

Device Overview

The RC32365 device is a member of the IDT™ Interprise™ family of integrated communications processors. This device is designed to address a range of communications applications that require the efficient processing of IPSec algorithms. These applications include gateways, wireless access points, and virtual private network (VPN) equipment. The key to the RC32365's efficient processing of IPSec algorithms is a highly programmable security engine which off-loads the CPU core of encryption/decryption, hashing, and padding tasks.

Features List

- ◆ **RC32300 32-bit CPU core**
 - 32-bit MIPS instruction set
 - Supports big or little endian operation
 - MMU
 - 16-entry TLB
 - Supports variable page sizes and enhanced write algorithm
 - Supports variable number of locked entries
 - 8KB Instruction Cache
 - 2-way set associative
 - LRU replacement algorithm
 - 4 word line size
 - Sub-block ordering
 - Word parity
 - Per line cache locking
 - 2KB Data Cache

- 2-way set associative
- LRU replacement algorithm
- 4 word line size
- Sub-block ordering
- Byte parity
- Per line cache locking
- Can be programmed on a page basis to implement write-through no write allocate, write-through write allocate, or write-back algorithms
- Enhanced EJTAG and JTAG Interfaces
 - Compatible with IEEE Std. 1149.1-1990

◆ **Security Engine**

- Dedicated DMA channels for high speed data transfers to and from the security engine
- On-chip memory for storage of two security contexts
- Supports ECB and CBC modes for the following symmetric encryption algorithms: DES, triple DES (both two key (k1=k3) and three key (k1≠k3) modes), AES-128 with 128-bit blocks, AES-192 with 128-bit blocks
- Hardware support for encryption pad generation and checking using one of seven popular padding algorithms: supports pad algorithm required by IPSec ESP
- Supports MD5 and SHA-1 one-way hash functions
- Programmable truncation length of computed hash and HMAC on a security context basis
- Supports concurrent hash and encryption operations

