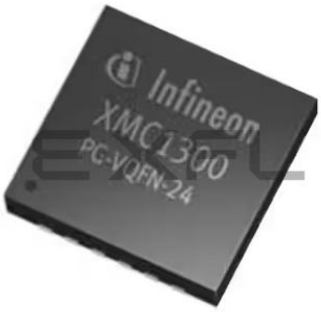

What is "Embedded - Microcontrollers"?

"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	32MHz
Connectivity	I²C, LINbus, SPI, UART/USART
Peripherals	Brown-out Detect/Reset, I²S, POR, PWM, WDT
Number of I/O	18
Program Memory Size	8KB (8K 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 13x12b
Oscillator Type	Internal
Operating Temperature	-40°C ~ 85°C (TA)
Mounting Type	Surface Mount
Package / Case	24-VFQFN Exposed Pad
Supplier Device Package	PG-VQFN-24-19
Purchase URL	https://www.e-xfl.com/product-detail/infineon-technologies/xmc1301q024f0008abxuma1

About this Document

This Data Sheet is addressed to embedded hardware and software developers. It provides the reader with detailed descriptions about the ordering designations, available features, electrical and physical characteristics of the XMC1300 series devices.

The document describes the characteristics of a superset of the XMC1300 series devices. For simplicity, the various device types are referred to by the collective term XMC1300 throughout this document.

XMC1000 Family User Documentation

The set of user documentation includes:

- **Reference Manual**
  - decribes the functionality of the superset of devices.
- **Data Sheets**
  - list the complete ordering designations, available features and electrical characteristics of derivative devices.
- **Errata Sheets**
  - list deviations from the specifications given in the related Reference Manual or Data Sheets. Errata Sheets are provided for the superset of devices.

Attention: Please consult all parts of the documentation set to attain consolidated knowledge about your device.

Application related guidance is provided by **Users Guides** and **Application Notes**.

Please refer to **http://www.infineon.com/xmc1000** to get access to the latest versions of those documents.

  - Ultra low power consumption
- Nested Vectored Interrupt Controller (NVIC)
- Event Request Unit (ERU) for processing of external and internal service requests
- MATH Co-processor (MATH)
  - CORDIC unit for trigonometric calculation
  - division unit

On-Chip Memories

- 8 kbytes on-chip ROM
- 16 kbytes on-chip high-speed SRAM
- up to 200 kbytes on-chip Flash program and data memory

Communication Peripherals

- Two Universal Serial Interface Channels (USIC), usable as UART, double-SPI, quad-SPI, IIC, IIS and LIN interfaces

Analog Frontend Peripherals

- A/D Converters
  - up to 12 analog input pins
  - 2 sample and hold stages with 8 analog input channels each
  - fast 12-bit analog to digital converter with adjustable gain
- Up to 8 channels of out of range comparators (ORC)
- Up to 3 fast analog comparators (ACMP)
- Temperature Sensor (TSE)

Industrial Control Peripherals

- Capture/Compare Units 4 (CCU4) as general purpose timers
- Capture/Compare Units 8 (CCU8) for motor control and power conversion
- Position Interfaces (POSIF) for hall and quadrature encoders and motor positioning
- Brightness and Colour Control Unit (BCCU), for LED color and dimming application

System Control

- Window Watchdog Timer (WDT) for safety sensitive applications
- Real Time Clock module with alarm support (RTC)
- System Control Unit (SCU) for system configuration and control
- Pseudo random number generator (PRNG) for fast random data generation

Input/Output Lines

- Tri-stated in input mode
- Push/pull or open drain output mode

- Configurable pad hysteresis

On-Chip Debug Support

- Support for debug features: 4 breakpoints, 2 watchpoints
- Various interfaces: ARM serial wire debug (SWD), single pin debug (SPD)

1.1 Ordering Information

The ordering code for an Infineon microcontroller provides an exact reference to a specific product. The code “XMC1<DDD>-<Z><PPP><T><FFFF>” identifies:

- <DDD> the derivatives function set
- <Z> the package variant
  - T: TSSOP
  - Q: VQFN
- <PPP> package pin count
- <T> the temperature range:
  - F: -40°C to 85°C
  - X: -40°C to 105°C
- <FFFF> the Flash memory size.

For ordering codes for the XMC1300 please contact your sales representative or local distributor.

