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XMC1400 AA-Step

Microcontroller Series
for Industrial Applications

XMC1000 Family

ARM[®] Cortex[®]-M0
32-bit processor core

Data Sheet

V1.3 2016-10

Edition 2016-10

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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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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 XMC1400 series devices.

The document describes the characteristics of a superset of the XMC1400 series devices. For simplicity, the various device types are referred to by the collective term XMC1400 throughout this document.

XMC1000 Family User Documentation

The set of user documentation includes:

- **Reference Manual**
 - describes 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.

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).

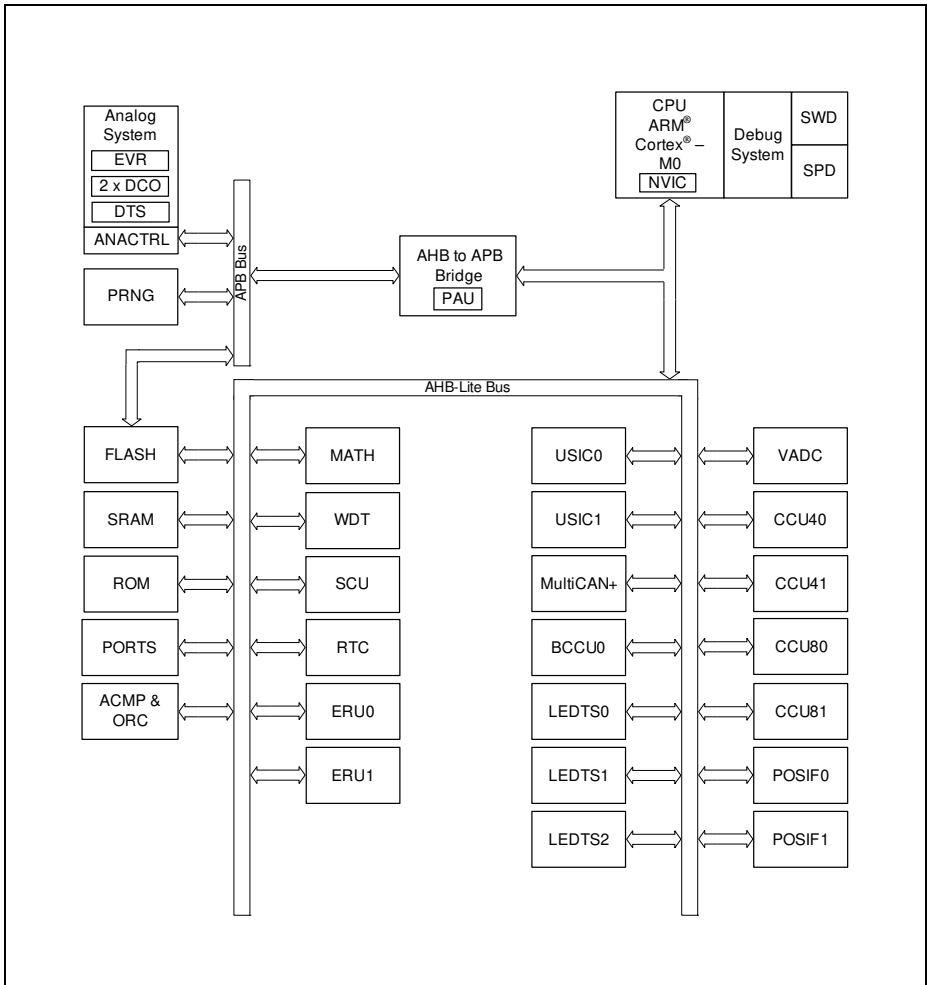


Figure 1 Block Diagram

Features

CPU subsystem

- 32-bit ARM Cortex-M0 CPU Core
 - 0.84 DMIPS/MHz (Dhrystone 2.1) at 48 MHz
- Nested Vectored Interrupt Controller
- 64 interrupt nodes
- MATH coprocessor
 - 24-bit trigonometric calculation (CORDIC)
 - 32-bit divide operation
- 2x4 channels ERU for event interconnections

On-Chip Memories

- 8 Kbyte ROM
- 16 Kbyte SRAM (with parity)
- up to 200 Kbyte Flash (with ECC)

