

xCORE XA Module Board Hardware Manual

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SYNOPSIS

This document pertains to the REV 2 revision of the xCORE XA Module Board.

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1 Overview

IN THIS CHAPTER

- ▶ Introduction
- ▶ Module Board Layout

1.1 Introduction

This document covers the hardware design of the xCORE XA Module Board.

The Core Board contains a fully pinned out 8-core xCORE-XA Processor, with its GPIOs connected to header connectors to interface with expansion cards, interposer boards and other external hardware. The Module Board also contains on board debugger hardware for interfacing with the xCORE and ARM processors on the xCORE XA device.

1.2 Module Board Layout

The diagram below shows an overview of the layout of the xCORE-XA Module Board.

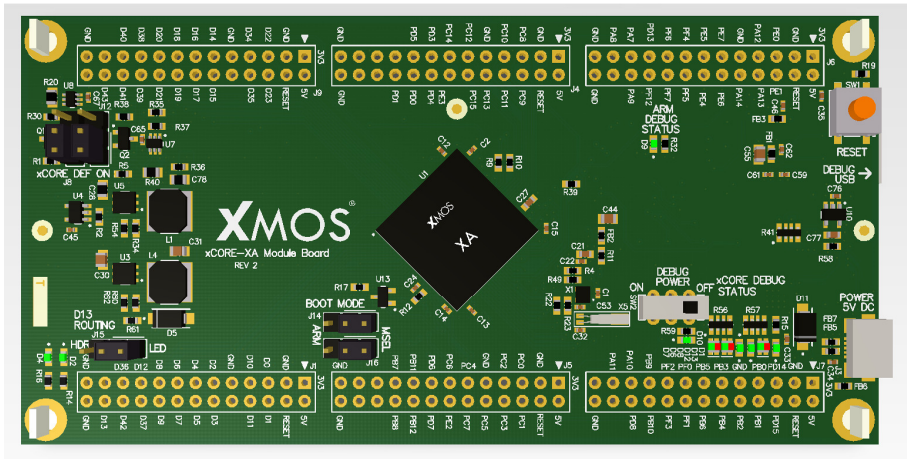


Figure 1:
Module Board
diagram

2 Module Board

IN THIS CHAPTER

- ▶ Setup
- ▶ Power Supply
- ▶ Debug
- ▶ xCORE-XA Boot
- ▶ XMOS Links
- ▶ Reset
- ▶ Clocking
- ▶ I/O
- ▶ LEDs
- ▶ ARM Peripherals

The Module Board contains the XMOS device plus support and debug circuitry.

A single XS1-XA8A-10-FB265 device has its GPIO connected to the headers.

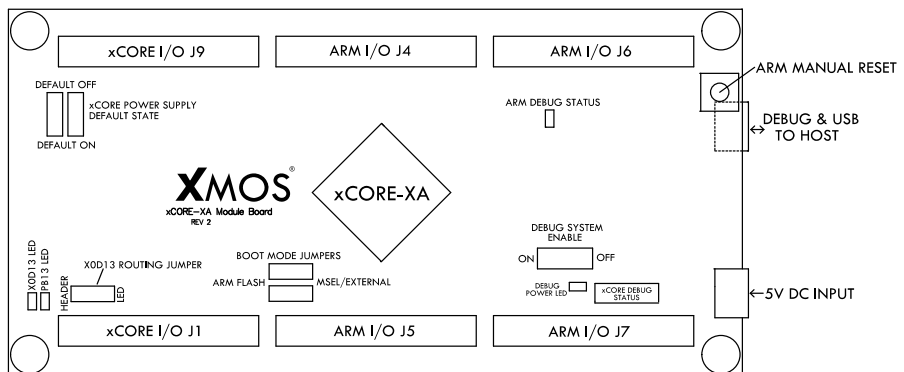


Figure 2:
xCORE-XA
Module Board

2.1 Setup

The Module Board is powered by a 5V external power supply.

For debugging, an on board XTAG device is available for debugging the xCOREs and a JLINK-OB device is available for debugging the ARM core.

