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## FEATURES

- ARM720T Processor
  - ARM7TDMI CPU
  - 8 KB of four-way set-associative cache
  - MMU with 64-entry TLB
  - Thumb code support enabled
- Ultra low power
  - 90 mW at 74 MHz typical
  - 30 mW at 18 MHz typical
  - 10 mW in the Idle State
  - <1 mW in the Standby State
- 48 KB of on-chip SRAM
- MaverickKey™ IDs
  - 32-bit unique ID can be used for SDMI compliance
  - 128-bit random ID
- Dynamically programmable clock speeds of 18, 36, 49, and 74 MHz

**High-performance,  
Low-power, System-on-chip  
with SDRAM & Enhanced  
Digital Audio Interface**

## OVERVIEW

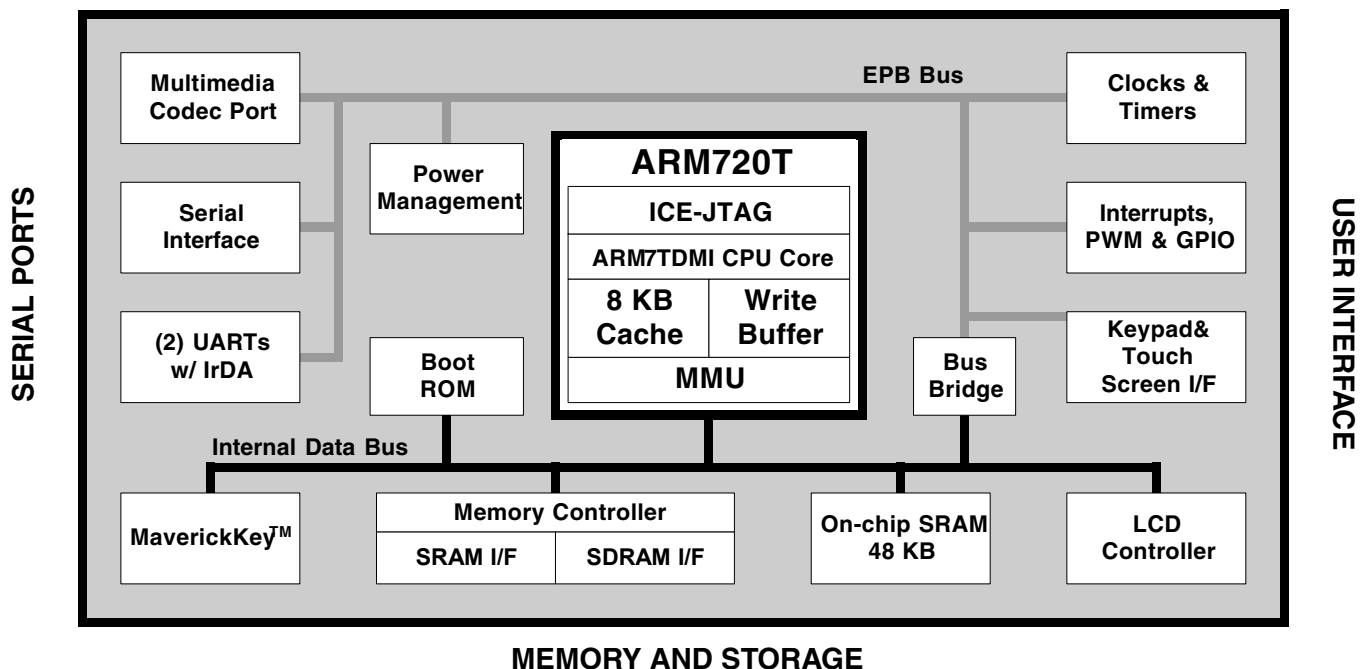
The Maverick™ EP7311 is designed for ultra-low-power applications such as PDAs, smart cellular phones, and industrial hand held information appliances. The core-logic functionality of the device is built around an ARM720T processor with 8 KB of four-way set-associative unified cache and a write buffer. Incorporated into the ARM720T is an enhanced memory management unit (MMU) which allows for support of sophisticated operating systems like Linux®.



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## BLOCK DIAGRAM



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## FEATURES (cont)

- LCD controller
  - Interfaces directly to a single-scan panel monochrome STN LCD
  - Interfaces to a single-scan panel color STN LCD with minimal external glue logic
- Full JTAG boundary scan and Embedded ICE® support
- Integrated Peripheral Interfaces
  - 32-bit SDRAM Interface up to 2 external banks
  - 8/32/16-bit SRAM/FLASH/ROM Interface
  - Multimedia Codec Port
  - Two Synchronous Serial Interfaces (SSI1, SSI2)
  - CODEC Sound Interface
  - 8×8 Keypad Scanner
  - 27 General Purpose Input/Output pins
  - Dedicated LED flasher pin from the RTC
- Internal Peripherals
  - Two 16550 compatible UARTs
  - IrDA Interface
  - Two PWM Interfaces
  - Real-time Clock
  - Two general purpose 16-bit timers
  - Interrupt Controller
  - Boot ROM
- Package
  - 208-Pin LQFP
  - 256-Ball PBGA
  - 204-Ball TFBGA
- The fully static EP7311 is optimized for low power dissipation and is fabricated on a 0.25 micron CMOS process
- Development Kits
  - EDB7312: Development Kit with color STN LCD on board.
  - EDB7312-LW: EDB7312 with Lynuxworks' BlueCat Linux Tools and software for Windows host (free 30 day BlueCat support from Lynuxworks).
  - EDB7312-LL: EDB7312 with Lynuxworks' BlueCat Linux Tools and software for Linux host (free 30 day BlueCat support from Lynuxworks).

*Note:* \* BlueCat available separately through Lynuxworks only.  
\* Use the EDB7312 Development Kit for all the EP73xx devices.

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## OVERVIEW (cont.)

The EP7311 is designed for low-power operation. Its core operates at only 2.5 V, while its I/O has an operation range of 2.5 V–3.3 V. The device has three basic power states: operating, idle and standby.

One of its notable features is MaverickKey unique IDs. These are factory programmed IDs in response to the growing concern over secure web content and commerce. With Internet security playing an important role in the delivery of digital

media such as books or music, traditional software methods are quickly becoming unreliable. The MaverickKey unique IDs consist of two registers, one 32-bit series register and one random 128-bit register that may be used by an OEM for an authentication mechanism.

Simply by adding desired memory and peripherals to the highly integrated EP7311 completes a low-power system solution. All necessary interface logic is integrated on-chip.

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## Processor Core - ARM720T

The EP7311 incorporates an ARM 32-bit RISC microcontroller that controls a wide range of on-chip peripherals. The processor utilizes a three-stage pipeline consisting of fetch, decode and execute stages. Key features include:

- ARM (32-bit) and Thumb (16-bit compressed) instruction sets
- Enhanced MMU for Microsoft Windows CE and other operating systems
- 8 KB of 4-way set-associative cache.
- Translation Look Aside Buffers with 64 Translated Entries

## Power Management

The EP7311 is designed for ultra-low-power operation. Its core operates at only 2.5 V, while its I/O has an operation range of 2.5 V–3.3 V allowing the device to achieve a performance level equivalent to 60 MIPS. The device has three basic power states:

- Operating — This state is the full performance state. All the clocks and peripheral logic are enabled.
- Idle — This state is the same as the Operating State, except the CPU clock is halted while waiting for an event such as a key press.
- Standby — This state is equivalent to the computer being switched off (no display), and the main oscillator shut down. An event such as a key press can wake-up the processor.

Pin Mnemonic	I/O	Pin Description
BATOK	I	Battery ok input
nEXTPWR	I	External power supply sense input
nPWRFL	I	Power fail sense input
nBATCHG	I	Battery changed sense input

Table A. Power Management Pin Assignments

## MaverickKey™ Unique ID

MaverickKey unique hardware programmed IDs are a solution to the growing concern over secure web content and commerce. With Internet security playing an important role in the delivery of digital media such as books or music, traditional software methods are quickly becoming unreliable. The MaverickKey unique IDs provide OEMs with a method of utilizing specific hardware IDs such as those assigned for SDMI (Secure Digital Music Initiative) or any other authentication mechanism.

Both a specific 32-bit ID as well as a 128-bit random ID is programmed into the EP7311 through the use of laser probing technology. These IDs can then be used to match secure copyrighted content with the ID of the target device the EP7311 is powering, and then deliver the copyrighted information over a secure connection. In addition, secure transactions can benefit by also matching device IDs to server IDs. MaverickKey IDs provide a level of hardware security required for today's Internet appliances.

## Memory Interfaces

There are two main external memory interfaces. The first one is the ROM/SRAM/FLASH-style interface that has programmable wait-state timings and includes burst-mode capability, with six chip selects decoding six 256 MB sections of addressable space. For maximum flexibility, each bank can be specified to be 8-, 16-, or 32-bits wide. This allows the use of 8-bit-wide boot ROM options to minimize overall system cost. The on-chip boot ROM can be used in product manufacturing to serially download system code into system FLASH memory. To further minimize system memory requirements and cost, the ARM Thumb instruction set is supported, providing for the use of high-speed 32-bit operations in 16-bit op-codes and yielding industry-leading code density.

Pin Mnemonic	I/O	Pin Description
nCS[5:0]	O	Chip select out
A[27:0]	O	Address output
D[31:0]	I/O	Data I/O
nMOE/nSDCAS (Note)	O	ROM expansion OP enable
nMWE/nSDWE (Note)	O	ROM expansion write enable
HALFWORD	O	Halfword access select output
WORD	O	Word access select output
WRITE/nSDRAS (Note)	O	Transfer direction

Table B. Static Memory Interface Pin Assignments

Note: Pins are multiplexed. See Table S on page 11 for more information.

The second is the programmable 16- or 32-bit-wide SDRAM interface that allows direct connection of up to two banks of SDRAM, totaling 512 Mb. To assure the lowest possible power consumption, the EP7311 supports self-refresh SDRAMs, which are placed in a low-power state by the device when it enters the low-power Standby State.

Pin Mnemonic	I/O	Pin Description
SDCLK	O	SDRAM clock output
SDCKE	O	SDRAM clock enable output
nSDCS[1:0]	O	SDRAM chip select out
WRITE/nSDRAS (Note 2)	O	SDRAM RAS signal output
nMOE/nSDCAS (Note 2)	O	SDRAM CAS control signal
nMWE/nSDWE (Note 2)	O	SDRAM write enable control signal
A[27:15]/DRA[0:12] (Note 1)	O	SDRAM address
A[14:13]/DRA[12:14]	O	SDRAM internal bank select
PD[7:6]/SDQM[1:0] (Note 2)	I/O	SDRAM byte lane mask
SDQM[3:2]	O	SDRAM byte lane mask
D[31:0]	I/O	Data I/O

**Table C. SDRAM Interface Pin Assignments**

*Note:* 1. Pins A[27:13] map to DRA[0:14] respectively. (i.e. A[27]/DRA[0], A[26]/DRA[1], etc.) This is to balance the load for large memory systems.  
 2. Pins are multiplexed. See [Table S on page 11](#) for more information.

## Digital Audio Capability

The EP7311 uses its powerful 32-bit RISC processing engine to implement audio decompression algorithms in software. The nature of the on-board RISC processor, and the availability of efficient C-compilers and other software development tools, ensures that a wide range of audio decompression algorithms can easily be ported to and run on the EP7311

## Universal Asynchronous Receiver/Transmitters (UARTs)

The EP7311 includes two 16550-type UARTs for RS-232 serial communications, both of which have two 16-byte FIFOs for receiving and transmitting data. The UARTs support bit rates up to 115.2 kbps. An IrDA SIR protocol encoder/decoder can be optionally switched into the RX/TX signals to/from

UART 1 to enable these signals to drive an infrared communication interface directly.

Pin Mnemonic	I/O	Pin Description
TXD[1]	O	UART 1 transmit
RXD[1]	I	UART 1 receive
CTS	I	UART 1 clear to send
DCD	I	UART 1 data carrier detect
DSR	I	UART 1 data set ready
TXD[2]	O	UART 2 transmit
RXD[2]	I	UART 2 receive
LEDDRV	O	Infrared LED drive output
PHDIN	I	Photo diode input

**Table D. Universal Asynchronous Receiver/Transmitters Pin Assignments**

## Multimedia Codec Port (MCP)

The Multimedia Codec Port provides access to an audio codec, a telecom codec, a touchscreen interface, four general purpose analog-to-digital converter inputs, and ten programmable digital I/O lines.

Pin Mnemonic	I/O	Pin Description
SIBCLK	O	Serial bit clock
SIBDOUT	O	Serial data out
SIBDIN	I	Serial data in
SIBSYNC	O	Sample clock

**Table E. MCP Interface Pin Assignments**

*Note:* See [Table R on page 11](#) for information on pin multiplexes.



## CODEC Interface

The EP7311 includes an interface to telephony-type CODECs for easy integration into voice-over-IP and other voice communications systems. The CODEC interface is multiplexed to the same pins as the MCP and SSI2.

Pin Mnemonic	I/O	Pin Description
PCMCLK	O	Serial bit clock
PCMOUT	O	Serial data out
PCMIN	I	Serial data in
PCMSYNC	O	Frame sync

Table F. CODEC Interface Pin Assignments

Note: See Table R on page 11 for information on pin multiplexes.

## SSI2 Interface

An additional SPI/Microwire1-compatible interface is available for both master and slave mode communications. The SSI2 unit shares the same pins as the MCP and CODEC interfaces through a multiplexer.

- Synchronous clock speeds of up to 512 kHz
- Separate 16 entry TX and RX half-word wide FIFOs
- Half empty/full interrupts for FIFOs
- Separate RX and TX frame sync signals for asymmetric traffic

Pin Mnemonic	I/O	Pin Description
SSICLK	I/O	Serial bit clock
SSITXDA	O	Serial data out
SSIRXDA	I	Serial data in
SSITXFR	I/O	Transmit frame sync
SSIRXFR	I/O	Receive frame sync

Table G. SSI2 Interface Pin Assignments

Note: See Table R on page 11 for information on pin multiplexes.

## Synchronous Serial Interface

- ADC (SSI) Interface: Master mode only; SPI and Microwire1-compatible (128 kbps operation)
- Selectable serial clock polarity

Pin Mnemonic	I/O	Pin Description
ADCLK	O	SSI1 ADC serial clock
ADCIN	I	SSI1 ADC serial input
ADCOUT	O	SSI1 ADC serial output
nADCCS	O	SSI1 ADC chip select
SMPCLK	O	SSI1 ADC sample clock

Table H. Serial Interface Pin Assignments

## LCD Controller

A DMA address generator is provided that fetches video display data for the LCD controller from memory. The display frame buffer start address is programmable, allowing the LCD frame buffer to be in SDRAM, internal SRAM or external SRAM.

- Interfaces directly to a single-scan panel monochrome STN LCD
- Interfaces to a single-scan panel color STN LCD with minimal external glue logic
- Panel width size is programmable from 32 to 1024 pixels in 16-pixel increments
- Video frame buffer size programmable up to 128 KB
- Bits per pixel of 1, 2, or 4 bits

Pin Mnemonic	I/O	Pin Description
CL1	O	LCD line clock
CL2	O	LCD pixel clock out
DD[3:0]	O	LCD serial display data bus
FRM	O	LCD frame synchronization pulse
M	O	LCD AC bias drive

Table I. LCD Interface Pin Assignments

## 64-Keypad Interface

Matrix keyboards and keypads can be easily read by the EP7311. A dedicated 8-bit column driver output generates strobes for each keyboard column signal. The pins of Port A, when configured as inputs, can be selectively OR'ed together to provide a keyboard interrupt that is capable of waking the system from a STANDBY or IDLE state.

- Column outputs can be individually set high with the remaining bits left at high-impedance
- Column outputs can be driven all-low, all-high, or all-high-impedance
- Keyboard interrupt driven by OR'ing together all Port A bits
- Keyboard interrupt can be used to wake up the system
- 8×8 keyboard matrix usable with no external logic, extra keys can be added with minimal glue logic

Pin Mnemonic	I/O	Pin Description
COL[7:0]	O	Keyboard scanner column drive

**Table J. Keypad Interface Pin Assignments**

## Interrupt Controller

When unexpected events arise during the execution of a program (i.e., interrupt or memory fault) an exception is usually generated. When these exceptions occur at the same time, a fixed priority system determines the order in which they are handled. The EP7311 interrupt controller has two interrupt types: interrupt request (IRQ) and fast interrupt request (FIQ). The interrupt controller has the ability to control interrupts from 22 different FIQ and IRQ sources.

- Supports 22 interrupts from a variety of sources (such as UARTs, SSII, and key matrix.)
- Routes interrupt sources to the ARM720T's IRQ or FIQ (Fast IRQ) inputs
- Five dedicated off-chip interrupt lines operate as level sensitive interrupts

Pin Mnemonic	I/O	Pin Description
nEINT[2:1]	I	External interrupt
EINT[3]	I	External interrupt
nEXTFIQ	I	External Fast Interrupt input
nMEDCHG/nBROM (Note)	I	Media change interrupt input

**Table K. Interrupt Controller Pin Assignments**

*Note:* Pins are multiplexed. See [Table S on page 11](#) for more information.

## Real-Time Clock

The EP7311 contains a 32-bit Real Time Clock (RTC) that can be written to and read from in the same manner as the timer counters. It also contains a 32-bit output match register which can be programmed to generate an interrupt.

- Driven by an external 32.768 kHz crystal oscillator

Pin Mnemonic	Pin Description
RTCIN	Real-Time Clock Oscillator Input
RTCOU	Real-Time Clock Oscillator Output
VDDRTC	Real-Time Clock Oscillator Power
VSSRTC	Real-Time Clock Oscillator Ground

**Table L. Real-Time Clock Pin Assignments**

## PLL and Clocking

- Processor and Peripheral Clocks operate from a single 3.6864 MHz crystal or external 13 MHz clock
- Programmable clock speeds allow the peripheral bus to run at 18 MHz when the processor is set to 18 MHz and at 36 MHz when the processor is set to 36, 49 or 74 MHz

Pin Mnemonic	Pin Description
MOSCIN	Main Oscillator Input
MOSCOU	Main Oscillator Output
VDDOSC	Main Oscillator Power
VSSOSC	Main Oscillator Ground

**Table M. PLL and Clocking Pin Assignments**

## DC-to-DC converter interface (PWM)

- Provides two 96 kHz clock outputs with programmable duty ratio (from 1-in-16 to 15-in-16) that can be used to drive a positive or negative DC to DC converter

Pin Mnemonic	I/O	Pin Description
DRIVE[1:0]	I/O	PWM drive output
FB[1:0]	I	PWM feedback input

Table N. DC-to-DC Converter Interface Pin Assignments

## Timers

- Internal (RTC) timer
- Two internal 16-bit programmable hardware count-down timers

## General Purpose Input/Output (GPIO)

- Three 8-bit and one 3-bit GPIO ports
- Supports scanning keyboard matrix

Pin Mnemonic	I/O	Pin Description
PA[7:0]	I/O	GPIO port A
PB[7:0]	I/O	GPIO port B
PD[0]/LEDFLSH (Note)	I/O	GPIO port D
PD[5:1]	I/O	GPIO port D
PD[7:6]/SDQM[1:0] (Note)	I/O	GPIO port D
PE[1:0]/BOOTSEL[1:0] (Note)	I/O	GPIO port E
PE[2]/CLKSEL (Note)	I/O	GPIO port E

Table O. General Purpose Input/Output Pin Assignments

Note: Pins are multiplexed. See [Table S on page 11](#) for more information.

## Hardware debug Interface

- Full JTAG boundary scan and Embedded ICE<sup>®</sup> support

Pin Mnemonic	I/O	Pin Description
TCLK	I	JTAG clock
TDI	I	JTAG data input
TDO	O	JTAG data output
nTRST	I	JTAG async reset input
TMS	I	JTAG mode select

Table P. Hardware Debug Interface Pin Assignments

## LED Flasher

A dedicated LED flasher module can be used to generate a low frequency signal on Port D pin 0 for the purpose of blinking an LED without CPU intervention. The LED flasher feature is ideal as a visual annunciator in battery powered applications, such as a voice mail indicator on a portable phone or an appointment reminder on a PDA.

