Infineon Technologies - XMC1403Q064X0064AAXUMA1 Datasheet

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	ARM® Cortex®-M0
Core Size	32-Bit Single-Core
Speed	48MHz
Connectivity	CANbus, I²C, LINbus, SPI, UART/USART
Peripherals	Brown-out Detect/Reset, I²S, POR, PWM, WDT
Number of I/O	48
Program Memory Size	64KB (64K x 8)
Program Memory Type	FLASH
EEPROM Size	-
RAM Size	16K x 8
Voltage - Supply (Vcc/Vdd)	1.8V ~ 5.5V
Data Converters	A/D 12x12b
Oscillator Type	Internal
Operating Temperature	-40°C ~ 105°C (TA)
Mounting Type	Surface Mount
Package / Case	64-VFQFN Exposed Pad
Supplier Device Package	PG-VQFN-64-6
Purchase URL	https://www.e-xfl.com/product-detail/infineon-technologies/xmc1403q064x0064aaxuma1

Trademarks

C166™, TriCore™, XMC™ and DAVE™ are trademarks of Infineon Technologies AG.

ARM®, ARM Powered®, Cortex®, Thumb® and AMBA® are registered trademarks of ARM, Limited.

CoreSight™, ETM™, Embedded Trace Macrocell™ and Embedded Trace Buffer™ are trademarks of ARM, Limited.

We Listen to Your Comments

Is there any information in this document that you feel is wrong, unclear or missing? Your feedback will help us to continuously improve the quality of this document. Please send your proposal (including a reference to this document) to:

mcdocu.comments@infineon.com

1.3 Device Types

These device types are available and can be ordered through Infineon's direct and/or distribution channels.

Table 2 Synopsis of XMC1400 Device Types

Derivative	Package	Flash Kbytes
XMC1401-Q048F0064	PG-VQFN-48	64
XMC1401-Q048F0128	PG-VQFN-48	128
XMC1401-F064F0064	PG-LQFP-64	64
XMC1401-F064F0128	PG-LQFP-64	128
XMC1402-T038X0032	PG-TSSOP-38	32
XMC1402-T038X0064	PG-TSSOP-38	64
XMC1402-T038X0128	PG-TSSOP-38	128
XMC1402-T038X0200	PG-TSSOP-38	200
XMC1402-Q040X0032	PG-VQFN-40	32
XMC1402-Q040X0064	PG-VQFN-40	64
XMC1402-Q040X0128	PG-VQFN-40	128
XMC1402-Q040X0200	PG-VQFN-40	200
XMC1402-Q048X0032	PG-VQFN-48	32
XMC1402-Q048X0064	PG-VQFN-48	64
XMC1402-Q048X0128	PG-VQFN-48	128
XMC1402-Q048X0200	PG-VQFN-48	200
XMC1402-Q064X0064	PG-VQFN-64	64
XMC1402-Q064X0128	PG-VQFN-64	128
XMC1402-Q064X0200	PG-VQFN-64	200
XMC1402-F064X0064	PG-LQFP-64	64
XMC1402-F064X0128	PG-LQFP-64	128
XMC1402-F064X0200	PG-LQFP-64	200
XMC1403-Q040X0064	PG-VQFN-40	64
XMC1403-Q040X0128	PG-VQFN-40	128
XMC1403-Q040X0200	PG-VQFN-40	200
XMC1403-Q048X0064	PG-VQFN-48	64
XMC1403-Q048X0128	PG-VQFN-48	128

Table 3 XMC1400 Chip Identification Number (cont'd)

Derivative	Value	Marking
XMC1402-Q048X0064	00014083 07FF00FF 1E071FF7 100F900F 00000D00 00001000 00011000 10204083_H	AA
XMC1402-Q048X0128	00014083 07FF00FF 1E071FF7 100F900F 00000D00 00001000 00021000 10204083_H	AA
XMC1402-Q048X0200	00014083 07FF00FF 1E071FF7 100F900F 00000D00 00001000 00033000 10204083_H	AA
XMC1402-Q064X0064	00014093 07FF00FF 1E071FF7 100F900F 00000D00 00001000 00011000 10204083_H	AA
XMC1402-Q064X0128	00014093 07FF00FF 1E071FF7 100F900F 00000D00 00001000 00021000 10204083_H	AA
XMC1402-Q064X0200	00014093 07FF00FF 1E071FF7 100F900F 00000D00 00001000 00033000 10204083_H	AA
XMC1402-F064X0064	000140A3 07FF00FF 1E071FF7 100F900F 00000D00 00001000 00011000 10204083_H	AA
XMC1402-F064X0128	000140A3 07FF00FF 1E071FF7 100F900F 00000D00 00001000 00021000 10204083_H	AA
XMC1402-F064X0200	000140A3 07FF00FF 1E071FF7 100F900F 00000D00 00001000 00033000 10204083_H	AA
XMC1403-Q040X0064	00014043 07CF00FF 1E071FF7 00B00000 00000D00 00001000 00011000 10204083_H	AA
XMC1403-Q040X0128	00014043 07CF00FF 1E071FF7 00B00000 00000D00 00001000 00021000 10204083_H	AA
XMC1403-Q040X0200	00014043 07CF00FF 1E071FF7 00B00000 00000D00 00001000 00033000 10204083_H	AA
XMC1403-Q048X0064	00014083 07CF00FF 1E071FF7 00B00000 00000D00 00001000 00011000 10204083_H	AA
XMC1403-Q048X0128	00014083 07CF00FF 1E071FF7 00B00000 00000D00 00001000 00021000 10204083_H	AA
XMC1403-Q048X0200	00014083 07CF00FF 1E071FF7 00B00000 00000D00 00001000 00033000 10204083_H	AA
XMC1403-Q064X0064	00014093 07CF00FF 1E071FF7 00B00000 00000D00 00001000 00011000 10204083_H	AA
XMC1403-Q064X0128	00014093 07CF00FF 1E071FF7 00B00000 00000D00 00001000 00021000 10204083_H	AA