This document describes several derivatives of the XMC1300 series, some descriptions may not apply to a specific product. Please see **Table 1**.

For simplicity the term **XMC1300** is used for all derivatives throughout this document.

1.2 Device Types

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

Table 1 Synopsis of XMC1300 Device Types

Derivative	Package	Flash Kbytes	SRAM Kbytes
XMC1301-T016F0008	PG-TSSOP-16-8	8	16
XMC1301-T016F0016	PG-TSSOP-16-8	16	16
XMC1301-T016F0032	PG-TSSOP-16-8	32	16
XMC1301-T016X0008	PG-TSSOP-16-8	8	16
XMC1301-T016X0016	PG-TSSOP-16-8	16	16
XMC1302-T016X0008	PG-TSSOP-16-8	8	16

Table 1 Synopsis of XMC1300 Device Types (cont'd)

Derivative	Package	Flash Kbytes	SRAM Kbytes
XMC1302-T016X0016	PG-TSSOP-16-8	16	16
XMC1302-T016X0032	PG-TSSOP-16-8	32	16
XMC1302-T028X0016	PG-TSSOP-28-8	16	16
XMC1301-T038F0008	PG-TSSOP-38-9	8	16
XMC1301-T038F0016	PG-TSSOP-38-9	16	16
XMC1301-T038F0032	PG-TSSOP-38-9	32	16
XMC1301-T038X0032	PG-TSSOP-38-9	32	16
XMC1301-T038F0064	PG-TSSOP-38-9	64	16
XMC1302-T038X0016	PG-TSSOP-38-9	16	16
XMC1302-T038X0032	PG-TSSOP-38-9	32	16
XMC1302-T038X0064	PG-TSSOP-38-9	64	16
XMC1302-T038X0128	PG-TSSOP-38-9	128	16
XMC1302-T038X0200	PG-TSSOP-38-9	200	16
XMC1301-Q024F0008	PG-VQFN-24-19	8	16
XMC1301-Q024F0016	PG-VQFN-24-19	16	16
XMC1302-Q024F0016	PG-VQFN-24-19	16	16
XMC1302-Q024F0032	PG-VQFN-24-19	32	16
XMC1302-Q024F0064	PG-VQFN-24-19	64	16
XMC1302-Q024X0016	PG-VQFN-24-19	16	16
XMC1302-Q024X0032	PG-VQFN-24-19	32	16
XMC1302-Q024X0064	PG-VQFN-24-19	64	16
XMC1301-Q040F0008	PG-VQFN-40-13	8	16
XMC1301-Q040F0016	PG-VQFN-40-13	16	16
XMC1301-Q040F0032	PG-VQFN-40-13	32	16
XMC1302-Q040X0016	PG-VQFN-40-13	16	16
XMC1302-Q040X0032	PG-VQFN-40-13	32	16
XMC1302-Q040X0064	PG-VQFN-40-13	64	16
XMC1302-Q040X0128	PG-VQFN-40-13	128	16
XMC1302-Q040X0200	PG-VQFN-40-13	200	16

