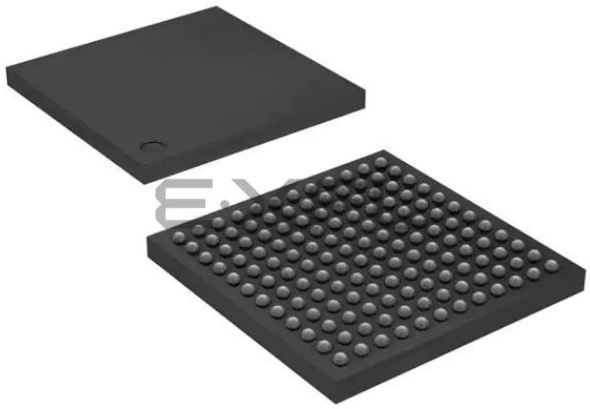


Welcome to E-XFL.COM

What is "Embedded - Microcontrollers"?

"Embedded - Microcontrollers" refer to small, integrated circuits designed to perform specific tasks within larger systems. These microcontrollers are essentially compact computers on a single chip, containing a processor core, memory, and programmable input/output peripherals. They are called "embedded" because they are embedded within electronic devices to control various functions, rather than serving as standalone computers. Microcontrollers are crucial in modern electronics, providing the intelligence and control needed for a wide range of applications.

Applications of "Embedded - Microcontrollers"

Details	
Product Status	Active
Core Processor	AVR
Core Size	32-Bit Single-Core
Speed	66MHz
Connectivity	EBI/EMI, Ethernet, I²C, SPI, SSC, UART/USART, USB OTG
Peripherals	Brown-out Detect/Reset, POR, PWM, WDT
Number of I/O	109
Program Memory Size	512KB (512K x 8)
Program Memory Type	FLASH
EEPROM Size	-
RAM Size	64K x 8
Voltage - Supply (Vcc/Vdd)	1.65V ~ 3.6V
Data Converters	A/D 8x10b
Oscillator Type	Internal
Operating Temperature	-40°C ~ 85°C (TA)
Mounting Type	Surface Mount
Package / Case	144-TFBGA
Supplier Device Package	144-FFBGA (11x11)
Purchase URL	https://www.e-xfl.com/product-detail/microchip-technology/at32uc3a0512-ctut

1. Description

The AT32UC3A is a complete System-On-Chip microcontroller based on the AVR32 UC RISC processor running at frequencies up to 66 MHz. AVR32 UC is a high-performance 32-bit RISC microprocessor core, designed for cost-sensitive embedded applications, with particular emphasis on low power consumption, high code density and high performance.

The processor implements a Memory Protection Unit (MPU) and a fast and flexible interrupt controller for supporting modern operating systems and real-time operating systems. Higher computation capabilities are achievable using a rich set of DSP instructions.

The AT32UC3A incorporates on-chip Flash and SRAM memories for secure and fast access. For applications requiring additional memory, an external memory interface is provided on AT32UC3A0 derivatives.

The Peripheral Direct Memory Access controller (PDCA) enables data transfers between peripherals and memories without processor involvement. PDCA drastically reduces processing overhead when transferring continuous and large data streams between modules within the MCU.

The PowerManager improves design flexibility and security: the on-chip Brown-Out Detector monitors the power supply, the CPU runs from the on-chip RC oscillator or from one of external oscillator sources, a Real-Time Clock and its associated timer keeps track of the time.

The Timer/Counter includes three identical 16-bit timer/counter channels. Each channel can be independently programmed to perform frequency measurement, event counting, interval measurement, pulse generation, delay timing and pulse width modulation.

The PWM modules provides seven independent channels with many configuration options including polarity, edge alignment and waveform non overlap control. One PWM channel can trigger ADC conversions for more accurate close loop control implementations.

The AT32UC3A also features many communication interfaces for communication intensive applications. In addition to standard serial interfaces like UART, SPI or TWI, other interfaces like flexible Synchronous Serial Controller, USB and Ethernet MAC are available.

The Synchronous Serial Controller provides easy access to serial communication protocols and audio standards like I2S.

The Full-Speed USB 2.0 Device interface supports several USB Classes at the same time thanks to the rich End-Point configuration. The On-The-GO (OTG) Host interface allows device like a USB Flash disk or a USB printer to be directly connected to the processor.

The media-independent interface (MII) and reduced MII (RMII) 10/100 Ethernet MAC module provides on-chip solutions for network-connected devices.

AT32UC3A integrates a class 2+ Nexus 2.0 On-Chip Debug (OCD) System, with non-intrusive real-time trace, full-speed read/write memory access in addition to basic runtime control.

- **Peripheral Bus A able to run on at divided bus speeds compared to the High Speed Bus**

Figure 4-1 gives an overview of the bus system. All modules connected to the same bus use the same clock, but the clock to each module can be individually shut off by the Power Manager. The figure identifies the number of master and slave interfaces of each module connected to the High Speed Bus, and which DMA controller is connected to which peripheral.