2.1.1 Default Jumper Settings

- ▶ Power up : Jumpers J8 and J12 should be connected to “xCORE DEF ON” to have the xCORE power default to on.
- ▶ Boot mode: Jumpers J14 and J16 should be connected to “MSEL” for initial xCORE debugging.
- ▶ D13 Routing: There is another jumper J15 that selects on board LED or GPIO (X0D13) in one of the I/O header. It should be connected in “LED” position.

2.2 Power Supply

Power input can be fed either via a USB micro B connector (J3), or to pin 2 any of the I/O headers. The 5V input supply is used to generate the 3.3V and 1.0V supplies required by the xCORE-XA device.

The 5V and 3.3V supplies are connected to the I/O headers, and can be supplied to or by the Module Board. The on board 3.3V supply is capable of supplying 1.25A to external circuits connected to the I/O headers, as long as a suitable 5V adapter is used to provide the system power.

2.2.1 xCORE Power Control

The xCORE power is controlled by two jumpers(J8,J9). The jumpers selects xCORE power default to on (XCORE DEF ON) or off. It is also controlled by ARM via GPIO's PD2 and PD10 to powering it down during low energy mode applications.

2.2.2 Power Supply Monitoring

The xCORE-XA power supply can be monitored via low power mode and sleep mode etc. Four ADC signals including two shunt signals with 100:1 gain are used for power monitoring.

2.3 Debug

Debug of the system is via the micro USB connector J2, on the bottom side of the Module Board. This should be connected to a host computer for debugging and programming.

2.3.1 Debug LEDs

The LEDs indicate the status of the device as shown in the below table.

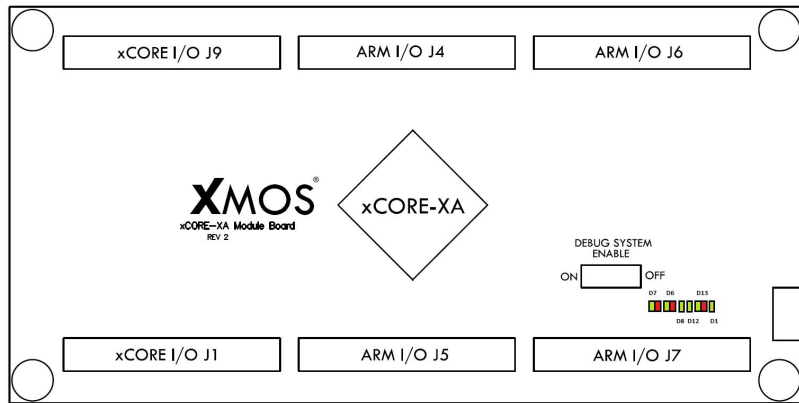


Figure 3:
Debug LEDs

LED	Status	Description
D1	Green	The xTAG is powered on
D7	Green	Target is running
	Red	Target is in debug mode and stopped
D13	Green	Target stop reason is expected e.g. breakpoint, print message
	Red	Target stop reason is unexpected e.g. exception
D12	Green	There is JTAG activity with the target happening
	Off	No JTAG
D8	Green Flashing	xSCOPE is enabled
	Off	No xSCOPE
D6	Green	Target device is detected after a Run Configuration or Debug Configuration is used (xrun or xgdb command)
	Red	Target device is not detected after a Run Configuration or Debug Configuration is used (xrun or xgdb command)

2.3.2 Debug System Disable

The debug system could be powered down(OFF) or enabled (ON) by setting the jumper J13. This allows the board in a standalone mode with typical power usage.

2.4 xCORE-XA Boot

The boot mode jumpers J14 & J16 can be selected to boot from ARM flash using LINKS or through external Flash or from xTAG(MSEL). This allows to develop xCORE code independent of ARM code and experiment with xCORE.

2.5 XMOS Links

This board contains two 5-bit xCONNECT links XLA and XLB which can be used for connecting more xCORES together. The 2-bit xCONNECT link XLC is used for xSCOPE.

