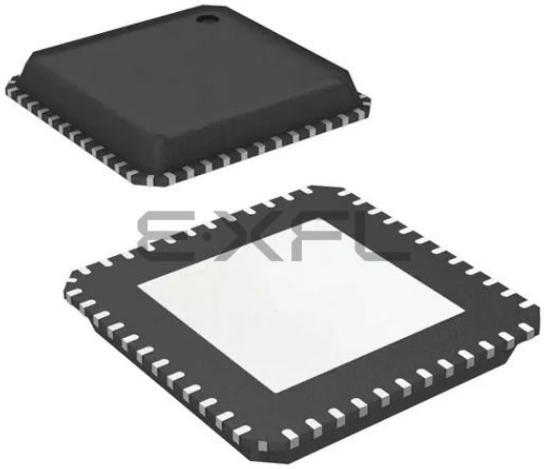
Infineon Technologies - XMC1404Q048X0064AAXUMA1 Datasheet



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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, LED, POR, PWM, WDT
Number of I/O	34
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	48-VFQFN Exposed Pad
Supplier Device Package	PG-VQFN-48-73
Purchase URL	https://www.e-xfl.com/product-detail/infineon-technologies/xmc1404q048x0064aaxuma1

XMC1400 AA-Step

Microcontroller Series
for Industrial Applications

XMC1000 Family

ARM® Cortex®-M0
32-bit processor core

Data Sheet

V1.3 2016-10

Microcontrollers

XMC1400 Data Sheet

Revision History: V1.3 2016-10

Previous Versions:
V1.2 2016-08
V1.1 2016-06
V1.0 2016-02
V0.3 2015-10

Page	Subjects
42, **43**	In Absolute Maximum Ratings renamed parameter V_{CM} to V_{INP2}, as the limitation is related to most P2 pins, also if no ACMP is available. Clarified limit to pins P2.[1,2,6:9,11] in Overload specification.
13	Corrected XMC1402-T038X0200 and XMC1402-Q048X0200 marking variants in **Table 2**
V1.2 2016-08	
many	Added XMC™ trademark
11, **13**, **15**	Added XMC1402-T038X0200, XMC1402-Q040X0200 and XMC1402-Q048X0200 marking variants
V1.1 2016-06	
many	Added TSSOP-38-9 package
11, **13**, **15**	Added XMC1402-T038 marking variants in TSSOP-38
11, **13**, **15**	Added XMC1403-Q040 marking variants
V1.0 2016-02	
10	The device provides four USIC channels.
11	XMC1401 devices available for max. ambient temperature of 85°C.
33	Reformatted pinout table.
58	Updated footnote to the definition of the start-up times of OSC_XTAL and RTC_XTAL oscillators.
73	Added Δf_{LT} parameter to on-chip oscillators DCO1 and DCO2.
85	Updated package outline drawings.

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1 Summary of Features

The XMC1400 devices are members of the XMC1000 Family of microcontrollers based on the ARM Cortex-M0 processor core. The XMC1400 series addresses the real-time control needs of motor control and digital power conversion. It also features peripherals for LED Lighting applications and Human-Machine Interface (HMI).