Table 5-1. Signal Description List

Signal Name	Function	Type	Active Level	Comments
Analog to Digital Converter - ADC				
AD0 - AD7	Analog input pins	Analog input		
ADVREF	Analog positive reference voltage input	Analog input		2.6 to 3.6V
Pulse Width Modulator - PWM				
PWM0 - PWM6	PWM Output Pins	Output		
Universal Serial Bus Device - USB				
DDM	USB Device Port Data -	Analog		
DDP	USB Device Port Data +	Analog		
VBUS	USB VBUS Monitor and OTG Negociation	Analog Input		
USBID	ID Pin of the USB Bus	Input		
USB_VBOF	USB VBUS On/off: bus power control port	output		
Audio Bitstream DAC (ABDAC)				
DATA0-DATA1	D/A Data out	Outpu		
DATAN0-DATAN1	D/A Data inverted out	Outpu		

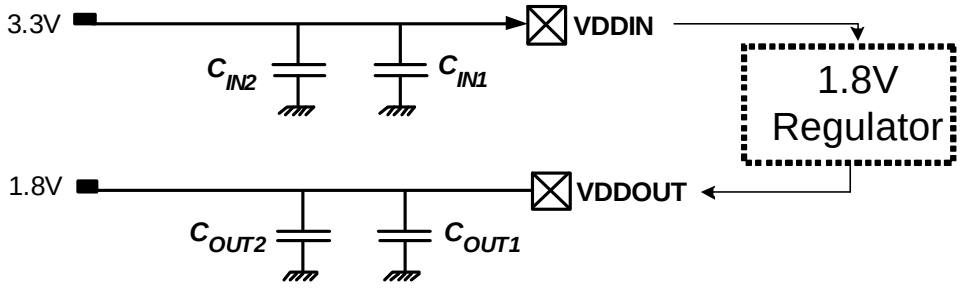
7.2 Voltage Regulator

7.2.1 Single Power Supply

The AT32UC3A embeds a voltage regulator that converts from 3.3V to 1.8V. The regulator takes its input voltage from VDDIN, and supplies the output voltage on VDDOUT. VDDOUT should be externally connected to the 1.8V domains.

Adequate input supply decoupling is mandatory for VDDIN in order to improve startup stability and reduce source voltage drop. Two input decoupling capacitors must be placed close to the chip.

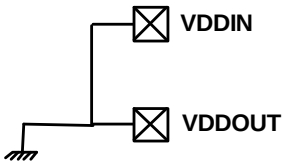
Adequate output supply decoupling is mandatory for VDDOUT to reduce ripple and avoid oscillations. The best way to achieve this is to use two capacitors in parallel between VDDOUT and GND as close to the chip as possible



Refer to Section 12.3 on page 42 for decoupling capacitors values and regulator characteristics

7.2.2 Dual Power Supply

In case of dual power supply, VDDIN and VDDOUT should be connected to ground to prevent from leakage current.



8. I/O Line Considerations

8.1 JTAG pins

TMS, TDI and TCK have pull-up resistors. TDO is an output, driven at up to VDDIO, and has no pull-up resistor.

8.2 RESET_N pin

The RESET_N pin is a schmitt input and integrates a permanent pull-up resistor to VDDIO. As the product integrates a power-on reset cell, the RESET_N pin can be left unconnected in case no reset from the system needs to be applied to the product.

8.3 TWI pins

When these pins are used for TWI, the pins are open-drain outputs with slew-rate limitation and inputs with inputs with spike-filtering. When used as GPIO-pins or used for other peripherals, the pins have the same characteristics as PIO pins.

8.4 GPIO pins

All the I/O lines integrate a programmable pull-up resistor. Programming of this pull-up resistor is performed independently for each I/O line through the GPIO Controllers. After reset, I/O lines default as inputs with pull-up resistors disabled, except when indicated otherwise in the column “Reset State” of the GPIO Controller multiplexing tables.

9. Memories

9.1 Embedded Memories

- **Internal High-Speed Flash**
  - **512 KBytes (AT32UC3A0512, AT32UC3A1512)**
  - **256 KBytes (AT32UC3A0256, AT32UC3A1256)**
  - **128 KBytes (AT32UC3A1128, AT32UC3A2128)**
    - **0 Wait State Access at up to 33 MHz in Worst Case Conditions**
    - **1 Wait State Access at up to 66 MHz in Worst Case Conditions**
    - **Pipelined Flash Architecture, allowing burst reads from sequential Flash locations, hiding penalty of 1 wait state access**
    - **Pipelined Flash Architecture typically reduces the cycle penalty of 1 wait state operation to only 15% compared to 0 wait state operation**
    - **100 000 Write Cycles, 15-year Data Retention Capability**
    - **4 ms Page Programming Time, 8 ms Chip Erase Time**
    - **Sector Lock Capabilities, Bootloader Protection, Security Bit**
    - **32 Fuses, Erased During Chip Erase**
    - **User Page For Data To Be Preserved During Chip Erase**
- **Internal High-Speed SRAM, Single-cycle access at full speed**
  - **64 KBytes (AT32UC3A0512, AT32UC3A0256, AT32UC3A1512, AT32UC3A1256)**
  - **32KBytes (AT32UC3A1128)**

