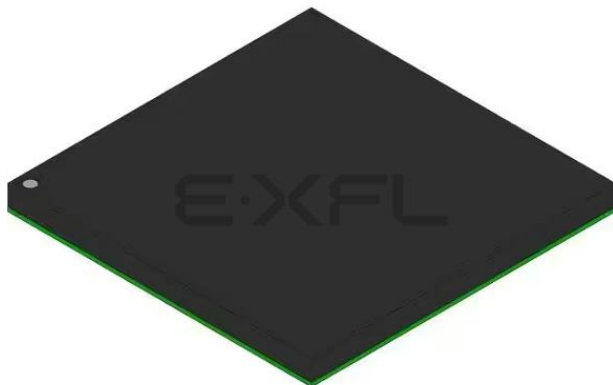




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SATA	-
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1 Overview

The MPC8323E incorporates the e300c2 (MPC603e-based) core built on Power Architecture® technology, which includes 16 Kbytes of L1 instruction and data caches, dual integer units, and on-chip memory management units (MMUs). The e300c2 core does not contain a floating point unit (FPU). The MPC8323E also includes a 32-bit PCI controller, four DMA channels, a security engine, and a 32-bit DDR1/DDR2 memory controller.

A new communications complex based on QUICC Engine technology forms the heart of the networking capability of the MPC8323E. The QUICC Engine block contains several peripheral controllers and a 32-bit RISC controller. Protocol support is provided by the main workhorses of the device—the unified communication controllers (UCCs). Note that the MPC8321 and MPC8321E do not support UTOPIA. A block diagram of the MPC8323E is shown in Figure 1.

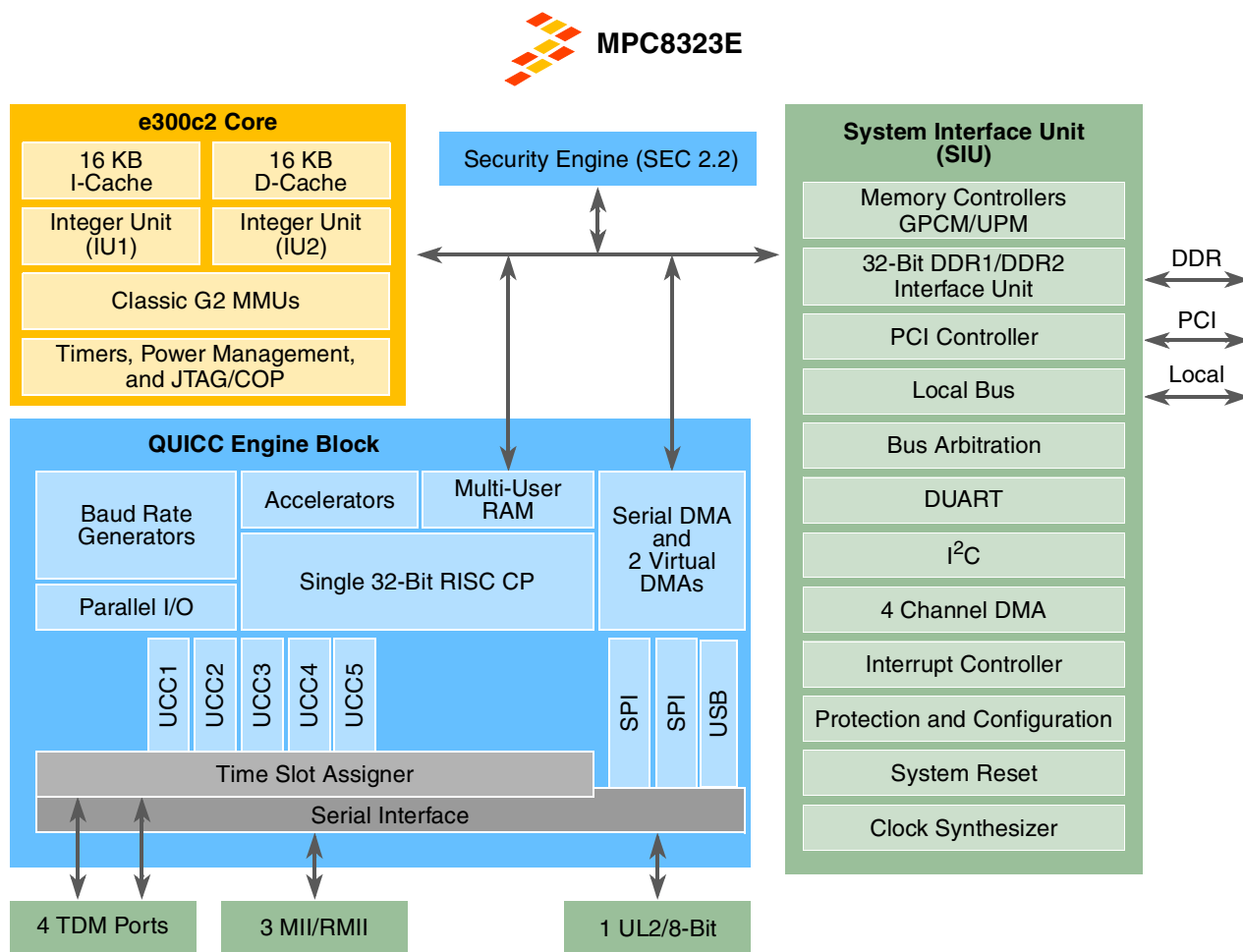


Figure 1. MPC8323E Block Diagram

Each of the five UCCs can support a variety of communication protocols: 10/100 Mbps Ethernet, serial ATM, HDLC, UART, and BISYNC—and, in the MPC8323E and MPC8323, multi-PHY ATM and ATM support for up to OC-3 speeds.

2.1.2 Power Supply Voltage Specification

Table 2 provides the recommended operating conditions for the MPC8323E. Note that these values are the recommended and tested operating conditions. Proper device operation outside of these conditions is not guaranteed.

Table 2. Recommended Operating Conditions³

Characteristic	Symbol	Recommended Value	Unit	Notes
Core supply voltage	V_{DD}	1.0 V $\pm$ 50 mV	V	1
PLL supply voltage	AV_{DD}	1.0 V $\pm$ 50 mV	V	1
DDR1 and DDR2 DRAM I/O voltage	GV_{DD}	2.5 V $\pm$ 125 mV 1.8 V $\pm$ 90 mV	V	1
PCI, local bus, DUART, system control and power management, I ² C, SPI, and JTAG I/O voltage	OV_{DD}	3.3 V $\pm$ 300 mV	V	1
Junction temperature	T_A/T_J	0 to 105	°C	2

Note:

1. GV_{DD} , OV_{DD} , AV_{DD} , and V_{DD} must track each other and must vary in the same direction—either in the positive or negative direction.
2. Minimum temperature is specified with T_A ; maximum temperature is specified with T_J .
3. All IO pins should be interfaced with peripherals operating at same voltage level.
4. This voltage is the input to the filter discussed in Section 24.2, “PLL Power Supply Filtering” and not necessarily the voltage at the AV_{DD} pin, which may be reduced due to voltage drop across the filter.

