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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	Obsolete
Core Processor	XCore
Core Size	32-Bit 8-Core
Speed	1000MIPS
Connectivity	USB
Peripherals	-
Number of I/O	33
Program Memory Size	1MB (1M x 8)
Program Memory Type	FLASH
EEPROM Size	-
RAM Size	128K x 8
Voltage - Supply (Vcc/Vdd)	0.95V ~ 3.6V
Data Converters	-
Oscillator Type	External
Operating Temperature	-40°C ~ 85°C (TA)
Mounting Type	Surface Mount
Package / Case	128-TQFP Exposed Pad
Supplier Device Package	128-TQFP (14x14)
Purchase URL	https://www.e-xfl.com/product-detail/xmos/xuf208-128-tq128-i10

Table of Contents

1 xCORE Multicore Microcontrollers

The xCORE-200 Series is a comprehensive range of 32-bit multicore microcontrollers that brings the low latency and timing determinism of the xCORE architecture to mainstream embedded applications. Unlike conventional microcontrollers, xCORE multicore microcontrollers execute multiple real-time tasks simultaneously and communicate between tasks using a high speed network. Because xCORE multicore microcontrollers are completely deterministic, you can write software to implement functions that traditionally require dedicated hardware.

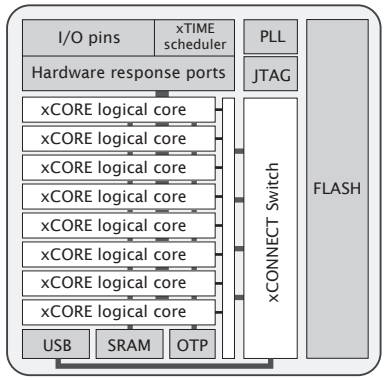


Figure 1: XUF208-128-TQ128 block diagram

Key features of the XUF208-128-TQ128 include:

- **Tiles**: Devices consist of one or more xCORE tiles. Each tile contains between five and eight 32-bit xCOREs with highly integrated I/O and on-chip memory.
- **Logical cores** Each logical core can execute tasks such as computational code, DSP code, control software (including logic decisions and executing a state machine) or software that handles I/O. Section 6.1
- **xTIME scheduler** The xTIME scheduler performs functions similar to an RTOS, in hardware. It services and synchronizes events in a core, so there is no requirement for interrupt handler routines. The xTIME scheduler triggers cores on events generated by hardware resources such as the I/O pins, communication channels and timers. Once triggered, a core runs independently and concurrently to other cores, until it pauses to wait for more events. Section 6.2
- **Channels and channel ends** Tasks running on logical cores communicate using channels formed between two channel ends. Data can be passed synchronously or asynchronously between the channel ends assigned to the communicating tasks. Section 6.5
- **xCONNECT Switch and Links** Between tiles, channel communications are implemented over a high performance network of xCONNECT Links and routed through a hardware xCONNECT Switch. Section 6.6

4 Signal Description

This section lists the signals and I/O pins available on the XUF208-128-TQ128. The device provides a combination of 1bit, 4bit, 8bit and 16bit ports, as well as wider ports that are fully or partially (gray) bonded out. All pins of a port provide either output or input, but signals in different directions cannot be mapped onto the same port.

Pins may have one or more of the following properties:

- PD/PU: The IO pin a weak pull-down or pull-up resistor. On GPIO pins this resistor can be enabled.
- ST: The IO pin has a Schmitt Trigger on its input.
- IOL/IOT/IOR: The IO pin is powered from VDDIOL, VDDIOT, and VDDIOR respectively

Power pins (10)			
Signal	**Function**	**Type**	**Properties**
GND	Digital ground	GND	
OTP_VCC	OTP power supply	PWR	
PLL_AGND	Analog ground for PLL	PWR	
PLL_AVDD	Analog PLL power	PWR	
USB_VDD	Digital tile power	PWR	
USB_VDD33	USB Analog power	PWR	
VDD	Digital tile power	PWR	
VDDIOL	Digital I/O power (left)	PWR	
VDDIOR	Digital I/O power (right)	PWR	
VDDIOT	Digital I/O power (top)	PWR	

