CYWB022XX Family

West Bridge®: Astoria™ USB and Mass Storage Peripheral Controller

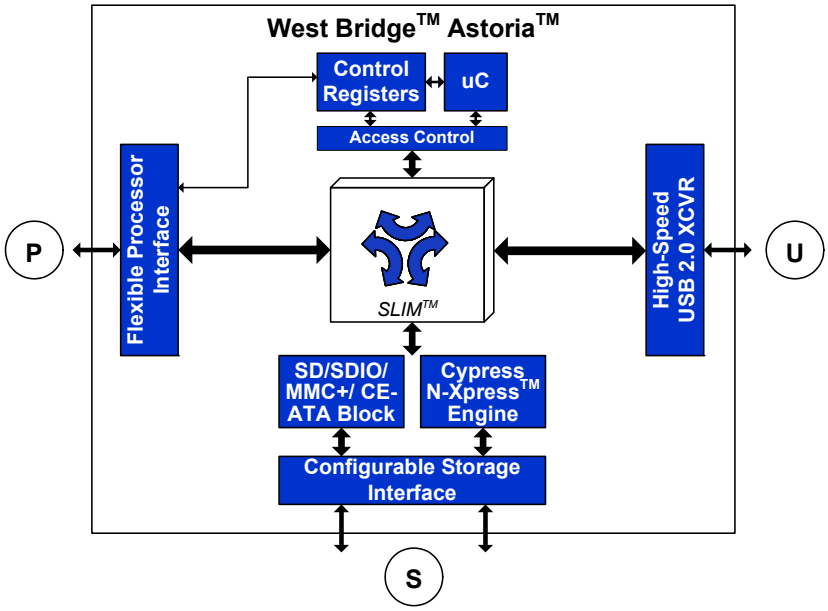
Features

- Multimedia device support
  - Up to two SD, SDIO, MMC, MMC+, and CE-ATA devices
- Supports Microsoft® Media Transfer Protocol (MTP) with optimized data throughput
- Simultaneous Link to Independent Multimedia (SLIM®) architecture, enabling simultaneous and independent data paths between the processor and USB, and between the USB and mass storage
- High-speed USB at 480 Mbps
  - USB 2.0 compliant
  - Integrated USB switch
  - Integrated USB 2.0 transceiver, smart serial interface engine
  - 16 programmable endpoints
- GPIF (General Programmable Interface)
  - Allows direct connection to most parallel interface
  - Programmable waveform descriptors and configuration registers to define waveforms
  - Supports multiple Ready (RDY) inputs and Control (CTL) outputs
- Flexible processor interface that supports:
  - Multiplexing and nonmultiplexing address and data interface
  - SRAM interface
  - Pseudo cellular random access memory (CRAM) interface (Antioch interface)
  - Pseudo NAND flash interface
  - SPI (slave mode) interface
  - Direct memory access (DMA) slave support
- FlexBoot
  - Processor can boot from the processor interface port
- Ultra low power, 1.8-V core operation
- Low power modes
- Small footprint:
  - 3.91 × 3.91 × 0.55 mm 81-ball WLCSP (SP and Lite SP)
  - 6 × 6 × 1.0 mm 100-ball VFBGA
  - 10 × 10 × 1.20 mm 121-ball FBGA
- Supports USB Boot, I^2C Boot and Processor Boot
- Selectable clock input frequencies
  - 19.2 MHz, 24 MHz, 26 MHz, and 48 MHz

Applications

- Cellular phones
- Portable media players
- Personal digital assistants
- Portable navigation devices
- Digital cameras
- POS terminals
- Portable video recorders
- Data cards and wireless dongles

Logic Block Diagram



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Functional Overview

Turbo-MTP Support

Turbo-MTP is an implementation of Microsoft's MTP enabled by West Bridge. In the current generation of MTP-enabled mobile phones, all protocol packets needs to be handled by the main processor. West Bridge Turbo-MTP switches these packet types and sends only control packets to the processor, while data payloads are written directly to mass storage, thereby bringing the high performance of West Bridge to MTP. For more information refer to the application note Optimizing Performance using West Bridge® Controllers with Turbo-MTP.

SLIM Architecture

The SLIM architecture enables three different interfaces (P-port, S-port, and U-port) to connect to one another independently.

With this architecture, connecting a device using Astoria to a PC through USB does not disturb any of the functions of the device. The device can still access mass storage at the same time as the PC synchronizes with the main processor.

The SLIM architecture enables new usage models in which a PC can access a mass storage device independent of the main processor or enumerate access to both the mass storage and the main processor at the same time.

In a handset, this typically enables using the phone as a thumb drive, downloading media files to the phone while still having full functionality available on the phone, or using the same phone as a modem to connect the PC to the web.

8051 Microprocessor

The 8051 microprocessor embedded in Astoria does basic transaction management for all the transactions between P-Port, S-Port, and U-Port. The 8051 does not reside in the data path; it manages the path. The data path is optimized for performance. The 8051 executes firmware that supports SD, SDIO, MMC+, and CE-ATA devices at the S-Port.

Configuration and Status Registers

The West Bridge Astoria device includes configuration and status registers that are accessible as memory mapped registers through the processor interface. The configuration registers allow the system to specify certain Astoria behaviors. For example, it is able to mask certain status registers from raising an interrupt. The status registers convey various status such as the addresses of buffers for read operations.

Processor Interface (P-Port)

Communication with the external processor is realized through a dedicated processor interface. This interface is configured to support different interface standards. This interface supports multiplexing and nonmultiplexing address or data bus in both synchronous and asynchronous pseudo CRAM-mapped, and nonmultiplexing address or data asynchronous SRAM-mapped memory accesses. The interface also can be configured to a pseudo NAND interface to support the processor's NAND interface. In addition, this interface can be configured to support SPI slave. Asynchronous accesses can reach a bandwidth of up to 66.7 MBps. Synchronous accesses can be performed at 33 MHz across 16 bits for up to 66.7 MBps bandwidth. The P-Port of the WLCSP package only supports PNAND and SPI interface.

The memory address is decoded to access any of the multiple endpoint buffers inside Astoria. These endpoints serve as buffers for data between each pair of ports, for example, between the processor port and the USB port. The processor writes and reads into these buffers through the memory interface.

Access to these buffers is controlled by either using a DMA protocol or using an interrupt to the main processor. These two modes are configurable by the external processor. The 81-ball WLCSP package only supports interrupt.

As a DMA slave, Astoria generates a DMA request signal to signify to the main processor that a specific buffer is ready to be read from or written to. The external processor monitors this signal and polls Astoria for the specific buffers ready for read or write. It then performs the appropriate read or write operations on the buffer through the processor interface. This way, the external processor only deals with the buffers to access a multitude of storage devices connected to Astoria.

In the interrupt mode, Astoria communicates important buffer status changes to the external processor using an interrupt signal. The external processor then polls Astoria for the specific buffers ready for read or write and it performs the appropriate read or write operations through the processor interface.

FlexBoot

FlexBoot is an optional feature that Astoria emulates a NAND Flash device. In this optional feature, the P-Port is configured as pseudo NAND interface. The processor can download its boot image through the P-Port.

When P-Port is configured to pseudo NAND interface, it supports two operation modes:

- Logic NAND Access (LNA) mode
- Non-Logic NAND Access (non-LNA) mode

LNA refers to the mode of operation where Astoria emulates a NAND flash device. This mode is designed for systems that require booting of the system processor from a NAND Flash device. In this type of application, the system processor can communicate to Astoria using common NAND commands to boot from a NAND Flash connected to Astoria's S-port. In this mode of operation, Astoria mimics a real NAND device and allows the system processor to use its internal boot-ROM to boot from Astoria, as it boots from a NAND Flash.

In the non-LNA mode of operation, the system processor interfaces with Astoria using standard NAND interface, but does not use standard NAND commands. In this mode, Astoria responds to a subset of NAND commands. The system processor uses a set of APIs provided by Cypress to communicate through its NAND controller to Astoria. For details, refer to the application note "Interfacing To West Bridge™ Astoria's™ Pseudo-NAND Processor Port".

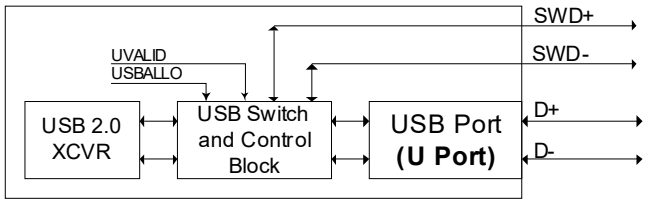
USB Interface (U-Port)

In accordance with the USB 2.0 specification, Astoria can operate in both full speed and high speed USB modes. The USB interface consists of the USB transceiver and can be accessed by both the P-Port and the S-Port.

The Astoria USB interface supports programmable CONTROL/BULK/INTERRUPT/ISOCHRONOUS endpoints.

Astoria also has an integrated USB switch (see Figure 1) that allows interfacing to an external full speed USB PHY.

Figure 1. U-Port With Switch and Control Block



Mass Storage Support (S-Port)

The S-Port is configurable in five different interface modes:

- Simultaneously supporting an SD/SDIO/MMC+/CE-ATA port and an GPIF
- Supporting two SD/SDIO/MMC+/CE-ATA ports
- Supporting SD/SDIO/MMC+/CE-ATA port and GPIO
- Supporting GPIF and GPIO
- Supporting GPIO

These configurations are controlled by the 8051 firmware.

S-Port Configuration Modes

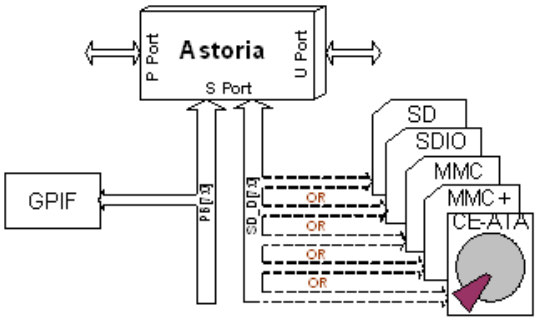
The S Port is configurable in six different interface modes:

- GPIF and SD/SDIO/MMC/CE-ATA interface mode
- Dual SD/SDIO/MMC/CE-ATA interface mode
- SD/SDIO/MMC/CE-ATA and GPIO interlace mode
- GPIF and GPIO interface mode
- GPIO interface mode

GPIF and SD/SDIO/MMC/CE-ATA Interface Mode

This mode configures the S-Port into GPIF and SD/SDIO/MMC/MMC+/CE-ATA ports as shown in Figure 2. The SD/SDIO/MMC/MMC+/CE-ATA port supports either SD, SDIO, MMC, MMC+, or CE-ATA device.

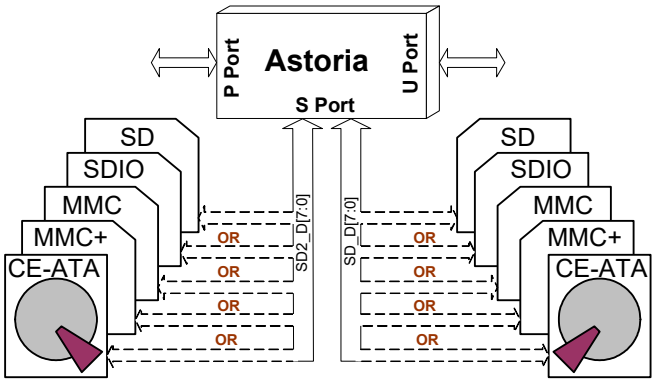
Figure 2. GPIF and SD/SDIO/MMC/CE-ATA Interface Mode



Dual SD/SDIO/MMC/CE-ATA Interface Mode

The dual SD/SDIO/MMC/MMC+/CE-ATA interface mode configures the S-Port for up to two SD/SDIO/MMC/MMC+/CE-ATA port as shown in Figure 3. Each SD/SDIO/MMC/MMC+/CE-ATA port is independent and supports different SD, SDIO, MMC, MMC+, or CE-ATA devices.

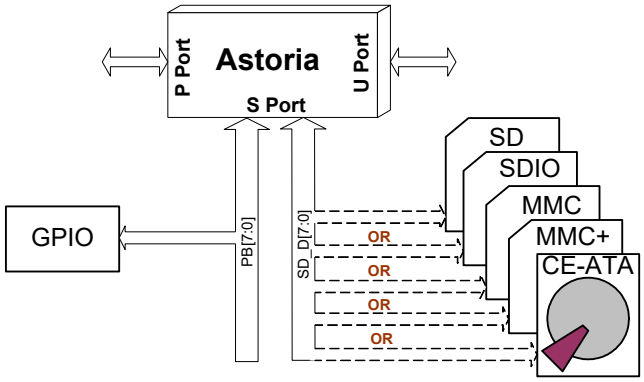
Figure 3. Dual SD/SDIO/MMC/CE-ATA Interface Mode



SD/SDIO/MMC/CE-ATA and GPIO Interface

The SD/SDIO/MMC/MMC+/CE-ATA and GPIO interface mode configures the S-Port to support SD/SDIO/MMC/MMC+/CE-ATA device and GPIOs as shown in Figure 4. Each GPIO is configured as either input or output independently. The processor accesses those GPIO through the P-Port driver's API.

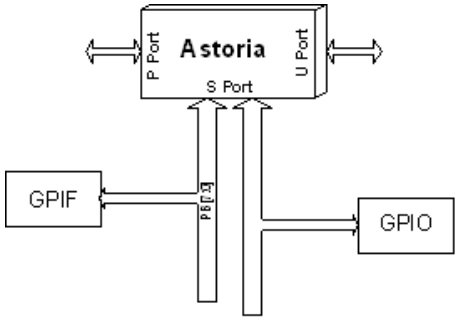
Figure 4. SD/SDIO/MMC/CE-ATA and GPIO Interface Mode



GPIF and GPIO Interface

The GPIF and GPIO interface mode configure the S-Port to support GPIF and GPIO as shown in Figure 5. Each GPIO is configured as either input or output independently. The processor accesses those GPIO through the P-Port driver's API.

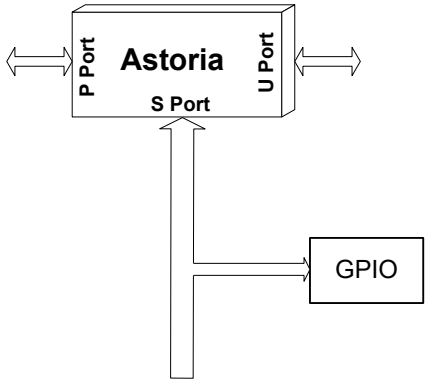
Figure 5. GPIF and GPIO Interface Mode



GPIO Interface Mode

The GPIO interface mode configures the S-Port to all GPIO as shown in Figure 6. Each GPIO is configured as either input or output independently. The processor accesses those GPIO through the P-Port driver's API.

Figure 6. GPIO Interface Mode



SD/SDIO/MMC+/CE-ATA Port (S-Port)

When Astoria is configured with firmware to support SD, SDIO, MMC+, and CE-ATA, this interface supports:

- The Multimedia Card System Specification, MMCA Technical Committee, Version 4.1
- SD Memory Card Specification – Part 1, Physical Layer Specification, SD Group, Version 1.10, October 15, 2004
- SD Memory Card Specification – Part 1, Physical Layer Specification, SD Group, Version 2.0, May 9, 2006
- SD Specifications – Part E1 SDIO Specification, Version 1.10, August 18, 2004
- CE-ATA Specification – CE-ATA Digital Protocol, CE-ATA Committee, Version 1.1, September, 2005

West Bridge Astoria provides support for 1-bit and 4-bit SD; SDIO cards; 1-bit, 4-bit, and 8-bit MMC; MMC+ cards; and CE-ATA drive. For the SD, SDIO, MMC/MMC Plus, and CE-ATA, this block supports one card for one physical bus interface.

Astoria supports SD commands including the multisector program command that are handled by the API.

GPIO Port (S-Port)

The GPIO in S-Port is configurable as either input or output direction independently. The processor accesses the GPIO through the P-Port driver's API.

Clocking

Astoria allows connection of a crystal between the XTALIN and XTALOUT pins or an external clock at the XTALIN pin. The 81-ball WLCSP package only supports the external clock. The power supply level at the crystal supply XVDDQ determines whether a crystal or a clock is provided. If XVDDQ is detected to be 1.8 V, Astoria assumes that a clock input is provided. For a crystal to be connected, XVDDQ must be 3.3 V.

Note Clock inputs at 3.3 V level are not supported.

Astoria's 100-ball VFBGA package supports external crystal and clock inputs at 19.2, 24, and 26 MHz frequencies. At 48 MHz, only clock inputs are supported. The 81-ball SPWLCSP only supports 19.2 and 26 MHz external clock input. The 81-ball Lite SP WLCSP only supports 26 MHz external clock or crystal input. The crystal or clock frequency selection is shown in Table 1 on page 6, Table 2 on page 6, and Table 3 on page 6.

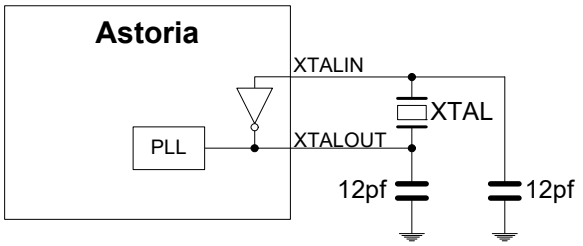
The XTALIN frequency is independent of the clock and data rate of the 8051 microprocessor or any of the device interfaces (including P-Port and S-Port). The internal PLL applies the proper clock multiply option depending on the input frequency.

For applications that use an external clock source to drive XTALIN, the XTALOUT pin must be left floating. The external clock source must also stop high or low and not toggle, to achieve the lowest possible current consumption. The requirements for an external clock source are shown in Table 4 on page 6.

Astoria has an on-chip oscillator circuit that uses an external 19.2, 24, and 26 MHz (±150 ppm) crystal with the following characteristics:

- Parallel resonant
- Fundamental mode
- 1 mW drive level
- 12 pF (5% tolerance) load capacitors
- 150 ppm

Figure 7. Crystal Configuration



* 12 pF capacitor values assumes a trace capacitance of 3 pF per side on a four layer FR4 PCA

Table 1. 100-ball FVBGA Clock Selection

XTALSLC[1]	XTALSLC[0]	Freq	Crystal/Clock
0	0	19.2 MHz	Crystal/Clock
0	1	24 MHz	Crystal/Clock
1	0	48 MHz	Clock
1	1	26 MHz	Crystal/Clock

Table 2. 81-ball SP WLCSP Clock Selection

XTALSLC	Freq	Crystal/Clock
0	19.2 MHz	Clock
1	26 MHz	Clock

Table 3. 81-ball Lite SP WLCSP Clock Supports 26 MHz

XTALSLC	Freq	Crystal/Clock
NA	26 MHz	Clock or Crystal

Table 4. External Clock Requirements

Parameter	Description	Specification		Unit
		Min	Max	
Vn (AVDDQ)	Supply voltage noise at frequencies < 50 MHz	–	20	mV p-p
PN_100	Input phase noise at 100 Hz	–	–75	dBc/Hz
PN_1k	Input phase noise at 1 kHz offset	–	–104	dBc/Hz
PN_10k	Input phase noise at 10 kHz offset	–	–120	dBc/Hz
PN_100k	Input phase noise at 100 kHz offset	–	–128	dBc/Hz
PN_1M	Input phase noise at 1 MHz offset	–	–130	dBc/Hz
	Duty cycle	30	70	%
	Maximum frequency deviation	–	150	ppm
	Overshoot	–	3	%
	Undershoot	–	–3	%

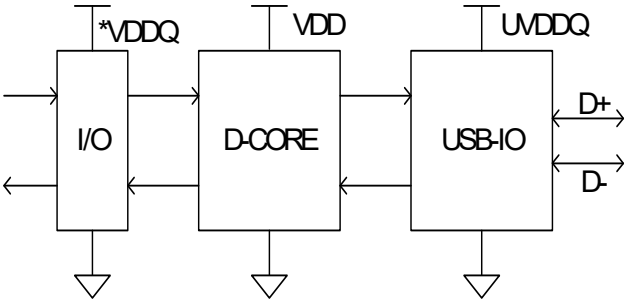
Power Domains

Astoria has multiple power domains that serve different purposes within the chip.

- VDDQ refers to a group of four independent supply domains for the digital I/Os. The nominal voltage level on these supplies are 1.8 V, 2.5 V, or 3.3 V. The three separate I/O power domains are:
  - PVDDQ – P-Port Processor interface I/O
  - SNVDDQ – S-Port GPIF interface I/O
  - SSVDDQ – S-Port SD interface I/O
  - GVDDQ – Other miscellaneous I/O
- UVDDQ is the 3.3-V nominal supply for the USB I/O and some analog circuits. It also supplies power to the USB transceiver
- VDD33 supply is required for the power sequence control circuits. For more details, see Pin Assignments on page 9.
- VDD is the supply voltage for the logic core. The nominal supply voltage level is 1.8 V. This supplies the core logic circuits. The same supply must also be used for AVDDQ
- AVDDQ is the 1.8 V supply for PLL and USB serializer analog components. The same supply must also be used for VDD. The maximum permitted noise on AVDDQ is 20 mV p-p
- XVDDQ is the clock I/O supply; 3.3 V for XTAL or 1.8 V for an external clock

Noise guideline for all supplies except AVDDQ is a maximum of 100 mV p-p. All I/O supplies of Astoria must be ON when a system is active even if Astoria is not in use. The core VDD can also be deactivated at any time to preserve power if there is a minimum impedance of 1 kΩ between the VDD pin and ground. All I/Os tristate when the core is disabled.

Figure 8. Astoria Power Supply Domains



Power Supply Sequence

The power supplies are independently sequenced without damaging the part. All power supplies must be up and stable before the device operates. If the supplies are not stable, the remaining domains are in low power (standby) state.

Power Modes

In addition to the normal operating mode, Astoria contains several low power states when normal operation is not required.

Normal Mode

Normal mode is the mode in which Astoria is fully functional. In this mode, data transfer functions described in this document are performed.

Suspend Mode

This mode is entered internally by 8051 (the external processor only initiates entry into this mode through Mailbox commands). This mode is exited by the D+ bus going low, GPIO[0] going to a pre-determined state or by asserting CE# LOW.

In Astoria's suspend mode:

- The clocks are shut off
- All I/Os maintain their previous state
- Core power supply must be retained
- The states of the configuration registers, endpoint buffers, and the program RAM are maintained. All transactions must be complete before Astoria enters suspend mode (state of outstanding transactions are not preserved)
- The firmware resumes its operation from where it was suspended because the program counter is not reset
- Only inputs that are sensed are RESET#, GPIO[0]/SD_CD, GPIO[1]/SD2_CD, SD_D3, SD2_D3, D+, and CE#. The last three are wake up sources (each can be individually enabled or disabled)
- Hard Reset can be performed by asserting the RESET# input, and Astoria is initialized

Standby Mode

Standby mode is a low-power state. This is the lowest power mode of Astoria while still maintaining external supply levels. This mode is entered through the deassertion of the WAKEUP input pin or through internal register settings. To leave this mode, assert the WAKEUP, CE#, and RESET#; change state of GPIO[0]/SD_CD, GPIO[1]/SD2_CD, SD_D3, and SD2_D3.

In this mode all configuration register settings and program RAM contents are preserved. However, data in the buffers or other parts of the data path, if any, is not guaranteed in values. Therefore, the external processor must ensure that the required data is read before placing Astoria in the standby mode.

In the standby mode:

- The program counter is reset on waking up from standby mode
- All outputs are tristated and I/O is placed in input only configuration. Values of I/Os in standby mode are listed in the pin assignments table
- Core power supply must be retained
- Hard Reset can be performed by asserting the RESET# input, and Astoria is initialized
- PLL is disabled
- USB switches the SWD+/SWD– to D+/D–

Core Power Down Mode

The core power supply V_{DD} is powered down in this state. Because AVDDQ is tied to the same supply as V_{DD}, it is also powered down. The endpoint buffers, configuration registers, and program RAM do not maintain state. All VDDQ power supplies (except AVDDQ) must be ON and not power down in this mode. VDD33 must also remain ON. It has an option that the UVDDQ can be powered down or stay ON while V_{DD} is powered down when SWD+/SWD– are not connected. The UVDDQ cannot be powered down when SWD+/SWD– is connected, or V_{DD} is active. When UVDDQ is powered down, D+/D– cannot be driven by an external device.

In the WLCSP package, AVDDQ is internally tied to XVDDQ. Due to this, the clock input at XTALIN must be brought to a steady low level prior to entry into Core Power Down Mode. In the WLCSP package, VDD33 is tied to UVDDQ internally. UVDDQ must be ON during the core power down mode

The core power down mode has two power down options:

- Core only power down – VDD power down
- Core and USB power down – VDD and UVDDQ are both powered down. In this option, SWD+/SWD– are not connected and cannot be driven by an external device

In these power down options, the endpoint buffers, configuration registers, or the program RAM do not maintain state. It is necessary to reload the firmware on exiting from this mode. All VDDQ power supplies must be ON and not powered down in this mode.

In the 82-ball WLCSP package, in the core power down mode, the USB switches the SWD+/SWD– to D+/D–.

Packages and Interface Options

Astoria provides one 100-ball VFBGA, one 100-ball BGA, one 121-ball FBGA and two types of 81-ball WLCSP packages. The two WLCSP packages are SP WLCSP and Lite SP WLCSP. These two packages have different interface options as listed in Table 5. The 100-ball VFBGA/BGA package pin list is listed in Table 6 on page 9, the 81-ball SP CSP package is listed in Table 10 on page 21, and the 81-ball Lite SP CSP package in Table 11 on page 24.

Table 5. Interface Options for 100-ball VFBGA, 81-ball SP, and 81-ball Lite SP

Package	P-Port						S-Port				Clock		
	PCRAM	SRAM	ADM	PNAND	I^2C	SPI	SD1	SD2	GPIF	GPIO	Ext CLK	Crystal	Freq. (MHz)
100-ball BGA / VFBGA	√	√	√	√	√	√	√	√	√	√	√	√	19.2, 24, 26, 48
121-ball FBGA	√	√	√	√	√	√	√	√	√	√	√	√	19.2, 24, 26, 48
81-ball SP WLCSP				√	√	√	√	√	√	√	√		19.2, 26
81-ball Lite SP WLCSP		√	√	√	√		√			√	√	√	26

Pin Assignments

Table 6. Astoria 100-ball VFBGA Package Pin Assignments

	Pin Name											Pin Description	Power Domain
	Ball #	PCRAM Non-Multiplexing	I/O	Address / Data bus Multiplexing (ADM)	I/O	SRAM	I/O	PNAND	I/O	SPI	I/O		
P-Port	J2	CLK (pull low in Asyn mode)	I	CLK (pull low in Async mode)	I	Ext pull low	I	Ext pull low	I	SCK	I	Clock	PVDDQ VGND
	G1	CE#	I	CE#	I	CE#	I	CE#	I	SS#	I	CE# or SPI Slave Select	
	H3	A7	I	Ext pull up	I	A7	I	A7 ≥ 1:SBD A7 ≥ 0:LBD	I	Ext pull up	I	Addr. Bus 7	
	H2	A6	I	SDA	I	A6	I	SDA	I/O	SDA	I/O	A6 or I^2C data	
	H1	A5	I	SCL	I	A5	I	SCL	I/O	SCL	I/O	A5 or I^2C clock	
	J3	A4	I	Ext pull up	I	A4	I	WP#	I	Ext pull up	I	A4 or PNAND WP	
	J1	A3	I	A3 = 0 (Ext pull low)	I	A3	I	A3 = 0 (Ext pull low)	I	A3 = 1 (Ext pull up)	I	A3	
	K3	A2	I	A2 = 1 (Ext pull up)	I	A2	I	A2 = 0 (Ext pull low)	I	A2 = 0 (Ext pull low)	I	A2	
	K2	A1	I	Ext pull up	I	A1	I	RB#	O	Ext pull up	I	A1 or PNAND R/B#	
	K1	A0	I	Ext pull up	I	A0	I	CLE	I	Ext pull up	I	A0 or PNAND CLE	
	G2	DQ[15]	I/O	AD[15]	I/O	DQ[15]	I/O	I/O[15]	I/O	Ext pull up	I	D15, AD15, or I/O15	
	G3	DQ[14]	I/O	AD[14]	I/O	DQ[14]	I/O	I/O[14]	I/O	Ext pull up	I	D14, AD14, or I/O14	
	F1	DQ[13]	I/O	AD[13]	I/O	DQ[13]	I/O	I/O[13]	I/O	Ext pull up	I	D13, AD13, or I/O13	
	F2	DQ[12]	I/O	AD[12]	I/O	DQ[12]	I/O	I/O[12]	I/O	Ext pull up	I	D12, AD12, or I/O12	
	F3	DQ[11]	I/O	AD[11]	I/O	DQ[11]	I/O	I/O[11]	I/O	Ext pull up	I	D11, AD11, or I/O11	
	E1	DQ[10]	I/O	AD[10]	I/O	DQ[10]	I/O	I/O[10]	I/O	Ext pull up	I	D10, AD10, or I/O10	
	E2	DQ[9]	I/O	AD[9]	I/O	DQ[9]	I/O	I/O[9]	I/O	Ext pull up	I	D9, AD9, or I/O9	
	E3	DQ[8]	I/O	AD[8]	I/O	DQ[8]	I/O	I/O[8]	I/O	Ext pull up	I	D8, AD8, or I/O8	
	D1	DQ[7]	I/O	AD[7]	I/O	DQ[7]	I/O	I/O[7]	I/O	Ext pull up	I	D7, AD7, or I/O7	
	D2	DQ[6]	I/O	AD[6]	I/O	DQ[6]	I/O	I/O[6]	I/O	Ext pull up	I	D6, AD6, or I/O6	
	D3	DQ[5]	I/O	AD[5]	I/O	DQ[5]	I/O	I/O[5]	I/O	Ext pull up	I	D5, AD5, or I/O5	
	C1	DQ[4]	I/O	AD[4]	I/O	DQ[4]	I/O	I/O[4]	I/O	Ext pull up	I	D4, AD4, or I/O4	
	C2	DQ[3]	I/O	AD[3]	I/O	DQ[3]	I/O	I/O[3]	I/O	Ext pull up	I	D3, AD3, or I/O3	
	C3	DQ[2]	I/O	AD[2]	I/O	DQ[2]	I/O	I/O[2]	I/O	Ext pull up	I	D2, AD2, or I/O2	
	B1	DQ[1]	I/O	AD[1]	I/O	DQ[1]	I/O	I/O[1]	I/O	SDO	O	SPI SDO, AD1or D1	
	B2	DQ[0]	I/O	AD[0]	I/O	DQ[0]	I/O	I/O[0]	I/O	SDI	I	SPI SDI, AD0, or D0	
	A1	ADV#	I	ADV#	I		I	ALE	I	Ext pull up	I	Address Valid	
	B3	OE#	I	OE#	I	OE#	I	RE#	I	Ext pull up	I	Output Enable	
	A2	WE#	I	WE#	I	WE#	I	WE#	I	Ext pull up	I	WE#	
DRQ & Int	A3	INT#	O	INT#	O	INT#	O	INT#	O	SINT#	O	INT Request	GVDDQ VGND
	A4	DRQ#	O	DRQ#	O	DRQ#	O	DRQ#	O	N/C	O	DMA Request	
	B4	DACK#	I	DACK#	I	DACK#	I	DACK#	I	Ext pull up	I	DMA Acknowledgement	
U-Port	A5	D+									I/O/Z	USB D+	UVDDQ UVSSQ
	A6	D–									I/O/Z	USB D–	
	A7	SWD+									I/O/Z	USB Switch DP	
	C6	SWD–									I/O/Z	USB Switch DM	

Table 6. Astoria 100-ball VFBGA Package Pin Assignments (continued)