- Software adjustable flash period and duty cycle
- Operates from 32 kHz RTC clock
- Will continue to flash in IDLE and STANDBY states
- 4 mA drive current

Pin Mnemonic	I/O	Pin Description
PD[0]/LEDFLSH (Note)	O	LED flasher driver

Table Q. LED Flasher Pin Assignments

Note: Pins are multiplexed. See [Table S on page 11](#) for more information.

## Internal Boot ROM

The internal 128 byte Boot ROM facilitates download of saved code to the on-board SRAM/FLASH.

## Packaging

The EP7311 is available in a 208-pin LQFP package, 256-ball PBGA package or a 204-ball TFBGA package.

## Pin Multiplexing

The following table shows the pin multiplexing of the MCP, SSI2 and the CODEC. The selection between SSI2 and the CODEC is controlled by the state of the SERSEL bit in SYSCON2. The choice between the SSI2, CODEC, and the MCP is controlled by the MCPSEL bit in SYSCON3 (see the EP73xx User's Manual for more information).

Pin Mnemonic	I/O	MCP	SSI2	CODEC
SSICLK	I/O	SIBCLK	SSICLK	PCMCLK
SSITXDA	O	SIBDOUT	SSITXDA	PCMOUT
SSIRXDA	I	SIBDIN	SSIRXDA	PCMIN
SSITXFR	I/O	SIBSYNC	SSITXFR	PCMSYNC
SSIRXFR	I	p/u	SSIRXFR	p/u
BUZ	O			

**Table R. MCP/SSI2/CODEC Pin Multiplexing**

The following table shows the pins that have been multiplexed in the EP7311.

Signal	Block	Signal	Block
nMOE	Static Memory	nSDCAS	SDRAM
nMWE	Static Memory	nSDWE	SDRAM
WRITE	Static Memory	nSDRAS	SDRAM
A[27:15]	Static Memory	DRA[0:12]	SDRAM
A[14:13]	Static Memory	DRA[13:14]	SDRAM
PD[7:6]	GPIO	SDQM[1:0]	SDRAM
RUN	System Configuration	CLKEN	System Configuration
nMEDCHG	Interrupt Controller	nBROM	Boot ROM select
PD[0]	GPIO	LEDFLSH	LED Flasher
PE[1:0]	GPIO	BOOTSEL[1:0]	System Configuration
PE[2]	GPIO	CLKSEL	System Configuration

**Table S. Pin Multiplexing**

## System Design

As shown in system block diagram, simply adding desired memory and peripherals to the highly integrated EP7311

completes a low-power system solution. All necessary interface logic is integrated on-chip.

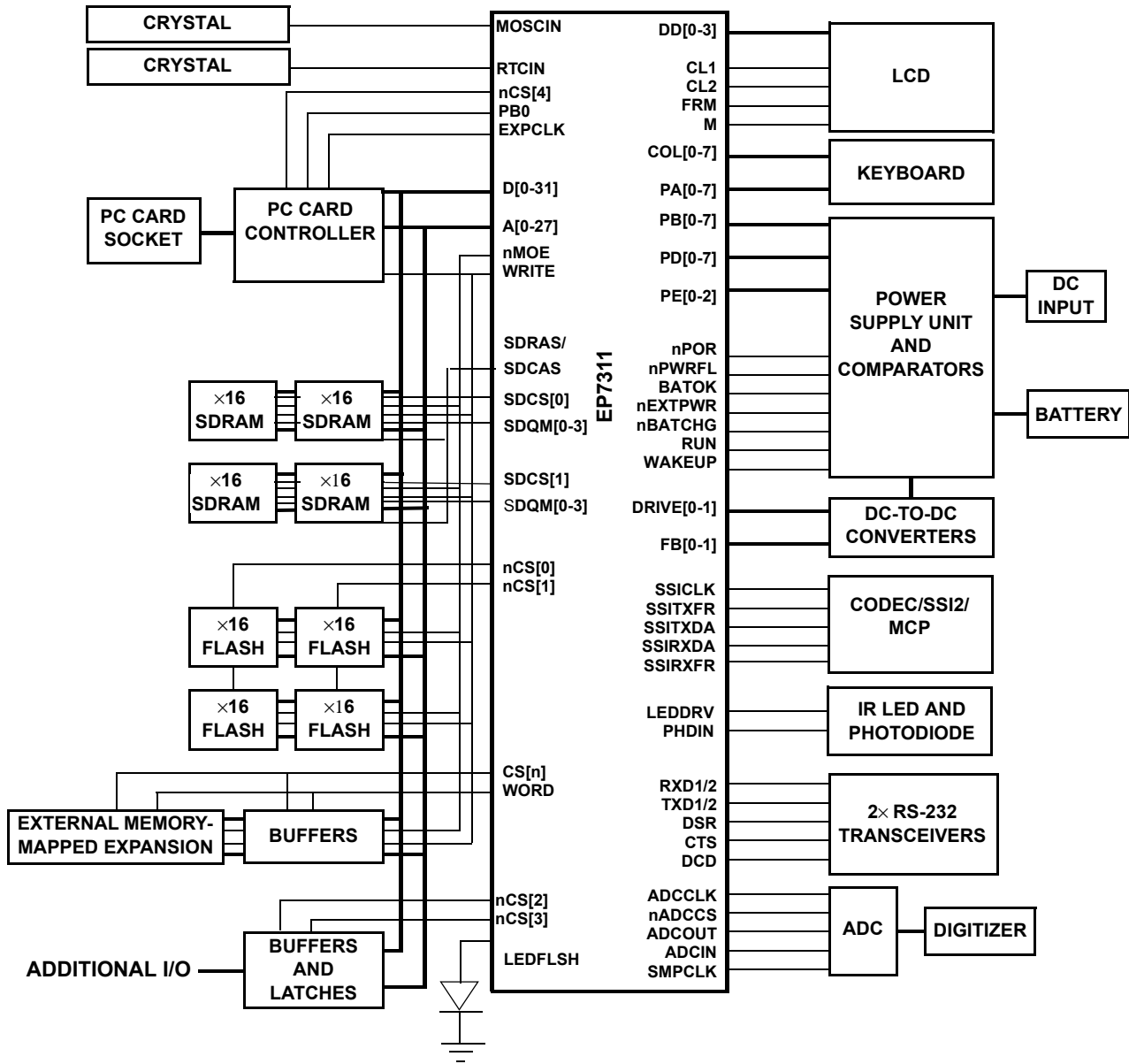


Figure 1. A Maximum EP7311 Based System

Note: A system can only use one of the following peripheral interfaces at any given time: SSI2, CODEC or MCP.

## ELECTRICAL SPECIFICATIONS

### Absolute Maximum Ratings

DC Core, PLL, and RTC Supply Voltage	2.9 V
DC I/O Supply Voltage (Pad Ring)	3.6 V
DC Pad Input Current	±10 mA/pin; ±100 mA cumulative
Storage Temperature, No Power	-40°C to +125°C

### Recommended Operating Conditions

DC core, PLL, and RTC Supply Voltage	2.5 V ± 0.2 V
DC I/O Supply Voltage (Pad Ring)	2.3 V - 3.5 V
DC Input / Output Voltage	O-I/O supply voltage
Operating Temperature	Extended -20°C to +70°C; Commercial 0°C to +70°C; Industrial -40°C to +85°C

### DC Characteristics

All characteristics are specified at  $V_{DDCORE} = 2.5$  V,  $V_{DDIO} = 3.3$  V and  $V_{SS} = 0$  V over an operating temperature of 0°C to +70°C for all frequencies of operation. The current consumption figures have test conditions specified per parameter.”

Symbol	Parameter	Min	Typ	Max	Unit	Conditions
VIH	CMOS input high voltage	$0.65 \times V_{DDIO}$	-	$V_{DDIO} + 0.3$	V	$V_{DDIO} = 2.5$ V
VIL	CMOS input low voltage	$V_{SS} - 0.3$	-	$0.25 \times V_{DDIO}$	V	$V_{DDIO} = 2.5$ V
VT+	Schmitt trigger positive going threshold	-	-	2.1	V	
VT-	Schmitt trigger negative going threshold	0.8	-	-	V	
Vhst	Schmitt trigger hysteresis	0.1	-	0.4	V	VIL to VIH
VOH	CMOS output high voltage <sup>a</sup>	$V_{DD} - 0.2$	-	-	V	IOH = 0.1 mA
	Output drive 1 <sup>a</sup>	2.5	-	-	V	IOH = 4 mA
	Output drive 2 <sup>a</sup>	2.5	-	-	V	IOH = 12 mA
VOL	CMOS output low voltage <sup>a</sup>	-	-	0.3	V	IOL = -0.1 mA
	Output drive 1 <sup>a</sup>	-	-	0.5	V	IOL = -4 mA
	Output drive 2 <sup>a</sup>	-	-	0.5	V	IOL = -12 mA
IIN	Input leakage current	-	-	1.0	μA	$V_{IN} = V_{DD}$ or GND
IOZ	Bidirectional 3-state leakage current <sup>b c</sup>	25	-	100	μA	$V_{OUT} = V_{DD}$ or GND
CIN	Input capacitance	8	-	10.0	pF	
COUT	Output capacitance	8	-	10.0	pF	

Symbol	Parameter	Min	Typ	Max	Unit	Conditions
CI/O	Transceiver capacitance	8	-	10.0	pF	
$IDD_{STANDBY}$ @ 25 C	Standby current consumption <sup>1</sup> Core, Osc, RTC @2.5 V I/O @ 3.3 V	- -	77 41	- -	$\mu$ A	Only nPOR, nPWRFAIL, nURESET, PE0, PE1, and RTS are driven, while all other float, $V_{IH} = V_{DD} \pm 0.1$ V, $V_{IL} = GND \pm 0.1$ V
$IDD_{STANDBY}$ @ 70 C	Standby current consumption <sup>1</sup> Core, Osc, RTC @2.5 V I/O @ 3.3 V	- -	- -	570 111	$\mu$ A	Only nPOR, nPWRFAIL, nURESET, PE0, PE1, and RTS are driven, while all other float, $V_{IH} = V_{DD} \pm 0.1$ V, $V_{IL} = GND \pm 0.1$ V
$IDD_{STANDBY}$ @ 85 C	Standby current consumption <sup>1</sup> Core, Osc, RTC @2.5 V I/O @ 3.3 V	- -	- -	1693 163	$\mu$ A	Only nPOR, nPWRFAIL, nURESET, PE0, PE1, and RTS are driven, while all other float, $V_{IH} = V_{DD} \pm 0.1$ V, $V_{IL} = GND \pm 0.1$ V
$IDD_{idle}$ at 74 MHz	Idle current consumption <sup>1</sup> Core, Osc, RTC @2.5 V I/O @ 3.3 V	- -	6 10	- -	mA	Both oscillators running, CPU static, Cache enabled, LCD disabled, $V_{IH} = V_{DD} \pm 0.1$ V, $V_{IL} = GND \pm 0.1$ V
$VDD_{STANDBY}$	Standby supply voltage	2.0	-	-	V	Minimum standby voltage for state retention, internal SRAM cache, and RTC operation only

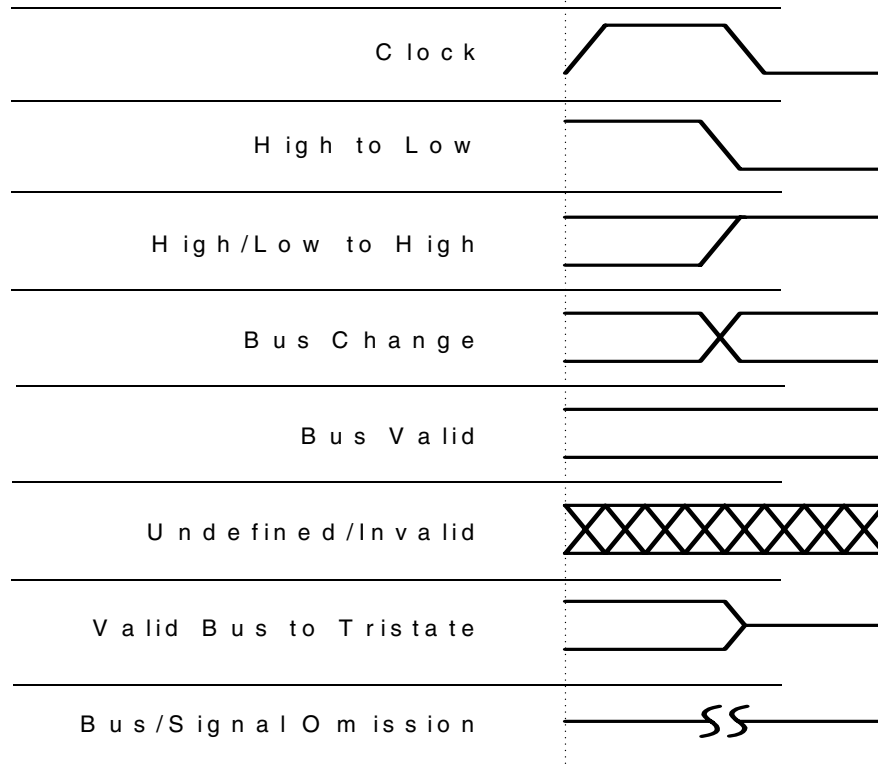
- a. Refer to the strength column in the pin assignment tables for all package types.
- b. Assumes buffer has no pull-up or pull-down resistors.
- c. The leakage value given assumes that the pin is configured as an input pin but is not currently being driven.

Note: 1) Total power consumption =  $IDD_{CORE} \times 2.5$  V +  $IDD_{IO} \times 3.3$  V  
 2) A typical design will provide 3.3 V to the I/O supply (i.e.,  $V_{DDIO}$ ), and 2.5 V to the remaining logic. This is to allow the I/O to be compatible with 3.3 V powered external logic (i.e., 3.3 V SDRAMs).  
 2) Pull-up current = 50  $\mu$ A typical at  $V_{DD} = 3.3$  V.

## Timings

### Timing Diagram Conventions

This data sheet contains timing diagrams. The following key explains the components used in these diagrams. Any variations are clearly labelled when they occur. Therefore, no additional meaning should be attached unless specifically stated.



**Figure 2. Legend for Timing Diagrams**

### Timing Conditions

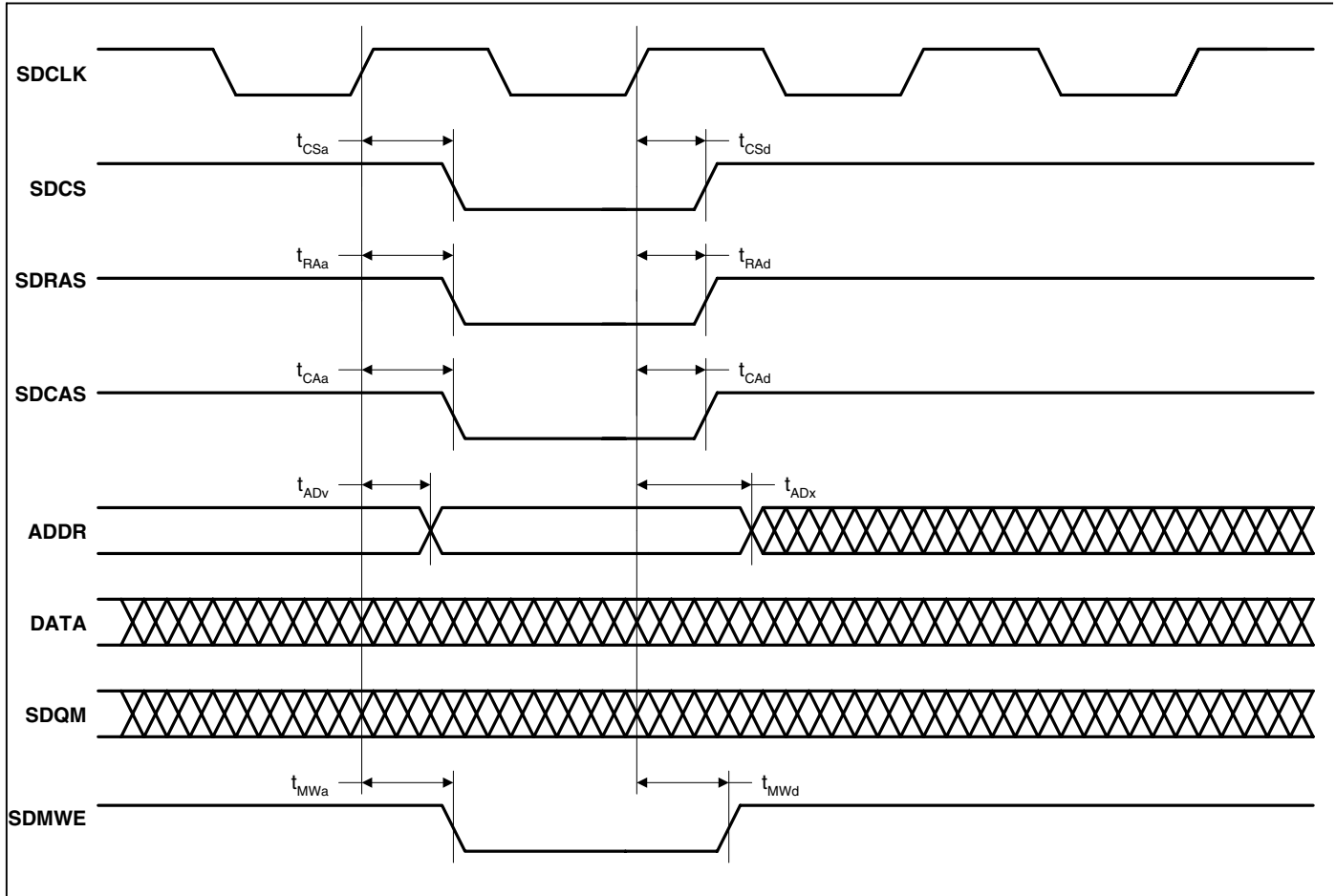
Unless specified otherwise, the following conditions are true for all timing measurements. All characteristics are specified at  $V_{DDIO} = 3.1 - 3.5 \text{ V}$  and  $V_{SS} = 0 \text{ V}$  over an operating temperature of  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ . Pin loadings is  $50 \text{ pF}$ . The timing values are referenced to  $1/2 V_{DD}$ .



## SDRAM Interface

Figure 3 through Figure 6 define the timings associated with all phases of the SDRAM. The following table contains the values for the timings of each of the SDRAM modes.