Block Diagram

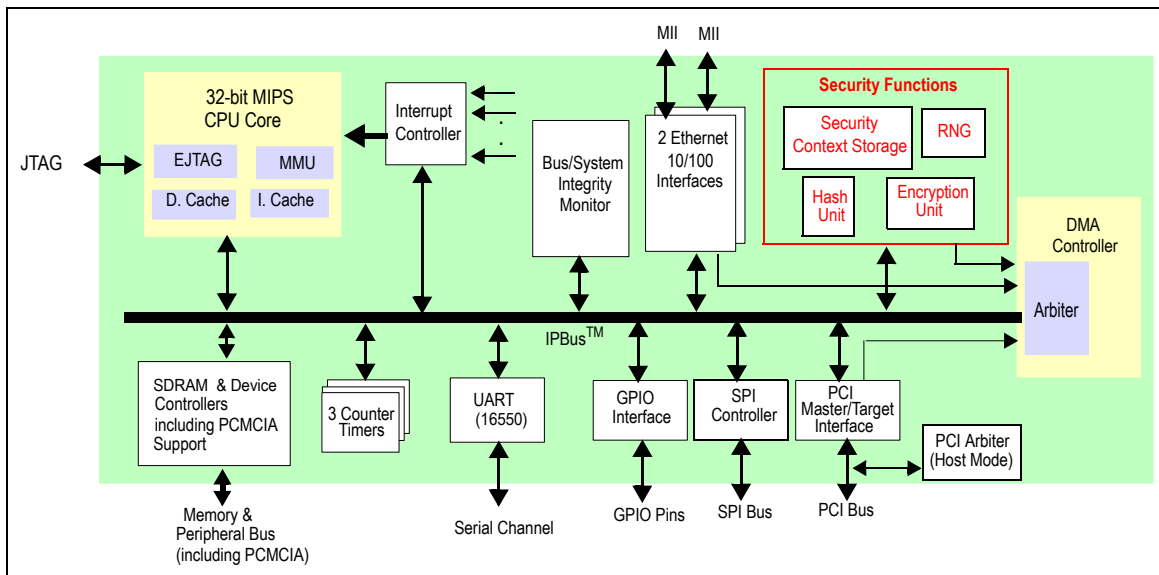


Figure 1 RC32365 Internal Block Diagram

- Optimized for IPsec AH, ESP, and AH+ESP (single MAC) tunnel and transport mode processing: initialization Vector (IV) insertion and extraction, HMAC checking, AH mutable field processing for both IPv4 and IPv6 packets, IPsec pad generation and checking
- ◆ **Random Number Generator**
 - True hardware random number generator suitable for security applications: may be used to generate symmetric and public keys, initialization vectors, and nonces
 - Dedicated DMA engine for transferring random numbers to memory
 - Generates random numbers at a bit rate equal to IPBus clock frequency divided by 32
 - Provides 4 word (16 byte) FIFO to queue random numbers
 - Randomness tester continually verifies proper operation of random number generator using a randomness test defined in FIPS 140-2
- ◆ **PCI Interface**
 - 32-bit PCI revision 2.2 compliant
 - Supports host or satellite operation in both master and target modes
 - PCI clock: supports frequencies from 16 MHz to 66 MHz, PCI clock may be asynchronous to master clock (CLK)
 - PCI arbiter in Host mode: supports 3 external masters, fixed priority or round robin arbitration
 - I₂O “like” PCI Messaging Unit
- ◆ **Two Ethernet Interfaces**
 - 10 and 100 Mb/s ISO/IEC 8802-3:1996 compliant
 - Two IEEE 802.3u compatible Media Independent Interfaces (MII) with serial management interface
 - MII supports IEEE 802.3u auto-negotiation speed selection
 - Supports 64 entry hash table based multicast address filtering
 - 512 byte transmit and receive FIFOs
 - Supports flow control functions outlined in IEEE Std. 802.3x-1997
- ◆ **SDRAM Controller**
 - Supports up to 512 MB of memory
 - 2 chip selects (each supports 2 or 4 banks internal SDRAM banks)
 - 32-bit data width, supports 8/16/32-bit width devices
 - Supports 16Mb, 64Mb, 128Mb, and 256Mb, and 512Mb devices
 - Automatic refresh generation
- ◆ **Memory and Peripheral Device Controller**
 - Provides “glueless” interface to standard SRAM, Flash, ROM, dual-port memory, and peripheral devices
 - Provides “glueless” interface to many 16-bit PCMCIA devices
 - Demultiplexed address and data buses: 32-bit data bus, 26-bit address bus, 6 chip selects, control for external data bus buffers
 - Supports 8-bit, 16-bit, and 32-bit width devices: automatic byte gathering and scattering
 - Flexible protocol configuration parameters: programmable number of wait states (0 to 63), programmable postread/postwrite delay (0 to 31), supports external wait state generation, supports Intel and Motorola style peripherals
 - Write protect capability per chip select

- Programmable bus transaction timer generates warm reset when counter expires
- Supports up to 64MB of memory per chip select
- ◆ **DMA Controller**
 - 9 DMA channels: two channels for each of the two Ethernet interfaces (transmit/receive), two channels for PCI (PCI to Memory and Memory to PCI), two channels for security engine (input/output), one channel for the hardware random number generator
 - Provides flexible descriptor based operation
 - Supports unaligned transfers (i.e., source or destination address may be on any byte boundary) with arbitrary byte length
- ◆ **General Purpose Peripherals**
 - Serial port compatible with 16550 Universal Asynchronous Receiver Transmitter (UART)
 - Three general purpose 32-bit counter/timers
 - Interrupt Controller
 - Serial Peripheral Interface (SPI) supporting host mode
 - 16 general purpose I/O (GPIO) pins which can be configured as interrupt sources
- ◆ **System Features**
 - JTAG Interface (IEEE Std. 1149.1 compatible)
 - 256 pin CABGA package
 - 2.5V core supply and 3.3V I/O supply

CPU Execution Core

The RC32365 is built around the RC32300 32-bit high performance microprocessor core. The RC32300 implements the enhanced MIPS-II ISA and helps meet the real-time goals and maximize throughput of communications and consumer systems by providing capabilities such as a prefetch instruction, multiple DSP instructions, and cache locking. The instruction set is largely compatible with the MIPS32 instruction set, allowing the customer to select from a broad range of software and development tools. Cache locking guarantees real-time performance by holding critical code and parameters in the cache for immediate availability. The microprocessor also implements an on-chip MMU with a TLB, making the it fully compliant with the requirements of real time operating systems.

Security Engine

The RC32365 incorporates an on-chip security engine that has been designed to accelerate IPsec performance and minimize the amount of performance required by the CPU to process secure packet traffic. The engine includes hardware support for the DES, 3DES, and AES encryption algorithms and the MD5 and SHA1 hash functions. The engine also supports hardware-assisted packet processing for the various modes of IPsec, including AH, ESP, and AH+ESP tunnel and transport modes. Two dedicated DMA channels are used to transfer data to and from the security engine, allowing the CPU to work on other tasks during this time.