	Pin Name											Pin Description	Power Domain
	Ball #	Double SDIO Configuration	I/O	SDIO & GPIO Configuration	I/O	GPIO Configuration	I/O	GPIF Configuration	I/O	GPIF & GPIO Configuration	I/O		
S-Port	G9	SD_D[7]	I/O	SD_D[7]	I/O	PD[7] (GPIO)	I/O	GPIF_DATA[15]	I/O	PD[7] (GPIO)	I/O	SD Data or GPIO or GPIF Data	SSVDDQ VGND
	G10	SD_D[6]	I/O	SD_D[6]	I/O	PD[6] (GPIO)	I/O	GPIF_DATA[14]	I/O	PD[6] (GPIO)	I/O	SD Data or GPIO or GPIF Data	
	F9	SD_D[5]	I/O	SD_D[5]	I/O	PD[5] (GPIO)	I/O	GPIF_DATA[13]	I/O	PD[5] (GPIO)	I/O	SD Data or GPIO or GPIF Data	
	F10	SD_D[4]	I/O	SD_D[4]	I/O	PD[4] (GPIO)	I/O	GPIF_DATA[12]	I/O	PD[4] (GPIO)	I/O	SD Data or GPIO or GPIF Data	
	E9	SD_D[3]	I/O	SD_D[3]	I/O	PD[3] (GPIO)	I/O	GPIF_DATA[11]	I/O	PD[3] (GPIO)	I/O	SD Data or GPIO or GPIF Data	
	E10	SD_D[2]	I/O	SD_D[2]	I/O	PD[2] (GPIO)	I/O	GPIF_DATA[10]	I/O	PD[2] (GPIO)	I/O	SD Data or GPIO or GPIF Data	
	D9	SD_D[1]	I/O	SD_D[1]	I/O	PD[1] (GPIO)	I/O	GPIF_DATA[9]	I/O	PD[1] (GPIO)	I/O	SD Data or GPIO or GPIF Data	
	D10	SD_D[0]	I/O	SD_D[0]	I/O	PD[0] (GPIO)	I/O	GPIF_DATA[8]	I/O	PD[0] (GPIO)	I/O	SD Data or GPIO or GPIF Data	
	F8	SD_CLK	O	SD_CLK	O	PC[7] (GPIO)	I/O	PC[7] (GPIO)	I/O	PC[7] (GPIO)	I/O	SD Clock or GPIO	
	G8	SD_CMD	I/O	SD_CMD	I/O	PC[3] (GPIO)	I/O	PC[3] (GPIO)	I/O	PC[3] (GPIO)	I/O	SD CMD or GPIO	
	H8	SD_POW		SD_POW		PC[6] (GPIO)	I/O	PC[6] (GPIO)	I/O	PC[6] (GPIO)	I/O	SD Power or GPIO	
	H10	SD_WP	I	SD_WP	I	N/C		N/C		PC[5] (GPIO)		SD Write Protect	
	K7	SD2_D[7]	I/O	PB[7] (GPIO)	I/O	PB[7] (GPIO)	I/O	GPIF_DATA[7]	I/O	GPIF_DATA[7]	I/O	SD2 Data or GPIO or GPIF Data	SNVDDQ VGND
	K8	SD2_D[6]	I/O	PB[6] (GPIO)	I/O	PB[6] (GPIO)	I/O	GPIF_DATA[6]	I/O	GPIF_DATA[6]	I/O	SD2 Data or GPIO or GPIF Data	
	J8	SD2_D[5]	I/O	PB[5] (GPIO)	I/O	PB[5] (GPIO)	I/O	GPIF_DATA[5]	I/O	GPIF_DATA[5]	I/O	SD2 Data or GPIO or GPIF Data	
	K9	SD2_D[4]	I/O	PB[4] (GPIO)	I/O	PB[4] (GPIO)	I/O	GPIF_DATA[4]	I/O	GPIF_DATA[4]	I/O	SD2 Data or GPIO or GPIF Data	
	J9	SD2_D[3]	I/O	PB[3] (GPIO)	I/O	PB[3] (GPIO)	I/O	GPIF_DATA[3]	I/O	GPIF_DATA[3]	I/O	SD2 Data or GPIO or GPIF Data	
	H9	SD2_D[2]	I/O	PB[2] (GPIO)	I/O	PB[2] (GPIO)	I/O	GPIF_DATA[2]	I/O	GPIF_DATA[2]	I/O	SD2 Data or GPIO or GPIF Data	
	K10	SD2_D[1]	I/O	PB[1] (GPIO)	I/O	PB[1] (GPIO)	I/O	GPIF_DATA[1]	I/O	GPIF_DATA[1]	I/O	SD2 Data or GPIO or GPIF Data	
	J10	SD2_D[0]	I/O	PB[0] (GPIO)	I/O	PB[0] (GPIO)	I/O	GPIF_DATA[0]	I/O	GPIF_DATA[0]	I/O	SD2 Data or GPIO or GPIF Data	
	K6	SD2_CLK	O	PA[6] (GPIO)	I/O	PA[6] (GPIO)	I/O	PA[6] (GPIO)	I/O	PA[6] (GPIO)	I/O	SD2 Clock or GPIO	
	J6	SD2_CMD	I/O	PA[7] (GPIO)	I/O	PA[7] (GPIO)	I/O	PA[7] (GPIO)	I/O	PA[7] (GPIO)	I/O	SD2 CMD or GPIO	
	J5	SD2_POW	O	PC[0] (GPIO)	I/O	PC[0] (GPIO)	I/O	PC[0] (GPIO)	I/O	PC[0] (GPIO)	I/O	SD2 Power or GPIO	
	K4	N/C	O	N/C	O	N/C	O	GPIF_CTL[1]	O	GPIF_CTL[1]	O	GPIF Control Signal	
	H6	N/C	O	N/C	O	N/C	O	GPIF_CTL[0]	O	GPIF_CTL[0]	O	GPIF Control Signal	
	J7	PA[5] (GPIO)	I/O	PA[5] (GPIO)	I/O	PA[5] (GPIO)	I/O	PA[5] (GPIO)	I/O	PA[5] (GPIO)	I/O	GPIO	
	J4	N/C	I	N/C	I	N/C	I	GPIF_RDY[0]	O	GPIF_RDY[0]	O	GPIF Ready Signal	
	K5	SD2_WP	O	PC[2] (GPIO)	I/O	PC[2] (GPIO)	I/O	PC[2] (GPIO)	I/O	PC[2] (GPIO)	I/O	SD Write Protect or GPIO	
Other	B10	RESETOUT	O	RESETOUT	O	RESETOUT	O	RESETOUT / GPIF_RDY[1]	O	RESETOUT / GPIF_RDY[1]	O	Reset Out	GVDDQ VGND
	C9	SD2_CD	I/O I	PC-5 (GPIO[1])	I/O	PC-5 (GPIO[1])	I/O	PC-5 (GPIO[1])	I/O	PC-5 (GPIO[1])	I/O	GPIO or SD2 CD	
	D8	PC-4 (GPIO[0]) or SD_CD	I/O I	PC-4 (GPIO[0]) or SD_CD	I/O I	PC-4 (GPIO[0])	I/O	PC-4 (GPIO[0])	I/O	PC-4 (GPIO[0])	I/O	GPIO or SD CD	
	C10	RESET#									I	RESET	
	C7	WAKEUP									I	Wake Up Signal	

Table 6. Astoria 100-ball VFBGA Package Pin Assignments (continued)

	Pin Name			Pin Description	Power Domain
Conf	C5	XTALSLC[1]	I	Clock Select 1	GVDDQ VGND
	C4	XTALSLC[0]		Clock Select 0	
	E8	TEST[2]	I	Test Cfg 2	
	C8	TEST[1]		Test Cfg 1	
	D7	TEST[0]		Test Cfg 0	
Clock	A8	XTALIN	I	Crystal/Clock IN	XVDDQ VGND
	B8	XTALOUT	O	Crystal Out	
Power	D4, H4	PVDDQ	Power	Processor I/F VDD	
	H5	SNVDDQ	Power	GPIF VDD	
	B5	UVDDQ	Power	USB VDD	
	H7	SSVDDQ	Power	SDIO VDD	
	D6	GVDDQ	Power	Misc I/O VDD	
	B9	AVDDQ	Power	Analog VDD	
	B7	XVDDQ	Power	Crystal VDD	
	D5, G4, G5, G6, G7, F7	VDD	Power	Core VDD	
	A10	VDD33	Power	Independent 3.3 V	
	B6	UVSSQ	Power	USB GND	
	A9	AVSSQ	Power	Analog GND	
	E4, E5, E6, E7, F4, F5, F6	VGND	Power	Core GND	

Table 7. Astoria CYWB0224ABS 121-ball FBGA Package Pin Assignments

	Pin Name											Pin Description	Power Domain
	Ball #	PCRAM Non Multiplexing	I/O	Addr/Data bus Multiplexing (ADM)	I/O	SRAM	I/O	PNAND	I/O	SPI	I/O		
P-Port	J2	CLK (pull-low in Asyn mode)	I	CLK (pull-low in Async mode)	I	Ext pull-low	I	Ext pull-low	I	SCK	I	Clock	PVDDQ VGND
	G1	CE#	I	CE#	I	CE#	I	CE#	I	SS#	I	CE# or SPI Slave Select	
	H3	A7	I	Ext pull-up	I	A7	I	A7 ≥ 1:SBD A7 ≥ 0: LBD	I	Ext pull-up	I	Addr. Bus 7	
	H2	A6	I	SDA	I	A6	I	SDA	I/O	SDA	I/O	A6 or I^2C data	
	H1	A5	I	SCL	I	A5	I	SCL	I/O	SCL	I/O	A5 or I^2C clock	
	J3	A4	I	Ext pull-up	I	A4	I	WP#	I	Ext pull-up	I	A4 or PNAND WP	
	J1	A3	I	A3 = 0 (Ext pull-low)	I	A3	I	A3 = 0 (Ext pull-low)	I	A3 = 1 (Ext pull-up)	I	A3	
	K3	A2	I	A2 = 1 (Ext pull-up)	I	A2	I	A2 = 0 (Ext pull-low)	I	A2 = 0 (Ext pull-low)	I	A2	
	K2	A1	I	Ext pull-up	I	A1	I	RB#	O	Ext pull-up	I	A1 or PNAND R/B#	
	K1	A0	I	Ext pull-up	I	A0	I	CLE	I	Ext pull-up	I	A0 or PNAND CLE	
	G2	DQ[15]	I/O	AD[15]	I/O	DQ[15]	I/O	I/O[15]	I/O	Ext pull-up	I	D15, AD15, or I/O15	
	G3	DQ[14]	I/O	AD[14]	I/O	DQ[14]	I/O	I/O[14]	I/O	Ext pull-up	I	D14, AD14, or I/O14	
	F1	DQ[13]	I/O	AD[13]	I/O	DQ[13]	I/O	I/O[13]	I/O	Ext pull-up	I	D13, AD13, or I/O13	
	F2	DQ[12]	I/O	AD[12]	I/O	DQ[12]	I/O	I/O[12]	I/O	Ext pull-up	I	D12, AD12, or I/O12	
	F3	DQ[11]	I/O	AD[11]	I/O	DQ[11]	I/O	I/O[11]	I/O	Ext pull-up	I	D11, AD11, or I/O11	
	E1	DQ[10]	I/O	AD[10]	I/O	DQ[10]	I/O	I/O[10]	I/O	Ext pull-up	I	D10, AD10, or I/O10	
	E2	DQ[9]	I/O	AD[9]	I/O	DQ[9]	I/O	I/O[9]	I/O	Ext pull-up	I	D9, AD9, or I/O9	
	E3	DQ[8]	I/O	AD[8]	I/O	DQ[8]	I/O	I/O[8]	I/O	Ext pull-up	I	D8, AD8, or I/O8	
	D1	DQ[7]	I/O	AD[7]	I/O	DQ[7]	I/O	I/O[7]	I/O	Ext pull-up	I	D7, AD7, or I/O7	
	D2	DQ[6]	I/O	AD[6]	I/O	DQ[6]	I/O	I/O[6]	I/O	Ext pull-up	I	D6, AD6, or I/O6	
	D3	DQ[5]	I/O	AD[5]	I/O	DQ[5]	I/O	I/O[5]	I/O	Ext pull-up	I	D5, AD5, or I/O5	
	C1	DQ[4]	I/O	AD[4]	I/O	DQ[4]	I/O	I/O[4]	I/O	Ext pull-up	I	D4, AD4, or I/O4	
	C2	DQ[3]	I/O	AD[3]	I/O	DQ[3]	I/O	I/O[3]	I/O	Ext pull-up	I	D3, AD3, or I/O3	
	C3	DQ[2]	I/O	AD[2]	I/O	DQ[2]	I/O	I/O[2]	I/O	Ext pull-up	I	D2, AD2, or I/O2	
	B1	DQ[1]	I/O	AD[1]	I/O	DQ[1]	I/O	I/O[1]	I/O	SDO	O	SPI SDO, AD1or D1	
	B2	DQ[0]	I/O	AD[0]	I/O	DQ[0]	I/O	I/O[0]	I/O	SDI	I	SPI SDI, AD0, or D0	
	A1	ADV#	I	ADV#	I		I	ALE	I	Ext pull-up	I	Address Valid	
	B3	OE#	I	OE#	I	OE#	I	RE#	I	Ext pull-up	I	Output Enable	
	A2	WE#	I	WE#	I	WE#	I	WE#	I	Ext pull-up	I	WE#	
DRQ & Int	A3	INT#	O	INT#	O	INT#	O	INT#	O	SINT#	O	INT Request	GVDDQ VGND
	A4	DRQ#	O	DRQ#	O	DRQ#	O	DRQ#	O	N/C	O	DMA Request	
	B4	DACK#	I	DACK#	I	DACK#	I	DACK#	I	Ext pull-up	I	DMA Acknowledgement	
U-Port	A5	D+									I/O/Z	USB D+	UVDDQ UVSSQ
	A6	D–									I/O/Z	USB D–	
	A7	SWD+									I/O/Z	USB Switch DP	
	C6	SWD–									I/O/Z	USB Switch DM	

Table 7. Astoria CYWB0224ABS 121-ball FBGA Package Pin Assignments (continued)

	Pin Name											Pin Description	Power Domain
	Ball #	Double SDIO Configuration	I/O	SDIO & GPIO Configuration	I/O	GPIO Configuration	I/O	GPIF Configuration	I/O	GPIF & GPIO Configuration	I/O		
S-Port	G9	SD_D[7]	I/O	SD_D[7]	I/O	PD[7] (GPIO)	I/O	GPIF_DATA[15]	I/O	PD[7] (GPIO)	I/O	SD Data or GPIO or GPIF Data	SSVDDQ VGND
	G10	SD_D[6]	I/O	SD_D[6]	I/O	PD[6] (GPIO)	I/O	GPIF_DATA[14]	I/O	PD[6] (GPIO)	I/O	SD Data or GPIO or GPIF Data	
	F9	SD_D[5]	I/O	SD_D[5]	I/O	PD[5] (GPIO)	I/O	GPIF_DATA[13]	I/O	PD[5] (GPIO)	I/O	SD Data or GPIO or GPIF Data	
	F10	SD_D[4]	I/O	SD_D[4]	I/O	PD[4] (GPIO)	I/O	GPIF_DATA[12]	I/O	PD[4] (GPIO)	I/O	SD Data or GPIO or GPIF Data	
	E9	SD_D[3]	I/O	SD_D[3]	I/O	PD[3] (GPIO)	I/O	GPIF_DATA[11]	I/O	PD[3] (GPIO)	I/O	SD Data or GPIO or GPIF Data	
	E10	SD_D[2]	I/O	SD_D[2]	I/O	PD[2] (GPIO)	I/O	GPIF_DATA[10]	I/O	PD[2] (GPIO)	I/O	SD Data or GPIO or GPIF Data	
	D9	SD_D[1]	I/O	SD_D[1]	I/O	PD[1] (GPIO)	I/O	GPIF_DATA[9]	I/O	PD[1] (GPIO)	I/O	SD Data or GPIO or GPIF Data	
	D10	SD_D[0]	I/O	SD_D[0]	I/O	PD[0] (GPIO)	I/O	GPIF_DATA[8]	I/O	PD[0] (GPIO)	I/O	SD Data or GPIO or GPIF Data	
	F8	SD_CLK	O	SD_CLK	O	PC[7] (GPIO)	I/O	PC[7] (GPIO)	I/O	PC[7] (GPIO)	I/O	SD Clock or GPIO	
	G8	SD_CMD	I/O	SD_CMD	I/O	PC[3] (GPIO)	I/O	PC[3] (GPIO)	I/O	PC[3] (GPIO)	I/O	SD CMD or GPIO	
	H8	SD_POW		SD_POW		PC[6] (GPIO)	I/O	PC[6] (GPIO)	I/O	PC[6] (GPIO)	I/O	SD Power or GPIO	
	H10	SD_WP	I	SD_WP	I	N/C	I	N/C		PC[5] (GPIO)		SD Write Protect	
	K7	SD2_D[7]	I/O	PB[7] (GPIO)	I/O	PB[7] (GPIO)	I/O	GPIF_DATA[7]	I/O	GPIF_DATA[7]	I/O	SD2 Data or GPIO or GPIF Data	SNVDDQ VGND
	K8	SD2_D[6]	I/O	PB[6] (GPIO)	I/O	PB[6] (GPIO)	I/O	GPIF_DATA[6]	I/O	GPIF_DATA[6]	I/O	SD2 Data or GPIO or GPIF Data	
	J8	SD2_D[5]	I/O	PB[5] (GPIO)	I/O	PB[5] (GPIO)	I/O	GPIF_DATA[5]	I/O	GPIF_DATA[5]	I/O	SD2 Data or GPIO or GPIF Data	
	K9	SD2_D[4]	I/O	PB[4] (GPIO)	I/O	PB[4] (GPIO)	I/O	GPIF_DATA[4]	I/O	GPIF_DATA[4]	I/O	SD2 Data or GPIO or GPIF Data	
	J9	SD2_D[3]	I/O	PB[3] (GPIO)	I/O	PB[3] (GPIO)	I/O	GPIF_DATA[3]	I/O	GPIF_DATA[3]	I/O	SD2 Data or GPIO or GPIF Data	
	H9	SD2_D[2]	I/O	PB[2] (GPIO)	I/O	PB[2] (GPIO)	I/O	GPIF_DATA[2]	I/O	GPIF_DATA[2]	I/O	SD2 Data or GPIO or GPIF Data	
	K10	SD2_D[1]	I/O	PB[1] (GPIO)	I/O	PB[1] (GPIO)	I/O	GPIF_DATA[1]	I/O	GPIF_DATA[1]	I/O	SD2 Data or GPIO or GPIF Data	
	J10	SD2_D[0]	I/O	PB[0] (GPIO)	I/O	PB[0] (GPIO)	I/O	GPIF_DATA[0]	I/O	GPIF_DATA[0]	I/O	SD2 Data or GPIO or GPIF Data	
	K6	SD2_CLK	O	PA[6] (GPIO)	I/O	PA[6] (GPIO)	I/O	PA[6] (GPIO)	I/O	PA[6] (GPIO)	I/O	SD2 Clock or GPIO	
	J6	SD2_CMD	I/O	PA[7] (GPIO)	I/O	PA[7] (GPIO)	I/O	PA[7] (GPIO)	I/O	PA [7] (GPIO)	I/O	SD2 CMD or GPIO	
	J5	SD2_POW	O	PC[0] (GPIO)	I/O	PC[0] (GPIO)	I/O	PC[0] (GPIO)	I/O	PC[0] (GPIO)	I/O	SD2 Power or GPIO	
	K4	N/C	O	N/C	O	N/C	O	GPIF_CTL[1]	O	GPIF_CTL[1]	O	GPIF Control Signal	
	H6	N/C	O	N/C	O	N/C	O	GPIF_CTL[0]	O	GPIF_CTL[0]	O	GPIF Control Signal	
	J7	PA[5] (GPIO)	I/O	PA[5] (GPIO)	I/O	PA[5] (GPIO)	I/O	PA[5] (GPIO)	I/O	PA[5] (GPIO)	I/O	GPIO	
	J4	N/C	I	N/C	I	N/C	I	GPIF_RDY[0]	O	GPIF_RDY[0]	O	GPIF Ready Signal	
	K5	SD2_WP	O	PC[2] (GPIO)	I/O	PC[2] (GPIO)	I/O	PC[2] (GPIO)	I/O	PC[2] (GPIO)	I/O	SD Write Protect or GPIO	
Other	B10	RESETOUT	O	RESETOUT	O	RESETOUT	O	RESETOUT / GPIF_RDY[1]	O	RESETOUT / GPIF_RDY[1]	O	RESETOUT	GVDDQ VGND
	C9	SD2_CD	I/O I	PC-5 (GPIO[1])	I/O	PC-5 (GPIO[1])	I/O	PC-5 (GPIO[1])	I/O	PC-5 (GPIO[1])	I/O	GPIO or SD2 CD	
	D8	PC-4 (GPIO[0]) or SD_CD	I/O I	PC-4 (GPIO[0]) or SD_CD	I/O I	PC-4 (GPIO[0])	I/O	PC-4 (GPIO[0])	I/O	PC-4 (GPIO[0])	I/O	GPIO or SD CD	
	C10	RESET#									I	RESET	
	C7	WAKEUP									I	Wake Up Signal	

Table 7. Astoria CYWB0224ABS 121-ball FBGA Package Pin Assignments (continued)

	Pin Name			Pin Description	Power Domain
Conf	C5	XTALSLC[1]	I	Clock Select 1	GVDDQ VGND
	C4	XTALSLC[0]		Clock Select 0	
	E8	TEST[2]	I	Test Cfg 2	
	C8	TEST[1]		Test Cfg 1	
	D7	TEST[0]		Test Cfg 0	
Clock	A8	XTALIN	I	Crystal / Clock IN	XVDDQ VGND
	B8	XTALOUT	O	Crystal Out	
Power	D4 H4	PVDDQ	Power	Processor I/F VDD	
	H5	SNVDDQ	Power	GPIF VDD	
	B5	UVDDQ	Power	USB VDD	
	H7	SSVDDQ	Power	SDIO VDD	
	D6	GVDDQ	Power	Misc I/O VDD	
	B9	AVDDQ	Power	Analog VDD	
	B7	XVDDQ	Power	Crystal VDD	
	D5, G4, G5, G6, G7, F7	VDD	Power	Core VDD	
	A10	VDD33	Power	Independent 3.3 V	
	B6	UVSSQ	Power	USB GND	
	A9	AVSSQ	Power	Analog GND	
	E4, E5, E6, E7, F4, F5, F6	VGND	Power	Core GND	

Table 8. Astoria CYWB0220ABS 121-ball FBGA Package Pin Assignments

	Pin Name											Pin Description	Power Domain
	Ball #	PCRAM Non Multiplexing	I/O	Addr/Data bus Multiplexing (ADM)	I/O	SRAM	I/O	PNAND	I/O	SPI	I/O		
P-Port	J2	CLK (pull-low in Asyn mode)	I	CLK (pull-low in Async mode)	I	Ext pull-low	I	Ext pull-low	I	SCK	I	Clock	PVDDQ VGND
	G1	CE#	I	CE#	I	CE#	I	CE#	I	SS#	I	CE# or SPI Slave Select	
	H3	A7	I	Ext pull-up	I	A7	I	A7 ≥ 1:SBD A7 ≥ 0: LBD	I	Ext pull-up	I	Addr. Bus 7	
	H2	A6	I	SDA	I	A6	I	SDA	I/O	SDA	I/O	A6 or I^2C data	
	H1	A5	I	SCL	I	A5	I	SCL	I/O	SCL	I/O	A5 or I^2C clock	
	J3	A4	I	Ext pull-up	I	A4	I	WP#	I	Ext pull-up	I	A4 or PNAND WP	
	J1	A3	I	A3 = 0 (Ext pull-low)	I	A3	I	A3 = 0 (Ext pull-low)	I	A3 = 1 (Ext pull-up)	I	A3	
	K3	A2	I	A2 = 1 (Ext pull-up)	I	A2	I	A2 = 0 (Ext pull-low)	I	A2 = 0 (Ext pull-low)	I	A2	
	K2	A1	I	Ext pull-up	I	A1	I	RB#	O	Ext pull-up	I	A1 or PNAND R/B#	
	K1	A0	I	Ext pull-up	I	A0	I	CLE	I	Ext pull-up	I	A0 or PNAND CLE	
	G2	DQ[15]	I/O	AD[15]	I/O	DQ[15]	I/O	I/O[15]	I/O	Ext pull-up	I	D15, AD15, or I/O15	
	G3	DQ[14]	I/O	AD[14]	I/O	DQ[14]	I/O	I/O[14]	I/O	Ext pull-up	I	D14, AD14, or I/O14	
	F1	DQ[13]	I/O	AD[13]	I/O	DQ[13]	I/O	I/O[13]	I/O	Ext pull-up	I	D13, AD13, or I/O13	
	F2	DQ[12]	I/O	AD[12]	I/O	DQ[12]	I/O	I/O[12]	I/O	Ext pull-up	I	D12, AD12, or I/O12	
	F3	DQ[11]	I/O	AD[11]	I/O	DQ[11]	I/O	I/O[11]	I/O	Ext pull-up	I	D11, AD11, or I/O11	
	E1	DQ[10]	I/O	AD[10]	I/O	DQ[10]	I/O	I/O[10]	I/O	Ext pull-up	I	D10, AD10, or I/O10	
	E2	DQ[9]	I/O	AD[9]	I/O	DQ[9]	I/O	I/O[9]	I/O	Ext pull-up	I	D9, AD9, or I/O9	
	E3	DQ[8]	I/O	AD[8]	I/O	DQ[8]	I/O	I/O[8]	I/O	Ext pull-up	I	D8, AD8, or I/O8	
	D1	DQ[7]	I/O	AD[7]	I/O	DQ[7]	I/O	I/O[7]	I/O	Ext pull-up	I	D7, AD7, or I/O7	
	D2	DQ[6]	I/O	AD[6]	I/O	DQ[6]	I/O	I/O[6]	I/O	Ext pull-up	I	D6, AD6, or I/O6	
	D3	DQ[5]	I/O	AD[5]	I/O	DQ[5]	I/O	I/O[5]	I/O	Ext pull-up	I	D5, AD5, or I/O5	
	C1	DQ[4]	I/O	AD[4]	I/O	DQ[4]	I/O	I/O[4]	I/O	Ext pull-up	I	D4, AD4, or I/O4	
	C2	DQ[3]	I/O	AD[3]	I/O	DQ[3]	I/O	I/O[3]	I/O	Ext pull-up	I	D3, AD3, or I/O3	
	C3	DQ[2]	I/O	AD[2]	I/O	DQ[2]	I/O	I/O[2]	I/O	Ext pull-up	I	D2, AD2, or I/O2	
	B1	DQ[1]	I/O	AD[1]	I/O	DQ[1]	I/O	I/O[1]	I/O	SDO	O	SPI SDO, AD1or D1	
	B2	DQ[0]	I/O	AD[0]	I/O	DQ[0]	I/O	I/O[0]	I/O	SDI	I	SPI SDI, AD0, or D0	
	A1	ADV#	I	ADV#	I		I	ALE	I	Ext pull-up	I	Address Valid	
	B3	OE#	I	OE#	I	OE#	I	RE#	I	Ext pull-up	I	Output Enable	
	A2	WE#	I	WE#	I	WE#	I	WE#	I	Ext pull-up	I	WE#	
DRQ & Int	A3	INT#	O	INT#	O	INT#	O	INT#	O	SINT#	O	INT Request	GVDDQ VGND
	A4	DRQ#	O	DRQ#	O	DRQ#	O	DRQ#	O	N/C	O	DMA Request	
	B4	DACK#	I	DACK#	I	DACK#	I	DACK#	I	Ext pull-up	I	DMA Acknowledgement	

Table 8. Astoria CYWB0220ABS 121-ball FBGA Package Pin Assignments (continued)

	Pin Name											Pin Description	Power Domain
		Double SDIO Configuration	I/O	SDIO & GPIO Configuration	I/O	GPIO Configuration	I/O	GPIF Configuration	I/O	GPIF & GPIO Configuration	I/O		
S-Port	G9	SD_D[7]	I/O	SD_D[7]	I/O	PD[7] (GPIO)	I/O	GPIF_DATA[15]	I/O	PD[7] (GPIO)	I/O	SD Data or GPIO or GPIF Data	SSVDDQ VGND
	G10	SD_D[6]	I/O	SD_D[6]	I/O	PD[6] (GPIO)	I/O	GPIF_DATA[14]	I/O	PD[6] (GPIO)	I/O	SD Data or GPIO or GPIF Data	
	F9	SD_D[5]	I/O	SD_D[5]	I/O	PD[5] (GPIO)	I/O	GPIF_DATA[13]	I/O	PD[5] (GPIO)	I/O	SD Data or GPIO or GPIF Data	
	F10	SD_D[4]	I/O	SD_D[4]	I/O	PD[4] (GPIO)	I/O	GPIF_DATA[12]	I/O	PD[4] (GPIO)	I/O	SD Data or GPIO or GPIF Data	
	E9	SD_D[3]	I/O	SD_D[3]	I/O	PD[3] (GPIO)	I/O	GPIF_DATA[11]	I/O	PD[3] (GPIO)	I/O	SD Data or GPIO or GPIF Data	
	E10	SD_D[2]	I/O	SD_D[2]	I/O	PD[2] (GPIO)	I/O	GPIF_DATA[10]	I/O	PD[2] (GPIO)	I/O	SD Data or GPIO or GPIF Data	
	D9	SD_D[1]	I/O	SD_D[1]	I/O	PD[1] (GPIO)	I/O	GPIF_DATA[9]	I/O	PD[1] (GPIO)	I/O	SD Data or GPIO or GPIF Data	
	D10	SD_D[0]	I/O	SD_D[0]	I/O	PD[0] (GPIO)	I/O	GPIF_DATA[8]	I/O	PD[0] (GPIO)	I/O	SD Data or GPIO or GPIF Data	
	F8	SD_CLK	O	SD_CLK	O	PC[7] (GPIO)	I/O	PC[7] (GPIO)	I/O	PC[7] (GPIO)	I/O	SD Clock or GPIO	
	G8	SD_CMD	I/O	SD_CMD	I/O	PC[3] (GPIO)	I/O	PC[3] (GPIO)	I/O	PC[3] (GPIO)	I/O	SD CMD or GPIO	
	H8	SD_POW		SD_POW		PC[6] (GPIO)	I/O	PC[6] (GPIO)	I/O	PC[6] (GPIO)	I/O	SD Power or GPIO	
	H10	SD_WP	I	SD_WP	I	N/C		N/C		PC[5] (GPIO)		SD Write Protect	
	K7	SD2_D[7]	I/O	PB[7] (GPIO)	I/O	PB[7] (GPIO)	I/O	GPIF_DATA[7]	I/O	GPIF_DATA[7]	I/O	SD2 Data or GPIO or GPIF Data	SNVDDQ VGND
	K8	SD2_D[6]	I/O	PB[6] (GPIO)	I/O	PB[6] (GPIO)	I/O	GPIF_DATA[6]	I/O	GPIF_DATA[6]	I/O	SD2 Data or GPIO or GPIF Data	
	J8	SD2_D[5]	I/O	PB[5] (GPIO)	I/O	PB[5] (GPIO)	I/O	GPIF_DATA[5]	I/O	GPIF_DATA[5]	I/O	SD2 Data or GPIO or GPIF Data	
	K9	SD2_D[4]	I/O	PB[4] (GPIO)	I/O	PB[4] (GPIO)	I/O	GPIF_DATA[4]	I/O	GPIF_DATA[4]	I/O	SD2 Data or GPIO or GPIF Data	
	J9	SD2_D[3]	I/O	PB[3] (GPIO)	I/O	PB[3] (GPIO)	I/O	GPIF_DATA[3]	I/O	GPIF_DATA[3]	I/O	SD2 Data or GPIO or GPIF Data	
	H9	SD2_D[2]	I/O	PB[2] (GPIO)	I/O	PB[2] (GPIO)	I/O	GPIF_DATA[2]	I/O	GPIF_DATA[2]	I/O	SD2 Data or GPIO or GPIF Data	
	K10	SD2_D[1]	I/O	PB[1] (GPIO)	I/O	PB[1] (GPIO)	I/O	GPIF_DATA[1]	I/O	GPIF_DATA[1]	I/O	SD2 Data or GPIO or GPIF Data	
	J10	SD2_D[0]	I/O	PB[0] (GPIO)	I/O	PB[0] (GPIO)	I/O	GPIF_DATA[0]	I/O	GPIF_DATA[0]	I/O	SD2 Data or GPIO or GPIF Data	
	K6	SD2_CLK	O	PA[6] (GPIO)	I/O	PA[6] (GPIO)	I/O	PA[6] (GPIO)	I/O	PA[6] (GPIO)	I/O	SD2 Clock or GPIO	
	J6	SD2_CMD	I/O	PA[7] (GPIO)	I/O	PA[7] (GPIO)	I/O	PA[7] (GPIO)	I/O	PA[7] (GPIO)	I/O	SD2 CMD or GPIO	
	J5	SD2_POW	O	PC[0] (GPIO)	I/O	PC[0] (GPIO)	I/O	PC[0] (GPIO)	I/O	PC[0] (GPIO)	I/O	SD2 Power or GPIO	
	K4	N/C	O	N/C	O	N/C	O	GPIF_CTL[1]	O	GPIF_CTL[1]	O	GPIF Control Signal	
	H6	N/C	O	N/C	O	N/C	O	GPIF_CTL[0]	O	GPIF_CTL[0]	O	GPIF Control Signal	
	J7	PA[5] (GPIO)	I/O	PA[5] (GPIO)	I/O	PA[5] (GPIO)	I/O	PA[5] (GPIO)	I/O	PA[5] (GPIO)	I/O	GPIO	
	J4	N/C	I	N/C	I	N/C	I	GPIF_RDY[0]	O	GPIF_RDY[0]	O	GPIF Ready Signal	
	K5	SD2_WP	O	PC[2] (GPIO)	I/O	PC[2] (GPIO)	I/O	PC[2] (GPIO)	I/O	PC[2] (GPIO)	I/O	SD Write Protect or GPIO	
Other	B10	RESETOUT	O	RESETOUT	O	RESETOUT	O	RESETOUT / GPIF_RDY[1]	O	RESETOUT / GPIF_RDY[1]	O	Reset Out	GVDDQ VGND
	C9	SD2_CD	I/O I	PC-5 (GPIO[1])	I/O	PC-5 (GPIO[1])	I/O	PC-5 (GPIO[1])	I/O	PC-5 (GPIO[1])	I/O	GPIO or SD2 CD	
	D8	PC-4 (GPIO[0]) or SD_CD	I/O I	PC-4 (GPIO[0]) or SD_CD	I/O I	PC-4 (GPIO[0])	I/O	PC-4 (GPIO[0])	I/O	PC-4 (GPIO[0])	I/O	GPIO or SD CD	
	C10	RESET#									I	RESET	
	C7	WAKEUP									I	Wake Up Signal	

Table 8. Astoria CYWB0220ABS 121-ball FBGA Package Pin Assignments (continued)

	Pin Name			Pin Description	Power Domain
Conf	C5	XTALSLC[1]	I	Clock Select 1	GVDDQ VGND
	C4	XTALSLC[0]		Clock Select 0	
	E8	TEST[2]	I	Test Cfg 2	
	C8	TEST[1]		Test Cfg 1	
	D7	TEST[0]		Test Cfg 0	
Clock	A8	XTALIN	I	Crystal / Clock IN	XVDDQ VGND
	B8	XTALOUT	O	Crystal Out	
Power	D4 H4	PVDDQ	Power	Processor I/F VDD	
	H5	SNVDDQ	Power	GPIF VDD	
	B5	UVDDQ	Power	USB VDD	
	H7	SSVDDQ	Power	SDIO VDD	
	D6	GVDDQ	Power	Misc I/O VDD	
	B9	AVDDQ	Power	Analog VDD	
	B7	XVDDQ	Power	Crystal VDD	
	D5, G4, G5, G6, G7, F7	VDD	Power	Core VDD	
	A10	VDD33	Power	Independent 3.3 V	
	B6	UVSSQ	Power	USB GND	
	A9	AVSSQ	Power	Analog GND	
	E4, E5, E6, E7, F4, F5, F6	VGND	Power	Core GND	

Table 9. Astoria CYWB0216ABS 121-ball FBGA Package Pin Assignments

	Pin Name			Pin Description	Power Domain
	Ball #	**Pull Direction**	**I/O**		
Unused Pins	J2	P/D	I	Pull-down	PVDDQ VGND
	G1	P/U	I	Pull-up	
	H3	P/U	I	Pull-up	
	J3	P/U	I	Pull-up	
	J1	P/U	I	Pull-up	
	K3	P/D	I	Pull-down	
	K2	P/U	I	Pull-up	
	K1	P/U	I	Pull-up	
	G2	P/U	I	Pull-up	
	G3	P/U	I	Pull-up	
	F1	P/U	I	Pull-up	
	F2	P/U	I	Pull-up	
	F3	P/U	I	Pull-up	
	E1	P/U	I	Pull-up	
	E2	P/U	I	Pull-up	
	E3	P/U	I	Pull-up	
	D1	P/U	I	Pull-up	
	D2	P/U	I	Pull-up	
	D3	P/U	I	Pull-up	
	C1	P/U	I	Pull-up	
	C2	P/U	I	Pull-up	
	C3	P/U	I	Pull-up	
	B1	P/U	O	Pull-up	
	B2	P/U	I	Pull-up	
	A1	P/U	I	Pull-up	
	B3	P/U	I	Pull-up	
	A2	P/U	I	Pull-up	
	A3	N/C	O	No Connect	GVDDQ VGND
	A4	N/C	O	No Connect	
	B4	P/U	I	Pull-up	
I2C Pins		**Interface Pins**	**I/O**	**Pin Description**	
	H2	SDA	I/O	I^2C data	PVDDQ VGND
	H1	SCL	I/O	I^2C clock	
U-Port	A5	D+	I/O/Z	USB D+	UVDDQ UVSSQ
	A6	D–	I/O/Z	USB D–	
	A7	SWD+	I/O/Z	USB Switch DP	
	C6	SWD–	I/O/Z	USB Switch DM	