Supply, Reset and Clock

- 1.8 V to 5.5 V supply with power on reset and brownout detector
- On-chip clock monitor
- External crystal oscillator support (32 kHz and 4 to 20 MHz)
- Internal slow and fast oscillators without the need of PLL

System Control

- Window watchdog
- Real time clock module
- Pseudo random number generator

Communication Peripherals

- Four USIC channels, usable as
 - UART (up to 12 Mb/s)
 - single-SPI (up to 12 Mb/s)
 - double-SPI (up to 2 × 12 Mb/s)
 - quad-SPI (up to 4 × 12 Mb/s)
 - IIC (up to 400 kb/s)
 - IIS (up to 12 Mb/s)
 - LIN interfaces (20kb/s)
- LEDTS in Human-Machine interface
 - up to 24 touch pads
 - drive up to 144 LEDs
- MultiCAN+, Full-CAN/Basic-CAN with 2 nodes, 32 message objects (up to 1 MBaud)

Analog Frontend Peripherals

- A/D Converters (up to 12 analog inputs)
 - 2 sample and hold stages
 - fast 12-bit ADC (up to 1.1 MS/s), adjustable gain
 - 0 V to 5.5 V input range
- Up to 8 channels out of range comparators
- Up to 4 fast analog comparators
- Temperature Sensor

Industrial Control Peripherals

- 2x4 16-bit 96 MHz CCU4 timers for signal monitoring and PWM
- 2x4 16-bit 96 MHz CCU8 timers for complex PWM, complementary high/low side switches and multi phase control
- 2x POSIF for hall and quadrature encoders, motor positioning
- 9 channel BCCU (brightness and color control) for LED lighting applications

Up to 56 Input/Output Ports

- 1.8 V to 5.5 V capable
- up to 8 high current pads (50 mA sink)

On-Chip Debug Support

- 4 breakpoints, 2 watchpoints
- ARM serial wire debug, single-pin debug interfaces

Programming Support

- Single-pin bootloader
- Secure bootstrap loader SBSL (optional)

Packages

- TSSOP-38 (9.7 × 6.4 mm²)
- VQFN-40/48/64 (5×5/7×7/8×8 mm²)
- LQFP-64 (12 × 12 mm²)

Tools

- Free DAVE™ toolchain with low level drivers and apps

1.1 Device Overview

The following table lists the available features per device type for the XMC1400 series.

Table 1 Features of XMC1400 Device Types¹⁾

Features	XMC1401-Q048	XMC1401-F064	XMC1402-T038	XMC1402-Q040	XMC1402-Q048	XMC1402-Q064	XMC1402-F064	XMC1403-Q040	XMC1403-Q048	XMC1403-Q064	XMC1404-Q048	XMC1404-Q064	XMC1404-F064
CPU frequency	48 MHz												
Operating temperature (ambient)	-40 to 85 °C		-40 to 105 °C										
Operating voltage	1.8 V to 5.5 V												
Flash options (Kbytes)	64, 128	64, 128	32, 64, 128, 200	32, 64, 128, 200	32, 64, 128, 200	64, 128, 200	64, 128, 200	64, 128, 200	64, 128, 200	64, 128, 200	64, 128, 200	64, 128, 200	64, 128, 200
SRAM (Kbytes)	16	16	16	16	16	16	16	16	16	16	16	16	16
MATH	-	-	1	1	1	1	1	-	-	-	1	1	1
Industrial Control	CCU4	2	2	2	2	2	2	2	2	2	2	2	2
	CCU8	-	-	2	2	2	2	2	-	-	-	2	2
	POSIF	-	-	1	1	2	2	2	-	-	-	2	2
	BCCU	-	-	1	1	1	1	1	-	-	-	1	1
Communication	USIC (modules / channels)	2 / 2	2 / 2	2 / 2	2 / 2	2 / 2	2 / 2	2 / 2	2 / 2	2 / 2	2 / 2	2 / 2	2 / 2
	LEDTS	3	3	-	-	-	-	-	-	-	-	3	3
	MultiCAN+ (nodes / MOs)	-	-	-	-	-	-	-	2 / 32	2 / 32	2 / 32	2 / 32	2 / 32

Table 1 Features of XMC1400 Device Types¹⁾ (cont'd)