Figure 2 shows the undershoot and overshoot voltages at the interfaces of the MPC8323E

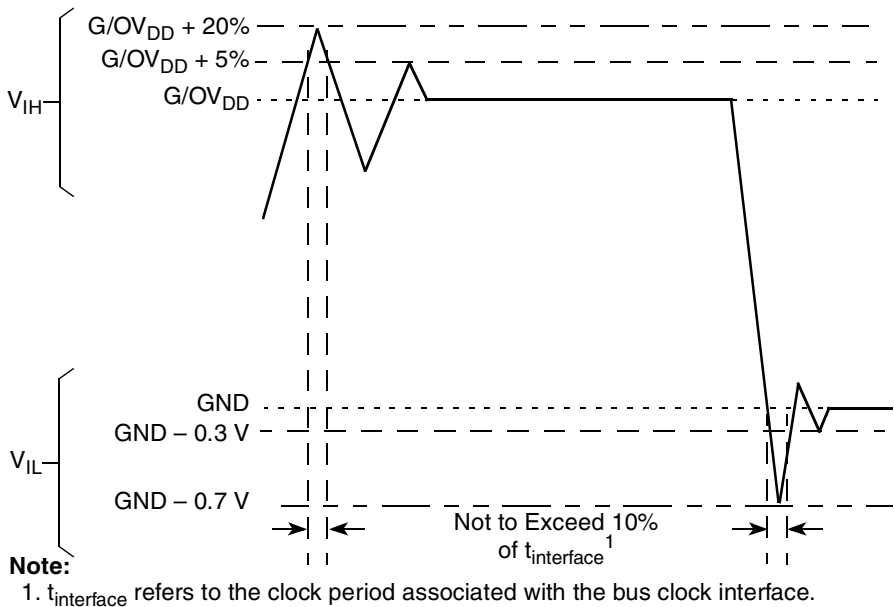


Figure 2. Overshoot/Undershoot Voltage for GV_{DD}/OV_{DD}

Table 7. CLKIN DC Electrical Characteristics (continued)

CLKIN input current	$0\text{ V} \leq V_{\text{IN}} \leq \text{OV}_{\text{DD}}$	I_{IN}	—	± 5	μA
PCI_SYNC_IN input current	$0\text{ V} \leq V_{\text{IN}} \leq 0.5\text{ V}$ or $\text{OV}_{\text{DD}} - 0.5\text{ V} \leq V_{\text{IN}} \leq \text{OV}_{\text{DD}}$	I_{IN}	—	± 5	μA
PCI_SYNC_IN input current	$0.5\text{ V} \leq V_{\text{IN}} \leq \text{OV}_{\text{DD}} - 0.5\text{ V}$	I_{IN}	—	± 50	μA

4.2 AC Electrical Characteristics

The primary clock source for the MPC8323E can be one of two inputs, CLKIN or PCI_CLK, depending on whether the device is configured in PCI host or PCI agent mode. Table 8 provides the clock input (CLKIN/PCI_CLK) AC timing specifications for the MPC8323E.

Table 8. CLKIN AC Timing Specifications

Parameter/Condition	Symbol	Min	Typical	Max	Unit	Notes
CLKIN/PCI_CLK frequency	f_{CLKIN}	25	—	66.67	MHz	1
CLKIN/PCI_CLK cycle time	t_{CLKIN}	15	—	—	ns	—
CLKIN rise and fall time	$t_{\text{KH}}, t_{\text{KL}}$	0.6	0.8	4	ns	2
PCI_CLK rise and fall time	$t_{\text{PCH}}, t_{\text{PCL}}$	0.6	0.8	1.2	ns	2
CLKIN/PCI_CLK duty cycle	$t_{\text{KHK}}/t_{\text{CLKIN}}$	40	—	60	%	3
CLKIN/PCI_CLK jitter	—	—	—	± 150	ps	4, 5

Notes:

- Caution:** The system, core, security, and QUICC Engine block must not exceed their respective maximum or minimum operating frequencies.
- Rise and fall times for CLKIN/PCI_CLK are measured at 0.4 and 2.7 V.
- Timing is guaranteed by design and characterization.
- This represents the total input jitter—short term and long term—and is guaranteed by design.
- The CLKIN/PCI_CLK driver's closed loop jitter bandwidth should be < 500 kHz at –20 dB. The bandwidth must be set low to allow cascade-connected PLL-based devices to track CLKIN drivers with the specified jitter.

5 RESET Initialization

This section describes the AC electrical specifications for the reset initialization timing requirements of the MPC8323E. Table 9 provides the reset initialization AC timing specifications for the reset component(s).

Table 9. RESET Initialization Timing Specifications

Parameter/Condition	Min	Max	Unit	Notes
Required assertion time of $\overline{\text{HRESET}}$ or $\overline{\text{SRESET}}$ (input) to activate reset flow	32	—	$t_{\text{PCI_SYNC_IN}}$	1
Required assertion time of $\overline{\text{PORESET}}$ with stable clock applied to CLKIN when the MPC8323E is in PCI host mode	32	—	t_{CLKIN}	2
Required assertion time of $\overline{\text{PORESET}}$ with stable clock applied to PCI_SYNC_IN when the MPC8323E is in PCI agent mode	32	—	$t_{\text{PCI_SYNC_IN}}$	1

6.2 DDR1 and DDR2 SDRAM AC Electrical Characteristics

This section provides the AC electrical characteristics for the DDR1 and DDR2 SDRAM interface.

6.2.1 DDR1 and DDR2 SDRAM Input AC Timing Specifications

Table 16 provides the input AC timing specifications for the DDR2 SDRAM ($Dn_GV_{DD}(typ) = 1.8\text{ V}$).

Table 16. DDR2 SDRAM Input AC Timing Specifications for 1.8-V Interface

At recommended operating conditions with Dn_GV_{DD} of $1.8 \pm 5\%$.

Parameter	Symbol	Min	Max	Unit	Notes
AC input low voltage	V_{IL}	—	$MVREFn_{REF} - 0.25$	V	—
AC input high voltage	V_{IH}	$MVREFn_{REF} + 0.25$	—	V	—

Table 17 provides the input AC timing specifications for the DDR1 SDRAM ($Dn_GV_{DD}(typ) = 2.5\text{ V}$).

Table 17. DDR1 SDRAM Input AC Timing Specifications for 2.5 V Interface

At recommended operating conditions with Dn_GV_{DD} of $2.5 \pm 5\%$.

Parameter	Symbol	Min	Max	Unit	Notes
AC input low voltage	V_{IL}	—	$MVREFn_{REF} - 0.31$	V	—
AC input high voltage	V_{IH}	$MVREFn_{REF} + 0.31$	—	V	—

Table 18 provides the input AC timing specifications for the DDR1 and DDR2 SDRAM interface.

Table 18. DDR1 and DDR2 SDRAM Input AC Timing Specifications

At recommended operating conditions with Dn_GV_{DD} of $(1.8\text{ or }2.5\text{ V}) \pm 5\%$.