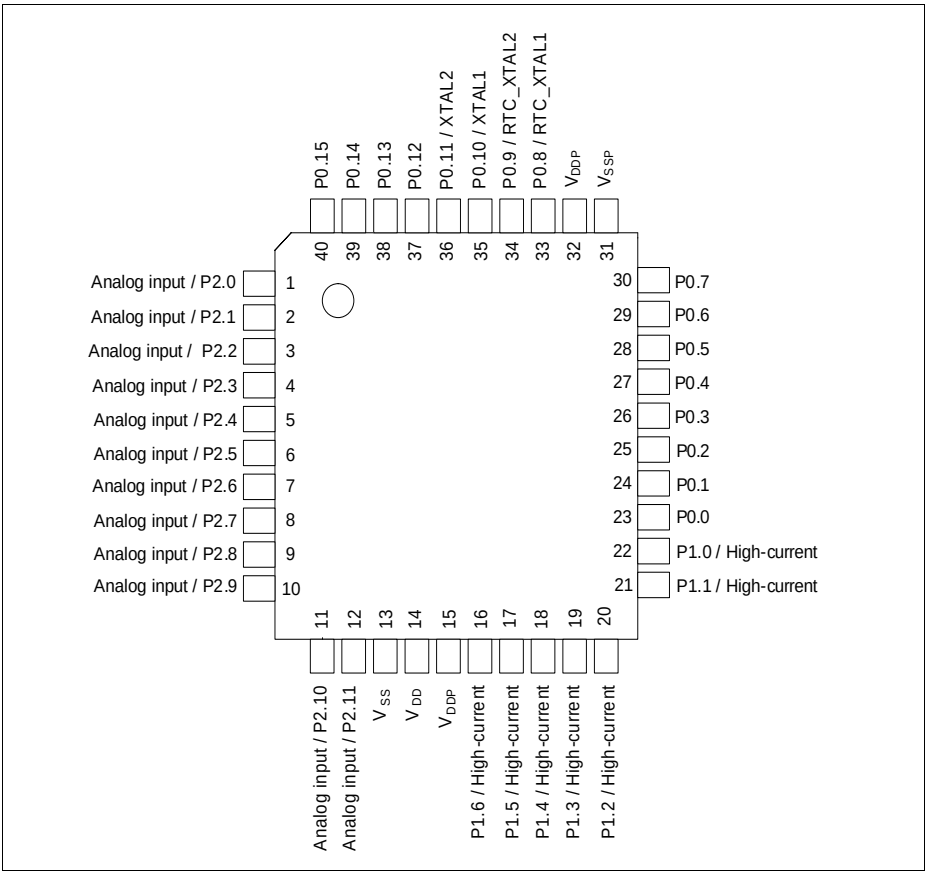


Figure 7 XMC1400 PG-VQFN-40-17 Pin Configuration (top view)

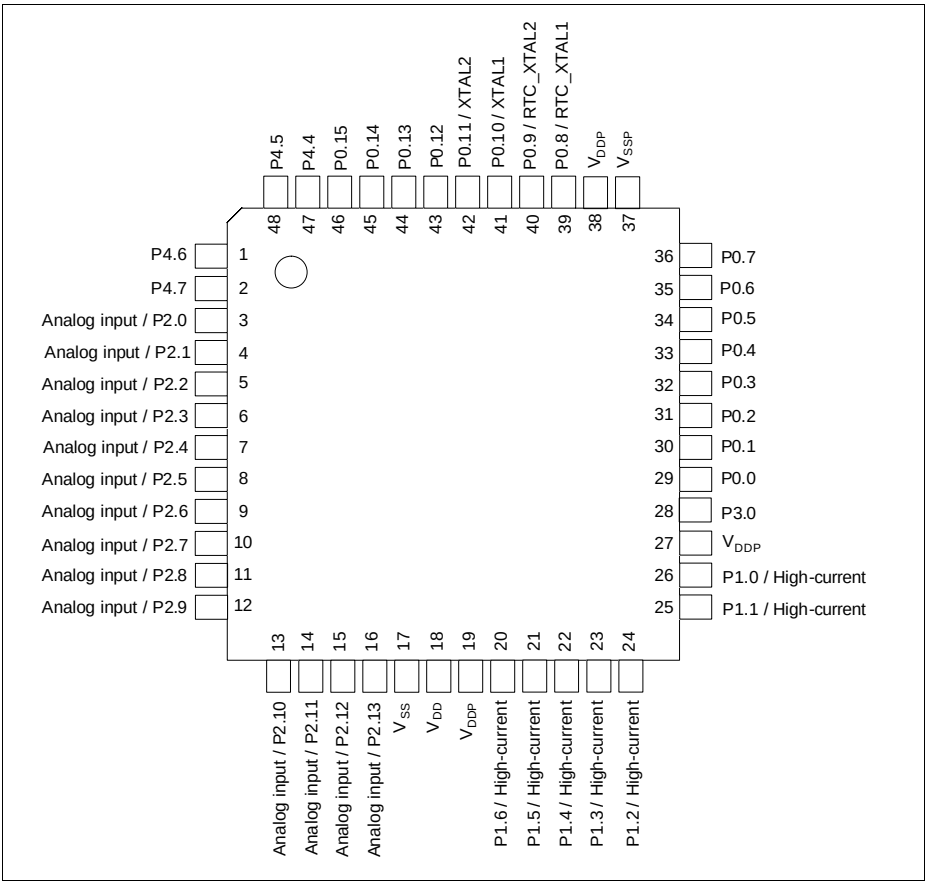


Figure 8 XMC1400 PG-VQFN-48-73 Pin Configuration (top view)