Table 9. Astoria CYWB0216ABS 121-ball FBGA Package Pin Assignments (continued)

	Pin Name											Pin Description	Power Domain
		Double SDIO Configuration	I/O	SDIO & GPIO Configuration	I/O	GPIO Configuration	I/O	GPIF Configuration	I/O	GPIF & GPIO Configuration	I/O		
S-Port	G9	SD_D[7]	I/O	SD_D[7]	I/O	PD[7] (GPIO)	I/O	GPIF_DATA[15]	I/O	PD[7] (GPIO)	I/O	SD Data or GPIO or GPIF Data	SSVDDQ VGND
	G10	SD_D[6]	I/O	SD_D[6]	I/O	PD[6] (GPIO)	I/O	GPIF_DATA[14]	I/O	PD[6] (GPIO)	I/O	SD Data or GPIO or GPIF Data	
	F9	SD_D[5]	I/O	SD_D[5]	I/O	PD[5] (GPIO)	I/O	GPIF_DATA[13]	I/O	PD[5] (GPIO)	I/O	SD Data or GPIO or GPIF Data	
	F10	SD_D[4]	I/O	SD_D[4]	I/O	PD[4] (GPIO)	I/O	GPIF_DATA[12]	I/O	PD[4] (GPIO)	I/O	SD Data or GPIO or GPIF Data	
	E9	SD_D[3]	I/O	SD_D[3]	I/O	PD[3] (GPIO)	I/O	GPIF_DATA[11]	I/O	PD[3] (GPIO)	I/O	SD Data or GPIO or GPIF Data	
	E10	SD_D[2]	I/O	SD_D[2]	I/O	PD[2] (GPIO)	I/O	GPIF_DATA[10]	I/O	PD[2] (GPIO)	I/O	SD Data or GPIO or GPIF Data	
	D9	SD_D[1]	I/O	SD_D[1]	I/O	PD[1] (GPIO)	I/O	GPIF_DATA[9]	I/O	PD[1] (GPIO)	I/O	SD Data or GPIO or GPIF Data	
	D10	SD_D[0]	I/O	SD_D[0]	I/O	PD[0] (GPIO)	I/O	GPIF_DATA[8]	I/O	PD[0] (GPIO)	I/O	SD Data or GPIO or GPIF Data	
	F8	SD_CLK	O	SD_CLK	O	PC[7] (GPIO)	I/O	PC[7] (GPIO)	I/O	PC[7] (GPIO)	I/O	SD Clock or GPIO	
	G8	SD_CMD	I/O	SD_CMD	I/O	PC[3] (GPIO)	I/O	PC[3] (GPIO)	I/O	PC[3] (GPIO)	I/O	SD CMD or GPIO	
	H8	SD_POW		SD_POW		PC[6] (GPIO)	I/O	PC[6] (GPIO)	I/O	PC[6] (GPIO)	I/O	SD Power or GPIO	
	H10	SD_WP	I	SD_WP	I	N/C		N/C		PC[5] (GPIO)		SD Write Protect	
	K7	SD2_D[7]	I/O	PB[7] (GPIO)	I/O	PB[7] (GPIO)	I/O	GPIF_DATA[7]	I/O	GPIF_DATA[7]	I/O	SD2 Data or GPIO or GPIF Data	SNVDDQ VGND
	K8	SD2_D[6]	I/O	PB[6] (GPIO)	I/O	PB[6] (GPIO)	I/O	GPIF_DATA[6]	I/O	GPIF_DATA[6]	I/O	SD2 Data or GPIO or GPIF Data	
	J8	SD2_D[5]	I/O	PB[5] (GPIO)	I/O	PB[5] (GPIO)	I/O	GPIF_DATA[5]	I/O	GPIF_DATA[5]	I/O	SD2 Data or GPIO or GPIF Data	
	K9	SD2_D[4]	I/O	PB[4] (GPIO)	I/O	PB[4] (GPIO)	I/O	GPIF_DATA[4]	I/O	GPIF_DATA[4]	I/O	SD2 Data or GPIO or GPIF Data	
	J9	SD2_D[3]	I/O	PB[3] (GPIO)	I/O	PB[3] (GPIO)	I/O	GPIF_DATA[3]	I/O	GPIF_DATA[3]	I/O	SD2 Data or GPIO or GPIF Data	
	H9	SD2_D[2]	I/O	PB[2] (GPIO)	I/O	PB[2] (GPIO)	I/O	GPIF_DATA[2]	I/O	GPIF_DATA[2]	I/O	SD2 Data or GPIO or GPIF Data	
	K10	SD2_D[1]	I/O	PB[1] (GPIO)	I/O	PB[1] (GPIO)	I/O	GPIF_DATA[1]	I/O	GPIF_DATA[1]	I/O	SD2 Data or GPIO or GPIF Data	
	J10	SD2_D[0]	I/O	PB[0] (GPIO)	I/O	PB[0] (GPIO)	I/O	GPIF_DATA[0]	I/O	GPIF_DATA[0]	I/O	SD2 Data or GPIO or GPIF Data	
	K6	SD2_CLK	O	PA[6] (GPIO)	I/O	PA[6] (GPIO)	I/O	PA[6] (GPIO)	I/O	PA[6] (GPIO)	I/O	SD2 Clock or GPIO	
	J6	SD2_CMD	I/O	PA[7] (GPIO)	I/O	PA[7] (GPIO)	I/O	PA[7] (GPIO)	I/O	PA[7] (GPIO)	I/O	SD2 CMD or GPIO	
	J5	SD2_POW	O	PC[0] (GPIO)	I/O	PC[0] (GPIO)	I/O	PC[0] (GPIO)	I/O	PC[0] (GPIO)	I/O	SD2 Power or GPIO	
	K4	N/C	O	N/C	O	N/C	O	GPIF_CTL[1]	O	GPIF_CTL[1]	O	GPIF Control Signal	
	H6	N/C	O	N/C	O	N/C	O	GPIF_CTL[0]	O	GPIF_CTL[0]	O	GPIF Control Signal	
	J7	PA[5] (GPIO)	I/O	PA[5] (GPIO)	I/O	PA[5] (GPIO)	I/O	PA[5] (GPIO)	I/O	PA[5] (GPIO)	I/O	GPIO	
	J4	N/C	I	N/C	I	N/C	I	GPIF_RDY[0]	O	GPIF_RDY[0]	O	GPIF Ready Signal	
	K5	SD2_WP	O	PC[2] (GPIO)	I/O	PC[2] (GPIO)	I/O	PC[2] (GPIO)	I/O	PC[2] (GPIO)	I/O	SD Write Protect or GPIO	
Other	B10	RESETOUT	O	RESETOUT	O	RESETOUT	O	RESETOUT / GPIF_RDY[1]	O	RESETOUT / GPIF_RDY[1]	O	Reset Out	GVDDQ VGND
	C9	SD2_CD	I/O I	PC-5 (GPIO[1])	I/O	PC-5 (GPIO[1])	I/O	PC-5 (GPIO[1])	I/O	PC-5 (GPIO[1])	I/O	GPIO or SD2 CD	
	D8	PC-4 (GPIO[0]) or SD_CD	I/O I	PC-4 (GPIO[0]) or SD_CD	I/O I	PC-4 (GPIO[0])	I/O	PC-4 (GPIO[0])	I/O	PC-4 (GPIO[0])	I/O	GPIO or SD CD	
	C10	RESET#									I	RESET	
	C7	WAKEUP									I	Wake Up Signal	

Table 9. Astoria CYWB0216ABS 121-ball FBGA Package Pin Assignments (continued)

	Pin Name			Pin Description	Power Domain
Conf	C5	XTALSLC[1]	I	Clock Select 1	GVDDQ VGND
	C4	XTALSLC[0]		Clock Select 0	
	E8	TEST[2]	I	Test Cfg 2	
	C8	TEST[1]		Test Cfg 1	
	D7	TEST[0]		Test Cfg 0	
Clock	A8	XTALIN	I	Crystal/Clock IN	XVDDQ VGND
	B8	XTALOUT	O	Crystal Out	
Power	D4 H4	PVDDQ	Power	Processor I/F VDD	
	H5	SNVDDQ	Power	NAND VDD	
	B5	UVDDQ	Power	USB VDD	
	H7	SSVDDQ	Power	SDIO VDD	
	D6	GVDDQ	Power	Misc I/O VDD	
	B9	AVDDQ	Power	Analog VDD	
	B7	XVDDQ	Power	Crystal VDD	
	D5, G4, G5, G6, G7, F7	VDD	Power	Core VDD	
	A10	VDD33	Power	Independent 3.3 V	
	B6	UVSSQ	Power	USB GND	
	A9	AVSSQ	Power	Analog GND	
	E4, E5, E6, E7, F4, F5, F6	VGND	Power	Core GND	

Table 10. Astoria 81-ball SP WLCSP Package Pin Assignments

	Pin Name					Pin Description	Power Domain
	Ball #	PNAND	I/O	SPI	I/O		
P-Port	H9	Ext pull low	I	SCK	I	Clock	PVDDQ VGND
	F9	CE#	I	SS#	I	CE# or SPI Slave Select	
	E7	SDA	I/O	SDA	I/O	I2C data	
	H8	SCL	I/O	SCL	I/O	I2C clock	
	J9	WP#	I	Ext pull up	I	PNAND WP	
	G8	A[3]=0; (Ext pull low)	I	A[3]=0; (Ext pull up)	I	A[3]	
	E6	A[2]=0; (Ext pull low)	I	A[2]=0; (Ext pull low)	I	A[2]	
	G9	RB#	O	Ext pull up	I	PNAND R/B#	
	F8	CLE	I	Ext pull up	I	PNAND CLE	
	D9	I/O[7]	I/O	Ext pull up	I	IO7	
	D8	I/O[6]	I/O	Ext pull up	I	IO6	
	C9	I/O[5]	I/O	Ext pull up	I	IO5	
	B9	I/O[4]	I/O	Ext pull up	I	IO4	
	C8	I/O[3]	I/O	Ext pull up	I	IO3	
	C7	I/O[2]	I/O	Ext pull up	I	IO2	
	B8	I/O[1]	I/O	SDO	O	IO1 or SPI SDO	
	A8	I/O[0]	I/O	SDI	I	IO0 or SPI SDI	
	B7	ALE	I	Ext pull up	I	Address Valid	
	B6	RE#	I	Ext pull up	I	Output Enable	
	A7	WE#	I	Ext pull up	I	WE#	
Int	C1	INT#	O	SINT#	O	INT Request	GVDDQ VGND
U-Port	A4	D+			I/O/Z	USB D+	UVDDQ UVSSQ
	A5	D–			I/O/Z	USB D–	
	C4	SWD+			I/O/Z	USB Switch D+	
	C5	SWD–			I/O/Z	USB Switch D–	

Table 10. Astoria 81-ball SP WLCSP Package Pin Assignments (continued)

	Pin Name											Pin Description	Power Domain
	Ball #	Double SDIO Configuration	I/O	SDIO & GPIO Configuration	I/O	GPIO Configuration	I/O	GPIF Configuration	I/O	GPIF & GPIO Configuration	I/O		
S-Port	H2	SD_D[7]	I/O	SD_D[7]	I/O	PD[7] (GPIO)	I/O	GPIF_DATA [15]	I/O	PD[7] (GPIO)	I/O	SD Data or GPIO or GPIF Data	SSVDDQ VGND
	H1	SD_D[6]	I/O	SD_D[6]	I/O	PD[6] (GPIO)	I/O	GPIF_DATA [14]	I/O	PD[6] (GPIO)	I/O	SD Data or GPIO or GPIF Data	
	G3	SD_D[5]	I/O	SD_D[5]	I/O	PD[5] (GPIO)	I/O	GPIF_DATA [13]	I/O	PD[5] (GPIO)	I/O	SD Data or GPIO or GPIF Data	
	G2	SD_D[4]	I/O	SD_D[4]	I/O	PD[4] (GPIO)	I/O	GPIF_DATA [12]	I/O	PD[4] (GPIO)	I/O	SD Data or GPIO or GPIF Data	
	F2	SD_D[3]	I/O	SD_D[3]	I/O	PD[3] (GPIO)	I/O	GPIF_DATA [11]	I/O	PD[3] (GPIO)	I/O	SD Data or GPIO or GPIF Data	
	F3	SD_D[2]	I/O	SD_D[2]	I/O	PD[2] (GPIO)	I/O	GPIF_DATA [10]	I/O	PD[2] (GPIO)	I/O	SD Data or GPIO or GPIF Data	
	E3	SD_D[1]	I/O	SD_D[1]	I/O	PD[1] (GPIO)	I/O	GPIF_DATA [9]	I/O	PD[1] (GPIO)	I/O	SD Data or GPIO or GPIF Data	
	E2	SD_D[0]	I/O	SD_D[0]	I/O	PD[0] (GPIO)	I/O	GPIF_DATA [8]	I/O	PD[0] (GPIO)	I/O	SD Data or GPIO or GPIF Data	
	G1	SD_CLK	O	SD_CLK		PC-7 (GPIO)	I/O	PC-7 (GPIO)	I/O	PC-7 (GPIO)	I/O	SD Clock or GPIO	
	F4	SD_CMD	I/O	SD_CMD	I/O	PC-3 (GPIO)	I/O	PC-3 (GPIO)	I/O	PC-3 (GPIO)	I/O	SD CMD or GPIO	
	J1	SD_POW	O	SD_POW	O	PC-6 (GPIO)	I/O	PC-6 (GPIO)	I/O	PC-6 (GPIO)	I/O	SD Power or GPIO	
	E1	SD_WP	I	SD_W	I	N/C	I	N/C	I	PC-5 (GPIO)	I/O	SD Write Protect	
	H5	SD2_D[7]	I/O	PB[7] (GPIO)	I/O	PB[7] (GPIO)	I/O	GPIF_DATA [7]	I/O	GPIF_DATA [7]	I/O	SD2 Data or GPIO or GPIF Data	SNVDDQ VGND
	J4	SD2_D[6]	I/O	PB[6] (GPIO)	I/O	PB[6] (GPIO)	I/O	GPIF_DATA [6]	I/O	GPIF_DATA [6]	I/O	SD2 Data or GPIO or GPIF Data	
	G5	SD2_D[5]	I/O	PB[5] (GPIO)	I/O	PB[5] (GPIO)	I/O	GPIF_DATA [5]	I/O	GPIF_DATA [5]	I/O	SD2 Data or GPIO or GPIF Data	
	H4	SD2_D[4]	I/O	PB[4] (GPIO)	I/O	PB[4] (GPIO)	I/O	GPIF_DATA [4]	I/O	GPIF_DATA [4]	I/O	SD2 Data or GPIO or GPIF Data	
	J3	SD2_D[3]	I/O	PB[3] (GPIO)	I/O	PB[3] (GPIO)	I/O	GPIF_DATA [3]	I/O	GPIF_DATA [3]	I/O	SD2 Data or GPIO or GPIF Data	
	G4	SD2_D[2]	I/O	PB[2] (GPIO)	I/O	PB[2] (GPIO)	I/O	GPIF_DATA [2]	I/O	GPIF_DATA [2]	I/O	SD2 Data or GPIO or GPIF Data	
	H3	SD2_D[1]	I/O	PB[1] (GPIO)	I/O	PB[1] (GPIO)	I/O	GPIF_DATA [1]	I/O	GPIF_DATA [1]	I/O	SD2 Data or GPIO or GPIF Data	
	J2	SD2_D[0]	I/O	PB[0] (GPIO)	I/O	PB[0] (GPIO)	I/O	GPIF_DATA [0]	I/O	GPIF_DATA [0]	I/O	SD2 Data or GPIO or GPIF Data	
	F7	SD2_CLK	O	PA[6] (GPIO)	I/O	PA[6] (GPIO)	I/O	PA-6 (GPIO)	I/O	PA-6 (GPIO)	I/O	SD2 Clock or GPIO	
	H6	SD2_CMD	I/O	PA[7] (GPIO)	I/O	PA[7] (GPIO)	I/O	PA-7 (GPIO)	I/O	PA-7 (GPIO)	I/O	SD2 CMD or GPIO	
	G7	SD2_POW	O	PC[0] (GPIO)	I/O	PC[0] (GPIO)	I/O	PC-0 (GPIO)	I/O	PC-0 (GPIO)	I/O	SD2 Power or GPIO	
	J8	N/C	O	N/C	O	N/C	O	GPIF_CTL[1]	O	GPIF_CTL[1]	O	GPIF Control Signal	
	J5	N/C	O	N/C	O	N/C	O	GPIF_CTL[0]	O	GPIF_CTL[0]	O	GPIF Control Signal	
	G6	PA-5 (GPIO)	I/O	PA-5 (GPIO)	I/O	PA-5 (GPIO)	I/O	PA-5 (GPIO)	I/O	PA-5 (GPIO)	I/O	GPIO	
	H7	N/C	I	N/C	I	N/C	I	GPIF_RDY[0]	O	GPIF_RDY[0]	O	GPIF Ready Signal	
	J7	SD2_WP	O	PC-2 (GPIO)	I/O	PC-2 (GPIO)	I/O	PC-2 (GPIO)	I/O	PC-2 (GPIO)	I/O	SD Write Protect or GPIO	
Other	C2	RESETOUT	O	RESETOUT	O	RESETOUT	O	RESETOUT / GPIF_RDY[1]	O	RESETOUT / GPIF_RDY[1]	O	RESETOUT or GPIF	GVDDQ VGND
	D2	PC-5 (GPIO[1]) or SD2_CD	I/O	PC-5 (GPIO[1])	I/O	PC-5 (GPIO[1])	I/O	PC-5 (GPIO[1])	I/O	PC-5 (GPIO[1])	I/O	GPIO or SD2 CD	
	D1	PC-4 (GPIO[0]) or SD_CD	I/O I	PC-4 (GPIO[0]) or SD_CD	I/O I	PC-4 (GPIO[0])	I/O	PC-4 (GPIO[0])	I/O	PC-4 (GPIO[0])	I/O	GPIO or SD CD	
	C3	RESET#									I	RESET	
	D4	WAKEUP									I	Wake Up Signal	

Table 10. Astoria 81-ball SP WLCSP Package Pin Assignments (continued)

	Pin Name			Pin Description	Power Domain
Conf	A1	XTALSLC	I	Clock Select	GVDDQ VGND
	B1	TEST[2]	I	Test Cfg 2	
	C6	TEST[1]	I	Test Cfg 1	
	B4	TEST[0]	I	Test Cfg 0	
CLK	A2	XTALIN	I	Crystal / Clock IN	XVDDQ VGND
Power	A9, E8	PVDDQ	Power	Processor I/F VDD	
	J6	SNVDDQ	Power	GPIF VDD	
	B5	UVDDQ	Power	USB VDD	
	F1	SSVDDQ	Power	SDIO VDD	
	D3	GVDDQ	Power	Misc I/O VDD	
	B3	AVDDQ	Power	Analog VDD	
	A6, D6, E5, F6	VDD	Power	Core VDD	
	A3	UVSSQ	Power	USB GND	
	B2	AVSSQ	Power	Analog GND	
	D5, D7, E4, E9, F5	VGND	Power	Core GND	

Table 11. Astoria 81-ball Lite SP WLCSP Package Pin Assignments

	Pin Name							Pin Description	Power Domain
	Ball #	SRAM Interface		ADM (Address/Data Multiplexing)	I/O	PNAND	I/O		
P-Port	G9	CE#	I	CE#	I	CE#	I	CE#	PVDDQ VGND
	H5	A7	I	External Pull Up	I	A7 ≥ 1:SBD A7 ≥ 0: LBD	I	A7	
	J8	A6	I	SDA	I/O	SDA	I/O	A7 or SDA	
	H6	A5	I	SCL	I/O	SCL	I/O	A6 or SCL	
	H7	A4	I	External Pull Up	I	WP#	I	A4 or WP#	
	J9	A3	I	External Pull Low	I	External Pull Low	I	A3	
	H8	A2	I	External Pull Up	I	External Pull Low	I	A2	
	H9	A1	I	External Pull Up	I	R/B#	I	A1 or R/B#	
	G8	A0	I	External Pull Up	I	CLE	I	A0 or CLE	
	G6	DQ[15]	I/O	AD[15]	I/O	I/O[15]	I/O	D15, AD15, or IO15	
	F9	DQ[14]	I/O	AD[14]	I/O	I/O[14]	I/O	D14, AD14, or IO14	
	F8	DQ[13]	I/O	AD[13]	I/O	I/O[13]	I/O	D13, AD13, or IO13	
	F7	DQ[12]	I/O	AD[12]	I/O	I/O[12]	I/O	D12, AD12, or IO12	
	E9	DQ[11]	I/O	AD[11]	I/O	I/O[11]	I/O	D11, AD11, or IO11	
	E8	DQ[10]	I/O	AD[10]	I/O	I/O[10]	I/O	D10, AD10, or IO10	
	D9	DQ[9]	I/O	AD[9]	I/O	I/O[9]	I/O	D9, AD9, or IO9	
	D7	DQ[8]	I/O	AD[8	I/O	I/O[8]	I/O	D8, AD8, or IO8	
	D8	DQ[7]	I/O	AD[7]	I/O	I/O[7]	I/O	D7, AD7, or IO7	
	C9	DQ[6]	I/O	AD[6]	I/O	I/O[6]	I/O	D6, AD6, or IO6	
	D6	DQ[5]	I/O	AD[5]	I/O	I/O[5]	I/O	D5, AD5, or IO5	
	B9	DQ[4]	I/O	AD[4]	I/O	I/O[4]	I/O	D4, AD4, or IO4	
	C8	DQ[3]	I/O	AD[3]	I/O	I/O[3]	I/O	D3, AD3, or IO3	
	C7	DQ[2]	I/O	AD[2]	I/O	I/O[2]	I/O	D2, AD2, or IO2	
	B8	DQ[1]	I/O	AD[1]	I/O	I/O[1]	I/O	D1, AD1, or IO1	
	A8	DQ[0]	I/O	AD[0]	I/O	I/O[0]	I/O	D0I, AD0, or IO0	
	B7		I	ADV#	I	ALE	I	Address Valid	
	B6	OE#	I	OE#	I	RE#	I	Output Enable	
	A7	WE#	I	WE#	I	WE#	I	WE#	
Int	C1	INT#	O	INT#	O	INT#	O	INT Request	GVDDQ VGND
	D4	DRQ#	O	DRQ#	O	DRQ#	O	DMA Request	
	D3	DACK#	I	DACK#	I	DACK#	I	DMA ACK	
U-Port	A4	D+					I/O/Z	USB D+	UVDDQ UVSSQ
	A5	D–					I/O/Z	USB D–	
	C4	SWD+					I/O/Z	USB Switch DP	
	C5	SWD–					I/O/Z	USB Switch DM	

Table 11. Astoria 81-ball Lite SP WLCSP Package Pin Assignments (continued)

		S-Port Interface	I/O		
S-Port	F3	SD_D[7]	I/O	SD Data or GPIO	SSVDDQ VGND
	H1	SD_D[6]	I/O	SD Data or GPIO	
	G2	SD_D[5]	I/O	SD Data or PIO	
	E3	SD_D[4]	I/O	SD Data or GPIO	
	F2	SD_D[3]	I/O	SD Data or GPIO	
	F1	SD_D[2]	I/O	SD Data or GPIO	
	E2	SD_D[1]	I/O	SD Data or GPIO	
	E1	SD_D[0]	I/O	SD Data or GPIO	
	G1	SD_CLK	I/O	SD Clock or GPIO	
	J1	SD_CMD	I/O	SD CMD or GPIO	
	J5	PB[7] (GPIO)	I/O	GPIOI	
	J4	PB[6] (GPIO)	I/O	GPIOI	
	H4	PB[5] (GPIO)	I/O	GPIOI	
	J3	PB[4] (GPIO)	I/O	GPIOI	
	H3	PB[3] (GPIO)	I/O	GPIOI	
	G4	PB[2] (GPIO)	I/O	GPIOI	
	J2	PB[1] (GPIO)	I/O	GPIOI	
	H2	PB[0] (GPIO)	I/O	GPIOI	
	J7	GPIF_RDY	O	Test Mode	
	J6	GPIF_CTL	I	Test Mode (Ext Pull-High)	
Other	D1	SD_CD	I	SD CD	GVDDQ VGND
	C2	RESET#	I	RESET	
	E5	WAKEUP	I	Wake Up Signal	
Conf	C3	TEST[2]	I	Test Cfg 2	GVDDQ VGND
	D5	TEST[1]	I	Test Cfg 1	
	B1	TEST[0]	I	Test Cfg 0	
CLK	A2	XTALIN	I	Clock IN	XVDDQ VGND
	A1	XTALOUT	O	Clock OUT	
Power	A9, F6	PVDDQ	Power	Processor I/F VDD	
	B5	UVDDQ	Power	USBVDD	
	E4	SSVDDQ	Power	SDIO VDD	
	D2	GVDDQ	Power	Misc I/O VDD	
	B3	AVDDQ	Power	Analog VDD	
	B4	XVDDQ	Power	Crystal VDD	
	E7, A6, C6, F5	VDD	Power	Core VDD	
	A3	UVSSQ	Power	USB GND	
	B2	AVSSQ	Power	Analog GND	
	G7, E6, G5, F4, G3	VGND	Power	Core GND	

Figure 9. Astoria 100-ball VFBGA Ball Map - Top View

	1	2	3	4	5	6	7	8	9	10	
A	ADV#	WE#	INT#	DRQ#	D+	D-	SWD+	XTALIN	AVSSQ	VDD33	A
B	DQ[1]	DQ[0]	OE#	DACK#	UVDDQ	UVSSQ	XVDDQ	XTALOUT	AVDDQ	RESETOUT	B
C	DQ[4]	DQ[3]	DQ[2]	XTALSLC[0]	XTALSLC[1]	SWD-	WAKEUP	TEST[1]	GPIO[1]	RESET#	C
D	DQ[7]	DQ[6]	DQ[5]	PVDDQ	VDD	GVDDQ	TEST[0]	GPIO[0]	SD_D[1]	SD_D[0]	D
E	DQ[10]	DQ[9]	DQ[8]	VGND	VGND	VGND	VGND	TEST[2]	SD_D[3]	SD_D[2]	E
F	DQ[13]	DQ[12]	DQ[11]	VGND	VGND	VGND	VDD	SD_CLK	SD_D[5]	SD_D[4]	F
G	CE#	DQ[15]	DQ[14]	VDD	VDD	VDD	VDD	SD_CMD	SD_D[7]	SD_D[6]	G
H	A[5]	A[6]	A[7]	PVDDQ	SNVDDQ	GPIF_CTL[0]	SSVDDQ	SD_POW	GPIF_DATA[2]	SD_WP	H
J	A[3]	CLK	A[4]	GPIF_RDY[0]	PC[0]	PA[7]	PA[5]	GPIF_DATA[5]	GPIF_DATA[3]	GPIF_DATA[0]	J
K	A[0]	A[1]	A[2]	GPIF_CTL[1]	PC[2]	PA[6]	GPIF_DATA[7]	GPIF_DATA[6]	GPIF_DATA[4]	GPIF_DATA[1]	K
	1	2	3	4	5	6	7	8	9	10	

POWER DOMAIN KEY	
	UVDDQ
	UVSSQ
	GVDDQ
	SSVDDQ
	VDDQ/AVDDQ
	VGND/AVSSQ
	PVDDQ
	SNVDDQ
	XVDDQ
	VDD33

Figure 10. Ball map_CYWB0216 - Top View

Top View

	1	2	3	4	5	6	7	8	9	10	11	
A	P/U	P/ U	N/C	N/C	D+	D-	SWD+	XTALIN	AVSSQ	VDD33	N/C	A
B	P/U	P/U	P/U	P/U	UVDDQ	UVSSQ	XVDDQ	XTALOUT	AVDDQ	RESETOUT	N/C	B
C	P/U	P/U	P/U	XTALSLC[0]	XTALSLC[1]	SWD-	WAKEUP	TEST[1]	GPIO[1]	RESET#	N/C	C
D	P/U	P/U	P/U	PVDDQ	VDD	GVDDQ	TEST[0]	GPIO[0]	SD_D[1]	SD_D[0]	N/C	D
E	P/U	P/U	P/U	VGND	VGND	VGND	VGND	TEST[2]	SD_D[3]	SD_D[2]	N/C	E
F	P/U	P/U	P/U	VGND	VGND	VGND	VDD	SD_CLK	SD_D[5]	SD_D[4]	N/C	F
G	P/U	P/U	P/U	VDD	VDD	VDD	VDD	SD_CMD	SD_D[7]	SD_D[6]	N/C	G
H	SCL	SDA	P/U	PVDDQ	SNVDDQ	GPIF_CTL [0]	SSVDDQ	SD_POW	GPIF_DATA[2]	SD_WP	N/C	H
J	P/U	P/D	P/U	GPIF_RDY [0]	PC [0]	PA [7]	PA [5]	GPIF_DATA[5]	GPIF_DATA[3]	GPIF_DATA[0]	N/C	J
K	P/U	P/U	P/D	GPIF_CTL [1]	PC [2]	PA [6]	GPIF_DATA[7]	GPIF_DATA[6]	GPIF_DATA[4]	GPIF_DATA[1]	N/C	K
L	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/ C	N/C	L
	1	2	3	4	5	6	7	8	9	10	11	

POWER DOMAIN KEY	
	UVDDQ
	UVSSQ
	GVDDQ
	SSVDDQ
	VDDQ/AVDDQ
	VGNDAVSSQ
	PVDDQ
	SNVDDQ
	XVDDQ
	VDD33
	P/U
	P/D
	N/C

Figure 11. Ball map_CYWB0220 - Top View

Top View

	1	2	3	4	5	6	7	8	9	10	11	
A	ADV#	WE#	INT#	DRQ#	N/C	N/C	N/C	XTALIN	AVSSQ	VDD33	N/C	A
B	DQ[1]	DQ[0]	OE#	DACK#	UVDDQ	UVSSQ	XVDDQ	XTALOUT	AVDDQ	RESETOUT	N/C	B
C	DQ[4]	DQ[3]	DQ[2]	XTALSLC[0]	XTALSLC[1]	N/C	WAKEUP	TEST[1]	GPIO[1]	RESET#	N/C	C
D	DQ[7]	DQ[6]	DQ[5]	PVDDQ	VDD	GVDDQ	TEST[0]	GPIO[0]	SD_D[1]	SD_D[0]	N/C	D
E	DQ[10]	DQ[9]	DQ[8]	VGND	VGND	VGND	VGND	TEST[2]	SD_D[3]	SD_D[2]	N/C	E
F	DQ[13]	DQ[12]	DQ[11]	VGND	VGND	VGND	VDD	SD_CLK	SD_D[5]	SD_D[4]	N/C	F
G	CE#	DQ[15]	DQ[14]	VDD	VDD	VDD	VDD	SD_CMD	SD_D[7]	SD_D[6]	N/C	G
H	A[5]	A[6]	A[7]	PVDDQ	SNVDDQ	GPIF_CTL[0]	SSVDDQ	SD_POW	GPIF_DATA[2]	SD_WP	N/C	H
J	A[3]	CLK	A[4]	GPIF_RDY[0]	PC [0]	PA [7]	PA[5]	GPIF_DATA[5]	GPIF_DATA[3]	GPIF_DATA[0]	N/C	J
K	A[0]	A[1]	A[2]	GPIF_CTL[1]	PC [2]	PA [6]	GPIF_DATA[7]	GPIF_DATA[6]	GPIF_DATA[4]	GPIF_DATA[1]	N/C	K
L	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/ C	N/C	L
	1	2	3	4	5	6	7	8	9	10	11	

POWER DOMAIN KEY	
	UVDDQ
	UVSSQ
	GVDDQ
	SSVDDQ
	VDDQ/AVDDQ
	VGNDAVSSQ
	PVDDQ
	SNVDDQ
	XVDDQ
	VDD33
	N/C

Figure 12. Ball map_CYWB0224 - Top View

Top View

	1	2	3	4	5	6	7	8	9	10	11	
A	ADV#	WE#	INT#	DRQ#	D+	D-	SWD+	XTALIN	AVSSQ	VDD33	N/C	A
B	DQ[1]	DQ[0]	OE#	DACK#	UVDDQ	UVSSQ	XVDDQ	XTALOUT	AVDDQ	RESETOUT	N/C	B
C	DQ[4]	DQ[3]	DQ[2]	XTALSLC[0]	XTALSLC[1]	SWD-	WAKEUP	TEST[1]	GPIO[1]	RESET#	N/C	C
D	DQ[7]	DQ[6]	DQ[5]	PVDDQ	VDD	GVDDQ	TEST[0]	GPIO[0]	SD_D[1]	SD_D[0]	N/C	D
E	DQ[10]	DQ[9]	DQ[8]	VGND	VGND	VGND	VGND	TEST[2]	SD_D[3]	SD_D[2]	N/C	E
F	DQ[13]	DQ[12]	DQ[11]	VGND	VGND	VGND	VDD	SD_CLK	SD_D[5]	SD_D[4]	N/C	F
G	CE#	DQ[15]	DQ[14]	VDD	VDD	VDD	VDD	SD_CMD	SD_D[7]	SD_D[6]	N/C	G
H	A[5]	A[6]	A[7]	PVDDQ	SNVDDQ	GPIF_CTL [0]	SSVDDQ	SD_POW	GPIF_DATA[2]	SD_WP	N/C	H
J	A[3]	CLK	A[4]	GPIF_RDY[0]	PC[0]	PA[7]	PA[5]	GPIF_DATA[5]	GPIF_DATA[3]	GPIF_DATA[0]	N/C	J
K	A[0]	A[1]	A[2]	GPIF_CTL[1]	PC[2]	PA[6]	GPIF_DATA[7]	GPIF_DATA[6]	GPIF_DATA[4]	GPIF_DATA[1]	N/C	K
L	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/ C	N/C	L
	1	2	3	4	5	6	7	8	9	10	11	

POWER DOMAIN KEY	
	UVDDQ
	UVSSQ
	GVDDQ
	SSVDDQ
	VDDQ/AVDDQ
	VGNDAVSSQ
	PVDDQ
	SNVDDQ
	XVDDQ
	VDD33
	N/C

Figure 13. Astoria 81-ball SP WLCSP Ball Map - Top View

	1	2	3	4	5	6	7	8	9	
A	XTALSLC	XTALIN	UVSSQ	D+	D-	VDD	WE#	IO[0]	PVDDQ	A
B	TEST[2]	AVSSQ	AVDDQ	TEST[0]	UVDDQ	RE#	ALE	IO[1]	IO[4]	B
C	INT#	RESETOUT	RESET#	SWD+	SWD-	TEST[1]	IO[2]	IO[3]	IO[5]	C
D	GPIO[0]	GPIO[1]	GVDDQ	WAKEUP	VGND	VDD	VGND	IO[6]	IO[7]	D
E	SD_WP	SD_D[0]	SD_D[1]	VGND	VDD	A[2]	SDA	PVDDQ	VGND	E
F	SSVDDQ	SD_D[3]	SD_D[2]	SD_CMD	VGND	VDD	PA[6]	CLE	CE#	F
G	SD_CLK	SD_D[4]	SD_D[5]	GPIF_DATA[2]	GPIF_DATA[5]	PA[5]	PC[0]	A[3]	R/B#	G
H	SD_D[6]	SD_D[7]	GPIF_DATA[1]	GPIF_DATA[4]	GPIF_DATA[7]	PA[7]	GPIF_RDY[0]	SCL	Pull-Low	H
J	POW	GPIF_DATA[0]	GPIF_DATA[3]	GPIF_DATA[6]	GPIF_CTL [0]	SNVDDQ	PC [2]	GPIF_CTL [1]	WP#	J
	1	2	3	4	5	6	7	8	9	

POWER DOMAIN KEY
UVDDQ
UVSSQ
GVDDQ
SSVDDQ
VDDQ/AVDDQ
VGND/AVSSQ
PVDDQ
SNVDDQ
XVDDQ

Figure 14. Astoria 81-ball Lite SP WLCSP Ball Map - Top View

	1	2	3	4	5	6	7	8	9	
A	XTALOUT	XTALIN	UVSSQ	D+	D-	VDD	WE#	DQ[0]	PVDDQ	A
B	TEST[0]	AVSSQ	AVDDQ	XVDDQ	UVDDQ	OE#	ADV#	DQ[1]	DQ[4]	B
C	INT#	RESET#	TEST[2]	SWD+	SWD-	VDD	DQ[2]	DQ[3]	DQ[6]	C
D	GPIO[0]	GVDDQ	DACK#	DRQ#	TEST[1]	DQ[5]	DQ[8]	DQ[7]	DQ[9]	D
E	SD_D[0]	SD_D[1]	SD_D[4]	SSVDDQ	WAKEUP	VGND	VDD	DQ[10]	DQ[11]	E
F	SD_D[2]	SD_D[3]	SD_D[7]	VGND	VDD	PVDDQ	DQ[12]	DQ[13]	DQ[14]	F
G	SD_CLK	SD_D[5]	VGND	PB[2] (GPIO)	VGND	DQ[15]	VGND	A[0]	CE#	G
H	SD_D[6]	PB[0] (GPIO)	PB[3] (GPIO)	PB[5] (GPIO)	A[7]	A[5]	A[4]	A[2]	A[1]	H
J	SD_CMD	PB[1] (GPIO)	PB[4] (GPIO)	PB[6] (GPIO)	PB[7] (GPIO)	GPIF_RDY	GPIF_CTL	A[6]	A[3]	J
	1	2	3	4	5	6	7	8	9	

POWER DOMAIN KEY	
	UVDDQ
	UVSSQ
	GVDDQ
	SSVDDQ
	VDD/AVDDQ
	VGND/AVSSQ
	PVDDQ
	XVDDQ

Absolute Maximum Ratings

Exceeding maximum ratings may shorten the useful life of the device. User guidelines are not tested.