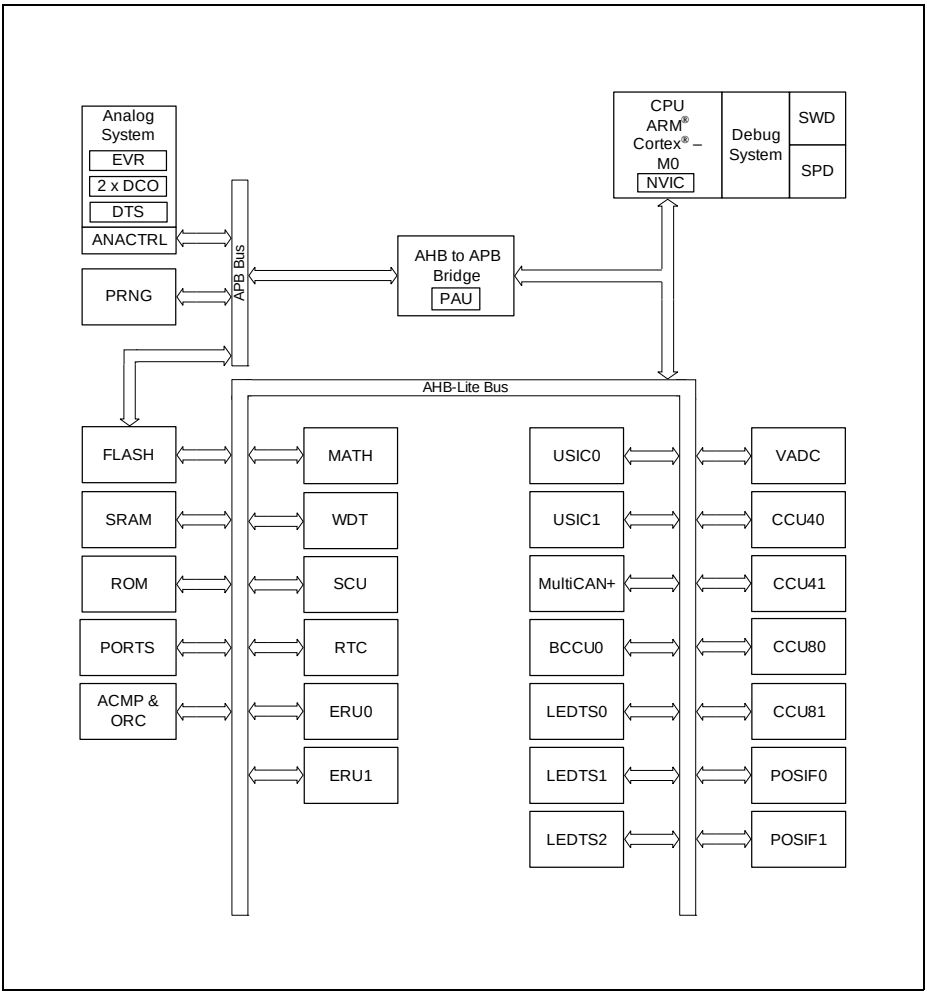

Figure 1 Block Diagram

1.4 Chip Identification Number

The Chip Identification Number allows software to identify the marking. It is an 8 words value with the most significant 7 words stored in Flash configuration sector 0 (CS0) at address location : 1000 $0F00_H$ (MSB) - 1000 $0F1B_H$ (LSB). The least significant word and most significant word of the Chip Identification Number are the value of registers DBGROMID and IDCHIP, respectively.

Table 3 XMC1400 Chip Identification Number

Derivative	Value	Marking
XMC1401-Q048F0064	00014082 07CF00FF 1E071FF7 20006000 00000D00 00001000 00011000 10204083_H	AA
XMC1401-Q048F0128	00014082 07CF00FF 1E071FF7 20006000 00000D00 00001000 00021000 10204083_H	AA
XMC1401-F064F0064	000140A2 07CF00FF 1E071FF7 20006000 00000D00 00001000 00011000 10204083_H	AA
XMC1401-F064F0128	000140A2 07CF00FF 1E071FF7 20006000 00000D00 00001000 00021000 10204083_H	AA
XMC1402-T038X0032	00014013 07FF00FF 1E071FF7 000F900F 00000D00 00001000 00009000 10204083_H	AA
XMC1402-T038X0064	00014013 07FF00FF 1E071FF7 000F900F 00000D00 00001000 00011000 10204083_H	AA
XMC1402-T038X0128	00014013 07FF00FF 1E071FF7 000F900F 00000D00 00001000 00021000 10204083_H	AA
XMC1402-T038X0200	00014013 07FF00FF 1E071FF7 000F900F 00000D00 00001000 00033000 10204083_H	AA
XMC1402-Q040X0032	00014043 07FF00FF 1E071FF7 000F900F 00000D00 00001000 00009000 10204083_H	AA
XMC1402-Q040X0064	00014043 07FF00FF 1E071FF7 000F900F 00000D00 00001000 00011000 10204083_H	AA
XMC1402-Q040X0128	00014043 07FF00FF 1E071FF7 000F900F 00000D00 00001000 00021000 10204083_H	AA
XMC1402-Q040X0200	00014043 07FF00FF 1E071FF7 000F900F 00000D00 00001000 00033000 10204083_H	AA
XMC1402-Q048X0032	00014083 07FF00FF 1E071FF7 100F900F 00000D00 00001000 00009000 10204083_H	AA

