X2100

IoT Application Processor

Data Sheet

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CONTENTS

1 Overview

X2100 is a low power consumption, high performance and high integrated application processor, the application is focus on IoT devices. And it can match the requirements of many other embedded products.

1.1 Block Diagram

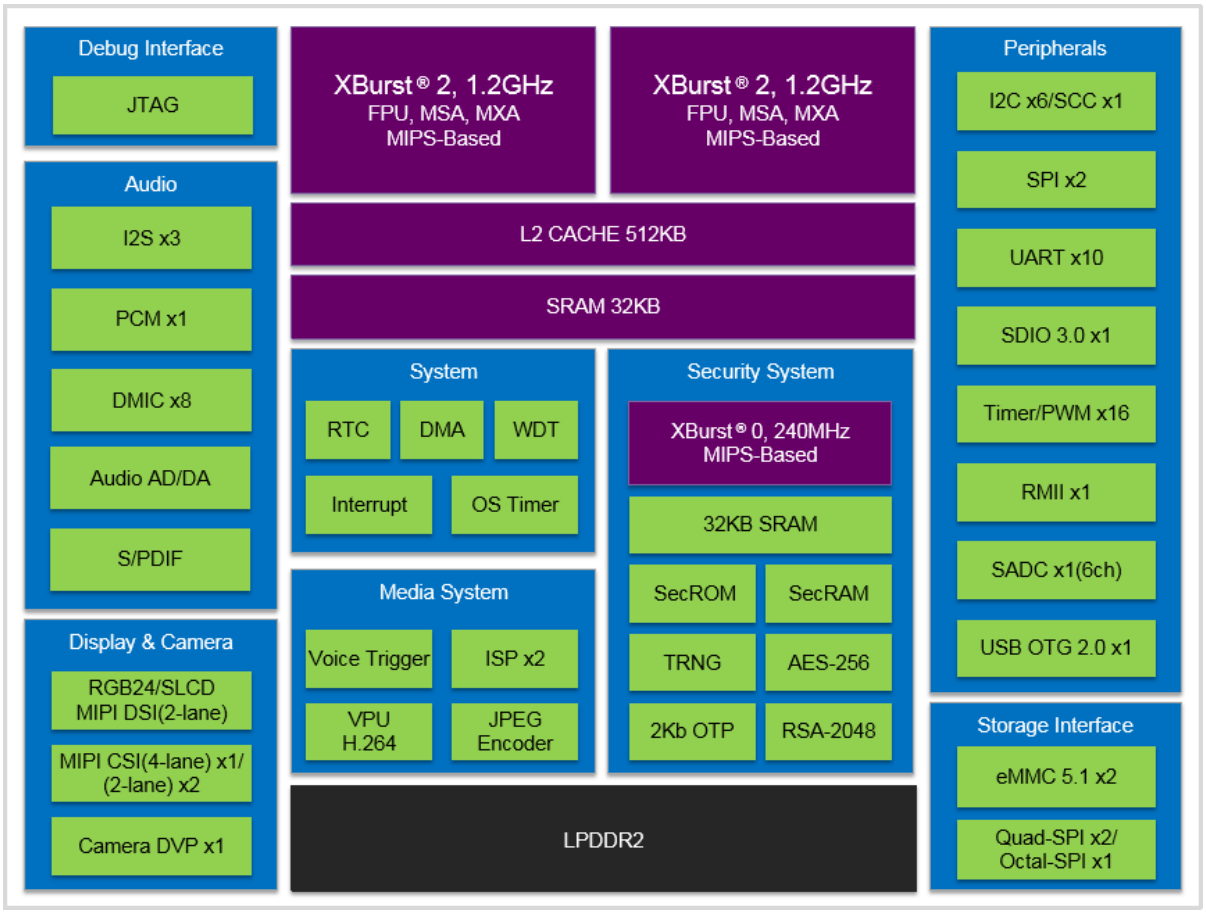


Figure 1-1 X2100 Diagram

1.2 Features

1.2.1 CPU Core

- XBurst® 2, at 1.2GHz, Dual Core, Dual-issue, high performance and low power implementation of MIPS32 ISA R5
- MIPS32 ISA R5 plus MIPS SIMD instruction set architecture:128bit MSA
- Ingenic SIMD instruction set architecture: 128bit MXA
- Dual-issue, superscalar, super pipeline with Simultaneous Multi-Threading (SMT)
  - 2 hardware threads per physical core
  - Quad instruction fetch per cycle
  - Dual issue instructions per cycle per thread
- 32KB L1 D cache +32K L1 I cache，512 KB L2 cache，32KB SRAM
- High-performance Floating-point Unit and SIMD Engine: FSE
  - 32 x 128-bit register set, 128-bit loads/stores to/from SIMD unit
  - IEEE-754 2008 compliant
- Programmable Memory Management Unit (MMU)
  - 1st level mini-TLBs (MTLBs) – 8 x 2 entry instruction TLB, 16 x 2 entry data TLB
  - 2nd level TLBs: 32 × 2 entry VTLB, 256 × 2 entry 4-way set associative FTLB
- The XBurst® processor system supports little endian only

1.2.2 Video Process Unit(VPU)

- H.264 Encoder
  - Input data format NV12/NV21
  - Encoding resolution and frame rate up to 1920x1080@30fps
  - Support hardware RBSP bytes insertion
  - Support auto-read of slice header
  - Support reference frame lossless compression
- H.264 Decoder
  - Output data format NV12/NV21
  - Decoding resolution and frame rate up to 1920x1080@30fps
  - Support hardware RBSP bytes eliminate
- JPEG Codec
  - JPEG compressing/decompressing up to 70Mega-pixels per second
  - Baseline ISO/IEC 10918-1 JPEG compliant
  - 8-bit pixel depth support
  - Up to four programmable Quantization tables
  - Fully programmable Huffman tables

1.2.3 Image Signal Processor(ISPx2)

- Data stream feature
  - DVP： raw8 / 10 / 12 / YUV422 input
  - MIPI： up to 1080P@60fps
  - Support dual-camera sync
  - Frame data check, make up for lost data and drop redundant data

- Advanced feature
  - 2A(Auto Exposure/Auto White Balance) supported
  - Advanced demosaic, color processing, lens shading, sharpen, static/dynamic defect pixel and other modules provide high image quality
  - 2-D noise reduction filter

1.2.4 Memory Interface

- DDR Controller
  - Support LPDDR2, 16Bit bus width, clock up to 800MHz
  - 64MB memory in package,
- SFC Controller
  - 1 group clock and CE pad
  - Two Quad SPI, one Octal SPI (SFC0/1)
  - Support Standard, Dual, Quad SPI and Octal DDR protocol
  - Clock frequency up to 80MHz in SDR mode
  - Support multiple transfer modes, standard SPI, dual-output/dual-Input SPI, Quad-Output/Quad-Input SPI, Dual-I/O SPI, Quad-I/O SPI, Full Dual-I/O SPI, Full Quad-I/O SPI, and Octal-I/O

1.2.5 Audio

- Digital Microphone Array Controller
  - Support 8 channels digital MIC
  - 24/16bit precision internal controller, sample rate support 8K, 16K, 32K, 48K and 96K
  - SNR: 90dB, THD: -90dB @ FS -20dB
  - Linear high pass filter include. Attenuation: -2.9dB@100Hz, -22dB@27Hz. -36dB@10Hz
  - Low power voice trigger when waiting to start talking.
  - Support voice data pre-fetch when trigger enable and the data interface disable, but do not increase the power dissipation.
  - Support low power voice trigger enable
- I2S(1~3) / I2S0
  - DMA transfer mode supported
  - Support share clock mode and split clock mode.
  - I2S0: Internal I2S CODEC supported
  - Support master mode and slave mode
  - Support number of data pin from 1 to 4
  - Support six modes of operation for TDM protocol
- PCM interface
  - Support master mode and slave mode
  - Support four modes of operation for PCM
    - DSP NORMAL \ LEFT MODE
    - PCM NORMAL \ LEFT MOD
- S/PDIF(IN and OUT)
  - Support IEC 60958-3 compliant, up to 2 channels

- Sample bit support 20-bit and 24-bit two mode
- Sample rate support, all of IEC60958-3 sample rate(44.1k up to 192k)

- Internal Audio Codec (**DAC and ADC working together**)
  - 24 bits DAC / ADC
  - Sample rate supported: 8k, 12k, 16k, 24k, 32k, 44.1k,48k,96k
  - **Mono Differential input/output**
  - DAC : SNR: 90dB A-Weighted, THD: -80dB @FS，-1dB ；ADC: SNR 90dB

1.2.6 MIPI-CSI

- MIPI-CSI2(v1.0) interface, resolution up to 1080P@120fps
  – Support dual 2-lane mode and single 4-lane mode
  – Support 1-lane, 2-lane and 4-lane mode

1.2.7 Camera

- Camera interface module(CIM)
  - Support DVP 8bit / MIPI input ,resolution up to 1280x720@30fps
  - Support snapshot control
  - Supported data format: RGB888, RGB565, YCbCr 4:2:2
  - Supports ITU656 (YCbCr 4:2:2) input
  - Support histogram output and global binarization

1.2.8 Display

- MIPI-DSI2(v1.0) interface
  Display size up to 1920x1080@40Hz
- SLCD controller
  - Display size up to 640x480@60Hz, 24BPP
  - Supports different size of display panel
- RGB controller
  - Display size up to 1280x720@60Hz, 24BPP
  - Support input format, ARGB8888, ARGB1555, RGB888, RGB565, RGB555, YUV422, YUV420
  - Support 4 modes parallel interface, 24-bit, 18-bit, 16-bit and 8-bit(third times)
  - Support frame buffer crop and dither

1.2.9 System Functions

- Clock generation and power management
  - On-chip oscillator circuit (support 24MHz)
  - Two phase-locked loops (PLL) with programmable multiplier
  - CCLK, HHCLK, H2CLK, PCLK, H0CLK, DDR_CLK frequency can be changed separately for software by setting registers
  - Functional-unit clock gating
  - Supply block power shut down

- TCU
  - 8 channels each channel has two pins
  - Support posedge / negedge / dualedge clock counting
  - Support gate counting(only count for gating signal)
  - Support quadrature counting
  - Support direction counting(add / sub because of input signal)
  - Support counting after posedge / negedge signal
  - Support capture counting, output signal high-level time and total cycle time
  - Support exclk / pclk two clock source
- PWM
  - 16 channels, output signal ~50MHz, signal precision ~500MHz
  - Cpu / dma mode to update config
- OS timer
  - One event timer for one logic core
  - One global timer for system time

- Interrupt controller
  - Total 64 interrupt sources
  - Each interrupt source can be independently enabled

- Watchdog timer
  - A 16-bit Data register and a 16-bit counter
  - Programmable interrupt generation prior to timeout
  - Counter clock uses the input clock selected by software
    - EXTAL / RTCCLK can be used as the clock for counter
    - The division ratio of the clock can be set to 1, 4, 16, 64, 256 and 1024 by software

- PDMA Controller
  - Support up to 32 independent DMA channels
  - Descriptor or No-Descriptor Transfer mode
  - Transfer data units: 1-byte, 2-byte, 4-byte, 16-byte, 32-byte, 64-byte, 128-byte
  - Transfer number of data unit: 1 ~ 2^{24} - 1
  - Independent source and destination port width: 8-bit, 16-bit, 32-bit
  - Fixed three priorities of channel groups: 0~3, highest; 4~11: mid; 12~31: lowest

- SAR A/D Controller
  - 6 Channels
  - Resolution: 10-bit

- RTC (Real Time Clock)
  - Need external 32768Hz oscillator for 32KHz clock generation.
  - 32-bits second counter
  - Programmable and adjustable counter to generate accurate 1 Hz clock

- Alarm interrupt, 1Hz interrupt
- Stand alone power supply, work in hibernating mode
- Power down controller
- Alarm wakeup
- External pin wakeup with up to 2s glitch filter
- Power Detect to Shut down PMU (find Core without voltage then shut PMU other voltage)

1.2.10 Peripherals

- General-Purpose I/O ports
  - Input / output / function port configurable
  - Low/high, rising/falling edge triggering. Every interrupt source can be masked independent
- Six I2C Controller (I2C0~5)
  - Two-wire I2C serial interface – consists of a serial data line (SDA) and a serial clock (SCL)
  - Three speeds mode
    - Standard mode (100 Kb/s)
    - Fast mode (400 Kb/s)
    - High speed mode (3.4Mb/s)
  - Programmable SCL generator
  - Master or slave I2C operation
  - 7-bit addressing/10-bit addressing
  - The number of devices that you can connect to the same I2C-bus is limited only by the maximum bus capacitance of 400pF

- One Smart Card Controller (SCC)
  - Supports normal card and UIM card.
  - Supports asynchronous character (T=0) communication modes.
  - Supports asynchronous block (T=1) communication modes.
  - Supports setting of clock-rate conversion factor F (372, 512, 558, etc.), and bit-rate adjustment factor D (1, 2, 4, 8, 16, 32, 12, 20, etc.).
  - Supports extra guard time waiting.
  - Auto-error detection in T=0 receive mode.
  - Auto-character repeat in T=0 transmit mode.
  - Transforms inverted format to regular format and vice versa.
  - Support stop clock function in some power consuming sensitive applications.