9.2 Physical Memory Map

The system bus is implemented as a bus matrix. All system bus addresses are fixed, and they are never remapped in any way, not even in boot. Note that AVR32 UC CPU uses unsegmented translation, as described in the AVR32 Architecture Manual. The 32-bit physical address space is mapped as follows:

Table 9-1. AT32UC3A Physical Memory Map

Device	Start Address	Size					
		AT32UC3A0512	AT32UC3A1512	AT32UC3A0256	AT32UC3A1256	AT32UC3A0128	AT32UC3A1128
Embedded SRAM	0x0000_0000	64 Kbyte	64 Kbyte	64 Kbyte	64 Kbyte	32 Kbyte	32 Kbyte
Embedded Flash	0x8000_0000	512 Kbyte	512 Kbyte	256 Kbyte	256 Kbyte	128 Kbyte	128 Kbyte
EBI SRAM CS0	0xC000_0000	16 Mbyte	-	16 Mbyte	-	16 Mbyte	-
EBI SRAM CS2	0xC800_0000	16 Mbyte	-	16 Mbyte	-	16 Mbyte	-
EBI SRAM CS3	0xCC00_0000	16 Mbyte	-	16 Mbyte	-	16 Mbyte	-
EBI SRAM CS1 /SDRAM CS0	0xD000_0000	128 Mbyte	-	128 Mbyte	-	128 Mbyte	-
USB Configuration	0xE000_0000	64 Kbyte	64 Kbyte	64 Kbyte	64 Kbyte	64 Kbyte	64 Kbyte
HSB-PB Bridge A	0xFFFE_0000	64 Kbyte	64 Kbyte	64 Kbyte	64 Kbyte	64 Kbyte	64 Kbyte
HSB-PB Bridge B	0xFFFF_0000	64 Kbyte	64 Kbyte	64 kByte	64 kByte	64 Kbyte	64 Kbyte

Figure 9-1. HMatrix Master / Slave Connections

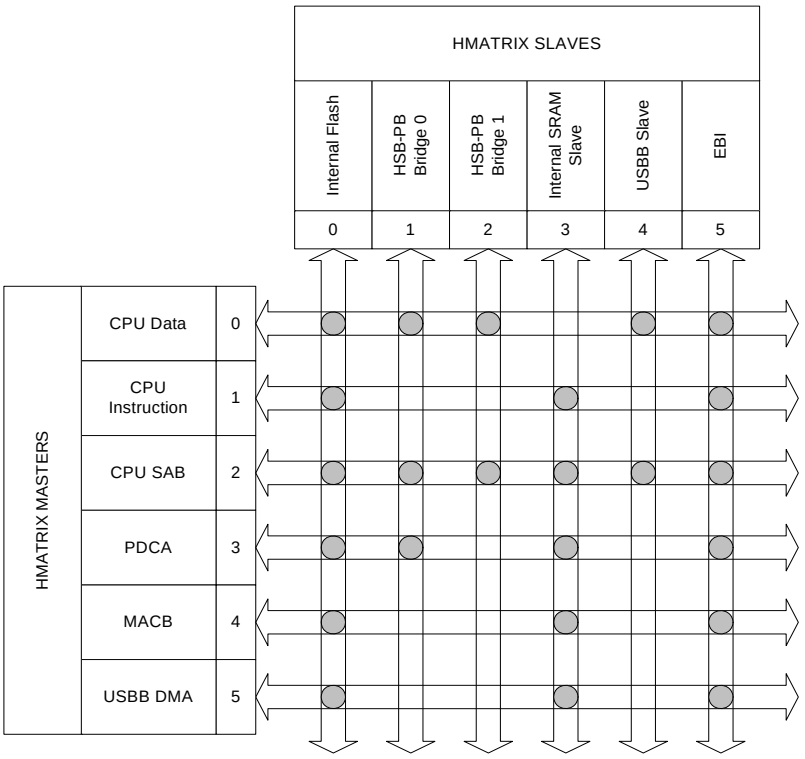


Table 10-1. Peripheral Address Mapping (Continued)

Address		Peripheral Name	Bus
0xFFFF1C00	USART2	Universal Synchronous Asynchronous Receiver Transmitter - USART2	PBA
0xFFFF2000	USART3	Universal Synchronous Asynchronous Receiver Transmitter - USART3	PBA
0xFFFF2400	SPI0	Serial Peripheral Interface - SPI0	PBA
0xFFFF2800	SPI1	Serial Peripheral Interface - SPI1	PBA
0xFFFF2C00	TWI	Two Wire Interface - TWI	PBA
0xFFFF3000	PWM	Pulse Width Modulation Controller - PWM	PBA
0xFFFF3400	SSC	Synchronous Serial Controller - SSC	PBA
0xFFFF3800	TC	Timer/Counter - TC	PBA
0xFFFF3C00	ADC	Analog To Digital Converter - ADC	PBA

10.2 CPU Local Bus Mapping

Some of the registers in the GPIO module are mapped onto the CPU local bus, in addition to being mapped on the Peripheral Bus. These registers can therefore be reached both by accesses on the Peripheral Bus, and by accesses on the local bus.