JTAG pins (6)			
Signal	**Function**	**Type**	**Properties**
RST_N	Global reset input	Input	IOL, PU, ST
TCK	Test clock	Input	IOL, PD, ST
TDI	Test data input	Input	IOL, PU
TDO	Test data output	Output	IOL, PD
TMS	Test mode select	Input	IOL, PU
TRST_N	Test reset input	Input	IOL, PU, ST

I/O pins (44)			
Signal	**Function**	**Type**	**Properties**
X0D00	$1A^0$	I/O	IOL, PD
X0D01	$1B^0$	I/O—	IOL, PD

(continued)

Signal	Function					Type	Properties
X0D02			$4A^0$	$8A^0$	$16A^0$ $32A^{20}$	I/O	IOL, PD
X0D03			$4A^1$	$8A^1$	$16A^1$ $32A^{21}$	I/O	IOL, PD
X0D04			$4B^0$	$8A^2$	$16A^2$ $32A^{22}$	I/O—	IOL, PD
X0D05			$4B^1$	$8A^3$	$16A^3$ $32A^{23}$	I/O—	IOL, PD
X0D06			$4B^2$	$8A^4$	$16A^4$ $32A^{24}$	I/O—	IOL, PD
X0D07			$4B^3$	$8A^5$	$16A^5$ $32A^{25}$	I/O—	IOL, PD
X0D08			$4A^2$	$8A^6$	$16A^6$ $32A^{26}$	I/O	IOL, PD
X0D09			$4A^3$	$8A^7$	$16A^7$ $32A^{27}$	I/O	IOL, PD
X0D10		$1C^0$				I/O—	IOL, PD
X0D11		$1D^0$				I/O	IOL, PD
X0D12		$1E^0$				I/O	IOR, PD
X0D13		$1F^0$				I/O	IOR, PD
X0D14			$4C^0$	$8B^0$	$16A^8$ $32A^{28}$	I/O	IOR, PD
X0D15			$4C^1$	$8B^1$	$16A^9$ $32A^{29}$	I/O	IOR, PD
X0D16	$XL4^4_{in}$		$4D^0$	$8B^2$	$16A^{10}$	I/O	IOR, PD
X0D17	$XL4^3_{in}$		$4D^1$	$8B^3$	$16A^{11}$	I/O	IOR, PD
X0D18	$XL4^2_{in}$		$4D^2$	$8B^4$	$16A^{12}$	I/O	IOR, PD
X0D19	$XL4^1_{in}$		$4D^3$	$8B^5$	$16A^{13}$	I/O	IOR, PD
X0D20			$4C^2$	$8B^6$	$16A^{14}$ $32A^{30}$	I/O	IOR, PD
X0D21			$4C^3$	$8B^7$	$16A^{15}$ $32A^{31}$	I/O	IOR, PD
X0D22		$1G^0$				I/O	IOR, PD
X0D23		$1H^0$				I/O	IOR, PD
X0D24	$XL7^0_{in}$	$1I^0$				I/O	IOR, PD
X0D25	$XL7^0_{out}$	$1J^0$				I/O	IOR, PD
X0D26	$XL7^3_{out}$		$4E^0$	$8C^0$	$16B^0$	I/O	IOR, PD
X0D27	$XL7^4_{out}$		$4E^1$	$8C^1$	$16B^1$	I/O	IOR, PD
X0D28			$4F^0$	$8C^2$	$16B^2$	I/O	IOR, PD
X0D29			$4F^1$	$8C^3$	$16B^3$	I/O	IOR, PD
X0D30			$4F^2$	$8C^4$	$16B^4$	I/O	IOR, PD
X0D31			$4F^3$	$8C^5$	$16B^5$	I/O	IOR, PD
X0D32			$4E^2$	$8C^6$	$16B^6$	I/O	IOR, PD
X0D33			$4E^3$	$8C^7$	$16B^7$	I/O	IOR, PD
X0D34	$XL7^1_{out}$	$1K^0$				I/O	IOR, PD
X0D35	$XL7^2_{out}$	$1L^0$				I/O	IOR, PD
X0D36		$1M^0$		$8D^0$	$16B^8$	I/O	IOL, PD
X0D37		$1N^0$		$8D^1$	$16B^9$	I/O	IOL, PD
X0D38		$1O^0$		$8D^2$	$16B^{10}$	I/O	IOL, PD
X0D39		$1P^0$		$8D^3$	$16B^{11}$	I/O	IOL, PD
X0D40	$XL0^1_{in}$			$8D^4$	$16B^{12}$	I/O	IOL, PD
X0D41	$XL0^0_{in}$			$8D^5$	$16B^{13}$	I/O	IOL, PD
X0D42	$XL0^0_{out}$			$8D^6$	$16B^{14}$	I/O	IOL, PD
X0D43	$XL0^1_{out}$			$8D^7$	$16B^{15}$	I/O	IOL, PD