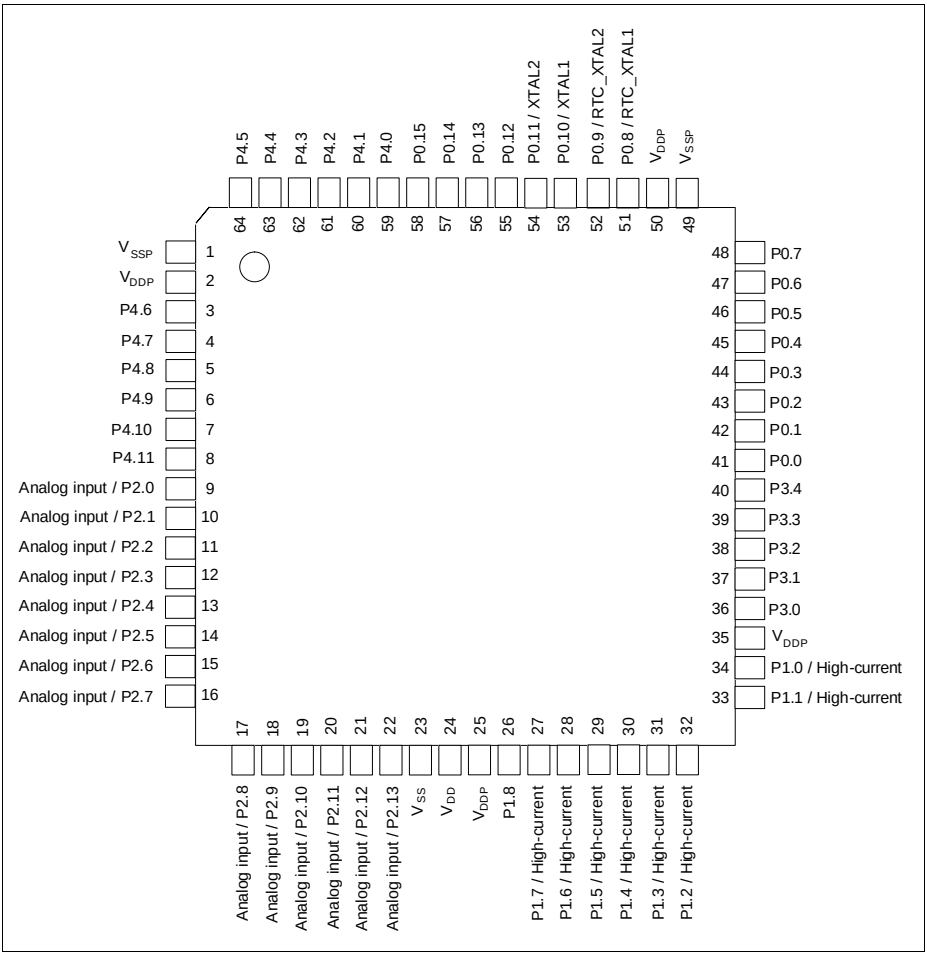

Figure 9 XMC1400 PG-LQFP-64-26 / PG-VQFN-64-6 Pin Configuration (top view)

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 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
P4.4	LEDTS2. EXTENDED0		LEDTS2.TSIN0	LEDTS2.TSIN0	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	
P4.5	LEDTS2. EXTENDED1		LEDTS2.TSIN1	LEDTS2.TSIN1				
P4.6	LEDTS2. EXTENDED2		LEDTS2.TSIN2	LEDTS2.TSIN2				
P4.7	LEDTS2. EXTENDED3		LEDTS2.TSIN3	LEDTS2.TSIN3				
P4.8	LEDTS2. EXTENDED4		LEDTS2.TSIN4	LEDTS2.TSIN4				
P4.9	LEDTS2. EXTENDED5		LEDTS2.TSIN5	LEDTS2.TSIN5				
P4.10	LEDTS2. EXTENDED6		LEDTS2.TSIN6	LEDTS2.TSIN6				
P4.11	LEDTS2. EXTENDED7		LEDTS2.TSIN7	LEDTS2.TSIN7				

3.1.2 Absolute Maximum Ratings

Stresses above the values listed under “Absolute Maximum Ratings” may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions may affect device reliability.

Table 11 Absolute Maximum Rating Parameters

Parameter	Symbol		Values			Unit	Note / Test Condition
			Min.	Typ.	Max.		
Junction temperature	T_J	SR	-40	–	115	°C	–
Storage temperature	T_{ST}	SR	-40	–	125	°C	–
Voltage on power supply pin with respect to V_{SSP}	V_{DDP}	SR	-0.3	–	6	V	–
Voltage on digital pins with respect to V_{SSP} [1]	V_{IN}	SR	-0.5	–	V_{DDP} + 0.5 or max. 6	V	whichever is lower
Voltage on P2 pins with respect to V_{SSP} [2]	V_{INP2}	SR	-0.3	–	V_{DDP} + 0.3	V	–
Voltage on analog input pins with respect to V_{SSP}	V_{AIN} V_{AREF}	SR	-0.5	–	V_{DDP} + 0.5 or max. 6	V	whichever is lower
Input current on any pin during overload condition	I_{IN}	SR	-10	–	10	mA	–
Absolute maximum sum of all input currents during overload condition	ΣI_{IN}	SR	-50	–	+50	mA	–

1) Excluding port pins P2.[1,2,6,7,8,9,11].

2) Applicable to port pins P2.[1,2,6,7,8,9,11].