Mapping these registers on the local bus allows cycle-deterministic toggling of GPIO pins since the CPU and GPIO are the only modules connected to this bus. Also, since the local bus runs at CPU speed, one write or read operation can be performed per clock cycle to the local bus-mapped GPIO registers.

The following GPIO registers are mapped on the local bus:

Table 10-2. Local bus mapped GPIO registers

Port	Register	Mode	Local Bus Address	Access
0	Output Driver Enable Register (ODER)	WRITE	0x4000_0040	Write-only
		SET	0x4000_0044	Write-only
		CLEAR	0x4000_0048	Write-only
		TOGGLE	0x4000_004C	Write-only
	Output Value Register (OVR)	WRITE	0x4000_0050	Write-only
		SET	0x4000_0054	Write-only
		CLEAR	0x4000_0058	Write-only
		TOGGLE	0x4000_005C	Write-only
	Pin Value Register (PVR)	-	0x4000_0060	Read-only
1	Output Driver Enable Register (ODER)	WRITE	0x4000_0140	Write-only
		SET	0x4000_0144	Write-only
		CLEAR	0x4000_0148	Write-only
		TOGGLE	0x4000_014C	Write-only
	Output Value Register (OVR)	WRITE	0x4000_0150	Write-only
		SET	0x4000_0154	Write-only
		CLEAR	0x4000_0158	Write-only
		TOGGLE	0x4000_015C	Write-only
	Pin Value Register (PVR)	-	0x4000_0160	Read-only
2	Output Driver Enable Register (ODER)	WRITE	0x4000_0240	Write-only
		SET	0x4000_0244	Write-only
		CLEAR	0x4000_0248	Write-only
		TOGGLE	0x4000_024C	Write-only
	Output Value Register (OVR)	WRITE	0x4000_0250	Write-only
		SET	0x4000_0254	Write-only
		CLEAR	0x4000_0258	Write-only
		TOGGLE	0x4000_025C	Write-only
	Pin Value Register (PVR)	-	0x4000_0260	Read-only

12.3 Regulator characteristics

Table 12-2. Electrical characteristics

Symbol	Parameter	Condition	Min.	Typ.	Max.	Units
V_{VDDIN}	Supply voltage (input)		3	3.3	3.6	V
V_{VDDOUT}	Supply voltage (output)		1.81	1.85	1.89	V
I_{OUT}	Maximum DC output current with $V_{VDDIN = 3.3V}$				100	mA
	Maximum DC output current with $V_{VDDIN = 2.7V}$				90	mA
I_{SCR}	Static Current of internal regulator	Low Power mode (stop, deep stop or static) at T_A =25°C		10		µA

Table 12-3. Decoupling requirements

Symbol	Parameter	Condition	Typ.	Techno.	Units
C_{IN1}	Input Regulator Capacitor 1		1	NPO	nF
C_{IN2}	Input Regulator Capacitor 2		4.7	X7R	uF
C_{OUT1}	Output Regulator Capacitor 1		470	NPO	pF
C_{OUT2}	Output Regulator Capacitor 2		2.2	X7R	uF

12.4 Analog characteristics

Table 12-4. Electrical characteristics

Symbol	Parameter	Condition	Min.	Typ.	Max.	Units
V_{ADVREF}	Analog voltage reference (input)		2.6		3.6	V

Table 12-5. Decoupling requirements

Symbol	Parameter	Condition	Typ.	Techno.	Units
C_{VREF1}	Voltage reference Capacitor 1		10	-	nF
C_{VREF2}	Voltage reference Capacitor 2		1	-	uF

12.4.1 BOD

Table 12-6. BODLEVEL Values

BODLEVEL Value	Typ.	Typ.	Typ.	Units.
00 0000b	1.40	1.47	1.55	V
01 0111b	1.45	1.52	1.6	V
01 1111b	1.55	1.6	1.65	V
10 0111b	1.65	1.69	1.75	V

The values in Table 12-6 describes the values of the BODLEVEL in the flash FGPFR register.