Parameter	Symbol	Min	Max	Unit	Notes
Controller skew for MDQS—MDQ/MDM	t_{CISKEW}			ps	1, 2
266 MHz		–750	750		
200 MHz		–1250	1250		

Notes:

- t_{CISKEW} represents the total amount of skew consumed by the controller between MDQS[n] and any corresponding bit that is captured with MDQS[n]. This should be subtracted from the total timing budget.
- The amount of skew that can be tolerated from MDQS to a corresponding MDQ signal is called t_{DISKEW} . This can be determined by the following equation: $t_{DISKEW} = \pm(T/4 - \text{abs}(t_{CISKEW}))$ where T is the clock period and $\text{abs}(t_{CISKEW})$ is the absolute value of t_{CISKEW} .

Table 19. DDR1 and DDR2 SDRAM Output AC Timing Specifications (continued)

At recommended operating conditions with $D_n_GV_{DD}$ of (1.8 or 2.5 V) $\pm$ 5%.

Parameter	Symbol ¹	Min	Max	Unit	Notes
MDQ/MDM output setup with respect to MDQS 266 MHz 200 MHz	t_{DDKHDS} , t_{DDKLDS}	0.9 1.0	— —	ns	5
MDQ/MDM output hold with respect to MDQS 266 MHz 200 MHz	t_{DDKHDX} , t_{DDKLDX}	1100 1200	— —	ps	5
MDQS preamble start	t_{DDKHMP}	$-0.5 \times t_{MCK} - 0.6$	$-0.5 \times t_{MCK} + 0.6$	ns	6
MDQS epilogue end	t_{DDKHME}	-0.6	0.6	ns	6

Notes:

- The symbols used for timing specifications follow the pattern of $t_{(\text{first two letters of functional block})(\text{signal})(\text{state})(\text{reference})(\text{state})}$ for inputs and $t_{(\text{first two letters of functional block})(\text{reference})(\text{state})(\text{signal})(\text{state})}$ for outputs. Output hold time can be read as DDR timing (DD) from the rising or falling edge of the reference clock (KH or KL) until the output went invalid (AX or DX). For example, t_{DDKHAS} symbolizes DDR timing (DD) for the time t_{MCK} memory clock reference (K) goes from the high (H) state until outputs (A) are setup (S) or output valid time. Also, t_{DDKLDX} symbolizes DDR timing (DD) for the time t_{MCK} memory clock reference (K) goes low (L) until data outputs (D) are invalid (X) or data output hold time.
- All $MCK/\overline{MCK}$ referenced measurements are made from the crossing of the two signals ± 0.1 V.
- ADDR/CMD includes all DDR SDRAM output signals except $MCK/\overline{MCK}$, $\overline{MCS}$, and MDQ/MDM/MDQS. For the ADDR/CMD setup and hold specifications, it is assumed that the Clock Control register is set to adjust the memory clocks by 1/2 applied cycle.
- Note that t_{DDKHMH} follows the symbol conventions described in note 1. For example, t_{DDKHMH} describes the DDR timing (DD) from the rising edge of the $MCK(n)$ clock (KH) until the MDQS signal is valid (MH). t_{DDKHMH} can be modified through control of the DQSS override bits in the TIMING_CFG_2 register. This is typically set to the same delay as the clock adjust in the CLK_CNTL register. The timing parameters listed in the table assume that these 2 parameters have been set to the same adjustment value. See the *MPC8323E PowerQUICC II Pro Integrated Communications Processor Reference Manual* for a description and understanding of the timing modifications enabled by use of these bits.
- Determined by maximum possible skew between a data strobe (MDQS) and any corresponding bit of data (MDQ), or data mask (MDM). The data strobe should be centered inside of the data eye at the pins of the microprocessor.
- All outputs are referenced to the rising edge of $MCK(n)$ at the pins of the microprocessor. Note that t_{DDKHMP} follows the symbol conventions described in note 1.

7 DUART

This section describes the DC and AC electrical specifications for the DUART interface of the MPC8323E.

7.1 DUART DC Electrical Characteristics

Table 20 provides the DC electrical characteristics for the DUART interface of the MPC8323E.

Table 20. DUART DC Electrical Characteristics

Parameter	Symbol	Min	Max	Unit
High-level input voltage	V_{IH}	2	$OV_{DD} + 0.3$	V
Low-level input voltage OV_{DD}	V_{IL}	-0.3	0.8	V
High-level output voltage, $I_{OH} = -100 \mu A$	V_{OH}	$OV_{DD} - 0.2$	—	V
Low-level output voltage, $I_{OL} = 100 \mu A$	V_{OL}	—	0.2	V
Input current ($0 V \leq V_{IN} \leq OV_{DD}$) ¹	I_{IN}	—	± 5	μA

Note:

- Note that the symbol V_{IN} , in this case, represents the OV_{IN} symbol referenced in Table 1 and Table 2.

7.2 DUART AC Electrical Specifications

Table 21 provides the AC timing parameters for the DUART interface of the MPC8323E.

Table 21. DUART AC Timing Specifications

Parameter	Value	Unit	Notes
Minimum baud rate	256	baud	
Maximum baud rate	> 1,000,000	baud	1
Oversample rate	16	—	2

Notes:

- Actual attainable baud rate is limited by the latency of interrupt processing.
- The middle of a start bit is detected as the 8th sampled 0 after the 1-to-0 transition of the start bit. Subsequent bit values are sampled each 16th sample.

8 Ethernet and MII Management

This section provides the AC and DC electrical characteristics for Ethernet and MII management.

8.1 Ethernet Controller (10/100 Mbps)—MII/RMII Electrical Characteristics

The electrical characteristics specified here apply to all MII (media independent interface) and RMII (reduced media independent interface), except MDIO (management data input/output) and MDC

Table 24. MII Receive AC Timing Specifications (continued)

At recommended operating conditions with OV_{DD} of $3.3\text{ V} \pm 10\%$.

Parameter/Condition	Symbol ¹	Min	Typical	Max	Unit
RX_CLK clock fall time	t_{MRXF}	1.0	—	4.0	ns

Note:

- The symbols used for timing specifications follow the pattern of $t_{(\text{first two letters of functional block})(\text{signal})(\text{state})(\text{reference})(\text{state})}$ for inputs and $t_{(\text{first two letters of functional block})(\text{reference})(\text{state})(\text{signal})(\text{state})}$ for outputs. For example, t_{MRDVKH} symbolizes MII receive timing (MR) with respect to the time data input signals (D) reach the valid state (V) relative to the t_{MRX} clock reference (K) going to the high (H) state or setup time. Also, t_{MRDXKL} symbolizes MII receive timing (GR) with respect to the time data input signals (D) went invalid (X) relative to the t_{MRX} clock reference (K) going to the low (L) state or hold time. Note that, in general, the clock reference symbol representation is based on three letters representing the clock of a particular functional. For example, the subscript of t_{MRX} represents the MII (M) receive (RX) clock. For rise and fall times, the latter convention is used with the appropriate letter: R (rise) or F (fall).