Table 5 Package Pin Mapping (cont'd)

Function	LQFP 64, VQFN 64	VQFN 48	VQFN 40	TSSOP 38	Pad Type	Notes
P2.8	17	11	9	5	STD_IN/AN	
P2.9	18	12	10	6	STD_IN/AN	
P2.10	19	13	11	7	STD_INOUT /AN	
P2.11	20	14	12	8	STD_INOUT /AN	
P2.12	21	15	-	-	STD_INOUT /AN	
P2.13	22	16	-	-	STD_INOUT /AN	
P3.0	36	28	-	-	STD_INOUT	
P3.1	37	-	-	-	STD_INOUT	
P3.2	38	-	-	-	STD_INOUT	
P3.3	39	-	-	-	STD_INOUT	
P3.4	40	-	-	-	STD_INOUT	
P4.0	59	-	-	-	STD_INOUT	
P4.1	60	-	-	-	STD_INOUT	
P4.2	61	-	-	-	STD_INOUT	
P4.3	62	-	-	-	STD_INOUT	
P4.4	63	47	-	-	STD_INOUT	
P4.5	64	48	-	-	STD_INOUT	
P4.6	3	1	-	-	STD_INOUT	
P4.7	4	2	-	-	STD_INOUT	
P4.8	5	-	-	-	STD_INOUT	
P4.9	6	-	-	-	STD_INOUT	
P4.10	7	-	-	-	STD_INOUT	
P4.11	8	-	-	-	STD_INOUT	
VSS	23	17	13	9	Power	Supply GND, ADC reference GND

Port I/O Function Table

Table 9 Port I/O Functions

Function	Outputs									Inputs											
	ALT1	ALT2	ALT3	ALT4	ALT5	ALT6	ALT7	ALT8	ALT9	Input	Input	Input	Input	Input	Input	Input	Input	Input	Input	Input	Input
P0.0	ERU0.PDOUT0	LEDTS0.LINE7	ERU0.GOUT0	CCU40.OUT0	CCU80.OUT00	USIC0_CH0.SELO0	USIC0_CH1.SELO0	CCU81.OUT00	USIC1_CH1.DOUT0	BCCU0.TRAPINB	CCU40.IN0AC					USIC1_CH1.DX0A	USIC0_CH0.DX2A		USIC0_CH1.DX2A		
P0.1	ERU0.PDOUT1	LEDTS0.LINE6	ERU0.GOUT1	CCU40.OUT1	CCU80.OUT01	BCCU0.OUT8	SCU.VDROP	USIC1_CH1.SCLKOUT	USIC1_CH1.DOUT0		CCU40.IN1AC					USIC1_CH1.DX0B	USIC1_CH1.DX1A				
P0.2	ERU0.PDOUT2	LEDTS0.LINE5	ERU0.GOUT2	CCU40.OUT2	CCU80.OUT02	VADC0.EMUX02	CCU80.OUT10	USIC1_CH0.SCLKOUT	USIC1_CH0.DOUT0		CCU40.IN2AC					USIC1_CH0.DX0A	USIC1_CH0.DX1A				
P0.3	ERU0.PDOUT3	LEDTS0.LINE4	ERU0.GOUT3	CCU40.OUT3	CCU80.OUT03	VADC0.EMUX01	CCU80.OUT11	USIC1_CH1.SCLKOUT	USIC1_CH0.DOUT0		CCU40.IN3AC					USIC1_CH0.DX0B					
P0.4	BCCU0.OUT0	LEDTS0.LINE3	LEDTS0.COL3	CCU40.OUT1	CCU80.OUT13	VADC0.EMUX00	WWDT.SERVICE_OUT	USIC1_CH1.SELO0	CAN.N0_TXD			CCU41.IN0AB	CCU80.IN0AB							CAN.N0_RXDA	
P0.5	BCCU0.OUT1	LEDTS0.LINE2	LEDTS0.COL2	CCU40.OUT0	CCU80.OUT12	ACMP2.OUT	CCU80.OUT01	VADC0.EMUX10	CAN.N0_TXD			CCU41.IN1AB	CCU80.IN1AB							CAN.N0_RXDB	
P0.6	BCCU0.OUT2	LEDTS0.LINE1	LEDTS0.COL1	CCU40.OUT0	CCU80.OUT11	USIC0_CH1.MCLKOUT	USIC0_CH1.DOUT0	VADC0.EMUX11	CCU41.OUT0		CCU40.IN0AB	CCU41.IN2AB						USIC0_CH1.DX0C			
P0.7	BCCU0.OUT3	LEDTS0.LINE0	LEDTS0.COL0	CCU40.OUT1	CCU80.OUT10	USIC0_CH0.SCLKOUT	USIC0_CH1.DOUT0	VADC0.EMUX12	CCU41.OUT1		CCU40.IN1AB	CCU41.IN3AB					USIC0_CH0.DX1C	USIC0_CH1.DX0D	USIC0_CH1.DX1C		
P0.8/ RTC_XTAL1	BCCU0.OUT4	LEDTS1.LINE0	LEDTS0.COLA	CCU40.OUT2	CCU80.OUT20	USIC0_CH0.SCLKOUT	USIC0_CH1.SCLKOUT	CCU81.OUT20	CCU41.OUT2		CCU40.IN2AB						USIC0_CH0.DX1B		USIC0_CH1.DX1B		
P0.9/ RTC_XTAL2	BCCU0.OUT5	LEDTS1.LINE1	LEDTS0.COL6	CCU40.OUT3	CCU80.OUT21	USIC0_CH0.SELO0	USIC0_CH1.SELO0	CCU81.OUT21	CCU41.OUT3		CCU40.IN3AB						USIC0_CH0.DX2B		USIC0_CH1.DX2B		
P0.10/ XTAL1	BCCU0.OUT6	LEDTS1.LINE2	LEDTS0.COL5	ACMP0.OUT	CCU80.OUT22	USIC0_CH0.SELO1	USIC0_CH1.SELO1	CCU81.OUT22					CCU80.IN2AB	CCU81.IN2AB			USIC0_CH0.DX2C		USIC0_CH1.DX2C		
P0.11/ XTAL2	BCCU0.OUT7	LEDTS1.LINE3	LEDTS0.COL4	USIC0_CH0.MCLKOUT	CCU80.OUT23	USIC0_CH0.SELO2	USIC0_CH1.SELO2	CCU81.OUT23									USIC0_CH0.DX2D		USIC0_CH1.DX2D		
P0.12	BCCU0.OUT6	LEDTS1.LINE4	LEDTS0.COL3	LEDTS1.COL3	CCU80.OUT33	USIC0_CH0.SELO3	CCU80.OUT20		CAN.N1_TXD	BCCU0.TRAPINA	CCU40.IN0AA	CCU40.IN1AA	CCU40.IN2AA	CCU81.IN0AU	CCU40.IN3AA	CCU80.IN0AA	USIC0_CH0.DX2E	CCU80.IN1AA	CCU80.IN2AA	CAN.N1_RXDA	CCU80.IN3AA