PCI Interface

The PCI interface on the RC32365 is compatible with version 2.2 of the PCI specification. An on-chip arbiter supports up to three external bus masters, supporting both fixed priority and rotating priority arbitration schemes. The RC32365 can support both satellite and host PCI configurations, enabling it to act as a slave controller for a PCI add-in card application, or as the primary PCI controller in the system. The PCI interface can be operated synchronously or asynchronously to the other I/O interfaces on the RC32365 device.

PCMCIA Interface

The RC32365 provides a "glueless" connection to a single PCMCIA I/O device via the memory and peripheral device controller. The PCMCIA interface allows the RC32365 to connect to various types of I/O peripherals including fax modems, storage devices, and wireless LAN chipsets. The RC32365 implementation provides a maximum throughput of 160 Mbps through the 16-bit wide interface as specified by the PCMCIA 2.1 Standard.

Ethernet Interface

The RC32365 has two Ethernet Channels supporting 10Mbps and 100Mbps speeds and provides a standard media independent interface (MII) off-chip, allowing a wide range of external devices to be connected efficiently.

Memory and I/O Controller

The RC32365 incorporates a flexible memory and peripheral device controller providing direct support for SDRAM, Flash ROM, SRAM, PCMCIA, and other I/O devices. It can interface directly to 8-bit boot ROM for a very low cost system implementation. It also offers various trade-offs in cost / performance for the main memory architecture. The timers implemented on the RC32365 satisfy the requirements of most real time operating systems.

DMA Controller

The DMA controller off-loads the CPU core from moving data among the on-chip interfaces, external peripherals, and memory. The DMA controller supports scatter / gather DMA with no alignment restrictions, appropriate for communications and graphics systems.

Enhanced JTAG Interface

For system debugging, the RC32300 CPU core includes an Enhanced JTAG (EJTAG) interface which operates in Run-Time Mode.

Thermal Considerations

The RC32365 is guaranteed in a ambient temperature range of 0° to +70° C for commercial temperature devices and - 40° to +85° for industrial temperature devices.

Revision History

March 17, 2003: Initial publication.

May 15, 2003: Removed "write protect capability" from features of the SDRAM Controller.

July 9, 2003: In Table 6, changed values for RSTN (output). Changed values in Tables 7, 8, 9, 10, and 17.

Pin Description Table

The following table lists the functions of the pins provided on the RC32365. Some of the functions listed may be multiplexed onto the same pin (indicated as alternate functions).

To define the active polarity of a signal, a suffix will be used. Signals ending with an “N” should be interpreted as being active, or asserted, when at a logic zero (low) level. All other signals (including clocks, buses, and select lines) will be interpreted as being active, or asserted, when at a logic one (high) level.

| Signal | Type | Name/Description |
|----------------------------------|------|--|
| Memory and Peripheral Bus | | |
| BDIRN | O | External Buffer Direction. Memory and peripheral bus external data bus buffer direction control. If the RC32365 memory and peripheral bus is connected to the A side of a transceiver such as an IDT74FCT245, then this pin may be directly connected to the direction control (e.g., BDIR) pin of the transceiver. |
| BOEN[1:0] | O | External Buffer Enable. These signals provide output enable control for external buffers on the memory and peripheral data bus. |
| BWEN[3:0] | O | Byte Write Enables. These signals are memory and peripheral bus byte write enable signals. BWEN[0] corresponds to byte lane MDATA[7:0] BWEN[1] corresponds to byte lane MDATA[15:8] BWEN[2] corresponds to byte lane MDATA[23:16] BWEN[3] corresponds to byte lane MDATA[31:24] |
| CSN[5:0] | O | Chip Selects. These signals are used to select an external device on the memory and peripheral bus. |
| MADDR[21:0] | O | Address Bus. 22-bit memory and peripheral bus address bus. MADDR[25:22] are available as GPIO[5:2] alternate functions. |
| MDATA[31:0] | I/O | Data Bus. 32-bit memory and peripheral data bus. During a cold reset, bits 0 through 16 of this data bus function as inputs that are used to load the boot configuration vector. |
| OEN | O | Output Enable. This signal is asserted when data should be driven by an external device on the memory and peripheral bus. |
| RWN | O | Read Write. This signal indicates whether the transaction on the memory and peripheral bus is a read transaction or a write transaction. A high level indicates a read from an external device. A low level indicates a write to an external device. |
| WAITACKN | I | Wait or Transfer Acknowledge. When configured as wait, this signal is asserted during a memory and peripheral bus transaction to extend the bus cycle. When configured as a transfer acknowledge, this signal is asserted during a transaction to signal the completion of the transaction. |
| RASN | O | SDRAM Row Address Strobe. Row address strobe asserted during memory and peripheral bus SDRAM transactions. |
| CASN | O | SDRAM Column Address Strobe. Column address strobe asserted during memory and peripheral bus SDRAM transactions. |
| SDCSN[1:0] | O | SDRAM Chip Selects. These signals are used to select SDRAM device(s) on the memory and peripheral bus. |
| SDWEN | O | SDRAM Write Enable. This signal is asserted during memory and peripheral bus SDRAM write transactions. |
| SDCLKOUT | O | SDRAM Clock Output. This clock is used for all SDRAM memory and peripheral bus operations. |
| SDCLKINP | I | SDRAM Clock Input. This clock input is typically a delayed version of SDCLKOUT. Data from the SDRAMs is sampled using this clock. |