Table 4 XMC1300 Chip Identification Number

Derivative	Value	Marking
XMC1301-T016F0008	00013032 01CF00FF 00001FF7 0000100F 00000C00 00001000 00003000 $201ED083_H$	AB
XMC1301-T016F0016	00013032 01CF00FF 00001FF7 0000100F 00000C00 00001000 00005000 $201ED083_H$	AB
XMC1301-T016F0032	00013032 01CF00FF 00001FF7 0000100F 00000C00 00001000 00009000 $201ED083_H$	AB
XMC1301-T016X0008	00013033 01CF00FF 00001FF7 0000100F 00000C00 00001000 00003000 $201ED083_H$	AB
XMC1301-T016X0016	00013033 01CF00FF 00001FF7 0000100F 00000C00 00001000 00005000 $201ED083_H$	AB
XMC1302-T016X0008	00013033 01FF00FF 00001FF7 0000900F 00000C00 00001000 00003000 $201ED083_H$	AB
XMC1302-T016X0016	00013033 01FF00FF 00001FF7 0000900F 00000C00 00001000 00005000 $201ED083_H$	AB
XMC1302-T016X0032	00013033 01FF00FF 00001FF7 0000900F 00000C00 00001000 00009000 $201ED083_H$	AB
XMC1302-T028X0016	00013023 01FF00FF 00001FF7 0000900F 00000C00 00001000 00005000 $201ED083_H$	AB
XMC1301-T038F0008	00013012 01CF00FF 00001FF7 0000100F 00000C00 00001000 00003000 $201ED083_H$	AB
XMC1301-T038F0016	00013012 01CF00FF 00001FF7 0000100F 00000C00 00001000 00005000 $201ED083_H$	AB
XMC1301-T038F0032	00013012 01CF00FF 00001FF7 0000100F 00000C00 00001000 00009000 $201ED083_H$	AB
XMC1301-T038X0032	00013013 01CF00FF 00001FF7 0000100F 00000C00 00001000 00009000 $201ED083_H$	AB
XMC1301-T038F0064	00013012 01CF00FF 00001FF7 0000100F 00000C00 00001000 00011000 $201ED083_H$	AB
XMC1302-T038X0016	00013013 01FF00FF 00001FF7 0000900F 00000C00 00001000 00005000 $201ED083_H$	AB
XMC1302-T038X0032	00013013 01FF00FF 00001FF7 0000900F 00000C00 00001000 00009000 $201ED083_H$	AB
XMC1302-T038X0064	00013013 01FF00FF 00001FF7 0000900F 00000C00 00001000 00011000 $201ED083_H$	AB

Table 6 Package Pin Mapping (cont'd)

Function	VQFN 40	TSSOP 38	TSSOP 28	VQFN 24	TSSOP 16	Pad Type	Notes
P0.7	30	24	17	18	10	STD_IN OUT	
P0.8	33	27	18	19	11	STD_IN OUT	
P0.9	34	28	19	20	12	STD_IN OUT	
P0.10	35	29	20	-	-	STD_IN OUT	
P0.11	36	30	-	-	-	STD_IN OUT	
P0.12	37	31	21	21	-	STD_IN OUT	
P0.13	38	32	22	22	-	STD_IN OUT	
P0.14	39	33	23	23	13	STD_IN OUT	
P0.15	40	34	24	24	14	STD_IN OUT	
P1.0	22	16	12	14	-	High Current	
P1.1	21	15	11	13	-	High Current	
P1.2	20	14	10	12	-	High Current	
P1.3	19	13	9	11	-	High Current	
P1.4	18	12	-	-	-	High Current	
P1.5	17	11	-	-	-	High Current	
P1.6	16	-	-	-	-	STD_IN OUT	
P2.0	1	35	25	1	15	STD_IN OUT/AN	

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 10 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.

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

Parameter	Symbol		Limit Values		Unit	Test Conditions
			Min.	Max.		
Input Hysteresis[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
Pin capacitance (digital inputs/outputs)	C_{IO}	CC	–	10	pF	
Pull-up resistor on port pins	R_{PUP}	CC	20	50	kohm	$V_{IN} = V_{SSP}$
Pull-down resistor on port pins	R_{PDP}	CC	20	50	kohm	$V_{IN} = V_{DDP}$
Input leakage current[9)]	I_{OZP}	CC	-1	1	µA	$0 < V_{IN} < V_{DDP}$, $T_A \leq 105$ °C
Voltage on any pin during V_{DDP} power off	V_{PO}	SR	–	0.3	V	[10)]
Maximum current per pin (excluding P1, V_{DDP} and V_{SS})	I_{MP}	SR	-10	11	mA	–
Maximum current per high currrent pins	I_{MP1A}	SR	-10	50	mA	–
Maximum current into V_{DDP} (TSSOP16, VQFN24)	I_{MVDD1}	SR	–	130	mA	[18)]
Maximum current into V_{DDP} (TSSOP38, VQFN40)	I_{MVDD2}	SR	–	260	mA	[18)]