Table 16 Input/Output Characteristics (Operating Conditions apply) (cont'd)

Parameter	Symbol		Limit Values		Unit	Test Conditions
			Min.	Max.		
Input low voltage on port pins (Large Hysteresis)	V_{ILPL}	SR	–	0.08 × V_{DDP}	V	CMOS Mode (5 V, 3.3 V & 2.2 V)
Input high voltage on port pins (Large Hysteresis)	V_{IHPL}	SR	0.85 × V_{DDP}	–	V	CMOS Mode (5 V, 3.3 V & 2.2 V)
Rise/fall time on High Current Pad[1)]	t_{HCPR}, t_{HCPF}	CC	–	9	ns	50 pF @ 5 V[2)]
			–	12	ns	50 pF @ 3.3 V[3)]
			–	25	ns	50 pF @ 1.8 V[4)]
Rise/fall time on Standard Pad[1)]	t_R, t_F	CC	–	12	ns	50 pF @ 5 V[5)]
			–	15	ns	50 pF @ 3.3 V[6)].
			–	31	ns	50 pF @ 1.8 V[7)].
Input Hysteresis on port pin except P2.3 - P2.9[8)]	HYS	CC	0.08 × V_{DDP}	–	V	CMOS Mode (5 V), Standard Hysteresis
			0.03 × V_{DDP}	–	V	CMOS Mode (3.3 V), Standard Hysteresis
			0.02 × V_{DDP}	–	V	CMOS Mode (2.2 V), Standard Hysteresis
			0.5 × V_{DDP}	0.75 × V_{DDP}	V	CMOS Mode(5 V), Large Hysteresis
			0.4 × V_{DDP}	0.75 × V_{DDP}	V	CMOS Mode(3.3 V), Large Hysteresis
			0.2 × V_{DDP}	0.65 × V_{DDP}	V	CMOS Mode(2.2 V), Large Hysteresis

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

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Maximum sample rate in 8-bit mode[4)]	f_{C8} CC	–	–	f_{ADC} / 38.5	–	1 sample pending
		–	–	f_{ADC} / 54.5	–	2 samples pending
RMS noise[5)]	EN_{RMS} CC	–	1.5	–	LSB 12	DC input, SHSCFG.AREF = 00_B, GNCTRxz.GAINy = 00_B (unity gain), V_{DD} = 5.0 V, V_{AIN} = 2.5 V, 25°C
DNL error	EA_{DNL} CC	–	±2.0	–	LSB 12	
INL error	EA_{INL} CC	–	±4.0	–	LSB 12	
Gain error with external reference	EA_{GAIN} CC	–	±0.5	–	%	SHSCFG.AREF = 00_B (calibrated)
Gain error with internal reference[6)]	EA_{GAIN} CC	–	±3.6	–	%	SHSCFG.AREF = $1X_B$ (calibrated), -40°C - 110°C
		–	±2.0	–	%	SHSCFG.AREF = $1X_B$ (calibrated), 0°C - 85°C
Offset error	EA_{OFF} CC	–	±8.0	–	mV	Calibrated, V_{DD} = 5.0 V

1) The parameters are defined for ADC clock frequencies f_{SH} = 32 MHz for the full supply range, and f_{SH} = 48 MHz at V_{DD_int}, V_{DD_ext} = 5 V. Usage of any other frequencies may affect the ADC performance.

2) The alternate reference ground connection is separate for each converter. This mode, therefore, provides the lowest noise impact.

3) No pending samples assumed, excluding sampling time and calibration.

4) Includes synchronization and calibration (average of gain and offset calibration).

5) This parameter can also be defined as an SNR value: SNR[dB] = 20 × log(A_{MAXeff} / N_{RMS}).
With A_{MAXeff} = 2^N / 2, SNR[dB] = 20 × log (2048 / N_{RMS}) [N = 12].
N_{RMS} = 1.5 LSB12, therefore, equals SNR = 20 × log (2048 / 1.5) = 62.7 dB.

6) Includes error from the reference voltage.

3.2.3 Out of Range Comparator (ORC) Characteristics

The Out-of-Range Comparator (ORC) triggers on analog input voltages (V_{AIN}) above V_{DDP} on selected input pins (ORCx.AIN) and generates a service request trigger (ORCx.OUT).