5 Example Application Diagram

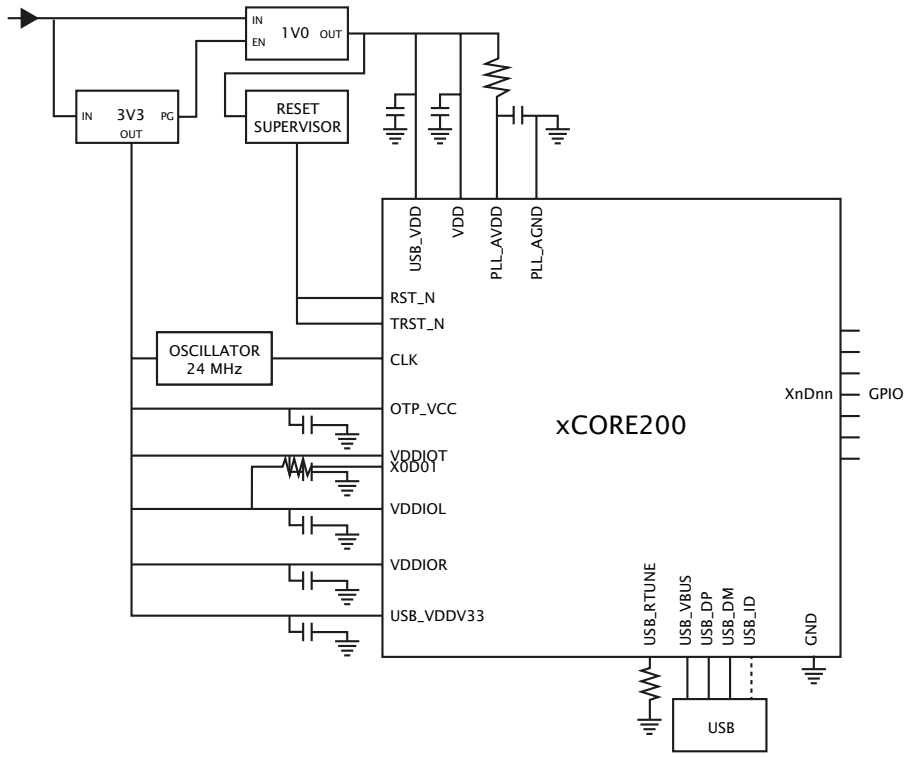
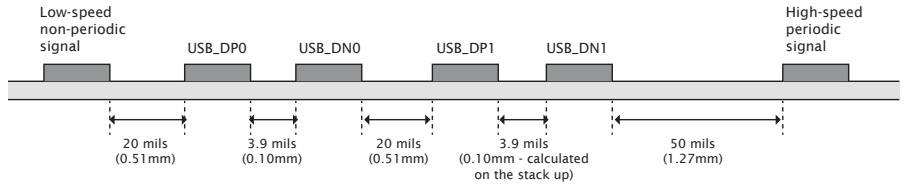


Figure 2: Simplified Reference Schematic

board traces for USB_DP and USB_DN are tightly matched. In addition, according to the USB 2.0 specification, the USB_DP and USB_DN differential impedance must be 90 Ω.

Figure 15: USB trace separation showing a low speed signal, two differential pairs and a high-speed clock



12.2.1 General routing and placement guidelines

The following guidelines will help to avoid signal quality and EMI problems on high speed USB designs. They relate to a four-layer (Signal, GND, Power, Signal) PCB.