Table 12-24. SMC Read Signals with no Hold Settings

Symbol	Parameter	Min	Units
NRD Controlled (READ_MODE = 1)			
SMC_{19}	Data Setup before NRD High	13.7	ns
SMC_{20}	Data Hold after NRD High	1	
NRD Controlled (READ_MODE = 0)			
SMC_{21}	Data Setup before NCS High	13.3	ns
SMC_{22}	Data Hold after NCS High	0	

Table 12-25. SMC Write Signals with Hold Settings

Symbol	Parameter	Min	Units
NRD Controlled (READ_MODE = 1)			
SMC_{23}	Data Out Valid before NWE High	(nwe pulse length - 1) * t_{CPSMC} - 0.9	ns
SMC_{24}	Data Out Valid after NWE High(1)	nwe hold length * t_{CPSMC} - 6	
SMC_{25}	NWE High to NBS0/A0 Change(1)	nwe hold length * t_{CPSMC} - 1.9	
SMC_{26}	NWE High to NBS1 Change(1)	nwe hold length * t_{CPSMC} - 1.9	
SMC_{29}	NWE High to NBS2/A1 Change(1)	nwe hold length * t_{CPSMC} - 1.9	
SMC_{30}	NWE High to NBS3 Change(1)	nwe hold length * t_{CPSMC} - 1.9	
SMC_{31}	NWE High to A2 - A25 Change(1)	nwe hold length * t_{CPSMC} - 1.7	
SMC_{32}	NWE High to NCS Inactive(1)	(nwe hold length - ncs wr hold length)* t_{CPSMC} - 2.9	
SMC_{33}	NWE Pulse Width	nwe pulse length * t_{CPSMC} - 0.9	
NRD Controlled (READ_MODE = 0)			
SMC_{34}	Data Out Valid before NCS High	(ncs wr pulse length - 1)* t_{CPSMC} - 4.6	ns
SMC_{35}	Data Out Valid after NCS High(1)	ncs wr hold length * t_{CPSMC} - 5.8	
SMC_{36}	NCS High to NWE Inactive(1)	(ncs wr hold length - nwe hold length)* t_{CPSMC} - 0.6	

Note: 1. hold length = total cycle duration - setup duration - pulse duration. “hold length” is for “ncs wr hold length” or “nwe hold length"

12.10 JTAG Timings

12.10.1 JTAG Interface Signals

Table 12-29. JTAG Interface Timing specification

Symbol	Parameter	Conditions	Min	Max	Units
$JTAG_0$	TCK Low Half-period	(1)	6		ns
$JTAG_1$	TCK High Half-period	(1)	3		ns
$JTAG_2$	TCK Period	(1)	9		ns
$JTAG_3$	TDI, TMS Setup before TCK High	(1)	1		ns
$JTAG_4$	TDI, TMS Hold after TCK High	(1)	0		ns
$JTAG_5$	TDO Hold Time	(1)	4		ns
$JTAG_6$	TCK Low to TDO Valid	(1)		6	ns
$JTAG_7$	Device Inputs Setup Time	(1)			ns
$JTAG_8$	Device Inputs Hold Time	(1)			ns
$JTAG_9$	Device Outputs Hold Time	(1)			ns
$JTAG_{10}$	TCK to Device Outputs Valid	(1)			ns

Note: 1. V_{VDDIO} from 3.0V to 3.6V, maximum external capacitor = 40pF

Figure 12-7. SPI Master mode with (CPOL=0 and NCPHA=1) or (CPOL=1 and NCPHA=0)

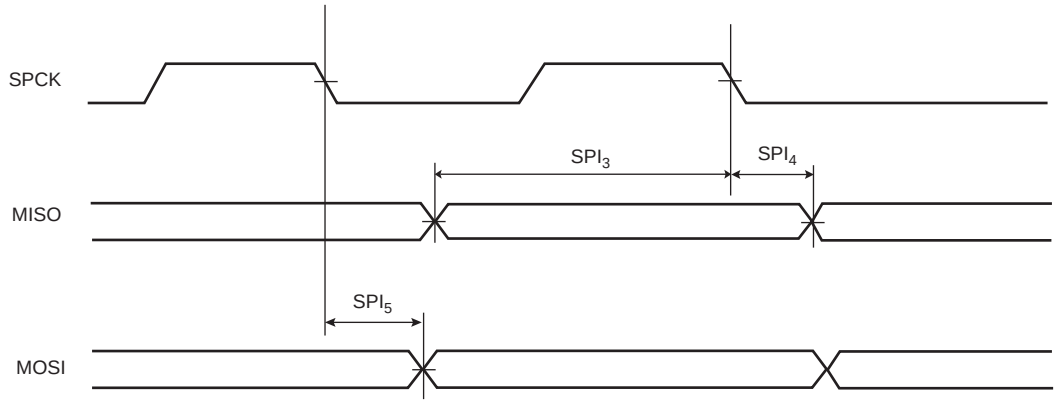


Figure 12-8. SPI Slave mode with (CPOL=0 and NCPHA=1) or (CPOL=1 and NCPHA=0)