Figure 8 provides the AC test load.

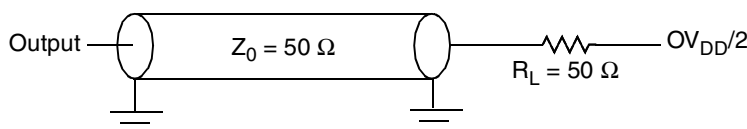
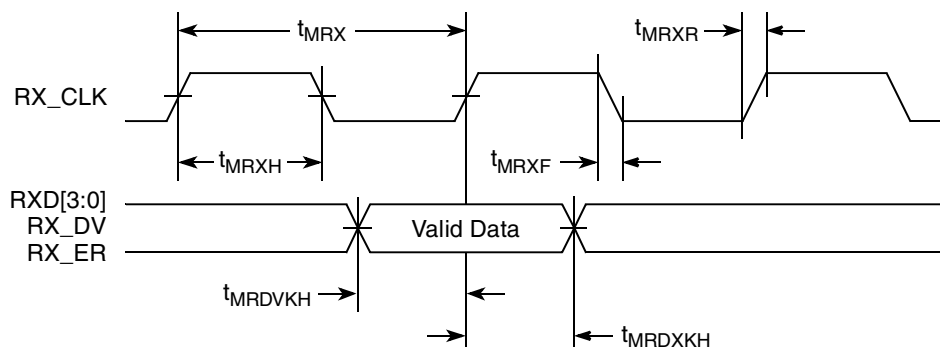

Figure 8. AC Test Load

Figure 9 shows the MII receive AC timing diagram.


Figure 9. MII Receive AC Timing Diagram

8.2.2 RMII AC Timing Specifications

This section describes the RMII transmit and receive AC timing specifications.

Table 30. Local Bus General Timing Parameters (continued)

Parameter	Symbol ¹	Min	Max	Unit	Notes
LALE output fall to LAD output transition (LATCH hold time)	$t_{LBOTOT2}$	3	—	ns	6
LALE output fall to LAD output transition (LATCH hold time)	$t_{LBOTOT3}$	2.5	—	ns	7
Local bus clock (LCLK _n) to output valid	t_{LBKHOV}	—	3	ns	3
Local bus clock (LCLK _n) to output high impedance for LAD/LDP	t_{LBKHOZ}	—	4	ns	8
Local bus clock (LCLK _n) duty cycle	t_{LBDC}	47	53	%	—
Local bus clock (LCLK _n) jitter specification	t_{LBRJ}	—	400	ps	—
Delay between the input clock (PCI_SYNC_IN) of local bus output clock (LCLK _n)	t_{LBCTL}	—	1.7	ns	—

Notes:

1. The symbols used for timing specifications follow the pattern of $t_{(\text{first two letters of functional block})(\text{signal})(\text{state})(\text{reference})(\text{state})}$ for inputs and $t_{(\text{first two letters of functional block})(\text{reference})(\text{state})(\text{signal})(\text{state})}$ for outputs. For example, $t_{LBIXKH1}$ symbolizes local bus timing (LB) for the input (I) to go invalid (X) with respect to the time the t_{LBK} clock reference (K) goes high (H), in this case for clock one(1).
2. All timings are in reference to falling edge of LCLK0 (for all outputs and for $\overline{\text{LGTA}}$ and LUPWAIT inputs) or rising edge of LCLK0 (for all other inputs).
3. All signals are measured from $OV_{DD}/2$ of the rising/falling edge of LCLK0 to $0.4 \times OV_{DD}$ of the signal in question for 3.3-V signaling levels.
4. Input timings are measured at the pin.
5. $t_{LBOTOT1}$ should be used when RCWH[LALE] is not set and the load on LALE output pin is at least 10 pF less than the load on LAD output pins.
6. $t_{LBOTOT2}$ should be used when RCWH[LALE] is set and the load on LALE output pin is at least 10 pF less than the load on LAD output pins.
7. $t_{LBOTOT3}$ should be used when RCWH[LALE] is set and the load on LALE output pin equals to the load on LAD output pins.
8. For purposes of active/float timing measurements, the Hi-Z or off state is defined to be when the total current delivered through the component pin is less than or equal to the leakage current specification.

Figure 14 provides the AC test load for the local bus.

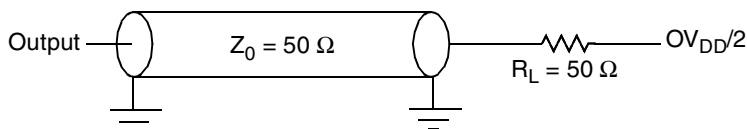

Figure 14. Local Bus C Test Load

Table 34. I²C AC Electrical Specifications (continued)

All values refer to V_{IH} (min) and V_{IL} (max) levels (see Table 33).

Parameter	Symbol ¹	Min	Max	Unit
Rise time of both SDA and SCL signals	t_{I2CR}	$20 + 0.1 C_b^4$	300	ns
Fall time of both SDA and SCL signals	t_{I2CF}	$20 + 0.1 C_b^4$	300	ns
Setup time for STOP condition	t_{I2PVKH}	0.6	—	μs
Bus free time between a STOP and START condition	t_{I2KHDX}	1.3	—	μs
Noise margin at the LOW level for each connected device (including hysteresis)	V_{NL}	$0.1 \times OV_{DD}$	—	V
Noise margin at the HIGH level for each connected device (including hysteresis)	V_{NH}	$0.2 \times OV_{DD}$	—	V

Notes:

- The symbols used for timing specifications follow the pattern of $t_{(first\ two\ letters\ of\ functional\ block)(signal)(state)(reference)(state)}$ for inputs and $t_{(first\ two\ letters\ of\ functional\ block)(reference)(state)(signal)(state)}$ for outputs. For example, t_{I2DVKH} symbolizes I²C timing (I2) with respect to the time data input signals (D) reach the valid state (V) relative to the t_{I2C} clock reference (K) going to the high (H) state or setup time. Also, t_{I2SXKL} symbolizes I²C timing (I2) for the time that the data with respect to the start condition (S) went invalid (X) relative to the t_{I2C} clock reference (K) going to the low (L) state or hold time. Also, t_{I2PVKH} symbolizes I²C timing (I2) for the time that the data with respect to the stop condition (P) reaching the valid state (V) relative to the t_{I2C} clock reference (K) going to the high (H) state or setup time. For rise and fall times, the latter convention is used with the appropriate letter: R (rise) or F (fall).
- MPC8323E provides a hold time of at least 300 ns for the SDA signal (referred to the V_{IH} (min) of the SCL signal) to bridge the undefined region of the falling edge of SCL.
- The maximum t_{I2DVKH} has only to be met if the device does not stretch the LOW period (t_{I2CL}) of the SCL signal.
- C_b = capacitance of one bus line in pF.

Figure 23 provides the AC test load for the I²C.