Table 1 Pin Description (Part 1 of 6)

| Signal | Type | Name/Description |
|----------------------------|------|--|
| General Purpose I/O | | |
| GPIO[0] | I/O | General Purpose I/O. This pin can be configured as a general purpose I/O pin. Alternate function pin name: U0SOUT Alternate function: UART channel 0 serial output. |
| GPIO[1] | I/O | General Purpose I/O. This pin can be configured as a general purpose I/O pin. Alternate function pin name: U0SINP Alternate function: UART channel 0 serial input. |
| GPIO[2] | I/O | General Purpose I/O. This pin can be configured as a general purpose I/O pin. Alternate function pin name: MADDR[22] Alternate function: Memory and Peripheral bus address bit 22 (output). |
| GPIO[3] | I/O | General Purpose I/O. This pin can be configured as a general purpose I/O pin. Alternate function pin name: MADDR[23] Alternate function: Memory and Peripheral bus address bit 23 (output). |
| GPIO[4] | I/O | General Purpose I/O. This pin can be configured as a general purpose I/O pin. Alternate function pin name: MADDR[24] Alternate function: Memory and Peripheral bus address bit 24 (output). |
| GPIO[5] | I/O | General Purpose I/O. This pin can be configured as a general purpose I/O pin. Alternate function pin name: MADDR[25] Alternate function: Memory and Peripheral bus address bit 25 (output). |
| GPIO[6] | I/O | General Purpose I/O. This pin can be configured as a general purpose I/O pin. Alternate function pin name: RNGCLK Alternate function: External random number generator clock input The value of this pin may be used as a Counter Timer Clock input. |
| GPIO[7] | I/O | General Purpose I/O. This pin can be configured as a general purpose I/O pin. Alternate function pin name: SDCKENP Alternate function: SDRAM clock enable output The value of this pin may be used as a Counter Timer Clock input. |
| GPIO[8] | I/O | General Purpose I/O. This pin can be configured as a general purpose I/O pin. Alternate function pin name: CEN1 Alternate function: PCMCIA chip enable 1 (CE1#) (output). |
| GPIO[9] | I/O | General Purpose I/O. This pin can be configured as a general purpose I/O pin. Alternate function pin name: CEN2 Alternate function: PCMCIA chip enable 2 (CE2#) (output). |
| GPIO[10] | I/O | General Purpose I/O. This pin can be configured as a general purpose I/O pin. Alternate function pin name: REGN Alternate function: PCMCIA Attribute Memory Select (REG#) (output). |
| GPIO[11] | I/O | General Purpose I/O. This pin can be configured as a general purpose I/O pin. Alternate function pin name: IORDN Alternate function: PCMCIA IO Read (IORD#) (output). |
| GPIO[12] | I/O | General Purpose I/O. This pin can be configured as a general purpose I/O pin. Alternate function pin name: IOWRN Alternate function: PCMCIA IO Write (IOWR#) (output). |
| GPIO[13] | I/O | General Purpose I/O. This pin can be configured as a general purpose I/O pin. Alternate function pin name: PCIREQN[2] Alternate function: PCI bus request 2 (output). |