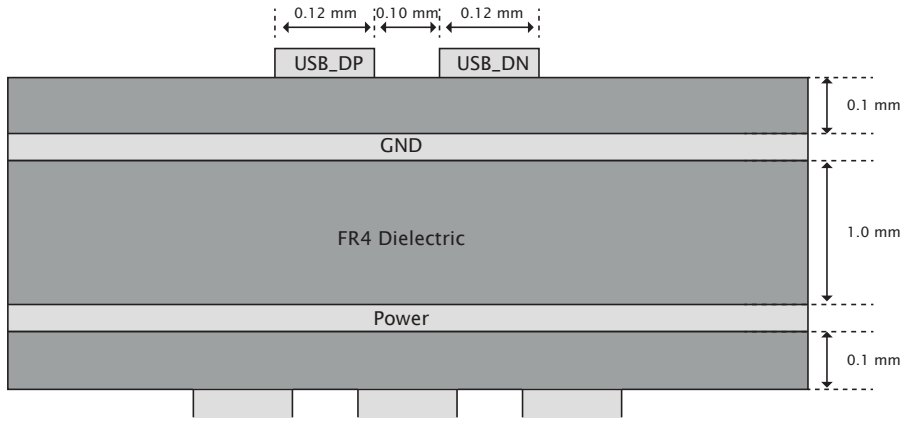


Figure 16: Example USB board stack

For best results, most of the routing should be done on the top layer (assuming the USB connector and XS2-UF8A-128-TQ128 are on the top layer) closest to GND. Reference planes should be below the transmission lines in order to maintain control of the trace impedance.

We recommend that the high-speed clock and high-speed USB differential pairs are routed first before any other routing. When routing high speed USB signals, the following guidelines should be followed:

- High speed differential pairs should be routed together.
- High-speed USB signal pair traces should be trace-length matched. Maximum trace-length mismatch should be no greater than 4mm.

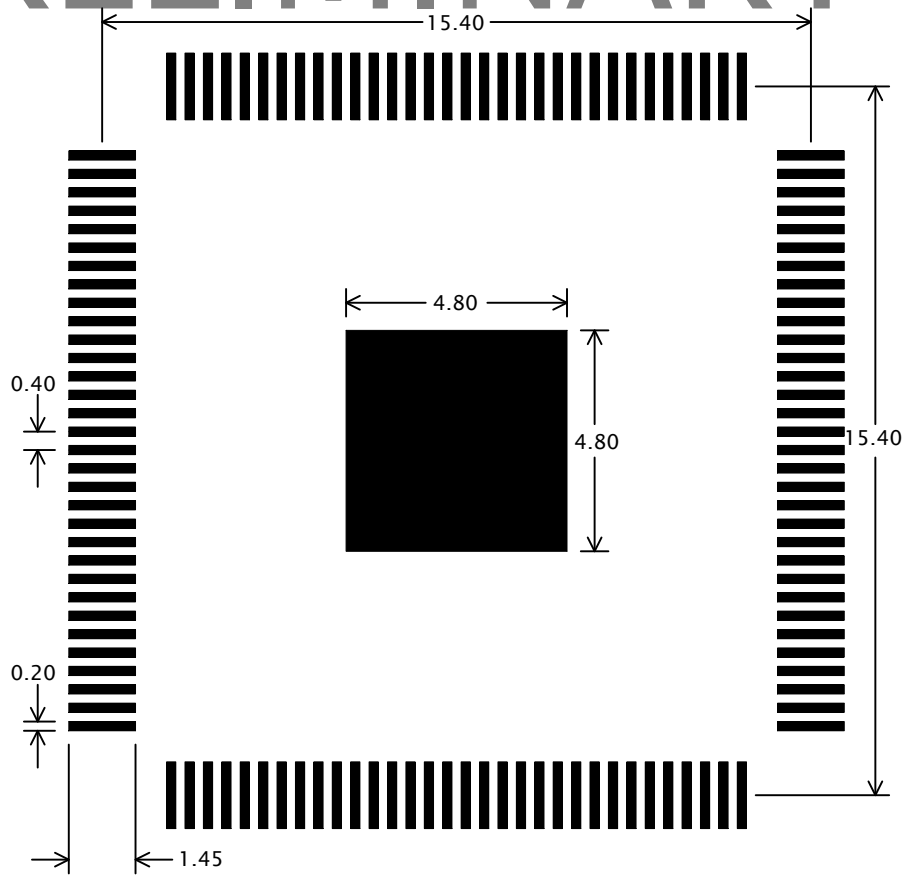


Figure 17: Example land pattern

The center pad solder paste level needs to be controlled so the device sits the correct height from the circuit board. For the 128 pin TQFP package, a 3x3 array of squares for solder paste is recommended as shown in Figure 18. This gives a paste level of 56%.

