packages affected by the issue

The following silicon errata was added:

- [2.18.19 USART](#)

Obsolete Data Sheet Clarifications were removed.

Rev. J (11/2019)

Added new silicon errata for [Temperature Sensor](#).

Rev. H (7/2019)

The Silicon errata for Device Operation for Temperature was updated with text denoting which silicon versions it applies to.

Rev. G (6/2019)

The [Errata Summary](#) Table and The affected silicon revision tables in [2. Silicon Errata Issues](#) have been updated to reflect the addition of EFP and Non-EFP silicon revisions.

The following Silicon issues were added:

- [2.1. Analog-to-Digital Converter \(ADC\)](#):
 - DMA Sequencing
 - DMA Sequencing
- [2.2. Analog Comparator \(AC\)](#): Output
- [2.8. 48 MHz Digital Frequency-Locked Loop \(DFLL48M\)](#): LLAW
- [2.9. Digital-to-Analog Converter \(DAC\)](#): Reference
- [2.17. Real-Time Counter \(RTC\)](#): Prescaler
- [2.18. Serial Communication Interface \(SERCOM\)](#):
 - SERCOM-USART: Wakeup
 - SERCOM-USART: Length

Rev F. (2/2019)

The following Silicon Issues were updated:

- FDPLL: Low-Frequency Input Clock on FDPLLn

The following Data Sheet Clarifications were added:

- Update to Initialization, Enabling, Disabling, and Resetting
- Update to Loop Divider Ratio Updates

Rev. E (11/2018)

The following silicon issues were added:

- SERCOM I²C
 - SEERCOM I2C: Repeated Start
- CAN-FD
 - Messages Transmitted with Wrong Arbitration and Control Fields
 - DAR Mode
 - High-Priority Message (HPM) Interrupt
 - TX FIFO Message Sequence Inversion
- DMAC
 - Channel Priority
 - DMAC in Debug Mode
- RTC
 - COUNTSYNC
 - Tamper Input Filter
 - Tamper Detection
 - Tamper Detection Timestamp

- SUPC
 - BOD33 Hysteresis
- TCC
 - ALOCK Feature
 - LUPD Feature in Down-Counting Mode

The following [Data Sheet Clarifications](#) were added:

- Table 54-35 Flash Timing Characteristics was updated.
- BOD12 Register Information was updated.

Rev. D (08/2018)

The current device data sheet revision letter was updated.

The following silicon issues were added:

- Configurable Custom Logic (CCL):
 - Enable Protected Registers
 - Sequential Logic Reference
- Device:
 - Reverse Current in VDDIOB Domain
- SERCOM:
 - Repeated Start in High-Speed Master Write Operation
 - Repeated Start in High-Speed Master Read Operation
 - STATUS.CLKHOLD Bit in Master and Slave Modes
- Supply Controller (SUPC):
 - Buck Converter Mode
- TCC:
 - TCC with EVSYS in SYNC/RESYNC Mode

Rev. C (04/2018)

The current device data sheet revision letter was updated.

The following silicon issues were added:

- Analog-to-Digital Converter (ADC):
 - Reference Buffer Offset Compensation
- Peripheral Access Controller (PAC):
 - PAC Protection
 - PAC Protection
- Real-Time Counter (RTC):
 - Write Corruption
- SERCOM-I2C:
 - Slave Mode with DMA
 - I²C Slave in DATA32B Mode
 - I²C Slave Mode in 10-bit Address
 - Repeated Start
- SERCOM-SPI
 - Data Preload

- SERCOM-UART:
 - Collision Detection

All Data Sheet Clarifications were removed.

Rev. B (10/2017)

This revision includes the following additions:

Silicon Issues

- Ethernet Functionality in 64-pin Packages

Data Sheet Clarifications

- ADC Operating Conditions
- GMAC IEEE 802.3AZ Energy Efficient Support
- SERCOM Baud Rate Equations
- SERCOM in SPI Mode Timing
- TQFP 64-pin Package
- DAC Operating Conditions

Rev. A (7/2017)

Initial release of this document.

The Microchip Website

Microchip provides online support via our website at www.microchip.com/. This website is used to make files and information easily available to customers. Some of the content available includes:

- **Product Support** – Data sheets and errata, application notes and sample programs, design resources, user's guides and hardware support documents, latest software releases and archived software
- **General Technical Support** – Frequently Asked Questions (FAQs), technical support requests, online discussion groups, Microchip design partner program member listing
- **Business of Microchip** – Product selector and ordering guides, latest Microchip press releases, listing of seminars and events, listings of Microchip sales offices, distributors and factory representatives

Product Change Notification Service

Microchip's product change notification service helps keep customers current on Microchip products. Subscribers will receive email notification whenever there are changes, updates, revisions or errata related to a specified product family or development tool of interest.

To register, go to www.microchip.com/pcn and follow the registration instructions.

Customer Support

Users of Microchip products can receive assistance through several channels:

- Distributor or Representative
- Local Sales Office
- Embedded Solutions Engineer (ESE)
- Technical Support

Customers should contact their distributor, representative or ESE for support. Local sales offices are also available to help customers. A listing of sales offices and locations is included in this document.