Parameter	Symbol	Min	Typ	Max	Unit
SDCLK rising edge to SDCS assert delay time	$t_{CSa}$	0	2	4	ns
SDCLK rising edge to SDCS deassert delay time	$t_{CSd}$	-3	2	10	ns
SDCLK rising edge to SDRAS assert delay time	$t_{RAa}$	1	3	7	ns
SDCLK rising edge to SDRAS deassert delay time	$t_{RA d}$	-3	1	10	ns
SDCLK rising edge to SDRAS invalid delay time	$t_{RAnv}$	2	4	7	ns
SDCLK rising edge to SDCAS assert delay time	$t_{CAa}$	-2	2	5	ns
SDCLK rising edge to SDCAS deassert delay time	$t_{CA d}$	-5	0	3	ns
SDCLK rising edge to ADDR transition time	$t_{ADv}$	-3	1	5	ns
SDCLK rising edge to ADDR invalid delay time	$t_{ADx}$	-2	2	5	ns
SDCLK rising edge to SDMWE assert delay time	$t_{MWa}$	-3	1	5	ns
SDCLK rising edge to SDMWE deassert delay time	$t_{MWd}$	-4	0	4	ns
DATA transition to SDCLK rising edge time	$t_{DA s}$	2	-	-	ns
SDCLK rising edge to DATA transition hold time	$t_{DA h}$	1	-	-	ns
SDCLK rising edge to DATA transition delay time	$t_{DA d}$	0	-	15	ns

**SDRAM Load Mode Register Cycle**

**Figure 3. SDRAM Load Mode Register Cycle Timing Measurement**

- Note:
1. Timings are shown with CAS latency = 2
  2. The SDCLK signal may be phase shifted relative to the rest of the SDRAM control and data signals due to uneven loading. Designers should take care to ensure that delays between SDRAM control and data signals are approximately equal

## SDRAM Burst Read Cycle

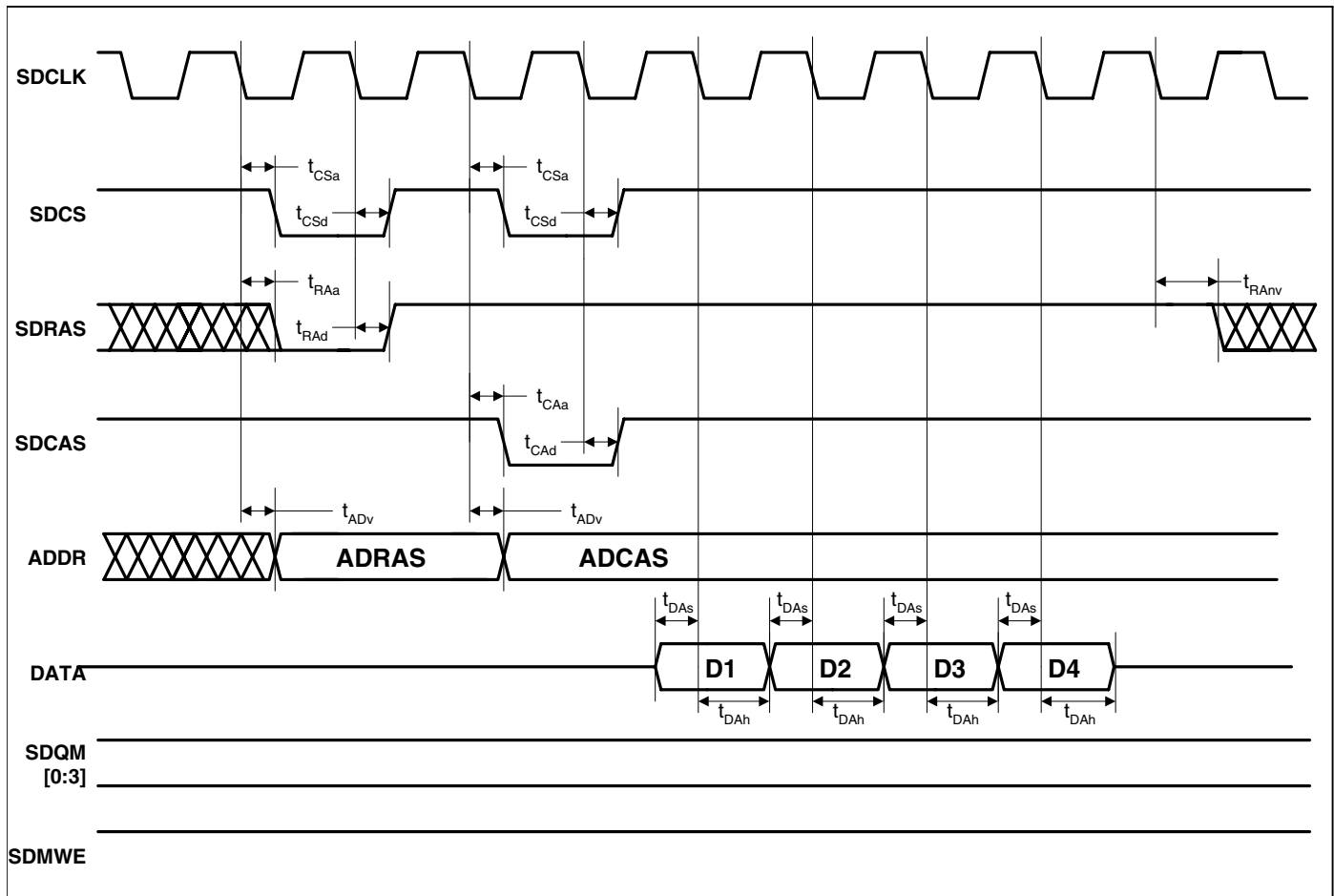
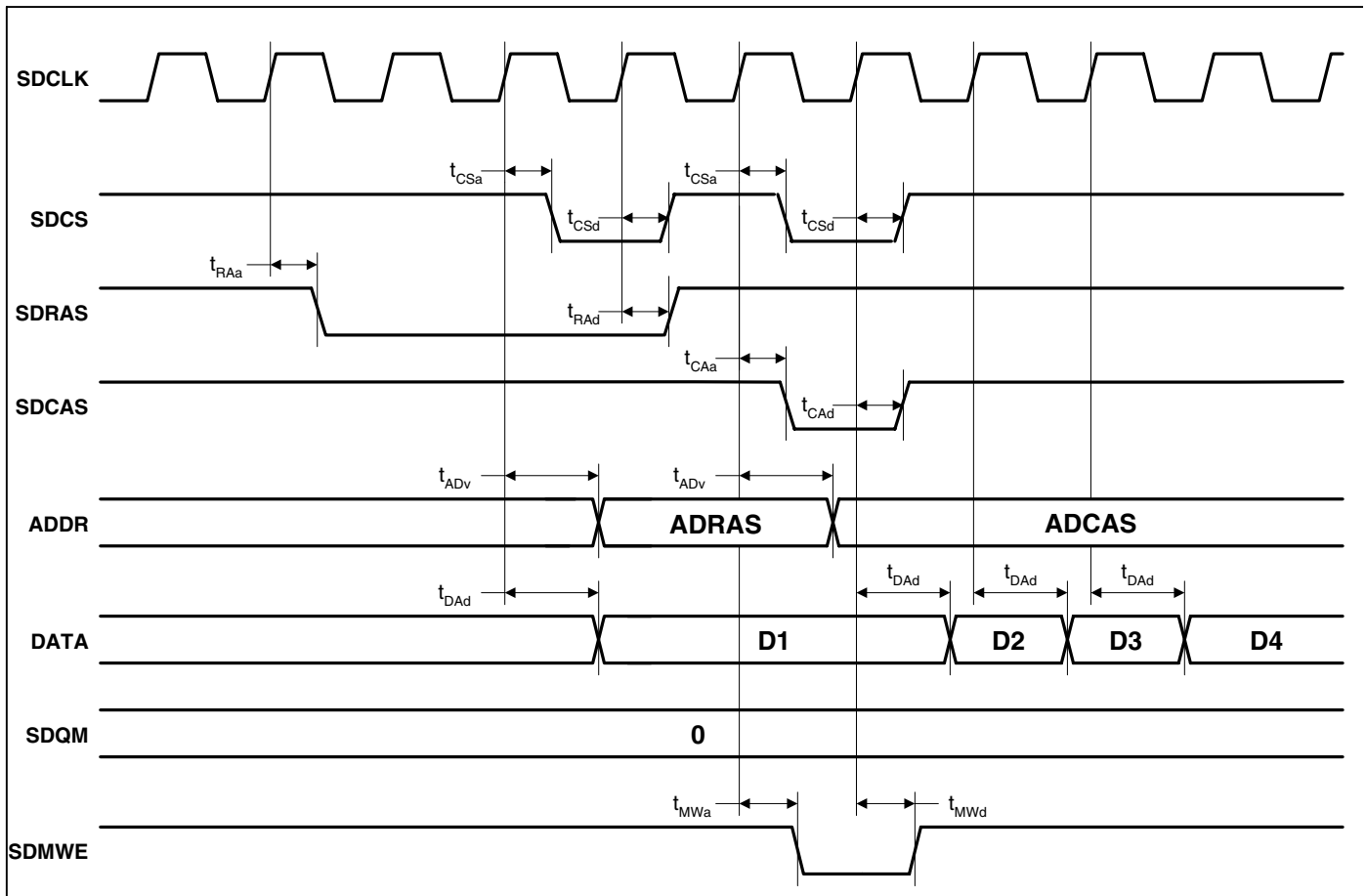


Figure 4. SDRAM Burst Read Cycle Timing Measurement

- Note:
1. Timings are shown with CAS latency = 2
  2. The SDCLK signal may be phase shifted relative to the rest of the SDRAM control and data signals due to uneven loading. Designers should take care to ensure that delays between SDRAM control and data signals are approximately equal.

**SDRAM Burst Write Cycle**


**Figure 5. SDRAM Burst Write Cycle Timing Measurement**

- Note:
1. Timings are shown with CAS latency = 2
  2. The SDCLK signal may be phase shifted relative to the rest of the SDRAM control and data signals due to uneven loading. Designers should take care to ensure that delays between SDRAM control and data signals are approximately equal

## SDRAM Refresh Cycle

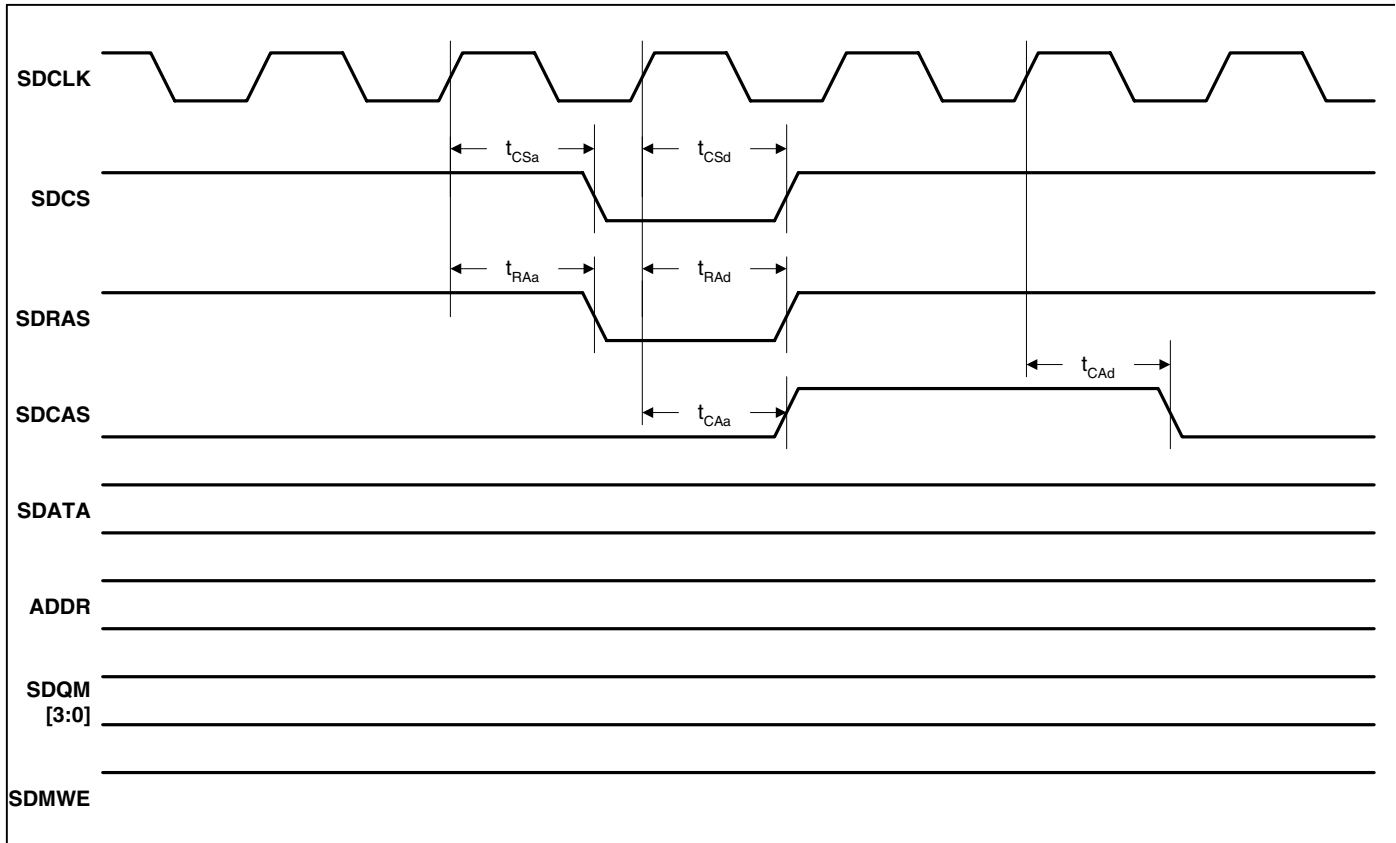


Figure 6. SDRAM Refresh Cycle Timing Measurement

- Note:
1. Timings are shown with CAS latency = 2
  2. The SDCLK signal may be phase shifted relative to the rest of the SDRAM control and data signals due to uneven loading. Designers should take care to ensure that delays between SDRAM control and data signals are approximately equal

## Static Memory

Figure 7 through Figure 10 define the timings associated with all phases of the Static Memory. The following table contains the values for the timings of each of the Static Memory modes.

Parameter	Symbol	Min	Typ	Max	Unit
EXPCLK rising edge to nCS assert delay time	$t_{CSd}$	2	8	20	ns
EXPCLK falling edge to nCS deassert hold time	$t_{CSh}$	2	7	20	ns
EXPCLK rising edge to A assert delay time	$t_{Ad}$	4	9	16	ns
EXPCLK falling edge to A deassert hold time	$t_{Ah}$	3	10	19	ns
EXPCLK rising edge to nMWE assert delay time	$t_{MWd}$	3	6	10	ns
EXPCLK rising edge to nMWE deassert hold time	$t_{MWh}$	3	6	10	ns
EXPCLK falling edge to nMOE assert delay time	$t_{MOEd}$	3	7	10	ns
EXPCLK falling edge to nMOE deassert hold time	$t_{MOEh}$	2	7	10	ns
EXPCLK falling edge to HALFWORD deassert delay time	$t_{HWd}$	2	8	20	ns
EXPCLK falling edge to WORD assert delay time	$t_{WDd}$	2	8	16	ns
EXPCLK rising edge to data valid delay time	$t_{Dv}$	8	13	21	ns
EXPCLK falling edge to data invalid delay time	$t_{Dnv}$	6	15	30	ns
Data setup to EXPCLK falling edge time	$t_{Ds}$	-	-	1	ns
EXPCLK falling edge to data hold time	$t_{Dh}$	-	-	3	ns
EXPCLK rising edge to WRITE assert delay time	$t_{WRd}$	5	11	23	ns
EXPREADY setup to EXPCLK falling edge time	$t_{EXs}$	-	-	0	ns
EXPCLK falling edge to EXPREADY hold time	$t_{EXh}$	-	-	0	ns

### Static Memory Single Read Cycle

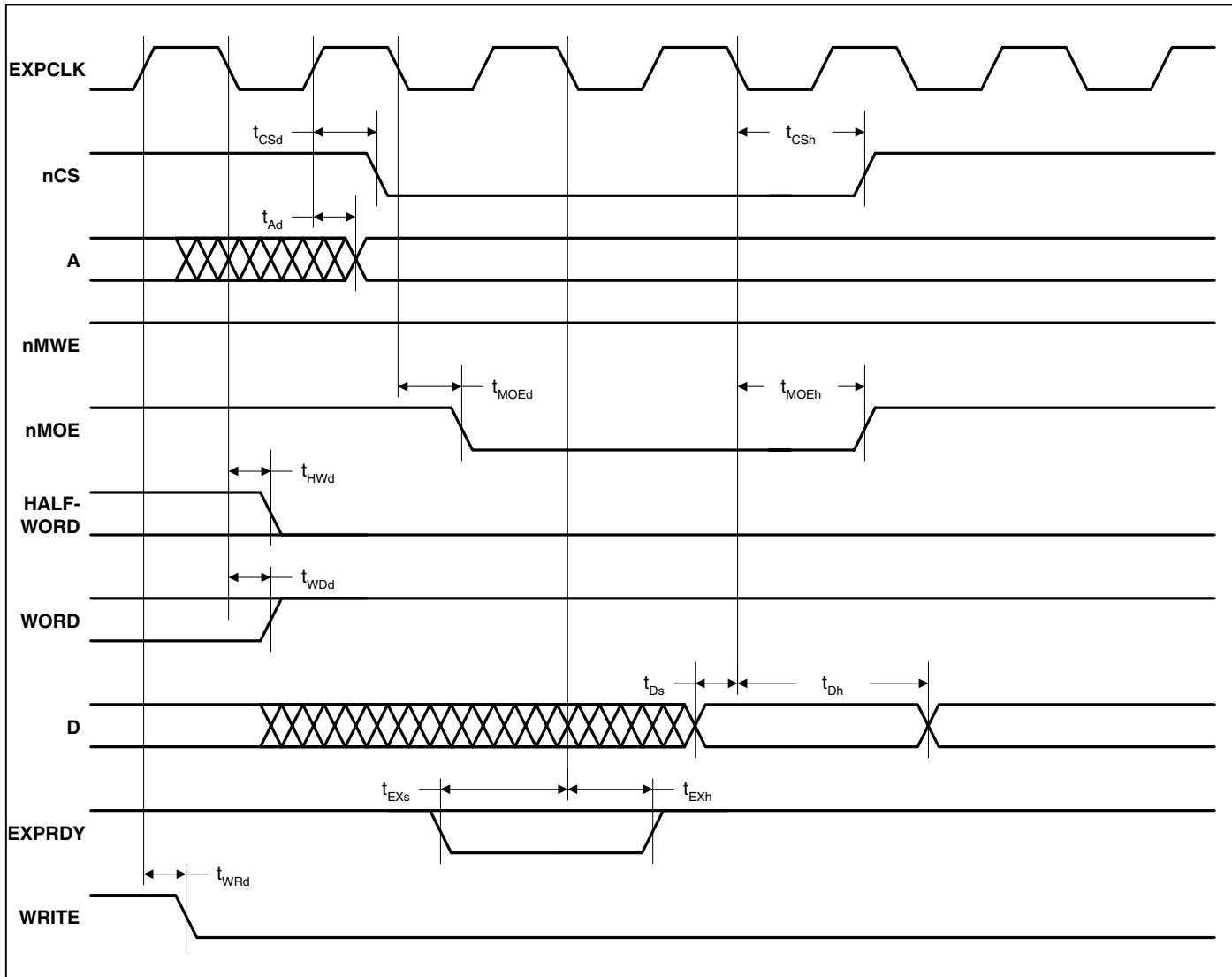
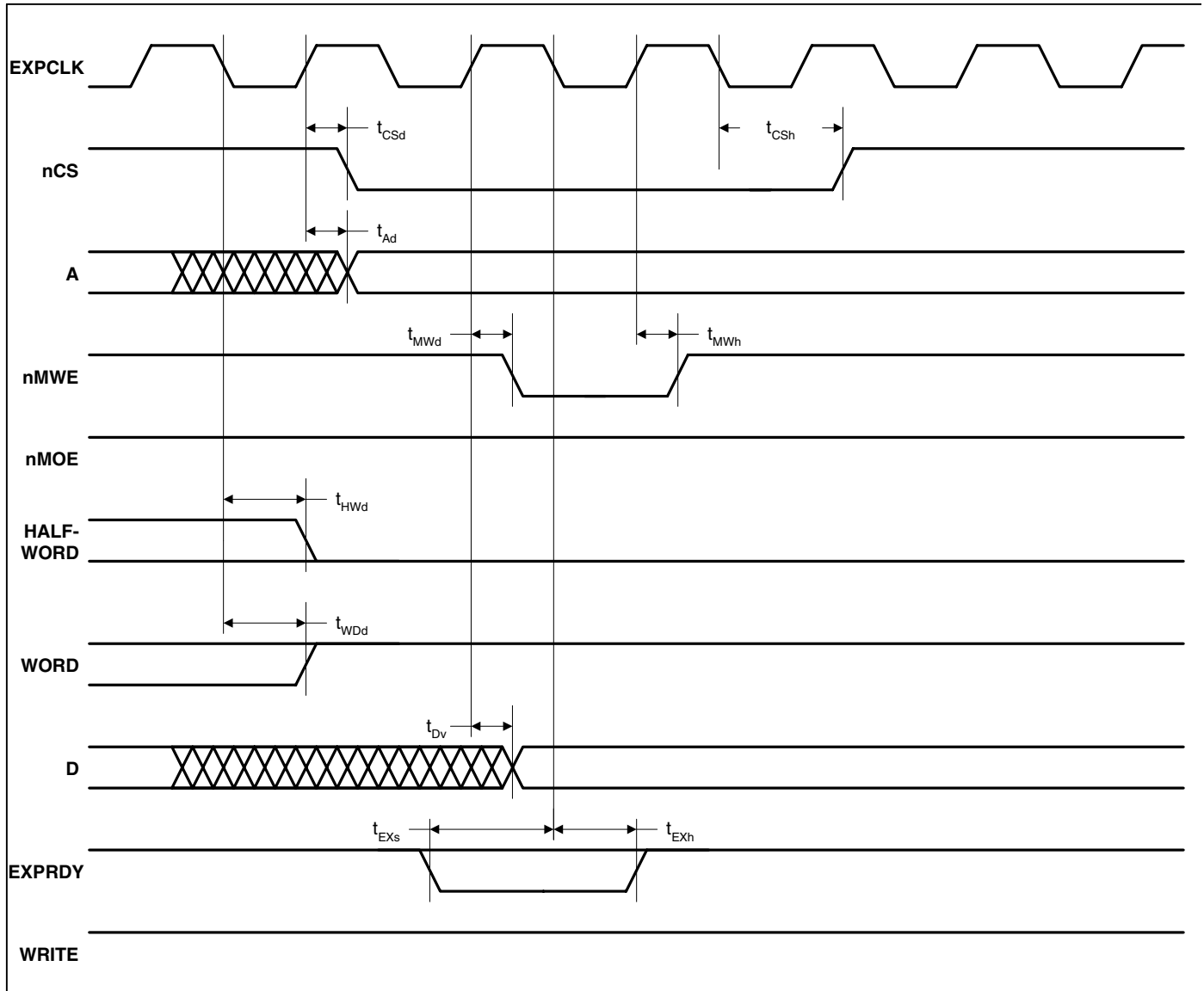


Figure 7. Static Memory Single Read Cycle Timing Measurement

Note: 1. The cycle time can be extended by integer multiples of the clock period (22 ns at 45 MHz, 27 ns at 36 MHz, 54 ns at 18.432 MHz, and 77 ns at 13 MHz), by either driving EXPRDY low and/or by programming a number of wait states. EXPRDY is sampled on the falling edge of EXPCLK before the data transfer. If low at this point, the transfer is delayed by one clock period where EXPRDY is sampled again. EXPCLK need not be referenced when driving EXPRDY, but is shown for clarity.  
2. Address, Halfword, Word, and Write hold state until next cycle.