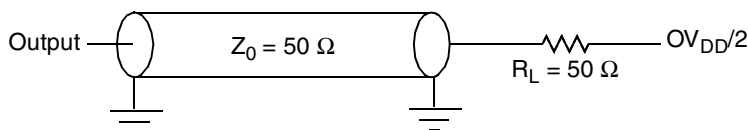

Figure 23. I²C AC Test Load

Figure 24 shows the AC timing diagram for the I²C bus.

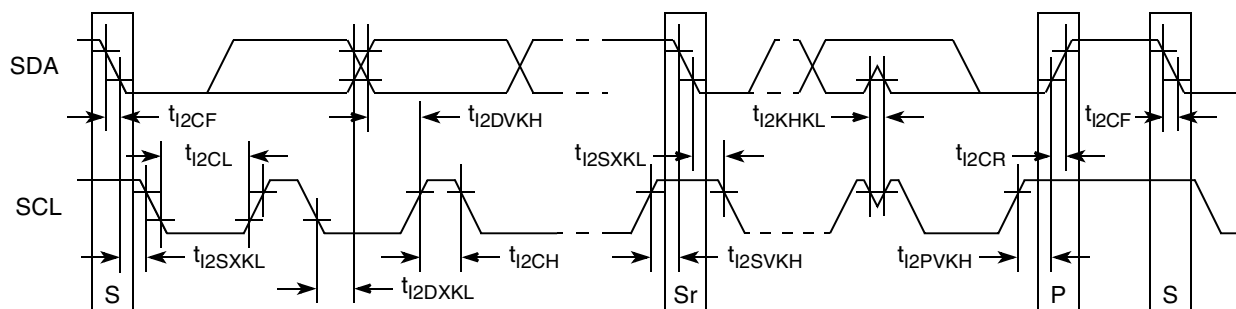

Figure 24. I²C Bus AC Timing Diagram

Table 37 shows the PCI AC timing specifications at 33 MHz.

Table 37. PCI AC Timing Specifications at 33 MHz

Parameter	Symbol ¹	Min	Max	Unit	Notes
Clock to output valid	t_{PCKHOV}	—	11	ns	2
Output hold from clock	t_{PCKHOX}	2	—	ns	2
Clock to output high impedance	t_{PCKHOZ}	—	14	ns	2, 3
Input setup to clock	t_{PCIVKH}	3.0	—	ns	2, 4
Input hold from clock	t_{PCIXKH}	0	—	ns	2, 4

Notes:

1. The symbols used for timing specifications follow the pattern of $t_{(first\ two\ letters\ of\ functional\ block)(signal)(state)(reference)(state)}$ for inputs and $t_{(first\ two\ letters\ of\ functional\ block)(reference)(state)(signal)(state)}$ for outputs. For example, t_{PCIVKH} symbolizes PCI timing (PC) with respect to the time the input signals (I) reach the valid state (V) relative to the PCI_SYNC_IN clock, t_{SYS} , reference (K) going to the high (H) state or setup time. Also, t_{PCRHFV} symbolizes PCI timing (PC) with respect to the time hard reset (R) went high (H) relative to the frame signal (F) going to the valid (V) state.
2. See the timing measurement conditions in the *PCI 2.3 Local Bus Specifications*.
3. For purposes of active/float timing measurements, the Hi-Z or off state is defined to be when the total current delivered through the component pin is less than or equal to the leakage current specification.
4. Input timings are measured at the pin.

Figure 25 provides the AC test load for PCI.

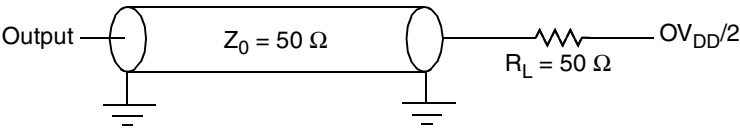


Figure 25. PCI AC Test Load

Figure 26 shows the PCI input AC timing conditions.

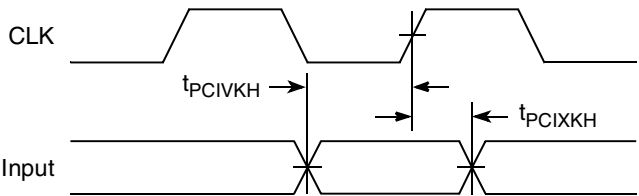


Figure 26. PCI Input AC Timing Measurement Conditions

Figure 29 provides the AC test load for the GPIO.

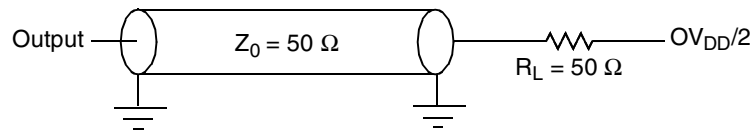


Figure 29. GPIO AC Test Load

15 IPIC

This section describes the DC and AC electrical specifications for the external interrupt pins of the MPC8323E.

15.1 IPIC DC Electrical Characteristics

Table 42 provides the DC electrical characteristics for the external interrupt pins of the MPC8323E.

Table 42. IPIC DC Electrical Characteristics^{1,2}

Characteristic	Symbol	Condition	Min	Max	Unit
Input high voltage	V_{IH}	—	2.0	$OV_{DD} + 0.3$	V
Input low voltage	V_{IL}	—	-0.3	0.8	V
Input current	I_{IN}	—	—	± 5	μA
Output low voltage	V_{OL}	$I_{OL} = 6.0 \text{ mA}$	—	0.5	V
Output low voltage	V_{OL}	$I_{OL} = 3.2 \text{ mA}$	—	0.4	V

Notes:

1. This table applies for pins $\overline{IRQ}[0:7]$, $\overline{IRQ_OUT}$, $\overline{MCP_OUT}$, and CE ports Interrupts.
2. $\overline{IRQ_OUT}$ and $\overline{MCP_OUT}$ are open drain pins, thus V_{OH} is not relevant for those pins.

15.2 IPIC AC Timing Specifications

Table 43 provides the IPIC input and output AC timing specifications.

Table 43. IPIC Input AC Timing Specifications¹

Characteristic	Symbol ²	Min	Unit
IPIC inputs—minimum pulse width	t_{PIWID}	20	ns

Notes:

1. Input specifications are measured from the 50% level of the signal to the 50% level of the rising edge of CLKIN. Timings are measured at the pin.
2. IPIC inputs and outputs are asynchronous to any visible clock. IPIC outputs should be synchronized before use by any external synchronous logic. IPIC inputs are required to be valid for at least t_{PIWID} ns to ensure proper operation when working in edge triggered mode.

Figure 39 shows the timing with external clock.