Technical support is available through the website at: www.microchip.com/support

Microchip Devices Code Protection Feature

Note the following details of the code protection feature on Microchip products:

- Microchip products meet the specifications contained in their particular Microchip Data Sheet.
- Microchip believes that its family of products is secure when used in the intended manner, within operating specifications, and under normal conditions.
- Microchip values and aggressively protects its intellectual property rights. Attempts to breach the code protection features of Microchip product is strictly prohibited and may violate the Digital Millennium Copyright Act.
- Neither Microchip nor any other semiconductor manufacturer can guarantee the security of its code. Code protection does not mean that we are guaranteeing the product is “unbreakable”. Code protection is constantly evolving. Microchip is committed to continuously improving the code protection features of our products.

Legal Notice

This publication and the information herein may be used only with Microchip products, including to design, test, and integrate Microchip products with your application. Use of this information

in any other manner violates these terms. Information regarding device applications is provided only for your convenience and may be superseded by updates. It is your responsibility to ensure that your application meets with your specifications. Contact your local Microchip sales office for additional support or, obtain additional support at www.microchip.com/en-us/support/design-help/client-support-services.

THIS INFORMATION IS PROVIDED BY MICROCHIP "AS IS". MICROCHIP MAKES NO REPRESENTATIONS OR WARRANTIES OF ANY KIND WHETHER EXPRESS OR IMPLIED, WRITTEN OR ORAL, STATUTORY OR OTHERWISE, RELATED TO THE INFORMATION INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTIES OF NON-INFRINGEMENT, MERCHANTABILITY, AND FITNESS FOR A PARTICULAR PURPOSE, OR WARRANTIES RELATED TO ITS CONDITION, QUALITY, OR PERFORMANCE.

IN NO EVENT WILL MICROCHIP BE LIABLE FOR ANY INDIRECT, SPECIAL, PUNITIVE, INCIDENTAL, OR CONSEQUENTIAL LOSS, DAMAGE, COST, OR EXPENSE OF ANY KIND WHATSOEVER RELATED TO THE INFORMATION OR ITS USE, HOWEVER CAUSED, EVEN IF MICROCHIP HAS BEEN ADVISED OF THE POSSIBILITY OR THE DAMAGES ARE FORESEEABLE. TO THE FULLEST EXTENT ALLOWED BY LAW, MICROCHIP'S TOTAL LIABILITY ON ALL CLAIMS IN ANY WAY RELATED TO THE INFORMATION OR ITS USE WILL NOT EXCEED THE AMOUNT OF FEES, IF ANY, THAT YOU HAVE PAID DIRECTLY TO MICROCHIP FOR THE INFORMATION.

Use of Microchip devices in life support and/or safety applications is entirely at the buyer's risk, and the buyer agrees to defend, indemnify and hold harmless Microchip from any and all damages, claims, suits, or expenses resulting from such use. No licenses are conveyed, implicitly or otherwise, under any Microchip intellectual property rights unless otherwise stated.

Trademarks

The Microchip name and logo, the Microchip logo, Adaptec, AnyRate, AVR, AVR logo, AVR Freaks, BesTime, BitCloud, chipKIT, chipKIT logo, CryptoMemory, CryptoRF, dsPIC, FlashFlex, flexPWR, HELDO, IGLOO, JukeBlox, KeeLoq, Klear, LANCheck, LinkMD, maXStylus, maXTouch, MediaLB, megaAVR, Microsemi, Microsemi logo, MOST, MOST logo, MPLAB, OptoLyzer, PackTime, PIC, picoPower, PICSTART, PIC32 logo, PolarFire, Prochip Designer, QTouch, SAM-BA, SenGenuity, SpyNIC, SST, SST Logo, SuperFlash, Symmetricom, SyncServer, Tachyon, TempTrackr, TimeSource, tinyAVR, UNI/O, Vectron, and XMEGA are registered trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.

APT, ClockWorks, The Embedded Control Solutions Company, EtherSynch, FlashTec, Hyper Speed Control, HyperLight Load, IntelliMOS, Libero, motorBench, mTouch, Powermite 3, Precision Edge, ProASIC, ProASIC Plus, ProASIC Plus logo, Quiet-Wire, SmartFusion, SyncWorld, Temux, TimeCesium, TimeHub, TimePictra, TimeProvider, Vite, WinPath, and ZL are registered trademarks of Microchip Technology Incorporated in the U.S.A.