Table 9 Port I/O Functions (cont'd)

Function	Outputs									Inputs											
	ALT1	ALT2	ALT3	ALT4	ALT5	ALT6	ALT7	ALT8	ALT9	Input	Input	Input	Input	Input	Input	Input	Input	Input	Input	Input	Input
P0.13	WWDT.SERVICE_OUT	LEDTS1.LINE5	LEDTS0.COL2	LEDTS1.COL2	CCU80.OUT32	USIC0_CH0.SELO4	CCU80.OUT21		CAN.N1_TXD				CCU80.IN3AB	CCU81.IN1AU	POSIF0.IN0B		USIC0_CH0.DX2F			CAN.N1_RXDB	
P0.14	BCCU0.OUT7	LEDTS1.LINE6	LEDTS0.COL1	LEDTS1.COL1	CCU80.OUT31	USIC0_CH0.DOUT0	USIC0_CH0.SCLKOUT		CAN.N0_TXD					CCU81.IN2AU	POSIF0.IN1B	USIC0_CH0.DX0A	USIC0_CH0.DX1A	USIC1_CH1.DX5B		CAN.N0_RXDC	
P0.15	BCCU0.OUT8	LEDTS1.LINE7	LEDTS0.COL0	LEDTS1.COL0	CCU80.OUT30	USIC0_CH0.DOUT0	USIC0_CH1.MCLKOUT		CAN.N0_TXD					CCU81.IN3AU	POSIF0.IN2B	USIC0_CH0.DX0B		USIC1_CH1.DX3B	USIC1_CH1.DX4B	CAN.N0_RXDD	
P1.0	BCCU0.OUT0	CCU40.OUT0	LEDTS0.COL0	LEDTS1.COLA	CCU80.OUT00	ACMP1.OUT	USIC0_CH0.DOUT0	CCU81.OUT00	CAN.N0_TXD						POSIF0.IN2A	USIC0_CH0.DX0C				CAN.N0_RXDG	
P1.1	ERU1.PDOUT1	CCU40.OUT1	LEDTS0.COL1	LEDTS1.COL0	CCU80.OUT01	USIC0_CH0.DOUT0	USIC0_CH1.SELO0	CCU81.OUT01	CAN.N0_TXD						POSIF0.IN1A	USIC0_CH0.DX0D	USIC0_CH0.DX1D		USIC0_CH1.DX2E	CAN.N0_RXDH	
P1.2	ERU1.PDOUT2	CCU40.OUT2	LEDTS0.COL2	LEDTS1.COL1	CCU80.OUT10	ACMP2.OUT	USIC0_CH1.DOUT0	CCU81.OUT10	CAN.N1_TXD						POSIF0.IN0A			USIC0_CH1.DX0B		CAN.N1_RXDG	
P1.3	ERU1.PDOUT3	CCU40.OUT3	LEDTS0.COL3	LEDTS1.COL2	CCU80.OUT11	USIC0_CH1.SCLKOUT	USIC0_CH1.DOUT0	CCU81.OUT11	CAN.N1_TXD									USIC0_CH1.DX0A	USIC0_CH1.DX1A	CAN.N1_RXDH	
P1.4	ERU1.PDOUT0	USIC0_CH1.SCLKOUT	LEDTS0.COL4	LEDTS1.COL3	CCU80.OUT20	USIC0_CH0.SELO0	USIC0_CH1.SELO1	CCU81.OUT20	CCU41.OUT0							USIC0_CH0.DX5E		USIC0_CH1.DX5E			
P1.5	ERU1.PDOUT1	USIC0_CH0.DOUT0	LEDTS0.COLA	BCCU0.OUT1	CCU80.OUT21	USIC0_CH0.SELO1	USIC0_CH1.SELO2	CCU81.OUT21	CCU41.OUT1									USIC0_CH1.DX5F			
P1.6	ERU1.PDOUT2	USIC0_CH1.DOUT0	LEDTS0.COL5	USIC0_CH0.SCLKOUT	BCCU0.OUT2	USIC0_CH0.SELO2	USIC0_CH1.SELO3	CCU81.OUT30	CCU41.OUT2						POSIF1.IN2A	USIC0_CH0.DX5F					
P1.7	BCCU0.OUT8	CCU40.OUT3	LEDTS0.COL6	LEDTS1.COL4		ACMP3.OUT	ERU1.PDOUT3	CCU81.OUT31	CCU41.OUT3						POSIF1.IN1A	USIC1_CH0.DX5B			USIC1_CH1.DX2C		
P1.8	BCCU0.OUT0	CCU40.OUT0	USIC1_CH1.SCLKOUT	VADC0.EMUX02		ACMP1.OUT	ERU1.PDOUT0	CCU81.OUT32							POSIF1.IN0A	USIC1_CH0.DX3B	USIC1_CH0.DX4B		USIC1_CH1.DX1C		
P2.0	ERU0.PDOUT3	CCU40.OUT0	ERU0.GOUT3	LEDTS1.COL5	CCU80.OUT20	USIC0_CH0.DOUT0	USIC0_CH0.SCLKOUT	CCU81.OUT20	CAN.N0_TXD		VADC0.G0CH5					USIC0_CH0.DX0E	USIC0_CH0.DX1E		USIC0_CH1.DX2F	CAN.N0_RXDE	ERU0.0B0
P2.1	ERU0.PDOUT2	CCU40.OUT1	ERU0.GOUT2	LEDTS1.COL6	CCU80.OUT21	USIC0_CH0.DOUT0	USIC0_CH1.SCLKOUT	CCU81.OUT21	CAN.N0_TXD	ACMP2.INP	VADC0.G0CH6					USIC0_CH0.DX0F		USIC0_CH1.DX3A	USIC0_CH1.DX4A	CAN.N0_RXDF	ERU0.1B0