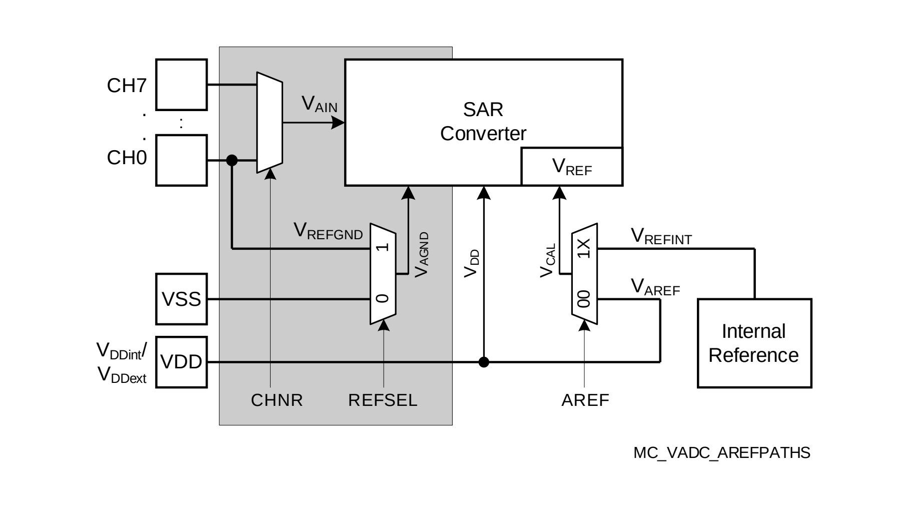

Figure 11 ADC Voltage Supply

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	$0°C \leq T_J \leq 20°C$
		–	-/+8	–	°C	$T_J < 0°C$
Start-up time after enabling	t_{TSSTE} SR	–	–	15	µs	

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

3.2.6 Power Supply Current

The total power supply current defined below consists of a leakage and a switching component.

Application relevant values are typically lower than those given in the following tables, and depend on the customer's system operating conditions (e.g. thermal connection or used application configurations).

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

Table 21 Power Supply Parameters; V_{DDP} = 5V

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.[1]	Max.		
Active mode current Peripherals enabled f_{MCLK} / f_{PCLK} in MHz[2]	I_{DDPAE} CC	–	9.2	12	mA	32 / 64
		–	8.1	-	mA	24 / 48
		–	6.6	-	mA	16 / 32
		–	5.5	-	mA	8 / 16
		–	4	-	mA	1 / 1
Active mode current Peripherals disabled f_{MCLK} / f_{PCLK} in MHz[3]	I_{DDPAD} CC	–	4.8	-	mA	32 / 64
		–	4.1	-	mA	24 / 48
		–	3.3	-	mA	16 / 32
		–	2.7	-	mA	8 / 16
		–	1.5	-	mA	1 / 1
Active mode current Code execution from RAM Flash is powered down f_{MCLK} / f_{PCLK} in MHz	I_{DDPAR} CC	–	7.3	-	mA	32 / 64
		–	6.3	-	mA	24 / 48
		–	5.2	-	mA	16 / 32
		–	4.2	-	mA	8 / 16
		–	3.3	-	mA	1 / 1
Sleep mode current Peripherals clock enabled f_{MCLK} / f_{PCLK} in MHz[4]	I_{DDPSE} CC	–	6.6	-	mA	32 / 64
			5.8	-	mA	24 / 48
			5.1	-	mA	16 / 32
			4.4	-	mA	8 / 16
			3.7	-	mA	1 / 1

Table 22 provides the active current consumption of some modules operating at 5 V power supply at 25° C. The typical values shown are used as a reference guide on the current consumption when these modules are enabled.

Table 22 Typical Active Current Consumption

Active Current Consumption	Symbol	Limit Values	Unit	Test Condition
		Typ.		
Baseload current	I_{CPUDDC}	5.04	mA	Modules including Core, SCU, PORT, memories, ANATOP[1)]
VADC and SHS	I_{ADCDDC}	3.4	mA	Set CGATCLR0.VADC to 1[2)]
USIC0	$I_{USIC0DDC}$	0.87	mA	Set CGATCLR0.USIC0 to 1[3)]
CCU40	$I_{CCU40DDC}$	0.94	mA	Set CGATCLR0.CCU40 to 1[4)]
CCU80	$I_{CCU80DDC}$	0.42	mA	Set CGATCLR0.CCU80 to 1[5)]
POSIF0	$I_{PIF0DDC}$	0.26	mA	Set CGATCLR0.POSIF0 to 1[6)]
BCCU0	$I_{BCCU0DDC}$	0.24	mA	Set CGATCLR0.BCCU0 to 1[7)]
MATH	$I_{MATHDDC}$	0.35	mA	Set CGATCLR0.MATH to 1[8)]
WDT	I_{WDTDDC}	0.03	mA	Set CGATCLR0.WDT to 1[9)]
RTC	I_{RTCDDC}	0.01	mA	Set CGATCLR0.RTC to 1[10)]