2.6 Reset

The reset can be applied to the board in two ways. Manual reset can be generated using push button SW1. In debug mode the reset from xTAG resets the whole system. The reset is connected to all I/O headers so any circuitry on them can be reset.

2.7 Clocking

There are two clock sources available in the board. One provides a 48MHZ system clock to both ARM and xCORE. The other is a 32.768 KHZ clock connected to ARM to allow low energy mode applications.

2.8 I/O

2.8.1 xCORE Headers

The xCORE signals are identified on the silkscreen layer of the Module Board, the table below lists their relationship to the internal ports.

J1 Pin	Designator	Function
1	3V3	Power supply 3.3V in/out
2	5V	Power supply 5.0V in/out
3	GND	Power supply ground
4	RESET	xCORE reset signal (active low)
5	D0	X0D00 P1A0
6	D1	X0D01 P1B0
7	D10	X0D10 P1C0
8	D11	X0D11 P1D0
9	GND	Power supply ground
10		Not Connected
11	D2	X0D02 P4A0 P8A0 P16A0 P32A20
12	D3	X0D03 P4A1 P8A1 P16A1 P32A21
13	D4	X0D04 P4B0 P8A2 P16A2 P32A22
14	D5	X0D05 P4B1 P8A3 P16A3 P32A23
15	D6	X0D06 P4B2 P8A4 P16A4 P32A24
16	D7	X0D07 P4B3 P8A5 P16A5 P32A25
17	D8	X0D08 P4A2 P8A6 P16A6 P32A26
18	D9	X0D09 P4A3 P8A7 P16A7 P32A27
19	D12	X0D12 P1E0
20	D37	X0D37 P1N0 P8D1 P16B9
21	D36	X0D36 P1M0 P8D0 P16B8
22	D42	X0D42 P8D6 P16B14
23		Not Connected
24	D13	X0D13 P1F0
25	GND	Power supply ground
26	GND	Power supply ground

J9 Pin	Designator	Function
1	3V3	Power supply 3.3V in/out
2	5V	Power supply 5.0V in/out
3	GND	Power supply ground
4	RESET	xCORE reset signal (active low)
5	D22	X0D22 P1G0
6	D23	X0D23 P1H0
7	D34	X0D34 P1K0
8	D35	X0D35 P1L0
9	GND	Power supply ground
10		Not Connected
11	D14	X0D14 P4C0 P8B0 P16A8 P32A28
12	D15	X0D15 P4C1 P8B1 P16A9 P32A29
13	D16	X0D16 P4D0 P8B2 P16A10
14	D17	X0D17 P4D1 P8B3 P16A11
15	D18	X0D18 P4D2 P8B4 P16A12
16	D19	X0D19 P4D3 P8B5 P16A13
17	D20	X0D20 P4C2 P8B6 P16A14 P32A30
18	D21	X0D21 P4C3 P8B7 P16A15 P32A31
19	D38	X0D38 P1O0 P8D2 P16B10
20	D39	X0D39 P1P0 P8D3 P16B11
21	D40	X0D40 P8D4 P16B12
22	D41	X0D41 P8D5 P16B13
23		Not Connected
24	D43	X0D43 P8D7 P16B15
25	GND	Power supply ground
26	GND	Power supply ground

2.8.2 ARM Headers

The ARM signals are identified on the silkscreen layer of the Module Board. All of the signals can be used as GPIO as well as being multiplexed to the internal peripherals, the table below lists their relationship to the peripherals.

J6 Pin	Designator	Function
1	3V3	Power supply 3.3V in/out
2	5V	Power supply 5.0V in/out
3	GND	Power supply ground
4	RESET	ARM reset signal (active low)
5	PE0	PCNT0 S0IN UART0 TX I2C1 SDA
6	PE1	PCNT0 S1IN UART0 RX I2C1 SCL
7	PA12	TIMER2 CC0
8	PA13	TIMER2 CC1
9	GND	Power supply ground
10	PA14	TIMER2 CC2
11	PE7	USART0 TX
12	PE6	USART0 RX
13	PE5	USART0 CLK
14	PE4	USART0 CS
15	PF4	GPIO
16	PF5	GPIO
17	PF6	GPIO
18	PF7	GPIO
19	PD13	GPIO
20	PF12	GPIO
21	PA7	GPIO
22	PA9	GPIO
23	PA8	GPIO
24		Not Connected
25	GND	Power supply ground
26	GND	Power supply ground