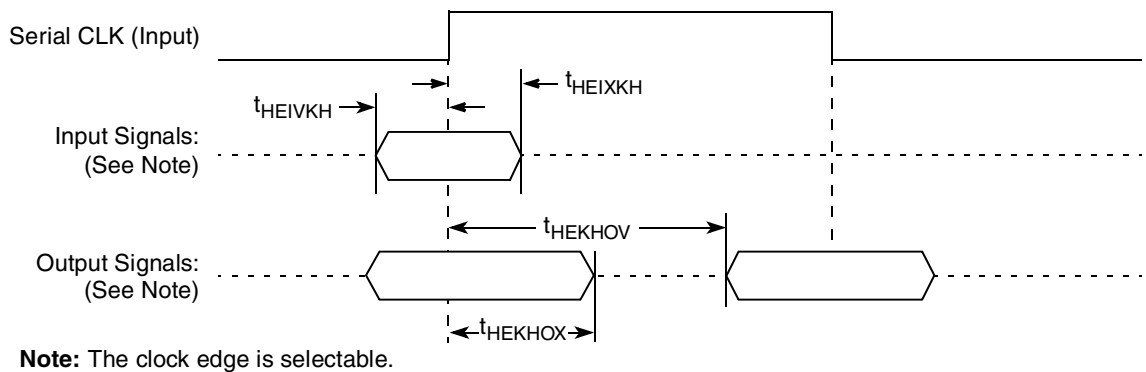


Figure 39. AC Timing (External Clock) Diagram

Figure 40 shows the timing with internal clock.

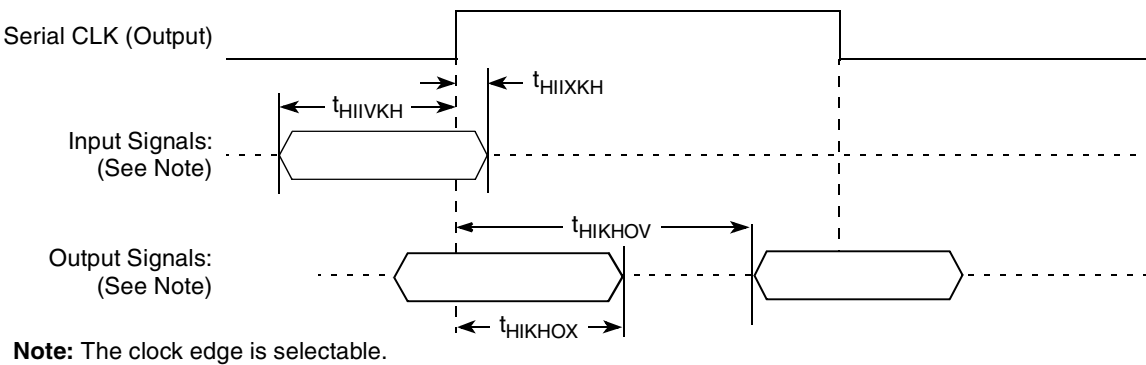
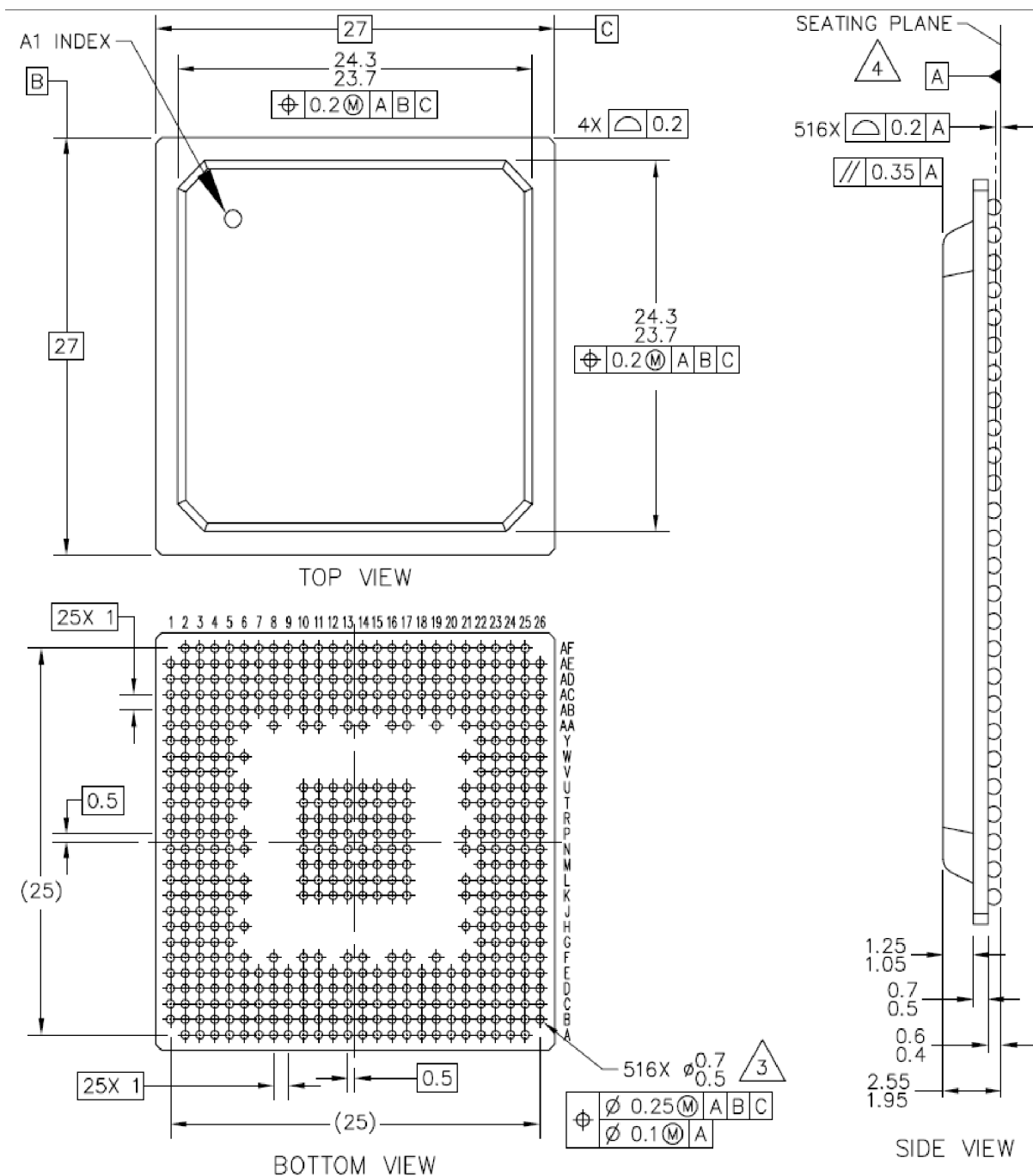


Figure 40. AC Timing (Internal Clock) Diagram



Notes:

1. All dimensions are in millimeters.
2. Dimensions and tolerances per ASME Y14.5M-1994.
3. Maximum solder ball diameter measured parallel to datum A.
4. Datum A, the seating plane, is determined by the spherical crowns of the solder balls.

Figure 42. Mechanical Dimensions and Bottom Surface Nomenclature of the MPC8323E PBGA

21.3 Pinout Listings

Table 55 shows the pin list of the MPC8323E.