Features		XMC1401-Q048	XMC1401-F064	XMC1402-T038	XMC1402-Q040	XMC1402-Q048	XMC1402-Q064	XMC1402-F064	XMC1403-Q040	XMC1403-Q048	XMC1403-Q064	XMC1404-Q048	XMC1404-Q064	XMC1404-F064
Analog	ADC (kernels / analog inputs)	2 / 12	2 / 12	2 / 12	2 / 12	2 / 12	2 / 12	2 / 12	2 / 12	2 / 12	2 / 12	2 / 12	2 / 12	2 / 12
	ACMP	-	-	3	3	4	4	4	-	-	-	4	4	4
GPIOs		34	48	26	27	34	48	48	27	34	48	34	48	48
GPIs		8	8	8	8	8	8	8	8	8	8	8	8	8
Packages		VQFN-48	LQFP-64	TSSOP-38	VQFN-40	VQFN-48	VQFN-64	LQFP-64	VQFN-40	VQFN-48	VQFN-64	VQFN-48	VQFN-64	LQFP-64

1) Features that are not included in this table are available in all the derivatives

1.2 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
 - F: LQFP
- <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 in Kbytes.

For ordering codes for the XMC1400 please contact your sales representative or local distributor.

This document describes several derivatives of the XMC1400 series, some descriptions may not apply to a specific product. Please see [Table 2](#).

For simplicity the term **XMC1400** is used for all derivatives throughout this document.

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 2 Synopsis of XMC1400 Device Types (cont'd)

Derivative	Package	Flash Kbytes
XMC1403-Q048X0200	PG-VQFN-48	200
XMC1403-Q064X0064	PG-VQFN-64	64
XMC1403-Q064X0128	PG-VQFN-64	128
XMC1403-Q064X0200	PG-VQFN-64	200
XMC1404-Q048X0064	PG-VQFN-48	64
XMC1404-Q048X0128	PG-VQFN-48	128
XMC1404-Q048X0200	PG-VQFN-48	200
XMC1404-Q064X0064	PG-VQFN-64	64
XMC1404-Q064X0128	PG-VQFN-64	128
XMC1404-Q064X0200	PG-VQFN-64	200
XMC1404-F064X0064	PG-LQFP-64	64
XMC1404-F064X0128	PG-LQFP-64	128
XMC1404-F064X0200	PG-LQFP-64	200

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

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

Table 3 XMC1400 Chip Identification Number (cont'd)

Derivative	Value	Marking
XMC1403-Q064X0200	00014093 07CF00FF 1E071FF7 00B00000 00000D00 00001000 00033000 10204083 _H	AA
XMC1404-Q048X0064	00014083 07FF00FF 1E071FF7 30BFF00F 00000D00 00001000 00011000 10204083 _H	AA
XMC1404-Q048X0128	00014083 07FF00FF 1E071FF7 30BFF00F 00000D00 00001000 00021000 10204083 _H	AA
XMC1404-Q048X0200	00014083 07FF00FF 1E071FF7 30BFF00F 00000D00 00001000 00033000 10204083 _H	AA
XMC1404-Q064X0064	00014093 07FF00FF 1E071FF7 30BFF00F 00000D00 00001000 00011000 10204083 _H	AA
XMC1404-Q064X0128	00014093 07FF00FF 1E071FF7 30BFF00F 00000D00 00001000 00021000 10204083 _H	AA
XMC1404-Q064X0200	00014093 07FF00FF 1E071FF7 30BFF00F 00000D00 00001000 00033000 10204083 _H	AA
XMC1404-F064X0064	000140A3 07FF00FF 1E071FF7 30BFF00F 00000D00 00001000 00011000 10204083 _H	AA
XMC1404-F064X0128	000140A3 07FF00FF 1E071FF7 30BFF00F 00000D00 00001000 00021000 10204083 _H	AA
XMC1404-F064X0200	000140A3 07FF00FF 1E071FF7 30BFF00F 00000D00 00001000 00033000 10204083 _H	AA

2 General Device Information

This section summarizes the logic symbols and package pin configurations with a detailed list of the functional I/O mapping.