**Static Memory Single Write Cycle**

**Figure 8. Static Memory Single Write Cycle Timing Measurement**

- Note:
1. The cycle time can be extended by integer multiples of the clock period (22 ns at 45 MHz, 27 ns at 36 MHz, 54 ns at 18.432 MHz, and 77 ns at 13 MHz), by either driving EXPRDY low and/or by programming a number of wait states. EXPRDY is sampled on the falling edge of EXPCLK before the data transfer. If low at this point, the transfer is delayed by one clock period where EXPRDY is sampled again. EXPCLK need not be referenced when driving EXPRDY, but is shown for clarity.
  2. Zero wait states for sequential writes is not permitted for memory devices which use nMWE pin, as this cannot be driven with valid timing under zero wait state conditions.
  3. Address, Data, Halfword, Word, and Write hold state until next cycle.



## Static Memory Burst Read Cycle

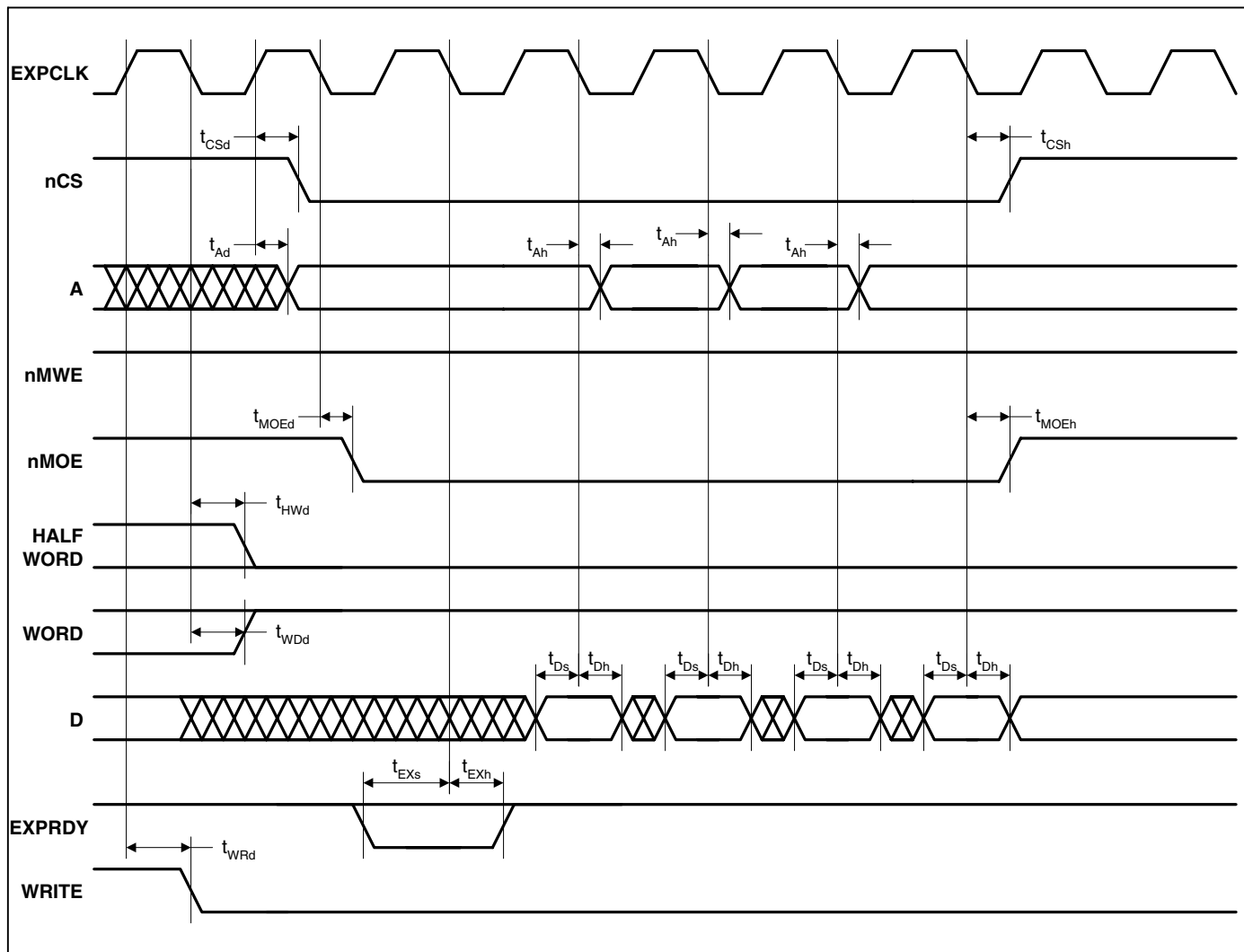
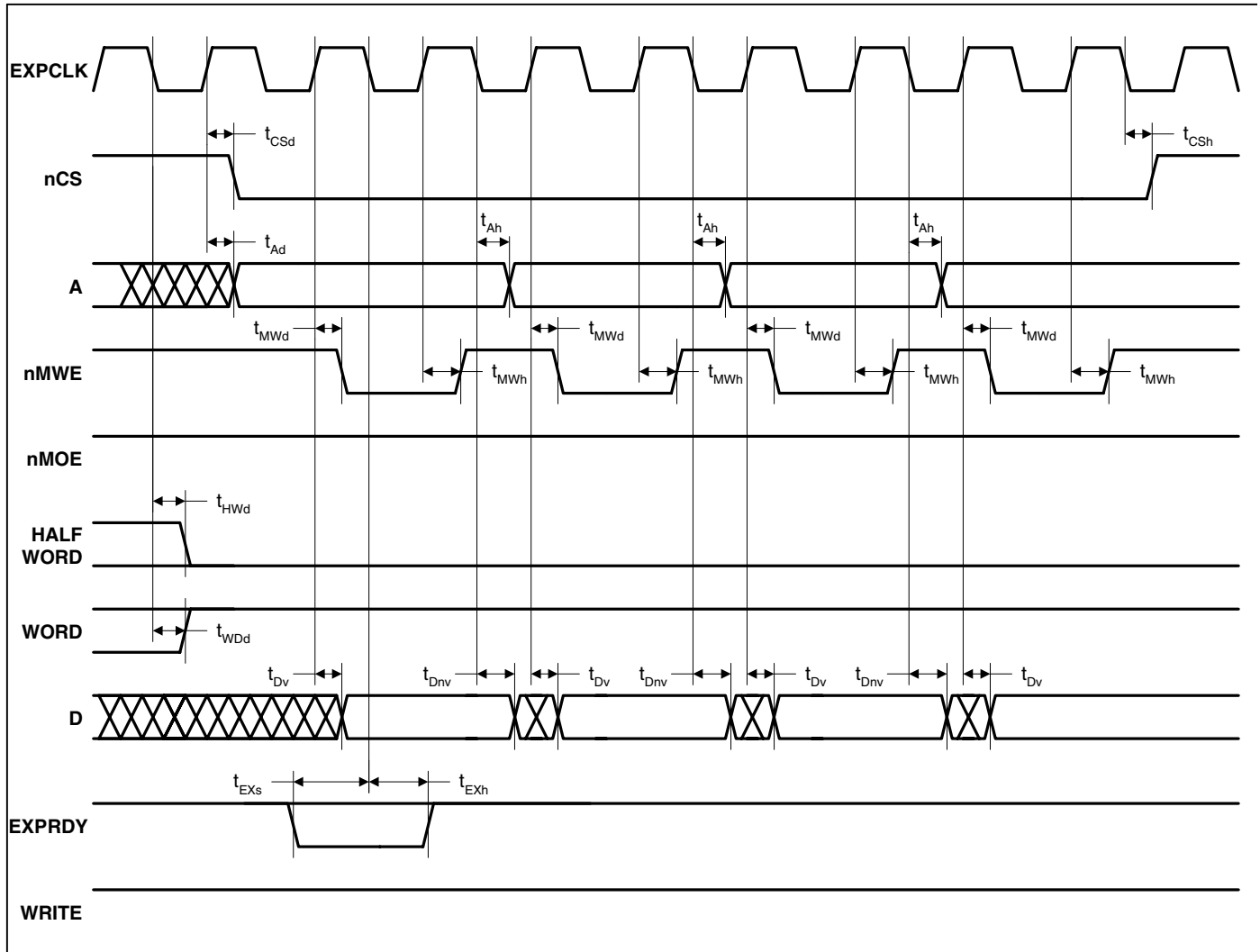


Figure 9. Static Memory Burst Read Cycle Timing Measurement

- Note:
1. Four cycles are shown in the above diagram (minimum wait states, 1-0-0-0). This is the maximum number of consecutive cycles that can be driven. The number of consecutive cycles can be programmed from 2 to 4, inclusively.
  2. The cycle time can be extended by integer multiples of the clock period (22 ns at 45 MHz, 27 ns at 36 MHz, 54 ns at 18.432 MHz, and 77 ns at 13 MHz), by either driving EXPRDY low and/or by programming a number of wait states. EXPRDY is sampled on the falling edge of EXPCLK before the data transfer. If low at this point, the transfer is delayed by one clock period where EXPRDY is sampled again. EXPCLK need not be referenced when driving EXPRDY, but is shown for clarity.
  3. Consecutive reads with sequential access enabled are identical except that the sequential access wait state field is used to determine the number of wait states, and no idle cycles are inserted between successive non-sequential ROM/expansion cycles. This improves performance so the SQAEN bit should always be set where possible.
  4. Address, Halfword, Word, and Write hold state until next cycle.

**Static Memory Burst Write Cycle**

**Figure 10. Static Memory Burst Write Cycle Timing Measurement**

- Note:
1. Four cycles are shown in the above diagram (minimum wait states, 1-1-1-1). This is the maximum number of consecutive cycles that can be driven. The number of consecutive cycles can be programmed from 2 to 4, inclusively.
  2. The cycle time can be extended by integer multiples of the clock period (22 ns at 45 MHz, 27 ns at 36 MHz, 54 ns at 18.432 MHz, and 77 ns at 13 MHz), by either driving EXPRDY low and/or by programming a number of wait states. EXPRDY is sampled on the falling edge of EXPCLK before the data transfer. If low at this point, the transfer is delayed by one clock period where EXPRDY is sampled again. EXPCLK need not be referenced when driving EXPRDY, but is shown for clarity.
  3. Zero wait states for sequential writes is not permitted for memory devices which use nMWE pin, as this cannot be driven with valid timing under zero wait state conditions.
  4. Address, Data, Halfword, Word, and Write hold state until next cycle.

## SSI1 Interface

Parameter	Symbol	Min	Max	Unit
ADCCLK falling edge to nADCCSS deassert delay time	$t_{Cd}$	9	10	ms
ADCIN data setup to ADCCLK rising edge time	$t_{INs}$	-	15	ns
ADCIN data hold from ADCCLK rising edge time	$t_{INh}$	-	14	ns
ADCCLK falling edge to data valid delay time	$t_{Ovd}$	-7	13	ns
ADCCLK falling edge to data invalid delay time	$t_{Od}$	-2	3	ns

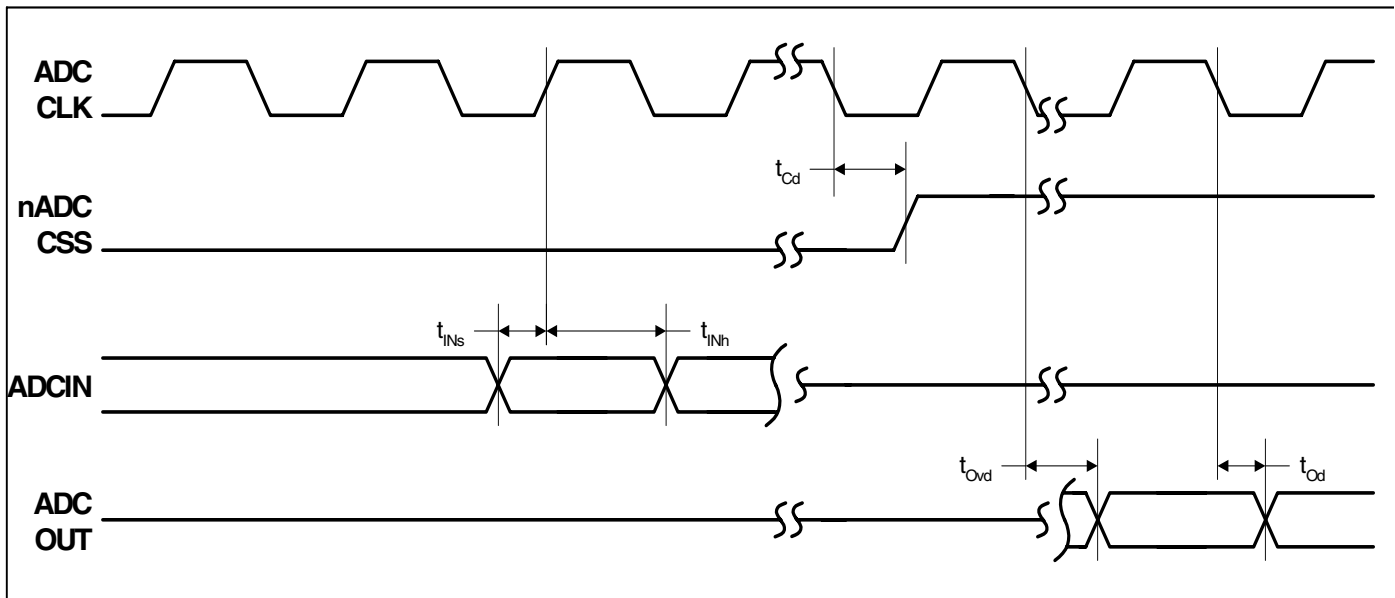
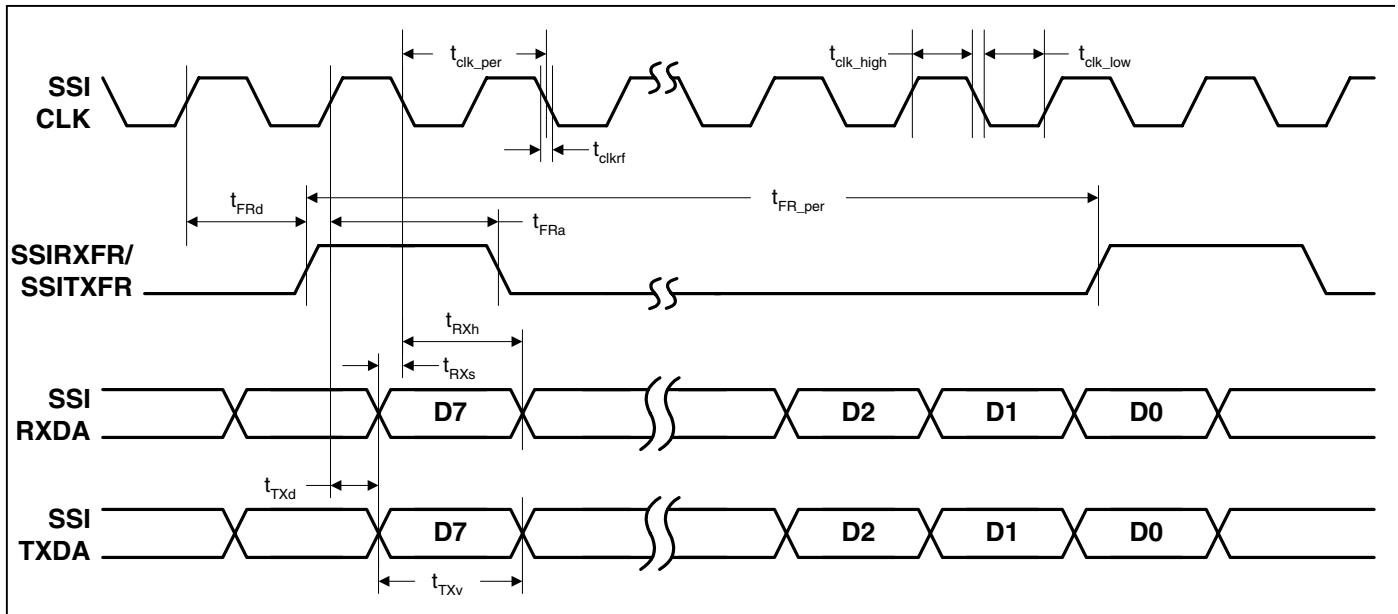


Figure 11. SSI1 Interface Timing Measurement

**SSI2 Interface**

Parameter	Symbol	Min	Max	Unit
SSICLK period (slave mode)	$t_{clk\_per}$	185	2050	ns
SSICLK high time	$t_{clk\_high}$	925	1025	ns
SSICLK low time	$t_{clk\_low}$	925	1025	ns
SSICLK rise/fall time	$t_{clkrf}$	3	18	ns
SSICLK rising edge to RX and/or TX frame sync high time	$t_{FRd}$	-	3	ns
SSICLK rising edge to RX and/or TX frame sync low time	$t_{FRa}$	-	8	ns
SSIRXFR and/or SSITXFR period	$t_{FR\_per}$	960	990	ns
SSIRXDA setup to SSICLK falling edge time	$t_{RXs}$	3	7	ns
SSIRXDA hold from SSICLK falling edge time	$t_{RXh}$	3	7	ns
SSICLK rising edge to SSITXDA data valid delay time	$t_{TXd}$	-	2	ns
SSITXDA valid time	$t_{TXv}$	960	990	ns


**Figure 12. SSI2 Interface Timing Measurement**

## LCD Interface

Parameter	Symbol	Min	Max	Unit
CL[2] falling to CL[1] rising delay time	$t_{CL1d}$	- 10	25	ns
CL[1] falling to CL[2] rising delay time	$t_{CL2d}$	80	3,475	ns
CL[1] falling to FRM transition time	$t_{FRMd}$	300	10,425	ns
CL[1] falling to M transition time	$t_{Md}$	- 10	20	ns
CL[2] rising to DD (display data) transition time	$t_{DDd}$	- 10	20	ns