12.4 Ground and Thermal Vias

Vias under the heat slug into the ground plane of the PCB are recommended for a low inductance ground connection and good thermal performance. A 3 x 3 grid of vias, with a 0.6mm diameter annular ring and a 0.3mm drill, equally spaced across the heat slug, would be suitable.

13 DC and Switching Characteristics

13.1 Operating Conditions

Symbol	Parameter	MIN	TYP	MAX	UNITS	Notes
VDD	Tile DC supply voltage	0.95	1.00	1.05	V	
VDDIOL	I/O supply voltage	3.135	3.30	3.465	V	
VDDIOR	I/O supply voltage	3.135	3.30	3.465	V	
VDDIOT 3v3	I/O supply voltage	3.135	3.30	3.465	V	
VDDIOT 2v5	I/O supply voltage	2.375	2.50	2.625	V	
VDD33	Peripheral supply	3.135	3.30	3.465	V	
PLL_AVDD	PLL analog supply	0.95	1.00	1.05	V	
CI	xCORE Tile I/O load capacitance			25	pF	
Ta	Ambient operating temperature (Commercial)	0		70	℃	
	Ambient operating temperature (Industrial)	-40		85	℃	
Tj	Junction temperature			125	℃	
Tstg	Storage temperature	-65		150	℃	

Figure 19: Operating conditions

13.2 DC Characteristics

Symbol	Parameter	MIN	TYP	MAX	UNITS	Notes
V(IH)	Input high voltage	2.00		3.60	V	A
V(IL)	Input low voltage	-0.30		0.70	V	A
V(OH)	Output high voltage	2.20			V	B, C
V(OL)	Output low voltage			0.40	V	B, C
R(PU)	Pull-up resistance		35K		Ω	D
R(PD)	Pull-down resistance		35K		Ω	D

Figure 20: DC characteristics

A All pins except power supply pins.

B All general-purpose I/Os are nominal 4 mA.

C Measured with 4 mA drivers sourcing 4 mA, 8 mA drivers sourcing 8 mA.

D Used to guarantee logic state for an I/O when high impedance. The internal pull-ups/pull-downs should not be used to pull external circuitry.

13.3 ESD Stress Voltage

Symbol	Parameter	MIN	TYP	MAX	UNITS	Notes
HBM	Human body model	-2.00		2.00	KV	
CDM	Charged Device Model	-500		500	V	

Figure 21: ESD stress voltage

B.1 RAM base address: 0x00

This register contains the base address of the RAM. It is initialized to 0x00040000.

0x00: RAM base address

Bits	Perm	Init	Description
31:2	RW		Most significant 16 bits of all addresses.
1:0	RO	-	Reserved

B.2 Vector base address: 0x01

Base address of event vectors in each resource. On an interrupt or event, the 16 most significant bits of the destination address are provided by this register; the least significant 16 bits come from the event vector.

0x01: Vector base address

Bits	Perm	Init	Description
31:18	RW		The event and interrupt vectors.
17:0	RO	-	Reserved

B.3 xCORE Tile control: 0x02

Register to control features in the xCORE tile

0x07: Ring Oscillator Value

Bits	Perm	Init	Description
31:16	RO	-	Reserved
15:0	RO	0	Ring oscillator Counter data.

B.8 Ring Oscillator Value: 0x08

This register contains the current count of the xCORE Tile Wire ring oscillator. This value is not reset on a system reset.

0x08: Ring Oscillator Value

Bits	Perm	Init	Description
31:16	RO	-	Reserved
15:0	RO	0	Ring oscillator Counter data.

B.9 Ring Oscillator Value: 0x09

This register contains the current count of the Peripheral Cell ring oscillator. This value is not reset on a system reset.

0x09: Ring Oscillator Value

Bits	Perm	Init	Description
31:16	RO	-	Reserved
15:0	RO	0	Ring oscillator Counter data.

B.10 Ring Oscillator Value: 0x0A

This register contains the current count of the Peripheral Wire ring oscillator. This value is not reset on a system reset.

0x0A: Ring Oscillator Value

Bits	Perm	Init	Description
31:16	RO	-	Reserved
15:0	RO	0	Ring oscillator Counter data.