1) Baseload current is measured with device running in user mode, MCLK=PCLK=32 MHz, with an endless loop in the flash memory. The clock to the modules stated in CGATSTAT0 are gated.
2) Active current is measured with: module enabled, MCLK=32 MHz, running in auto-scan conversion mode
3) Active current is measured with: module enabled, alternating messages sent to PC at 57.6kbaud every 200ms
4) Active current is measured with: module enabled, MCLK=PCLK=32 MHz, 1 CCU4 slice for PWM switching from 1500Hz and 1000Hz at regular intervals, 1 CCU4 slice in capture mode for reading period and duty cycle
5) Active current is measured with: module enabled, MCLK=PCLK=32 MHz, 1 CCU8 slice with PWM frequency at 1500Hz and a period match interrupt used to toggle duty cycle between 10% and 90%
6) Active current is measured with: module enabled, MCLK=32 MHz, PCLK=64MHz, hall sensor mode
7) Active current is measured with: module enabled, MCLK=32 MHz, PCLK=64MHz, FCLK=0.8MHz, Normal mode (BCCU Clk = FCLK/4), 3 BCCU Channels and 1 Dimming Engine, change color or dim every 1s
8) Active current is measured with: module enabled, MCLK=32 MHz, PCLK=64MHz, tangent calculation in while loop; CORDIC circular rotation, no keep, autostart; 32-by-32 bit signed DIV, autostart, DVS right shift by 11
9) Active current is measured with: module enabled, MCLK=32 MHz, time-out mode; WLB = 0, WUB = 0x00008000; WDT serviced every 1s
10) Active current is measured with: module enabled, MCLK=32 MHz, Periodic interrupt enabled

3.3 AC Parameters

3.3.1 Testing Waveforms

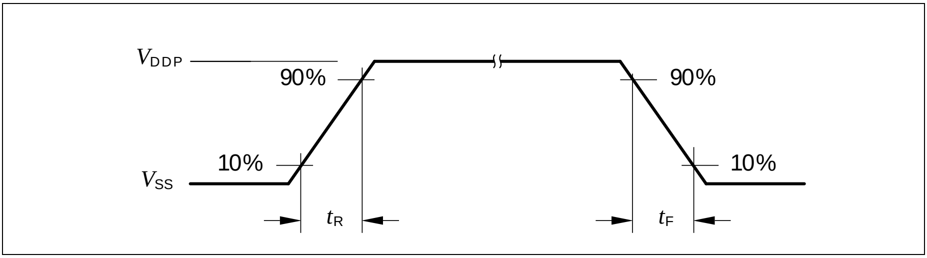

Figure 16 Rise/Fall Time Parameters

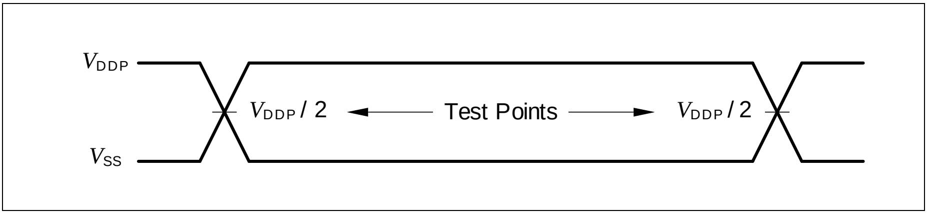

Figure 17 Testing Waveform, Output Delay

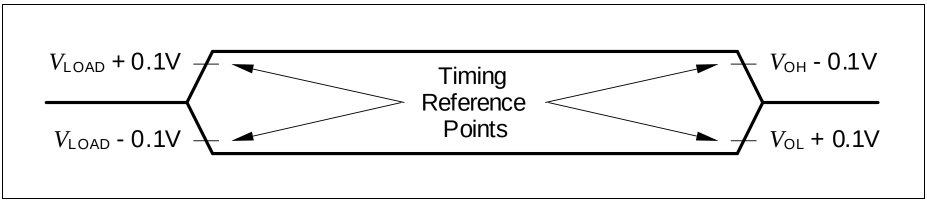

Figure 18 Testing Waveform, Output High Impedance

Table 24 Power-Up and Supply Monitoring Parameters (Operating Conditions apply) (cont'd)