Storage temperature ..... –65 °C to +150 °C

Ambient temperature with power supplied (Industrial) ..... –40 °C to +85 °C

Supply voltage to ground potential
VDD, AVDDQ .....–0.5 V to +2.0 V
GVDDQ, PVDDQ, SSVDDQ, SNVDDQ, UVDDQ, and VDD33 and XVDDQ .....–0.5 V to +4.0 V

DC input voltage to any input pin (Depends on I/O supply voltage. Inputs are not overvoltage tolerant.) .....1.89 V to 3.6 V

DC voltage applied to outputs in High Z state ..... –0.5 V to VDDQ + 0.5 V

Static discharge voltage (ESD) from JESD22-A114 .....> 2000 V

Latch up current .....> 200 mA

Maximum output short circuit current for all I/O configurations. (Vout = 0 V) [1] .....–100 mA

Operating Conditions

T_A (ambient temperature under bias)
Industrial ..... –40 °C to +85 °C

VDD, AVDDQ supply voltage .....1.7 V to 1.9 V

UVDDQ supply voltage .....3.0 V to 3.6 V

PVDDQ, GVDDQ, SNVDDQ, SSVDDQ supply voltage .....1.7 V to 3.6 V

XVDDQ (Crystal I/O) supply voltage .....3.0 V to 3.6 V

XVDDQ (Ext. Clock I/O) supply voltage .....1.7 V to 1.9 V

Note
1. Do not test more than one output at a time. Duration of the short circuit must not exceed one second. Tested initially and after any design or process changes that may affect these parameters

DC Characteristics

Table 12. DC Specifications for All Voltage Supplies (Except USB Switch)

Parameter	Description	Conditions		Min	Typ	Max	Unit
V_{DD}	Core voltage supply			1.7	1.8	1.9	V
AVDDQ	Analog voltage supply			1.7	1.8	1.9	V
XVDDQ	Crystal voltage supply			3.0	3.3	3.6	V
XVDDQ	Clock voltage supply			1.7	1.8	1.9	V
PVDDQ[4]	Processor interface I/O			1.7	1.8, 2.5, 3.3	3.6	V
GVDDQ[4]	Miscellaneous I/O voltage supply			1.7	1.8, 2.5, 3.3	3.6	V
SNVDDQ[3, 4]	S-Port GPIF voltage supply			1.7	1.8, 2.5, 3.3	3.6	V
SSVDDQ[3, 4]	S-Port SD I/O voltage supply			1.7	1.8, 2.5, 3.3	3.6	V
UVDDQ[6]	USB voltage supply			3.0	3.3	3.6	V
VDD33	Power sequence control supply			3.0	3.3	3.6	V
V_{IH1}[5]	Input HIGH voltage 1	All ports except USB, 2.0 V ≤ V_{CC} ≤ 3.6 V		0.625 × V_{CC}	–	V_{CC} + 0.3	V
V_{IH2}[5]	Input HIGH voltage 2	All ports except USB, 1.7 V ≤ V_{CC} < 2.0 V		V_{CC} – 0.4	–	V_{CC} + 0.3	
V_{IL}	Input LOW voltage			–0.3	–	0.25 × V_{CC}	V
V_{OH}	Output HIGH voltage	I_{OH}(MAX) = –0.1 mA		0.9 × V_{CC}	–		V
V_{OL}	Output LOW voltage	I_{OL}(MIN) = 0.1 mA			–	0.1 × V_{CC}	V
I_{IX}	Input leakage current	All I/O signals held at VDDQ		–1	–	1	µA
I_{OZ}	Output leakage current	All I/O signals held at VDDQ		–1	–	1	µA
I_{CC} Core	Operating current of core voltage supply (V_{DD}) and analog voltage supply (AVDDQ)	VFBGA package outputs tri-stated		–	–	110	mA
		WLCSP package outputs tri-stated		–	–	115	mA
I_{CC} Crystal	Operating current of crystal voltage supply (XVDDQ)[8]	VFBGA package XTALOUT floating		–	–	5	mA
		WLCSP package		–		N/A	
I_{CC} USB	Operating current of USB voltage supply (UVDDQ)[8]	Operating and terminated for high speed mode		–	–	25	mA
I_{SB1} (For 100-ball VFBGA and 81-ball SP WLCSP-Packages)	Total standby current of Astoria when device is in suspend mode	1. *VDDQ = 3.3 V nominal (3.0–3.6 V) 2. Outputs and Bidirs high or floating[7] 3. XTALOUT floating 4. D+ floating, D–grounded 5. Device in suspend mode	25 °C	–	300[2]	–	µA
			85 °C	–	–	3000	µA

Notes
2. Isb1 typical value is not a maximum specification but a typical value. Isb1 maximum current value specified for 85°C.
3. The SSVDDQ I/O voltage can be dynamically changed (for example, from high range to low range) as long as the supply voltage undershoot does not surpass the lower minimum voltage limit. SSVDDQ and SNVDDQ levels for SD modes: 2.0 V–3.6 V, MMC modes: 1.7 V–3.6 V.
4. Interfaces with a voltage range are adjustable with respect to the I/O voltage and supports multiple I/O voltages.
5. V_{CC} = pertinent VDDQ value.
6. When U-Port is in a disabled state, UVDDQ can go down to 2.4 V, provided UVDDQ is still the highest supply voltage level.
7. The Outputs and Bidirs that are forced low in standby mode can increase I/O supply standby current beyond specified value.
8. Active Current Conditions:
   -UVDDQ: USB transmitting 50% of the time, receiving 50% of the time.
   -PVDDQ/SNVDDQ/SSVDDQ/GVDDQ: Active current depends on I/O activity, bus load and supply level.
   -XVDDQ: Assume highest frequency clock (48 MHz) or crystal (26 MHz).

Table 12. DC Specifications for All Voltage Supplies (Except USB Switch) (continued)

Parameter	Description	Conditions		Min	Typ	Max	Unit
I_{SB1} (For 81-ball Lite SP WLCSP)	Total standby current of Astoria when device is in suspend mode	6. *VDDQ = 3.3 V nominal (3.0–3.6 V) 7. Outputs and Bidirs high or floating[7] 8. XTALOUT floating 9. D+ floating, D– grounded 10.Device in suspend mode	25 °C	TBD	TBD	TBD	µA
			85 °C	TBD	TBD	TBD	µA
I_{SB2}	Total standby current of Astoria when device is in standby mode	1. *VDDQ = 3.3 V Nominal (3.0–3.6 V) 2. Outputs and Bidirs High or Floating[7] 3. XTALOUT Floating 4. D+ Floating, D– Grounded	25 °C	–	–	52	µA
			85 °C	–	–	450	µA
I_{SB3}	Total standby current of Astoria when device is in core power-down mode	1. Outputs and Bidirs High or Floating[7] 2. XTALOUT Floating 3. D+ Floating, D– Grounded 4. Core Powered Down	25 °C	–	–	28	µA
			85 °C	–	–	139	µA

Table 13. USB Switch DC Specifications

Parameter	Description	Conditions	Min	Typ	Max	Unit
V_{IH}	Input voltage HIGH		1.6	–	–	V
V_{IL}	Input voltage LOW		–	–	0.8	V
R_{ON}	On resistance		4.5	7	10	Ω
R_{OFF}	Off resistance		1M	–	–	Ω
C_{DP/DM_ON}	D+/D– on capacitance (with Full-Speed switch On)		–	–	25	pF
C_{DP/DM_OFF}	D+/D– off capacitance		–	–	20	pF

Table 14. Capacitance

Parameter	Description	Conditions	Typ	Max	Unit
C_{IN}	Input pin capacitance, except D+/D–	TA = 25 °C, f = 1 MHz, $V_{CC} = V_{CCIO}$	–	9	pF
	Input pin capacitance, D+/D–		–	15	pF
C_{OUT}	Output pin capacitance		–	10	pF

AC Timing Parameters

P Port Interface

PCRAM Non Multiplexing Asynchronous Mode

Table 15. Asynchronous Mode Timing Parameters

Parameter	Description	Min	Max	Unit
Read Timing Parameters				
	Interface bandwidth (MBPS)	–	66.7	MBps
tAA	Address to data valid	–	30	ns
tOH	Data output hold from address change	3	–	ns
tEA	Chip enable to data valid	–	30	ns
tAADV	ADV# to data valid access time	–	30	ns
tAVS	Address valid to ADV# HIGH	5	–	ns
tAVH	ADV# HIGH to address hold	2[10]	–	ns
tCVS	CE# low setup time to ADV# HIGH	5	–	ns
tVPH	ADV# HIGH time	15[9]	–	ns
tVP	ADV# pulse width LOW	7.5	–	ns
tOE	OE# LOW to data valid	–	22.5	ns
tOLZ	OE# LOW to Low Z	3	–	ns
tOHZ	OE# HIGH to High Z	0	22.5	ns
tLZ	CE# LOW to Low Z	3	–	ns
tHZ	CE# HIGH to High Z	–	22.5	ns
Write Timing Parameters				
tCW	CE# LOW to write end	30	–	ns
tAW	Address Valid to write end	30	–	ns
tAS	Address setup to write start	0	–	ns
tADVS	ADV# setup to write start	0	–	ns
tWP	WE# pulse width	22	–	ns
tWPH	WE# HIGH time	10	–	ns
tCPH	CE# HIGH time	10	–	ns
tAVS	Address valid to ADV# HIGH	5	–	ns
tAVH	ADV# HIGH to address hold	2[10]	–	ns
tCVS	CE# LOW setup time to ADV# HIGH	5	–	ns
tVPH	ADV# HIGH time	15[9]	–	ns
tVP	ADV# pulse width LOW	7.5	–	ns
tVS	ADV# LOW to end of write	30	–	ns
tDW	Data setup to write end	18	–	ns
tDH	Data hold from write end	0	–	ns
tWHZ	Write to DQ High Z output	–	22.5	ns
tOW	End of write to Low Z output	3	–	ns

Notes
9. In applications where access cycle time is at least 60 ns, t_{VPH} can be relaxed to 12 ns.
10. In applications where back-to-back accesses are not performed on different endpoint addresses, the minimum t_{AVH} spec. can be relaxed to 0 ns.

Figure 15. Non Multiplexing Asynchronous Pseudo CRAM Mode Single Read Time Parameters

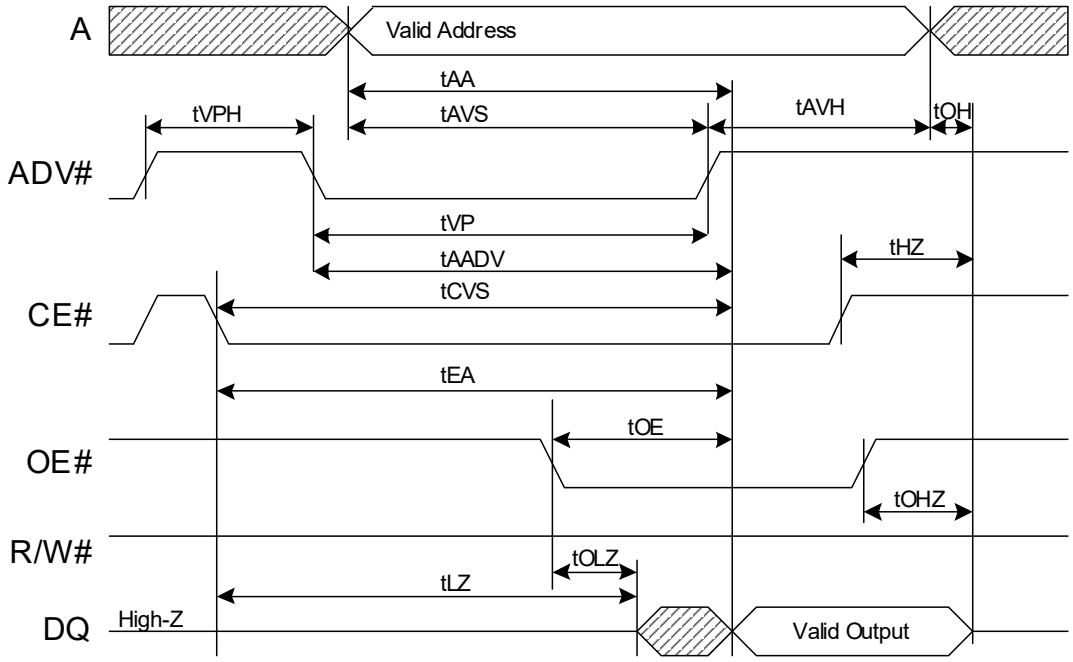


Figure 16. Non Multiplexing Asynchronous Pseudo CRAM mode Back to Back Read Timing Parameters

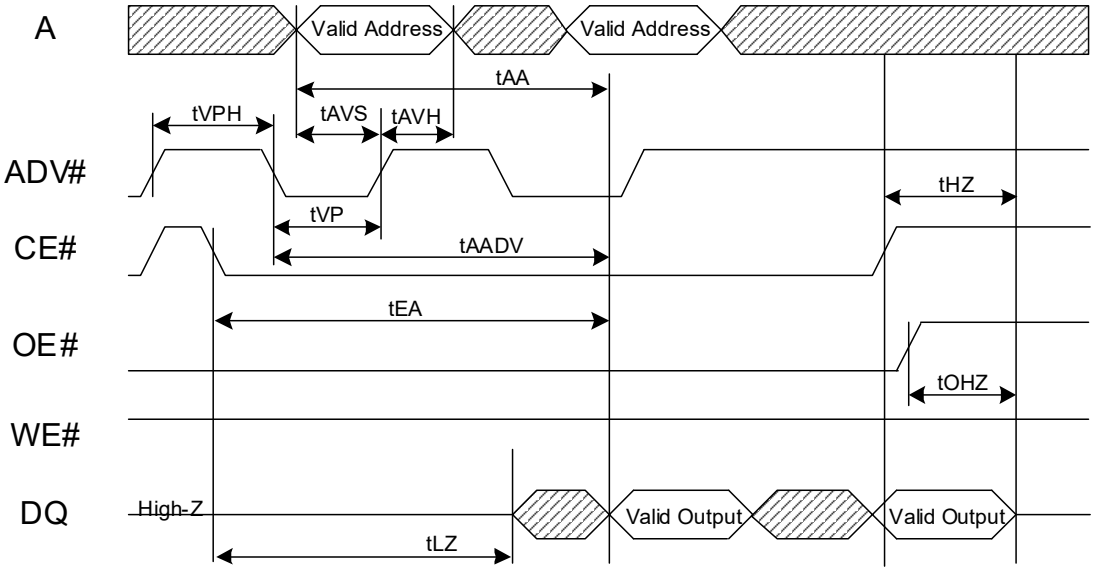


Figure 17. Non Multiplexing Asynchronous Pseudo CRAM Mode Back to Back Write Timing Parameters

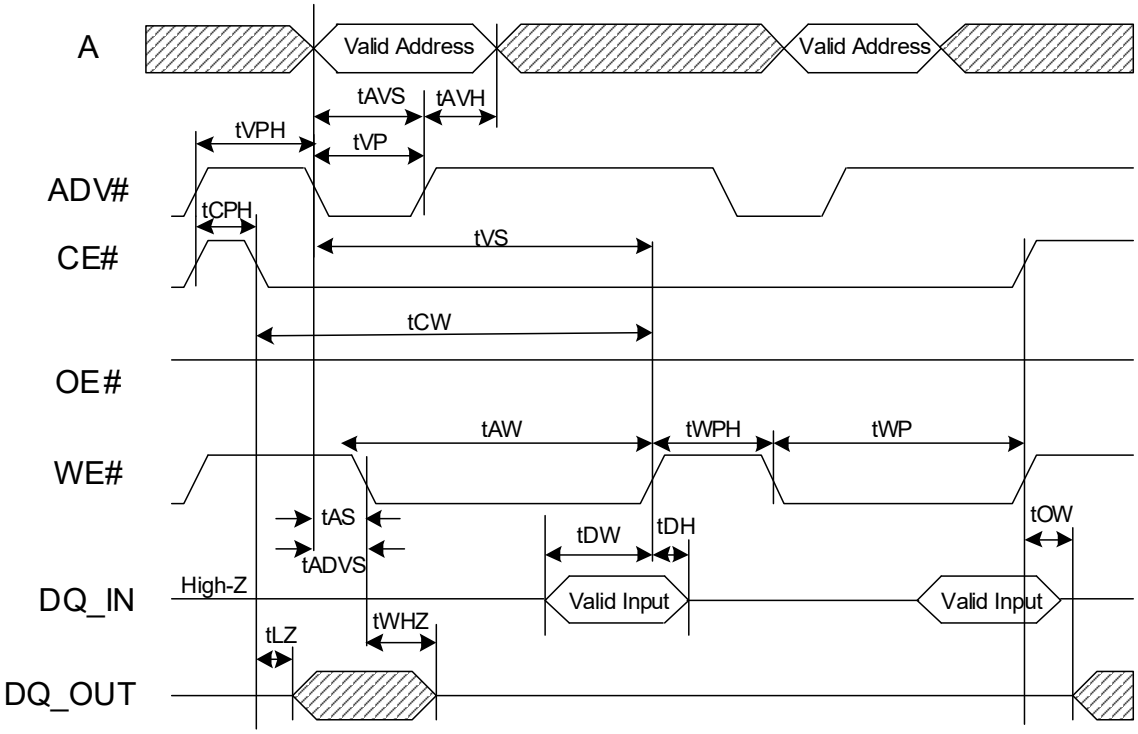


Figure 18. Non Multiplexing Asynchronous Pseudo CRAM Mode Read to Write Timing Parameters

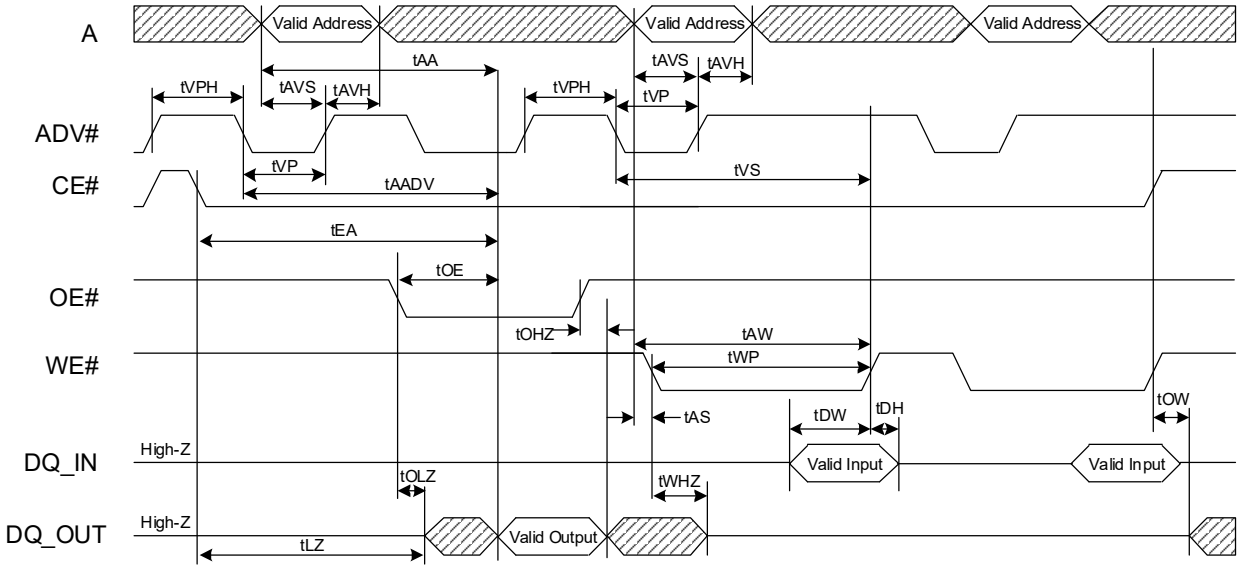
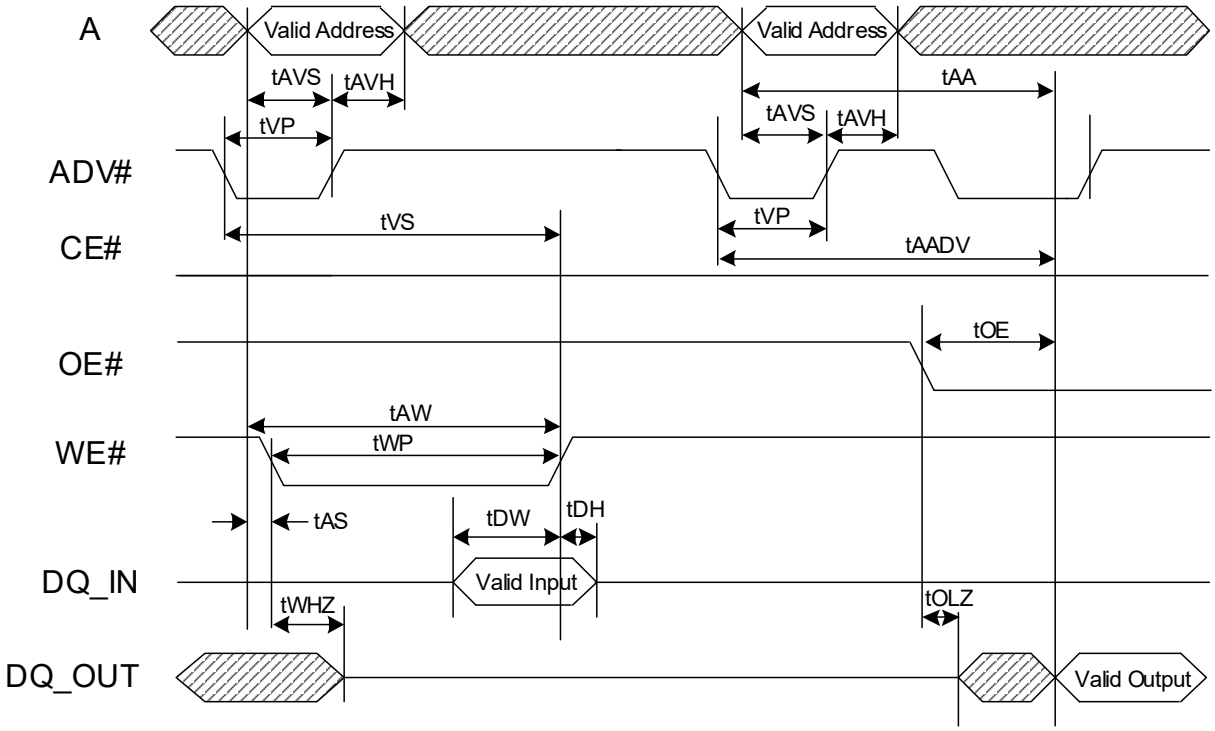


Figure 19. Non Multiplexing Asynchronous Pseudo CRAM Mode Write to Read Timing Parameters



Address Data Multiplexing Asynchronous Mode

Table 16. Address Data Multiplexing Asynchronous Mode Timing Parameters

Parameter	Description	Min	Max	Unit
Read Timing Parameters				
	Interface bandwidth	–	50	MBps
tAA	Address to data valid	–	30	ns
tEA	Chip enable access time	–	30	ns
tAADV	ADV# to data valid access time	–	30	ns
tAVS	Address valid to ADV# HIGH	5	–	ns
tAVH	ADV# HIGH to address hold	2	–	ns
tCVS	CE# LOW setup time to ADV# HIGH	5	–	ns
tVPH	ADV# HIGH time	15	–	ns
tVP	ADV# pulse width LOW	7.5	–	ns
tAVDOE	ADV# HIGH to OE# LOW	0	–	ns
tOE	OE# LOW to data valid	–	22.5	ns
tOLZ	OE# LOW to Low Z	3	–	ns
tOHZ	OE# HIGH to High Z	–	22.5	ns
tLZ	CE# LOW to Low Z	3	–	ns
tHZ	CE# HIGH to High Z	–	22.5	ns
Write Timing Parameters				
tCW	CE# LOW to write end	30	–	ns
tAW	Address valid to write end	30	–	ns
tAVDWE	ADV# HIGH to write start	0	–	ns
tWP	WE# pulse width	22	–	ns
tAVS	Address valid to ADV# HIGH	5	–	ns
tAVH	ADV# HIGH to address hold	2	–	ns
tCVS	CE# LOW setup time to ADV# HIGH	5	–	ns
tVPH	ADV# HIGH time	15	–	ns
tVP	ADV# pulse width LOW	7.5	–	ns
tVS	ADV# LOW to end of write	30	–	ns
tDS	Data setup to write end	18	–	ns
tDH	Data hold from write end	0	–	ns

Figure 20. Address Data Multiplexing Asynchronous Single Read Timing Parameters

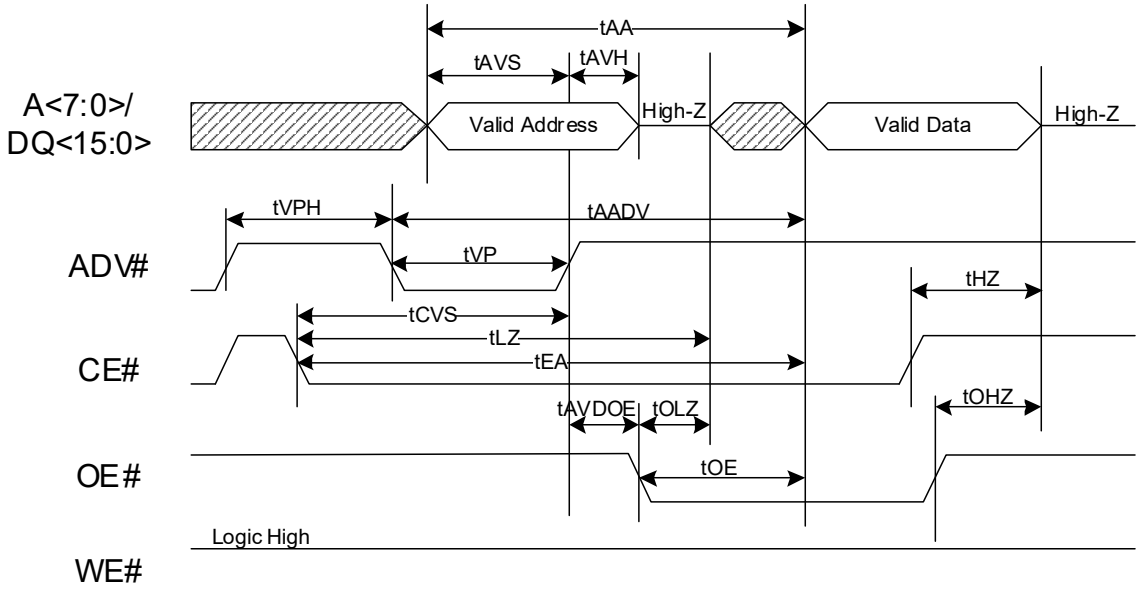
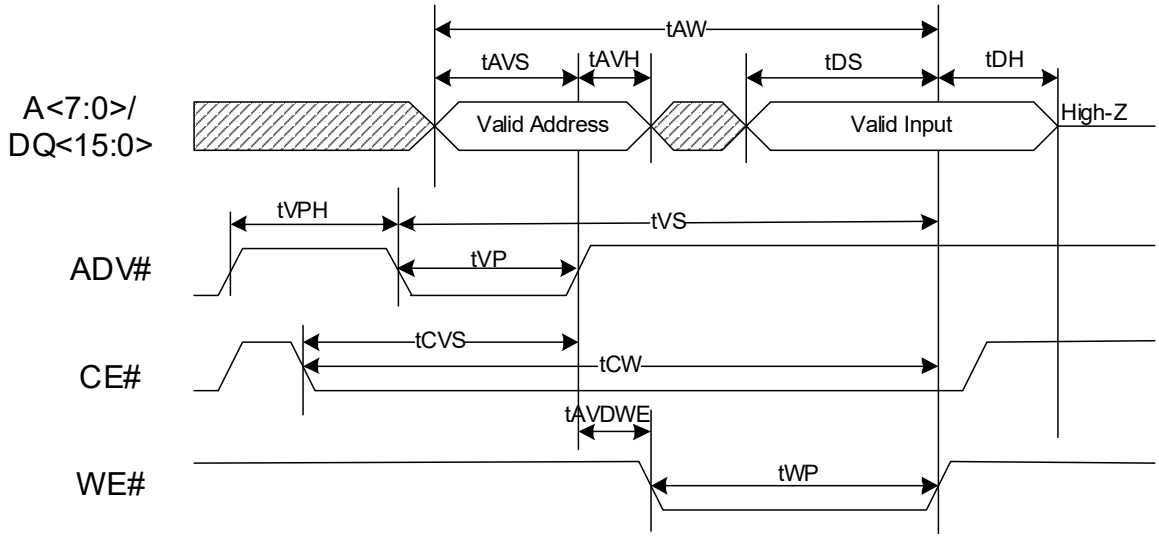