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

Table 18 Out of Range Comparator (ORC) Characteristics (Operating Conditions apply; V_{DDP} = 3.0 V - 5.5 V; C_L = 0.25pF)

Parameter	Symbol		Values			Unit	Note / Test Condition
			Min.	Typ.	Max.		
DC Switching Level	V_{ODC}	CC	–	–	180	mV	$V_{AIN} \geq V_{DDP} + V_{ODC}$
Hysteresis	V_{OHYS}	CC	15	–	54	mV	
Always detected Overvoltage Pulse	t_{OPDD}	CC	103	–	–	ns	$V_{AIN} \geq V_{DDP}$ + 150 mV
			88	–	–	ns	$V_{AIN} \geq V_{DDP}$ + 350 mV
Never detected Overvoltage Pulse	t_{OPDN}	CC	–	–	21	ns	$V_{AIN} \geq V_{DDP}$ + 150 mV
			–	–	11	ns	$V_{AIN} \geq V_{DDP}$ + 350 mV
Detection Delay	t_{ODD}	CC	39	–	132	ns	$V_{AIN} \geq V_{DDP}$ + 150 mV
			31	–	121	ns	$V_{AIN} \geq V_{DDP}$ + 350 mV
Release Delay	t_{ORD}	CC	44	–	240	ns	$V_{AIN} \leq V_{DDP}$; V_{DDP} = 5 V
			57	–	340	ns	$V_{AIN} \leq V_{DDP}$; V_{DDP} = 3.3 V
Enable Delay	t_{OED}	CC	–	–	300	ns	ORCCTRL.ENORCx = 1

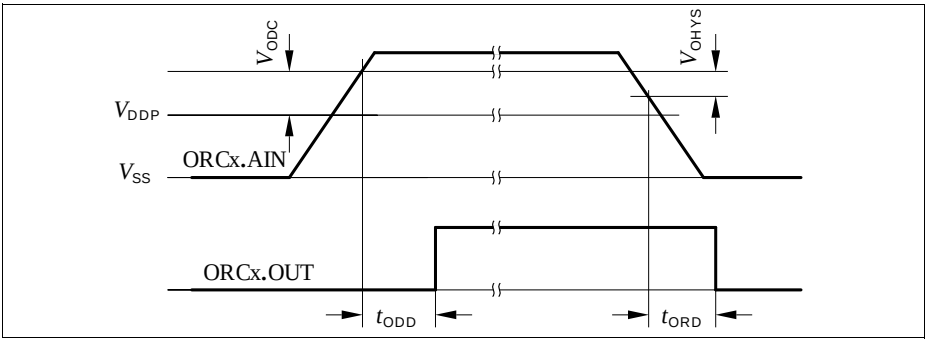

Figure 13 ORCx.OUT Trigger Generation

Table 22 RTC_XTAL Parameters

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Input frequency	f_{OSC} SR	–	32.768	–	kHz	
Oscillator start-up time[1)2)]	t_{OSCS} CC	–	–	5	s	
Input voltage at RTC_XTAL1	V_{IX} SR	-0.3	–	1.5	V	
Input amplitude (peak-to-peak) at RTC_XTAL1[2)3)]	V_{PPX} SR	0.2	–	1.2	V	

1) t_{OSCS} is defined from the moment the oscillator is enabled by the user with SCU_ANAOSCLPCTRL.MODE until the oscillations reach an amplitude at RTC_XTAL1 of 0.9 * V_{PPX}.

2) The external oscillator circuitry must be optimized by the customer and checked for negative resistance and amplitude as recommended and specified by crystal suppliers.

3) If the shaper unit is enabled and not bypassed.

10) Active current is measured with: module enabled, MCLK=48 MHz, time-out mode; WLB = 0, WUB = 0x00008000; WDT serviced every 1 s

11) Active current is measured with: module enabled, MCLK=48 MHz, Periodic interrupt enabled

12) Active current is measured with: module enabled, MCLK=48 MHz, running at 20 MHz baudrate generator, 1 node activated, 1 transmit and 1 receive object active.

3.2.8 Flash Memory Parameters

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

Table 25 Flash Memory Parameters

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Erase time per page / sector	t_{ERASE} CC	6.8	7.1	7.6	ms	
Program time per block	t_{PSER} CC	102	152	204	µs	
Wake-Up time	t_{WU} CC	–	32.2	–	µs	
Read time per word	t_a CC	–	50	–	ns	
Data Retention Time	t_{RET} CC	10	–	–	years	Max. 100 erase / program cycles
Flash Wait States [1]	$N_{WSFLASH}$ CC	0	0	0		f_{MCLK} = 8 MHz
		0	1	1		f_{MCLK} = 16 MHz
		1	2	2		f_{MCLK} = 32 MHz
		2	2	3		f_{MCLK} = 48 MHz
Erase Cycles	N_{ECYC} CC	–	–	$5*10^4$	cycles	Sum of page and sector erase cycles
Total Erase Cycles	N_{TECYC} CC	–	–	$2*10^6$	cycles	

1) Flash wait states are automatically inserted by the Flash module during memory read when needed. Typical values are calculated from the execution of the Dhrystone benchmark program.