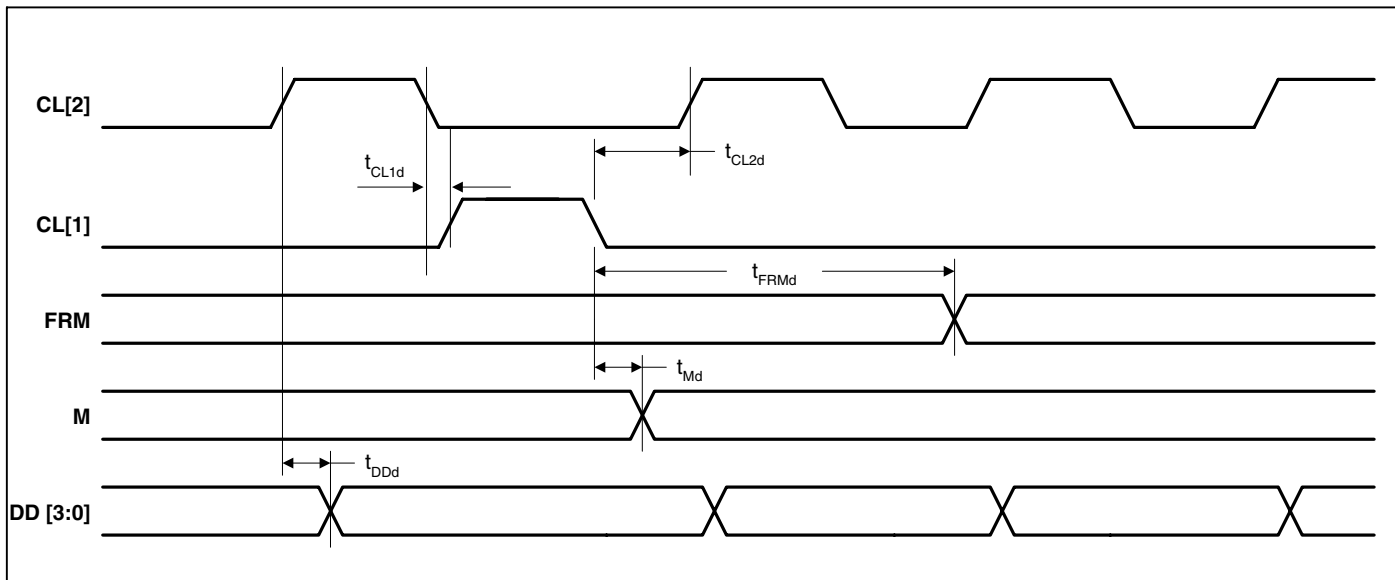
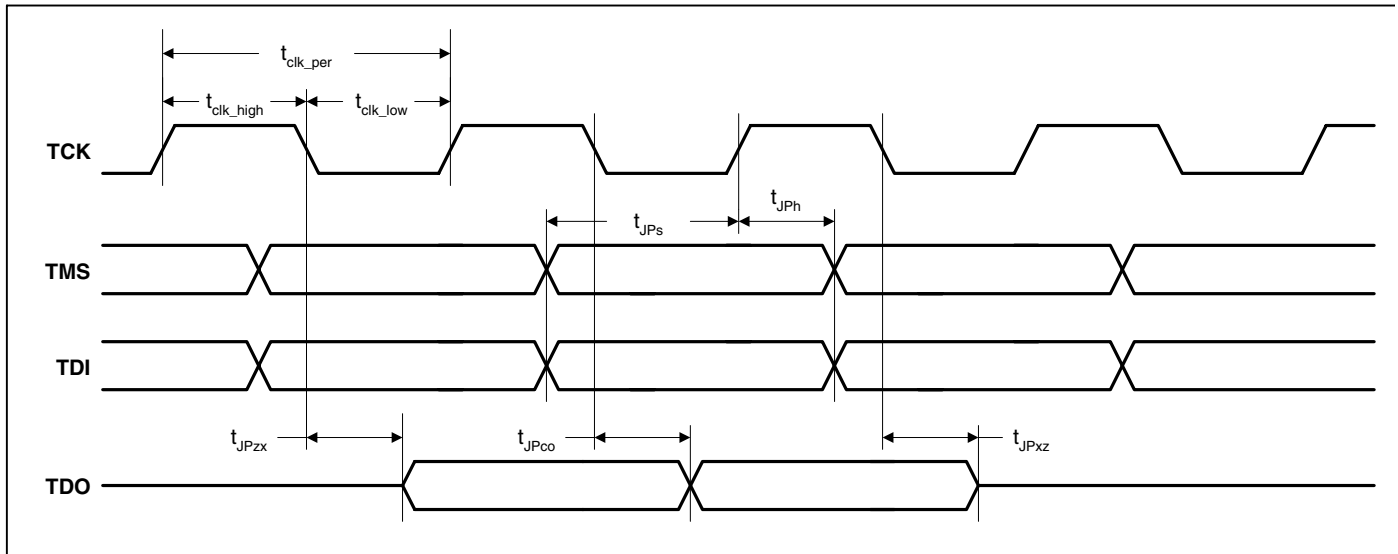


Figure 13. LCD Controller Timing Measurement

## JTAG Interface

Parameter	Symbol	Min	Max	Units
TCK clock period	$t_{clk\_per}$	2	-	ns
TCK clock high time	$t_{clk\_high}$	1	-	ns
TCK clock low time	$t_{clk\_low}$	1	-	ns
JTAG port setup time	$t_{JP_s}$	-	0	ns
JTAG port hold time	$t_{JP_h}$	-	3	ns
JTAG port clock to output	$t_{JP_{co}}$	-	10	ns
JTAG port high impedance to valid output	$t_{JP_{zx}}$	-	12	ns
JTAG port valid output to high impedance	$t_{JP_{xz}}$	-	19	ns



**Figure 14. JTAG Timing Measurement**

## Packages

### 208-Pin LQFP Package Characteristics

#### 208-Pin LQFP Package Specifications

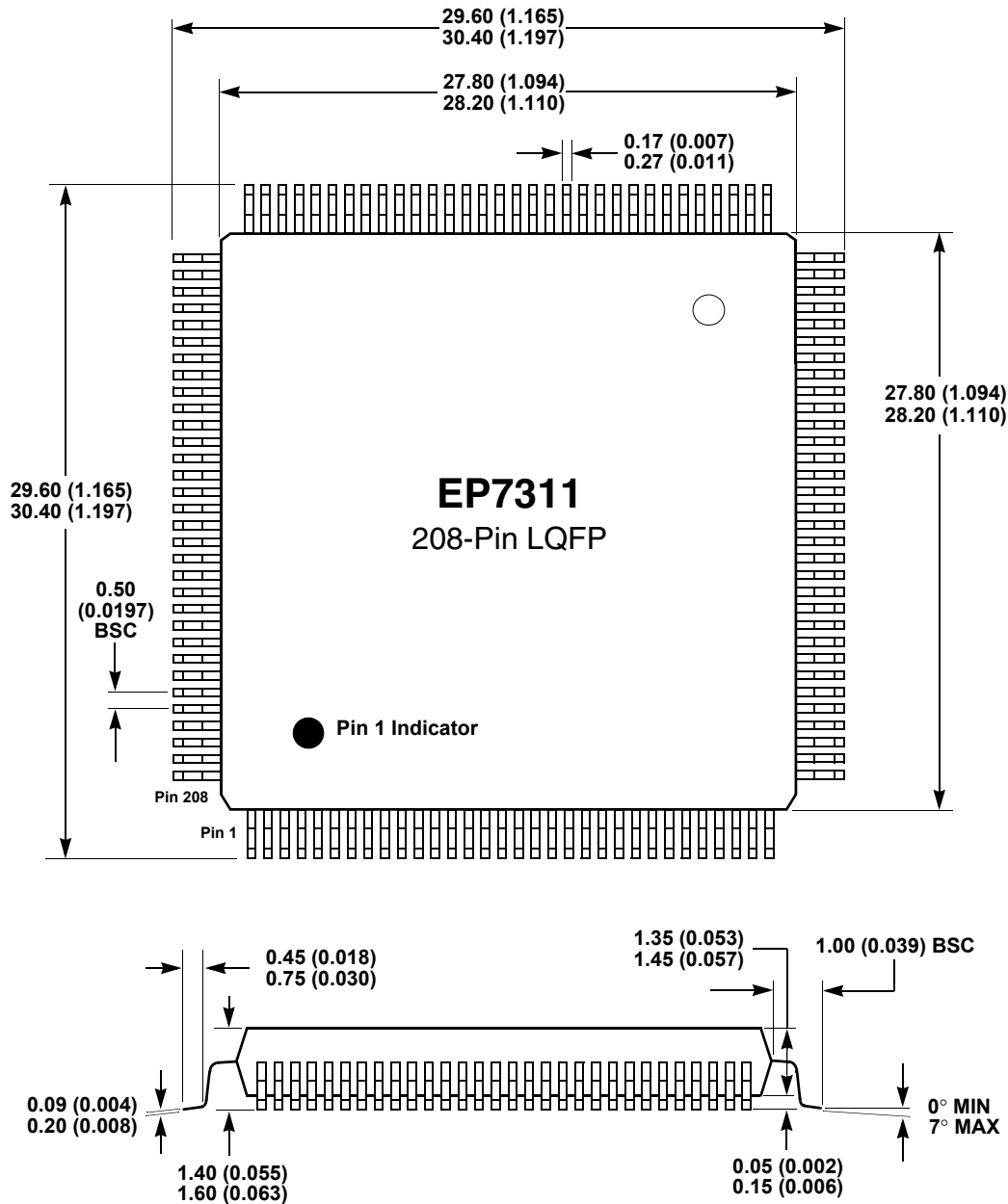


Figure 15. 208-Pin LQFP Package Outline Drawing

- Note:
- 1) Dimensions are in millimeters (inches), and controlling dimension is millimeter.
  - 2) Drawing above does not reflect exact package pin count.
  - 3) Before beginning any new design with this device, please contact Cirrus Logic for the latest package information.
  - 4) For pin locations, please see [Figure 16](#). For pin descriptions see the EP7311 User's Manual.

208-Pin LQFP Pin Diagram

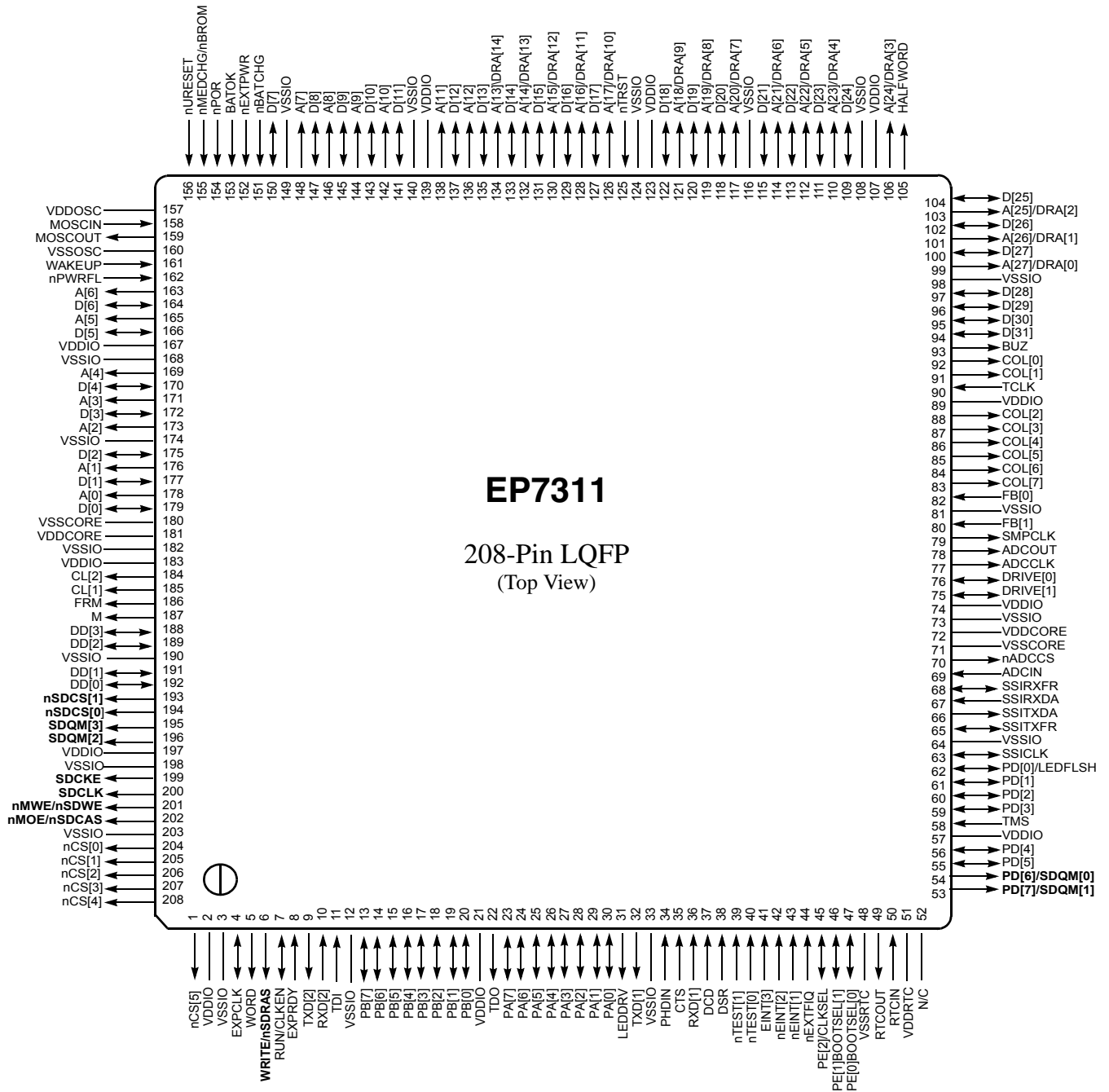


Figure 16. 208-Pin LQFP (Low Profile Quad Flat Pack) Pin Diagram

- Note:
1. N/C should not be grounded but left as no connects.
  2. Pin differences between the EP7211 and the EP7311 are bolded.



## 208-Pin LQFP Numeric Pin Listing

Table T. 208-Pin LQFP Numeric Pin Listing

Pin No.	Signal	Type	Strength	Reset State
1	nCS[5]	O	1	Low
2	VDDIO	Pad Pwr		
3	VSSIO	Pad Gnd		
4	EXPCLK	I/O	1	
5	WORD	Out	1	Low
6	WRITE/nSDRAS	Out	1	Low
7	RUN/CLKEN	O	1	Low
8	EXPRDY	I	1	
9	TXD[2]	O	1	High
10	RXD[2]	I		
11	TDI	I	with p/u*	
12	VSSIO	Pad Gnd		
13	PB[7]	I/O	1	Input
14	PB[6]	I/O	1	Input
15	PB[5]	I/O	1	Input
16	PB[4]	I/O	1	Input
17	PB[3]	I/O	1	Input
18	PB[2]	I/O	1	Input
19	PB[1]/PRDY2	I/O	1	Input
20	PB[0]/PRDY1	I/O	1	Input
21	VDDIO	Pad Pwr		
22	TDO	O	1	Three state
23	PA[7]	I/O	1	Input
24	PA[6]	I/O	1	Input
25	PA[5]	I/O	1	Input
26	PA[4]	I/O	1	Input
27	PA[3]	I/O	1	Input
28	PA[2]	I/O	1	Input
29	PA[1]	I/O	1	Input
30	PA[0]	I/O	1	Input
31	LEDDRV	O	1	Low
32	TXD[1]	O	1	High
33	VSSIO	Pad Gnd	1	High
34	PHDIN	I		
35	CTS	I		
36	RXD[1]	I		

Table T. 208-Pin LQFP Numeric Pin Listing (Continued)

Pin No.	Signal	Type	Strength	Reset State
37	DCD	I		
38	DSR	I		
39	nTEST[1]	I	With p/u*	
40	nTEST[0]	I	With p/u*	
41	EINT[3]	I		
42	nEINT[2]	I		
43	nEINT[1]	I		
44	nEXTFIQ	I		
45	PE[2]/CLKSEL	I/O	1	Input
46	PE[1]/ BOOTSEL[1]	I/O	1	Input
47	PE[0]/ BOOTSEL[0]	I/O	1	Input
48	VSSRTC	RTC Gnd		
49	RTCCOUT	O		
50	RTCCIN	I		
51	VDDRTC	RTC power		
52	N/C			
53	PD[7]/SDQM[1]	I/O	1	Low
54	PD[6]/SDQM[0]	I/O	1	Low
55	PD[5]	I/O	1	Low
56	PD[4]	I/O	1	Low
57	VDDIO	Pad Pwr		
58	TMS	I	with p/u*	
59	PD[3]	I/O	1	Low
60	PD[2]	I/O	1	Low
61	PD[1]	I/O	1	Low
62	PD[0]/LEDFLSH	I/O	1	Low
63	SSICLK	I/O	1	Input
64	VSSIO	Pad Gnd		
65	SSITXFR	I/O	1	Low
66	SSITXDA	O	1	Low
67	SSIRXDA	I		
68	SSIRXFR	I/O		Input
69	ADCIN	I		
70	nADCCS	O	1	High
71	VSSCORE	Core Gnd		
72	VDDCORE	Core Pwr		

**Table T. 208-Pin LQFP Numeric Pin Listing (Continued)**

Pin No.	Signal	Type	Strength	Reset State
73	VSSIO	Pad Gnd		
74	VDDIO	Pad Pwr		
75	DRIVE[1]	I/O	2	High / Low
76	DRIVE[0]	I/O	2	High / Low
77	ADCCLK	O	1	Low
78	ADCOUT	O	1	Low
79	SMPCLK	O	1	Low
80	FB[1]	I		
81	VSSIO	Pad Gnd		
82	FB[0]	I		
83	COL[7]	O	1	High
84	COL[6]	O	1	High
85	COL[5]	O	1	High
86	COL[4]	O	1	High
87	COL[3]	O	1	High
88	COL[2]	O	1	High
89	VDDIO	Pad Pwr		
90	TCLK	I		
91	COL[1]	O	1	High
92	COL[0]	O	1	High
93	BUZ	O	1	Low
94	D[31]	I/O	1	Low
95	D[30]	I/O	1	Low
96	D[29]	I/O	1	Low
97	D[28]	I/O	1	Low
98	VSSIO	Pad Gnd		
99	A[27]/DRA[0]	O	2	Low
100	D[27]	I/O	1	Low
101	A[26]/DRA[1]	O	2	Low
102	D[26]	I/O	1	Low
103	A[25]/DRA[2]	O	2	Low
104	D[25]	I/O	1	Low
105	HALFWORD	O	1	Low
106	A[24]/DRA[3]	O	1	Low
107	VDDIO	Pad Pwr		—
108	VSSIO	Pad Gnd		—
109	D[24]	I/O	1	Low

**Table T. 208-Pin LQFP Numeric Pin Listing (Continued)**

Pin No.	Signal	Type	Strength	Reset State
110	A[23]/DRA[4]	O	1	Low
111	D[23]	I/O	1	Low
112	A[22]/DRA[5]	O	1	Low
113	D[22]	I/O	1	Low
114	A[21]/DRA[6]	O	1	Low
115	D[21]	I/O	1	Low
116	VSSIO	Pad Gnd		
117	A[20]/DRA[7]	O	1	Low
118	D[20]	I/O	1	Low
119	A[19]/DRA[8]	O	1	Low
120	D[19]	I/O	1	Low
121	A[18]/DRA[9]	O	1	Low
122	D[18]	I/O	1	Low
123	VDDIO	Pad Pwr		
124	VSSIO	Pad Gnd		
125	nTRST	I		
126	A[17]/DRA[10]	O	1	Low
127	D[17]	I/O	1	Low
128	A[16]/DRA[11]	O	1	Low
129	D[16]	I/O	1	Low
130	A[15]/DRA[12]	O	1	Low
131	D[15]	I/O	1	Low
132	A[14]/DRA[13]	O	1	Low
133	D[14]	I/O	1	Low
134	A[13]/DRA[14]	O	1	Low
135	D[13]	I/O	1	Low
136	A[12]	O	1	Low
137	D[12]	I/O	1	Low
138	A[11]	O	1	Low
139	VDDIO	Pad Pwr		
140	VSSIO	Pad Gnd		
141	D[11]	I/O	1	Low
142	A[10]	O	1	Low
143	D[10]	I/O	1	Low
144	A[9]	O	1	Low
145	D[9]	I/O	1	Low
146	A[8]	O	1	Low
147	D[8]	I/O	1	Low