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
V_{DDP} brownout reset voltage	V_{DDPBO} CC	1.55	1.62	1.75	V	calibrated, before user code starts running
V_{DDP} voltage to ensure defined pad states	V_{DDPPA} CC	–	1.0	–	V	
Start-up time from power-on reset	t_{SSW} SR	–	320	–	μs	Time to the first user code instruction[3)]
BMI program time	t_{BMI} SR	–	8.25	–	ms	Time taken from a user-triggered system reset after BMI installation is is requested

1) A capacitor of at least 100 nF has to be added between VDDP and VSSP to fulfill the requirement as stated for this parameter.

2) Valid for a 100 nF buffer capacitor connected to supply pin where current from capacitor is forwarded only to the chip. A larger capacitor value has to be chosen if the power source sink a current.

3) This values does not include the ramp-up time. During startup firmware execution, MCLK is running at 32 MHz and the clocks to peripheral as specified in register CGATSTAT0 are gated.

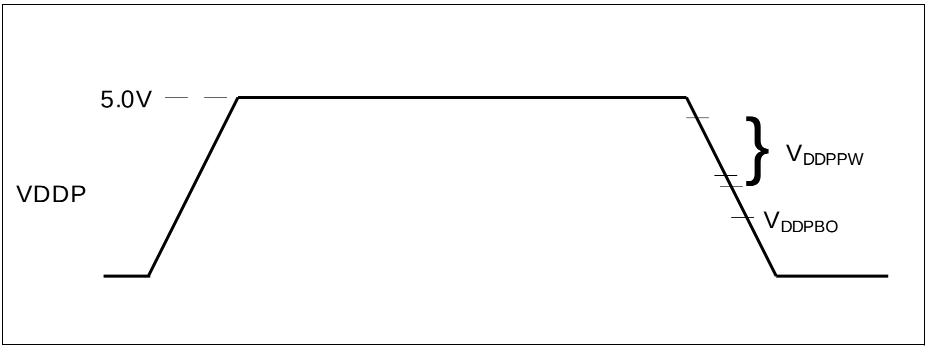

Figure 19 Supply Threshold Parameters

3.3.3 On-Chip Oscillator Characteristics

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

Table 25 provides the characteristics of the 64 MHz clock output from the digital controlled oscillator, DCO1 in XMC1300.

Table 25 64 MHz DCO1 Characteristics (Operating Conditions apply)

Parameter	Symbol		Limit Values			Unit	Test Conditions
			Min.	Typ.	Max.		
Nominal frequency	f_{NOM}	CC	–	64	–	MHz	under nominal conditions[1] after trimming
Accuracy[2]	Δf_{LT}	CC	-1.7	–	3.4	%	with respect to f_{NOM}(typ), over temperature (T_A = 0 °C to 85 °C)
			-3.9	–	4.0	%	with respect to f_{NOM}(typ), over temperature (T_A = -40 °C to 105 °C)

1) The deviation is relative to the factory trimmed frequency at nominal V_{DDC} and T_A = + 25 °C.

2) The accuracy can be further improved through alternative methods, refer to XMC1000 Oscillator Handling Application Note.

Figure 20 shows the typical curves for the accuracy of DCO1, with and without calibration based on temperature sensor, respectively.