- Two Synchronous serial interfaces (SSI0~1)
  - 3 protocols support: National's Microwire, TI's SSP, and Motorola's SPI
  - Full-duplex or transmit-only or receive-only operation
  - Programmable transfer order: MSB first or LSB first

- Configurable normal transfer mode or Interval transfer mode
- Programmable clock phase and polarity for Motorola's SSI format
- Two slave select signal (SSI0_CE0_ / SSI1_CE0_) supporting up to 2 slave devices
- Back-to-back character transmission/reception mode
- Loop back mode for testing
- Data transfer up to 30Mbits/s

- Ten UARTs (UART0~9)
  - Full-duplex operation
  - Baud rate supports 4800, 9600, 19200, 38400, 43000, 56000, 57600, 115200, 230400, 460800, 576000, 921600, 1000000, 1152000, 1500000, 2000000, 2500000, 3000000, 3500000, 4000000, 6000000, 8000000, 12000000
  - 5-, 6-, 7- or 8-bit characters with optional no parity or even or odd parity and with 1, 1½, or 2 stop bits
  - Internal diagnostic capability Loopback control and break, parity, overrun and framing-error is provided
  - Separate DMA requests for transmit and receive data services in FIFO mode
  - Supports modem flow control by software or hardware

- Three MMC/SD/SDIO controllers (MSC0,MSC2,SDIO)
  - All support eMMC 5.1 (command queueing)
  - Support SD Specification 3.0
  - Support SD I/O Specification 1.0 with 1 command channel and 4 data channels
  - Maximum clock speed is 104MHz
  - Both support MMC data width 1bit ,4bit, only MSC0 support 8bit
  - Single or multi block access to the card including erase operation
  - The maximum block length is 4096bytes

- USB 2.0 OTG interface
  - Complies with the USB 2.0 standard for high-speed (480 Mbps) functions and with the On-The-Go supplement to the USB 2.0 specification
  - Support operating as USB peripheral, as USB host
  - Support split transmission
  - Support hub
  - Support remote-wakeup

- MAC controller
  - 10/100 Mbps operation
  - Supports RMII PHY interfaces
  - Support IEEE 1588-2002

- Security System
  - XBurst®, 240MHz

- Secret ROM and RAM
- Up to 32KB SRAM
- True Random Number Generator
- Encryption Engine
  - MD5, SHA, SHA2
  - AES, support 256-bit, 192-bit, 128-bit key size Algorithm
  - RSA, support 1024/2048-bit key size
- Support secure boot

- OTP Slave Interface
  - Total 2Kb.

1.2.11 Bootrom

16KB Boot ROM memory and 16KB Security Boot ROM

2 PAD Information

2.1 Pin Map

X2100 Ball Assignment Ver1.0

BGA264, 10mm X 10mm X 1.2mm, 0.43mm row/column pitch, top view

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
A	SDIO_CMD_SSI0_DT_PD09		SDIO_D3_SSI0_CE0__PD13		AVDEFUSE		UART3_TXD_PCM_DO_TCK_PD03		VDDMEM		VDDMEM		VREF		DDRPLL_VCCA		UART3_TXD_I2C4_SDA_PC26		SD0_LCD_D16_PB16		SD2_LCD_D18_PB18		SAIT_LCD_D11_SLCD_D11_PB11	A
B		SDIO_D1_I2C1_SCK_PD11		UART2_RXD_I2C3_SCK_PWM0_TCU0_IN0_PD30		UART3_RXD_PCM_CLK_TDI_PD02		I2C5_SDA_PCM_SYNC_PD05		VDDMEM		DDR_VDD1		ZQ		UART3_RXD_I2C4_SCK_PC25		UART3_RTS__I2C5_SDA_PC28		SD8_LCD_PCLK_SLCD_CE__PB24		SA12_LCD_D12_SLCD_D12_PB12		B
C	SDIO_CLK_SSI0_CLK_PD08		SDIO_D0_SSI0_DR_PD10		UART2_TXD_I2C3_SDA_PWM1_TCU0_IN1_PD31		I2C5_SCK_PCM_DI_TMS_PD04		VDDMEM		VDDMEM		DDR_VDD1		DDR_VSSA		UART3_CTS__I2C5_SCK_PC27		SD11_LCD_DE_SLCD_TE_PB27		RD__LCD_D13_SLCD_D13_PB13		SD5_LCD_D21_PB21	C
D		MSC0_D2_SFC0_DQ2_WP__I2C2_SDA_PD21		SDIO_D2_I2C1_SDA_PD12			UART3_RTS__I2C4_SDA_TDO_PD01		VSS		VSS		VSS		VSS	VDDMEM		SD15_SSI0_CLK_UART9_TXD_PB31		SD9_LCD_VSYNC_SLCD_DC_PB25		WE__LCD_D14_SLCD_D14_PB14		D
E	MSC0_D0_SFC0_DQ0_SSI1_DR_PD19		MSC0_D3_SFC0_DQ3_HOLD__SSI1_CE0__PD22		MSC0_D7_SFC1_DQ3_HOLD__UART0_RTS__PD26		UART3_CTS__I2C4_SCK_PD00		VSS		VDDMEM		VDDMEM		VDDMEM		VSS		SD14_SSI0_DT_UART9_RXD_PB30		SD7_LCD_D23_I2C2_SDA_PB23		SA8_LCD_D8_SLCD_D8_PB08	E
F		MSC0_D1_SFC0_DQ1_I2C2_SCK_PD20		MSC0_D6_SFC1_DQ2_WP__UART0_CTS__PD25		TRST		VSS		VSS		VSS		VSS		VSS		SD13_SSI0_DR_UART8_TXD_PB29		SD12_SSI0_CE0__UART8_RXD_PB28		SA9_LCD_D9_SLCD_D9_PB09		F
G	MSC0_CLK_SFC0_CLK_SSI1_CLK_PD17		MSC0_CMD_SFC0_CE__SSI1_DT_PD18		MSC0_D4_SFC1_DQ0_UART0_RXD_PD23				VDD		VDD		VSS		VDD		VSS		SD10_LCD_HSYNC_SLCD_WR_PB26		SD6_LCD_D22_I2C2_SCK_PB22		SA3_LCD_D3_SLCD_D3_PB03	G
H		VDDIO_RTC		MSC0_D5_SFC1_DQ1_UART0_TXD_PD24		EXCLK_CIM_VIC_MCLK_PE24		VSS		VDD		VSS		VDD		VDD		SD4_LCD_D20_PB20		WAIT__LCD_D15_SLCD_D15_PB15		SA4_LCD_D4_SLCD_D4_PB04		H
J	VDD_RTC		PWRON		RTC32K_PE23		VSS		VSS		VDD		VDD		VDD		VSS		SD3_LCD_D19_PB19		SA6_LCD_D6_SLCD_D6_PB06		SA1_LCD_D1_SLCD_D1_PB01	J
K		OSC32_XI		OSC32_XO		PPRST_		VDDIO		VSS		VSS		VDD		VSS		SA10_LCD_D10_SLCD_D10_PB10		SD1_LCD_D17_PB17		SA2_LCD_D2_SLCD_D2_PB02		K
L	PLL_AVDD		WKUP_PE31		VSS_RTC		VDDIO		VDD		VSS		VSS		VSS		VSS		SA5_LCD_D5_SLCD_D5_PB05		TX_DATAP0		TX_DATAN0	L
M		PLL_VDD		PLL_AVSS		PLL_VSS		VSS		VDD		VSS		VDD		VDDIO33		SA7_LCD_D7_SLCD_D7_PB07		SA0_LCD_D0_SLCD_D0_PB00		TX_DATAP1		M
N	EXCLK_XI		EXCLK_XO		BOOT_SEL1_PE26		VSS		VDD		VSS		VDD		VDD		VDDIO18		DSI_AVD09		TX_CLKP		TX_DATAN1	N
P		I2C3_SDA_I2S2_RX_BCLK_PA17		BOOT_SEL2_PE27		BOOT_SEL0_PE25		VSS		VDD		VSS		VDD		VDDIO33		DSI_AVSS		DSI_AVD18		TX_CLKN		P
R	I2C3_SCK_I2S3_TX_BCLK_PA16		CIM_VIC_VSYNC_I2S2_RX_DATA3_PA13		CIM_VIC_HSYNC_I2S2_RX_DATA2_PA12		VSS		VSS		VSS		VDD		VDD		VDDIO18		CSI_AVD09		RX_DATAN0		RX_DATAP0	R
T		CIM_VIC_PCLK_PA14		CIM_EXPOSURE_PA15		VIC_D10_I2S2_RX_DATA0_PA10		VDDIO18_CIM		VSS		VDDIO33_SD		VSS		VSS		CSI_AVSS		CSI_AVD18		RX_DATAP1		T
U	VIC_D8_UART7_RXD_PA08		VIC_D9_UART7_TXD_I2S2_RX_LRCK_PA09		VIC_D11_I2S2_RX_DATA1_PA11		VDDIO33_CIM		VSS		VDDIO18_SD		VSS		VSS		VSS		DMIC_IN2_UART1_RXD_I2C1_SCK_NEMC_CS1__PC23		RX_CLKP0		RX_DATAN1	U
V		CIM_VIC_D7_UART6_TXD_I2S2_RX_MCLK_PA07		CIM_VIC_D6_UART6_RXD_I2S3_TX_DATA3_PA06		CIM_VIC_D5_UART5_TXD_I2S3_TX_DATA2_PA05		USB_AVSS		MSC2_D1_PWM5_TCU2_IN1_PE03		MSC2_D3_PWM7_TCU3_IN1_PE05		PWM6_TCU3_IN0_RMII0_RXD0_I2S1_TX_LRCK_UART5_TXD_PC06		PWM11_TCU5_IN1_RMII0_RX_DV_SSI1_DT_UART4_RXD_PC11		DMIC_IN0_UART1_CTS__PC21		DMIC_IN3_UART1_TXD_I2C1_SDA_NEMC_CS2__PC24		RX_CLKN0		V
W	CIM_VIC_D2_UART4_RXD_I2S3_TX_LRCK_PA02		CIM_VIC_D3_UART4_TXD_I2S3_TX_DATA0_PA03		CIM_VIC_D4_UART5_RXD_I2S3_TX_DATA1_PA04		SADC_AVSS		CODEC_AVSS		MSC2_CMD_PWM3_TCU1_IN1_PE01		MSC2_CLK_PWM2_TCU1_IN0_PE00		PWM7_TCU3_IN1_RMII0_RXD1_I2S1_TX_DATA_UART6_RXD_PC07		PWM0_TCU0_IN0_PC00		DMIC_IN1_UART1_RTS__PC22		RX_DATAP2		RX_DATAN2	W
Y		CIM_VIC_D1_UART4_RTS__PA01		AUX2		AUX0		USB_AVD33		MSC2_D0_PWM4_TCU2_IN0_PE02		MSC2_D2_PWM6_TCU3_IN0_PE04		PWM10_TCU5_IN0_RMII0_TX_EN_SSI1_DR_UART4_RTS__PC10		PWM4_TCU2_IN0_I2S1_RX_DATA_SCC_SDA_PC04		DMIC_CLK_PC20		PWM1_TCU0_IN1_RMII0_PHY_CLK_I2S1_RX_MCLK_UART7_RXD_PC01		RX_DATAP3		Y
AA	CIM_VIC_D0_UART4_CTS__I2S3_TX_MCLK_PA00		AUX4		USB_DM0		USB_AVD18		CODEC_MICLN		CODEC_HPOUTP		SFC0_DQ0_SSI1_DR_PE18		SFC0_DQ1_I2C2_SCK_PE19		PWM5_TCU2_IN1_I2S1_TX_BCLK_UART5_RXD_PC05		PWM8_TCU4_IN0_I2S1_TX_MCLK_UART6_TXD_PC08		RX_CLKP1		RX_DATAN3	AA
AB		AUX1		AUX5		USB_AVD09		CODEC_MICLP		CODEC_AVDD		SFC0_CE__SSI1_DT_PE17		SFC0_DQ3_HOLD__SSI1_CE0__PE21		PWM3_TCU1_IN1_RMII0_TXD1_I2S1_RX_LRCK_SCC_SCK_PC03		PWM14_TCU7_IN0_SPDIF_OUT_I2C0_SDA_PC14		PWM15_TCU7_IN1_RMII0_RX_CLK_CIM_VIC_MCLK_PC15		RX_CLKN1		AB
AC	AUX3		SADC_AVDD		USB_DP0		USB_BIAS		CODEC_VCM		CODEC_HPOUTN		SFC0_CLK_SSI1_CLK_PE16		SFC0_DQ2_WP_I2C2_SDA_PE20		PWM2_TCU1_IN0_RMII0_TXD0_I2S1_RX_BCLK_UART7_TXD_PC02		PWM9_TCU4_IN1_SSI1_CE0__UART4_CTS__PC09		PWM12_TCU6_IN0_RMII0_MDC_SSI1_CLK_UART4_TXD_PC12		PWM13_TCU6_IN1_RMII0_MDIO_SPDIF_IN_I2C0_SCK_PC13	AC
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	