2.1 Logic Symbols

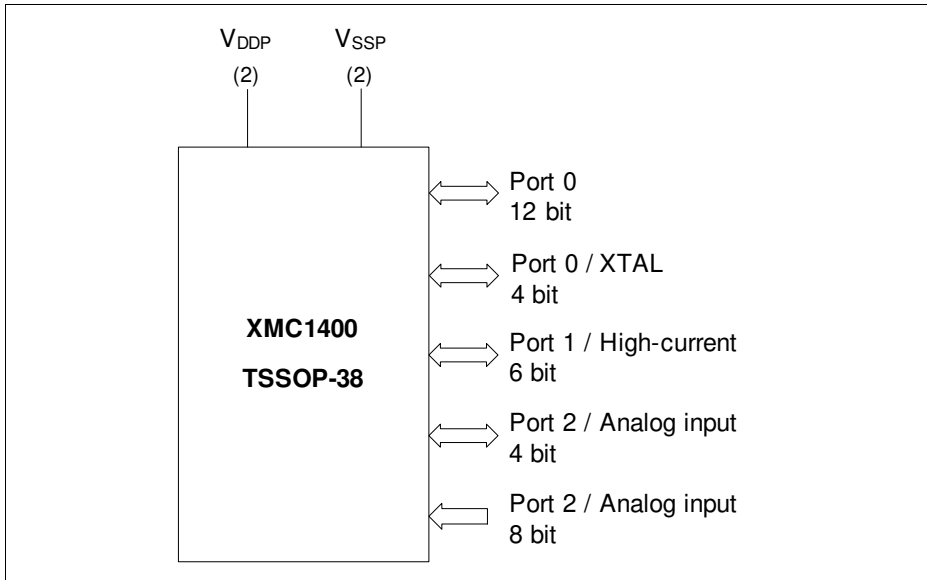


Figure 2 XMC1400 Logic Symbol for TSSOP-38-9

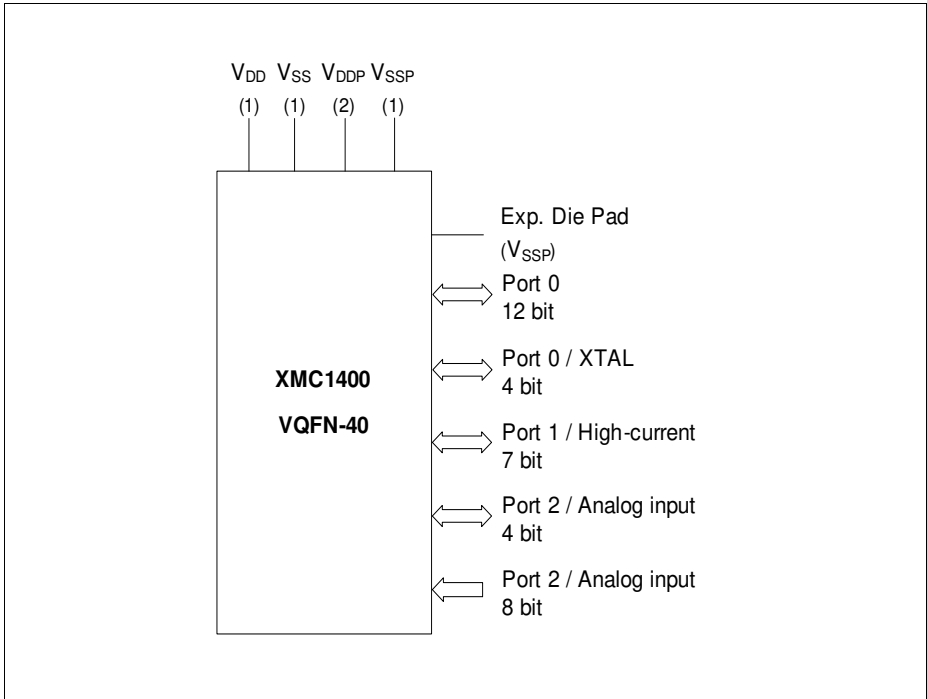


Figure 3 XMC1400 Logic Symbol for PG-VQFN-40-17