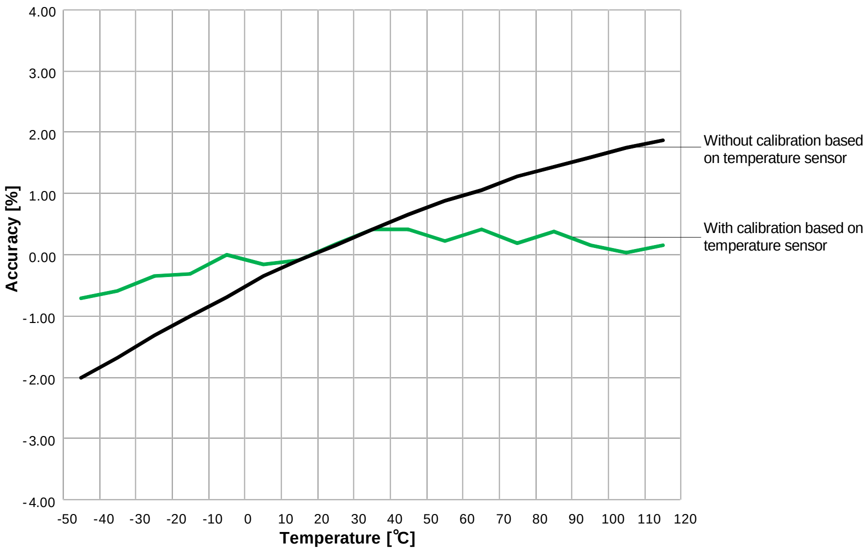

Figure 20 Typical DCO1 accuracy over temperature

Table 26 provides the characteristics of the 32 kHz clock output from digital controlled oscillators, DCO2 in XMC1300.

Table 26 32 kHz DCO2 Characteristics (Operating Conditions apply)

Parameter	Symbol		Limit Values			Unit	Test Conditions
			Min.	Typ.	Max.		
Nominal frequency	f_{NOM}	CC	–	32.75	–	kHz	under nominal conditions[1] after trimming
Accuracy	Δf_{LT}	CC	-1.7	–	3.4	%	with respect to f_{NOM}(typ), over temperature (0 °C to 85 °C)
			-3.9	–	4.0	%	with respect to f_{NOM}(typ), over temperature (-40 °C to 105 °C)

1) The deviation is relative to the factory trimmed frequency at nominal V_{DDC} and T_A = + 25 °C.

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 27 SWD Interface Timing Parameters(Operating Conditions apply)

Parameter	Symbol		Values			Unit	Note / Test Condition
			Min.	Typ.	Max.		
SWDCLK high time	$t1$	SR	50	–	500000	ns	–
SWDCLK low time	t_2	SR	50	–	500000	ns	–
SWDIO input setup to SWDCLK rising edge	$t3$	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	

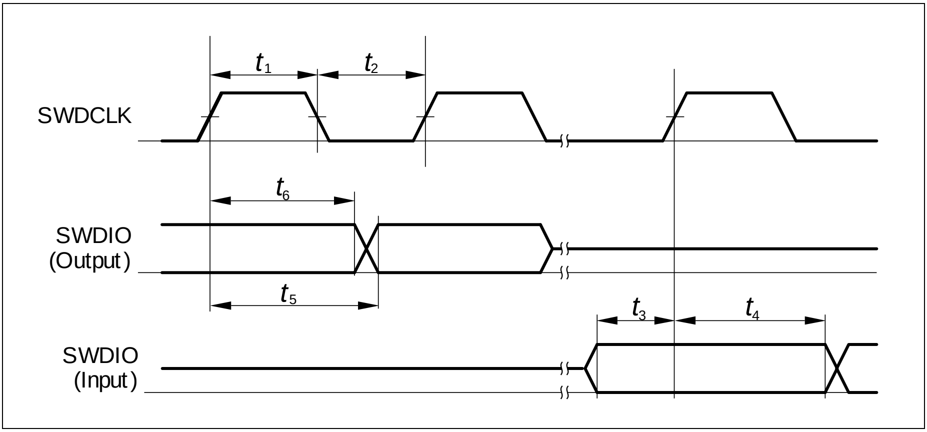

Figure 21 SWD Timing

The difference between junction temperature and ambient temperature is determined by
$\Delta T = (P_{INT} + P_{IOSTAT} + P_{IODYN}) \times R_{\Theta JA}$

The internal power consumption is defined as
$P_{INT} = V_{DDP} \times I_{DDP}$ (switching current and leakage current).

The static external power consumption caused by the output drivers is defined as
$P_{IOSTAT} = \Sigma((V_{DDP}-V_{OH}) \times I_{OH}) + \Sigma(V_{OL} \times I_{OL})$

The dynamic external power consumption caused by the output drivers (P_{IODYN}) depends on the capacitive load connected to the respective pins and their switching frequencies.