2.2 Pin Description

2.2.1 GPIO Group A

Ball No.	Ball Name	In/ Out	Pull	Slew Rate	Sch mitt	GPIO	Func0	Func1	Func2	Power
AA1	CIM_VIC_D0_ UART4_CTS__ I2S3_TX_MCLK_PA00	IO	PU	Yes	Yes	GPA[0]	CIM/VIC_D0	UART4_CTS_	I2S3_TX_MCLK	VDDIO33_CIM
Y2	CIM_VIC_D1_UART4_RTS__PA01	IO	PU	Yes	Yes	GPA[1]	CIM/VIC_D1	UART4_RTS_		VDDIO33_CIM
W1	CIM_VIC_D2_UART4_RXD_I2S3_TX_LRCK_PA02	IO	PU	Yes	Yes	GPA[2]	CIM/VIC_D2	UART4_RXD	I2S3_TX_LRCK	VDDIO33_CIM
W3	CIM_VIC_D3_UART4_TXD_I2S3_TX_DATA0_PA03	IO	PU	Yes	Yes	GPA[3]	CIM/VIC_D3	UART4_TXD	I2S3_TX_DATA0	VDDIO33_CIM
W5	CIM_VIC_D4_UART5_RXD_I2S3_TX_DATA1_PA04	IO	PU	Yes	Yes	GPA[4]	CIM/VIC_D4	UART5_RXD	I2S3_TX_DATA1	VDDIO33_CIM
V6	CIM_VIC_D5_UART5_TXD_I2S3_TX_DATA2_PA05	IO	PU	Yes	Yes	GPA[5]	CIM/VIC_D5	UART5_TXD	I2S3_TX_DATA2	VDDIO33_CIM
V4	CIM_VIC_D6_UART6_RXD_I2S3_TX_DATA3_PA06	IO	PU	Yes	Yes	GPA[6]	CIM/VIC_D6	UART6_RXD	I2S3_TX_DATA3	VDDIO33_CIM
V2	CIM_VIC_D7_UART6_TXD_I2S2_RX_MCLK_PA07	IO	PU	Yes	Yes	GPA[7]	CIM/VIC_D7	UART6_TXD	I2S2_RX_MCLK	VDDIO33_CIM
U1	VIC_D8_UART7_RXD_PA08	IO	PU	Yes	Yes	GPA[8]	VIC_D8	UART7_RXD		VDDIO33_CIM
U3	VIC_D9_UART7_TXD_I2S2_RX_LRCK_PA09	IO	PU	Yes	Yes	GPA[9]	VIC_D9	UART7_TXD	I2S2_RX_LRCK	VDDIO33_CIM
T6	VIC_D10_I2S2_RX_DATA0_PA10	IO	PU	Yes	Yes	GPA[10]	VIC_D10		I2S2_RX_DATA0	VDDIO33_CIM
U5	VIC_D11_I2S2_RX_DATA1_PA11	IO	PU	Yes	Yes	GPA[11]	VIC_D11		I2S2_RX_DATA1	VDDIO33_CIM
R5	CIM_VIC_HSYNC_I2S2_RX_DATA2_PA12	IO	PD	Yes	Yes	GPA[12]	CIM_VIC_HSYNC		I2S2_RX_DATA2	VDDIO33_CIM
R3	CIM_VIC_VSYNC_I2S2_RX_DATA3_PA13	IO	PD	Yes	Yes	GPA[13]	CIM_VIC_VSYNC		I2S2_RX_DATA3	VDDIO33_CIM
T2	CIM_VIC_PCLK_PA14	IO	PD	Yes	Yes	GPA[14]	CIM/VIC_PCLK			VDDIO33_CIM
T4	CIM_EXPOSURE_PA15	IO	PD	Yes	Yes	GPA[15]	CIM_EXPOSURE			VDDIO33_CIM
R1	I2C3_SCK_I2S3_TX_BCLK_PA16	IO	PU	Yes	Yes	GPA[16]	I2C3_SCK		I2S3_TX_BCLK	VDDIO33_CIM
P2	I2C3_SDA_I2S2_RX_BCLK_PA17	IO	PU	Yes	Yes	GPA[17]	I2C3_SDA		I2S2_RX_BCLK	VDDIO33_CIM

2.2.2 GPIO Group B

Ball No.	Ball Name	In/ Out	Pull	Slew Rate	Schmitt	GPIO	Func0	Func1	Func2	Func3	Power
M20	SA0_LCD_D0_SLCD_D0_PB00	IO	PD	No	Yes	GPB[0]	SA0	LCD_D0	SLCD_D0		VDDIO33
J23	SA1_LCD_D1_SLCD_D1_PB01	IO	PD	No	Yes	GPB[1]	SA1	LCD_D1	SLCD_D1		VDDIO33
K22	SA2_LCD_D2_SLCD_D2_PB02	IO	PD	No	Yes	GPB[2]	SA2	LCD_D2	SLCD_D2		VDDIO33
G23	SA3_LCD_D3_SLCD_D3_PB03	IO	PD	No	Yes	GPB[3]	SA3	LCD_D3	SLCD_D3		VDDIO33
H22	SA4_LCD_D4_SLCD_D4_PB04	IO	PD	No	Yes	GPB[4]	SA4	LCD_D4	SLCD_D4		VDDIO33
L19	SA5_LCD_D5_SLCD_D5_PB05	IO	PD	No	Yes	GPB[5]	SA5	LCD_D5	SLCD_D5		VDDIO33
J21	SA6_LCD_D6_SLCD_D6_PB06	IO	PD	No	Yes	GPB[6]	SA6	LCD_D6	SLCD_D6		VDDIO33
M18	SA7_LCD_D7_SLCD_D7_PB07	IO	PD	No	Yes	GPB[7]	SA7	LCD_D7	SLCD_D7		VDDIO33
E23	SA8_LCD_D8_SLCD_D8_PB08	IO	PD	No	Yes	GPB[8]	SA8	LCD_D8	SLCD_D8		VDDIO33
F22	SA9_LCD_D9_SLCD_D9_PB09	IO	PD	No	Yes	GPB[9]	SA9	LCD_D9	SLCD_D9		VDDIO33
K18	SA10_LCD_D10_SLCD_D10_PB10	IO	PD	No	Yes	GPB[10]	SA10	LCD_D10	SLCD_D10		VDDIO33
A23	SA11_LCD_D11_SLCD_D11_PB11	IO	PD	No	Yes	GPB[11]	SA11	LCD_D11	SLCD_D11		VDDIO33
B22	SA12_LCD_D12_SLCD_D12_PB12	IO	PD	No	Yes	GPB[12]	SA12	LCD_D12	SLCD_D12		VDDIO33
C21	RD__LCD_D13_SLCD_D13_PB13	IO	PU	No	Yes	GPB[13]	RD_	LCD_D13	SLCD_D13		VDDIO33
D22	WE__LCD_D14_SLCD_D14_PB14	IO	PU	No	Yes	GPB[14]	WE_	LCD_D14	SLCD_D14		VDDIO33
H20	WAIT__LCD_D15_SLCD_D15_PB15	IO	PU	No	Yes	GPB[15]	WAIT_	LCD_D15	SLCD_D15		VDDIO33
A19	SD0_LCD_D16_PB16	IO	PU	No	Yes	GPB[16]	SD0	LCD_D16	SLCDRD		VDDIO33
K20	SD1_LCD_D17_PB17	IO	PU	No	Yes	GPB[17]	SD1	LCD_D17			VDDIO33
A21	SD2_LCD_D18_PB18	IO	PU	No	Yes	GPB[18]	SD2	LCD_D18			VDDIO33
J19	SD3_LCD_D19_PB19	IO	PU	No	Yes	GPB[19]	SD3	LCD_D19			VDDIO33
H18	SD4_LCD_D20_PB20	IO	PU	No	Yes	GPB[20]	SD4	LCD_D20			VDDIO33
C23	SD5_LCD_D21_PB21	IO	PU	No	Yes	GPB[21]	SD5	LCD_D21			VDDIO33
G21	SD6_LCD_D22_I2C2_SCK_PB22	IO	PU	No	Yes	GPB[22]	SD6	LCD_D22	I2C2_SCK		VDDIO33
E21	SD7_LCD_D23_I2C2_SDA_PB23	IO	PU	No	Yes	GPB[23]	SD7	LCD_D23	I2C2_SDA		VDDIO33
B20	SD8_LCD_PCLK_SLCD_CE__PB24	IO	PU	No	Yes	GPB[24]	SD8	LCD_PCLK	SLCD_CE_		VDDIO33
D20	SD9_LCD_VSYNC_SLCD_DC_PB25	IO	PU	No	Yes	GPB[25]	SD9	LCD_VSYNC	SLCD_DC		VDDIO33
G19	SD10_LCD_HSYNC_SLCD_WR_PB26	IO	PU	No	Yes	GPB[26]	SD10	LCD_HSYNC	SLCD_WR		VDDIO33

C19	SD11_LCD_DE_SLCD_TE_PB27	IO	PU	No	Yes	GPB[27]	SD11	LCD_DE	SLCD_TE		VDDIO33
F20	SD12_SSI0_CE0__UART8_RXD_PB28	IO	PU	No	Yes	GPB[28]	SD12	SSI0_CE0_	UART8_RXD		VDDIO33
F18	SD13_SSI0_DR_UART8_TXD_PB29	IO	PU	No	Yes	GPB[29]	SD13	SSI0_DR	UART8_TXD		VDDIO33
E19	SD14_SSI0_DT_UART9_RXD_PB30	IO	PU	No	Yes	GPB[30]	SD14	SSI0_DT	UART9_RXD		VDDIO33
D18	SD15_SSI0_CLK_UART9_TXD_PB31	IO	PU	No	Yes	GPB[31]	SD15	SSI0_CLK	UART9_TXD		VDDIO33

2.2.3 GPIO Group C

Ball No.	Ball Name	In/ Out	Pull	Slew Rate	Sch mitt	GPIO	Func0	Func1	Func2	Func3	Power
W17	PWM0_TCU0_IN0_PC00	IO	PD	No	Yes	GPC[0]	PWM0_TCU0_IN0				VDDIO33
Y20	PWM1_TCU0_IN1_RMII0_PHY_CLK_I2S1_RX_MCLK_UART7_RXD_PC01	IO	PU	No	Yes	GPC[1]	PWM1_TCU0_IN1	RMII0_PHY_CLK	I2S1_RX_MCLK	UART7_RXD	VDDIO33
AC17	PWM2_TCU1_IN0_RMII0_TXD0_I2S1_RX_BCLK_UART7_TXD_PC02	IO	PU	No	Yes	GPC[2]	PWM2_TCU1_IN0	RMII0_TXD0	I2S1_RX_BCLK	UART7_TXD	VDDIO33
AB16	PWM3_TCU1_IN1_RMII0_TXD1_I2S1_RX_LRCK_SCC_SCK_PC03	IO	PU	No	Yes	GPC[3]	PWM3_TCU1_IN1	RMII0_TXD1	I2S1_RX_LRCK	SCC_SCK	VDDIO33
Y16	PWM4_TCU2_IN0_I2S1_RX_DATA_SCC_SDA_PC04	IO	PU	No	Yes	GPC[4]	PWM4_TCU2_IN0		I2S1_RX_DATA	SCC_SDA	VDDIO33
AA17	PWM5_TCU2_IN1_I2S1_TX_BCLK_UART5_RXD_PC05	IO	PU	No	Yes	GPC[5]	PWM5_TCU2_IN1		I2S1_TX_BCLK	UART5_RXD	VDDIO33
V14	PWM6_TCU3_IN0_RMII0_RXD0_I2S1_TX_LRCK_UART5_TXD_PC06	IO	PU	No	Yes	GPC[6]	PWM6_TCU3_IN0	RMII0_RXD0	I2S1_TX_LRCK	UART6_RXD	VDDIO33
W15	PWM7_TCU3_IN1_RMII0_RXD1_I2S1_TX_DATA_UART6_RXD_PC07	IO	PU	No	Yes	GPC[7]	PWM7_TCU3_IN1	RMII0_RXD1	I2S1_TX_DATA	UART6_RXD	VDDIO33
AA19	PWM8_TCU4_IN0_I2S1_TX_MCLK_UART6_TXD_PC08	IO	PU	No	Yes	GPC[8]	PWM8_TCU4_IN0		I2S1_TX_MCLK	UART6_TXD	VDDIO33
AC19	PWM9_TCU4_IN1_SSI1_CE0__UART4_CTS__PC09	IO	PU	No	Yes	GPC[9]	PWM9_TCU4_IN1		SSI1_CE0_	UART4_CTS_	VDDIO33
Y14	PWM10_TCU5_IN0_RMII0_TX_EN_SSI1_DR_UART4_RTS__PC10	IO	PU	No	Yes	GPC[10]	PWM10_TCU5_IN0	RMII0_TX_EN	SSI1_DR	UART4_RTS_	VDDIO33
V16	PWM11_TCU5_IN1_RMII0_CRS_DV_SSI1_DT_UART4_RXD_PC11	IO	PU	No	Yes	GPC[11]	PWM11_TCU5_IN1	RMII0_CRS_DV	SSI1_DT	UART4_RXD	VDDIO33

AC21	PWM12_TCU6_IN0_RMII0_MDC_SSI 1_CLK_UART4_TXD_PC12	IO	PU	No	Yes	GPC[12]	PWM12_TCU 6_IN0	RMII0_MDC	SSI1_CLK	UART4_TXD	VDDIO33
AC23	PWM13_TCU6_IN1_RMII0_MDIO_SP DIF_IN_I2C0_SCK_PC13	IO	PU	No	Yes	GPC[13]	PWM13_TCU 6_IN1	RMII0_MDIO	SPDIF_IN	I2C0_SCK	VDDIO33
AB18	PWM14_TCU7_IN0_SPDIF_OUT_I2C 0_SDA_PC14	IO	PU	No	Yes	GPC[14]	PWM14_TCU 7_IN0		SPDIF_OU T	I2C0_SDA	VDDIO33
AB20	PWM15_TCU7_IN1_RMII0_REF_CLK _CIM_VIC_MCLK_PC15	IO	PU	No	Yes	GPC[15]	PWM15_TCU 7_IN1	RMII0_REF_ CLK	CIM/VIC_M CLK		VDDIO33
Y18	DMIC_CLK_PC20	IO	PD	No	Yes	GPC[20]	DMIC_CLK				VDDIO33
V18	DMIC_IN0_UART1_CTS__PC21	IO	PU	No	Yes	GPC[21]	DMIC_IN0	UART1_CTS_			VDDIO33
W19	DMIC_IN1_UART1_RTS__PC22	IO	PU	No	Yes	GPC[22]	DMIC_IN1	UART1_RTS_			VDDIO33
U19	DMIC_IN2_UART1_RXD_I2C1_SCK_ NEMC_CS1__PC23	IO	PU	No	Yes	GPC[23]	DMIC_IN2	UART1_RXD	I2C1_SCK	NEMC_CS1_	VDDIO33
V20	DMIC_IN3_UART1_TXD_I2C1_SDA_ NEMC_CS2__PC24	IO	PU	No	Yes	GPC[24]	DMIC_IN3	UART1_TXD	I2C1_SDA	NEMC_CS2_	VDDIO33
B16	UART3_RXD_I2C4_SCK_PC25	IO	PU	No	Yes	GPC[25]	UART3_RXD	I2C4_SCK			VDDIO33
A17	UART3_TXD_I2C4_SDA_PC26	IO	PU	No	Yes	GPC[26]	UART3_TXD	I2C4_SDA			VDDIO33
C17	UART3_CTS__I2C5_SCK_PC27	IO	PU	No	Yes	GPC[27]	UART3_CTS_	I2C5_SCK			VDDIO33
B18	UART3_RTS__I2C5_SDA_PC28	IO	PU	No	Yes	GPC[28]	UART3_RTS_	I2C5_SDA			VDDIO33