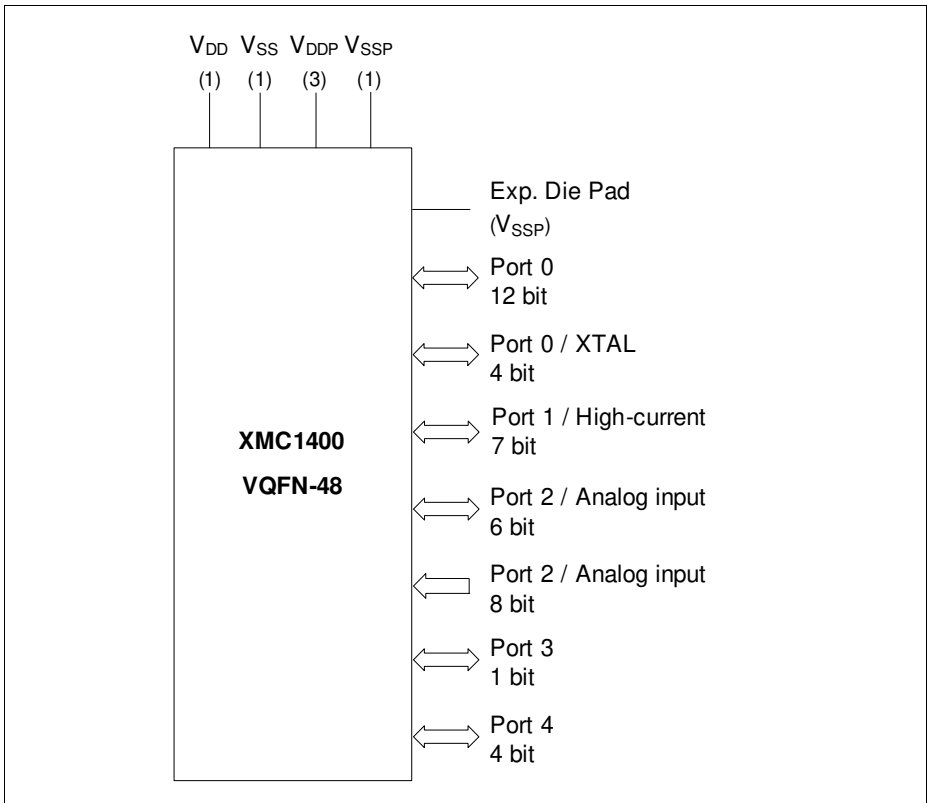


Figure 4 XMC1400 Logic Symbol for PG-VQFN-48-73

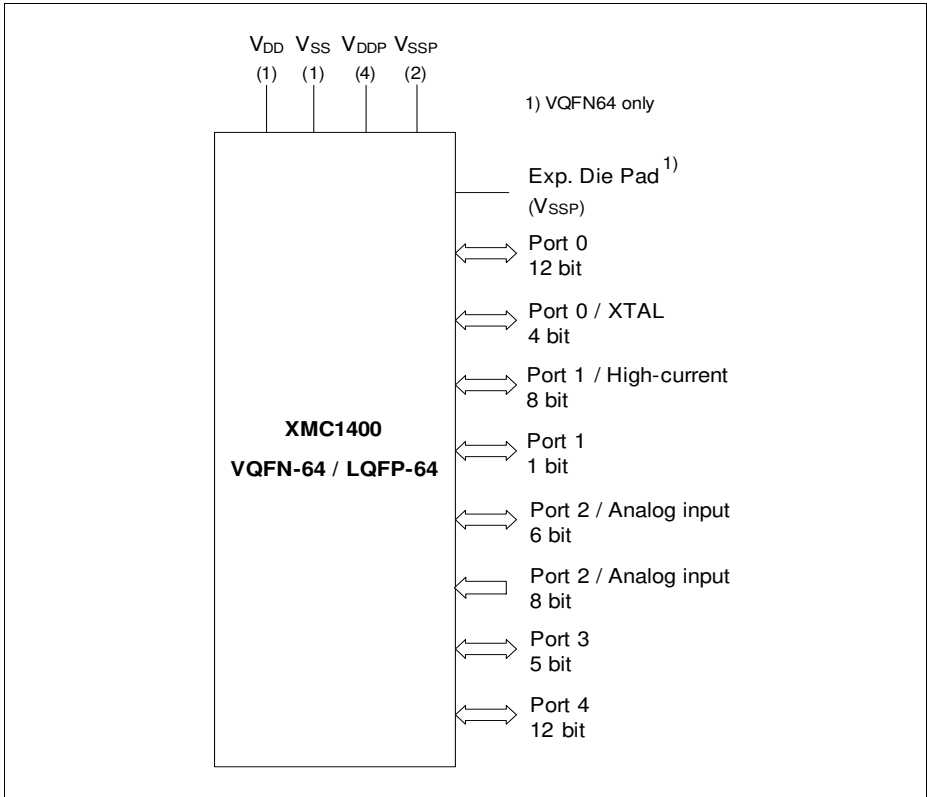


Figure 5 XMC1400 Logic Symbol for PG-LQFP-64-26 / PG-VQFN-64-6

2.2 Pin Configuration and Definition