Table 9 Port I/O Functions (cont'd)

Function	Outputs									Inputs										
	ALT1	ALT2	ALT3	ALT4	ALT5	ALT6	ALT7	ALT8	ALT9	Input	Input	Input	Input	Input	Input	Input	Input	Input	Input	Input
P4.10		LEDTS2.LINE6	LEDTS2.COL1	LEDTS1.COL1	CCU80.OUT00	CCU40.OUT2	USIC1_CH0.SELO3	CCU81.OUT32	CCU81.OUT00	BCCU0.TRAPIND	CCU40.IN2AV	CCU41.IN2BA		CCU81.IN3AB			USIC1_CH0.DX2D	USIC1_CH1.DX5A			
P4.11		LEDTS2.LINE7	LEDTS2.COL0	LEDTS1.COL0	CCU80.OUT01	CCU40.OUT3	USIC1_CH0.SELO4	CCU81.OUT33	CCU81.OUT01		CCU40.IN3AV	CCU41.IN3BA					USIC1_CH0.DX2E	USIC1_CH1.DX3A	USIC1_CH1.DX4A		

Table 10 Hardware I/O Controlled Functions

Function	Outputs	Outputs	Inputs	Inputs	Pull Control	Pull Control	Pull Control	Pull Control
	HWO0	HWO1	HWI0	HWI1	HW0_PD	HW0_PU	HW1_PD	HW1_PU
P0.0	LEDTS0. EXTENDED7		LEDTS0.TSIN7	LEDTS0.TSIN7	Reserved for LEDTS Scheme A: pull-down disabled always	Reserved for LEDTS Scheme A: pull-down enabled always	Reserved for LEDTS Scheme B: pull-up enabled and pull-down disabled, and vice versa	
P0.1	LEDTS0. EXTENDED6		LEDTS0.TSIN6	LEDTS0.TSIN6				
P0.2	LEDTS0. EXTENDED5		LEDTS0.TSIN5	LEDTS0.TSIN5				
P0.3	LEDTS0. EXTENDED4		LEDTS0.TSIN4	LEDTS0.TSIN4				
P0.4	LEDTS0. EXTENDED3		LEDTS0.TSIN3	LEDTS0.TSIN3				
P0.5	LEDTS0. EXTENDED2		LEDTS0.TSIN2	LEDTS0.TSIN2				
P0.6	LEDTS0. EXTENDED1		LEDTS0.TSIN1	LEDTS0.TSIN1				
P0.7	LEDTS0. EXTENDED0		LEDTS0.TSIN0	LEDTS0.TSIN0				
P0.8	LEDTS1. EXTENDED0		LEDTS1.TSIN0	LEDTS1.TSIN0				
P0.9	LEDTS1. EXTENDED1		LEDTS1.TSIN1	LEDTS1.TSIN1				
P0.10	LEDTS1. EXTENDED2		LEDTS1.TSIN2	LEDTS1.TSIN2				
P0.11	LEDTS1. EXTENDED3		LEDTS1.TSIN3	LEDTS1.TSIN3				
P0.12	LEDTS1. EXTENDED4		LEDTS1.TSIN4	LEDTS1.TSIN4				
P0.13	LEDTS1. EXTENDED5		LEDTS1.TSIN5	LEDTS1.TSIN5				
P0.14	LEDTS1. EXTENDED6		LEDTS1.TSIN6	LEDTS1.TSIN6				
P0.15	LEDTS1. EXTENDED7		LEDTS1.TSIN7	LEDTS1.TSIN7				
P1.0		USIC0_CH0.DOUT0		USIC0_CH0.HWIN0	$\overline{\text{BCCU0.OUT2}}$	BCCU0.OUT2		
P1.1		USIC0_CH0.DOUT1		USIC0_CH0.HWIN1	$\overline{\text{BCCU0.OUT3}}$	BCCU0.OUT3		
P1.2		USIC0_CH0.DOUT2		USIC0_CH0.HWIN2	$\overline{\text{BCCU0.OUT4}}$	BCCU0.OUT4		