2.2.4 GPIO Group D

Ball No.	Ball Name	In/ Out	Pull	Slew Rate	Schmitt	GPIO	Func0	Func1	Func2	Func3	Power
E7	UART3_CTS__I2C4_SCK_PD00	IO	PU	No	No	GPD[0]	GPIO0	UART3_CTS_	I2C4_SCK		VDDIO
D6	UART3_RTS__I2C4_SDA_TDO_PD01	IO	PU	No	No	GPD[1]	GPIO1	UART3_RTS_	I2C4_SDA	TDO	VDDIO
B6	UART3_RXD_PCM_CLK_TDI_PD02	IO	PU	No	No	GPD[2]	GPIO2	UART3_RXD	PCM_CLK	TDI	VDDIO
A7	UART3_TXD_PCM_DO_TCK_PD03	IO	PU	No	No	GPD[3]	GPIO3	UART3_TXD	PCM_DO	TCK	VDDIO
C7	I2C5_SCK_PCM_DI_TMS_PD04	IO	PU	No	No	GPD[4]	GPIO4	I2C5_SCK	PCM_DI	TMS	VDDIO
B8	I2C5_SDA_PCM_SYNC_PD05	IO	PU	No	No	GPD[5]	GPIO5	I2C5_SDA	PCM_SYNC		VDDIO
C1	SDIO_CLK_SSI0_CLK_PD08	IO	PU	No	No	GPD[8]	SDIO_CLK	SSI0_CLK			VDDIO
A1	SDIO_CMD_SSI0_DT_PD09	IO	PU	No	No	GPD[9]	SDIO_CMD	SSI0_DT			VDDIO
C3	SDIO_D0_SSI0_DR_PD10	IO	PU	No	No	GPD[10]	SDIO_D0	SSI0_DR			VDDIO
B2	SDIO_D1_I2C1_SCK_PD11	IO	PU	No	No	GPD[11]	SDIO_D1	I2C1_SCK			VDDIO
D4	SDIO_D2_I2C1_SDA_PD12	IO	PU	No	No	GPD[12]	SDIO_D2	I2C1_SDA			VDDIO
A3	SDIO_D3_SSI0_CE0__PD13	IO	PU	No	No	GPD[13]	SDIO_D3	SSI0_CE0_			VDDIO
G1	MSC0_CLK_SFC0_CLK_SSI1_CLK_PD17	IO	PU	No	No	GPD[17]	MSC0_CLK	SFC0_CLK	SSI1_CLK		VDDIO
G3	MSC0_CMD_SFC0_CE__SSI1_DT_PD18	IO	PU	No	No	GPD[18]	MSC0_CMD	SFC0_CE_	SSI1_DT		VDDIO
E1	MSC0_D0_SFC0_DQ0_SSI1_DR_PD19	IO	PU	No	No	GPD[19]	MSC0_D0	SFC0_DQ0	SSI1_DR		VDDIO
F2	MSC0_D1_SFC0_DQ1_I2C2_SCK_PD20	IO	PU	No	No	GPD[20]	MSC0_D1	SFC0_DQ1	I2C2_SCK		VDDIO
D2	MSC0_D2_SFC0_DQ2_WP__I2C2_SDA_PD21	IO	PU	No	No	GPD[21]	MSC0_D2	SFC0_DQ2_WP_	I2C2_SDA		VDDIO
E3	MSC0_D3_SFC0_DQ3_HOLD__SSI1_CE0__PD22	IO	PU	No	No	GPD[22]	MSC0_D3	SFC0_DQ3_HOLD_	SSI1_CE0_		VDDIO
G5	MSC0_D4_SFC1_DQ0_UART0_RXD_PD23	IO	PU	No	No	GPD[23]	MSC0_D4	SFC1_DQ0	UART0_RXD		VDDIO
H4	MSC0_D5_SFC1_DQ1_UART0_TXD_PD24	IO	PU	No	No	GPD[24]	MSC0_D5	SFC1_DQ1	UART0_TXD		VDDIO
F4	MSC0_D6_SFC1_DQ2_WP__UART0_CTS__PD25	IO	PU	No	No	GPD[25]	MSC0_D6	SFC1_DQ2_WP_	UART0_CTS_		VDDIO
E5	MSC0_D7_SFC1_DQ3_HOLD__UART0_RTS__PD26	IO	PU	No	No	GPD[26]	MSC0_D7	SFC1_DQ3_HOLD_	UART0_RTS_		VDDIO
B4	UART2_RXD_I2C3_SCK_PWM0_TCU0_IN0_PD30	IO	PU	No	No	GPD[30]	UART2_RXD	I2C3_SCK	PWM0_TCU0_IN0		VDDIO

C5	UART2_TXD_I2C3_SDA_PWM1_TCU0_IN1_PD31	IO	PU	No	No	GPD[31]	UART2_TXD	I2C3_SDA	PWM1_TCU0_IN1		VDDIO

2.2.5 GPIO Group E

Ball No.	Ball Name	In/ Out	Pull	Slew Rate	Schmitt	GPIO	Func0	Func1	Power
W13	MSC2_CLK_PWM2_TCU1_IN0_PE00	IO	PU	Yes	Yes	GPE[0]	MSC2_CLK	PWM2/TCU1_IN0	VDDIO33_SD
W11	MSC2_CMD_PWM3_TCU1_IN1_PE01	IO	PU	Yes	Yes	GPE[1]	MSC2_CMD	PWM3/TCU1_IN1	VDDIO33_SD
Y10	MSC2_D0_PWM4_TCU2_IN0_PE02	IO	PU	Yes	Yes	GPE[2]	MSC2_D0	PWM4/TCU2_IN0	VDDIO33_SD
V10	MSC2_D1_PWM5_TCU2_IN1_PE03	IO	PU	Yes	Yes	GPE[3]	MSC2_D1	PWM5/TCU2_IN1	VDDIO33_SD
Y12	MSC2_D2_PWM6_TCU3_IN0_PE04	IO	PU	Yes	Yes	GPE[4]	MSC2_D2	PWM6/TCU3_IN0	VDDIO33_SD
V12	MSC2_D3_PWM7_TCU3_IN1_PE05	IO	PU	Yes	Yes	GPE[5]	MSC2_D3	PWM7/TCU3_IN1	VDDIO33_SD
AC13	SFC0_CLK_SSI1_CLK_PE16	IO	PU	No	Yes	GPE[16]	SFC0_CLK	SSI1_CLK	VDDIO33
AB12	SFC0_CE__SSI1_DT_PE17	IO	PU	No	Yes	GPE[17]	SFC0_CE_	SSI1_DT	VDDIO33
AA13	SFC0_DQ0_SSI1_DR_PE18	IO	PU	No	Yes	GPE[18]	SFC0_DQ0	SSI1_DR	VDDIO33
AA15	SFC0_DQ1_I2C2_SCK_PE19	IO	PU	No	Yes	GPE[19]	SFC0_DQ1	I2C2_SCK	VDDIO33
AC15	SFC0_DQ2_WP__I2C2_SDA_PE20	IO	PU	No	Yes	GPE[20]	SFC0_DQ2_WP_	I2C2_SDA	VDDIO33
AB14	SFC0_DQ3_HOLD__SSI1_CE0__PE21	IO	PU	No	Yes	GPE[21]	SFC0_DQ3_HOLD_	SSI1_CE0_	VDDIO33
J5	RTC32K_PE23	IO	PD	No	No	GPE[23]	RTC32K		VDDIO
H6	EXCLK_CIM_VIC_MCLK_PE24	IO	PD	No	No	GPE[24]	EXCLK	CIM/VIC_MCLK	VDDIO
P6	BOOT_SEL0_PE25	IO	PD	No	No	GPE[25]	BOOT_SEL0		VDDIO
N5	BOOT_SEL1_PE26	IO	PD	No	No	GPE[26]	BOOT_SEL1		VDDIO
P4	BOOT_SEL2_PE27	IO	PD	No	No	GPE[27]	BOOT_SEL2		VDDIO

2.3 X2100 Analog PAD DESCRIPTION

Table 2-1 X2100 function pin description

Ball No.	Pin Names	IO	Power	Pin Description
Debug				
F6	TRST	I	VDDIO	JTAG reset
Memory				
B12	DDR_VDD1	P	-	For SDRAM supply
C13	DDR_VDD1	P	-	For SDRAM supply
A15	DDRPLL_VCCA	P	-	DDR PHY PLL supply 1.8V
C15	DDR_VSSA	P	-	ground
A13	VREF	P		for SDRAM, reference voltage
B14	ZQ	I		for SDRAM, external reference resistor for output calibrating
Power and Ground				
A9	VDDMEM	P	-	DDR PHY LPDDR2/3 IO 1.2V supply
A11	VDDMEM	P	-	DDR PHY LPDDR2/3 IO 1.2V supply
B10	VDDMEM	P	-	DDR PHY LPDDR2/3 IO 1.2V supply
C9	VDDMEM	P	-	DDR PHY LPDDR2/3 IO 1.2V supply
C11	VDDMEM	P	-	DDR PHY LPDDR2/3 IO 1.2V supply
D16	VDDMEM	P	-	DDR PHY LPDDR2/3 IO 1.2V supply
E11	VDDMEM	P	-	DDR PHY LPDDR2/3 IO 1.2V supply
E13	VDDMEM	P	-	DDR PHY LPDDR2/3 IO 1.2V supply
E15	VDDMEM	P	-	DDR PHY LPDDR2/3 IO 1.2V supply
K8	VDDIO	P	-	GPIO 1.8V supply
L7	VDDIO	P	-	GPIO 1.8V supply
N17	VDDIO18	P	-	GPIO 1.8V supply for 3.3V PAD
R17	VDDIO18	P	-	GPIO 1.8V supply for 3.3V PAD

T8	VDDIO18_CIM	P	-	CIM Type PAD1.8V supply
U11	VDDIO18_SD	P	-	Connect to 1uf capacity for SD type PAD
M16	VDDIO33	P	-	GPIO 3.3V supply for 3.3V PAD
P16	VDDIO33	P	-	GPIO 3.3V supply for 3.3V PAD
U7	VDDIO33_CIM	P	-	CIM GPIO 3.3V /1.8Vsupply
T12	VDDIO33_SD	P	-	SD GPIO 3.3V/1.8V supply
E9	VSS	P	-	Core digital ground for none DRAM and CORE digital ground, 0V
U9	VSS	P	-	Core digital ground for none DRAM and CORE digital ground, 0V
U13	VSS	P	-	Core digital ground for none DRAM and CORE digital ground, 0V
U15	VSS	P	-	Core digital ground for none DRAM and CORE digital ground, 0V
U17	VSS	P	-	Core digital ground for none DRAM and CORE digital ground, 0V
T10	VSS	P	-	Core digital ground for none DRAM and CORE digital ground, 0V
T14	VSS	P	-	Core digital ground for none DRAM and CORE digital ground, 0V
T16	VSS	P	-	Core digital ground for none DRAM and CORE digital ground, 0V
R7	VSS	P	-	Core digital ground for none DRAM and CORE digital ground, 0V
R9	VSS	P	-	Core digital ground for none DRAM and CORE digital ground, 0V
R11	VSS	P	-	Core digital ground for none DRAM and CORE digital ground, 0V
P8	VSS	P	-	Core digital ground for none DRAM and CORE digital ground, 0V
P12	VSS	P	-	Core digital ground for none DRAM and CORE digital ground, 0V
N7	VSS	P	-	Core digital ground for none DRAM and CORE digital ground, 0V
N11	VSS	P	-	Core digital ground for none DRAM and CORE digital ground, 0V
M8	VSS	P	-	Core digital ground for none DRAM and CORE digital ground, 0V
M12	VSS	P	-	Core digital ground for none DRAM and CORE digital ground, 0V
L11	VSS	P	-	Core digital ground for none DRAM and CORE digital ground, 0V
L13	VSS	P	-	Core digital ground for none DRAM and CORE digital ground, 0V
L15	VSS	P	-	Core digital ground for none DRAM and CORE digital ground, 0V
L17	VSS	P	-	Core digital ground for none DRAM and CORE digital ground, 0V
K10	VSS	P	-	Core digital ground for none DRAM and CORE digital ground, 0V
K12	VSS	P	-	Core digital ground for none DRAM and CORE digital ground, 0V
K16	VSS	P	-	Core digital ground for none DRAM and CORE digital ground, 0V
J7	VSS	P	-	Core digital ground for none DRAM and CORE digital ground, 0V
J9	VSS	P	-	Core digital ground for none DRAM and CORE digital ground, 0V