The following figures summarize all pins, showing their locations on the different packages.

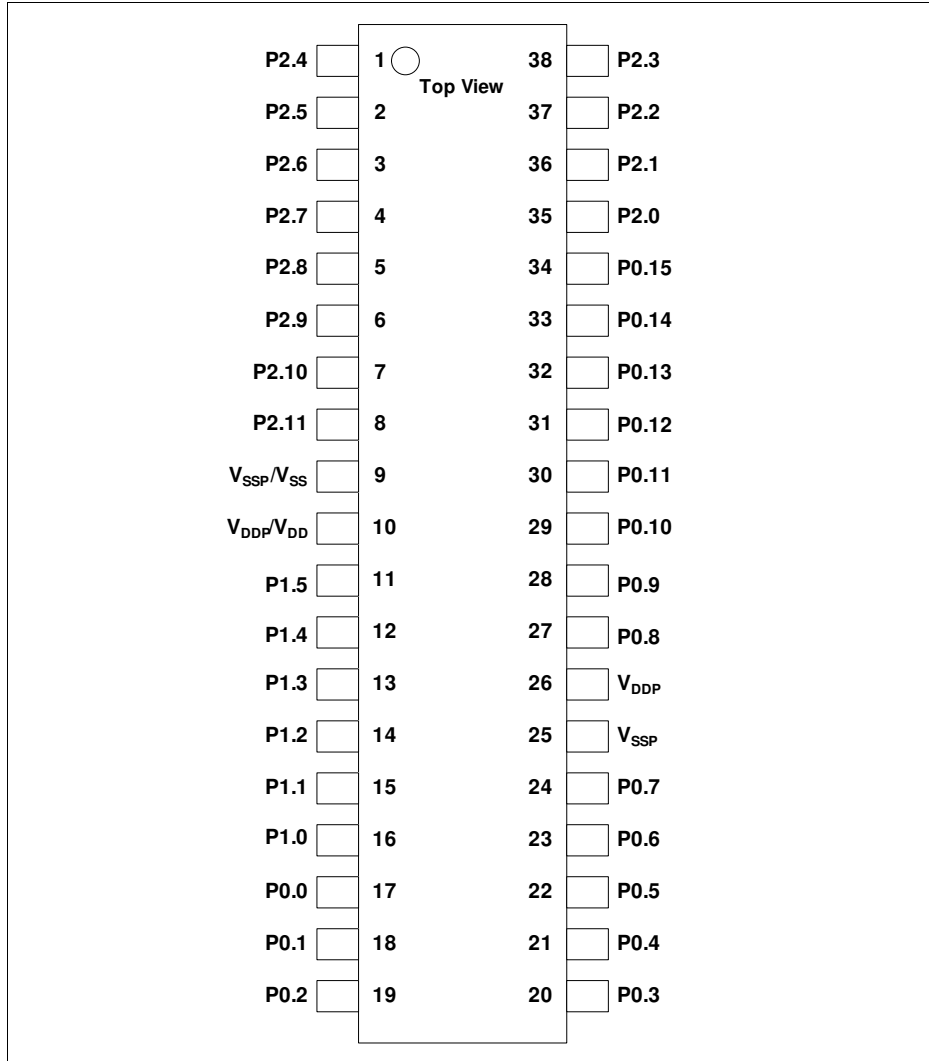


Figure 6 XMC1400 PG-TSSOP-38-9 Pin Configuration (top view)