Figure 21. Address Data Multiplexing Asynchronous Single Write Timing Parameters

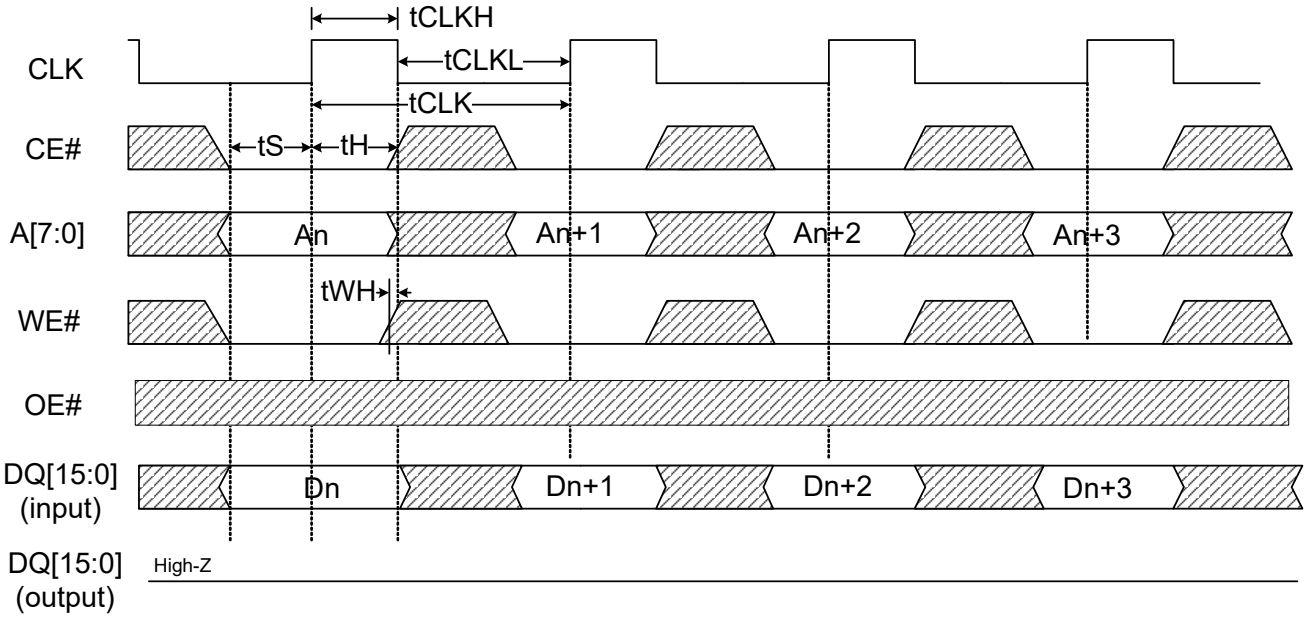


Non Multiplexing Synchronous Mode Timing Parameters

Table 17. Non Multiplexing Synchronous Mode Timing Parameters

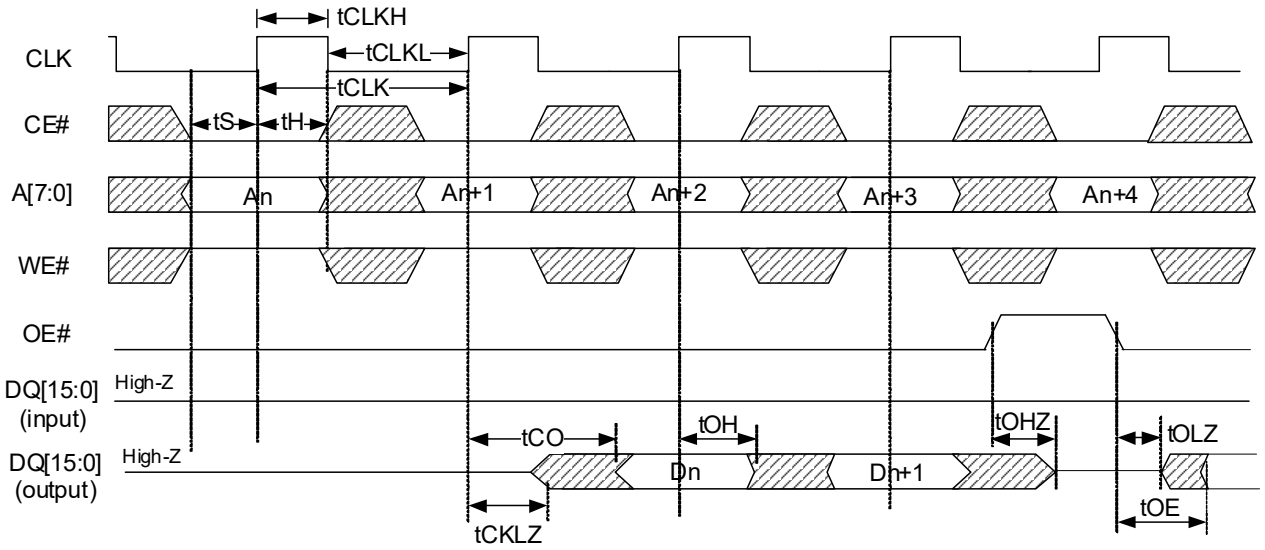
Parameter	Description	Min	Max	Unit
FREQ	Interface clock frequency	–	33	MHz
tCLK	Clock period	30	–	ns
tCLKH	Clock HIGH time	12	–	ns
tCLKL	Clock LOW time	12	–	ns
tWH	Address hold time (write to the register) for the first time that processor configures the P-Port from non-ADM asynchronous mode to non-ADM synchronous mode	0	–	ns
tS	CE#/WE#/ADDR/DQ setup time	7.5	–	ns
tH	CE#/WE#/ADDR/DQ hold time	1.5	–	ns
tCO	Clock to valid data	–	18	ns
tOH	Clock to data hold time	2	–	ns
tOLZ	OE# LOW to data Low Z	3	–	ns
tOHZ	OE# HIGH to data High Z	–	22.5	ns
tOE	OE# LOW to data valid	–	22.5	ns
tCKHZ	Clock to data High Z	–	18	ns
tCKLZ	Clock to data Low Z	3	–	ns

Figure 22. Non Multiplexing Synchronous Pseudo CRAM Mode Write Timing Parameters



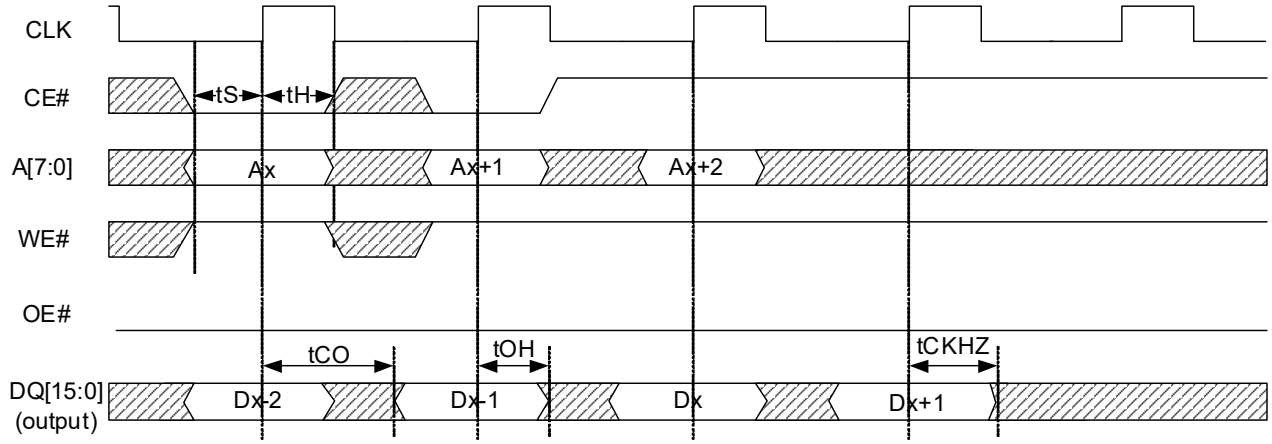
Note:
- Assumes previous cycle had CE# deselected
- OE# is don't care during write operations

Figure 23. Non Multiplexing Synchronous Pseudo CRAM Mode Read Timing Parameters



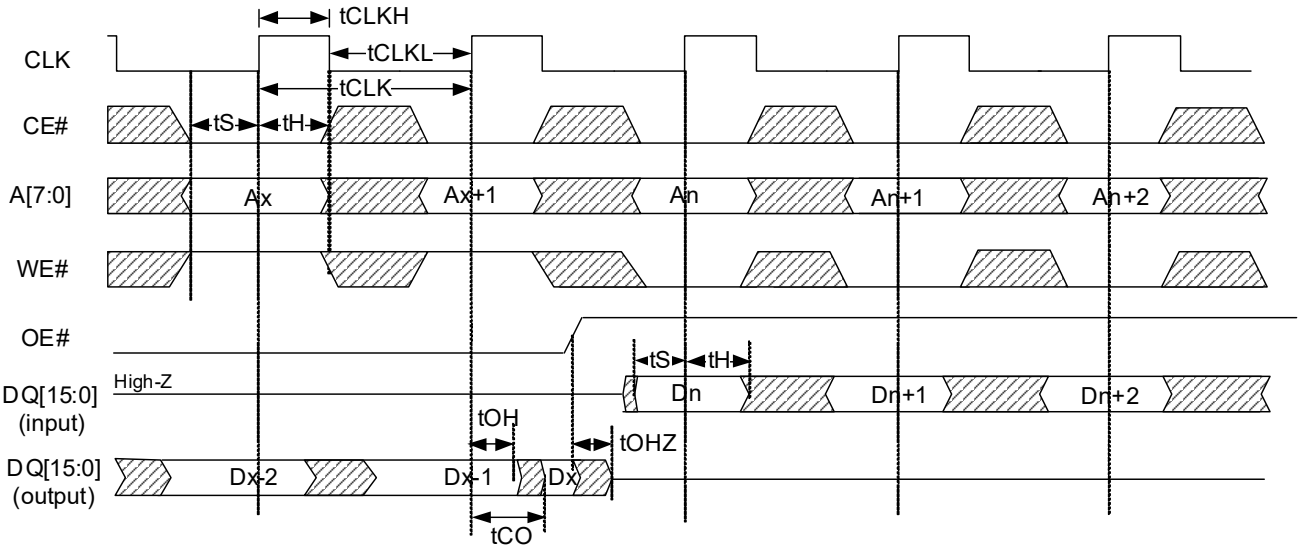
Note:
- Assumes previous cycle had CE# deselected

Figure 24. Non Multiplexing Synchronous Mode Read (OE# Fixed LOW) Timing Parameters



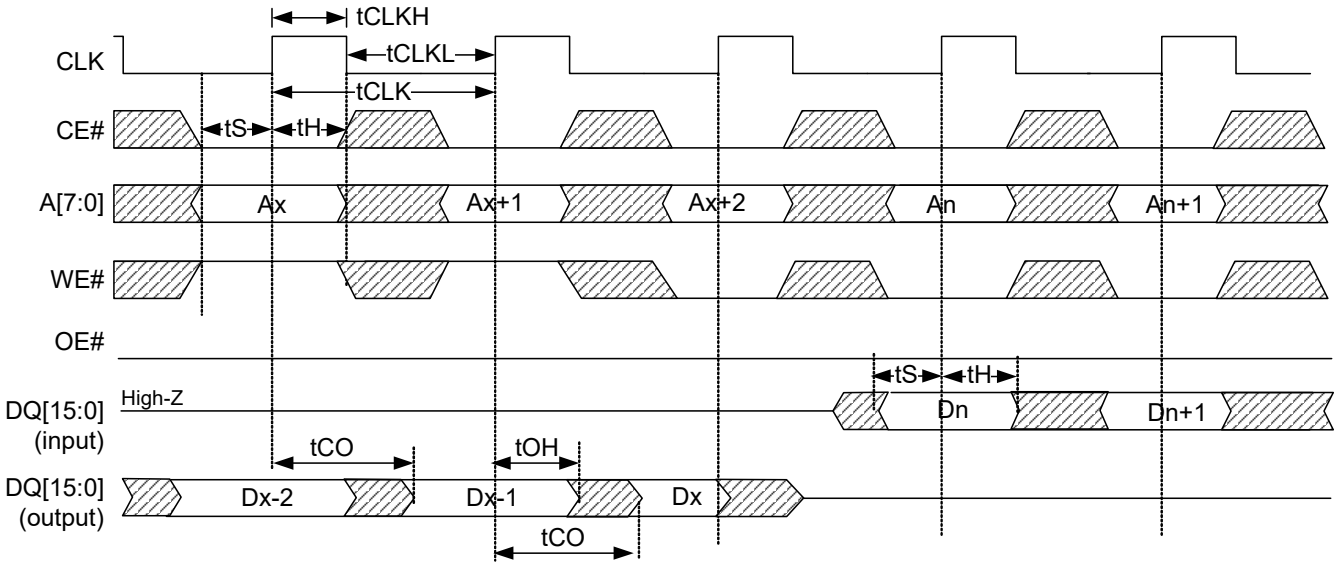
Note:
- Assumes previous several cycles were Read

Figure 25. Non Multiplexing Synchronous Mode Read to Write (OE# Controlled) Timing Parameters



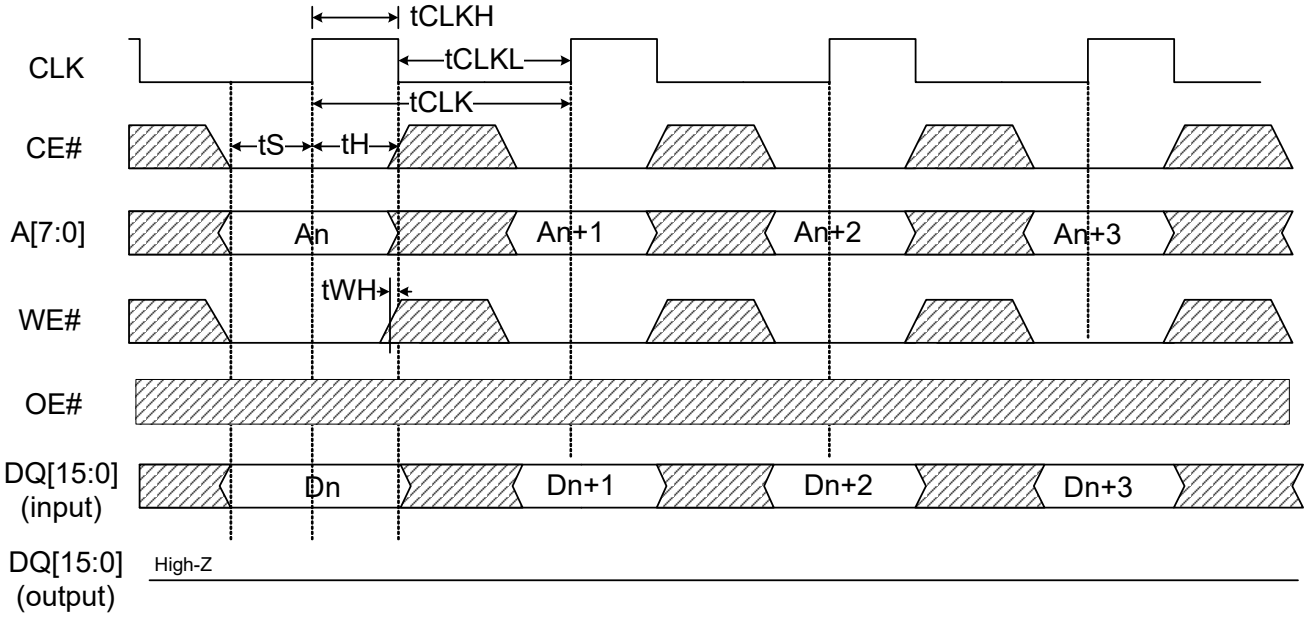
Note:
- Assumes previous several cycles were Read
- (Ax) and (Ax+1) cycles are turnaround . (Ax+1) operation does not cross pipeline .

Figure 26. Non Multiplexing Synchronous Mode Read to Write (OE# Fixed LOW) Timing Parameters



Note:
- Assumes previous several cycles were Read
- In this scenario, OE# is held LOW
- (Ax) and (Ax+1) cycles are turnaround. (Ax+1) operation does not cross pipeline.
- No operation is performed during the Ax+2 cycle (true turnaround operation)

Figure 27. Non Multiplexing Synchronous Mode Write to Read Timing Parameters



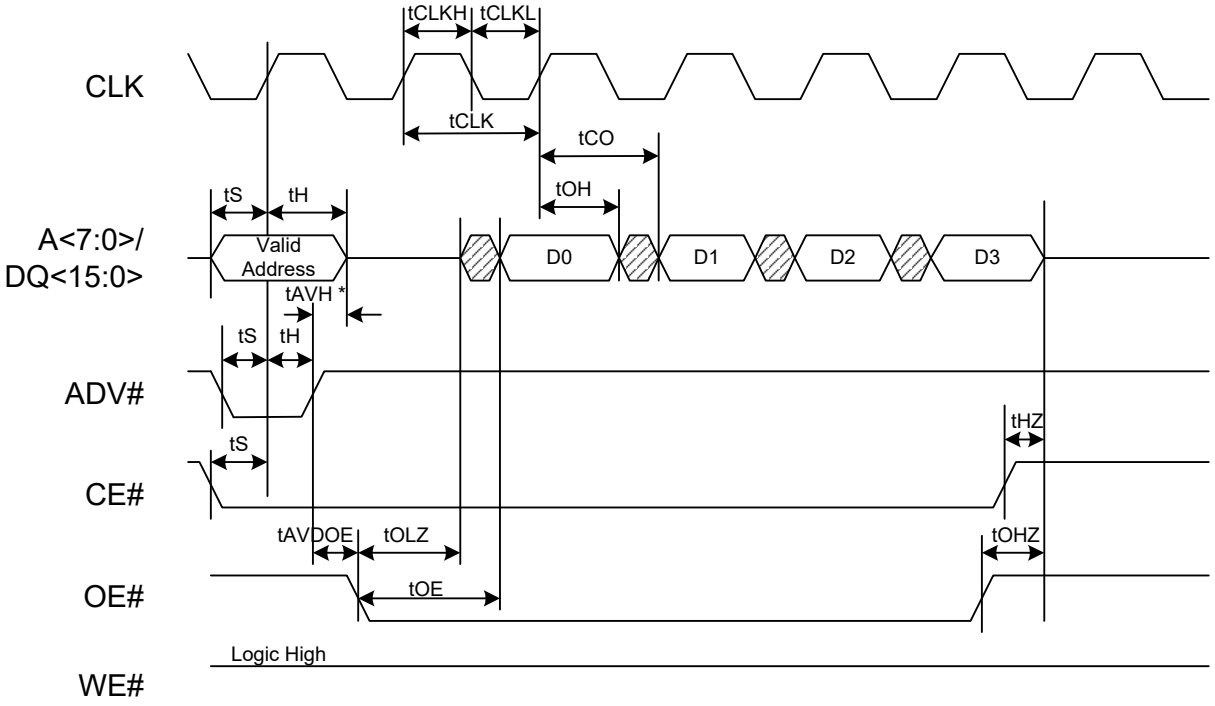
Note:
- Assumes previous cycle had CE# deselected
- OE# is don't care during write operations

Address Data Multiplexing Synchronous Mode

Table 18. Address Data Multiplexing Synchronous Mode Parameters

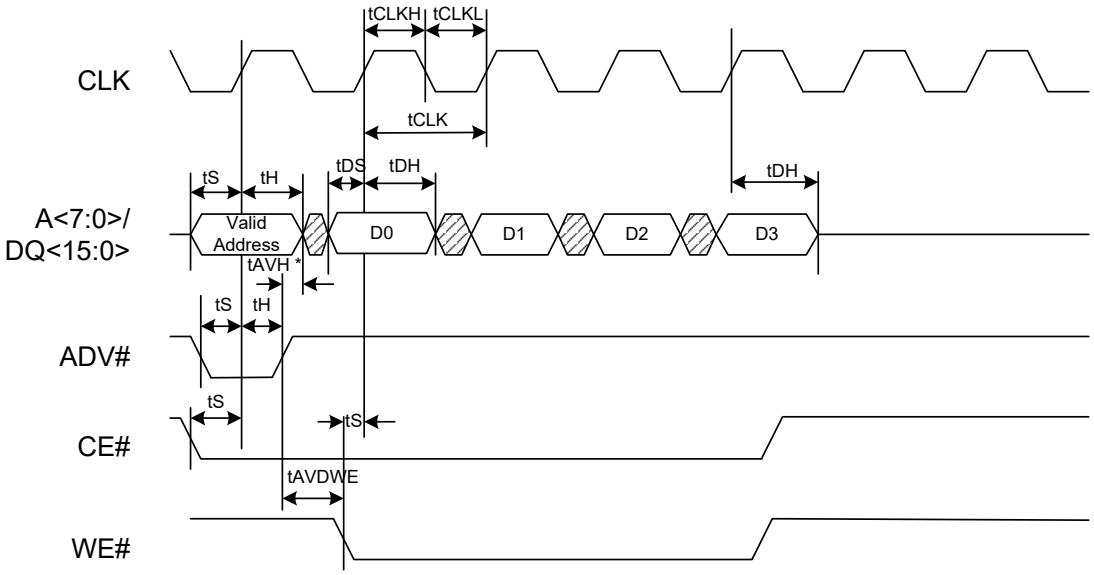
Parameter	Description	Min	Max	Unit
FREQ	Interface clock frequency	–	33	MHz
tAVH	Address hold time (write to the register) for the first time that processor configures the P-Port from ADM asynchronous mode to ADM synchronous mode	2	–	ns
tCLK	Clock period	30	–	ns
tCLKH	Clock High time	12	–	ns
tCLKL	Clock Low time	12	–	ns
tS	CE#/WE#/DQ setup time	7.5	–	ns
tH	CE#/WE#/DQ hold time	1.5	–	ns
tCO	Clock to valid data	–	18	ns
tOH	Clock to data hold time	2	–	ns
tAVDOE	ADV# HIGH to OE# LOW	0	–	ns
tAVDWE	ADV# HIGH to WE# LOW	0	–	ns
tHZ	CE# HIGH to data High Z	–	22.5	ns
tOHZ	OE# HIGH to data High Z	–	22.5	ns
tOLZ	OE# LOW to data Low Z	3	–	ns
tOE	OE# LOW to data Valid	–	22.5	ns

Figure 28. Address Data Multiplexing Synchronous Burst Read Timing Parameters (Burst of 4 with Latency=2, WE#=HIGH)



* tAVH is the ADM address hold time (write to the register) for the first time that Processor configure the P-Port Astoria from ADM Async mode to ADM Sync mode

Figure 29. Address Data Multiplexing Synchronous Burst Write Timing Parameters (Burst of 4 with Latency=2, OE# is Ignored)



* tAVH is the ADM address hold time (write to the register) for the first time that Processor configure the P-Port Astoria from ADM Async mode to ADM Sync mode

Non Multiplexing Asynchronous SRAM Mode

Table 19. Asynchronous SRAM Mode Timing Parameters

Parameter	Description	Min	Max	Unit
	Interface bandwidth (MBPS)	–	66.7	MBPS
Read Timing Parameters				
tRC	Read cycle time	30	–	ns
tAA	Address to data valid	–	30	ns
tOH	Data output hold from address change	3	–	ns
tEA	Chip enable to data valid	–	30	ns
tOE	OE# LOW to data valid	–	22.5	ns
tOLZ	OE# LOW to Low Z	3	–	ns
tOHZ	OE# HIGH to High Z	0	22.5	ns
tLZ	CE# LOW to Low Z	3	–	ns
tHZ	CE# HIGH to High Z	–	22.5	ns
Write Timing Parameters				
tWC	Write cycle time	30	–	ns
tCW	CE# LOW to write end	30	–	ns
tAW	Address valid to WE# end	30	–	ns
tAS	Address setup to WE# or CE# start	0	–	ns
tAH	Address hold time from WE# or CE# end for PCRAM to SRAM changes (Astoria is default in the PCRAM mode after RESET. This timing is the requirement for the first time to access the P-Port Interface Configuration Register to change the Astoria to PSRAM mode)	2	–	ns
	Address hold time from WE# or CE# end for PSRAM mode	0	–	
tWP	WE# pulse width	22	–	ns
tWPH	WE# HIGH time	10	–	ns
tCPH	CE# HIGH time	10	–	ns
tDS	Data setup to write end	18	–	ns
tDH	Data hold from write end	0	–	ns
tWHZ	Write to DQ High Z output	–	22.5	ns
tOW	End of write to Low Z output	3	–	ns
tDPW	DRQ# pulse width	110	–	ns

Figure 30. Non Multiplexing Asynchronous SRAM Read Timing Parameters

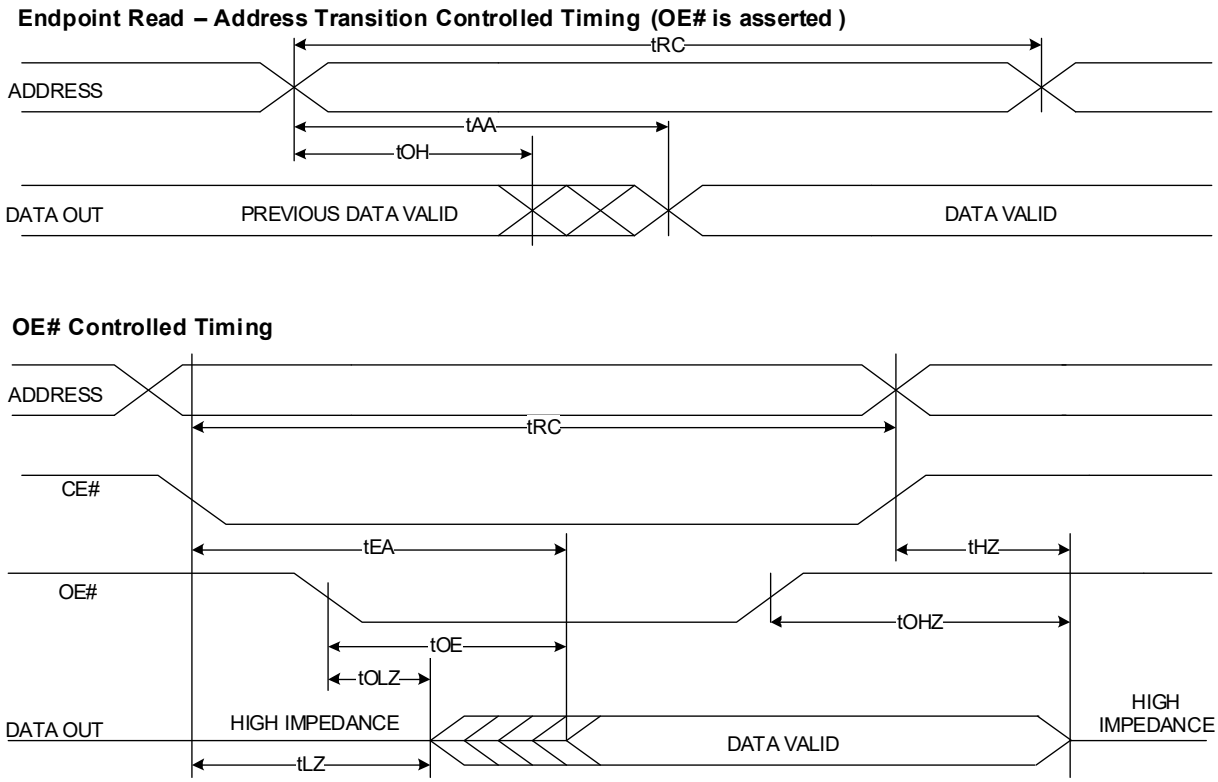
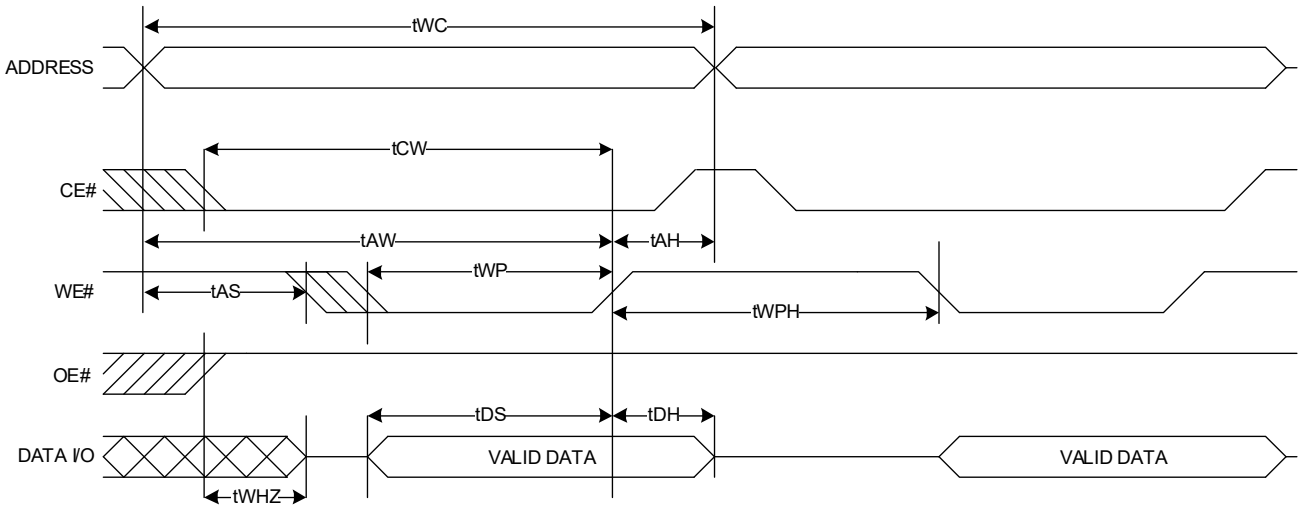


Figure 31. Non Multiplexing Asynchronous SRAM Write Timing (WE# and CE# Controlled)

Write Cycle 1 WE# Controlled, OE# High During Write



Write Cycle 2 CE# Controlled, OE# High During Write

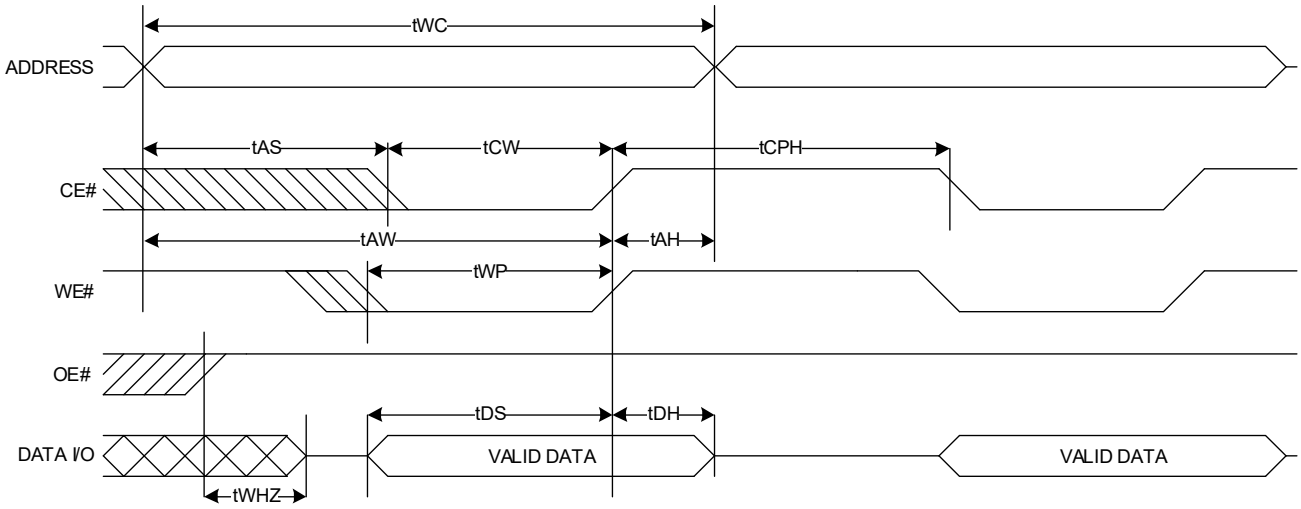
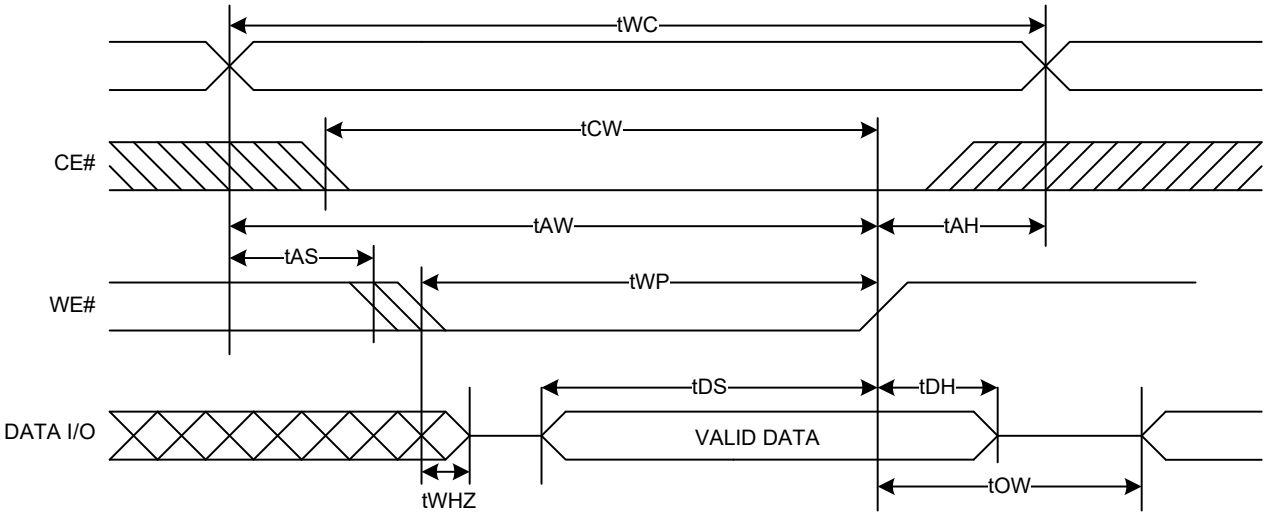


Figure 32. Non Multiplexing Asynchronous SRAM Write Timing (WE# Controlled, OE# LOW)

Write Cycle 3 WE# Controlled. OE# Low



Pseudo NAND (PNAND) Mode

Table 20. PNAND Mode Parameters

Parameter	Description		Min	Max	Unit
tADL	Address to data loading time	Non LNA Mode Register Write	100	–	ns
		Non LNA Mode EP Write	100	–	ns
		LNA Mode	450	–	ns
tALH	ALE hold time		5	–	ns
tALS	ALE setup time		15	–	ns
tAR	ALE to RE# delay		10	–	ns
tBERS	Block erase time		MCU/S-Port NAND dependent		
tCEA	CE# access time		–	35	ns
tCH	CE# hold time		5	–	ns
tCHZ	CE# HIGH to O/P HI-Z		–	40	ns
tCLH	CLE hold time		5	–	ns
tCLR	CLE to RE# time		10	–	ns
tCLS	CLE setup time		15	–	ns
tCS	CE# setup time		20	–	ns
tDH	Data hold time		5	–	ns
tDS	Data setup time		15	–	ns
tOH	Data output hold time		15	–	ns
tPROG	Program time for LNA mode		Depends on MCU/S-Port/NAND		ns
	Program time for register write in non LNA mode		130	–	ns
	Program time for EP write in non LNA mode		130	–	ns
tR	Busy duration during Non LNA register read using page read		130	–	ns
	Busy duration during non LNA EP read using page read		130	–	ns
	Busy duration during LNA page read (SBD/SLD)		Depends on MCU/S-Port/NAND		ns
tRC	Read cycle time (VFBGA Package)		30	–	ns
	Read cycle time (WLCSP package)		33	–	
tREA	RE# for register access time		–	30	ns
	RE# for EP access time		–	30	ns
tREH	RE# HIGH hold time		10	–	ns
tRHW	RE# HIGH to WE LOW		40	–	ns
tRHZ	RE# HIGH to output High Z		–	40	ns
tRP	RE# pulse width		15	–	ns
tRR	Ready to RE LOW		20	–	ns
tRST	Device reset time		Depends on MCU/S-Port/NAND		ns
tWB	WE# HIGH to busy		–	100	ns
tWC	Write cycle time (VFBGA package)		30	–	ns
	Write Cycle Time (WLCSP package)		33	–	

Table 20. PNAND Mode Parameters (continued)