Table 55. MPC8323E PBGA Pinout Listing

Signal	Package Pin Number	Pin Type	Power Supply	Notes
DDR Memory Controller Interface				
MEMC_MDQ0	AE9	IO	GV _{DD}	—
MEMC_MDQ1	AD10	IO	GV _{DD}	—
MEMC_MDQ2	AF10	IO	GV _{DD}	—
MEMC_MDQ3	AF9	IO	GV _{DD}	—
MEMC_MDQ4	AF7	IO	GV _{DD}	—
MEMC_MDQ5	AE10	IO	GV _{DD}	—
MEMC_MDQ6	AD9	IO	GV _{DD}	—
MEMC_MDQ7	AF8	IO	GV _{DD}	—
MEMC_MDQ8	AE6	IO	GV _{DD}	—
MEMC_MDQ9	AD7	IO	GV _{DD}	—
MEMC_MDQ10	AF6	IO	GV _{DD}	—
MEMC_MDQ11	AC7	IO	GV _{DD}	—
MEMC_MDQ12	AD8	IO	GV _{DD}	—
MEMC_MDQ13	AE7	IO	GV _{DD}	—
MEMC_MDQ14	AD6	IO	GV _{DD}	—
MEMC_MDQ15	AF5	IO	GV _{DD}	—
MEMC_MDQ16	AD18	IO	GV _{DD}	—
MEMC_MDQ17	AE19	IO	GV _{DD}	—
MEMC_MDQ18	AF17	IO	GV _{DD}	—
MEMC_MDQ19	AF19	IO	GV _{DD}	—
MEMC_MDQ20	AF18	IO	GV _{DD}	—
MEMC_MDQ21	AE18	IO	GV _{DD}	—
MEMC_MDQ22	AF20	IO	GV _{DD}	—
MEMC_MDQ23	AD19	IO	GV _{DD}	—
MEMC_MDQ24	AD21	IO	GV _{DD}	—
MEMC_MDQ25	AF22	IO	GV _{DD}	—
MEMC_MDQ26	AC21	IO	GV _{DD}	—
MEMC_MDQ27	AF21	IO	GV _{DD}	—
MEMC_MDQ28	AE21	IO	GV _{DD}	—

Table 55. MPC8323E PBGA Pinout Listing (continued)

Signal	Package Pin Number	Pin Type	Power Supply	Notes
IRQ3	J2	I	OV _{DD}	—
IRQ4	J1	I	OV _{DD}	—
IRQ5	AE26	I	OV _{DD}	—
IRQ6/CKSTOP_OUT	AE25	IO	OV _{DD}	—
IRQ7/CKSTOP_IN	AF25	I	OV _{DD}	—
CFG_CLKIN_DIV	F1	I	OV _{DD}	—
CFG_LBIU_MUX_EN	M23	I	OV _{DD}	—
JTAG				
TCK	W26	I	OV _{DD}	—
TDI	Y26	I	OV _{DD}	4
TDO	AA26	O	OV _{DD}	3
TMS	AB26	I	OV _{DD}	4
TRST	AC26	I	OV _{DD}	4
TEST				
TEST_MODE	N23	I	OV _{DD}	6
PMC				
QUIESCE	T23	O	OV _{DD}	—
System Control				
HRESET	AC23	IO	OV _{DD}	1
PORESET	AD23	I	OV _{DD}	—
SRESET	AD24	IO	OV _{DD}	2
Clocks				
CLKIN	R3	I	OV _{DD}	—
CLKIN	P4	O	OV _{DD}	—
PCI_SYNC_OUT	V1	O	OV _{DD}	3
RTC_PIT_CLOCK	U23	I	OV _{DD}	—
PCI_SYNC_IN/PCI_CLK	V2	I	OV _{DD}	—
PCI_CLK0/clcpd_cerisc1_ipg_clkout/DPTC_OSC	T3	O	OV _{DD}	—
PCI_CLK1/clcpd_half_cemb4ucc1_ipg_clkout/ CLOCK_XLB_CLOCK_OUT	U2	O	OV _{DD}	—
PCI_CLK2/clcpd_third_cesog_ipg_clkout/ cecl_ipg_ce_clock	R4	O	OV _{DD}	—

Table 55. MPC8323E PBGA Pinout Listing (continued)

Signal	Package Pin Number	Pin Type	Power Supply	Notes
Power and Ground Supplies				
AV _{DD} 1	P3	I	AV _{DD} 1	—
AV _{DD} 2	AA1	I	AV _{DD} 2	—
AV _{DD} 3	AB15	I	AV _{DD} 3	—
AV _{DD} 4	C24	I	AV _{DD} 4	—
MVREF1	AB8	I	DDR reference voltage	—
MVREF2	AB17	I	DDR reference voltage	—
PCI				
PCI_INTA /IRQ_OUT	AF2	O	OV _{DD}	2
PCI_RESET_OUT	AE2	O	OV _{DD}	—
PCI_AD0/MSRCID0 (DDR ID)	L1	IO	OV _{DD}	—
PCI_AD1/MSRCID1 (DDR ID)	L2	IO	OV _{DD}	—
PCI_AD2/MSRCID2 (DDR ID)	M1	IO	OV _{DD}	—
PCI_AD3/MSRCID3 (DDR ID)	M2	IO	OV _{DD}	—
PCI_AD4/MSRCID4 (DDR ID)	L3	IO	OV _{DD}	—
PCI_AD5/MDVAL (DDR ID)	N1	IO	OV _{DD}	—
PCI_AD6	N2	IO	OV _{DD}	—
PCI_AD7	M3	IO	OV _{DD}	—
PCI_AD8	P1	IO	OV _{DD}	—
PCI_AD9	R1	IO	OV _{DD}	—
PCI_AD10	N3	IO	OV _{DD}	—
PCI_AD11	N4	IO	OV _{DD}	—
PCI_AD12	T1	IO	OV _{DD}	—
PCI_AD13	R2	IO	OV _{DD}	—
PCI_AD14/ECID_TMODE_IN	T2	IO	OV _{DD}	—
PCI_AD15	U1	IO	OV _{DD}	—
PCI_AD16	Y2	IO	OV _{DD}	—
PCI_AD17	Y1	IO	OV _{DD}	—
PCI_AD18	AA2	IO	OV _{DD}	—
PCI_AD19	AB1	IO	OV _{DD}	—

22.1 Clocking in PCI Host Mode

When the MPC8323E is configured as a PCI host device ($RCWH[PCIHOST] = 1$), CLKIN is its primary input clock. CLKIN feeds the PCI clock divider ($\div 2$) and the PCI_SYNC_OUT and PCI_CLK_OUT multiplexors. The CFG_CLKIN_DIV configuration input selects whether CLKIN or CLKIN/2 is driven out on the PCI_SYNC_OUT signal.

PCI_SYNC_OUT is connected externally to PCI_SYNC_IN to allow the internal clock subsystem to synchronize to the system PCI clocks. PCI_SYNC_OUT must be connected properly to PCI_SYNC_IN, with equal delay to all PCI agent devices in the system.