B.11 RAM size: 0x0C

The size of the RAM in bytes

0x00: Device identification

Bits	Perm	Init	Description
31:24	CRO		Processor ID of this XCore.
23:16	CRO		Number of the node in which this XCore is located.
15:8	CRO		XCore revision.
7:0	CRO		XCore version.

C.2 xCORE Tile description 1: 0x01

This register describes the number of logical cores, synchronisers, locks and channel ends available on this xCORE tile.

0x01: xCORE Tile description 1

Bits	Perm	Init	Description
31:24	CRO		Number of channel ends.
23:16	CRO		Number of the locks.
15:8	CRO		Number of synchronisers.
7:0	RO	-	Reserved

C.3 xCORE Tile description 2: 0x02

This register describes the number of timers and clock blocks available on this xCORE tile.

0x02: xCORE Tile description 2

Bits	Perm	Init	Description
31:16	RO	-	Reserved
15:8	CRO		Number of clock blocks.
7:0	CRO		Number of timers.

C.4 Control PSwitch permissions to debug registers: 0x04

This register can be used to control whether the debug registers (marked with permission CRW) are accessible through the tile configuration registers. When this bit is set, write -access to those registers is disabled, preventing debugging of the xCORE tile over the interconnect.

0x04: Control PSwitch permissions to debug registers

Bits	Perm	Init	Description
31	CRW	0	When 1 the PSwitch is restricted to RO access to all CRW registers from SSwitch, XCore(PS_DBG_Scratch) and JTAG
30:1	RO	-	Reserved
0	CRW	0	When 1 the PSwitch is restricted to RO access to all CRW registers from SSwitch

C.5 Cause debug interrupts: 0x05

This register can be used to raise a debug interrupt in this xCORE tile.

0x05: Cause debug interrupts

Bits	Perm	Init	Description
31:2	RO	-	Reserved
1	CRW	0	1 when the processor is in debug mode.
0	CRW	0	Request a debug interrupt on the processor.

C.6 xCORE Tile clock divider: 0x06

This register contains the value used to divide the PLL clock to create the xCORE tile clock. The divider is enabled under control of the tile control register

0x06: xCORE Tile clock divider

Bits	Perm	Init	Description
31	CRW	0	Clock disable. Writing '1' will remove the clock to the tile.
30:16	RO	-	Reserved
15:0	CRW	0	Clock divider.

C.7 Security configuration: 0x07

Copy of the security register as read from OTP.

C.24 SR of logical core 7: 0x67

Value of the SR of logical core 7

0x67: SR of logical core 7

Bits	Perm	Init	Description
31:0	CRO		Value.

D.2 System switch description: 0x01

This register specifies the number of processors and links that are connected to this switch.

0x01: System switch description

Bits	Perm	Init	Description
31:24	RO	-	Reserved
23:16	RO		Number of SLinks on the SSwitch.
15:8	RO		Number of processors on the SSwitch.
7:0	RO		Number of processors on the device.

D.3 Switch configuration: 0x04

This register enables the setting of two security modes (that disable updates to the PLL or any other registers) and the header-mode.

0x04: Switch configuration

Bits	Perm	Init	Description
31	RW	0	0 = SSCTL registers have write access. 1 = SSCTL registers can not be written to.
30:9	RO	-	Reserved
8	RW	0	0 = PLL_CTL_REG has write access. 1 = PLL_CTL_REG can not be written to.
7:1	RO	-	Reserved
0	RW	0	0 = 2-byte headers, 1 = 1-byte headers (reset as 0).

D.4 Switch node identifier: 0x05

This register contains the node identifier.

0x05: Switch node identifier

Bits	Perm	Init	Description
31:16	RO	-	Reserved
15:0	RW	0	The unique ID of this node.

D.5 PLL settings: 0x06

An on-chip PLL multiplies the input clock up to a higher frequency clock, used to clock the I/O, processor, and switch, see Oscillator. Note: a write to this register will cause the tile to be reset.

0x06: PLL settings

Bits	Perm	Init	Description
31	RW		If set to 1, the chip will not be reset
30	RW		If set to 1, the chip will not wait for the PLL to re-lock. Only use this if a gradual change is made to the PLL
29	DW		If set to 1, set the PLL to be bypassed
28	DW		If set to 1, set the boot mode to boot from JTAG
27:26	RO	-	Reserved
25:23	RW		Output divider value range from 1 (8'h0) to 250 (8'hF9). P value.
22:21	RO	-	Reserved
20:8	RW		Feedback multiplication ratio, range from 1 (8'h0) to 255 (8'hFE). M value.
7	RO	-	Reserved
6:0	RW		Oscilator input divider value range from 1 (8'h0) to 32 (8'h0F). N value.