Parameter	Description	Min	Max	Unit
tWH	WE# HIGH hold time	10	–	ns
tWHR	WE# HIGH to RE LOW in non LNA mode	30	–	ns
	WE# HIGH to RE LOW in LNA mode	450	–	ns
tWP	WE# pulse width	15	–	ns

Figure 33. PNAND Mode Command Latch Cycle

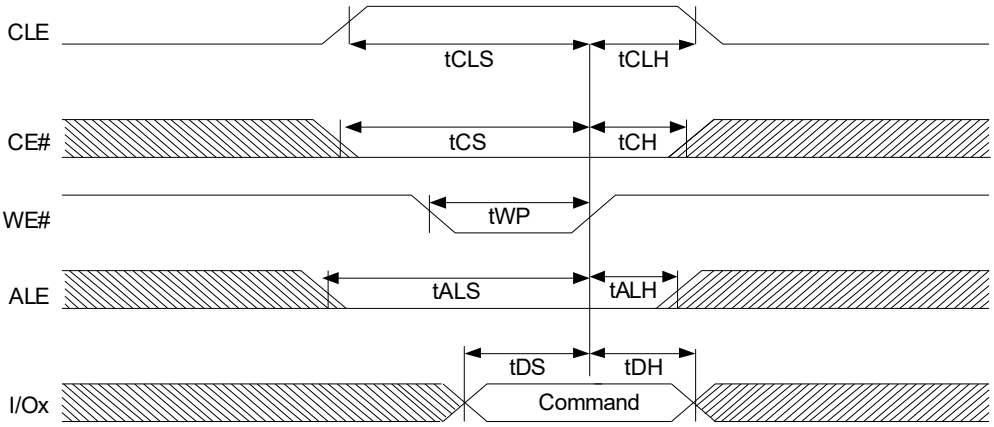


Figure 34. PNAND Mode Address Latch Cycle

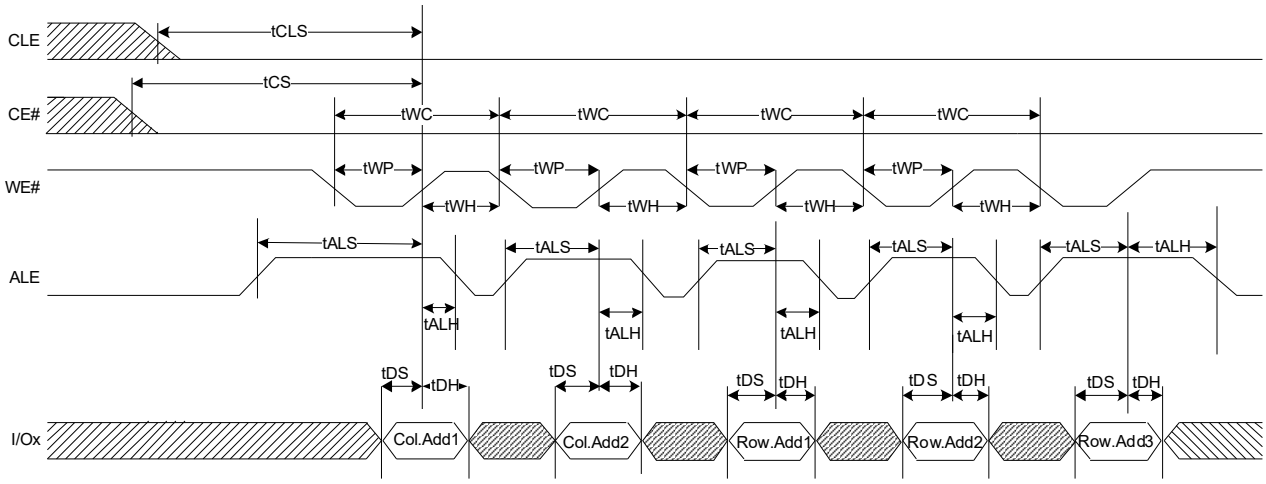


Figure 35. PNAND Mode Input Data Latch Cycle

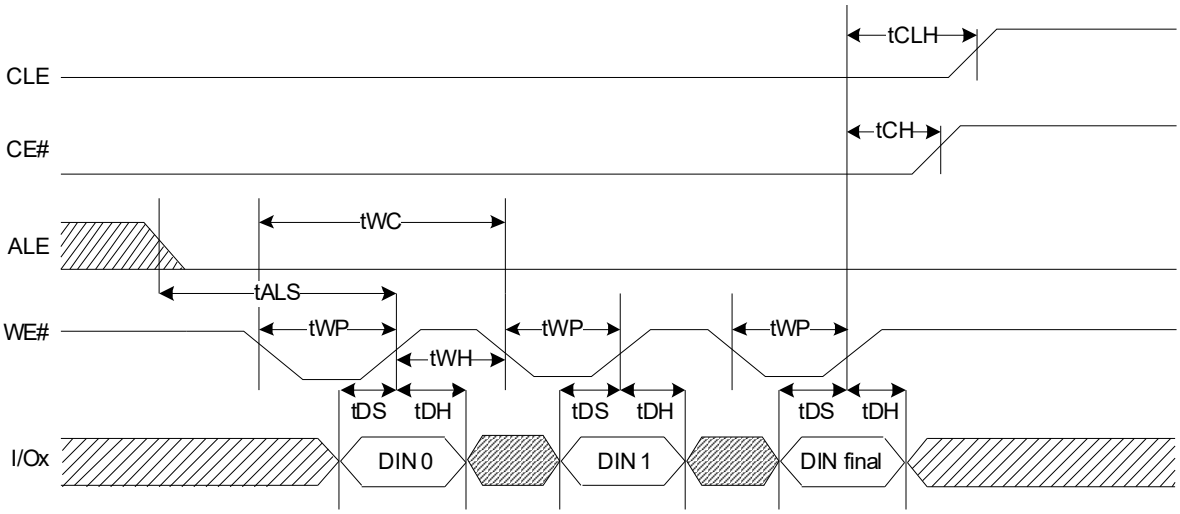


Figure 36. PNAND Mode Serial Access Cycle After Read

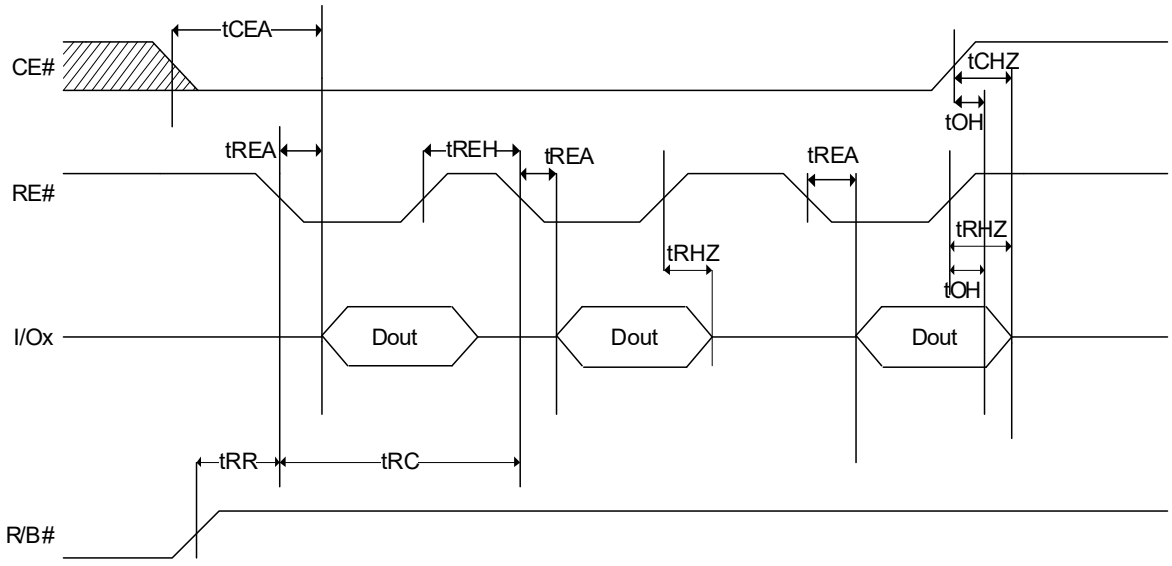


Figure 37. PNAND Mode Status Read Cycle

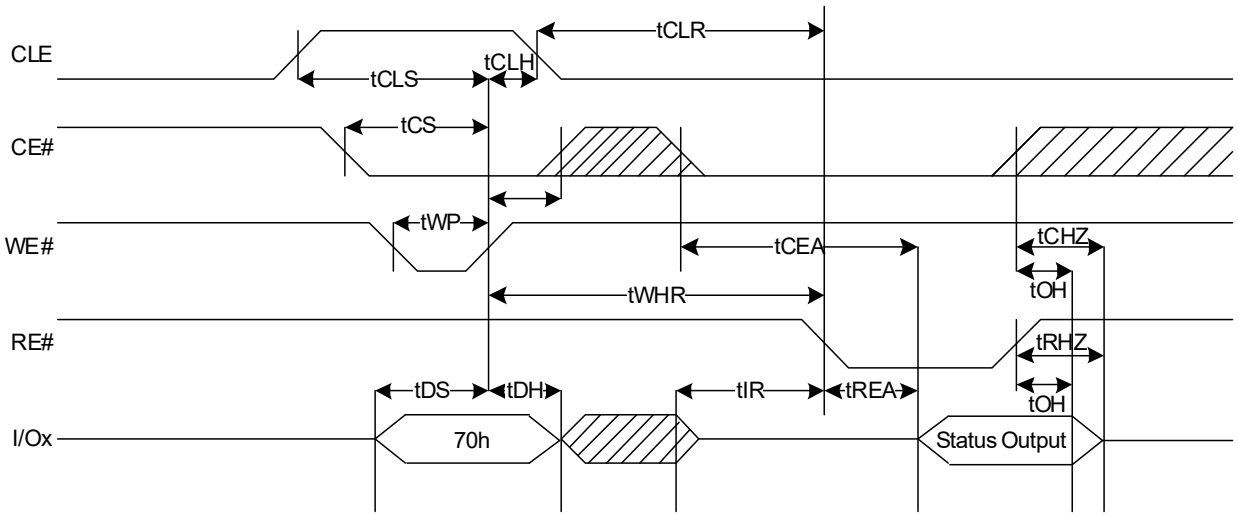


Figure 38. PNAND LBD Read Operation

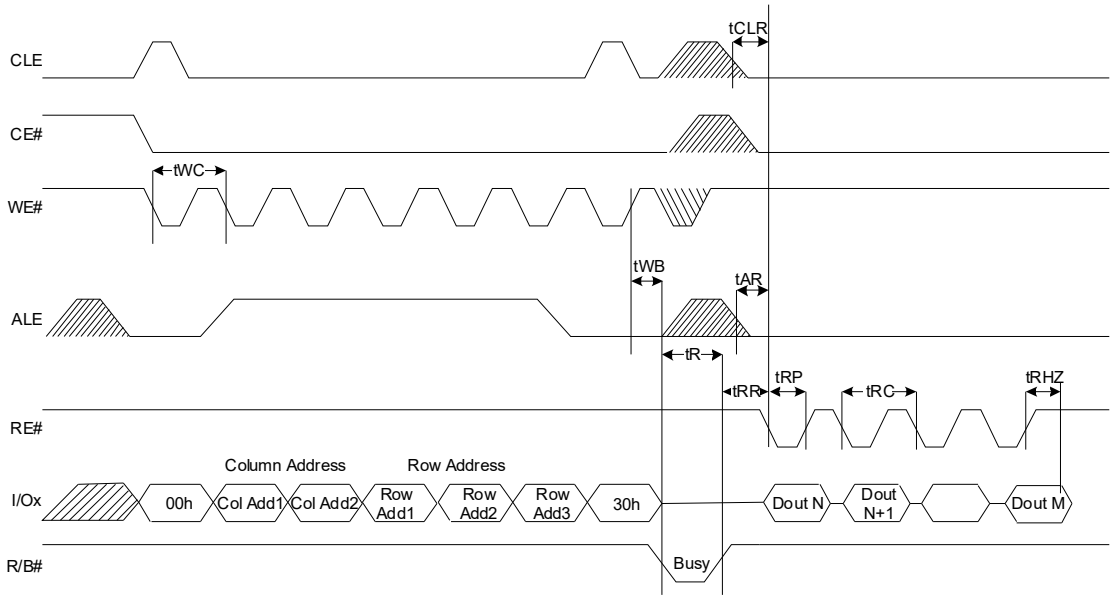


Table 21. Page-Read Command Sequence for Large-Block Devices

Cycle type	IO bus	Comments
CMD0	00h	Page-read command - 1st cycle
CA0	EP_Offset[7:0]/ REG_Addr[7:0]	REG_Sel field determines how the two column address cycles are interpreted EP_Offset[11:10] = REG_Sel = 2`b11 ‡ Register EP_Offset[11:10] = REG_Sel = 2`b0x, 2`b10 ‡EP buffer offset EP_Offset[11:0] = EP buffer offset
CA1	{4'b0000, EP_Offset[11:8]}	
RA0	Row address byte 0	First row-address cycle RA0[4:0] = default EPA – Endpoint address
RA1	Row address byte 1	The number row-address bytes present in Page-read command depend on RA_COUNT configuration parameter setting. LNA row addresses are interpreted by firmware;
RA2	Row address byte 2	
RA3	Row address byte 3	
CMD1	30h	Page-read command - 2nd cycle
Data[0-2111]	Data	Data is returned by Astoria delay tR beyond the second command.

Figure 39. Large Block Device mode address cycles

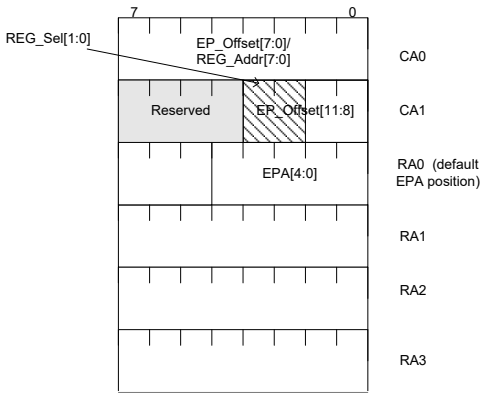
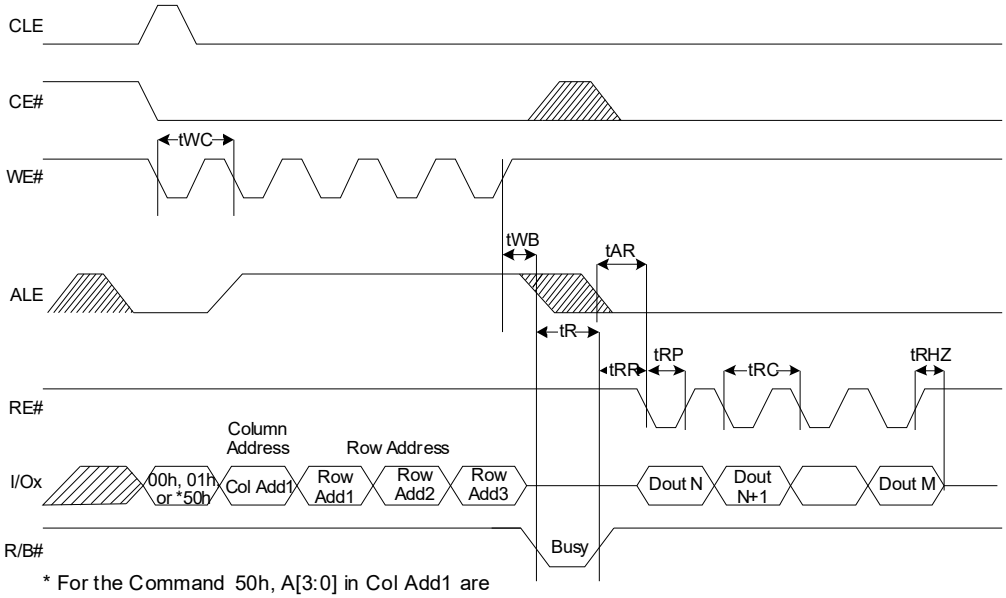


Figure 40. PNAND SBD Read Operation



* For the Command 50h, A[3:0] in Col Add1 are valid address and A [7:4] are Don't care

Table 22. Page-Read Command Sequence for Small-Block Devices

Cycle type	IO bus	Comments
CMD0	00h/01h/50h	Sets base-address within page as 0, 256, or 512, for read operation.
CA0	EP_Offset[7:0]/ REG_Addr[7:0]	EP_Offset[7:0] = EP buffer offset for non-register accesses. REG_Addr[7:0] specifies register address when EPA[4:0] field = 5`b10000.
RA0	Row address byte 0	First row-address cycle RA0[4:0] = default EPA – Endpoint address EPA may be specified in any other row-address byte.
RA1	Row address byte 1	The number row-address bytes present in Page-read command depend on RA_COUNT configuration parameter setting. LNA row addresses are interpreted by firmware;
RA2	Row address byte 2	
RA3	Row address byte 3	
Data[0–527]	Data	Data is returned by Astoria delay tR beyond the second command.

Figure 41. Small Block Device Mode Address Cycles

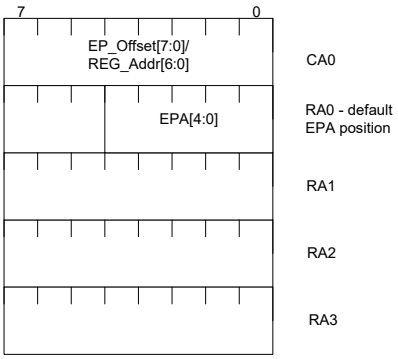


Figure 42. PNAND Mode LBD Random Data Operation (CASDO)

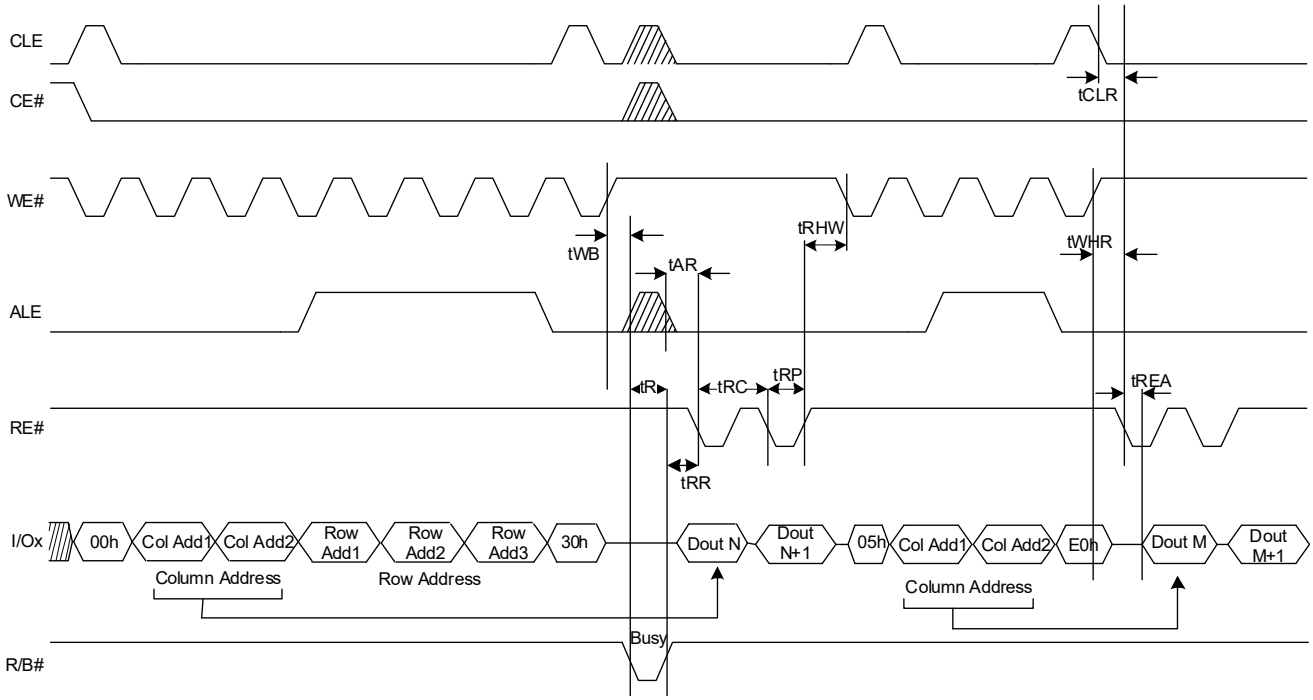
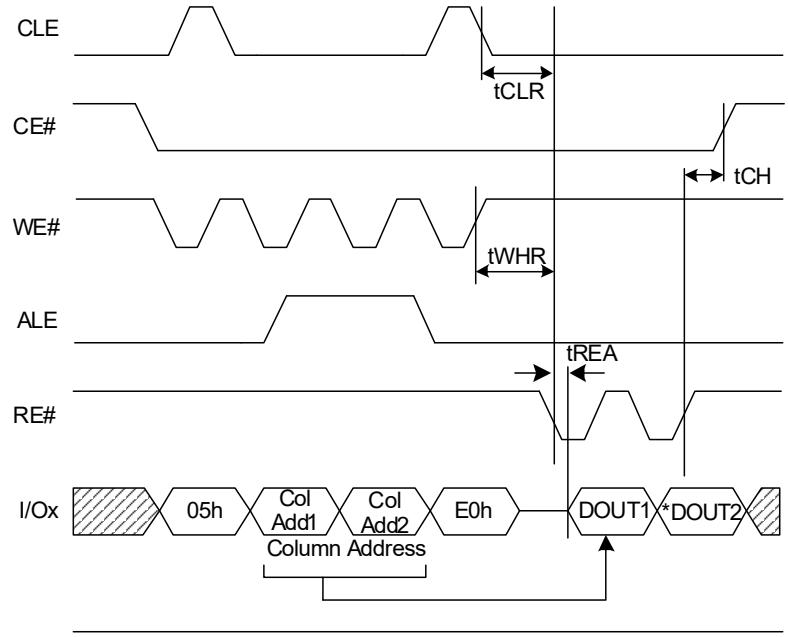


Figure 43. PNAND Mode Register Read Using CASDO in 8-Bit Mode



* This timing diagram shows the 8-bit register read. For 16-bit register read, DOUT2 is not available

Figure 44. PNAND Mode LBD Read Operation (With CE# Don't Care)

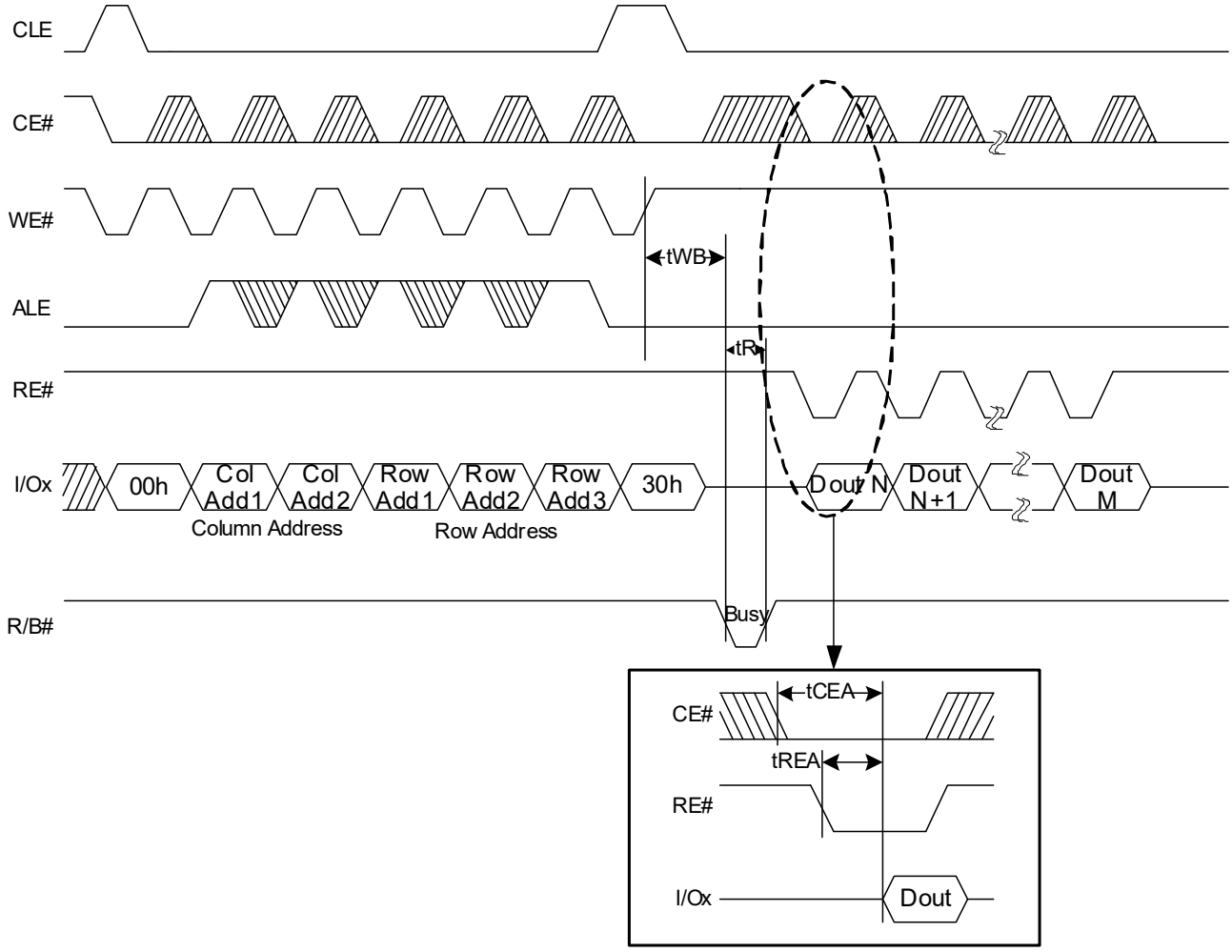


Figure 45. PNAND Mode SBD Read Operation (With CE# Don't Care)

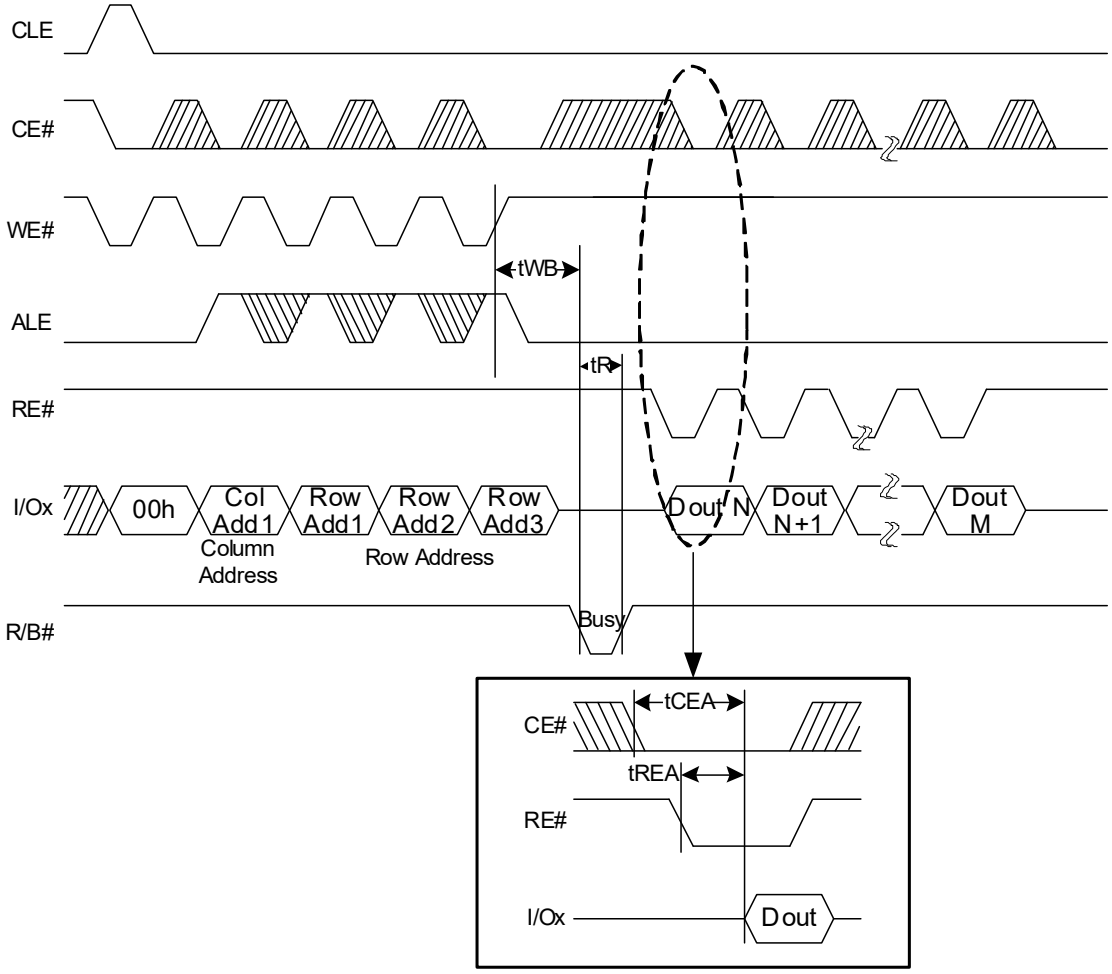
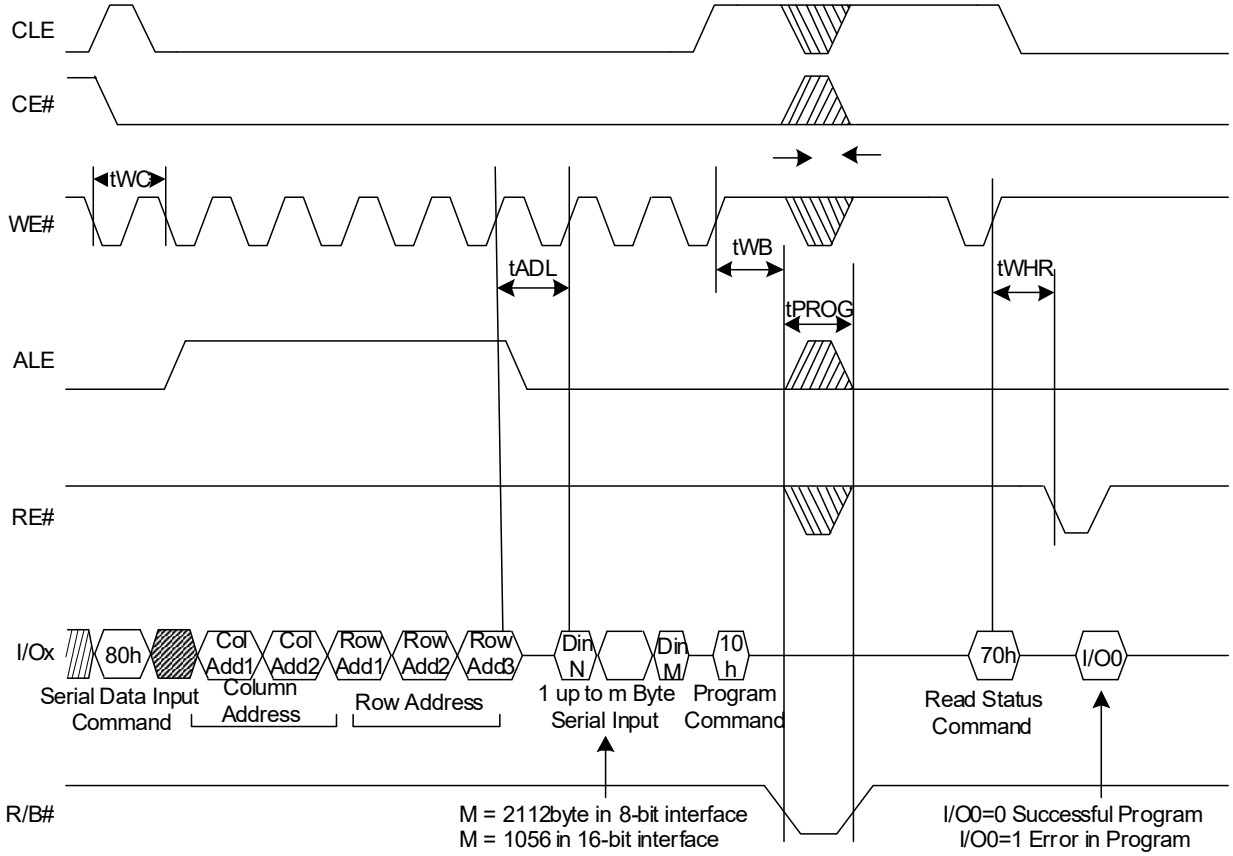


Figure 46. PNAND Mode LBD Page Program Operation



Note: tADL is the time from WE rising edge of final address cycle to the WE rising edge of first data cycle