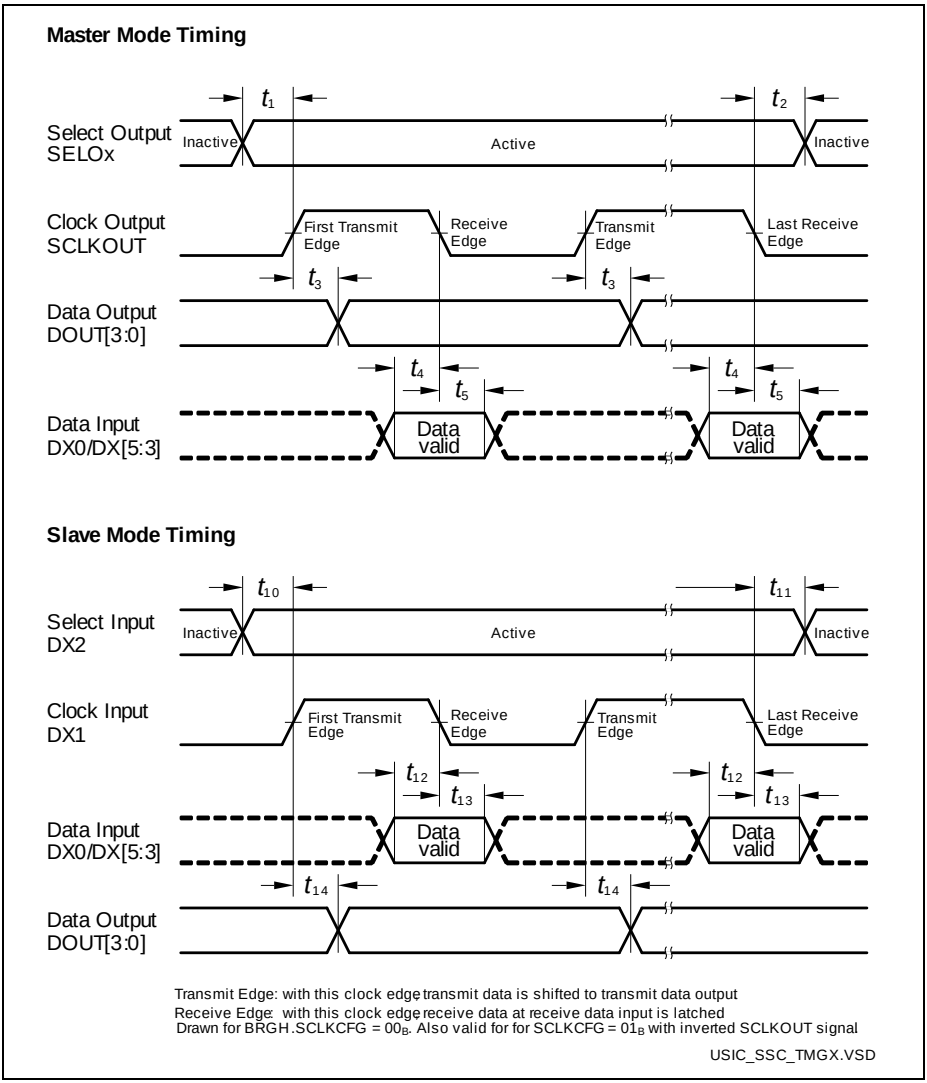

Figure 25 USIC - SSC Master/Slave Mode Timing

Note: This timing diagram shows a standard configuration, for which the slave select signal is low-active, and the serial clock signal is not shifted and not inverted.

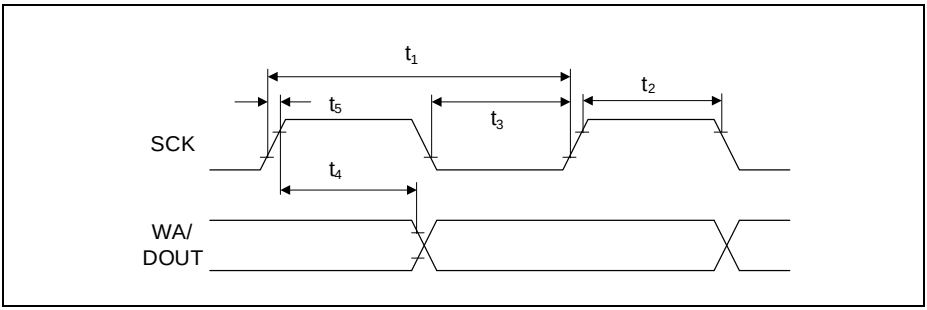

Figure 27 USIC IIS Master Transmitter Timing

Table 36 USIC IIS Slave Receiver Timing

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Clock period	t_6 SR	$4/f_{MCLK}$	-	-	ns	
Clock HIGH	t_7 SR	0.35 x t_{6min}	-	-	ns	
Clock Low	t_8 SR	0.35 x t_{6min}	-	-	ns	
Set-up time	t_9 SR	0.3 x t_{6min}	-	-	ns	
Hold time	t_{10} SR	15	-	-	ns	