Adjacent Key Suppression, AKS, Analog-for-the-Digital Age, Any Capacitor, AnyIn, AnyOut, BlueSky, BodyCom, CodeGuard, CryptoAuthentication, CryptoAutomotive, CryptoCompanion, CryptoController, dsPICDEM, dsPICDEM.net, Dynamic Average Matching, DAM, ECAN, EtherGREEN, In-Circuit Serial Programming, ICSP, INICnet, Inter-Chip Connectivity, JitterBlocker, KlearNet, KlearNet logo, memBrain, Mindi, MiWi, MPASM, MPF, MPLAB Certified logo, MPLIB, MPLINK, MultiTRAK, NetDetach, Omniscient Code Generation, PICDEM, PICDEM.net, PICkit, PICtail, PowerSmart, PureSilicon, QMatrix, REAL ICE, Ripple Blocker, SAM-ICE, Serial Quad I/O, SMART-I.S., SQI, SuperSwitcher, SuperSwitcher II, Total Endurance, TSHARC, USBCheck, VariSense, ViewSpan, WiperLock, Wireless DNA, and ZENA are trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.

SQTP is a service mark of Microchip Technology Incorporated in the U.S.A.

The Adaptec logo, Frequency on Demand, Silicon Storage Technology, and Symmcom are registered trademarks of Microchip Technology Inc. in other countries.

GestlC is a registered trademark of Microchip Technology Germany II GmbH & Co. KG, a subsidiary of Microchip Technology Inc., in other countries.

All other trademarks mentioned herein are property of their respective companies.

© 2019, Microchip Technology Incorporated, Printed in the U.S.A., All Rights Reserved.

ISBN: 978-1-6683-3010-4

Quality Management System

For information regarding Microchip's Quality Management Systems, please visit www.microchip.com/quality.

Worldwide Sales and Service

AMERICAS	ASIA/PACIFIC	ASIA/PACIFIC	EUROPE
Corporate Office 2355 West Chandler Blvd. Chandler, AZ 85224-6199 Tel: 480-792-7200 Fax: 480-792-7277 Technical Support: www.microchip.com/support Web Address: www.microchip.com	Australia - Sydney Tel: 61-2-9868-6733 China - Beijing Tel: 86-10-8569-7000 China - Chengdu Tel: 86-28-8665-5511 China - Chongqing Tel: 86-23-8980-9588 China - Dongguan Tel: 86-769-8702-9880 China - Guangzhou Tel: 86-20-8755-8029 China - Hangzhou Tel: 86-571-8792-8115 China - Hong Kong SAR Tel: 852-2943-5100 China - Nanjing Tel: 86-25-8473-2460 China - Qingdao Tel: 86-532-8502-7355 China - Shanghai Tel: 86-21-3326-8000 China - Shenyang Tel: 86-24-2334-2829 China - Shenzhen Tel: 86-755-8864-2200 China - Suzhou Tel: 86-186-6233-1526 China - Wuhan Tel: 86-27-5980-5300 China - Xian Tel: 86-29-8833-7252 China - Xiamen Tel: 86-592-2388138 China - Zhuhai Tel: 86-756-3210040	India - Bangalore Tel: 91-80-3090-4444 India - New Delhi Tel: 91-11-4160-8631 India - Pune Tel: 91-20-4121-0141 Japan - Osaka Tel: 81-6-6152-7160 Japan - Tokyo Tel: 81-3-6880-3770 Korea - Daegu Tel: 82-53-744-4301 Korea - Seoul Tel: 82-2-554-7200 Malaysia - Kuala Lumpur Tel: 60-3-7651-7906 Malaysia - Penang Tel: 60-4-227-8870 Philippines - Manila Tel: 63-2-634-9065 Singapore Tel: 65-6334-8870 Taiwan - Hsin Chu Tel: 886-3-577-8366 Taiwan - Kaohsiung Tel: 886-7-213-7830 Taiwan - Taipei Tel: 886-2-2508-8600 Thailand - Bangkok Tel: 66-2-694-1351 Vietnam - Ho Chi Minh Tel: 84-28-5448-2100	Austria - Wels Tel: 43-7242-2244-39 Fax: 43-7242-2244-393 Denmark - Copenhagen Tel: 45-4485-5910 Fax: 45-4485-2829 Finland - Espoo Tel: 358-9-4520-820 France - Paris Tel: 33-1-69-53-63-20 Fax: 33-1-69-30-90-79 Germany - Garching Tel: 49-8931-9700 Germany - Haan Tel: 49-2129-3766400 Germany - Heilbronn Tel: 49-7131-72400 Germany - Karlsruhe Tel: 49-721-625370 Germany - Munich Tel: 49-89-627-144-0 Fax: 49-89-627-144-44 Germany - Rosenheim Tel: 49-8031-354-560 Israel - Ra'anana Tel: 972-9-744-7705 Italy - Milan Tel: 39-0331-742611 Fax: 39-0331-466781 Italy - Padova Tel: 39-049-7625286 Netherlands - Drunen Tel: 31-416-690399 Fax: 31-416-690340 Norway - Trondheim Tel: 47-72884388 Poland - Warsaw Tel: 48-22-3325737 Romania - Bucharest Tel: 40-21-407-87-50 Spain - Madrid Tel: 34-91-708-08-90 Fax: 34-91-708-08-91 Sweden - Gothenberg Tel: 46-31-704-60-40 Sweden - Stockholm Tel: 46-8-5090-4654 UK - Wokingham Tel: 44-118-921-5800 Fax: 44-118-921-5820