D.6 System switch clock divider: 0x07

Sets the ratio of the PLL clock and the switch clock.

0x07: System switch clock divider

Bits	Perm	Init	Description
31:16	RO	-	Reserved
15:0	RW	0	SSwitch clock generation

D.7 Reference clock: 0x08

Sets the ratio of the PLL clock and the reference clock used by the node.

0x08: Reference clock

Bits	Perm	Init	Description
31:16	RO	-	Reserved
15:0	RW	3	Software ref. clock divider

Bits	Perm	Init	Description
31:26	RO	-	Reserved
25:24	RO		Identify the SRC_TARGET type 0 - SLink, 1 - PLink, 2 - SSCTL, 3 - Undefine.
23:16	RO		When the link is in use, this is the destination link number to which all packets are sent.
15:6	RO	-	Reserved
5:4	RW	0	Determines the network to which this link belongs, reset as 0.
3	RO	-	Reserved
2	RO		1 when the current packet is considered junk and will be thrown away.
1	RO		1 when the dest side of the link is in use.
0	RO		1 when the source side of the link is in use.

0x40 .. 0x47: PLink status and network

D.17 Link configuration and initialization: 0x80 .. 0x88

These registers contain configuration and debugging information specific to external links. The link speed and width can be set, the link can be initialized, and the link status can be monitored. The registers control links 0..7.

Bits	Perm	Init	Description
31	RW		Write to this bit with '1' will enable the XLink, writing '0' will disable it. This bit controls the muxing of ports with overlapping xlinks.
30	RW	0	0: operate in 2 wire mode; 1: operate in 5 wire mode
29:28	RO	-	Reserved
27	RO		Rx buffer overflow or illegal token encoding received.
26	RO	0	This end of the xlink has issued credit to allow the remote end to transmit
25	RO	0	This end of the xlink has credit to allow it to transmit.
24	WO		Clear this end of the xlink's credit and issue a HELLO token.
23	WO		Reset the receiver. The next symbol that is detected will be the first symbol in a token.
22	RO	-	Reserved
21:11	RW	0	Specify min. number of idle system clocks between two continuous symbols witin a transmit token -1.
10:0	RW	0	Specify min. number of idle system clocks between two continuous transmit tokens -1.

0x80 .. 0x88: Link configuration and initialization

F USB PHY Configuration

The USB PHY is connected to the ports shown in section 10.

The *USB PHY* is peripheral 1. The control registers are accessed using 32-bit reads and writes (use `write_periph_32(device, 1, ...)` and `read_periph_32(device, 1, ...)` for reads and writes).

Number	Perm	Description
0x00	WO	UIFM reset
0x04	RW	UIFM IFM control
0x08	RW	UIFM Device Address
0x0C	RW	UIFM functional control
0x10	RW	UIFM on-the-go control
0x14	RO	UIFM on-the-go flags
0x18	RW	UIFM Serial Control
0x1C	RW	UIFM signal flags
0x20	RW	UIFM Sticky flags
0x24	RW	UIFM port masks
0x28	RW	UIFM SOF value
0x2C	RO	UIFM PID
0x30	RO	UIFM Endpoint
0x34	RW	UIFM Endpoint match
0x38	RW	OTG Flags mask
0x3C	RW	UIFM power signalling
0x40	RW	UIFM PHY control

Figure 35: Summary

F.1 UIFM reset: 0x00

A write to this register with any data resets all UIFM state, but does not otherwise affect the phy.

0x00: UIFM reset

Bits	Perm	Init	Description
31:0	WO		Value.

F.2 UIFM IFM control: 0x04

General settings of the UIFM IFM state machine.