J4 Pin	Designator	Function
1	3V3	Power supply 3.3V in/out
2	5V	Power supply 5.0V in/out
3	GND	Power supply ground
4	RESET	ARM reset signal (active low)
5	PC8	ACMP1 CH0
6	PC9	ACMP1 CH1
7	PC10	ACMP1 CH2
8	PC11	ACMP1 CH3
9	GND	Power supply ground
10	PC13	ACMP1 CH5 OPAMP1 OUTALT1
11	PC12	ACMP1 CH4 OPAMP1 OUTALTO
12	PC15	ACMP1 CH7 OPAMP1 OUTALT3
13	PC14	ACMP1 CH6 OPAMP1 OUTALT2
14	PE3	ACMP1 OUT
15	PD3	ADC0 CH3 OPAMP2 N2
16	PD4	ADC0 CH4 OPAMP2 P2
17	PD5	ADC0 CH5 OPAMP2 OUT0
18	PD0	ADC0 CH0 OPAMP2 OUT1 OPAMP0 OUTALT4
19		Not Connected
20	PD1	ADC0 CH1 OPAMP1 OUTALT4
21		Not Connected
22		Not Connected
23		Not Connected
24		Not Connected
25	GND	Power supply ground
26	GND	Power supply ground

J7 Pin	Designator	Function
1	3V3	Power supply 3.3V in/out
2	5V	Power supply 5.0V in/out
3	GND	Power supply ground
4	RESET	ARM reset signal (active low)
5	PD14	I2C0 SDA
6	PD15	I2C0 SCL
7	PB0	TIMER1 CC0
8	PB1	TIMER1 CC1
9	GND	Power supply ground
10	PB2	TIMER1 CC2
11	PB3	USART2 TX
12	PB4	USART2 RX
13	PB5	USART2 CLK
14	PB6	USART2 CS
15	PF0	GPIO
16	PF1	GPIO
17	PF2	GPIO
18	PF3	GPIO
19	PB9	UART1 TX
20	PB10	UART1 RX
21	PA10	GPIO
22	PD8	CMU CLK1
23	PA11	GPIO
24		Not Connected
25	GND	Power supply ground
26	GND	Power supply ground

J5 Pin	Designator	Function
1	3V3	Power supply 3.3V in/out
2	5V	Power supply 5.0V in/out
3	GND	Power supply ground
4	RESET	ARM reset signal (active low)
5	PC0	ACMP0 CH0 OPAMP0 OUTALT0 USART1 TX
6	PC1	ACMP0 CH1 OPAMP0 OUTALT1 USART1 RX
7	PC2	ACMP0 CH2 OPAMP0 OUTALT2
8	PC3	ACMP0 CH3 OPAMP0 OUTALT3
9	GND	Power supply ground
10	PC5	ACMP0 CH5 OPAMP0 N0
11	PC4	ACMP0 CH4 OPAMP0 P0
12	PC7	ACMP0 CH7
13	PC6	ACMP0 CH6
14	PE2	ACMP0 OUT
15	PD6	ADC0 CH6 OPAMP1 P1
16	PD7	ADC0 CH7 OPAMP1 N1
17	PB11	OPAMP0 OUT0
18	PB12	OPAMP0 OUT1
19	PB7	USART1 CLK LFXO P
20	PB8	USART1 CS LFXO N
21		Not Connected
22		Not Connected
23		Not Connected
24		Not Connected
25	GND	Power supply ground
26	GND	Power supply ground

2.9 LEDs

Access to two gpio leds. D2 is connected to PB13 and D4 is connected X0D13. Jumper J15 should be connected to "LED" position to access D4.