J17	VSS	P	-	Core digital ground for none DRAM and CORE digital ground, 0V
H8	VSS	P	-	Core digital ground for none DRAM and CORE digital ground, 0V
H12	VSS	P	-	Core digital ground for none DRAM and CORE digital ground, 0V
G13	VSS	P	-	Core digital ground for none DRAM and CORE digital ground, 0V
G17	VSS	P	-	Core digital ground for none DRAM and CORE digital ground, 0V
F8	VSS	P	-	Core digital ground for none DRAM and CORE digital ground, 0V
F10	VSS	P	-	Core digital ground for none DRAM and CORE digital ground, 0V
F12	VSS	P	-	Core digital ground for none DRAM and CORE digital ground, 0V
F14	VSS	P	-	Core digital ground for none DRAM and CORE digital ground, 0V
F16	VSS	P	-	Core digital ground for none DRAM and CORE digital ground, 0V
E17	VSS	P	-	Core digital ground for none DRAM and CORE digital ground, 0V
D8	VSS	P	-	Core digital ground for none DRAM and CORE digital ground, 0V
D10	VSS	P	-	Core digital ground for none DRAM and CORE digital ground, 0V
D12	VSS	P	-	Core digital ground for none DRAM and CORE digital ground, 0V
D14	VSS	P	-	Core digital ground for none DRAM and CORE digital ground, 0V
R13	VDD	P	-	CORE digital power, 0.9V
R15	VDD	P	-	CORE digital power, 0.9V
P10	VDD	P	-	CORE digital power, 0.9V
P14	VDD	P	-	CORE digital power, 0.9V
N9	VDD	P	-	CORE digital power, 0.9V
N13	VDD	P	-	CORE digital power, 0.9V
N15	VDD	P	-	CORE digital power, 0.9V
M10	VDD	P	-	CORE digital power, 0.9V
M14	VDD	P	-	CORE digital power, 0.9V
L9	VDD	P	-	CORE digital power, 0.9V
K14	VDD	P	-	CORE digital power, 0.9V
J11	VDD	P	-	CORE digital power, 0.9V
J13	VDD	P	-	CORE digital power, 0.9V
J15	VDD	P	-	CORE digital power, 0.9V
H10	VDD	P	-	CORE digital power, 0.9V
H14	VDD	P	-	CORE digital power, 0.9V

H16	VDD	P	-	CORE digital power, 0.9V
G9	VDD	P	-	CORE digital power, 0.9V
G11	VDD	P	-	CORE digital power, 0.9V
G15	VDD	P	-	CORE digital power, 0.9V
Audio Codec				
AB10	CODEC_AVDD	P	-	1.8V supply
W9	CODEC_AVSS	P	-	Ground
AC11	CODEC_HPOUTN	AO	CODEC_AVDD	DAC Differential output N
AA11	CODEC_HPOUTP	AO	CODEC_AVDD	DAC Differential output P
AA9	CODEC_MICLN	AI	CODEC_AVDD	ADC Differential input N end
AB8	CODEC_MICLP	AI	CODEC_AVDD	ADC Differential input P end
AC9	CODEC_VCM	AO	CODEC_AVDD	Reference voltage output
SADC				
Y6	AUX0	AI	SADC_AVDD	Analog input 0
AB2	AUX1	AI	SADC_AVDD	Analog input 1
Y4	AUX2	AI	SADC_AVDD	Analog input 2
AC1	AUX3	AI	SADC_AVDD	Analog input 3
AA3	AUX4	AI	SADC_AVDD	Analog input 4
AB4	AUX5	AI	SADC_AVDD	Analog input 5
W7	SADC_AVSS	P	-	ground
AC3	SADC_AVDD	P	-	1.8V supply
DSI				
L23	TX_DATAN0	AO	DSI_AVD18	Lane0 negative end
L21	TX_DATAP0	AO	DSI_AVD18	Lane0 positive end
N23	TX_DATAN1	AO	DSI_AVD18	Lane1 negative end
M22	TX_DATAP1	AO	DSI_AVD18	Lane1 positive end
P22	TX_CLKN	AO	DSI_AVD18	CLK negative end
N21	TX_CLKP	AO	DSI_AVD18	CLK positive end
P18	DSI_AVSS	P	-	ground
N19	DSI_AVD09	P	-	0.9V Analog supply
P20	DSI_AVD18	P	-	1.8V Analog supply

CSI				
R21	RX_DATAN0	AI	CSI_AVD18	Lane0 negative end
R23	RX_DATAP0	AI	CSI_AVD18	Lane0 positive end
U23	RX_DATAN1	AI	CSI_AVD18	Lane1 negative end
T22	RX_DATAP1	AI	CSI_AVD18	Lane1 positive end
W23	RX_DATAN2	AI	CSI_AVD18	Lane2 negative end
W21	RX_DATAP2	AI	CSI_AVD18	Lane2 positive end
AA23	RX_DATAN3	AI	CSI_AVD18	Lane3 negative end
Y22	RX_DATAP3	AI	CSI_AVD18	Lane3 positive end
V22	RX_CLKN0	AI	CSI_AVD18	CLK lane0 negative end
U21	RX_CLKP0	AI	CSI_AVD18	CLK lane0 positive end
AB22	RX_CLKN1	AI	CSI_AVD18	CLK lane1 negative end
AA21	RX_CLKP1	AI	CSI_AVD18	CLK lane0 positive end
T18	CSI_AVSS	P	-	ground
R19	CSI_AVD09	P	-	0.9V Analog supply
T20	CSI_AVD18	P	-	1.8V Analog supply
USB OTG				
AC5	USB_DP0	AIO	USB_AVD33	USB OTG data plus
AA5	USB_DM0	AIO	USB_AVD33	USB OTG data minus
AC7	USB_BIAS	AIO	USB_AVD09	Connect to 135 ohm +/- 1% resistor, all internal bias base on it
V8	USB_AVSS	P	-	USB analog ground
AB6	USB_AVD09	P	-	USB analog power.0.9V
AA7	USB_AVD18	P	-	USB analog power.1.8V
Y8	USB_AVD33	P	-	USB analog power.3.3V
EFUSE				
A5	AVDEFUSE	P	AVEFUSE	EFUSE programming power, 0V/1.8V
CPM				
K2	OSC32_XI	AI	VDDIO_RTC	RTC OSC input.
K4	OSC32_XO	AO	VDDIO_RTC	RTC OSC output.
N1	EXCLK_XI	AI	VDDIO	EXCLK OSC Input

N3	EXCLK_XO	AO	VDDIO	EXCLK OSC Output
M2	PLL_VDD	P	-	PLL digital power
M6	PLL_VSS	P	-	PLL digital ground
L1	PLL_AVDD	P	-	PLL analog power
M4	PLL_AVSS	P	-	PLL analog ground
RTC				
J3	PWRON	O	VDDIO_RTC	Power on/off control of main power
K6	PPRST_	I	VDDIO_RTC	RTC power on reset and RESET-KEY reset input
H2	VDDIO_RTC	P	-	1.8V supply to RTC IO
J1	VDD_RTC	P	-	0.9V supply to RTC
L5	VSS_RTC	P	-	RTC ground
L3	WKUP_PE31	I	VDDIO_RTC	Wakeup signal after main power down, GPIO group E bit 31, input/interrupt only

2.4 X2100 Digital PAD DESCRIPTION

Table 2-2 X2100 Function Description

Signal Name	In/Out	Description
SLCD(Smart LCD)		
SLCD_D0	Output	Smart LCD data output bit 0
SLCD_D1	Output	Smart LCD data output bit 1
SLCD_D2	Output	Smart LCD data output bit 2
SLCD_D3	Output	Smart LCD data output bit 3
SLCD_D4	Output	Smart LCD data output bit 4
SLCD_D5	Output	Smart LCD data output bit 5
SLCD_D6	Output	Smart LCD data output bit 6
SLCD_D7	Output	Smart LCD data output bit 7
SLCD_D8	Output	Smart LCD data output bit 8
SLCD_D9	Output	Smart LCD data output bit 9
SLCD_D10	Output	Smart LCD data output bit 10

SLCD_D11	Output	Smart LCD data output bit 11
SLCD_D12	Output	Smart LCD data output bit 12
SLCD_D13	Output	Smart LCD data output bit 13
SLCD_D14	Output	Smart LCD data output bit 14
SLCD_D15	Output	Smart LCD data output bit 15
SLCD_RD	Output	Smart LCD read signal
SLCD_WR	Output	Smart LCD write signal
SLCD_CE_	Output	Smart LCD chip select signal
SLCD_TE	Input	Smart LCD tearing effect signal
SLCD_DC	Output	Smart LCD data/command select signal
LCD		
LCD_Dn	Output	LCD data output bit n
LCD_PCLK	Output	LCD pixel clock
LCD_VSYNC	Output	LCD frame sync
LCD_HSYNC	Output	LCD line sync
LCD_DE	Output	LCD data enable
CIM(Camera Interface)		
CIM_EXPOSURE	Output	CIM exposure signal to sensor to generate snapshot
CIM_VIC_PCLK	Input	CIM pixel clock input
CIM_VIC_HSYNC	Input	CIM line horizontal sync input
CIM_VIC_VSYNC	Input	CIM vertical sync input
CIM_VIC_MCLK	Output	CIM master clock output
VIC_D11	Input	CIM data input bit 11
VIC_D10	Input	CIM data input bit 10
VIC_D9	Input	CIM data input bit 9
VIC_D8	Input	CIM data input bit 8
CIM_VIC_D7	Input	CIM/VIC data input bit 7
CIM_VIC_D6	Input	CIM/VIC data input bit 6
CIM_VIC_D5	Input	CIM/VIC data input bit 5
CIM_VIC_D4	Input	CIM/VIC data input bit 4
CIM_VIC_D3	Input	CIM/VIC data input bit 3

CIM_VIC_D2	Input	CIM/VIC data input bit 2
CIM_VIC_D1	Input	CIM/VIC data input bit 1
CIM_VIC_D0	Input	CIM/VIC data input bit 0
I2S		
I2Sn_MCLK	Output	I2S n master clock out
I2Sn_BCLK	Bidirection	I2S n bit clock
I2Sn_LRCLK	Bidirection	I2S n LR clock
I2Sn_DI	Input	I2S n data input
I2Sn_DO	Output	I2S n data output
PCM		
PCM_CLK	Bidirection	PCM clock
PCM_DO	Output	PCM data out
PCM_DI	Input	PCM data in
PCM_SYN	Bidirection	PCM sync
DMIC		
DMIC_IN0	Input	DMIC data in for DMIC 0/1
DMIC_IN1	Input	DMIC data in for DMIC 2/3
DMIC_IN2	Input	DMIC data in for DMIC 4/5
DMIC_IN3	Input	DMIC data in for DMIC 6/7
DMIC_CLK	Output	Digital MIC clock output
SFC		
SFC0_CLK	Output	Serial Flash clock output
SFC0_CE_	Output	Serial Flash chip enable
SFCn_DQ0	Bidirection	Serial Flash data (n=0,1)
SFCn_DQ1	Bidirection	Serial Flash data
SFCn_DQ2_WP_	Bidirection	Serial Flash n write protect signal
SRCn_DQ3_HOLD_	Bidirection	Serial Flash n hold signal
PWM		
PWM0/TCU0_IN0	Bidirection	PWM/TCU data output/input
PWM1/TCU0_IN1	Bidirection	PWM/TCU data output/input
PWM2/TCU1_IN0	Bidirection	PWM/TCU data output/input
PWM3/TCU1_IN1	Bidirection	PWM/TCU data output/input

PWM4/TCU2_IN0	Bidirection	PWM/TCU data output/input
PWM5/TCU2_IN1	Bidirection	PWM/TCU data output/input
PWM6/TCU3_IN0	Bidirection	PWM/TCU data output/input
PWM7/TCU3_IN1	Bidirection	PWM/TCU data output/input
PWM8/TCU4_IN0	Bidirection	PWM/TCU data output/input
PWM9/TCU4_IN1	Bidirection	PWM/TCU data output/input
PWM10/TCU5_IN0	Bidirection	PWM/TCU data output/input
PWM11/TCU5_IN1	Bidirection	PWM/TCU data output/input
PWM12/TCU6_IN0	Bidirection	PWM/TCU data output/input
PWM13TCU6_IN1	Bidirection	PWM/TCU data output/input
PWM14/TCU7_IN0	Bidirection	PWM/TCU data output/input
PWM15/TCU7_IN1	Bidirection	PWM/TCU data output/input
RTC		
RTC32K	Output	32768Hz clock output
I2C		
I2Cn_SCK	Bidirection	I2C n serial clock
I2Cn_SDA	Bidirection	I2C n serial data
SCC		
SCC_SCK	Bidirection	Smart Card clock
SCC_SDA	Bidirection	Smart Card data
SSI		
SSIn_CLK	Output	SSI n clock output
SSIn_CE0_	Output	SSI n chip enable 0
SSIn_DT	Output	SSI n data output
SSIn_DR	Input	SSI n data input
UART		
UARTn_RXD	Input	UART n receiving data
UARTn_TXD	Output	UART n transmitting data
UARTn_CTS_	Input	UART clear to send control
UARTn_RTS_	Output	UART request to send control
MSC		

MSCn_D7	Bidirection	MSC(MMC/SD) n data bit 7
MSCn_D6	Bidirection	MSC(MMC/SD) n data bit 6
MSCn_D5	Bidirection	MSC(MMC/SD) n data bit 5
MSCn_D4	Bidirection	MSC(MMC/SD) n data bit 4
MSCn_D3	Bidirection	MSC(MMC/SD) n data bit 3
MSCn_D2	Bidirection	MSC(MMC/SD) n data bit 2
MSCn_D1	Bidirection	MSC(MMC/SD) n data bit 1
MSCn_D0	Bidirection	MSC(MMC/SD) n data bit 0
MSCn_CLK	Output	MSC(MMC/SD) n clock output
MSCn_CMD	Bidirection	MSC(MMC/SD) n command
USB 2.0 OTG		
DRV_VBUS	Output	USB OTG VBUS driver control signal
RMII		
RMII0_PHY_CLK	Output	Ethernet PHY clock (50MHz)
RMII0_CRS_DV	Input	Ethernet carrier sense
RMII0_REF_CLK	Input	Ethernet reference clock (50MHz)
RMII0_RXD1	Input	receive data bit 1
RMII0_RXD0	Input	receive data bit 0
RMII0_TX_EN	Output	Ethernet n transmit enable
RMII0_TXD1	Output	TX data bit 1
RMII0_TXD0	Output	TX data bit 0
RMII0_MDC	Output	Ethernet management clock
RMII0_MDIO	Bidirection	Ethernet management data
NEMC		
SAn	Output	NEMC Address (n=12)
SDn	Bidirection	NEMC Data (n=16)
RD_	Output	NEMC read enable, low active
WE_	Output	NEMC write enable, low active
NEMC_CS1_	Output	NEMC chip select1
NEMC_CS2	Output	NEMC chip select2
WAIT_	Input	NEMC wait for external memory

DEBUG		
TDO	Output	JTAG serial data output
TDI	Input	JTAG serial data input
TCK	Input	JTAG clock
TMS	Input	JTAG mode select

NOTES:

1 The meaning of phases in IO cell characteristics are:
   a PU: The IO cell contains a pull-up resistor.
   b PD: The IO cell contains a pull-down resistor.
   c Schmitt: The IO cell is Schmitt trig input.
2 All GPIO shared pins are reset to GPIO input.