Table T. 208-Pin LQFP Numeric Pin Listing (Continued)

Pin No.	Signal	Type	Strength	Reset State
148	A[7]	O	1	Low
149	VSSIO	Pad Gnd		
150	D[7]	I/O	1	Low
151	nBATCHG	I		
152	nEXTPWR	I		
153	BATOK	I		
154	nPOR	I	Schmitt	
155	nMEDCHG/ nBROM	I		
156	nURESET	I	Schmitt	
157	VDDOSC	Osc Pwr		
158	MOSCIN	Osc		
159	MOSCOU	Osc		
160	VSSOSC	Osc Gnd		
161	WAKEUP	I	Schmitt	
162	nPWRFL	I		
163	A[6]	O	1	Low
164	D[6]	I/O	1	Low
165	A[5]	Out	1	Low
166	D[5]	I/O	1	Low
167	VDDIO	Pad Pwr		
168	VSSIO	Pad Gnd		
169	A[4]	O	1	Low
170	D[4]	I/O	1	Low
171	A[3]	O	2	Low
172	D[3]	I/O	1	Low
173	A[2]	O	2	Low
174	VSSIO	Pad Gnd		
175	D[2]	I/O	1	Low
176	A[1]	O	2	Low
177	D[1]	I/O	1	Low
178	A[0]	O	2	Low
179	D[0]	I/O	1	Low
180	VSS CORE	Core Gnd		
181	VDD CORE	Core Pwr		
182	VSSIO	Pad Gnd		
183	VDDIO	Pad Pwr		
184	CL[2]	O	1	Low
185	CL[1]	O	1	Low

Table T. 208-Pin LQFP Numeric Pin Listing (Continued)

Pin No.	Signal	Type	Strength	Reset State
186	FRM	O	1	Low
187	M	O	1	Low
188	DD[3]	I/O	1	Low
189	DD[2]	I/O	1	Low
190	VSSIO	Pad Gnd		
191	DD[1]	I/O	1	Low
192	DD[0]	I/O	1	Low
193	nSDCS[1]	O	1	High
194	nSDCS[0]	O	1	High
195	SDQM[3]	I/O	2	Low
196	SDQM[2]	I/O	2	Low
197	VDDIO	Pad Pwr		
198	VSSIO	Pad Gnd		
199	SDCKE	I/O	2	Low
200	SDCLK	I/O	2	Low
201	nMWE/nSDWE	O	1	High
202	nMOE/nSDCAS	O	1	High
203	VSSIO	Pad Gnd		
204	nCS[0]	O	1	High
205	nCS[1]	O	1	High
206	nCS[2]	O	1	High
207	nCS[3]	O	1	High
208	nCS[4]	O	1	High

\*With p/u' means with internal pull-up on the pin.

## 204-Ball TFBGA Package Characteristics

### 204-Ball TFBGA Package Specifications

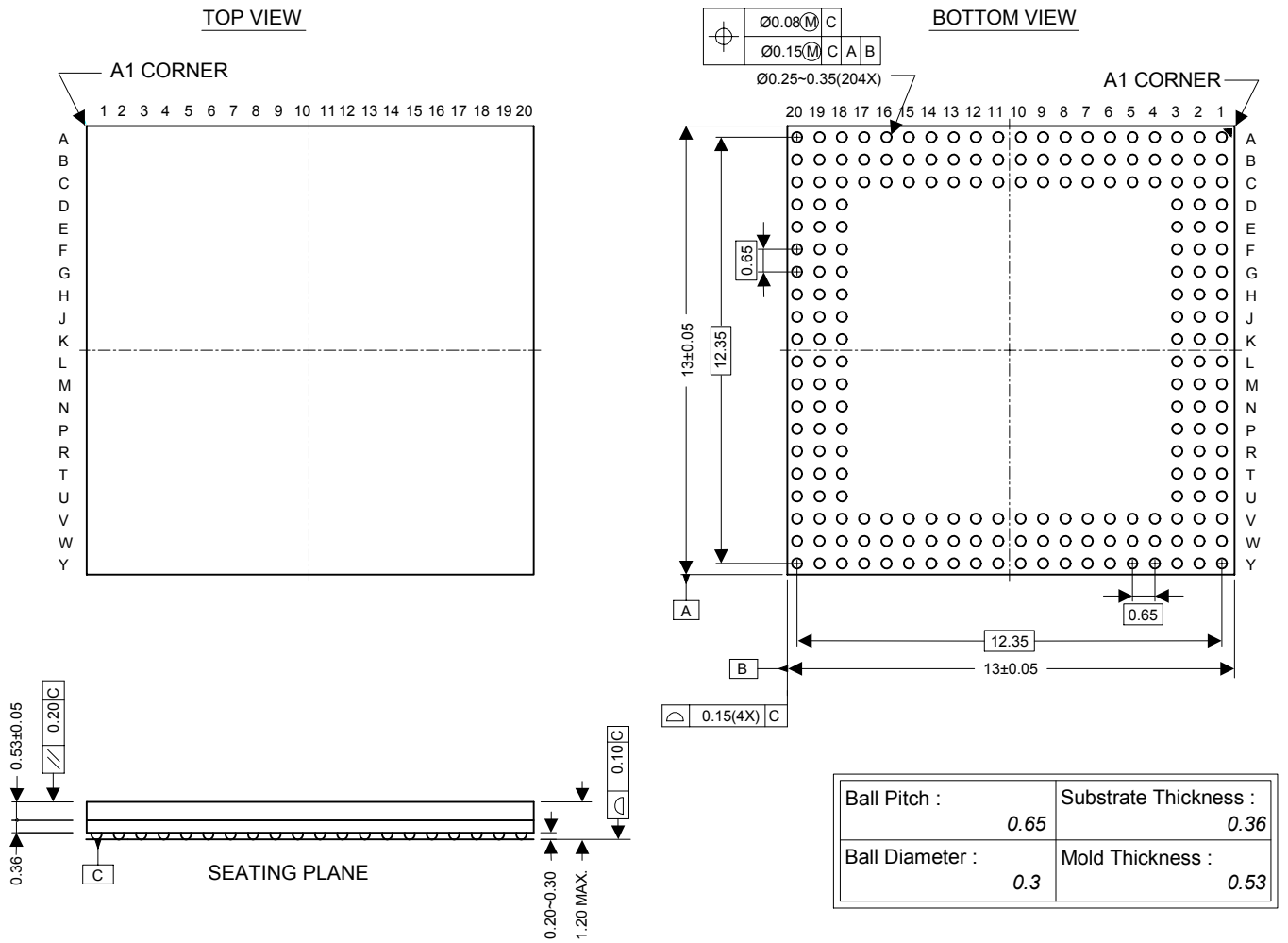


Figure 17. 204-Ball TFBGA Package

204-Ball TFBGA Pinout (Top View)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
A	VDDIO	EXPCLK	nCS3	nCS1	nMWE/ nSDWE	SDQM2	nSDCS1	DD2	FRM	CL1	GNDCOR E	D1	A2	D4	A5	nPWRFL	MOSCOUT	GNDIO	GNDIO	GNDIO	A
B	WORD	VDDIO	nCS5	nCS2	nMOE/ nSDCAS	SDCKE	nSDCS0	DD1	M	CL2	D0	A1	D3	A4	D6	WAKEUP	MOSCIN	GNDIO	GNDIO	nURESET	B
C	RUN/ CLKEN	EXPRDY	VDDIO	nCS4	nCS0	SDCLK	SDQM3	DD0	DD3	VDDCO RE	A0	D2	A3	D5	A6	GNDOS C	VDDOSC	GNDIO	BATOK	nPOR	C
D	PB7	RXD2	VDDIO															GNDIO	nBATCHG	A7	D
E	PB4	TXD2	WRITE/ nSDRAS															nMEDCHG nBROM	nEXTPWR	D9	E
F	PB3	PB6	TDI															D7	A8	D10	F
G	PB1/ PRDY2	PB2	PB5															D8	A9	D11	G
H	PA7	TDO	PB0/ PRDY1															A10	D12	A12	H
J	PA4	PA5	PA6															A11	D13	A13/ DRA14	J
K	PA1	PA2	VDDIO															D14	A14/ DRA13	D15	K
L	TXD1	LEDDRV	PA3															VDDIO	D16	A16/ DRA11	L
M	RXD1	CTS	PA0															A15/ DRA12	A17/ DRA10	nTRST	M
N	DSR	nTEST1	PHDIN															D17	D19	A18/ DRA9	N
P	EINT3	nEINT2	DCD															D18	A20/ DRA7	D20	P
R	nEXTFIQ	PE2/ CLKSEL	nTEST0															A19/ DRA8	D22	A21/ DRA6	R
T	PE1/ BOOT SEL1	PE0/ BOOT SEL0	nEINT1															D21	D23	A22/ DRA5	T
U	GNDRTC	RTXCOUT	RTCIN															HALF WORD	D24	A23/ DRA4	U
V	VDDRTC	GNDIO	GNDIO	PD7/ SDQM1	PD4	PD2	SSICLK	SSIRXDA	nADCCS	VDDIO	ADCCLK	COL7	COL4	TCLK	BUZ	D29	A26/ DRA1	VDDIO	VDDIO	A24/ DRA3	V
W	GNDIO	GNDIO	GNDIO	PD6/ SD QM0	TMS	PD1	SSITXFR	SSIRXFR	GNDCO RE	DRIVE1	ADCOUT	FB0	COL5	COL2	COL0	D30	A27/ DRA0	D26	VDDIO	D25	W
Y	GNDIO	GNDIO	GNDIO	PD5	PD3	PD0/ LED FLSH	SSITXDA	ADCIN	VDDCO RE	DRIVE0	SMPCLK	FB1	COL6	COL3	COL1	D31	D28	D27	A25/ DRA2	VDDIO	Y

## 204-Ball TFBGA Ball Listing

The list is ordered by ball location.

**Table 21. 204-Ball TFBGA Ball Listing**

Ball Location	Name	Strength <sup>†</sup>	Reset State	Type	Description
A1	VDDIO			Pad power	Digital I/O power, 3.3 V
A2	EXPCLK	1		I	Expansion clock input
A3	nCS[3]	1	High	O	Chip select 3
A4	nCS[1]	1	High	O	Chip select 1
A5	nMWE/nSDWE	1	High	O	ROM, expansion write enable/SDRAM write enable control signal
A6	SDQM[2]	2	Low	O	SDRAM byte lane mask
A7	nSDCS[1]	1	High	O	SDRAM chip select 2
A8	DD[2]	1	Low	O	LCD serial display data
A9	FRM	1	Low	O	LCD frame synchronization pulse
A10	CL[1]	1	Low	O	LCD line clock
A11	VSSCORE			Core ground	Core ground
A12	D[1]	1	Low	I/O	Data I/O
A13	A[2]	2	Low	O	System byte address
A14	D[4]	1	Low	I/O	Data I/O
A15	A[5]	1	Low	O	System byte address
A16	nPWRFL			I	Power fail sense input
A17	MOSCOUT			O	Main oscillator out
A18	VSSIO			Pad ground	I/O ground
A19	VSSIO			Pad ground	I/O ground
A20	VSSIO			Pad ground	I/O ground
B1	WORD	1	Low	O	Word access select output
B2	VDDIO			Pad power	Digital I/O power, 3.3 V
B3	nCS[5]	1	Low	O	Chip select 5
B4	nCS[2]	1	High	O	Chip select 2
B5	nMOE/nSDCAS	1	High	O	ROM, expansion OP enable/SDRAM CAS control signal
B6	SDCKE	2	Low	O	SDRAM clock enable output
B7	nSDCS[0]	1	High	O	SDRAM chip select 0

Table 21. 204-Ball TFBGA Ball Listing (Continued)

Ball Location	Name	Strength <sup>†</sup>	Reset State	Type	Description
B8	DD[1]	1	Low	O	LCD serial display data
B9	M	1	Low	O	LCD AC bias drive
B10	CL[2]	1	Low	O	LCD pixel clock out
B11	D[0]	1	Low	I/O	Data I/O
B12	A[1]	2	Low	O	System byte address
B13	D[3]	2	Low	I/O	Data I/O
B14	A[4]	1	Low	O	System byte address
B15	D[6]	1	Low	I/O	Data I/O
B16	WAKEUP	Schmitt		I	System wake up input
B17	MOSCIN			I	Main oscillator input
B18	VSSIO			Pad ground	I/O ground
B19	VSSIO			Pad ground	I/O ground
B20	nURESET	Schmitt		I	User reset input
C1	RUN/CLKEN	1	Low	O	Run output / clock enable output
C2	EXPRDY	1		I	Expansion port ready input
C3	VDDIO			Pad power	Digital I/O power, 3.3 V
C4	nCS[4]	1	High	O	Chip select 4
C5	nCS[0]	1	High	O	Chip select 0
C6	SDCLK	2	Low	O	SDRAM clock out
C7	SDQM[3]	2	Low	O	SDRAM byte lane mask
C8	DD[0]	1	Low	O	LCD serial display data
C9	DD[3]	1	Low	O	LCD serial display data
C10	VDDCORE			Core power	Digital core power, 2.5 V
C11	A[0]	2	Low	O	System byte address
C12	D[2]	1	Low	I/O	Data I/O
C13	A[3]	2	Low	O	System byte address
C14	D[5]	1	Low	I/O	Data I/O
C15	A[6]	1	Low	O	System byte address
C16	VSSOSC			Oscillator ground	PLL ground
C17	VDDOSC			Oscillator power	Oscillator power in, 2.5V
C18	VSSIO			Pad ground	I/O ground
C19	BATOK			I	Battery ok input

**Table 21. 204-Ball TFBGA Ball Listing (Continued)**

Ball Location	Name	Strength †	Reset State	Type	Description
C20	nPOR	Schmitt		I	Power-on reset input
D1	PB[7]	1	Input †	I	GPIO port B
D2	RXD[2]			I	UART 2 receive data input
D3	VDDIO			Pad power	Digital I/O power, 3.3V
D18	VSSIO			Pad ground	I/O ground
D19	nBATCHG			I	Battery changed sense input
D20	A[7]	1	Low	O	System byte address
E1	PB[4]	1	Input †	I	GPIO port B
E2	TXD[2]	1	High	O	UART 2 transmit data output
E3	WRITE/nSDRAS	1	Low	O	Transfer direction / SDRAM RAS signal output
E18	nMEDCHG/nBROM			I	Media change interrupt input / internal ROM boot enable
E19	nEXTPWR			I	External power supply sense input
E20	D[9]	1	Low	I/O	Data I/O
F1	PB[3]	1	Input †	I/O	GPIO port B
F2	PB[6]	1	Input †	I/O	GPIO port B
F3	TDI	with p/u*		I	JTAG data input
F18	D[7]	1	Low	I/O	Data I/O
F19	A[8]	1	Low	O	System byte address
F20	D[10]	1	Low	I/O	Data I/O
G1	PB[1]	1	Input †	I/O	
G2	PB[2]	1	Input †	I/O	GPIO port B
G3	PB[5]	1	Input †	I/O	GPIO port B
G18	D[8]	1	Input †	I/O	Data I/O
G19	A[9]	1	Low	O	System byte address
G20	D[11]	1	Low	I/O	Data I/O
H1	PA[7]	1	Input †	I/O	GPIO port A
H[2]	TDO	1	Input †	O	JTAG data out
H[3]	PB[0]	1	Input †	I/O	GPIO port B
H[18]	A[10]	1	Low	O	System byte address



Table 21. 204-Ball TFBGA Ball Listing (Continued)

Ball Location	Name	Strength †	Reset State	Type	Description
H19	D[12]	1	Low	I/O	Data I/O
H20	A[12]	1	Low	O	System byte address
J1	PA[4]	1	Input †	I/O	GPIO port A
J2	PA[5]	1	Input †	I/O	GPIO port A
J3	PA[6]	1	Input †	I/O	GPIO port A
J18	A[11]	1	Low	O	System byte address
J19	D[13]	1	Low	I/O	Data I/O
J20	A[13]/DRA[14]	1	Low	O	System byte address / SDRAM address
K1	PA[1]	1	Input †	I/O	GPIO port A
K2	PA[2]	1	Input †	I/O	GPIO port A
K3	VDDIO			Pad power	Digital I/O power, 3.3V
K18	D[14]	1	Low	I/O	Data I/O
K19	A[14]/DRA[13]	1	Low	O	System byte address / SDRAM address
K20	D[15]	1	Low	I/O	Data I/O
L1	TXD[1]	1	High	O	UART 1 transmit data out
L2	LEDDRV	1	Low	O	IR LED drive
L3	PA[3]	1	Input †	I/O	GPIO port A
L18	VDDIO			Pad power	Digital I/O power, 3.3V
L19	D[16]	1	Low	I/O	Data I/O
L20	A[16]/DRA[11]	1	Low	O	System byte address / SDRAM address
M1	RXD[1]			I	UART 1 receive data input
M2	CTS			I	UART 1 clear to send input
M3	PA[0]	1	Input †	I/O	GPIO port A
M18	A[15]/DRA[12]	1	Low	O	System byte address / SDRAM address
M19	A[17]/DRA[10]	1	Low	O	System byte address / SDRAM address
M20	nTRST			I	JTAG async reset input
N1	DSR			I	UART 1 data set ready input
N2	nTEST[1]	With p/u*		I	Test mode select input
N3	PHDIN			I	Photodiode input

**Table 21. 204-Ball TFBGA Ball Listing (Continued)**

Ball Location	Name	Strength †	Reset State	Type	Description
N18	D[17]	1	Low	I/O	Data I/O
N19	D[19]	1	Low	I/O	Data I/O
N20	A[18]/DRA[9]	1	Low	O	System byte address / SDRAM address
P1	EINT[3]			I	External interrupt
P2	nEINT[2]			I	External interrupt input
P3	DCD			I	UART 1 data carrier detect
P18	D[18]	1	Low	I/O	Data I/O
P19	A[20]/DRA[7]	1	Low	O	System byte address / SDRAM address
P20	D[20]	1	Low	I/O	Data I/O
R1	nEXTFIQ			I	External fast interrupt input
R2	PE[2]/CLKSEL	1	Input †	I/O	GPIO port E / clock input mode select
R3	nTEST[0]	With p/u*		I	Test mode select input
R18	A[19]/DRA[8]	1	Low	O	System byte address / SDRAM address
R19	D[22]	1	Low	I/O	Data I/O
R20	A[21]/DRA[6]	1	Low	O	System byte address / SDRAM address
T1	PE[1]/BOOTSEL[1]	1	Input †	I/O	GPIO port E / boot mode select
T2	PE[0]/BOOTSEL[0]	1	Input †	I/O	GPIO port E / boot mode select
T3	nEINT[1]			I	External interrupt input
T18	D[21]	1	Low	I/O	Data I/O
T19	D[23]	1	Low	I/O	Data I/O
T20	A[22]/DRA[5]	1	Low	O	System byte address / SDRAM address
U1	VSSRTC			RTC ground	Real time clock ground
U2	RTCOUT			O	Real time clock oscillator output
U3	RTCIN			I/O	Real time clock oscillator input
U18	HALFWORD	1	Low	O	Halfword access select output
U19	D[24]	1	Low	I/O	Data I/O
U20	A[23]/DRA[4]	1	Low	O	System byte address / SDRAM address
V1	VDDRRTC			RTC power	Real time clock power, 2.5V

Table 21. 204-Ball TFBGA Ball Listing (Continued)