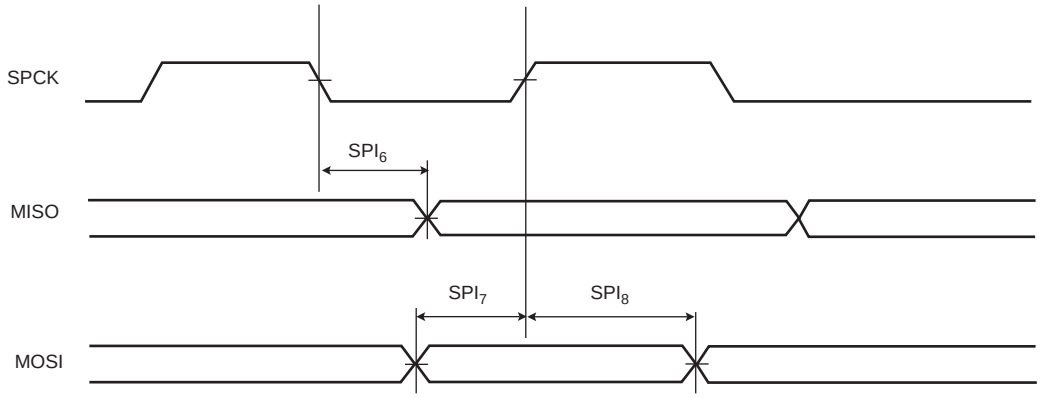


Figure 12-9. SPI Slave mode with (CPOL = NCPHA = 0) or (CPOL= NCPHA= 1)

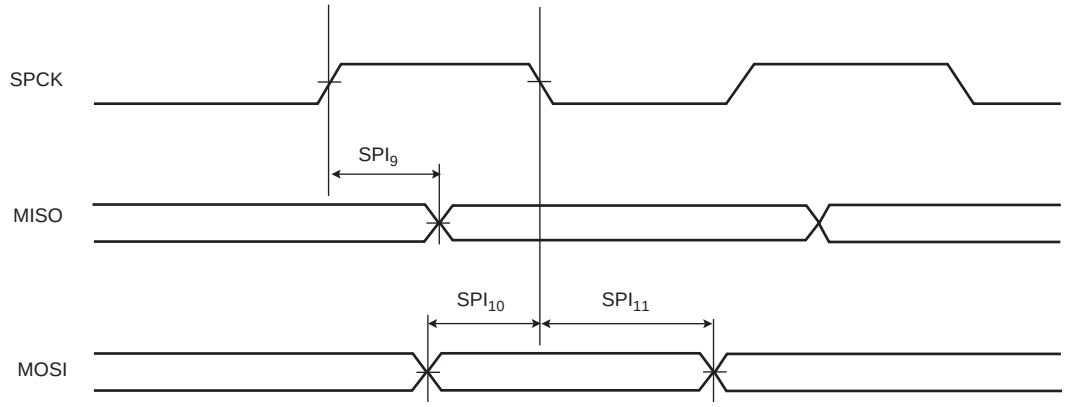


Table 12-30. SPI Timings

Symbol	Parameter	Conditions	Min	Max	Units
SPI_0	MISO Setup time before SPCK rises (master)	3.3V domain(1)	22 + (t_{CPMCK})/2(2)		ns
SPI_1	MISO Hold time after SPCK rises (master)	3.3V domain(1)	0		ns
SPI_2	SPCK rising to MOSI Delay (master)	3.3V domain(1)		7	ns
SPI_3	MISO Setup time before SPCK falls (master)	3.3V domain(1)	22 + (t_{CPMCK})/2(2)		ns
SPI_4	MISO Hold time after SPCK falls (master)	3.3V domain (1)	0		ns
SPI_5	SPCK falling to MOSI Delay (master)	3.3V domain (1)		7	ns
SPI_6	SPCK falling to MISO Delay (slave)	3.3V domain (1)		26.5	ns
SPI_7	MOSI Setup time before SPCK rises (slave)	3.3V domain (1)	0		ns
SPI_8	MOSI Hold time after SPCK rises (slave)	3.3V domain (1)	1.5		ns
SPI_9	SPCK rising to MISO Delay (slave)	3.3V domain (1)		27	ns
SPI_{10}	MOSI Setup time before SPCK falls (slave)	3.3V domain (1)	0		ns
SPI_{11}	MOSI Hold time after SPCK falls (slave)	3.3V domain (1)	1		ns

Notes: 1. 3.3V domain: V_{VDDIO} from 3.0V to 3.6V, maximum external capacitor = 40 pF.
2. t_{CPMCK}: Master Clock period in ns.