3 Electrical Specifications

3.1 Absolute Maximum Ratings

The absolute maximum ratings for the processors are listed in Table 3-1. Do not exceed these parameters or the part may be damaged permanently. Operation at absolute maximum ratings is not guaranteed.

Table 3-1 Absolute Maximum Ratings

Parameter	Min	Max	Unit
Storage Temperature	-65	150	°C
Operation Temperature	-40	85	°C
VDDMEM power supplies voltage	-0.3	1.32	V
DDR_VDD1 power supplies voltage	-0.5	1.98	V
DDRPLL power supplies voltage	-0.5	1.98	V
VDDIO power supplies voltage	-0.5	1.98	V
VDDIO33 power supplies voltage	-0.5	3.63	V
VDDIO18 power supplies voltage	-0.5	1.98	V
VDDIO33_CIM power supplies voltage	-0.5	3.63	V
VDDIO18_CIM power supplies voltage	-0.5	1.98	V
VDDIO33_SD power supplies voltage	-0.5	3.63	V
VDD core power supplies voltage	-0.2	1.1	V
PLLVDD power supplies voltage	-0.2	1.1	V
PLLAVDD power supplies voltage	-0.5	1.98	V
AVDEFUSE power supplies voltage	-0.5	1.98	V
VDDIORTC power supplies voltage	-0.5	1.98	V
VDDRTC power supplies voltage	-0.2	1.1	V
USB_AVD33 power supplies voltage	-0.5	3.6	V
USB_AVD18 power supplies voltage	-0.5	1.98	V
USB_AVD09 power supplies voltage	-0.2	1.1	V
CODEC_AVDD power supplies voltage	-0.5	1.98	V
SADC_AVDD	-0.5	1.98	V
CSI_AVD18	-0.5	1.98	V
CSI_AVD09	-0.2	1.1	V
DSI_AVD18	-0.5	1.98	V
DSI_AVD09	-0.2	1.1	V
Input voltage to VDDMEM supplied non-supply pins	-0.3	1.32	V
Input voltage to VDDIO supplied non-supply pins	-0.3	1.98	V
Input voltage to VDDIO33 supplied non-supply pins	-0.3	3.6	V
Input voltage to VDDIO33_CIM supplied non-supply pins	-0.3	3.6	V
Input voltage to VDDIO33_SD supplied non-supply pins	-0.3	3.6	V
Input voltage to VDDIORTC supplied non-supply pins	-0.3	1.98	V
Input voltage to USB_AVD33 supplied non-supply pins	-0.3	3.6	V
Input voltage to CODEC_AVDD supplied non-supply pins	-0.3	1.98	V
Input voltage to SADC_AVDD supplied non-supply pins	-0.3	1.98	V
Input voltage to CSI_AVD18 supplied non-supply pins	-0.3	1.98	V
Output voltage from VDDMEM supplied non-supply pins	-0.3	1.32	V
Output voltage from VDDIO supplied non-supply pins	-0.3	1.98	V
Output voltage from VDDIO33 supplied non-supply pins	-0.3	3.6	V
Output voltage from VDDIO33_CIM supplied non-supply pins	-0.3	3.6	V
Output voltage from VDDIO18_CIM supplied non-supply pins	-0.3	1.98	V
Output voltage from VDDIORTC supplied non-supply pins	-0.3	1.98	V

Output voltage from USB_AVD33 supplied non-supply pins	-0.3	3.6	V
Output voltage from CODEC_AVDD supplied non-supply pins	-0.3	1.98	V
Output voltage from DSI_AVD18 supplied non-supply pins	-0.3	1.98	V
Maximum ESD stress voltage, Human Body Model; Any pin to any supply pin, either polarity, or Any pin to all non-supply pins together, either polarity. Three stresses maximum.	-	2000	V

3.2 Recommended operating conditions

Table 3-2 Recommended operating conditions for power supplies

Symbol	Description	Min	Typical	Max	Unit
VMEM	VDDMEM voltage for LPDDR3	1.14	1.2	1.3	V
	VDDMEM voltage for LPDDR2	1.08	1.2	1.32	V
VDDR	DDR_VDD1 voltage	1.7	1.8	1.95	V
VDDRPLL	DDRPLL voltage	1.62	1.8	1.98	V
VIO(1.8V)	VDDIO voltage	1.71	1.8	1.89	V
VIO18	VDDIO18 voltage	1.71	1.8	1.89	V
VIO33	VDDIO33 voltage	3.135	3.3	3.465	V
VCIM33(3.3V)	VDDIO33_CIM voltage, use as 3.3V	3.135	3.3	3.465	V
VCIM33(1.8V)	VDDIO33_CIM voltage, use as 1.8V	1.71	1.8	1.89	V
VCIM18	VDDIO18_CIM voltage	1.71	1.8	1.89	V
VSD33(3.3V)	VDDIO33_SD voltage, use as 3.3V	3.135	3.3	3.465	V
VSD33(1.8V)	VDDIO33_SD voltage, use as 1.8V	1.71	1.8	1.89	V
VCORE	VDD core voltage	0.9	0.9	1	V
VPLLVDD	PLLVDD voltage	0.9	0.9	1	V
VPLLAVDD	PLLAVDD voltage	1.71	1.8	1.89	V
VEFUSE	AVDEFUSE voltage	1.71	1.8	1.89	V
VRTCIO18	VDDIORTC voltage	1.71	1.8	1.89	V
VRTC	VDDRTC voltage	0.9	0.9	1	V
VUSB33	USB_AVD33 voltage	3.135	3.3	3.465	V
VUSB18	USB_AVD18 voltage	1.71	1.8	1.89	V
VUSB09	USB_AVD09 voltage	0.9	0.9	1	V
VCDC	CODEC_AVDD voltage	1.71	1.8	1.89	V
VADC	SADC_AVDD voltage	1.71	1.8	1.89	V
VCSI18	CSI_AVD18 voltage	1.62	1.8	1.98	V
VCSI09	CSI_AVD09 voltage	0.9	0.9	1	V
VDSI18	DSI_AVD18 voltage	1.71	1.8	1.89	V
VDSI09	DSI_AVD09 voltage	0.9	0.9	1	V

Table 3-3 Recommended operating conditions for VDDIO/VDDIO33/VDDIO33_SD/VDDIO33_CIM/VDDIO33_SD/VDDIORTC supplied pins

Symbol	Parameter	Min	Typical	Max	Unit
VIH18	Input high voltage for 1.8V I/O application	1.17	1.8	1.98	V
VIL18	Input low voltage for 1.8V I/O application	–0.3	0	0.63	V
VIH33	Input high voltage for 3.3V I/O application	2.0	3.3	3.465	V
VIL33	Input low voltage for 3.3V I/O application	–0.3	0	0.8	V

Table 3-4 Recommended operating conditions for others

Symbol	Description	Min	Typical	Max	Unit
TA	Ambient temperature	–40	-	85	℃

3.3 DC Specifications

The DC characteristics for each pin include input-sense levels and output-drive levels and currents. These parameters can be used to determine maximum DC loading, and also to determine maximum transition times for a given load. All DC specification values are valid for the entire temperature range of the device.

Table 3-5 DC characteristics for VREF

Symbol	Parameter	Min	Typical	Max	Unit
VREF	Reference voltage supply	0.49	0.5	0.51	VMEM

Table 3-6 DC characteristics for VDDIO/VDDIORTC supplied pins for 1.8V application

Symbol	Parameter	Min	Typical	Max	Unit
V_T	Threshold point	0.82	0.89	0.97	V
V_{T+}	Schmitt trig low to high threshold point	0.96	1.03	1.1	V
V_{T-}	Schmitt trig high to low threshold point	0.64	0.75	0.86	V
V_{TPU}	Threshold point with pull-up resistor enabled	0.81	0.88	0.97	V
V_{TPD}	Threshold point with pull-down resistor enabled	0.82	0.89	0.98	V
V_{TPU+}	Schmitt trig low to high threshold point with pull-up resistor enabled	0.95	1.02	1.09	V
V_{TPU-}	Schmitt trig high to low threshold point with pull-down resistor enabled	0.63	0.75	0.85	V
V_{TPD+}	Schmitt trig low to high threshold point with pull-down resistor enabled	0.96	1.05	1.11	V
V_{TPD-}	Schmitt trig high to low threshold point with pull-up resistor enabled	0.65	0.76	0.86	V
I_L	Input Leakage Current @ V_I=1.8V or 0V	-	-	±10	μA
I_{OZ}	Tri-State output leakage current @ V_I=1.8V or 0V	-	-	±10	μA
R_{PU}	Pull-up Resistor	60	89	137	kΩ
R_{PD}	Pull-down Resistor	61	104	196	kΩ
V_{OL}	Output low voltage	-	-	0.45	V
V_{OH}	Output high voltage	1.35	-	-	V
I_{OL}	Low level output current @ V_{OL}(max)	11.1	18.2	25.6	mA
I_{OH}	High level output current @ V_{OH}(min)	13.1	19.1	26.2	mA

Table 3-7 DC characteristics for VDDIO33_SD supplied pins for 1.8V application

Symbol	Parameter	Min	Typical	Max	Unit
V_T	Threshold point	0.76	0.94	1.24	V
V_{T+}	Schmitt trig low to high threshold point	0.94	1.09	1.36	V
V_{T-}	Schmitt trig high to low threshold point	0.68	0.89	1.2	V
V_{TPU}	Threshold point with pull-up resistor enabled	0.74	0.92	1.22	V
V_{TPD}	Threshold point with pull-down resistor enabled	0.76	0.95	1.25	V
V_{TPU+}	Schmitt trig low to high threshold point with pull-up resistor enabled	0.93	1.07	1.34	V

V_{TPU-}	Schmitt trig high to low threshold point with pull-down resistor enabled		0.66	0.88	1.18	V
V_{TPD+}	Schmitt trig low to high threshold point with pull-down resistor enabled		0.95	1.1	1.388	V
V_{TPD-}	Schmitt trig high to low threshold point with pull-up resistor enabled		0.68	0.9	1.22	V
I_L	Input Leakage Current @ V_I=1.8V or 0V		-	-	±10	μA
I_{OZ}	Tri-State output leakage current @ V_I=1.8V or 0V		-	-	±10	μA
R_{PU}	Pull-up Resistor		33	59	91	kΩ
R_{PD}	Pull-down Resistor		34	61	108	kΩ
V_{OL}	Output low voltage		-	-	0.4	V
V_{OH}	Output high voltage		2.475	-	-	V
I_{OL}	Low level output current @ V_{OL}(max)	(DS2,DS1,DS0) = 000	4.5	7.7	11.3	mA
		(DS2,DS1,DS0) = 001	6.7	11.4	16.7	mA
		(DS2,DS1,DS0) = 010	9	15.2	22.1	mA
		(DS2,DS1,DS0) = 011	11.2	18.8	27.3	mA
		(DS2,DS1,DS0) = 100	13.4	22.6	32.7	mA
		(DS2,DS1,DS0) = 101	15.6	26.2	37.8	mA
		(DS2,DS1,DS0) = 110	17.7	29.7	42.8	mA
		(DS2,DS1,DS0) = 111	19.9	33.2	47.7	mA
I_{OH}	High level output current @ V_{OH}(min)	(DS2,DS1,DS0) = 000	2.6	6.3	11.9	mA
		(DS2,DS1,DS0) = 001	3.8	9.4	17.7	mA
		(DS2,DS1,DS0) = 010	5.1	12.6	23.7	mA
		(DS2,DS1,DS0) = 011	6.4	15.7	29.4	mA
		(DS2,DS1,DS0) = 100	7.6	18.8	35.2	mA
		(DS2,DS1,DS0) = 101	8.9	21.8	40.9	mA
		(DS2,DS1,DS0) = 110	10.1	24.9	46.6	mA
		(DS2,DS1,DS0) = 111	11.4	27.9	52.2	mA