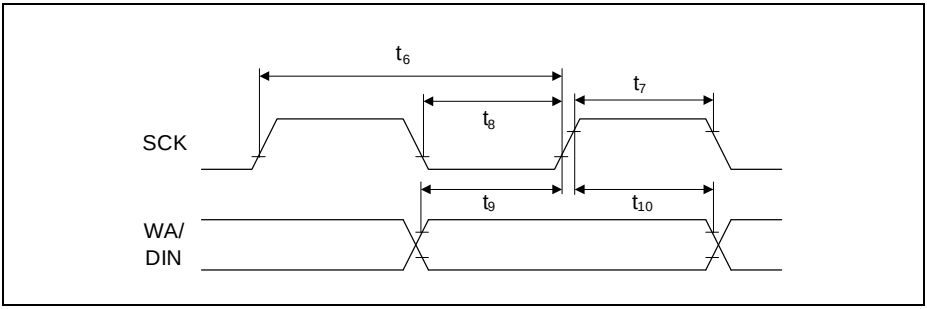

Figure 28 USIC IIS Slave Receiver Timing

4 Package and Reliability

The XMC1400 is a member of the XMC1000 Family of microcontrollers. It is also compatible to a certain extent with members of similar families or subfamilies.

Each package is optimized for the device it houses. Therefore, there may be slight differences between packages of the same pin-count but for different device types. In particular, the size of the exposed die pad may vary.

If different device types are considered or planned for an application, it must be ensured that the board layout fits all packages under consideration.

4.1 Package Parameters

Table 37 provides the thermal characteristics of the packages used in XMC1400.

Table 37 Thermal Characteristics of the Packages

Parameter	Symbol	Limit Values		Unit	Package Types
		Min.	Max.		
Exposed Die Pad Dimensions	Ex × Ey CC	-	3.7 × 3.7	mm	PG-VQFN-40-17
		-	4.2 × 4.2	mm	PG-VQFN-48-73
		-	4.6 × 4.6	mm	PG-VQFN-64-6
Thermal resistance Junction-Ambient	$R_{\Theta JA}$ CC	-	86.0	K/W	PG-TSSOP-38-9[1)]
		-	45.3	K/W	PG-VQFN-40-17[1)]
		-	44.9	K/W	PG-VQFN-48-73[1)]
		-	66.7	K/W	PG-LQFP-64-26[1)]
		-	44.7	K/W	PG-VQFN-64-6[1)]

1) Device mounted on a 4-layer JEDEC board (JESD 51-5); exposed pad soldered.

Note: For electrical reasons, it is required to connect the exposed pad to the board ground V_{SSP}, independent of EMC and thermal requirements.

4.1.1 Thermal Considerations

When operating the XMC1400 in a system, the total heat generated in the chip must be dissipated to the ambient environment to prevent overheating and the resulting thermal damage.

The maximum heat that can be dissipated depends on the package and its integration into the target board. The “Thermal resistance $R_{\Theta JA}$” quantifies these parameters. The power dissipation must be limited so that the average junction temperature does not exceed 115 °C.