3.1.3 Pin Reliability in Overload

When receiving signals from higher voltage devices, low-voltage devices experience overload currents and voltages that go beyond their own IO power supplies specification.

Table 12 defines overload conditions that will not cause any negative reliability impact if all the following conditions are met:

- full operation life-time is not exceeded
- **Operating Conditions** are met for
  - pad supply levels (V_{DDP})
  - temperature

If a pin current is outside of the **Operating Conditions** but within the overload conditions, then the parameters of this pin as stated in the Operating Conditions can no longer be guaranteed. Operation is still possible in most cases but with relaxed parameters.

Note: An overload condition on one or more pins does not require a reset.

Note: A series resistor at the pin to limit the current to the maximum permitted overload current is sufficient to handle failure situations like short to battery.

Table 12 Overload Parameters

Parameter	Symbol		Values			Unit	Note / Test Condition
			Min.	Typ.	Max.		
Input current on any port pin during overload condition	I_{OV}	SR	-5	–	5	mA	
Absolute sum of all input circuit currents during overload condition	I_{OVS}	SR	–	–	25	mA	

Figure 11 shows the path of the input currents during overload via the ESD protection structures. The diodes against V_{DDP} and ground are a simplified representation of these ESD protection structures.

3.2 DC Parameters

3.2.1 Input/Output Characteristics

Table 16 provides the characteristics of the input/output pins of the XMC1400.

Note: These parameters are not subject to production test, but verified by design and/or characterization.

Note: Unless otherwise stated, input DC and AC characteristics, including peripheral timings, assume that the input pads operate with the standard hysteresis.

Table 16 Input/Output Characteristics (Operating Conditions apply)

Parameter	Symbol		Limit Values		Unit	Test Conditions
			Min.	Max.		
Output low voltage on port pins (with standard pads)	V_{OLP}	CC	–	1.0	V	I_{OL} = 11 mA (5 V) I_{OL} = 7 mA (3.3 V)
			–	0.4	V	I_{OL} = 5 mA (5 V) I_{OL} = 3.5 mA (3.3 V)
Output low voltage on high current pads	V_{OLP1}	CC	–	1.0	V	I_{OL} = 50 mA (5 V) I_{OL} = 25 mA (3.3 V)
			–	0.32	V	I_{OL} = 10 mA (5 V)
			–	0.4	V	I_{OL} = 5 mA (3.3 V)
Output high voltage on port pins (with standard pads)	V_{OHP}	CC	V_{DDP} - 1.0	–	V	I_{OH} = -10 mA (5 V) I_{OH} = -7 mA (3.3 V)
			V_{DDP} - 0.4	–	V	I_{OH} = -4.5 mA (5 V) I_{OH} = -2.5 mA (3.3 V)
Output high voltage on high current pads	V_{OHP1}	CC	V_{DDP} - 0.32	–	V	I_{OH} = -6 mA (5 V)
			V_{DDP} - 1.0	–	V	I_{OH} = -8 mA (3.3 V)
			V_{DDP} - 0.4	–	V	I_{OH} = -4 mA (3.3 V)
Input low voltage on port pins (Standard Hysteresis)	V_{ILPS}	SR	–	0.19 × V_{DDP}	V	CMOS Mode (5 V, 3.3 V & 2.2 V)
Input high voltage on port pins (Standard Hysteresis)	V_{IHPS}	SR	0.7 × V_{DDP}	–	V	CMOS Mode (5 V, 3.3 V & 2.2 V)

Table 17 ADC Characteristics (Operating Conditions apply)[1)] (cont'd)