12.12 MACB Characteristics

Table 12-31. Ethernet MAC Signals

Symbol	Parameter	Conditions	Min (ns)	Max (ns)
$EMAC_1$	Setup for EMDIO from EMDC rising	Load: 20pF(2)		
$EMAC_2$	Hold for EMDIO from EMDC rising	Load: 20pF(2)		
$EMAC_3$	EMDIO toggling from EMDC falling	Load: 20pF(2)		

Notes: 1. f: MCK frequency (MHz)
2. V_{VDDIO} from 3.0V to 3.6V, maximum external capacitor = 20 pF

Table 12-32. Ethernet MAC MII Specific Signals

Symbol	Parameter	Conditions	Min (ns)	Max (ns)
$EMAC_4$	Setup for ECOL from ETXCK rising	Load: 20pF (1)	3	
$EMAC_5$	Hold for ECOL from ETXCK rising	Load: 20pF (1)	0	
$EMAC_6$	Setup for ECRS from ETXCK rising	Load: 20pF (1)	3	
$EMAC_7$	Hold for ECRS from ETXCK rising	Load: 20pF (1)	0	
$EMAC_8$	ETXER toggling from ETXCK rising	Load: 20pF (1)		15
$EMAC_9$	ETXEN toggling from ETXCK rising	Load: 20pF (1)		15
$EMAC_{10}$	ETX toggling from ETXCK rising	Load: 20pF (1)		15
$EMAC_{11}$	Setup for ERX from ERXCK	Load: 20pF (1)	1	

Table 12-35. Programming Time

Temperature Operating Range Part	Page Programming Time (ms)	Chip Erase Time (ms)
Industrial	4	4
Automotive	16	16

14. Ordering Information

Table 14-1. Ordering Information

Device	Ordering Code	Package	Conditioning	Temperature Operating Range
AT32UC3A0512	AT32UC3A0512-ALUT	144 LQFP	Tray	Industrial (-40·C to 85·C)
	AT32UC3A0512-ALUR	144 LQFP	Reel	Industrial (-40·C to 85·C)
	AT32UC3A0512-ALTR	144 LQFP	Reel	Automotive (-40·C to 85·C)
	AT32UC3A0512-ALTT	144 LQFP	Tray	Automotive (-40·C to 85·C)
	AT32UC3A0512-ALTES	144 LQFP	Tray	Automotive (-40·C to 85·C) samples
	AT32UC3A0512-CTUT	144 FFBGA	Tray	Industrial (-40·C to 85·C)
	AT32UC3A0512-CTUR	144 FFBGA	Reel	Industrial (-40·C to 85·C)
AT32UC3A0256	AT32UC3A0256-ALUT	144 LQFP	Tray	Industrial (-40·C to 85·C)
	AT32UC3A0256-ALUR	144 LQFP	Reel	Industrial (-40·C to 85·C)
	AT32UC3A0256-CTUT	144 FFBGA	Tray	Industrial (-40·C to 85·C)
	AT32UC3A0256-CTUR	144 FFBGA	Reel	Industrial (-40·C to 85·C)
AT32UC3A0128	AT32UC3A0128-ALUT	144 LQFP	Tray	Industrial (-40·C to 85·C)
	AT32UC3A0128-ALUR	144 LQFP	Reel	Industrial (-40·C to 85·C)
	AT32UC3A0128-CTUT	144 FFBGA	Tray	Industrial (-40·C to 85·C)
	AT32UC3A0128-CTUR	144 FFBGA	Reel	Industrial (-40·C to 85·C)
AT32UC3A1512	AT32UC3A1512-AUT	100 TQFP	Tray	Industrial (-40·C to 85·C)
	AT32UC3A1512-AUR	100 TQFP	Reel	Industrial (-40·C to 85·C)
AT32UC3A1256	AT32UC3A1256-AUT	100 TQFP	Tray	Industrial (-40·C to 85·C)
	AT32UC3A1256-AUR	100 TQFP	Reel	Industrial (-40·C to 85·C)
AT32UC3A1128	AT32UC3A1128-AUT	100 TQFP	Tray	Industrial (-40·C to 85·C)
	AT32UC3A1128-AUR	100 TQFP	Reel	Industrial (-40·C to 85·C)

14.1 Automotive Quality Grade

The AT32UC3A have been developed and manufactured according to the most stringent requirements of the international standard ISO-TS-16949. This data sheet will contain limit values extracted from the results of extensive characterization (Temperature and Voltage). The quality and reliability of the AT32UC3A is verified during regular product qualification as per AEC-Q100 grade 3.

As indicated in the ordering information paragraph, the product is available in only one temperature grade T: -40°C / + 85°C.

When multiple CS are in use, if one of the baudrate equals 1, the other must also equal 1 if CPOL=1 and CPHA=0.

4. **SPI Glitch on RXREADY flag in slave mode when enabling the SPI or during the first transfer**
   In slave mode, the SPI can generate a false RXREADY signal during enabling of the SPI or during the first transfer.

   Fix/Workaround
   1. Set slave mode, set required CPOL/CPHA.
   2. Enable SPI.
   3. Set the polarity CPOL of the line in the opposite value of the required one.
   4. Set the polarity CPOL to the required one.
   5. Read the RXHOLDING register.

   Transfers can now befin and RXREADY will now behave as expected.

5. **SPI Disable does not work in Slave mode**
   Fix/workaround
   Read the last received data then perform a Software reset.

15.2.4 Power Manager

1. **If the BOD level is higher than VDDCORE, the part is constantly under reset**
   If the BOD level is set to a value higher than VDDCORE and enabled by fuses, the part will be in constant reset.