4.2 Package Outlines

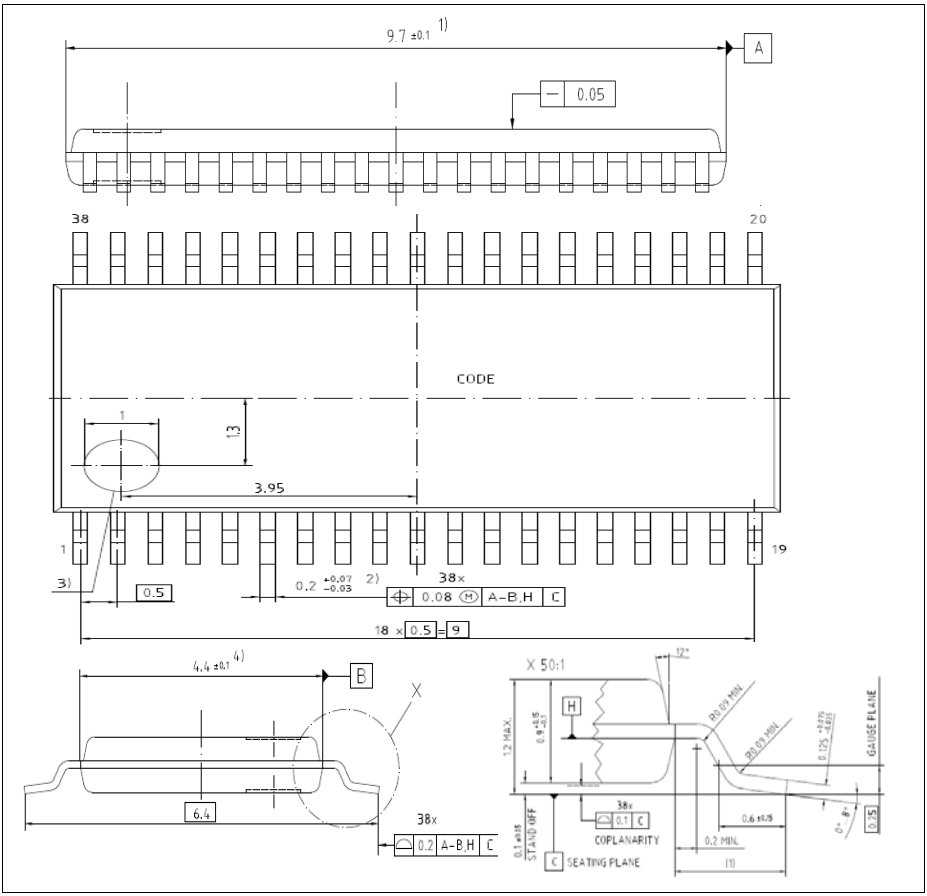

Figure 29 PG-TSSOP-38-9

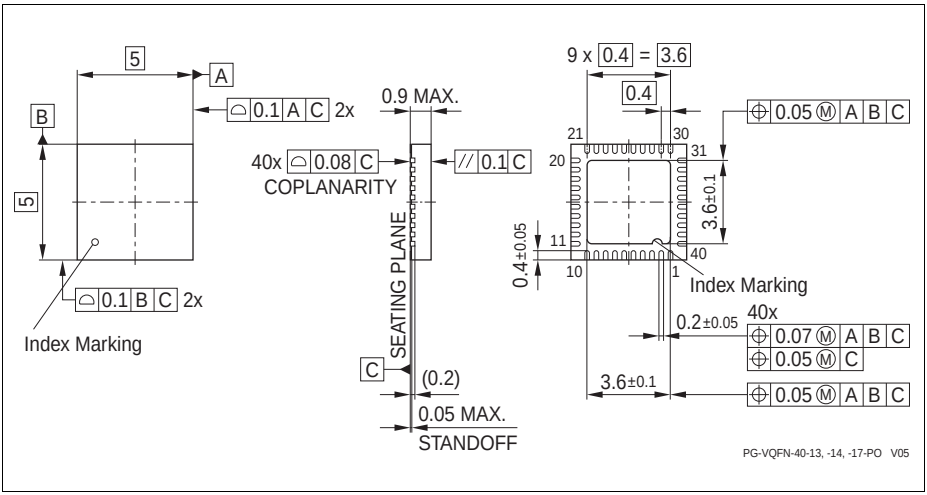

Figure 30 PG-VQFN-40-17

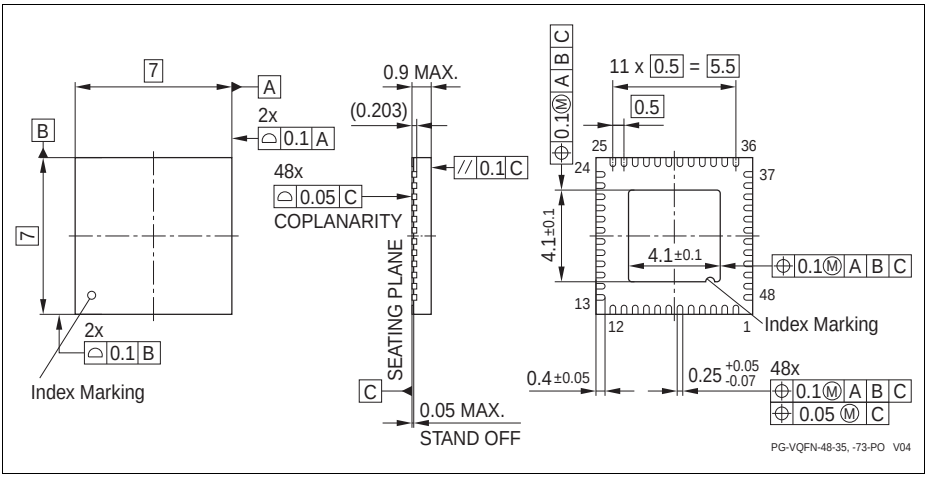

Figure 31 PG-VQFN-48-73