Ball Location	Name	Strength <sup>†</sup>	Reset State	Type	Description
V2	VSSIO			Pad ground	I/O ground
V3	VSSIO			Pad ground	I/O ground
V4	PD[7]/SDQM[1]	1	Low	I/O	GPIO port D / SDRAM byte lane mask
V5	PD[4]	1	Low	I/O	GPIO port D
V6	PD[2]	1	Low	I/O	GPIO port D
V7	SSICLK	1	Input <sup>‡</sup>	I/O	DAI/CODEC/SSI2 serial clock
V8	SSIRXDA			I/O	DAI/CODEC/SSI2 serial data input
V9	nADCCS	1	High	O	SSI1 ADC chip select
V10	VDDIO			Pad power	Digital I/O power, 3.3V
V11	ADCCLK	1	Low	O	SSI1 ADC serial clock
V12	COL[7]	1	High	O	Keyboard scanner column drive
V13	COL[4]	1	High	O	Keyboard scanner column drive
V14	TCLK			I	JTAG clock
V15	BUZ	1	Low	O	Buzzer drive output
V16	D[29]	1	Low	I/O	Data I/O
V17	A[26]/DRA[1]	2	Low	O	System byte address / SDRAM address
V18	VDDIO			Pad power	Digital I/O power, 3.3 V
V19	VDDIO			Pad power	Digital I/O power, 3.3 V
V20	A[24]/DRA[3]		Low	O	System byte address / SDRAM address
W1	VSSIO			Pad ground	I/O ground
W2	VSSIO			Pad ground	I/O ground
W3	VSSIO			Pad ground	I/O ground
W4	PD[6]/SDQM[0]	1	Low	I/O	GPIO port D / SDRAM byte lane mask
W5	TMS	with p/u*		I	JTAG mode select
W6	PD[1]	1	Low	I/O	GPIO port D
W7	SSITXFR	1	Low	I/O	DAI/CODEC/SSI2 frame sync
W8	SSIRXFR	1	Input <sup>‡</sup>	I/O	DAI/CODEC/SSI2 frame sync
W9	VSSCORE			Core Ground	Core Ground
W10	DRIVE[1]	2	High / Low	I/O	PWM drive output

**Table 21. 204-Ball TFBGA Ball Listing (Continued)**

Ball Location	Name	Strength †	Reset State	Type	Description
W11	ADCOUT	1	Low	O	SSI1 ADC serial data output
W12	FB[0]			I	PWM feedback input
W13	COL[5]	1	High	O	Keyboard scanner column drive
W14	COL[2]	1	High	O	Keyboard scanner column drive
W15	COL[0]	1	High	O	Keyboard scanner column drive
W16	D[30]	1	Low	I/O	Data I/O
W17	A[27]/DRA[0]	2	Low	O	System byte address / SDRAM address
W18	D[26]	1	Low	I/O	Data I/O
W19	VDDIO			Pad power	Digital I/O power, 3.3V
W20	D[25]	1	Low	I/O	Data I/O
Y1	VSSIO			Pad ground	I/O ground
Y2	VSSIO			Pad ground	I/O ground
Y3	VSSIO			Pad ground	I/O ground
Y4	PD[5]	1	Low	I/O	GPIO port D
Y5	PD[3]	1	Low	I/O	GPIO port D
Y6	PD[0]/LEDFLSH	1	Low	I/O	GPIO port D / LED blinker output
Y7	SSITXDA	1	Low	O	DAI/CODEC/SSI2 serial data output
Y8	ADCIN			I	SSI1 ADC serial input
Y9	VDDCORE			Core power	Digital core power, 2.5V
Y10	DRIVE[0]	2	Input ‡	I/O	PWM drive output
Y11	SMPCLK	1	Low	O	SSI1 ADC sample clock
Y12	FB[1]			I	PWM feedback input
Y13	COL[6]	1	High	O	Keyboard scanner column drive
Y14	COL[3]	1	High	O	Keyboard scanner column drive
Y15	COL[1]	1	High	O	Keyboard scanner column drive
Y16	D[31]	1	Low	I/O	Data I/O
Y17	D[28]	1	Low	I/O	Data I/O
Y18	D[27]	1	Low	I/O	Data I/O
Y19	A[25]/DRA[2]	2	Low	O	System byte address / SDRAM address

Table 21. 204-Ball TFBGA Ball Listing (Continued)

Ball Location	Name	Strength †	Reset State	Type	Description
Y20	VDDIO			Pad power	Digital I/O power, 3.3V

\*“With p/u” means with internal pull-up of 100 KOhms on the pin.

† Strength 1 = 4 ma

Strength 2 = 12 ma

‡ Input. Port A,B,D,E GPIOs default to input at nPOR and URESET conditions.

## 256-Ball PBGA Package Characteristics

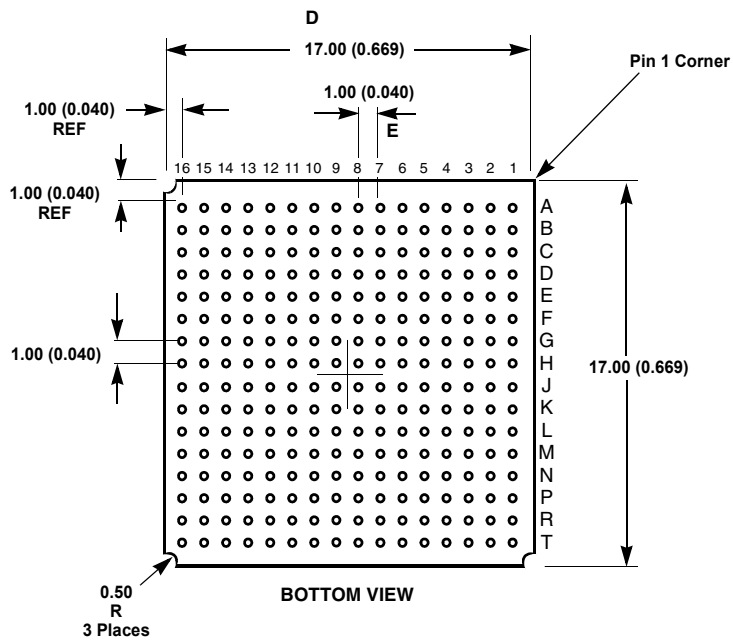
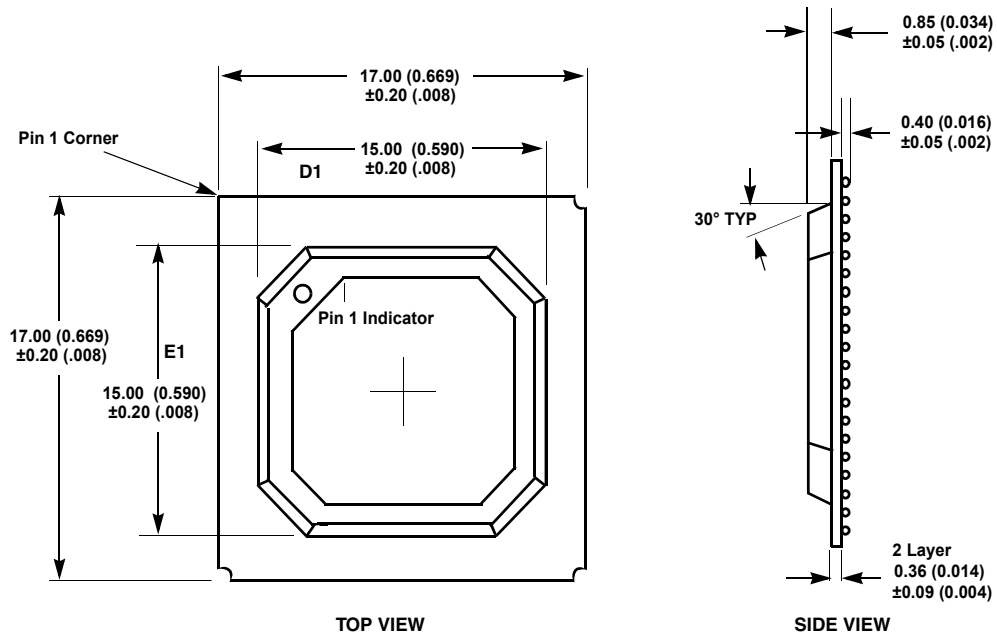
### 256-Ball PBGA Package Specifications

Figure 18. 256-Ball PBGA Package

- Note: 1) For pin locations see [Table V](#).  
2) Dimensions are in millimeters (inches), and controlling dimension is millimeter  
3) Before beginning any new EP7311 design, contact Cirrus Logic for the latest package information.

### 256-Ball PBGA Pinout (Top View)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
A	VDDIO	nCS[4]	nCS[1]	SDCLK	SDQM[3]	DD[1]	M	VDDIO	D[0]	D[2]	A[3]	VDDIO	A[6]	MOSCOU	VDDOSC	VSSIO	A
B	nCS[5]	VDDIO	nCS[3]	nMOE/ nSDCAS	VDDIO	nSDCS[1]	DD[2]	CL[1]	VDDCORE	D[1]	A[2]	A[4]	A[5]	WAKEUP	VDDIO	nURESET	B
C	VDDIO	EXPCLK	VSSIO	VDDIO	VSSIO	VSSIO	VSSIO	VDDIO	VSSIO	VSSIO	VSSIO	VDDIO	VSSIO	VSSIO	nPOR	nEXTPWR	C
D	WRITE/ nSDRAS	EXPRDY	VSSIO	VDDIO	nCS[2]	nMWE/ nSDWE	nSDCS[0]	CL[2]	VSSRTC	D[4]	nPWRFL	MOSCIN	VDDIO	VSSIO	D[7]	D[8]	D
E	RXD[2]	PB[7]	TDI	WORD	VSSIO	nCS[0]	SDQM[2]	FRM	A[0]	D[5]	VSSOSC	VSSIO	nMEDCHG/ nBROM	VDDIO	D[9]	D[10]	E
F	PB[5]	PB[3]	VSSIO	TXD[2]	RUN/ CLKEN	VSSIO	SDCKE	DD[3]	A[1]	D[6]	VSSRTC	BATOK	nBATCHG	VSSIO	D[11]	VDDIO	F
G	PB[1]	VDDIO	TDO	PB[4]	PB[6]	VSSRTC	VSSRTC	DD[0]	D[3]	VSSRTC	A[7]	A[8]	A[9]	VSSIO	D[12]	D[13]	G
H	PA[7]	PA[5]	VSSIO	PA[4]	PA[6]	PB[0]	PB[2]	VSSRTC	VSSRTC	A[10]	A[11]	A[12]	A[13]/ DRA[14]	VSSIO	D[14]	D[15]	H
J	PA[3]	PA[1]	VSSIO	PA[2]	PA[0]	TXD[1]	CTS	VSSRTC	VSSRTC	A[17]/ DRA[10]	A[16]/ DRA[11]	A[15]/ DRA[12]	A[14]/ DRA[13]	nTRST	D[16]	D[17]	J
K	LEDDRV	PHDIN	VSSIO	DCD	nTEST[1]	EINT[3]	VSSRTC	ADCIN	COL[4]	TCLK	D[20]	D[19]	D[18]	VSSIO	VDDIO	VDDIO	K
L	RXD[1]	DSR	VDDIO	nEINT[1]	PE[2]/ CLKSEL	VSSRTC	PD[0]/ LEDFLSH	VSSRTC	COL[6]	D[31]	VSSRTC	A[22]/ DRA[5]	A[21]/ DRA[6]	VSSIO	A[18]/ DRA[9]	A[19]/ DRA[8]	L
M	nTEST[0]	nEINT[2]	VDDIO	PE[0]/ BOOTSEL[0]	TMS	VDDIO	SSITXFR	DRIVE[1]	FB[0]	COL[0]	D[27]	VSSIO	A[23]/ DRA[4]	VDDIO	A[20]/ DRA[7]	D[21]	M
N	nEXTFIQ	PE[1]/ BOOTSEL[1]	VSSIO	VDDIO	PD[5]	PD[2]	SSIRXDA	ADCCLK	SMPCLK	COL[2]	D[29]	D[26]	HALFWORD	VSSIO	D[22]	D[23]	N
P	VSSRTC	RTCOUT	VSSIO	VSSIO	VDDIO	VSSIO	VSSIO	VDDIO	VSSIO	VDDIO	VSSIO	VSSIO	VDDIO	VSSIO	D[24]	VDDIO	P
R	RTCIN	VDDIO	PD[4]	PD[1]	SSITXDA	nADCCS	VDDIO	ADCOUT	COL[7]	COL[3]	COL[1]	D[30]	A[27]/ DRA[0]	A[25]/ DRA[2]	VDDIO	A[24]/ DRA[3]	R
T	VDDRTC	PD[7]/ SDQM[1]	PD[6]/ SDQM[0]	PD[3]	SSICLK	SSIRXFR	VDDCORE	DRIVE[0]	FB[1]	COL[5]	VDDIO	BUZ	D[28]	A[26]/ DRA[1]	D[25]	VSSIO	T



**JEDEC #: MO-151**  
**Ball Diameter: 0.50 mm ± 0.10 mm**  
**17 ¥ 17 ¥ 1.61 mm body**

## 256-Ball PBGA Ball Listing

The list is ordered by ball location.

**Table V. 256-Ball PBGA Ball Listing**

Ball Location	Name	Type	Description
A1	VDDIO	Pad power	Digital I/O power, 3.3V
A2	nCS[4]	O	Chip select out
A3	nCS[1]	O	Chip select out
A4	SDCLK	O	SDRAM clock out
A5	SDQM[3]	O	SDRAM byte lane mask
A6	DD[1]	O	LCD serial display data
A7	M	O	LCD AC bias drive
A8	VDDIO	Pad power	Digital I/O power, 3.3V
A9	D[0]	I/O	Data I/O
A10	D[2]	I/O	Data I/O
A11	A[3]	O	System byte address
A12	VDDIO	Pad power	Digital I/O power, 3.3V
A13	A[6]	O	System byte address
A14	MOSCOUT	O	Main oscillator out
A15	VDDOSC	Oscillator power	Oscillator power in, 2.5V
A16	VSSIO	Pad ground	I/O ground
B1	nCS[5]	O	Chip select out
B2	VDDIO	Pad power	I/O ground
B3	nCS[3]	O	Chip select out
B4	nMOE/nSDCAS	O	ROM, expansion OP enable/SDRAM CAS control signal
B5	VDDIO	Pad power	Digital I/O power, 3.3V
B6	nSDCS[1]	O	SDRAM chip select out
B7	DD[2]	O	LCD serial display data
B8	CL[1]	O	LCD line clock
B9	VDDCORE	Core power	Digital core power, 2.5V
B10	D[1]	I/O	Data I/O
B11	A[2]	O	System byte address
B12	A[4]	O	System byte address
B13	A[5]	O	System byte address
B14	WAKEUP	I	System wake up input
B15	VDDIO	Pad power	Digital I/O power, 3.3V
B16	nURESET	I	User reset input
C1	VDDIO	Pad power	Digital I/O power, 3.3V
C2	EXPCLK	I	Expansion clock input
C3	VSSIO	Pad ground	I/O ground
C4	VDDIO	Pad power	Digital I/O power, 3.3V
C5	VSSIO	Pad ground	I/O ground
C6	VSSIO	Pad ground	I/O ground
C7	VSSIO	Pad ground	I/O ground
C8	VDDIO	Pad power	Digital I/O power, 3.3V
C9	VSSIO	Pad ground	I/O ground
C10	VSSIO	Pad ground	I/O ground
C11	VSSIO	Pad ground	I/O ground

**Table V. 256-Ball PBGA Ball Listing (Continued)**

Ball Location	Name	Type	Description
C12	VDDIO	Pad power	Digital I/O power, 3.3V
C13	VSSIO	Pad ground	I/O ground
C14	VSSIO	Pad ground	I/O ground
C15	nPOR	I	Power-on reset input
C16	nEXTPWR	I	External power supply sense input
D1	WRITE/nSDRAS	O	Transfer direction / SDRAM RAS signal output
D2	EXPRDY	I	Expansion port ready input
D3	VSSIO	Pad ground	I/O ground
D4	VDDIO	Pad power	Digital I/O power, 3.3V
D5	nCS[2]	O	Chip select out
D6	nMWE/nSDWE	O	ROM, expansion write enable/ SDRAM write enable control signal
D7	nSDCS[0]	O	SDRAM chip select out
D8	CL[2]	O	LCD pixel clock out
D9	VSSRTC	Core ground	Real time clock ground
D10	D[4]	I/O	Data I/O
D11	nPWRFL	I	Power fail sense input
D12	MOSCIN	I	Main oscillator input
D13	VDDIO	Pad power	Digital I/O power, 3.3V
D14	VSSIO	Pad ground	I/O ground
D15	D[7]	I/O	Data I/O
D16	D[8]	I/O	Data I/O
E1	RXD[2]	I	UART 2 receive data input
E2	PB[7]	I	GPIO port B
E3	TDI	I	JTAG data input
E4	WORD	O	Word access select output
E5	VSSIO	Pad ground	I/O ground
E6	nCS[0]	O	Chip select out
E7	SDQM[2]	O	SDRAM byte lane mask
E8	FRM	O	LCD frame synchronization pulse
E9	A[0]	O	System byte address
E10	D[5]	I/O	Data I/O
E11	VSSOSC	Oscillator ground	PLL ground
E12	VSSIO	Pad ground	I/O ground
E13	nMEDCHG/nBROM	I	Media change interrupt input / internal ROM boot enable
E14	VDDIO	Pad power	Digital I/O power, 3.3V
E15	D[9]	I/O	Data I/O
E16	D[10]	I/O	Data I/O
F1	PB[5]	I	GPIO port B
F2	PB[3]	I	GPIO port B
F3	VSSIO	Pad ground	I/O ground
F4	TXD[2]	O	UART 2 transmit data output
F5	RUN/CLKEN	O	Run output / clock enable output
F6	VSSIO	Pad ground	I/O ground

**Table V. 256-Ball PBGA Ball Listing (Continued)**

Ball Location	Name	Type	Description
F7	SDCKE	O	SDRAM clock enable output
F8	DD[3]	O	LCD serial display data
F9	A[1]	O	System byte address
F10	D[6]	I/O	Data I/O
F11	VSSRTC	RTC ground	Real time clock ground
F12	BATOK	I	Battery ok input
F13	nBATCHG	I	Battery changed sense input
F14	VSSIO	Pad ground	I/O ground
F15	D[11]	I/O	Data I/O
F16	VDDIO	Pad power	Digital I/O power, 3.3V
G1	PB[1]	I	GPIO port B
G2	VDDIO	Pad power	Digital I/O power, 3.3V
G3	TDO	O	JTAG data out
G4	PB[4]	I	GPIO port B
G5	PB[6]	I	GPIO port B
G6	VSSRTC	Core ground	Real time clock ground
G7	VSSRTC	RTC ground	Real time clock ground
G8	DD[0]	O	LCD serial display data
G9	D[3]	I/O	Data I/O
G10	VSSRTC	RTC ground	Real time clock ground
G11	A[7]	O	System byte address
G12	A[8]	O	System byte address
G13	A[9]	O	System byte address
G14	VSSIO	Pad ground	I/O ground
G15	D[12]	I/O	Data I/O
G16	D[13]	I/O	Data I/O
H1	PA[7]	I	GPIO port A
H2	PA[5]	I	GPIO port A
H3	VSSIO	Pad ground	I/O ground
H4	PA[4]	I	GPIO port A
H5	PA[6]	I	GPIO port A
H6	PB[0]	I	GPIO port B
H7	PB[2]	I	GPIO port B
H8	VSSRTC	RTC ground	Real time clock ground
H9	VSSRTC	RTC ground	Real time clock ground
H10	A[10]	O	System byte address
H11	A[11]	O	System byte address
H12	A[12]	O	System byte address
H13	A[13]/DRA[14]	O	System byte address / SDRAM address
H14	VSSIO	Pad ground	I/O ground
H15	D[14]	I/O	Data I/O
H16	D[15]	I/O	Data I/O
J1	PA[3]	I	GPIO port A
J2	PA[1]	I	GPIO port A
J3	VSSIO	Pad ground	I/O ground
J4	PA[2]	I	GPIO port A
J5	PA[0]	I	GPIO port A
J6	TXD[1]	O	UART 1 transmit data out