Table 3-8 DC characteristics for VDDIO33_SD supplied pins for 3.3V application

Symbol	Parameter	Min	Typical	Max	Unit
V_T	Threshold point	1.39	1.5	1.65	V
V_{T+}	Schmitt trig low to high threshold point	1.62	1.75	1.9	V
V_{T-}	Schmitt trig high to low threshold point	1.18	1.29	1.44	V
V_{TPU}	Threshold point with pull-up resistor enabled	1.36	1.48	1.64	V
V_{TPD}	Threshold point with pull-down resistor enabled	1.4	1.52	1.66	V
V_{TPU+}	Schmitt trig low to high threshold point with pull-up resistor enabled	1.62	1.75	1.89	V
V_{TPU-}	Schmitt trig high to low threshold point with pull-down resistor enabled	1.16	1.28	1.43	V
V_{TPD+}	Schmitt trig low to high threshold point with pull-down resistor enabled	1.64	1.77	1.91	V
V_{TPD-}	Schmitt trig high to low threshold point with pull-up resistor enabled	1.19	1.31	1.45	V
I_L	Input Leakage Current @ VI=1.8V or 0V	-	-	±10	μA
I_{OZ}	Tri-State output leakage current @ VI=1.8V or 0V	-	-	±10	μA
R_{PU}	Pull-up Resistor	34	51	81	kΩ
R_{PD}	Pull-down Resistor	35	51	88	kΩ
V_{OL}	Output low voltage	-	-	0.4	V

V_{OH}	Output high voltage		2.4	-	-	V
I_{OL}	Low level output current @ V_{OL}(max)	(DS2,DS1,DS0) = 000	2.8	5.4	9.8	mA
		(DS2,DS1,DS0) = 001	4.1	8.0	14.6	mA
		(DS2,DS1,DS0) = 010	5.5	10.7	19.4	mA
		(DS2,DS1,DS0) = 011	6.8	13.2	23.9	mA
		(DS2,DS1,DS0) = 100	8.2	15.9	28.7	mA
		(DS2,DS1,DS0) = 101	9.6	18.4	33.2	mA
		(DS2,DS1,DS0) = 110	10.9	20.9	37.6	mA
		(DS2,DS1,DS0) = 111	12.2	23.4	42.0	mA
I_{OH}	High level output current @ V_{OH}(min)	(DS2,DS1,DS0) = 000	4.4	7.6	13.5	mA
		(DS2,DS1,DS0) = 001	6.6	11.4	20.2	mA
		(DS2,DS1,DS0) = 010	8.8	15.2	26.9	mA
		(DS2,DS1,DS0) = 011	10.9	18.9	33.5	mA
		(DS2,DS1,DS0) = 100	13.1	22.6	40.1	mA
		(DS2,DS1,DS0) = 101	15.2	26.3	46.7	mA
		(DS2,DS1,DS0) = 110	17.4	30.1	53.3	mA
		(DS2,DS1,DS0) = 111	19.6	23.7	59.7	mA

Table 3-9 DC characteristics for VDDIO33/VDDIO18 supplied pins for 3.3V application

Symbol	Parameter		Min	Typical	Max	Unit
V_T	Threshold point		1.02	1.17	1.36	V
V_{T+}	Schmitt trig low to high threshold point		1.22	1.34	1.5	V
V_{T-}	Schmitt trig high to low threshold point		0.96	1.13	1.33	V
V_{TPU}	Threshold point with pull-up resistor enabled		1	1.15	1.34	V
V_{TPD}	Threshold point with pull-down resistor enabled		1.03	1.19	1.38	V
V_{TPU+}	Schmitt trig low to high threshold point with pull-up resistor enabled		1.21	1.32	1.47	V
V_{TPU-}	Schmitt trig high to low threshold point with pull-down resistor enabled		0.94	1.1	1.3	V
V_{TPD+}	Schmitt trig low to high threshold point with pull-down resistor enabled		1.23	1.35	1.52	V
V_{TPD-}	Schmitt trig high to low threshold point with pull-up resistor enabled		0.97	1.14	1.34	V
I_L	Input Leakage Current @ VI=1.8V or 0V		-	-	±10	μA
I_{OZ}	Tri-State output leakage current @ VI=1.8V or 0V		-	-	±10	μA
R_{PU}	Pull-up Resistor		26	46	71	kΩ
R_{PD}	Pull-down Resistor		27	48	103	kΩ
V_{OL}	Output low voltage		-	-	0.4	V
V_{OH}	Output high voltage		2.4	-	-	V
I_{OL}	Low level output current @ V_{OL}(max)	(DS2,DS1,DS0) = 000	4	6.3	8.9	mA
		(DS2,DS1,DS0) = 001	6	9.4	13.3	mA
		(DS2,DS1,DS0) = 010	8	12.5	17.6	mA
		(DS2,DS1,DS0) = 011	9.9	15.5	21.8	mA
		(DS2,DS1,DS0) = 100	11.9	18.6	26.1	mA
		(DS2,DS1,DS0) = 101	13.9	21.6	30.2	mA
		(DS2,DS1,DS0) = 110	15.8	24.5	34.2	mA
		(DS2,DS1,DS0) = 111	17.7	27.4	38.1	mA
I_{OH}	High level output current @ V_{OH}(min)	(DS2,DS1,DS0) = 000	5.9	9.3	14.2	mA
		(DS2,DS1,DS0) = 001	8.8	13.9	21.2	mA
		(DS2,DS1,DS0) = 010	11.7	18.5	28.2	mA
		(DS2,DS1,DS0) = 011	14.6	23.1	35.2	mA
		(DS2,DS1,DS0) = 100	17.5	27.7	42.2	mA
		(DS2,DS1,DS0) = 101	20.3	32.2	49.1	mA
		(DS2,DS1,DS0) = 110	23.2	36.8	56	mA
		(DS2,DS1,DS0) = 111	26.1	41.3	62.8	mA

Table 3-10 DC characteristics for VDDIO33_CIM/VDDIO18_CIM supplied pins for 3.3V application

Symbol	Parameter		Min	Typical	Max	Unit
V_T	Threshold point		0.76	0.94	1.24	V
V_{T+}	Schmitt trig low to high threshold point		0.94	1.09	1.37	V
V_{T-}	Schmitt trig high to low threshold point		0.68	0.89	1.21	V
V_{TPU}	Threshold point with pull-up resistor enabled		0.74	0.93	1.22	V
V_{TPD}	Threshold point with pull-down resistor enabled		0.76	0.95	1.26	V
V_{TPU+}	Schmitt trig low to high threshold point with pull-up resistor enabled		0.93	1.08	1.34	V
V_{TPU-}	Schmitt trig high to low threshold point with pull-down resistor enabled		0.67	0.88	1.18	V
V_{TPD+}	Schmitt trig low to high threshold point with pull-down resistor enabled		0.95	1.1	1.38	V
V_{TPD-}	Schmitt trig high to low threshold point with pull-up resistor enabled		0.68	0.9	1.22	V
I_L	Input Leakage Current @ VI=1.8V or 0V		-	-	±10	μA
I_{OZ}	Tri-State output leakage current @ VI=1.8V or 0V		-	-	±10	μA
R_{PU}	Pull-up Resistor		33	59	91	kΩ
R_{PD}	Pull-down Resistor		34	61	108	kΩ
V_{OL}	Output low voltage		-	-	0.4	V
V_{OH}	Output high voltage		2.4	-	-	V
I_{OL}	Low level output current @ V_{OL}(max)	(DS1,DS0) = 00	2.8	5.4	9.8	mA
		(DS1,DS0) = 01	4.1	8.0	14.6	mA
		(DS1,DS0) = 10	5.5	10.6	19.3	mA
		(DS1,DS0) = 11	6.8	13.2	23.8	mA
I_{OH}	High level output current @ V_{OH}(min)	(DS1,DS0) = 00	4.4	7.6	13.5	mA
		(DS1,DS0) = 01	6.6	11.4	20.2	mA
		(DS1,DS0) = 10	8.8	15.2	26.9	mA
		(DS1,DS0) = 11	10.9	18.9	33.6	mA

Table 3-11 DC characteristics for VDDIO33_CIM/VDDIO18_CIM supplied pins for 1.8V application

Symbol	Parameter		Min	Typical	Max	Unit
V_T	Threshold point		0.85	0.95	1.08	V
V_{T+}	Schmitt trig low to high threshold point		0.97	1.06	1.17	V
V_{T-}	Schmitt trig high to low threshold point		0.7	0.82	0.94	V
V_{TPU}	Threshold point with pull-up resistor enabled		0.85	0.95	1.07	V
V_{TPD}	Threshold point with pull-down resistor enabled		0.86	0.96	1.09	V
V_{TPU+}	Schmitt trig low to high threshold point with pull-up resistor enabled		0.97	1.06	1.16	V
V_{TPU-}	Schmitt trig high to low threshold point with pull-down resistor enabled		0.69	0.81	0.93	V
V_{TPD+}	Schmitt trig low to high threshold point with pull-down resistor enabled		0.98	1.07	1.18	V
V_{TPD-}	Schmitt trig high to low threshold point with pull-up resistor enabled		0.7	0.82	0.95	V
I_L	Input Leakage Current @ VI=1.8V or 0V		-	-	±10	μA
I_{OZ}	Tri-State output leakage current @ VI=1.8V or 0V		-	-	±10	μA
R_{PU}	Pull-up Resistor		33	59	90	kΩ
R_{PD}	Pull-down Resistor		34	61	95	kΩ
V_{OL}	Output low voltage		-	-	0.45	V
V_{OH}	Output high voltage		1.4	-	-	V
I_{OL}	Low level output current @ V_{OL}(max)	(DS1,DS0) = 00	4.5	7.6	11.2	mA
		(DS1,DS0) = 01	6.7	11.4	16.6	mA
		(DS1,DS0) = 10	8.9	15.1	22	mA
		(DS1,DS0) = 11	11.1	18.7	27.2	mA
I_{OH}	High level output current @ V_{OH}(min)	(DS1,DS0) = 00	2.6	6.3	11.9	mA
		(DS1,DS0) = 01	3.8	9.5	17.8	mA
		(DS1,DS0) = 10	5.1	12.6	23.7	mA
		(DS1,DS0) = 11	6.4	15.7	29.4	mA

3.4 Audio codec

Measurement conditions: T = 25°C, AVDD = 1.8 V, DVDD = 0.9V, 1KHz Sine Input, FS = 48KHZ					
Parameter	Test conditions	Min.	Type	Max.	Unit
Analog Supply	-	1.62	1.8	1.98	V
Digital Supply	-	0.81	0.9	0.99	V
Temperature	-	-40	-	125	℃
ADC					
SNR	A-weighted	-	92	-	dB
THD	-	-	-81	-	dB
Bias Voltage	-	0.5*AVDD	-	0.85*AVDD	V
Bias Current	-	-	-	3	mA
Mic Gain	-	0	-	20	dB
ALC Gain	-	-18	-	28.5	dB
Gain Step Size	-	-	1.5	-	dB
input Resistance	-	8	-	88	KΩ
input Capacitance	-	-	10	-	pF
DAC					
SNR	A-weighted	-	93	-	dB
THD	60mWΩ	-	-70	-	dB
	30mWΩ	-	-75	-	dB
	600Ω	-	-80	-	dB
Programmable Gain	-	-39	-	6	dB
Gain Step Size	-	-	1.5	-	
Output Resistance	-	-	-	1	Ω
Output Capacitance	-	-	20	-	pF
Power Supply Rejection	1KHZ	-	55	-	dB
Power Consumption					
Standby	-	-	0.1	-	mA

3.5 Power On, Reset and BOOT

3.5.1 Power-On Timing

The external voltage regulator and other power-on devices must provide the X2100 processor with a specific sequence of power and reset to ensure proper operation. Figure 3-1 shows this sequence and Table 3-12 gives the timing parameters. Following are the name of the power.

VDDIORTC: VDDIORTC

VDDRTC: VDDRTC

VDDIO18: all other 1.8V power supplies, include VDDIO,VDDIO18, PLLAVDD, VDDIO18_CIM, CSI_AVD18, DSI_AVD18, USB_AVD18, CODEC_AVDD, SADC_AVDD, DDRPLL, DDR_VDD1

VMEM: VDDMEM

VDDIO33: all 3.3V power supplies, include VDDIO33, VDDIO33_CIM, VDDIO33_SD, AVDUSB33

VDD: all other 0.9V power supplies: VDD, PLLVDD, DSI_AVD09, CSI_AVD09, USB_AVD09

AVDEFUSE: AVDEFUSE

Table 3-12 Power-On Timing Parameters

Symbol	Parameter	Min	Max	Unit
t_{D_VDDRTC}	Delay between VDDIORTC arriving 50% to VDDRTC arriving 90%[1]	0	–	ms
$t_{D\_VDDIO18}$	Delay between VDDIORTC arriving 50% to VDDIO18 arriving 50%[1]	0	–	ms
t_{D_VMEM}	Delay between VDDIO18 arriving 90% to VMEM to be turned on	0	–	ms
$t_{D\_VDDIO33}$	Delay between VDDIO18 arriving 90% to VDDIO33 to be turned on	20	–	us
t_{D_VDD}	Delay between VDDIO18 arriving 50% to VDD arriving 90%[1]	0	–	ms
$t_{D\_PPRST\_}$	Delay between all power rails get stable and power-on reset PPRST_ de-asserted[2]	TBD[3]	–	ms[2]
$t_{D\_AVDEFUSE}$	Delay between PPRST_ finished and E-fuse programming power apply	0	–	ms
$t_{H\_AVDEFUSE}$	E-fuse programming time	–	1	s

NOTES:

1 The power rails have same skew.

2 The PPRST_ must be kept at least 1ms. After PPRST_ is deasserted, the corresponding chip reset will be extended at least 10ms.

