



Chipsmall Limited consists of a professional team with an average of over 10 year of expertise in the distribution of electronic components. Based in Hongkong, we have already established firm and mutual-benefit business relationships with customers from,Europe,America and south Asia,supplying obsolete and hard-to-find components to meet their specific needs.

With the principle of “Quality Parts,Customers Priority,Honest Operation,and Considerate Service”,our business mainly focus on the distribution of electronic components. Line cards we deal with include Microchip,ALPS,ROHM,Xilinx,Pulse,ON,Everlight and Freescale. Main products comprise IC,Modules,Potentiometer,IC Socket,Relay,Connector.Our parts cover such applications as commercial,industrial, and automotives areas.

We are looking forward to setting up business relationship with you and hope to provide you with the best service and solution. Let us make a better world for our industry!



## Contact us

Tel: +86-755-8981 8866 Fax: +86-755-8427 6832

Email & Skype: info@chipsmall.com Web: www.chipsmall.com

Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China



# xCORE XA Module Board Hardware Manual

---

Document Number: XM006580A

Publication Date: 2014/12/18  
XMOS © 2014, All Rights Reserved.



SYNOPSIS

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

## Table of Contents

|  |           |
|--|-----------|
| <b>1 Overview</b>                          | <b>4</b>  |
| 1.1 Introduction                           | 4         |
| 1.2 Module Board Layout                    | 4         |
| <b>2 Module Board</b>                      | <b>5</b>  |
| 2.1 Setup                                  | 5         |
| 2.1.1 Default Jumper Settings              | 6         |
| 2.2 Power Supply                           | 6         |
| 2.2.1 xCORE Power Control                  | 6         |
| 2.2.2 Power Supply Monitoring              | 6         |
| 2.3 Debug                                  | 6         |
| 2.3.1 Debug LEDs                           | 6         |
| 2.3.2 Debug System Disable                 | 8         |
| 2.4 xCORE-XA Boot                          | 8         |
| 2.5 XMOS Links                             | 8         |
| 2.6 Reset                                  | 8         |
| 2.7 Clocking                               | 8         |
| 2.8 I/O                                    | 8         |
| 2.8.1 xCORE Headers                        | 8         |
| 2.8.2 ARM Headers                          | 10        |
| 2.9 LEDs                                   | 14        |
| 2.10 ARM Peripherals                       | 14        |
| <b>3 Add On Board Design</b>               | <b>16</b> |
| <b>4 New Designs Based on Module Board</b> | <b>17</b> |
| 4.1 Power Supply                           | 17        |
| 4.2 Debug                                  | 17        |
| 4.3 I/O                                    | 18        |
| <b>5 Errata</b>                            | <b>19</b> |