Figure 47. PNAND Mode SBD Page Program Operation

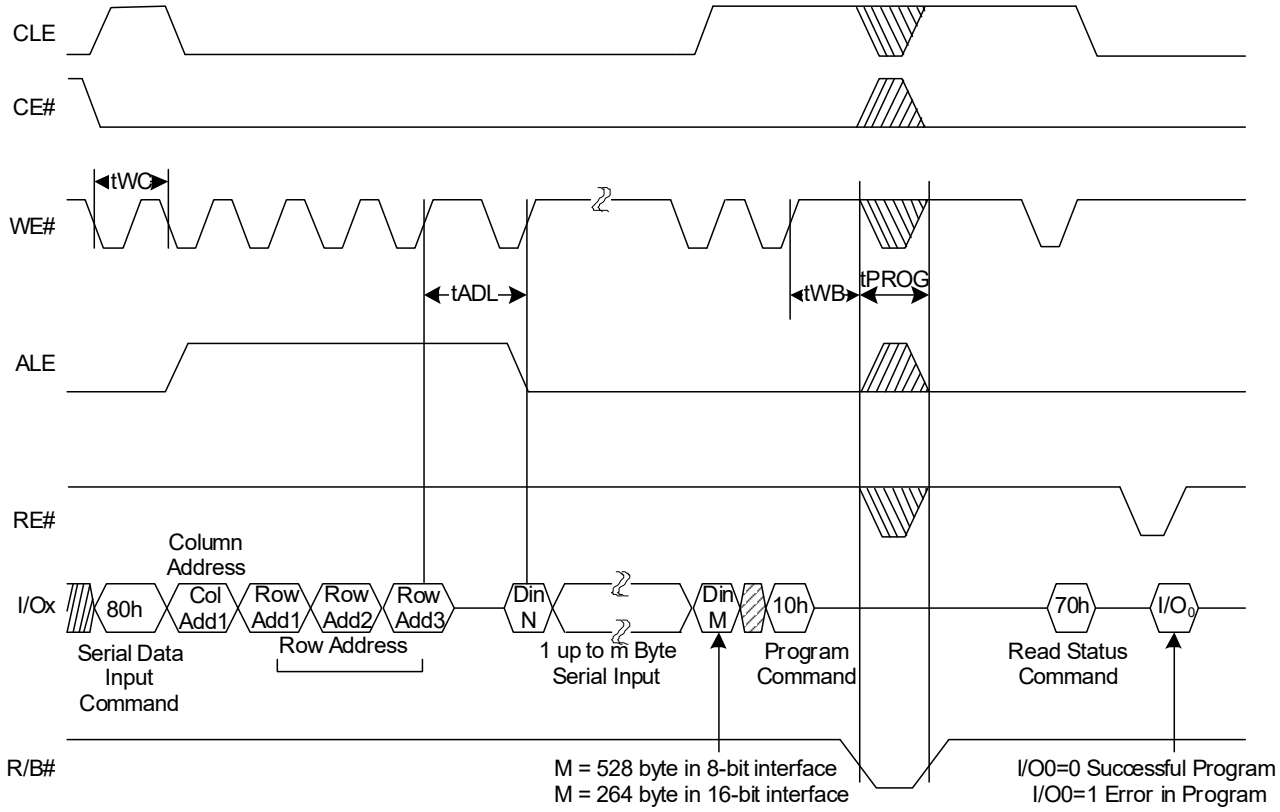
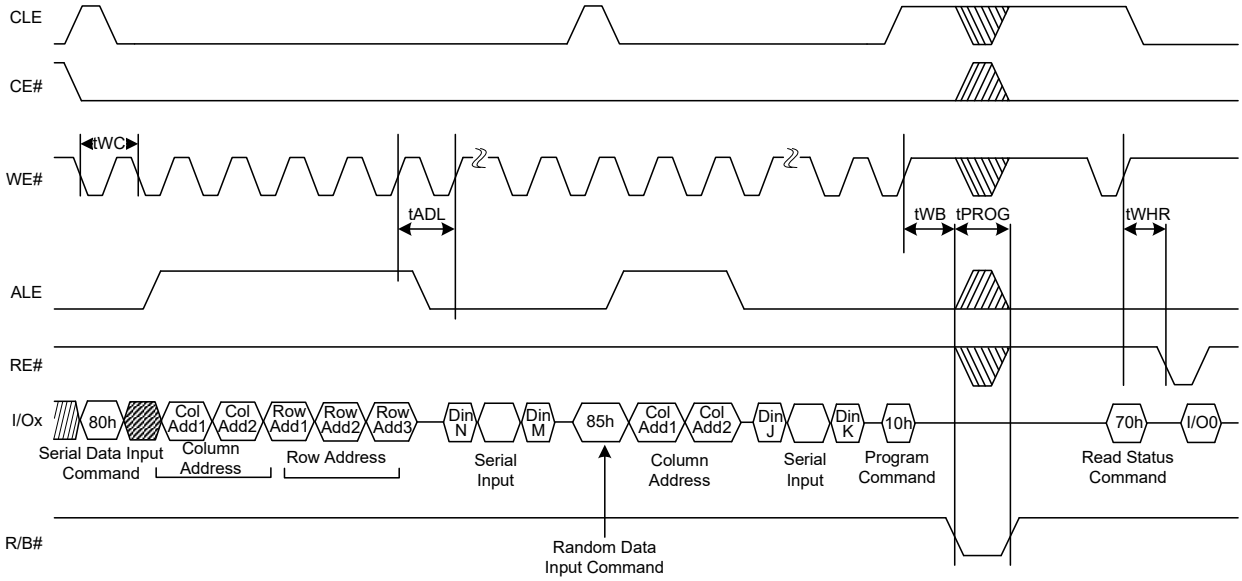
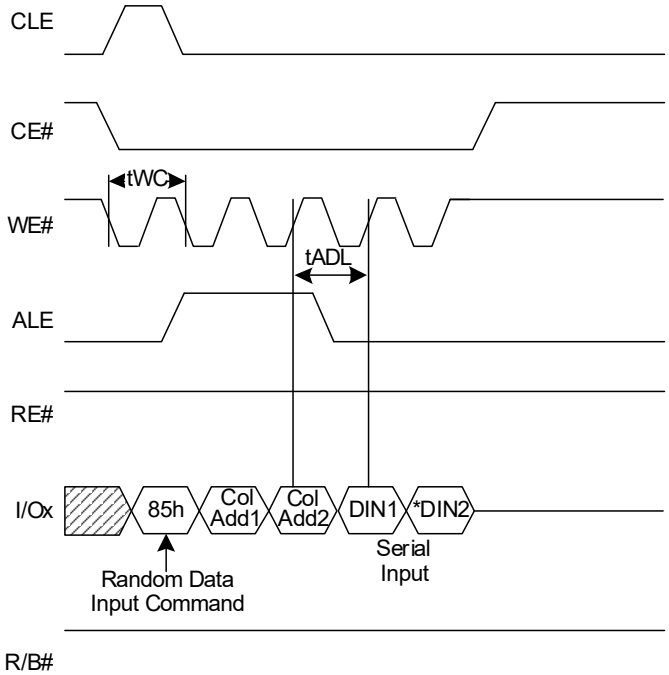


Figure 48. PNAND Mode LBD Page Program Operation with Random Data Input (CASDI)



*Random Programming (CASDI) to endpoint is only supported during logical NAND emulation (LNA mode) of LBD device. Partial page programming is not supported

Figure 49. PNAND Mode Register Write Using CASDI in 8-Bit Mode



* This timing diagram shows the 8-bit register write. For 16-bit register write, DIN2 should not be available

Figure 50. PNAND Mode LBD Page Program Operation (With CE# Don't Care)

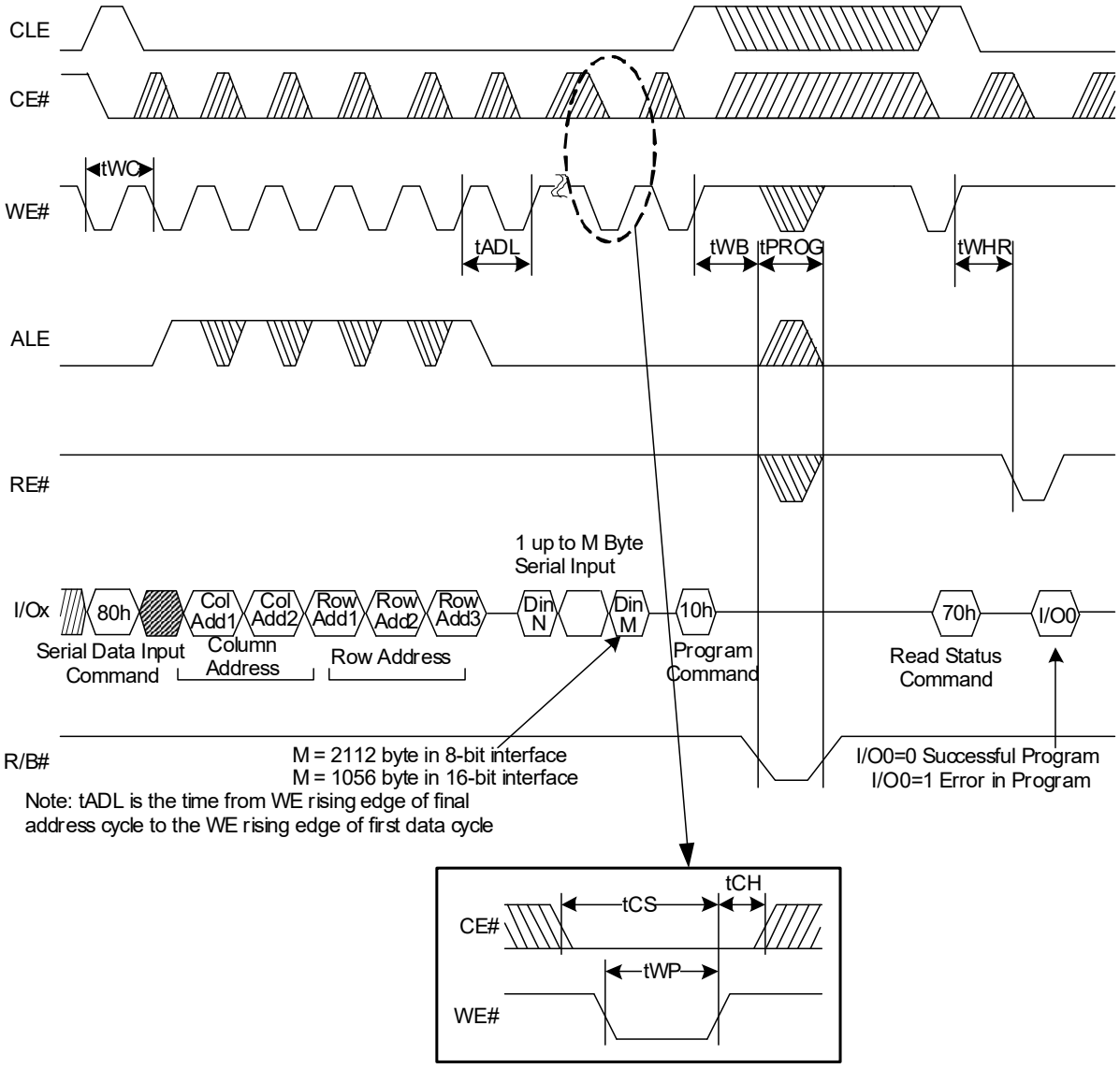


Figure 51. PNAND Mode SBD Page Program Operation (With CE# Don't Care)

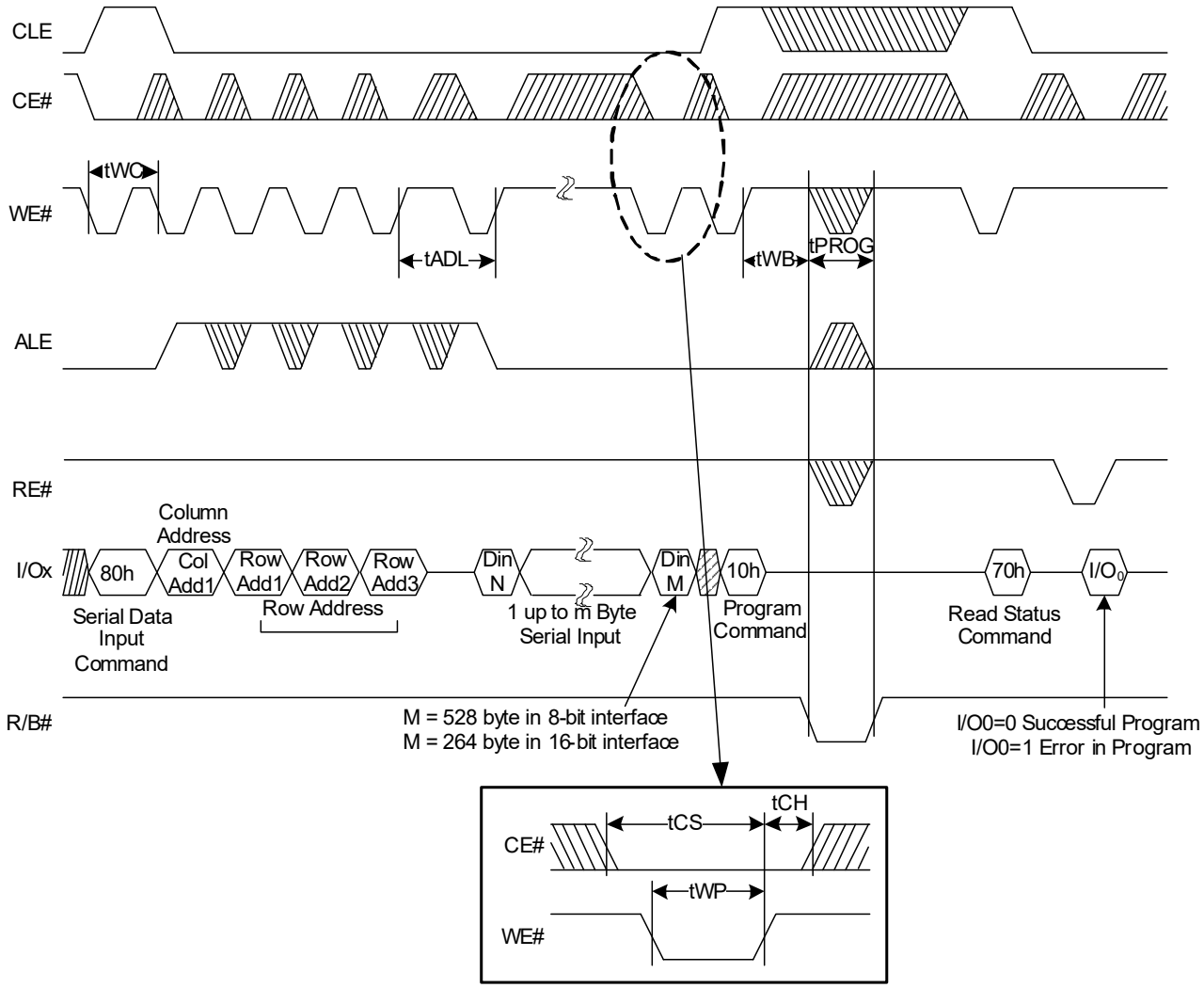


Figure 52. PNAND Mode Block Erase Operation

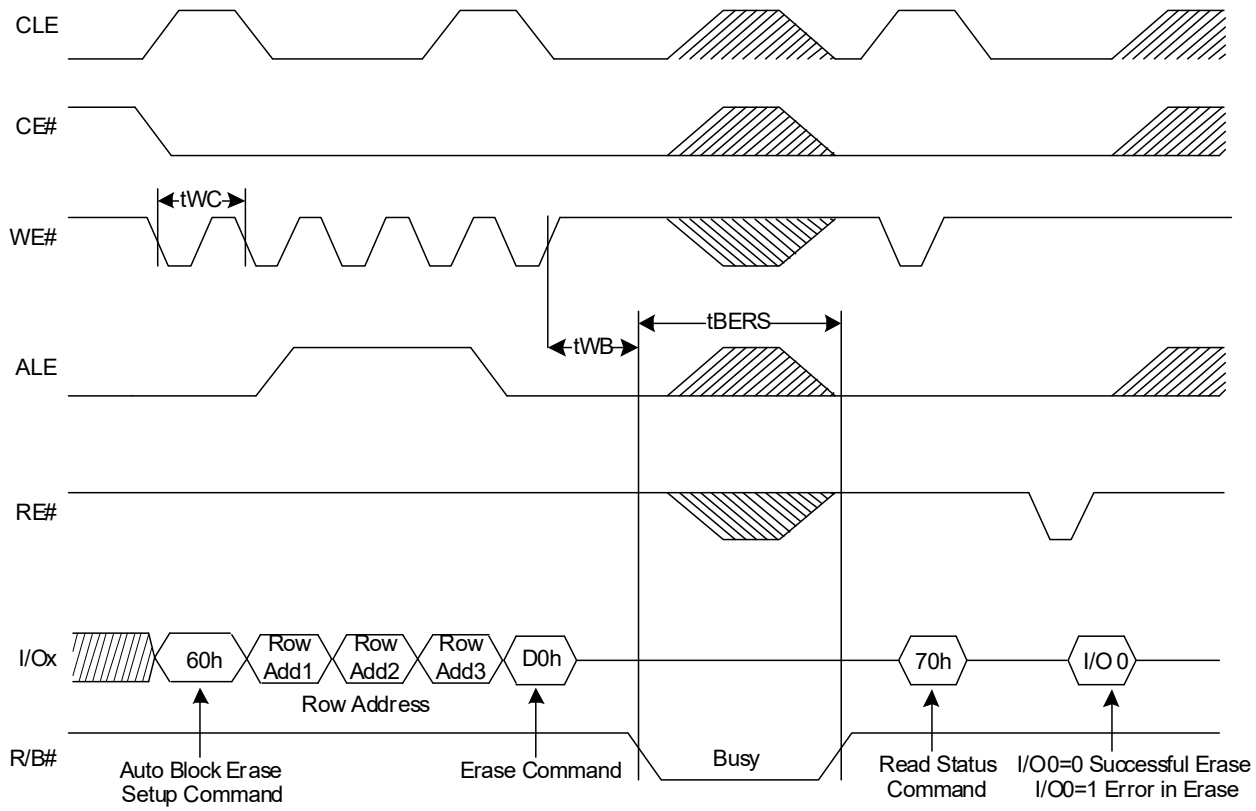
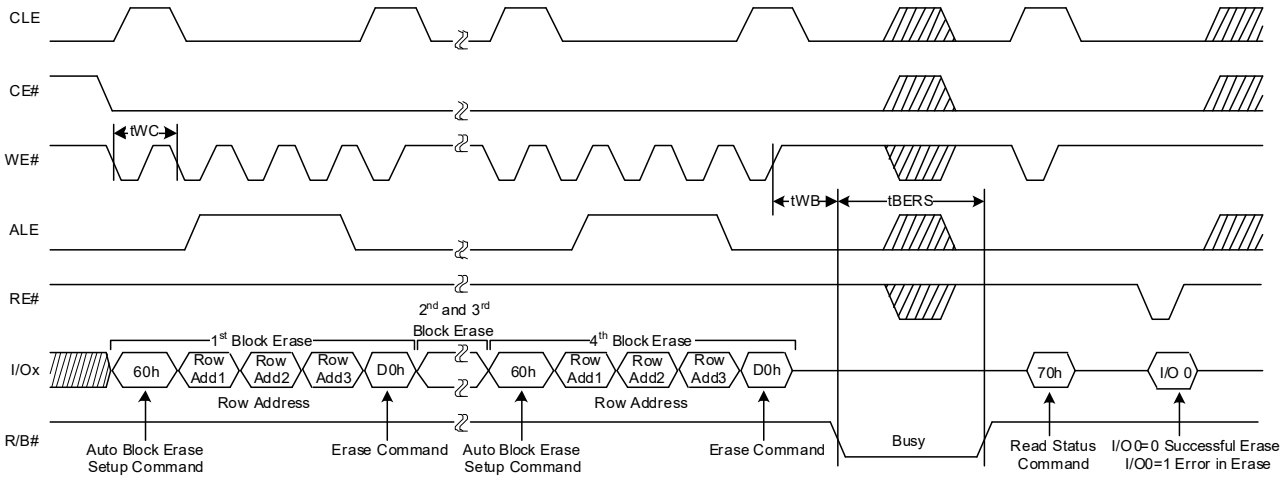
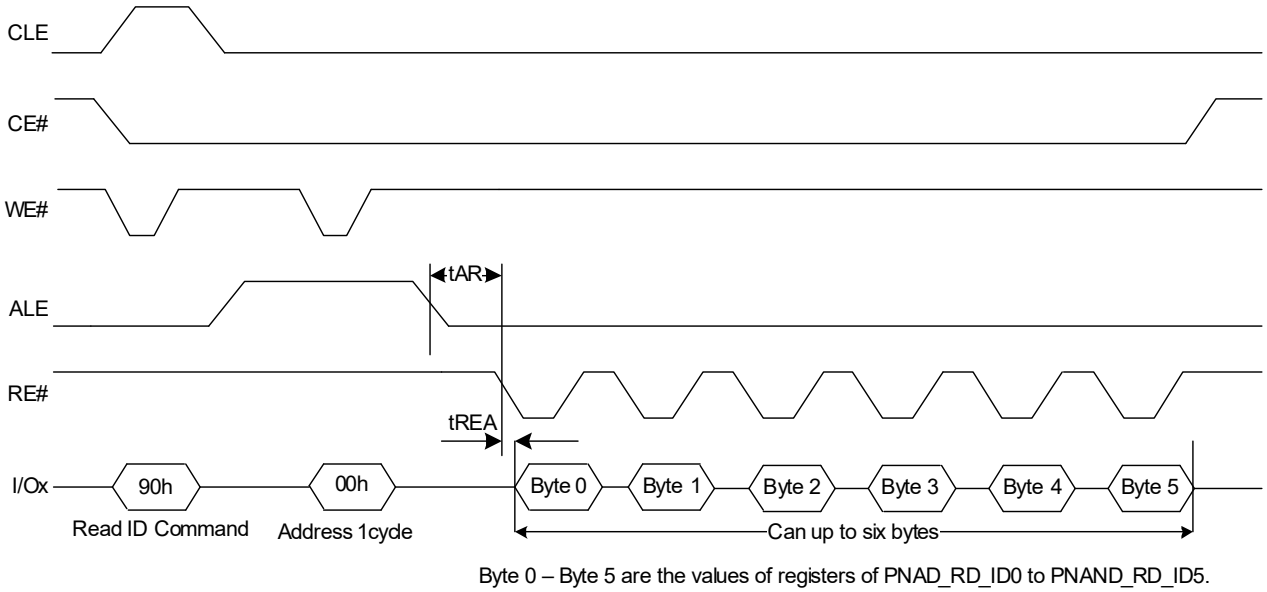


Figure 53. PNAND Mode Multi-Blocks (up to 4) Erase



Note: The multi-block erase can support up to 4 blocks erase

Figure 54. PNAND Mode Read ID Operation



Byte 0 – Byte 5 are the values of registers of PNAD_RD_ID0 to PNAND_RD_ID5.

Figure 55. PNAND Mode Read ID2 Operation

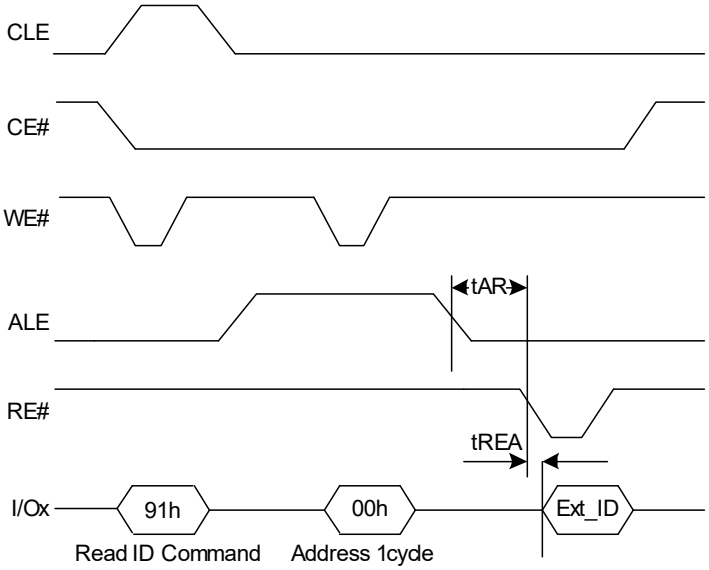
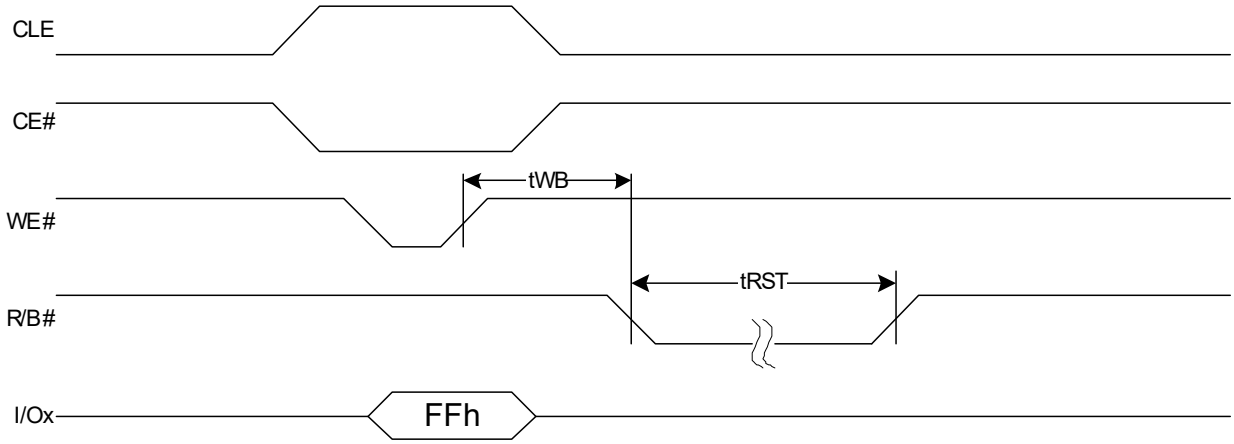


Figure 56. PNAND Mode Reset Operation

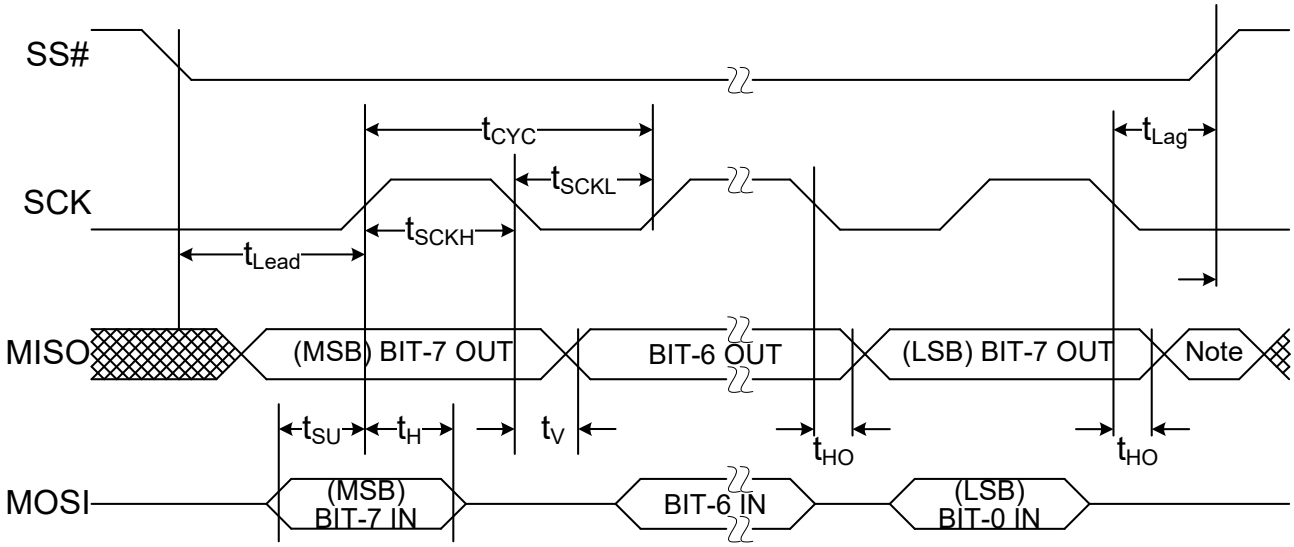


SPI and PI2C Interface

Table 23. SPI Mode Parameters

Parameter	Description	Min	Max	Units
f_{OP}	Operating frequency	0	26	MHz
t_{CYC}	Cycle time	38.5	–	ns
t_{Lead}	Enable lead time	19.23	–	ns
t_{Lag}	Enable lag time	19.23	–	ns
t_{SCKH}	Clock high time	17.33	–	ns
t_{SCKL}	Clock low time	17.33		ns
t_{SU}	Data setup time (inputs)	–	7	ns
t_{H}	Data hold time (inputs)	–	7	ns
t_{V}	Data valid time, after enable edge	–	18	ns
t_{HO}	Data hold time, after enable edge	0	–	ns

Figure 57. SPI Timing Diagram



Note: Not defined but normal MSB of character just received

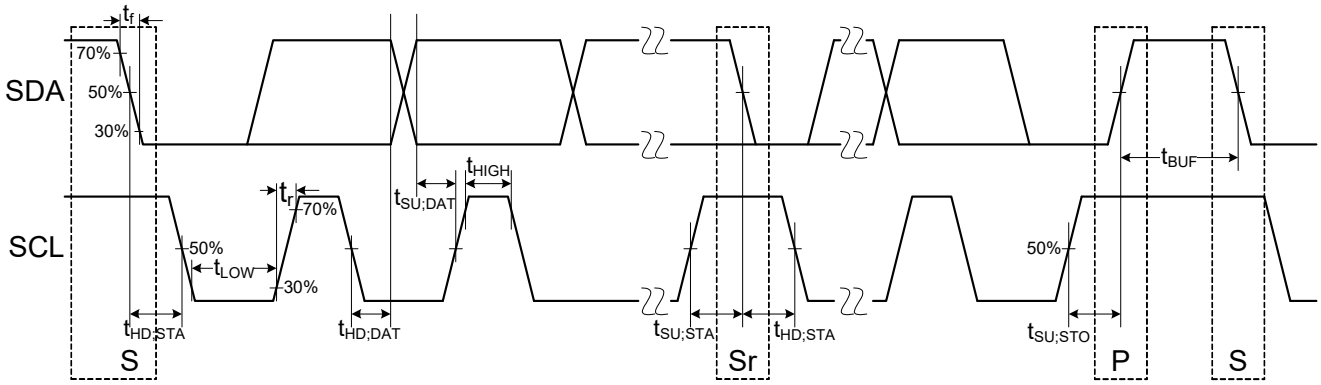
Table 24. PI2C Interface Standard Mode Parameters

Parameter	Description	Min	Max	Units
F	Operating frequency	0	82	kHz
tBUF	Bus free time (between stop and start conditions)	4.7	–	µs
tHD:STA	Hold time after (Repeated) start condition. After this period the first clock is generated	4.0	–	µs
tSU:STA	Repeated start condition setup time	4.7	–	µs
tSU:STO	Stop condition setup time	4.0	–	µs
tHD:DAT	Data hold time	0	–	ns
tSU:DAT	Data setup time	250	–	ns
tTIMEOUT	Detect clock low timeout	NA		ms
tLOW	Clock low period	4.7	–	µs
tHIGH	Clock high period	4.0	–	µs
tLOW:SEXT	Cumulative clock low extend time (slave device)	NA		ms
t_r	Rise time	–	1000	ns
t_f	Fall time	–	300	ns

Table 25. PI2C Interface Fast Mode Parameters

Parameter	Description	Min	Max	Units
F	Operating frequency	0	312	kHz
tBUF	Bus free time (between stop and start condition)	1.3	–	µs
tHD:STA	Hold time after (Repeated) start condition. After this period the first clock is generated	0.6	–	µs
tSU:STA	Repeated start condition setup time	0.6	–	µs
tSU:STO	Stop condition setup time	0.6	–	µs
tHD:DAT	Data hold time	0	0.9	ns
tSU:DAT	Data setup time	100	–	ns
tTIMEOUT	Detect clock low timeout	NA		ms
tLOW	Clock low period	1.3	–	µs
tHIGH	Clock high period	0.6	–	µs
tLOW:SEXT	Cumulative clock low extend time (slave device)	NA		ms
t_r	Rise time	–	300	ns
t_f	Fall time	–	300	ns

Figure 58. PI2C Timing Diagram



Other P-Port Timings

DRQ# Min Pulse Width (tDPW): The minimum duration that DRQ# is deasserted following a DRQ acknowledgement (clear of DMAVAL) is 110 ns in Async mode or five P-Port clock (CLK) cycles in Sync mode.

Same Register Write-to-Read Holdoff (tWRHO): A read of a particular register must wait for a holdoff period following a write operation to that same register address to ensure that valid updated data is read. In Async mode, this holdoff time is 150 ns. In Sync mode, this holdoff time is seven P-Port clock (CLK) cycles.

Register Update-to-Read Holdoff (tURHO): Same status registers are updated as side effect from accesses to other registers. For example, clearing the DMAVAL field automatically clears the associated endpoint buffer bit within the DRQ status register. A holdoff time must elapse from the first register access before the update is reflected in a subsequent read operation. This holdoff time is identical to the tWRHO.

S Port Interface AC Timing Parameters

SD/MMC/MMC+/CE-ATA Timing Parameters

For all conditions, SD/MMC data is driven and sampled on the rising edge of SD_CLK. Note that CE-ATA electrical and timing parameters are equivalent to MMC.

Figure 59. SD/MMC/CE-ATA Timing Waveform – All Modes

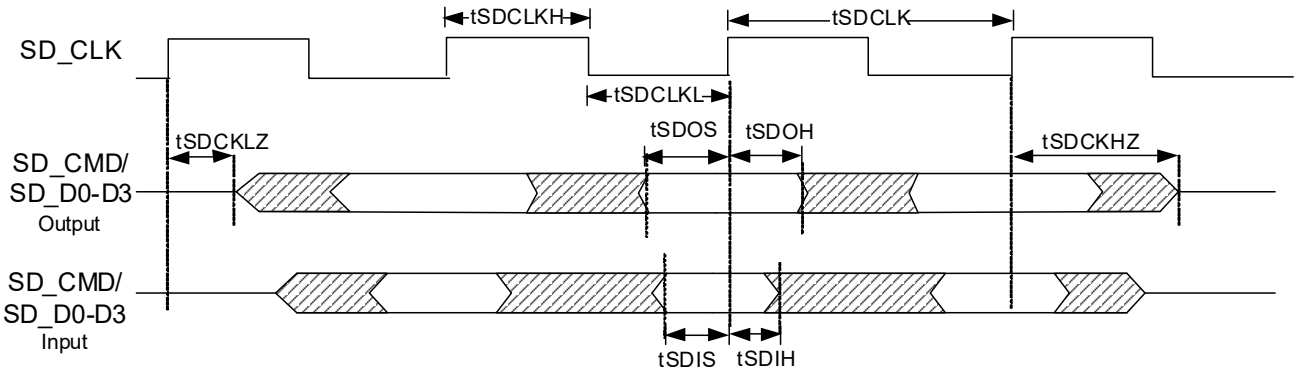


Table 26. Common Timing Parameters for SD/MMC/CE-ATA – During Identification Mode

Parameter	Description	Min	Max	Units
SDFREQ	SD_CLK interface clock frequency	0	400	kHz
tSDCLK	Clock period	2.5	–	µs
tSDCLKH	Clock high time	1.0	–	µs
tSDCLKL	Clock low time	1.0	–	µs

Table 27. Common Timing Parameters for SD/MMC/CE-ATA – During Data Transfer Mode

Parameter	Description	Min	Max	Units
SDFREQ	SD_CLK interface clock frequency	5	48	MHz
tSDCLK	Clock period	20.8	200	ns
tSDCLKOD	Clock duty cycle	40	60	%
tSCLKR	Clock rise time	–	3	ns
tSCLKF	Clock fall time	–	3	ns

Table 28. Timing Parameters for SD – All Modes

Parameter	Description	Min	Max	Units
tSDIS	Input setup time	4	–	ns
tSDIH	Input hold time	2.5	–	ns
tSDOS	Output setup time	7	–	ns
tSDOH	Output hold time	6	–	ns
tSDCKHZ	Clock to data High Z	–	18	ns
tSDCKLZ	Clock to data Low Z	3	–	ns

Table 29. Timing Parameters for MMC/CE-ATA – All Modes

Parameter	Description	Min	Max	Units
tSDIS	Input setup time	4	–	ns
tSDIH	Input hold time	4	–	ns
tSDOS	Output setup time	6	–	ns
tSDOH	Output hold time	6	–	ns
tSDCKHZ	Clock to data High Z	–	18	ns
tSDCKLZ	Clock to data Low Z	3	–	ns

Reset and Standby Timing Parameters

The Astoria reset mechanism and the standby mode are described in this section.