0x10: UIFM on-the-go control

Bits	Perm	Init	Description
31:8	RO	-	Reserved
7	RW	0	Set to 1 to switch UIFM to EXTVBUSIND mode.
6	RW	0	Set to 1 to switch UIFM to DRVVBUSEXT mode.
5	RO	-	Reserved
4	RW	0	Set to 1 to switch UIFM to UTMI+ CHRGVBUS mode.
3	RW	0	Set to 1 to switch UIFM to UTMI+ DISCHRGVBUS mode.
2	RW	0	Set to 1 to switch UIFM to UTMI+ DMPULLDOWN mode.
1	RW	0	Set to 1 to switch UIFM to UTMI+ DPPULLDOWN mode.
0	RW	0	Set to 1 to switch UIFM to IDPULLUP mode.

F.6 UIFM on-the-go flags: 0x14

Status flags used for on-the-go negotiation

0x14: UIFM on-the-go flags

Bits	Perm	Init	Description
31:6	RO	-	Reserved
5	RO	0	Value of UTMI+ Bvalid flag.
4	RO	0	Value of UTMI+ IDGND flag.
3	RO	0	Value of UTMI+ HOSTDIS flag.
2	RO	0	Value of UTMI+ VBUSVLD flag.
1	RO	0	Value of UTMI+ SESSVLD flag.
0	RO	0	Value of UTMI+ SESSEND flag.

G Device Errata

This section describes minor operational differences from the data sheet and recommended workarounds. As device and documentation issues become known, this section will be updated the document revised.

To guarantee a logic low is seen on the pins RST_N, TRST_N, TMS, and TDI, the driving circuit should present an impedance of less than 100 Ω to ground. Usually this is not a problem for CMOS drivers driving single inputs. If one or more of these inputs are placed in parallel, however, additional logic buffers may be required to guarantee correct operation.

For static inputs tied high or low, the relevant input pin should be tied directly to GND or VDDIO.

H JTAG, xSCOPE and Debugging

If you intend to design a board that can be used with the XMOS toolchain and xTAG debugger, you will need an xSYS header on your board. Figure 36 shows a decision diagram which explains what type of xSYS connectivity you need. The three subsections below explain the options in detail.

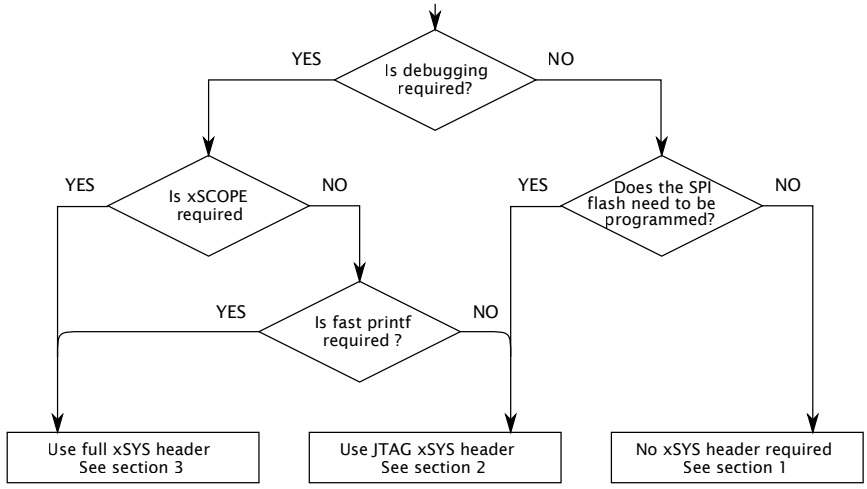


Figure 36: Decision diagram for the xSYS header

H.1 No xSYS header

The use of an xSYS header is optional, and may not be required for volume production designs. However, the XMOS toolchain expects the xSYS header; if you do not have an xSYS header then you must provide your own method for writing to flash/OTP and for debugging.

K Associated Design Documentation

Document Title	Information	Document Number
Estimating Power Consumption For XS1-UF Devices	Power consumption	
Programming XC on XMOS Devices	Timers, ports, clocks, cores and channels	X9577
xTIMEcomposer User Guide	Compilers, assembler and linker/mapper Timing analyzer, xScope, debugger Flash and OTP programming utilities	X3766

L Related Documentation

Document Title	Information	Document Number
The XMOS XS1 Architecture	ISA manual	X7879
XS1 Port I/O Timing	Port timings	X5821
xCONNECT Architecture	Link, switch and system information	X4249
XS1-UF Link Performance and Design Guidelines	Link timings	
XS1-UF Clock Frequency Control	Advanced clock control	