If the total power dissipation for a given system configuration exceeds the defined limit, countermeasures must be taken to ensure proper system operation:

- Reduce V_{DDP}, if possible in the system
- Reduce the system frequency
- Reduce the number of output pins
- Reduce the load on active output drivers

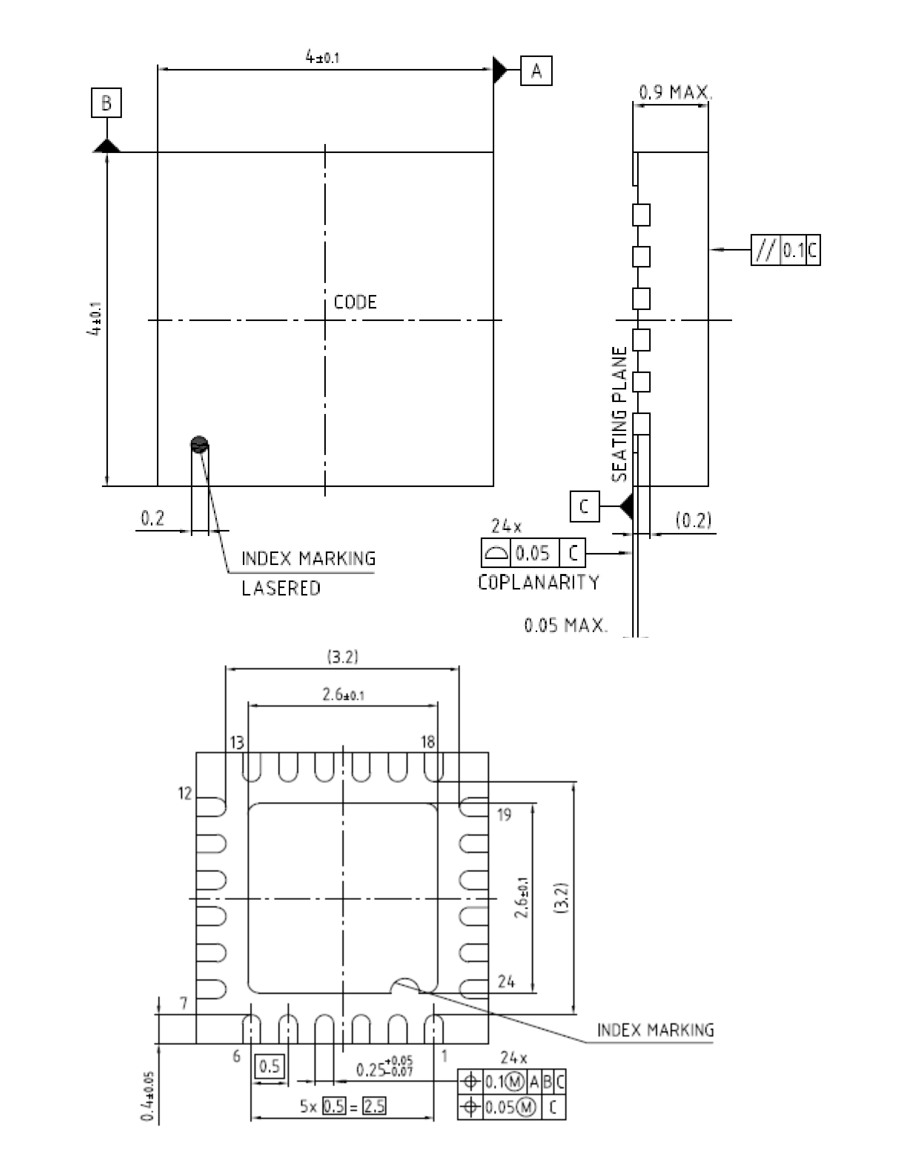

Figure 29 PG-VQFN-24-19

5 Quality Declaration

Table 36 shows the characteristics of the quality parameters in the XMC1300.

Table 36 Quality Parameters

Parameter	Symbol	Limit Values		Unit	Notes
		Min.	Max.		
ESD susceptibility according to Human Body Model (HBM)	V_{HBM} SR	-	2000	V	Conforming to EIA/JESD22-A114-B
ESD susceptibility according to Charged Device Model (CDM) pins	V_{CDM} SR	-	500	V	Conforming to JESD22-C101-C
Moisture sensitivity level	MSL CC	-	3	-	JEDEC J-STD-020D
Soldering temperature	T_{SDR} SR	-	260	°C	Profile according to JEDEC J-STD-020D