   Fix/Workaround
   Apply an external voltage on VDDCORE that is higher than the BOD level and is lower than VDDCORE max and disable the BOD.

15.2.5 PDCA

1. **Wrong PDCA behavior when using two PDCA channels with the same PID.**
   Fix/Workaround
   The same PID should not be assigned to more than one channel.

15.2.6 TWI

1. **The TWI RXRDY flag in SR register is not reset when a software reset is performed.**
   Fix/Workaround
   After a Software Reset, the register TWI RHR must be read.

15.2.7 SDRAMC

1. **Code execution from external SDRAM does not work**
   Code execution from SDRAM does not work.

   Fix/Workaround
   Do not run code from SDRAM.

15.2.8 GPIO

1. **PA29 (TWI SDA) and PA30 (TWI SCL) GPIO VIH (input high voltage) is 3.6V max instead of 5V tolerant**
   The following GPIOs are not 5V tolerant : PA29 and PA30.
   Fix/Workaround

15.3 Rev. I

15.3.1 PWM

1. **PWM channel interrupt enabling triggers an interrupt**
   When enabling a PWM channel that is configured with center aligned period (CALG=1), an interrupt is signalled.

   Fix/Workaround
   When using center aligned mode, enable the channel and read the status before channel interrupt is enabled.

2. **PWM counter restarts at 0x0001**
   The PWM counter restarts at 0x0001 and not 0x0000 as specified. Because of this the first PWM period has one more clock cycle.
   Fix/Workaround
   - The first period is 0x0000, 0x0001, ..., period
   - Consecutive periods are 0x0001, 0x0002, ..., period

3. **PWM update period to a 0 value does not work**
   It is impossible to update a period equal to 0 by the using the PWM update register (PWM_CUPD).

   Fix/Workaround
   Do not update the PWM_CUPD register with a value equal to 0.

15.3.2 ADC

1. **Sleep Mode activation needs additional A to D conversion**
   If the ADC sleep mode is activated when the ADC is idle the ADC will not enter sleep mode before after the next AD conversion.

   Fix/Workaround
   Activate the sleep mode in the mode register and then perform an AD conversion.

15.3.3 SPI

1. **SPI Slave / PDCA transfer: no TX UNDERRUN flag**
   There is no TX UNDERRUN flag available, therefore in SPI slave mode, there is no way to be informed of a character lost in transmission.

   Fix/Workaround
   For PDCA transfer: none.

2. **SPI FDIV option does not work**
   Selecting clock signal using FDIV = 1 does not work as specified.

   Fix/Workaround
   Do not set FDIV = 1.

3. **SPI Bad Serial Clock Generation on 2nd chip_select when SCBR = 1, CPOL=1 and NCPHA=0**
   When multiple CS are in use, if one of the baudrate equals to 1 and one of the others doesn't equal to 1, and CPOL=1 and CPHA=0, then an aditional pulse will be generated on SCK.
   Fix/workaround

Fix/workaround

When multiple CS are in use, if one of the baudrate equals 1, the other must also equal 1 if CPOL=1 and CPHA=0.

15.5.2 PWM

1. **PWM counter restarts at 0x0001**

   The PWM counter restarts at 0x0001 and not 0x0000 as specified. Because of this the first PWM period has one more clock cycle.

   Fix/Workaround

   - The first period is 0x0000, 0x0001, ..., period

   - Consecutive periods are 0x0001, 0x0002, ..., period

2. **PWM channel interrupt enabling triggers an interrupt**

   When enabling a PWM channel that is configured with center aligned period (CALG=1), an interrupt is signalled.

   Fix/Workaround

   When using center aligned mode, enable the channel and read the status before channel interrupt is enabled.

3. **PWM update period to a 0 value does not work**

   It is impossible to update a period equal to 0 by the using the PWM update register (PWM_CUPD).

   Fix/Workaround

   Do not update the PWM_CUPD register with a value equal to 0.

4. **PWM channel status may be wrong if disabled before a period has elapsed**

   Before a PWM period has elapsed, the read channel status may be wrong. The CHIDx-bit for a PWM channel in the PWM Enable Register will read '1' for one full PWM period even if the channel was disabled before the period elapsed. It will then read '0' as expected.

   Fix/Workaround

   Reading the PWM channel status of a disabled channel is only correct after a PWM period has elapsed.

15.5.3 SSC

1. **SSC does not trigger RF when data is low**

   The SSC cannot transmit or receive data when CKS = CKDIV and CKO = none, in TCMR or RCMR respectively.

   Fix/Workaround

   Set CKO to a value that is not "none" and bypass the output of the TK/RK pin with the PIO.

2. **SSC Data is not sent unless clock is set as output**

   The SSC cannot transmit or receive data when CKS = CKDIV and CKO = none, in TCMR or RCMR respectively.

   Fix/Workaround

   Set CKO to a value that is not "none" and bypass the output of the TK/RK pin with the PIO.