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Gain settings	G_{IN} CC		1		–	GNCTRxz.GAINy = 00_B (unity gain)
			3		–	GNCTRxz.GAINy = 01_B (gain g1)
			6		–	GNCTRxz.GAINy = 10_B (gain g2)
			12		–	GNCTRxz.GAINy = 11_B (gain g3)
Sample Time	t_{sample} CC	5	–	–	1 / f_{ADC}	V_{DD} = 5.0 V, f_{ADCI} = 48 MHz
		3	–	–	1 / f_{ADC}	V_{DD} = 5.0 V, f_{ADCI} = 32 MHz
		3	–	–	1 / f_{ADC}	V_{DD} = 3.3 V, f_{ADCI} = 32 MHz
		30	–	–	1 / f_{ADC}	V_{DD} = 2.0 V, f_{ADCI} = 32 MHz
Conversion time in fast compare mode	t_{CF} CC		9		1 / f_{ADC}	3)
Conversion time in 12-bit mode	t_{C12} CC		20		1 / f_{ADC}	3)
Maximum sample rate in 12-bit mode[4)]	f_{C12} CC	–	–	f_{ADC} / 42.5	–	1 sample pending
		–	–	f_{ADC} / 62.5	–	2 samples pending
Conversion time in 10-bit mode	t_{C10} CC		18		1 / f_{ADC}	3)
Maximum sample rate in 10-bit mode[4)]	f_{C10} CC	–	–	f_{ADC} / 40.5	–	1 sample pending
		–	–	f_{ADC} / 58.5	–	2 samples pending
Conversion time in 8-bit mode	t_{C8} CC		16		1 / f_{ADC}	3)

3.2.5 Temperature Sensor Characteristics

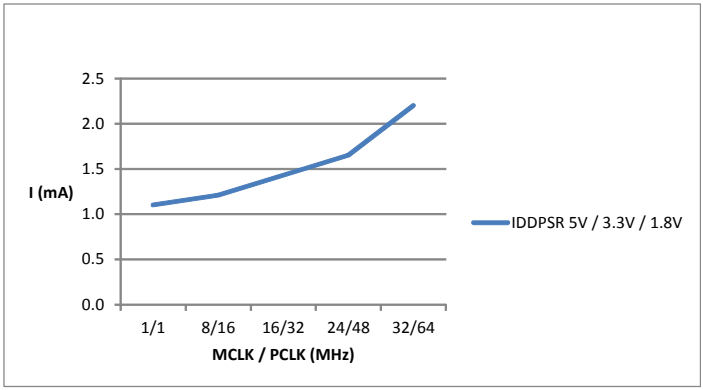
Note: These parameters are not subject to production test, but verified by design and/or characterization.

Table 20 Temperature Sensor Characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Measurement time	t_M CC	–	–	10	ms	
Temperature sensor range	T_{SR} SR	-40	–	115	°C	
Sensor Accuracy[1)]	T_{TSAL} CC	-6	–	6	°C	T_J > 20°C
		-10	–	10	°C	0°C ≤ T_J ≤ 20°C
		–	-/+8	–	°C	T_J < 0°C
Start-up time	t_{TSST} SR	–	–	15	µs	

1) The temperature sensor accuracy is independent of the supply voltage.

Figure 18 shows typical graphs for sleep mode current for V_{DDP} = 5 V, V_{DDP} = 3.3 V, V_{DDP} = 1.8 V across different clock frequencies.



Condition:
1. TA = +25° C

Figure 18 Sleep mode, peripherals clocks disabled, Flash powered down: Supply current I_{DDPSD} over supply voltage V_{DDP} for different clock frequencies

3.3 AC Parameters

3.3.1 Testing Waveforms

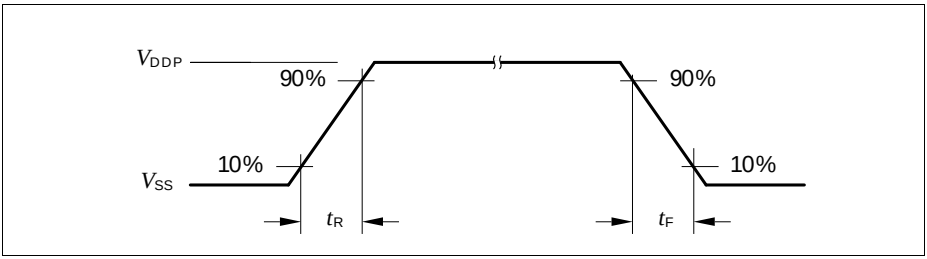


Figure 20 Rise/Fall Time Parameters

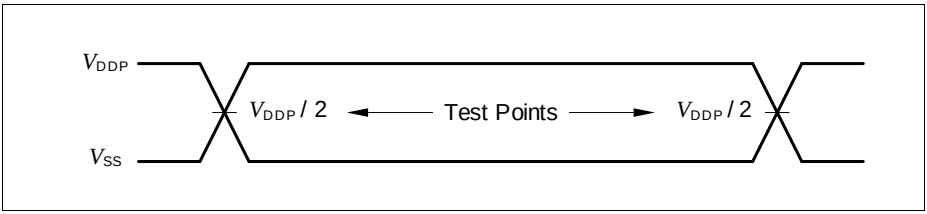


Figure 21 Testing Waveform, Output Delay

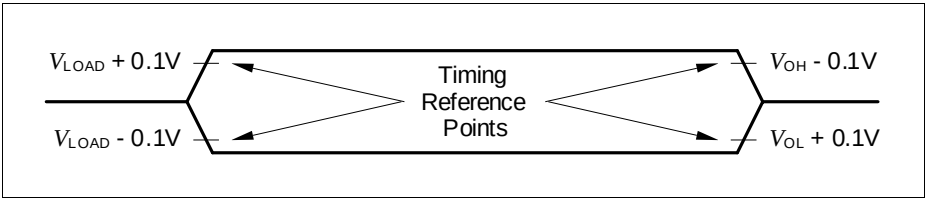


Figure 22 Testing Waveform, Output High Impedance

3.3.2 Power-Up and Supply Threshold Characteristics

Table 26 provides the characteristics of the supply threshold in XMC1400.