# 1 Overview

## IN THIS CHAPTER

- ▶ Introduction
- ▶ Module Board Layout

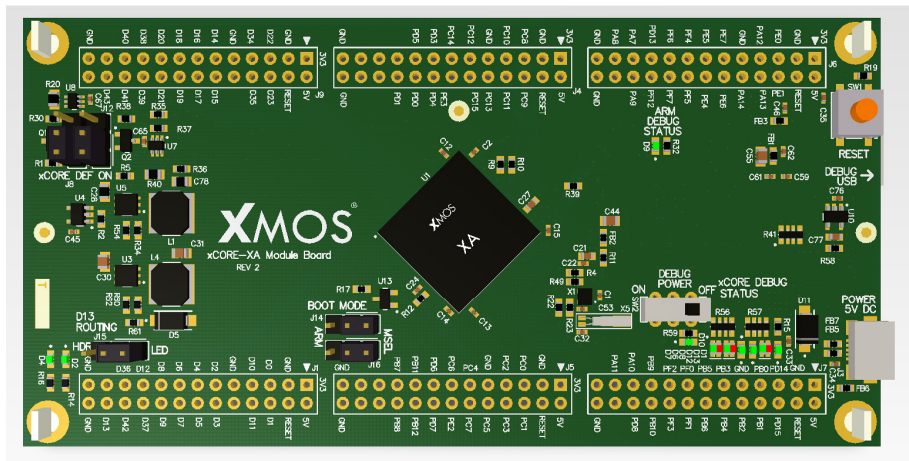
## 1.1 Introduction

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

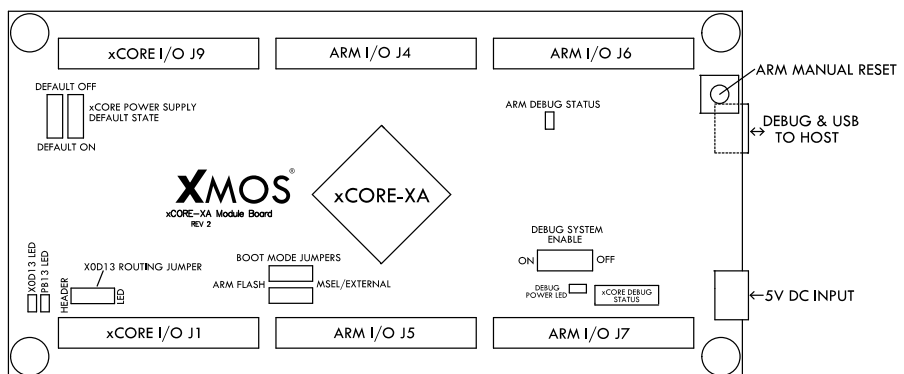
## 2 Module Board

### 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

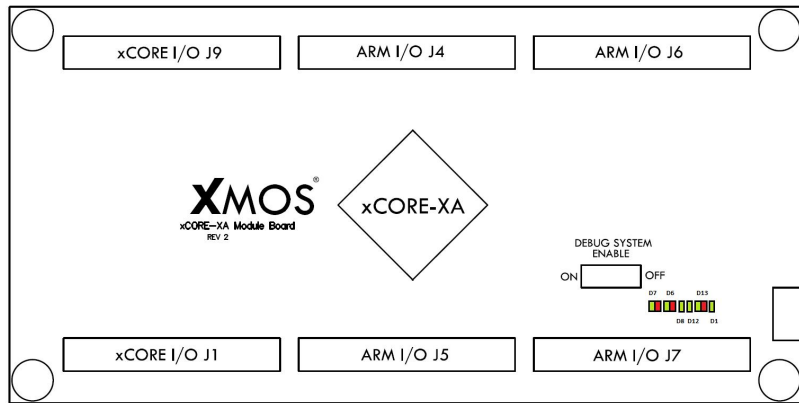
The xCORE-XA power supply can be monitored via low power mode and sleep mode etc. Four ADC signals including two shunt signals with 100:1 gain are used for power monitoring.

## 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           |

---

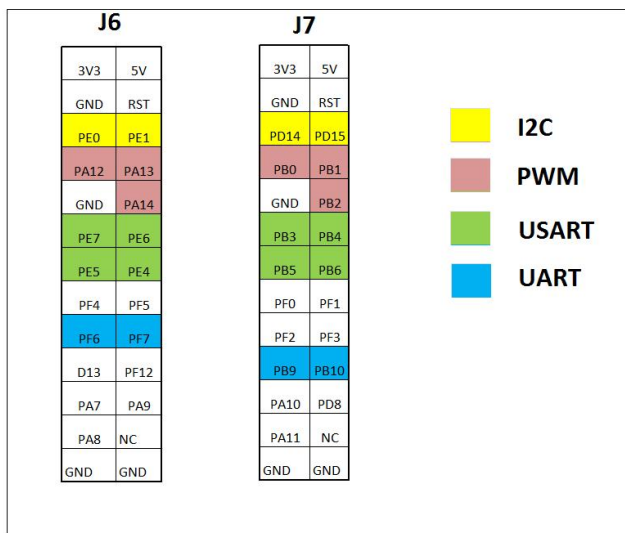
| J5 Pin | Designator | Function                                     |
|--------|------------|--|
| 1      | 3V3        | Power supply 3.3V in/out                     |
| 2      | 5V         | Power supply 5.0V in/out                     |
| 3      | GND        | Power supply ground                          |
| 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

---



Copyright © 2014, All Rights Reserved.

---

Xmos Ltd. is the owner or licensee of this design, code, or Information (collectively, the "Information") and is providing it to you "AS IS" with no warranty of any kind, express or implied and shall have no liability in relation to its use. Xmos Ltd. makes no representation that the Information, or any particular implementation thereof, is or will be free from any claims of infringement and again, shall have no liability in relation to any such claims.

XMOS and the XMOS logo are registered trademarks of Xmos Ltd. in the United Kingdom and other countries, and may not be used without written permission. All other trademarks are property of their respective owners. Where those designations appear in this book, and XMOS was aware of a trademark claim, the designations have been printed with initial capital letters or in all capitals.