**Table V. 256-Ball PBGA Ball Listing (Continued)**

Ball Location	Name	Type	Description
J7	CTS	I	UART 1 clear to send input
J8	VSSRTC	RTC ground	Real time clock ground
J9	VSSRTC	RTC ground	Real time clock ground
J10	A[17]/DRA[10]	O	System byte address / SDRAM address
J11	A[16]/DRA[11]	O	System byte address / SDRAM address
J12	A[15]/DRA[12]	O	System byte address / SDRAM address
J13	A[14]/DRA[13]	O	System byte address / SDRAM address
J14	nTRST	I	JTAG async reset input
J15	D[16]	I/O	Data I/O
J16	D[17]	I/O	Data I/O
K1	LEDDRV	O	IR LED drivet
K2	PHDIN	I	Photodiode input
K3	VSSIO	Pad ground	I/O ground
K4	DCD	I	UART 1 data carrier detect
K5	nTEST[1]	I	Test mode select input
K6	EINT[3]	I	External interrupt
K7	VSSRTC	RTC ground	Real time clock ground
K8	ADCIN	I	SSI1 ADC serial input
K9	COL[4]	O	Keyboard scanner column drive
K10	TCLK	I	JTAG clock
K11	D[20]	I/O	Data I/O
K12	D[19]	I/O	Data I/O
K13	D[18]	I/O	Data I/O
K14	VSSIO	Pad ground	I/O ground
K15	VDDIO	Pad power	Digital I/O power, 3.3V
K16	VDDIO	Pad power	Digital I/O power, 3.3V
L1	RXD[1]	I	UART 1 receive data input
L2	DSR	I	UART 1 data set ready input
L3	VDDIO	Pad power	Digital I/O power, 3.3V
L4	nEINT[1]	I	External interrupt input
L5	PE[2]/CLKSEL	I	GPIO port E / clock input mode select
L6	VSSRTC	RTC ground	Real time clock ground
L7	PD[0]/LEDFLSH	I/O	GPIO port D / LED blinker output
L8	VSSRTC	Core ground	Real time clock ground
L9	COL[6]	O	Keyboard scanner column drive
L10	D[31]	I/O	Data I/O
L11	VSSRTC	RTC ground	Real time clock ground
L12	A[22]/DRA[5]	O	System byte address / SDRAM address
L13	A[21]/DRA[6]	O	System byte address / SDRAM address
L14	VSSIO	Pad ground	I/O ground
L15	A[18]/DRA[9]	O	System byte address / SDRAM address
L16	A[19]/DRA[8]	O	System byte address / SDRAM address
M1	nTEST[0]	I	Test mode select input
M2	nEINT[2]	I	External interrupt input
M3	VDDIO	Pad power	Digital I/O power, 3.3V
M4	PE[0]/BOOTSEL[0]	I	GPIO port E / Boot mode select
M5	TMS	I	JTAG mode select
M6	VDDIO	Pad power	Digital I/O power, 3.3V



Table V. 256-Ball PBGA Ball Listing (Continued)

Ball Location	Name	Type	Description
M7	SSITXFR	I/O	MCP/CODEC/SSI2 frame sync
M8	DRIVE[1]	I/O	PWM drive output
M9	FB[0]	I	PWM feedback input
M10	COL[0]	O	Keyboard scanner column drive
M11	D[27]	I/O	Data I/O
M12	VSSIO	Pad ground	I/O ground
M13	A[23]/DRA[4]	O	System byte address / SDRAM address
M14	VDDIO	Pad power	Digital I/O power, 3.3V
M15	A[20]/DRA[7]	O	System byte address / SDRAM address
M16	D[21]	I/O	Data I/O
N1	nEXTFIQ	I	External fast interrupt input
N2	PE[1]/BOOTSEL[1]	I	GPIO port E / boot mode select
N3	VSSIO	Pad ground	I/O ground
N4	VDDIO	Pad power	Digital I/O power, 3.3V
N5	PD[5]	I/O	GPIO port D
N6	PD[2]	I/O	GPIO port D
N7	SSIRXDA	I/O	MCP/CODEC/SSI2 serial data input
N8	ADCCLK	O	SSI1 ADC serial clock
N9	SMPCLK	O	SSI1 ADC sample clock
N10	COL[2]	O	Keyboard scanner column drive
N11	D[29]	I/O	Data I/O
N12	D[26]	I/O	Data I/O
N13	HALFWORD	O	Halfword access select output
N14	VSSIO	Pad ground	I/O ground
N15	D[22]	I/O	Data I/O
N16	D[23]	I/O	Data I/O
P1	VSSRTC	RTC ground	Real time clock ground
P2	RTCOUT	O	Real time clock oscillator output
P3	VSSIO	Pad ground	I/O ground
P4	VSSIO	Pad ground	I/O ground
P5	VDDIO	Pad power	Digital I/O power, 3.3V
P6	VSSIO	Pad ground	I/O ground
P7	VSSIO	Pad ground	I/O ground
P8	VDDIO	Pad power	Digital I/O power, 3.3V
P9	VSSIO	Pad ground	I/O ground
P10	VDDIO	Pad power	Digital I/O power, 3.3V
P11	VSSIO	Pad ground	I/O ground
P12	VSSIO	Pad ground	I/O ground
P13	VDDIO	Pad power	Digital I/O power
P14	VSSIO	Pad ground	I/O ground
P15	D[24]	I/O	Data I/O
P16	VDDIO	Pad power	Digital I/O power, 3.3V
R1	RTCIN	I/O	Real time clock oscillator input
R2	VDDIO	Pad power	Digital I/O power, 3.3V
R3	PD[4]	I/O	GPIO port D
R4	PD[1]	I/O	GPIO port D
R5	SSITXDA	O	MCP/CODEC/SSI2 serial data output
R6	nADCCS	O	SSI1 ADC chip select

Table V. 256-Ball PBGA Ball Listing (Continued)

Ball Location	Name	Type	Description
R7	VDDIO	Pad power	Digital I/O power, 3.3V
R8	ADCOUT	O	SSI1 ADC serial data output
R9	COL[7]	O	Keyboard scanner column drive
R10	COL[3]	O	Keyboard scanner column drive
R11	COL[1]	O	Keyboard scanner column drive
R12	D[30]	I/O	Data I/O
R13	A[27]/DRA[0]	O	System byte address / SDRAM address
R14	A[25]/DRA[2]	O	System byte address / SDRAM address
R15	VDDIO	Pad power	Digital I/O power, 3.3V
R16	A[24]/DRA[3]	O	System byte address / SDRAM address
T1	VDDRTC	RTC power	Real time clock power, 2.5V
T2	PD[7]/SDQM[1]	I/O	GPIO port D / SDRAM byte lane mask
T3	PD[6]/SDQM[0]	I/O	GPIO port D / SDRAM byte lane mask
T4	PD[3]	I/O	GPIO port D
T5	SSICLK	I/O	MCP/CODEC/SSI2 serial clock
T6	SSIRXFR	-	MCP/CODEC/SSI2 frame sync
T7	VDDCORE	Core power	Core power, 2.5V
T8	DRIVE[0]	I/O	PWM drive output
T9	FB[1]	I	PWM feedback input
T10	COL[5]	O	Keyboard scanner column drive
T11	VDDIO	Pad power	Digital I/O power, 3.3V
T12	BUZ	O	Buzzer drive output
T13	D[28]	I/O	Data I/O
T14	A[26]/DRA[1]	O	System byte address / SDRAM address
T15	D[25]	I/O	Data I/O
T16	VSSIO	Pad ground	I/O ground

## JTAG Boundary Scan Signal Ordering

**Table W. JTAG Boundary Scan Signal Ordering**

<b>LQFP Pin No.</b>	<b>TFBGA Ball</b>	<b>PBGA Ball</b>	<b>Signal</b>	<b>Type</b>	<b>Position</b>
1	B3	B1	nCS[5]	O	1
4	A2	C2	EXPCLK	I/O	3
5	B1	E4	WORD	O	6
6	E3	D1	WRITE/nSDRAS	O	8
7	C1	F5	RUN/CLKEN	O	10
8	C2	D2	EXPRDY	I	13
9	E2	F4	TXD2	O	14
10	D2	E1	RXD2	I	16
13	F3	E2	PB[7]	I/O	17
14	D1	G5	PB[6]	I/O	20
15	F2	F1	PB[5]	I/O	23
16	G3	G4	PB[4]	I/O	26
17	E1	F2	PB[3]	I/O	29
18	F1	H7	PB[2]	I/O	32
19	G2	G1	PB[1]/PRDY2	I/O	35
20	G1	H6	PB[0]/PRDY1	I/O	38
23	H3	H1	PA[7]	I/O	41
24	H1	H5	PA[6]	I/O	44
25	J3	H2	PA[5]	I/O	47
26	J2	H4	PA[4]	I/O	50
27	J1	J1	PA[3]	I/O	53
28	L3	J4	PA[2]	I/O	56
29	K2	J2	PA[1]	I/O	59
30	K1	J5	PA[0]	I/O	62
31	M3	K1	LEDDR	O	65
32	L2	J6	TXD1	O	67
34	L1	K2	PHDIN	I	69
35	N3	J7	CTS	I	70
36	M2	L1	RXD1	I	71
37	M1	K4	DCD	I	72
38	P3	L2	DSR	I	73
39	N1	K5	nTEST1	I	74
40	N2	M1	nTEST0	I	75
41	R3	K6	EINT3	I	76
42	P1	M2	nEINT2	I	77
43	P2	L4	nEINT1	I	78

Table W. JTAG Boundary Scan Signal Ordering (Continued)

LQFP Pin No.	TFBGA Ball	PBGA Ball	Signal	Type	Position
44	T3	N1	nEXTFIQ	I	79
45	R1	L5	PE[2]/CLKSEL	I/O	80
46	R2	N2	PE[1]/BOOTSEL1	I/O	83
47	T1	M4	PE[0]/BOOTSEL0	I/O	86
53	T2	T2	PD[7]/SDQM[1]	I/O	89
54	V4	T3	PD[6]/SDQM[0]	I/O	92
55	W4	N5	PD[5]	I/O	95
56	Y4	R3	PD[4]	I/O	98
59	V5	T4	PD[3]	I/O	101
60	W5	N6	PD[2]	I/O	104
61	Y5	R4	PD[1]	I/O	107
62	V6	L7	PD[0]/LEDFLSH	O	110
68	W6	T6	SSIRXFR	I/O	122
69	Y6	K8	ADCIN	I	125
70	W8	R6	nADCCS	O	126
75	Y8	M8	DRIVE1	I/O	128
76	V9	T8	DRIVE0	I/O	131
77	W10	N8	ADCCLK	O	134
78	Y10	R8	ADCOUT	O	136
79	V11	N9	SMPCLK	O	138
80	W11	T9	FB1	I	140
82	Y11	M9	FB0	I	141
83	Y12	R9	COL7	O	142
84	W12	L9	COL6	O	144
85	V12	T10	COL5	O	146
86	Y13	K9	COL4	O	148
87	W13	R10	COL3	O	150
88	V13	N10	COL2	O	152
91	Y14	R11	COL1	O	154
92	W14	M10	COL0	O	156
93	A1	T12	BUZ	O	158
94	V14	L10	D[31]	I/O	160
95	Y15	R12	D[30]	I/O	163
96	W15	N11	D[29]	I/O	166
97	V15	T13	D[28]	I/O	169
99	Y16	R13	A[27]/DRA[0]	Out	172
100	W16	M11	D[27]	I/O	174
101	V16	T14	A[26]/DRA[1]	O	177

**Table W. JTAG Boundary Scan Signal Ordering (Continued)**

<b>LQFP Pin No.</b>	<b>TFBGA Ball</b>	<b>PBGA Ball</b>	<b>Signal</b>	<b>Type</b>	<b>Position</b>
102	Y17	N12	D[26]	I/O	179
103	W17	R14	A[25]/DRA[2]	O	182
104	Y18	T15	D[25]	I/O	184
105	V17	N13	HALFWORD	O	187
106	W18	R16	A[24]/DRA[3]	O	189
109	Y19	P15	D[24]	I/O	191
110	W20	M13	A[23]/DRA[4]	O	194
111	U18	N16	D[23]	I/O	196
112	V20	L12	A[22]/DRA[5]	O	199
113	U19	N15	D[22]	I/O	201
114	U20	L13	A[21]/DRA[6]	O	204
115	T19	M16	D[21]	I/O	206
117	T20	M15	A[20]/DRA[7]	O	209
118	R19	K11	D[20]	I/O	211
119	R20	L16	A[19]/DRA[8]	O	214
120	T18	K12	D[19]	I/O	216
121	P19	L15	A[18]/DRA[9]	O	219
122	P20	K13	D[18]	I/O	221
126	R18	J10	A[17]/DRA[10]	O	224
127	N19	J16	D[17]	I/O	226
128	N20	J11	A[16]/DRA[11]	O	229
129	P18	J15	D[16]	I/O	231
130	M19	J12	A[15]/DRA[12]	O	234
131	N18	H16	D[15]	I/O	236
132	L20	J13	A[14]/DRA[13]	O	239
133	L19	H15	D[14]	I/O	241
134	M18	H13	A[13]/DRA[14]	O	244
135	K20	G16	D[13]	I/O	246
136	K19	H12	A[12]	O	249
137	K18	G15	D[12]	I/O	251
138	J20	H11	A[11]	O	254
141	J19	F15	D[11]	I/O	256
142	H20	H10	A[10]	O	259
143	H19	E16	D[10]	I/O	261
144	J18	G13	A[9]	O	264
145	K3	E15	D[9]	I/O	266
146	Y3	G12	A[8]	O	269
147	G20	D16	D[8]	I/O	271

Table W. JTAG Boundary Scan Signal Ordering (Continued)

LQFP Pin No.	TFBGA Ball	PBGA Ball	Signal	Type	Position
148	H18	G11	A[7]	O	274
150	F20	D15	D[7]	I/O	276
151	G19	F13	nBATCHG	I	279
152	E20	C16	nEXTPWR	I	280
153	F19	F12	BATOK	I	281
154	G18	C15	nPOR	I	282
155	D20	E13	nMEDCHG/nBROM	I	283
156	F18	B16	nURESET	I	284
161	D19	B14	WAKEUP	I	285
162	E19	D11	nPWRFL	I	286
163	C19	A13	A[6]	O	287
164	C20	F10	D[6]	I/O	289
165	E18	B13	A[5]	O	292
166	B20	E10	D[5]	I/O	294
169	B16	B12	A[4]	O	297
170	A16	D10	D[4]	I/O	299
171	C15	A11	A[3]	O	302
172	B15	G9	D[3]	I/O	304
173	A15	B11	A[2]	O	307
175	C14	A10	D[2]	I/O	309
176	B14	F9	A[1]	O	312
177	A14	B10	D[1]	I/O	314
178	C13	E9	A[0]	O	317
179	B13	A9	D[0]	I/O	319
184	A13	D8	CL2	O	322
185	C12	B8	CL1	O	324
186	B12	E8	FRM	O	326
187	A12	A7	M	O	328
188	C11	F8	DD[3]	I/O	330
189	B11	B7	DD[2]	I/O	333
191	B10	A6	DD[1]	I/O	336
192	A10	G8	DD[0]	I/O	339
193	A9	B6	nSDCS[1]	O	342
194	B9	D7	nSDCS[0]	O	344
195	C9	A5	SDQM[3]	I/O	346
196	A8	E7	SDQM[2]	I/O	349
199	B8	F7	SDCKE	I/O	352
200	C8	A4	SDCLK	I/O	355

Table W. JTAG Boundary Scan Signal Ordering (Continued)

LQFP Pin No.	TFBGA Ball	PBGA Ball	Signal	Type	Position
201	A7	D6	nMWE/nSDWE	O	358
202	B7	B4	nMOE/nSDCAS	O	360
204	C7	E6	nCS[0]	O	362
205	A6	A3	nCS[1]	O	364
206	B6	D5	nCS[2]	O	366
207	C6	B3	nCS[3]	O	368
208	A5	A2	nCS[4]	O	370

- 1) See EP7311 Users' Manual for pin naming / functionality.
- 2) For each pad, the JTAG connection ordering is input, output, then enable as applicable.

## CONVENTIONS

This section presents acronyms, abbreviations, units of measurement, and conventions used in this data sheet.

### Acronyms and Abbreviations

Table X lists abbreviations and acronyms used in this data sheet.

Table X. Acronyms and Abbreviations

Acronym/ Abbreviation	Definition
A/D	analog-to-digital
ADC	analog-to-digital converter
CODEC	coder / decoder
D/A	digital-to-analog
DMA	direct-memory access
EPB	embedded peripheral bus
FCS	frame check sequence
FIFO	first in / first out
FIQ	fast interrupt request
GPIO	general purpose I/O
ICT	in circuit test
IR	infrared
IRQ	standard interrupt request
IrDA	Infrared Data Association
JTAG	Joint Test Action Group
LCD	liquid crystal display
LED	light-emitting diode
LQFP	low profile quad flat pack
LSB	least significant bit
MIPS	millions of instructions per second
MMU	memory management unit
MSB	most significant bit
PBGA	plastic ball grid array
PCB	printed circuit board
PDA	personal digital assistant
PLL	phase locked loop
p/u	pull-up resistor
RISC	reduced instruction set computer
RTC	Real-Time Clock
SIR	slow (9600–115.2 kbps) infrared
SRAM	static random access memory
SSI	synchronous serial interface

Table X. Acronyms and Abbreviations (Continued)

Acronym/ Abbreviation	Definition
TAP	test access port
TLB	translation lookaside buffer
UART	universal asynchronous receiver

### Units of Measurement

Table Y. Unit of Measurement

Symbol	Unit of Measure
°C	degree Celsius
fs	sample frequency
Hz	hertz (cycle per second)
kbps	kilobits per second
KB	kilobyte (1,024 bytes)
kHz	kilohertz
kΩ	kilohm
Mbps	megabits (1,048,576 bits) per second
MB	megabyte (1,048,576 bytes)
MBps	megabytes per second
MHz	megahertz (1,000 kilohertz)
μA	microampere
μF	microfarad
μW	microwatt
μs	microsecond (1,000 nanoseconds)
mA	milliampere
mW	milliwatt
ms	millisecond (1,000 microseconds)
ns	nanosecond
V	volt
W	watt

## General Conventions

Hexadecimal numbers are presented with all letters in uppercase and a lowercase “h” appended or with a 0x at the beginning. For example, 0x14 and 03CAh are hexadecimal numbers. Binary numbers are enclosed in single quotation marks when in text (for example, ‘11’ designates a binary number). Numbers not indicated by an “h”, 0x or quotation marks are decimal.

Registers are referred to by acronym, with bits listed in brackets separated by a colon (:) (for example, CODR[7:0]), and are described in the EP7311 User’s Manual. The use of “TBD” indicates values that are “to be determined,” “n/a” designates “not available,” and “n/c” indicates a pin that is a “no connect.”

## Pin Description Conventions

Abbreviations used for signal directions are listed in Table Z.

**Table Z. Pin Description Conventions**

Abbreviation	Direction
I	Input
O	Output
I/O	Input or Output



## Ordering Information

Model	Temperature	Package
EP7311-CB	0 to +70 °C	256-pin PBGA, 17mm X 17mm
EP7311-CB-90 (90 MHz)		
EP7311-IB	-40 to +85 °C.	
EP7311-IB-90 (90 MHz)		
EP7311-CV	0 to +70 °C	208-pin LQFP.
EP7311-IV	-40 to +85 °C.	
EP7311-CR	0 to +70 °C	204-pin TFBGA, 13mm X 13mm.
EP7311-CR-90 (90 MHz)		

## Environmental, Manufacturing, & Handling Information

Model Number	Peak Reflow Temp	MSL Rating*	Max Floor Life
EP7311-CB	225 °C	3	7 Days
EP7311-CB-90 (90 MHz)			
EP7311-IB			
EP7311-IB-90 (90 MHz)			
EP7311-CV			
EP7311-IV			
EP7311-CR			
EP7311-CR-90 (90 MHz)			

\* MSL (Moisture Sensitivity Level) as specified by IPC/JEDEC J-STD-020.

## Revision History

Revision	Date	Changes
PP1	NOV 2003	First preliminary release.
F1	AUG 2005	Updated SDRAM timing. Added MSL data.

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### Contacting Cirrus Logic Support

For all product questions and inquiries contact a Cirrus Logic Sales Representative.

To find the one nearest to you go to [www.cirrus.com](http://www.cirrus.com)

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