The guard band between the lowest valid operating voltage and the brownout reset threshold provides a margin for noise immunity and hysteresis. The electrical parameters may be violated while V_{DDP} is outside its operating range.

The brownout detection triggers a reset within the defined range. The prewarning detection can be used to trigger an early warning and issue corrective and/or fail-safe actions in case of a critical supply voltage drop.

Note: These parameters are not subject to production test, but verified by design and/or characterization.

Table 26 Power-Up and Supply Threshold Parameters (Operating Conditions apply)

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
V_{DDP} ramp-up time	t_{RAMPUP} SR	V_{DDP}/ $S_{VDDPrise}$	–	10^7	µs	
V_{DDP} slew rate	S_{VDDPOP} SR	0	–	0.1	V/µs	Slope during normal operation
	S_{VDDP10} SR	0	–	10	V/µs	Slope during fast transient within +/-10% of V_{DDP}
	$S_{VDDPrise}$ SR	0	–	10	V/µs	Slope during power-on or restart after brownout event
	$S_{VDDPfall}$[1] SR	0	–	0.25	V/µs	Slope during supply falling out of the +/-10% limits[2]
V_{DDP} prewarning voltage	V_{DDPPW} CC	2.1	2.25	2.4	V	ANAVDEL.VDEL_SELECT = 00_B
		2.85	3	3.15	V	ANAVDEL.VDEL_SELECT = 01_B
		4.2	4.4	4.6	V	ANAVDEL.VDEL_SELECT = 10_B

3.3.4 Serial Wire Debug Port (SW-DP) Timing

The following parameters are applicable for communication through the SW-DP interface.

Note: These parameters are not subject to production test, but verified by design and/or characterization.

Table 29 SWD Interface Timing Parameters(Operating Conditions apply)

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
SWDCLK high time	t_1 SR	50	–	500000	ns	–
SWDCLK low time	t_2 SR	50	–	500000	ns	–
SWDIO input setup to SWDCLK rising edge	t_3 SR	10	–	–	ns	–
SWDIO input hold after SWDCLK rising edge	t_4 SR	10	–	–	ns	–
SWDIO output valid time after SWDCLK rising edge	t_5 CC	–	–	68	ns	C_L = 50 pF
		–	–	62	ns	C_L = 30 pF
SWDIO output hold time from SWDCLK rising edge	t_6 CC	4	–	–	ns	

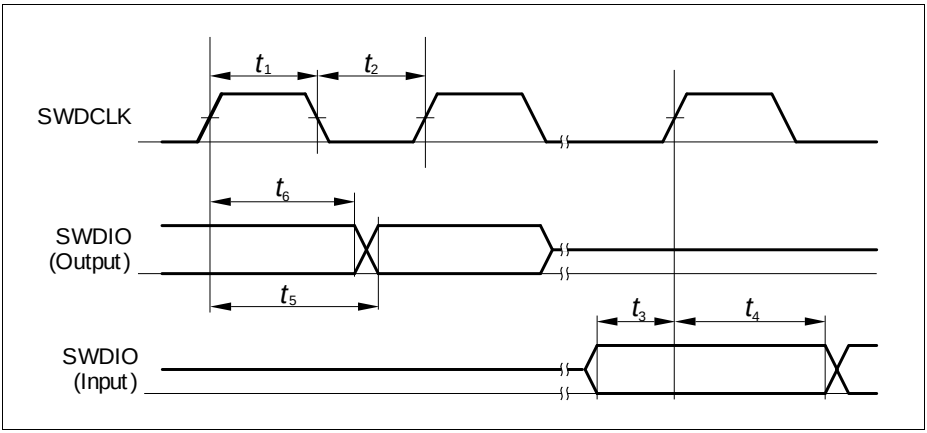


Figure 24 SWD Timing

Table 34 USIC IIC Fast Mode Timing[1)]

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Fall time of both SDA and SCL	t_1 CC/SR	20 + 0.1*C_b [2)]	-	300	ns	
Rise time of both SDA and SCL	t_2 CC/SR	20 + 0.1*C_b	-	300	ns	
Data hold time	t_3 CC/SR	0	-	-	µs	
Data set-up time	t_4 CC/SR	100	-	-	ns	
LOW period of SCL clock	t_5 CC/SR	1.3	-	-	µs	
HIGH period of SCL clock	t_6 CC/SR	0.6	-	-	µs	
Hold time for (repeated) START condition	t_7 CC/SR	0.6	-	-	µs	
Set-up time for repeated START condition	t_8 CC/SR	0.6	-	-	µs	
Set-up time for STOP condition	t_9 CC/SR	0.6	-	-	µs	
Bus free time between a STOP and START condition	t_{10} CC/SR	1.3	-	-	µs	
Capacitive load for each bus line	C_b SR	-	-	400	pF	

1) Due to the wired-AND configuration of an IIC bus system, the port drivers of the SCL and SDA signal lines need to operate in open-drain mode. The high level on these lines must be held by an external pull-up device, approximalely 10 kOhm for operation at 100 kbit/s, approximately 2 kOhm for operation at 400 kbit/s.

2) C_b refers to the total capacitance of one bus line in pF.

w w w . i n f i n e o n . c o m

Published by Infineon Technologies AG