3 It must make sure the EXCLK is stable and all power(except AVDEFUSE) is stable.

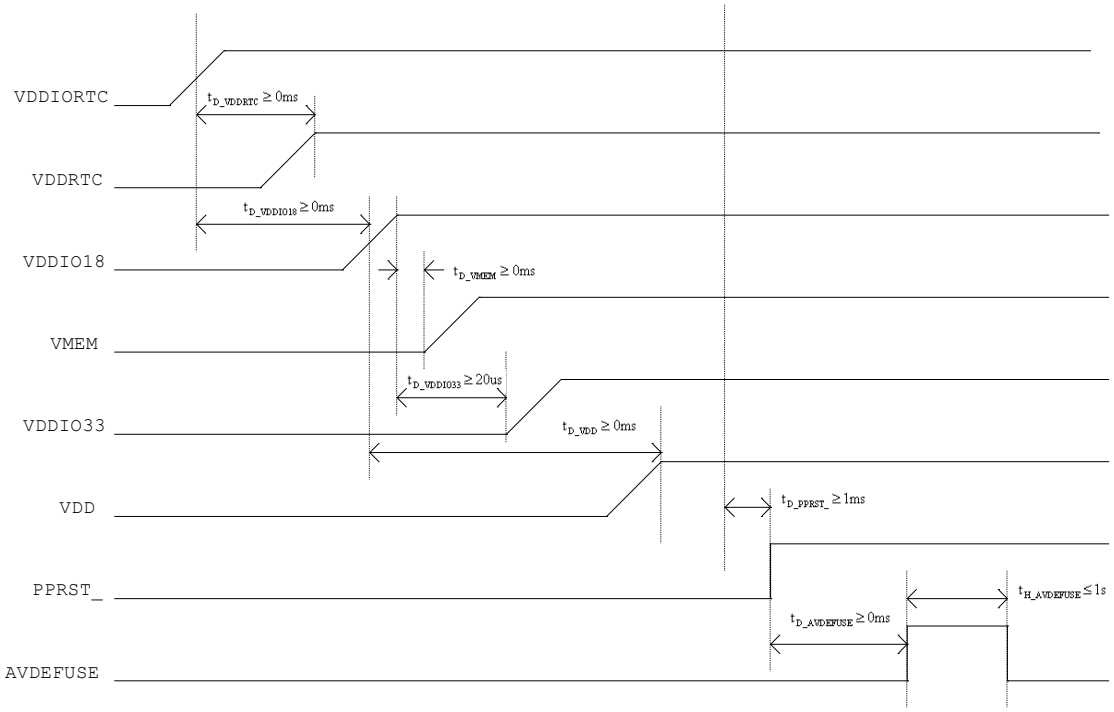


Figure 3-1 Power-On Timing Diagram

3.5.2 Reset procedure

There 3 reset sources: 1 PPRST_ pin reset; 2 WDT timeout reset; and 3 hibernating reset when exiting hibernating mode. After reset, program start from boot.

1 PPRST_ pin reset.
This reset is trigged when PPRST_ pin is put to logic 0. It happens in power on RTC power and RESET-KEY pressed to reset the chip from unknown dead state. The reset end time is about 10ms (512 clock whose frequence is exclk/512) after rising edge of PPRST_.

2 WDT reset.
This reset happens in case of WDT timeout.

3 Hibernating reset.
This reset happens in case of wakeup the main power from power down. The reset keeps for about 125ms as default and can be programed up to 1s, plus 10ms (512 clock whose frequence is exclk/512), start after WKUP_ signal is recognized.

After reset, all GPIO shared pins are put to GPIO input function，except JTAG relate TCK/TMS/TDI /TDO which reset to function mode, and most of their internal pull-up/down resistor are set to on. The PWRON is output 1. The oscillators are on.

3.5.3 BOOT

The boot sequence of the X2100 is controlled by boot_sel [2:0], GPIO PE27/26/25 PAD

Table 3-13 Boot Configuration of X2100

boot_sel[2]	boot_sel[1]	boot_sel[0]	Boot configuration
0	0	0	SFC0@PE 3.3v
0	0	1	MSC2@PE 3.3v
X	1	0	USB
0	1	1	Nor
1	0	0	SFC0@PD 1.8V
1	0	1	MSC0@PD 1.8V
1	1	1	MSC2@PE 1.8V

X: means "Don't Care"

After reset, the boot program on the internal boot ROM executes as follows:

1 Disable all interrupts, prepare the program running environment.

2 Read and save efuse values, efuse values to determine whether to improve system clock frequency, set MSC 4bit transmission data, gpio HI-Z, USB eye diagram.

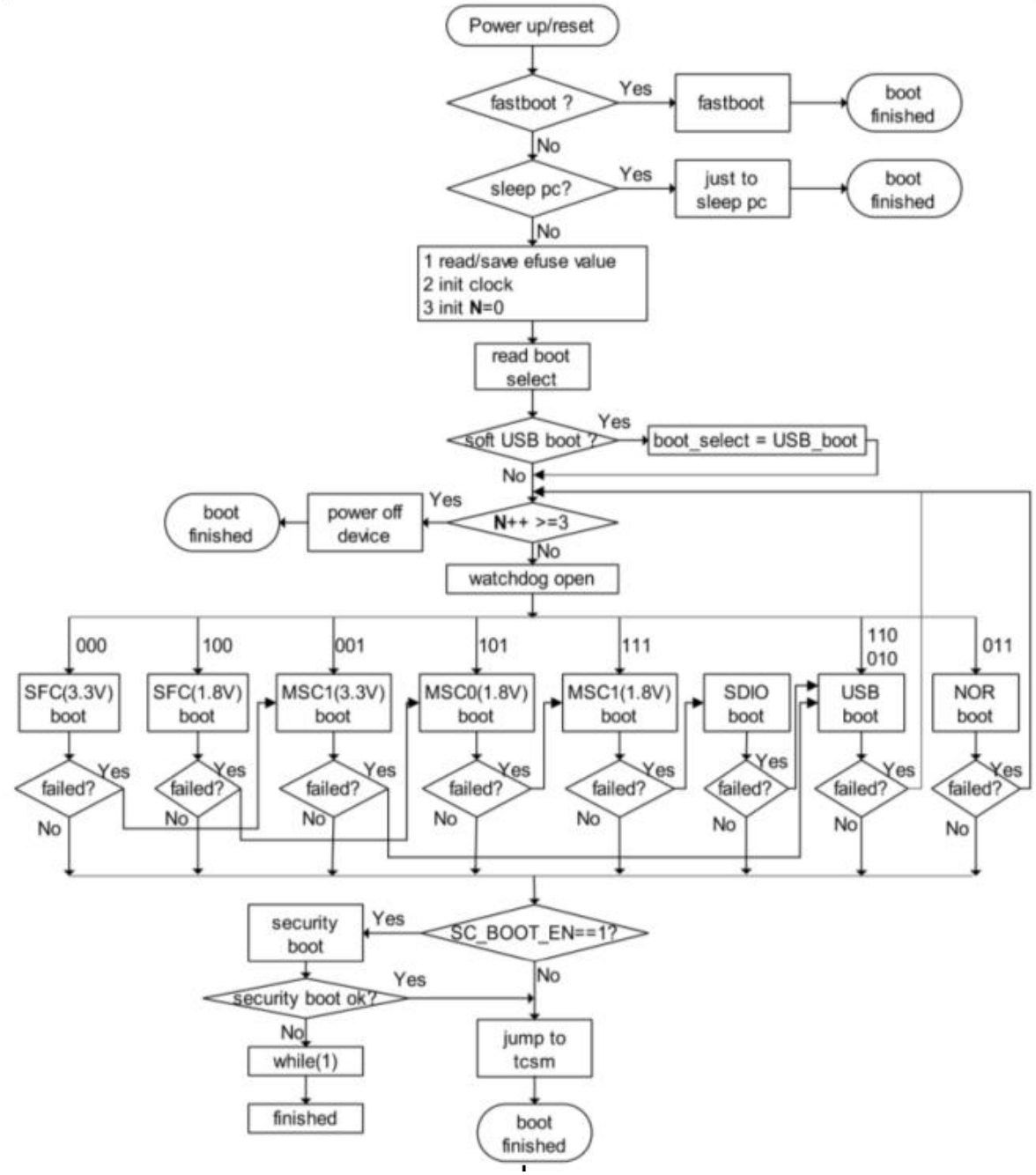
3 Initialize clock and read boot_sel[2:0] to determine the boot method.

4 If it is boot from MMC/SD card at MSC0/MSC2, its function pins MSC_D0, MSC_CLK, MSC_CMD are initialized, the boot program loads the 24KB data from MMC/SD card to SRAM and jump to it. Only one data bus which is MSC_D0 is used. The clock EXTCLK/122 is used initially. When reading data, the clock EXTCLK/4 is used. If the msc_bus_width_4 efuse values is set to 1, function pins MSC_D0, MSC_D1, MSC_D2, MSC_D3 are initialized for 4bit data transmission.

5 If it is boot from USB, a block of code will be received through USB cable connected with host PC and be stored in tcsm. Then branch to this area in tcsm.

6 If it is boot from SPI nor/nand at SFC, its function pins SFC_CLK, SFC_CE, SFC_DR, SFC_DT, SFC_WP, SFC_HOL are initialized, the boot program loads the spl size bytes code from nor/nand to SRAM and jump to it.

NOTE: The X2100's SRAM is 32KB, its address is from 0xB2400000 to 0xB2408000.

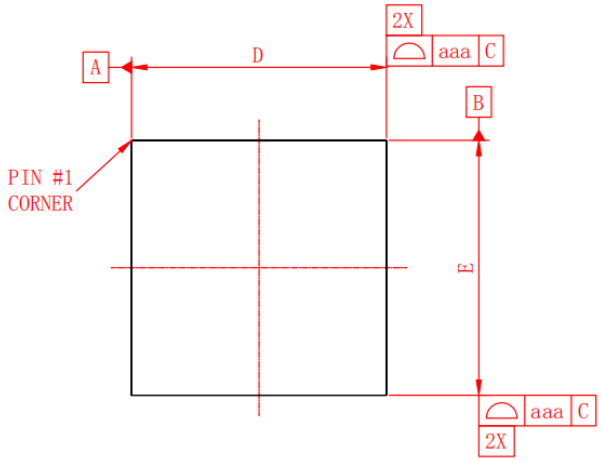


4 Packaging Information

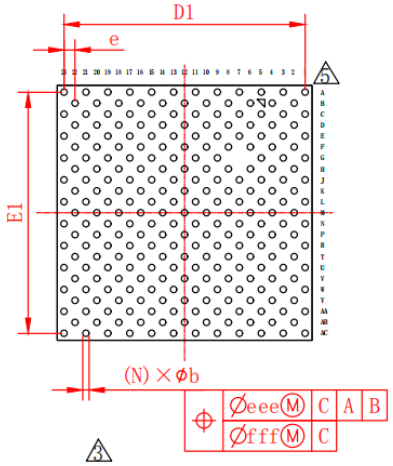
4.1 Overview

X2100 processor is offered in 264-pin BGA package, which is 10mm x 10mm x 1.2mm outline, 23 x 23 matrix ball grid array and 0.43mm Row/column spacing, show in Figure 4-1.

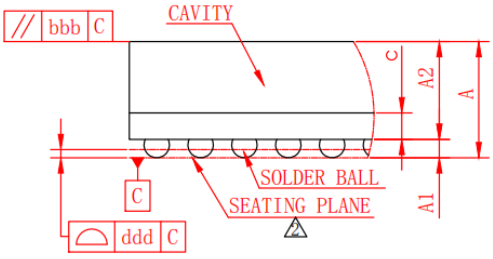
4.2 Device Dimensions



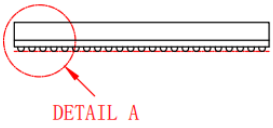
Top View



Bottom View



DETAIL A



Side View

symbol	Dimension in mm			Dimension in inch		
	MIN	NOM	MAX	MIN	NOM	MAX
A	---	---	1.240	---	---	0.049
A1	0.130	0.180	0.230	0.005	0.007	0.009
A2	0.910	0.960	1.010	0.036	0.038	0.040
c	0.220	0.260	0.300	0.009	0.010	0.012
D	9.900	10.000	10.100	0.390	0.394	0.398
E	9.900	10.000	10.100	0.390	0.394	0.398
D1	---	9.460	---	---	0.372	---
E1	---	9.460	---	---	0.372	---
e	---	0.430	---	---	0.017	---
b	0.200	0.250	0.300	0.008	0.010	0.012
aaa	0.100			0.004		
bbb	0.100			0.004		
ddd	0.080			0.003		
eee	0.150			0.006		
fff	0.050			0.002		
Ball Diam	0.250			0.010		
N	264			264		
MD/ME	23/23			23/23		

Figure 4-1 X2100 package outline drawing

Notes:

1. BALL PAD OPENING: 0.230mm;
2. PRIMARY DATUM C AND SEATING PLANE ARE THE SOLDER BALLS;
3. DIMENSION b IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM C;
4. SPECIAL CHARACTERISTICS C CLASS: bbb,ddd;
5. THE PATTERN OF PIN 1 FIDUCIAL IS FOR REFERENCE ONLY;
6. BAN TO USE THE LEVEL 1 ENVIRONMENT-RELATED SUBSTANCES;

4.3 Solder Ball Materials

Both the top (joint) and bottom solder ball materials of X2100 are SAC125.

4.4 Moisture Sensitivity Level

X2100 package moisture sensitivity is level 3.