22.1.1 PCI Clock Outputs (PCI_CLK_OUT[0:2])

When the MPC8323E is configured as a PCI host, it provides three separate clock output signals, PCI_CLK_OUT[0:2], for external PCI agents.

When the device comes out of reset, the PCI clock outputs are disabled and are actively driven to a steady low state. Each of the individual clock outputs can be enabled (enable toggling of the clock) by setting its corresponding OCCR[PCICOEn] bit. All output clocks are phase-aligned to each other.

22.2 Clocking in PCI Agent Mode

When the MPC8323E is configured as a PCI agent device, PCI_CLK is the primary input clock. In agent mode, the CLKIN signal should be tied to GND, and the clock output signals, PCI_CLK_OUTn and PCI_SYNC_OUT, are not used.

22.3 System Clock Domains

As shown in [Figure 43](#), the primary clock input (frequency) is multiplied up by the system phase-locked loop (PLL) and the clock unit to create three major clock domains:

- The coherent system bus clock (*csb_clk*)
- The QUICC Engine clock (*ce_clk*)
- The internal clock for the DDR controller (*ddr_clk*)
- The internal clock for the local bus controller (*lb_clk*)

The *csb_clk* frequency is derived from a complex set of factors that can be simplified into the following equation:

$$csb_clk = [PCI_SYNC_IN \times (1 + \sim \overline{CFG_CLKIN_DIV})] \times SPMF$$

In PCI host mode, $PCI_SYNC_IN \times (1 + \sim \overline{CFG_CLKIN_DIV})$ is the CLKIN frequency.

The *csb_clk* serves as the clock input to the e300c2 core. A second PLL inside the core multiplies up the *csb_clk* frequency to create the internal clock for the core (*core_clk*). The system and core PLL multipliers are selected by the SPMF and COREPLL fields in the reset configuration word low (RCWL) which is loaded at power-on reset or by one of the hard-coded reset options. See the “Reset Configuration” section in the *MPC8323E PowerQUICC II Pro Communications Processor Reference Manual* for more information.

Table 64. Package Thermal Characteristics for PBGA (continued)

Characteristic	Board type	Symbol	Value	Unit	Notes
Junction-to-package top	Natural convection	Ψ_{JT}	2	°C/W	6

Notes:

1. Junction temperature is a function of die size, on-chip power dissipation, package thermal resistance, mounting site (board) temperature, ambient temperature, air flow, power dissipation of other components on the board, and board thermal resistance.
2. Per JEDEC JESD51-2 with the single layer board horizontal. Board meets JESD51-9 specification.
3. Per JEDEC JESD51-6 with the board horizontal.
4. Thermal resistance between the die and the printed-circuit board per JEDEC JESD51-8. Board temperature is measured on the top surface of the board near the package.
5. Thermal resistance between the die and the case top surface as measured by the cold plate method (MIL SPEC-883 Method 1012.1).
6. Thermal characterization parameter indicating the temperature difference between package top and the junction temperature per JEDEC JESD51-2. When Greek letters are not available, the thermal characterization parameter is written as Psi-JT.

23.2 Thermal Management Information

For the following sections, $P_D = (V_{DD} \times I_{DD}) + P_{I/O}$, where $P_{I/O}$ is the power dissipation of the I/O drivers.

23.2.1 Estimation of Junction Temperature with Junction-to-Ambient Thermal Resistance

An estimation of the chip junction temperature, T_J , can be obtained from the equation:

$$T_J = T_A + (R_{\theta JA} \times P_D)$$

where:

T_J = junction temperature (°C)

T_A = ambient temperature for the package (°C)

$R_{\theta JA}$ = junction-to-ambient thermal resistance (°C/W)

P_D = power dissipation in the package (W)

The junction-to-ambient thermal resistance is an industry standard value that provides a quick and easy estimation of thermal performance. As a general statement, the value obtained on a single layer board is appropriate for a tightly packed printed-circuit board. The value obtained on the board with the internal planes is usually appropriate if the board has low power dissipation and the components are well separated. Test cases have demonstrated that errors of a factor of two (in the quantity $T_J - T_A$) are possible.

23.2.2 Estimation of Junction Temperature with Junction-to-Board Thermal Resistance

The thermal performance of a device cannot be adequately predicted from the junction-to-ambient thermal resistance. The thermal performance of any component is strongly dependent on the power dissipation of surrounding components. In addition, the ambient temperature varies widely within the application. For many natural convection and especially closed box applications, the board temperature at the perimeter

While $\overline{\text{HRESET}}$ is asserted however, these pins are treated as inputs. The value presented on these pins while $\overline{\text{HRESET}}$ is asserted, is latched when $\overline{\text{HRESET}}$ deasserts, at which time the input receiver is disabled and the I/O circuit takes on its normal function. Careful board layout with stubless connections to these pull-up/pull-down resistors coupled with the large value of the pull-up/pull-down resistor should minimize the disruption of signal quality or speed for output pins thus configured.

24.7 Pull-Up Resistor Requirements

The MPC8323E requires high resistance pull-up resistors (10 k Ω is recommended) on open drain type pins including I²C pins, Ethernet Management MDIO pin, and IPIC interrupt pins.

For more information on required pull-up resistors and the connections required for the JTAG interface, see AN3361, “MPC8321E/MPC8323E PowerQUICC Design Checklist,” Rev. 1.

25 Ordering Information

This section presents ordering information for the devices discussed in this document, and it shows an example of how the parts are marked. Ordering information for the devices fully covered by this document is provided in [Section 25.1, “Part Numbers Fully Addressed by This Document.”](#)

25.1 Part Numbers Fully Addressed by This Document

[Table 66](#) provides the Freescale part numbering nomenclature for the MPC8323E family. Note that the individual part numbers correspond to a maximum processor core frequency. For available frequencies, contact your local Freescale sales office. In addition to the maximum processor core frequency, the part numbering scheme also includes the maximum effective DDR memory speed and QUICC Engine bus frequency. Each part number also contains a revision code which refers to the die mask revision number.

Table 66. Part Numbering Nomenclature

MPC	nnnn	E	C	VR	AF	D	C	A
Product Code	Part Identifier	Encryption Acceleration	Temperature Range ¹	Package ²	e300 Core Frequency ³	DDR Frequency	QUICC Engine Frequency	Revision Level
MPC	8323	Blank = Not included E = included	Blank = 0 to 105°C C = -40 to 105°C	VR = Pb-free PBGA ZQ = Pb PBGA	AD = 266 MHz AF = 333 MHz	D = 266 MHz	C = 200 MHz	Contact local Freescale sales office

Notes:

1. Contact local Freescale office on availability of parts with C temperature range.
2. See [Section 21, “Package and Pin Listings,”](#) for more information on available package types.
3. Processor core frequencies supported by parts addressed by this specification only. Not all parts described in this specification support all core frequencies. Additionally, parts addressed by Part Number Specifications may support other maximum core frequencies.

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Japan:

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1-8-1, Shimo-Meguro, Meguro-ku
Tokyo 153-0064
Japan
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+81 3 5437 9125
support.japan@freescale.com

Asia/Pacific:

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China
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