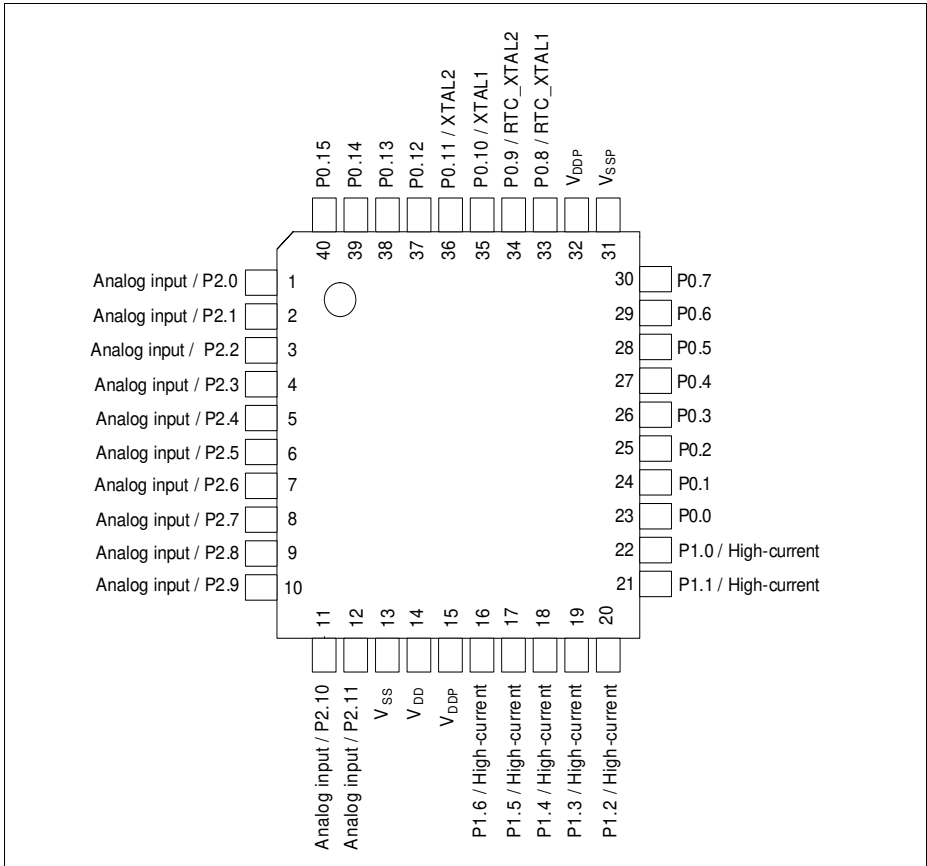


Figure 7 XMC1400 PG-VQFN-40-17 Pin Configuration (top view)