Sleep Time (tSLP): The maximum time from deassertion of WAKEUP to when Astoria enters low power state (sleep mode) is 1 ms.

Wakeup Time (tWU): The minimum time from assertion of WAKEUP pin (or initial power on with WAKEUP HIGH) to when any register operation is conducted is 1 ms if an external clock is present, or 5 ms if a crystal is used. The CY_AN_MEM_PWR_MAGT_STAT.WAKEUP field can only be polled after wakeup time following reset deassertion or WAKEUP assertion.

Minimum RESET# pulse width (tRPW): 5 ms when a crystal is used as clock or 1 ms when an external clock is used.

Minimum WAKEUP pulse width (tWPW): 5 ms.

Minimum HIGH on RESET# and WAKEUP (tRH, TWH): The WAKEUP and RESET# pins must be held HIGH for a minimum of 5 ms.

Reset Recovery Time (tRR): A minimum 1 ms reset recovery time must be allowed before Astoria registers can be accessed for read or write.

Figure 60. Reset and Standby Timing Diagram

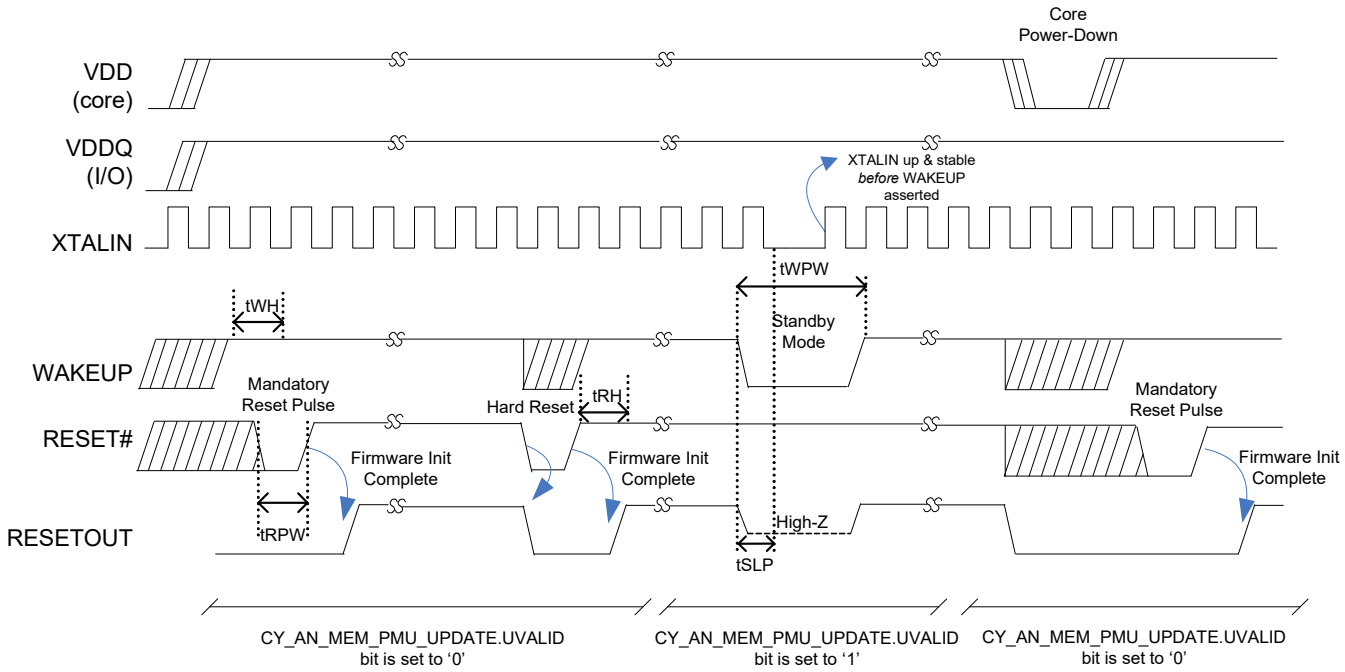
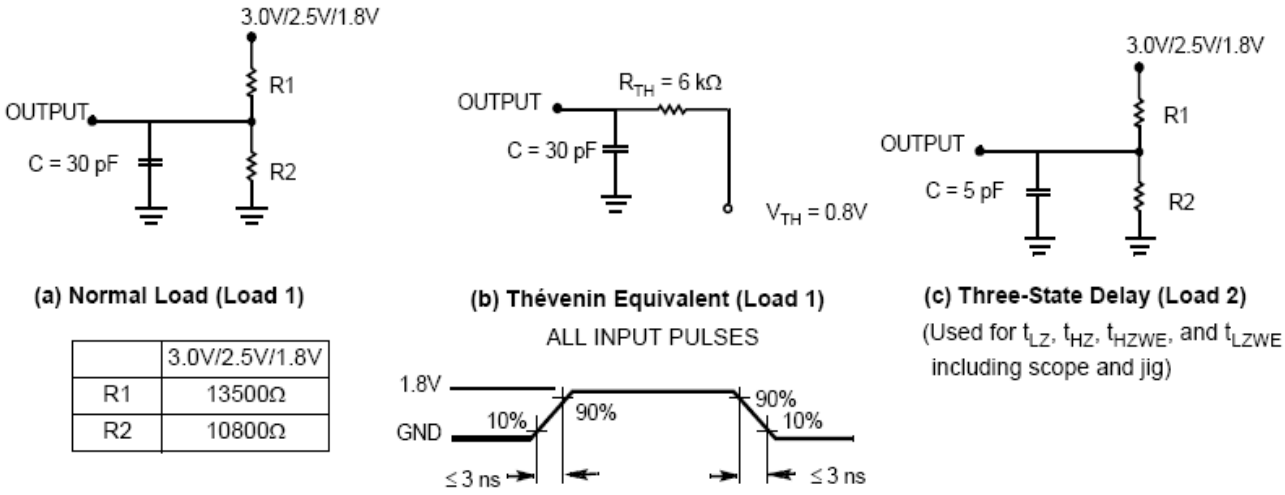


Table 30. Reset and Standby Timing Parameters

Parameter	Description	Conditions	Min	Max	Units
tSLP	Sleep time		–	1	ms
tWU	Wakeup time from standby mode	Clock on XTALIN	1	–	ms
		Crystal on XTALIN-XTALOUT	5	–	ms
tWH	WAKEUP high time		5	–	ms
tWPW	WAKEUP pulse width		5	–	ms
tRH	RESET# high time		5	–	ms
tRPW	RESET# pulse width	Clock on XTALIN	1	–	ms
		Crystal on XTALIN-XTALOUT	5	–	ms
tRP	RESET# recovery time		1	–	ms

AC Test Loads and Waveforms

Figure 61. AC Test Loads and Waveforms (Except SD and MMC, SD and MMC are comply with the SD/MMC specification)



(a) Normal Load (Load 1)

	3.0V/2.5V/1.8V
R1	13500Ω
R2	10800Ω

(b) Thévenin Equivalent (Load 1)

ALL INPUT PULSES

(c) Three-State Delay (Load 2)

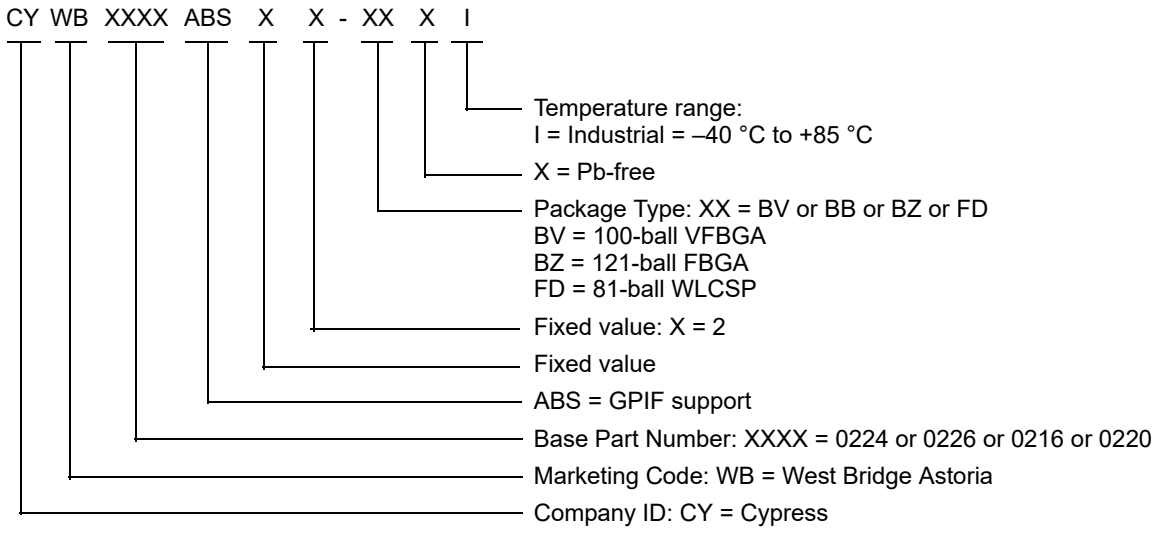
(Used for t_{LZ}, t_{HZ}, t_{HZWE}, and t_{LZWE} including scope and jig)

Ordering Information

Astoria provides many options with multiple ordering part numbers as shown in the following table:

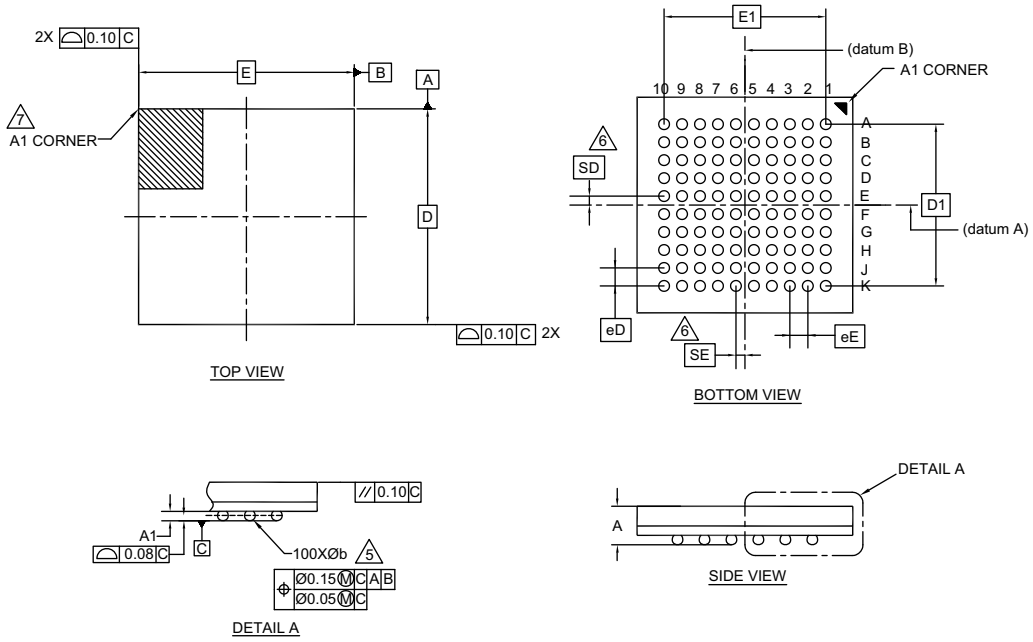
Ordering Code	Package Type	Optional Features			Clock Input Frequencies (MHz)	Status
		FlexBoot™	USB Switch	Turbo MTP		
CYWB0220ABSX2-FDXIT	81-ball WLCSP (Pb-free)		√		26	Sample
CYWB0224ABM-BVXIES	100-ball VFBGA (Pb-free)				19.2, 24, 26, 48	Sample
CYWB0224ABS-BZXI	121-ball FBGA (Pb-free)				19.2, 24, 26, 48	Production Release
CYWB0224ABS-BVXI	100-ball VFBGA (Pb-free)				19.2, 24, 26, 48	Production Release
CYWB0224ABS-BVXIT	100-ball VFBGA (Pb-free)				19.2, 24, 26, 48	Production Release
CYWB0224ABS-BVXIES	100-ball VFBGA (Pb-free)				19.2, 24, 26, 48	Sample
CYWB0226ABS-BVXI	100-ball VFBGA (Pb-free)		√		19.2, 24, 26, 48	Production Release
CYWB0226ABS-BVXIT	100-ball VFBGA (Pb-free)		√		19.2, 24, 26, 48	Production Release

Ordering Code Definitions



Package Diagrams

Figure 62. 100-ball VFBGA (6 × 6 × 1.0 mm) BZ100 Package Outline, 51-85209



SYMBOL	DIMENSIONS		
	MIN.	NOM.	MAX.
A	-	-	1.00
A1	0.16	-	-
D	6.00 BSC		
E	6.00 BSC		
D1	4.50 BSC		
E1	4.50 BSC		
MD	10		
ME	10		
N	100		
Ø b	0.25	0.30	0.35
eD	0.50 BSC		
eE	0.50 BSC		
SD	0.25 BSC		
SE	0.25 BSC		

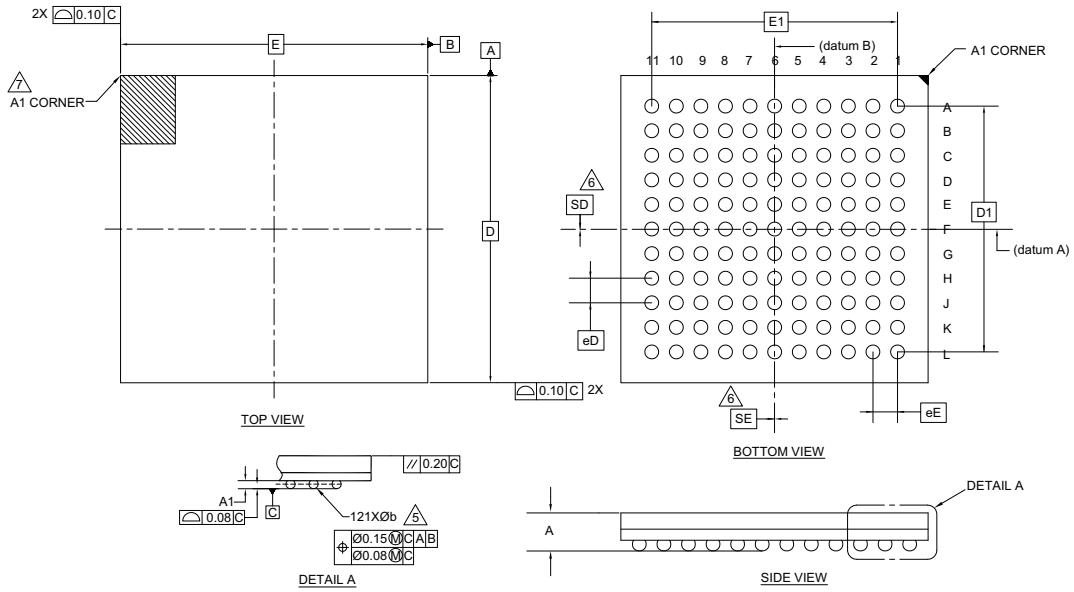
NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETERS.
2. SOLDER BALL POSITION DESIGNATION PER JEP95, SECTION 3, SPP-020.
3. "e" REPRESENTS THE SOLDER BALL GRID PITCH.
4. SYMBOL "MD" IS THE BALL MATRIX SIZE IN THE "D" DIRECTION.
   SYMBOL "ME" IS THE BALL MATRIX SIZE IN THE "E" DIRECTION.
   N IS THE NUMBER OF POPULATED SOLDER BALL POSITIONS FOR MATRIX SIZE MD X ME.
5. DIMENSION "b" IS MEASURED AT THE MAXIMUM BALL DIAMETER IN A PLANE PARALLEL TO DATUM C.
6. "SD" AND "SE" ARE MEASURED WITH RESPECT TO DATUMS A AND B AND DEFINE THE POSITION OF THE CENTER SOLDER BALL IN THE OUTER ROW.
   WHEN THERE IS AN ODD NUMBER OF SOLDER BALLS IN THE OUTER ROW "SD" OR "SE" = 0.
   WHEN THERE IS AN EVEN NUMBER OF SOLDER BALLS IN THE OUTER ROW, "SD" = eD/2 AND "SE" = eE/2.
7. A1 CORNER TO BE IDENTIFIED BY CHAMFER, LASER OR INK MARK METALIZED MARK, INDENTATION OR OTHER MEANS.
8. "+" INDICATES THE THEORETICAL CENTER OF DEPOPULATED SOLDER BALLS.
9. JEDEC SPECIFICATION NO. REF. : MO-195C.

51-85209 *F

100-ball VFBGA Package Outline Number	Revision	Date Released
51-85209	*E	12/10/2014

Figure 63. 121-ball FBGA (10 × 10 × 1.20 mm) (0.30 Ball Diameter) Package Outline, 001-54471



SYMBOL	DIMENSIONS		
	MIN.	NOM.	MAX.
A	-	-	1.20
A1	0.15	-	-
D	10.00 BSC		
E	10.00 BSC		
D1	8.00 BSC		
E1	8.00 BSC		
MD	11		
ME	11		
N	121		
∅ b	0.25	0.30	0.35
eD	0.80 BSC		
eE	0.80 BSC		
SD	0.00		
SE	0.00		

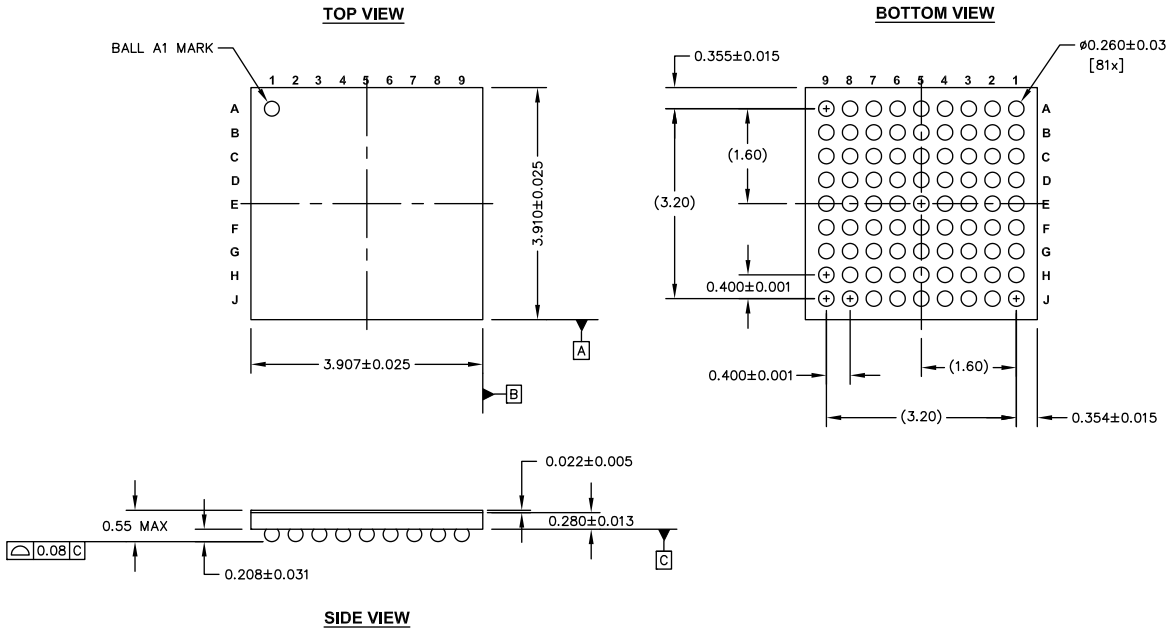
NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETERS.
2. SOLDER BALL POSITION DESIGNATION PER JEP95, SECTION 3, SPP-020.
3. "e" REPRESENTS THE SOLDER BALL GRID PITCH.
4. SYMBOL "MD" IS THE BALL MATRIX SIZE IN THE "D" DIRECTION.
   SYMBOL "ME" IS THE BALL MATRIX SIZE IN THE "E" DIRECTION.
   N IS THE NUMBER OF POPULATED SOLDER BALL POSITIONS FOR MATRIX SIZE MD X ME.
5. DIMENSION "b" IS MEASURED AT THE MAXIMUM BALL DIAMETER IN A PLANE PARALLEL TO DATUM C.
6. "SD" AND "SE" ARE MEASURED WITH RESPECT TO DATUMS A AND B AND DEFINE THE POSITION OF THE CENTER SOLDER BALL IN THE OUTER ROW.
   WHEN THERE IS AN ODD NUMBER OF SOLDER BALLS IN THE OUTER ROW, "SD" OR "SE" = 0.
   WHEN THERE IS AN EVEN NUMBER OF SOLDER BALLS IN THE OUTER ROW, "SD" = eD/2 AND "SE" = eE/2.
7. A1 CORNER TO BE IDENTIFIED BY CHAMFER, LASER OR INK MARK METALIZED MARK, INDENTATION OR OTHER MEANS.
8. "+" INDICATES THE THEORETICAL CENTER OF DEPOPULATED SOLDER BALLS.

001-54471 *F

121-ball FBGA Package Outline Number	Revision	Date Released
001-54471	*D	08/30/2012

Figure 64. Astoria WLCSP (3.91 × 3.91× 0.55 mm) FN81B Package Outline, 001-45618



NOTES:
1. ALL DIMENSION ARE IN MM
2. PACKAGE WEIGHT: See Cypress Package Material Declaration Datasheet (PMDD) posted on the Cypress Web
3. JEDEC – Publication 95; Design Guide 4.18

001-45618 *D

Astoria WLCSP Package Outline Number	Revision	Date Released
001-45618	*D	03/11/2015

Acronyms

Acronym	Description
CRAM	Cellular Random Access Memory
DMA	Direct Memory Access
ECC	Error Correction Code
GPIF	General Purpose Interface
MMC	Multimedia Card
MTP	Media Transfer Protocol
PLL	Phase-Locked Loop
SD	Secure Digital
SDIO	Secure Digital Input / Output
SLC	Single-Level Cell
SPI	Serial Peripheral Interface
USB	Universal Serial Bus
VFBGA	Very Fine-Pitch Ball Grid Array
WLCSP	Wafer Level Chip Scale Package

Document Conventions

Units of Measure

Symbol	Unit of Measure
°C	degree Celsius
µA	microampere
µs	microsecond
mA	milliampere
Mbps	mega bytes per second
MHz	megahertz
ms	millisecond
ns	nanosecond
Ω	ohm
pF	picofarad
V	volt

Document History Page

Document Title: CYWB022XX Family, West Bridge®: Astoria™ USB and Mass Storage Peripheral Controller Document Number: 001-13805				
Rev.	**ECN No.**	**Orig. of Change**	**Submission Date**	**Description of Change**
**	866960	VSO / PSZ	03/22/2007	New data sheet.
*A	2208371	JYEE / VSO	03/14/2008	Updated Document Title to read as “CYWB0224ABS/CYWB0224ABM/ CYWB0226ABS/CYWB0226ABM, West Bridge™: Astoria™ USB and Mass Storage Peripheral Controller”. Updated Features: Updated description. Updated Logic Block Diagram. Updated Functional Overview: Updated USB Interface (U-Port): Updated description. Added Figure 1. Updated Mass Storage Support (S-Port): Updated description. Added “N-Xpress NAND Controller (S-Port)”. Updated Pin Assignments: Updated Figure 9. Updated Table 6. Updated DC Characteristics: Updated Table 12: Updated details in “Conditions”, “Min”, “Typ”, “Max” columns corresponding to I_{SB1}, I_{SB2}, I_{SB3} parameters. Added Table 13. Updated AC Timing Parameters: Updated S Port Interface AC Timing Parameters: Updated PCRAM Non Multiplexing Asynchronous Mode: Updated Figure 15. Updated Figure 16. Updated Figure 17. Updated Figure 18. Updated Figure 19. Updated Table 15. Updated Address Data Multiplexing Asynchronous Mode: Updated Figure 20. Updated Figure 21. Updated Table 16. Updated Non Multiplexing Synchronous Mode Timing Parameters: Updated Figure 22. Updated Figure 23. Added Figure 24. Updated Figure 25. Updated Figure 26. Updated Figure 27. Updated Table 17. Updated Address Data Multiplexing Synchronous Mode: Updated Figure 28. Updated Figure 29. Updated Table 18. Updated Non Multiplexing Asynchronous SRAM Mode: Updated Figure 30. Updated Figure 31. Updated Figure 32. Added Table 19.

Document History Page (continued)

Document Title: CYWB022XX Family, West Bridge®: Astoria™ USB and Mass Storage Peripheral Controller Document Number: 001-13805				
Rev.	**ECN No.**	**Orig. of Change**	**Submission Date**	**Description of Change**
*A (cont.)	2208371	JYEE / VSO	03/14/2008	Updated Pseudo NAND (PNAND) Mode: Updated Figure 33. Updated Figure 34. Updated Figure 35. Updated Figure 36. Updated Figure 37. Removed figure “PNAND Read Operation”. Added Figure 38. Added Figure 40. Removed figure “PNAND Random Data Output in a Page”. Removed figure “PNAND Mode Read Operation (Intercepted by CE#)”. Removed figure “PNAND Mode Page Program Operation”. Removed figure “PNAND Page Program Operation with Random Data Input”. Added Figure 42. Added Figure 43. Added Figure 44. Added Figure 45. Added Figure 46. Added Figure 47. Added Figure 48. Added Figure 49. Added Figure 50. Added Figure 51. Updated Figure 52. Added Figure 53. Updated Figure 54. Added Figure 55. Added Figure 56. Updated Table 20. Updated SPI and PI2C Interface: Updated Figure 58. Updated Table 23. Updated Table 24. Updated Table 25. Updated SD/MMC/MMC+/CE-ATA Timing Parameters: Updated Figure 59. Updated Table 26. Updated Table 27. Removed table “Timing Parameters for SD/MMC/CE-ATA - All Modes”. Added Table 28. Added Table 29. Updated Reset and Standby Timing Parameters: Updated Figure 60. Added Table 30. Updated Ordering Information: Updated part numbers. Updated to new template.
*B	2503171	VSO / AESA	05/13/2008	Updated Features: Updated description (Added “3.91 × 3.91 mm 81-ball WLCSP” under “Small footprint”.

Document History Page (continued)

Document Title: CYWB022XX Family, West Bridge®: Astoria™ USB and Mass Storage Peripheral Controller Document Number: 001-13805				
Rev.	**ECN No.**	**Orig. of Change**	**Submission Date**	**Description of Change**
*B (cont.)	2503171	VSO / AESA	05/13/2008	Updated Functional Overview: Updated Processor Interface (P-Port): Updated description. Updated Clocking: Updated description. Added Table 1. Added Table 2. Updated Pin Assignments: Updated Table 6: Added a column “Ball #” and added details under the column. Added Table 10. Updated Figure 9 (Removed the grid line). Added Figure 13. Updated AC Timing Parameters: Updated P Port Interface: Updated Pseudo NAND (PNAND) Mode: Updated Table 20: Splitted t_{RC} parameter into two rows namely “Read Cycle Time (VFBGA Package)” and “Read Cycle Time (WLCSP Package)”. Retained the original values for t_{RC} parameter corresponding to “Read Cycle Time (VFBGA Package)” and added new values for t_{RC} parameter corresponding to “Read Cycle Time (WLCSP Package)”. Splitted t_{WC} parameter into two rows namely “Write Cycle Time (VFBGA Package)” and “Write Cycle Time (WLCSP Package)”. Retained the original values for t_{WC} parameter corresponding to “Write Cycle Time (VFBGA Package)” and added new values for t_{WC} parameter corresponding to “Write Cycle Time (WLCSP Package)”. Updated SPI and PI2C Interface: Updated Figure 57. Updated Ordering Information: Updated part numbers.
*C	2521024	VSO / AESA	06/25/2008	Changed status from “Preliminary” to “Confidential”. Updated Functional Overview: Updated Power Modes: Updated Core Power Down Mode: Updated description. Updated DC Characteristics: Updated Table 12: Updated Note 3.

Document History Page (continued)

Document Title: CYWB022XX Family, West Bridge®: Astoria™ USB and Mass Storage Peripheral Controller Document Number: 001-13805				
Rev.	**ECN No.**	**Orig. of Change**	**Submission Date**	**Description of Change**
*C (cont.)	2521024	VSO / AESA	06/25/2008	Updated AC Timing Parameters: Updated P Port Interface: Updated Non Multiplexing Synchronous Mode Timing Parameters: Updated Table 17: Added t_{WH} parameter and its details. Updated Figure 22. Updated Figure 27. Updated Address Data Multiplexing Synchronous Mode: Updated Table 18: Added t_{AVH} parameter and its details. Updated Figure 28. Updated Figure 29. Updated Pseudo NAND (PNAND) Mode: Updated Table 20: Replaced “140 ns” with “130 ns” in “Min” column corresponding to “t_{PROG}” parameter. Replaced “140 ns” with “130 ns” in “Min” column corresponding to “t_R” parameter. Updated SPI and PI2C Interface: Updated Table 23: Removed “t_A” parameter and its details. Updated Figure 58.
*D	2663942	VSO / AESA	02/24/2009	Updated Features: Updated description. Updated Functional Overview: Updated Clocking: Updated description. Added Table 3. Added Packages and Interface Options. Updated Pin Assignments: Updated Table 10 (Replaced “WLCSP” with “SP WLCSP” in caption). Added Table 11. Updated Figure 13 (Replaced “WLCSP” with “SP WLCSP” in caption; changed the color of AVDDQ). Added Figure 14. Updated DC Characteristics: Updated Table 12: Updated Note 2. Updated Ordering Information: Updated part numbers.
*E	2905597	VSO	04/05/2010	Updated Ordering Information: Updated part numbers. Updated Package Diagrams: spec 51-85209 – Changed revision from *B to *C. spec 001-45618 – Changed revision from ** to *B.
*F	2920278	VSO / AESA	04/21/2010	Updated DC Characteristics: Updated Table 12: Splitted I_{SB1} parameter into two rows namely “I_{SB1} (For 100-pin VFBGA and 81-pin SP WLCSPPackages)” and “I_{SB1} (For 81-pin Lite SP WLCSP)”. Retained the original values for “I_{SB1} (For 100-pin VFBGA and 81-pin SP WLCSPPackages)” and added TBD for “I_{SB1} (For 81-pin Lite SP WLCSP)”. Updated to new template.
*G	2954592	ESH	06/17/2010	Updated Ordering Information: Updated part numbers.

Document History Page (continued)

Document Title: CYWB022XX Family, West Bridge®: Astoria™ USB and Mass Storage Peripheral Controller Document Number: 001-13805				
Rev.	**ECN No.**	**Orig. of Change**	**Submission Date**	**Description of Change**
*H	3057588	ODC	10/13/2010	Removed “MLC NAND Flash” related information in all instances across the document. Updated Ordering Information: Updated part numbers. Added Ordering Code Definitions.
*I	3164752	ANOP	02/07/2011	Updated Pin Assignments: Updated Table 11: Added ‘#’ to DRQ under “SRAM Interface”, “ADM” and “PNAND” columns in “D4” row. Added “#” to “DACK” under “SRAM Interface”, “ADM” and “PNAND” columns in “D3” row.
*J	3191625	ANOP	03/09/2011	Updated AC Timing Parameters: Updated P Port Interface: Updated Pseudo NAND (PNAND) Mode: Added Figure 39. Added Figure 41. Added Table 21. Added Table 22. Updated Package Diagrams: spec 51-85209 – Changed revision from *C to *D. Completing Sunset Review.
*K	3465771	SIRK	12/22/2011	Changed status from Confidential to Final. Updated Functional Overview: Updated USB Interface (U-Port): Updated Mass Storage Support (S-Port): Updated description. Removed “N-Xpress NAND Controller (S-Port)”. Removed “NAND Flash and SD/SDIO/MMC/CE-ATA Interface Mode”. Added GPIF and SD/SDIO/MMC/CE-ATA Interface Mode. Removed “NAND Flash Interface Mode”. Removed “NAND Flash and GPIO Interface”. Added GPIF and GPIO Interface. Removed “NAND Port (S-Port)”. Updated Pin Assignments: Updated Table 6. Added Table 7. Added Table 8. Added Table 9. Updated Table 10. Updated Table 11. Updated Figure 9. Added Figure 10. Added Figure 11. Added Figure 12. Updated Figure 13. Updated Figure 14. Updated Ordering Information: Updated part numbers. Updated Package Diagrams: Added spec 51-85107 *D. Added spec 001-54471 *C

Document History Page (continued)

Document Title: CYWB022XX Family, West Bridge®: Astoria™ USB and Mass Storage Peripheral Controller Document Number: 001-13805				
Rev.	**ECN No.**	**Orig. of Change**	**Submission Date**	**Description of Change**
*L	3539318	SIRK	03/01/2012	Updated Package Diagrams: spec 001-45618 – Changed revision from *B to *C. Posted to external web. Completing Sunset Review.
*M	3665980	AASI	07/06/2012	Updated Features: Removed 100-ball BGA package related information. Updated Ordering Information: Updated part numbers. Updated Package Diagrams: Removed spec 51-85107 *D.
*N	3847849	DBIR	12/19/2012	Updated Ordering Information: Updated part numbers. Updated Package Diagrams: spec 001-54471 – Changed revision from *C to *D.
*O	4584086	GAYA	12/01/2014	Updated Features: Replaced “Supports I^2C Boot and Processor Boot” with “Supports USB Boot, I^2C Boot and Processor Boot”. Updated Ordering Information: Updated part numbers. Updated to new template.
*P	4776800	DBIR	06/01/2015	Updated Package Diagrams: spec 51-85209 – Changed revision from *D to *E. spec 001-45618 – Changed revision from *C to *D. Updated to new template. Completing Sunset Review.
*Q	6114093	DBIR	03/29/2018	Updated Package Diagrams: spec 51-85209 – Changed revision from *E to *F. spec 001-54471 – Changed revision from *D to *F. Updated to new template. Completing Sunset Review.

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