2.10 ARM Peripherals

xCORE-XA ARM includes dedicated low energy peripherals, low energy sensor interfaces and a full speed USB. ARM I/O header includes peripherals like I2C, UART, USART, PWM and ADC. The I/O from the ARM core in the xCORE-XA is bought out to four headers. The I/O is laid out to give two pairs of similar layout (J6 & J4, J7 & J5) one containing GPIO linked to analogue I/O and the other containing GPIOs linked to digital peripherals.

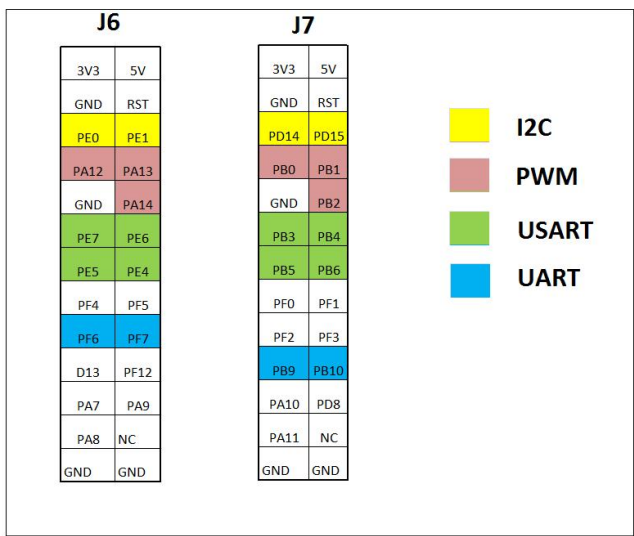


Figure 4:
ARM I/O
Header with
peripheral
locations

3 Add On Board Design

The module board can be plug down into a application specific larger motherboard, or have smaller daughter boards plugged into it from above.

Each set of I/O headers includes power, ground and reset for maximum flexibility. Flexible power supply options allow this board to be powered from a microUSB supply, supplying the add on board, or from the add on board, via the headers.

This board plugs into top of the xCORE-XA industrial board. Custom daughter cards, such as the xCORE-XA vision module and click board interposer can be attached this board.

4 New Designs Based on Module Board

IN THIS CHAPTER

- ▶ Power Supply
 - ▶ Debug
 - ▶ I/O
-

There are a number of sections of the design of the xCORE-XA Module Board that have been optimized for flexibility to cover as many use cases as possible. Therefore some consideration may be required in what to leave out or change in a custom design. Some of the important points to consider are dealt with in this section.

Some general points to consider when implementing your own design are:

- ▶ Always check the datasheet of the xCORE device. In the case where the reference design and datasheet conflict, the datasheet presides.
- ▶ XMOS datasheets contain additional hardware design requirements and guidelines that are not covered in this document, which users of XMOS hardware reference designs must ensure are followed.
- ▶ The presence of a third party device in an XMOS hardware reference design does not make any statement about its general availability. You must make your own arrangements to ensure that all components can be sourced in the required volumes.

4.1 Power Supply

For custom designs the minimum power supply requirements for the xCORE-XA device should be met. A 1.0V supply, capable of supplying at least 500mA is required for the xCORE-XA core, and a 3.3V supply, capable of supplying at least 100mA is required for the xCORE-XA I/O and ARM core supply. The required capability of the 3.3V supply will vary depending on the I/O usage and may need to be higher to supply peripheral devices. The 1.0V, 3.3V supplies and reset should all be sequenced in accordance with the requirements stated in the datasheet.

4.2 Debug

In a custom design debug and programming interfaces for both the xCORE cores and the ARM core will be required. A standard XSYS connection should be added to debug and program the xCORE cores by way of an XTAG debug adapter. A standard SWD interface should be implemented, for connection to an external debug adapter.

4.3 I/O

Attention should be paid to the I/O planning for both the xCORE and ARM cores. The peripherals provided by the ARM core can be multiplexed to a variety of different pin groups, care should be taken to ensure there is no overlap. the xCORE I/O should be mapped, with care taken to ensure that port types are used appropriately, and that bi-directional usage for wide ports is avoided.

5 Errata



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