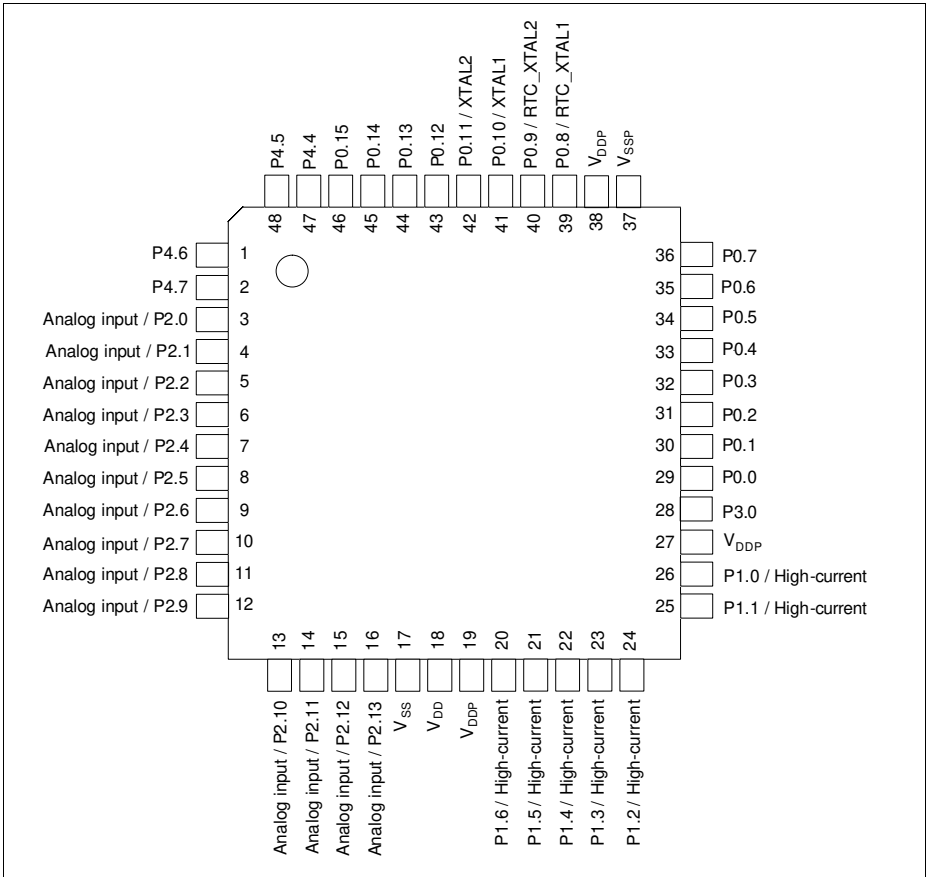


Figure 8 XMC1400 PG-VQFN-48-73 Pin Configuration (top view)

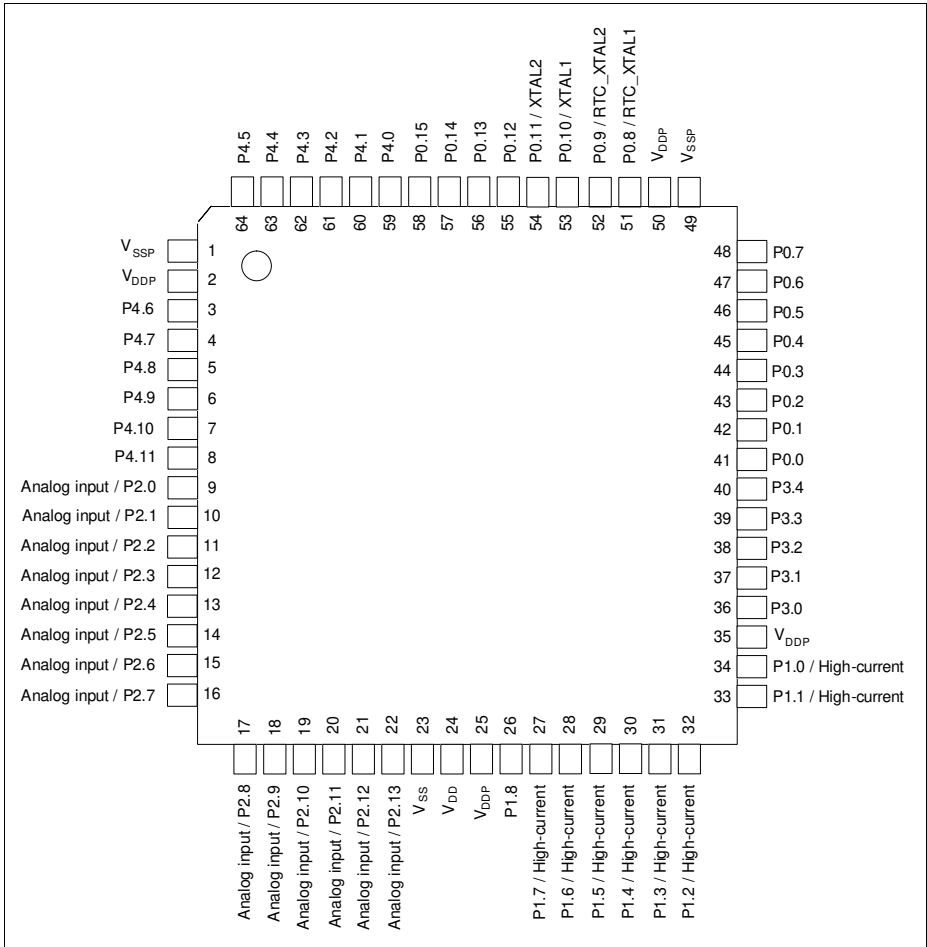


Figure 9 XMC1400 PG-LQFP-64-26 / PG-VQFN-64-6 Pin Configuration (top view)