Table 1 Pin Description (Part 2 of 6)

| Signal | Type | Name/Description |
|-------------------------|------|--|
| GPIO[14] | I/O | General Purpose I/O. This pin can be configured as a general purpose I/O pin. Alternate function pin name: PCIGNTN[2] Alternate function: PCI bus grant 2 (output). |
| GPIO[15] | I/O | General Purpose I/O. This pin can be configured as a general purpose I/O pin. Alternate function pin name: PCIMUINTN Alternate function: PCI Messaging unit interrupt output. |
| Serial Interface | | |
| SCK | I/O | Serial Clock. This signal is used as the serial SPI clock output. This pin may be used as a bit input/output port. |
| SDI | I/O | Serial Data Input. This signal is used to shift in serial SPI data. This pin may be used as a bit input/output port. |
| SDO | I/O | Serial Data Output. This signal is used to shift out serial SPI data. This pin may be used as a bit input/output port. |
| PCI Bus | | |
| PCIAD[31:0] | I/O | PCI Multiplexed Address/Data Bus. Address is driven by a bus master during initial PCIFRAMEN assertion. Data is then driven by the bus master during writes or by the bus target during reads. |
| PCICBEN[3:0] | I/O | PCI Multiplexed Command/Byte Enable Bus. PCI command is driven by the bus master during the initial PCIFRAMEN assertion. Byte enables are driven by the bus master during subsequent data phase(s). |
| PCICLK | I | PCI Clock. Clock used for all PCI bus transactions. |
| PCIDEVSELN | I/O | PCI Device Select. This signal is driven by a bus target to indicate that the target has decoded the address as one of its own address spaces. |
| PCIFRAMEN | I/O | PCI Frame. Driven by a bus master. Assertion indicates the beginning of a bus transaction. Negation indicates the last data. |
| PCIGNTN[1:0] | I/O | PCI Bus Grant. In PCI host mode with internal arbiter: The assertion of these signals indicates to the agent that the internal RC32365 arbiter has granted the agent access to the PCI bus. In PCI host mode with external arbiter: PCIGNTN[0]: asserted by an external arbiter to indicate to the RC32365 that access to the PCI bus has been granted. PCIGNTN[1]: unused and driven high. In PCI satellite mode: PCIGNTN[0]: this signal is asserted by an external arbiter to indicate to the RC32365 that access to the PCI bus has been granted. PCIGNTN[1]: this signal takes on the alternate function of PCIEECS and is used as a PCI Serial EEPROM chip select. |
| PCIIRDYN | I/O | PCI Initiator Ready. Driven by the bus master to indicate that the current data can complete. |
| PCILOCKN | I/O | PCI Lock. This signal is asserted by an external bus master to indicate that an exclusive operation is occurring. |
| PCIPAR | I/O | PCI Parity. Even parity of the PCIAD[31:0] bus. Driven by the bus master during address and write data phases. Driven by the bus target during the read data phases. |
| PCIPERRN | I/O | PCI Parity Error. This signal is asserted by the receiving bus agent 2 clocks after the data is received if a parity error is detected. |

Table 1 Pin Description (Part 3 of 6)

| Signal | Type | Name/Description |
|---------------------------|------|--|
| PCIREQN[1:0] | I/O | <p>PCI Bus Request. In PCI host mode with internal arbiter: These signals are inputs whose assertion indicates to the internal RC32365 arbiter that an agent desires ownership of the PCI bus.</p> <p>In PCI host mode with external arbiter: PCIREQN[0]: asserted by the RC32365 to request ownership of the PCI bus. PCIREQN[1]: unused and driven high.</p> <p>In PCI satellite mode: PCIREQN[0]: this signal is asserted by the RC32365 to request ownership of the PCI bus. PCIREQN[1]: function changes to PCIIDSEL and is used as a chip select during configuration read and write transactions.</p> |
| PCIRSTN | I/O | PCI Reset. In host mode, this signal is asserted by the RC32365 to generate a PCI reset. In satellite mode, assertion of this signal initiates a warm reset. |
| PCISERRN | I/O | PCI System Error. This signal is driven by an agent to indicate an address parity error, data parity error during a special cycle command, or any other system error. Requires an external pull-up. |
| PCISTOPN | I/O | PCI Stop. Driven by the bus target to terminate the current bus transaction. For example, to indicate a retry. |
| PCITRDYN | I/O | PCI Target Ready. Driven by the bus target to indicate that the current data can complete. |
| Ethernet Interface | | |
| MII0CL | I | Ethernet 0 MII Collision Detected. This signal is asserted by the ethernet PHY when a collision is detected. |
| MII0CRS | I | Ethernet 0 MII Carrier Sense. This signal is asserted by the ethernet PHY when either the transmit or receive medium is not idle. |
| MII0RXCLK | I | Ethernet 0 MII Receive Clock. This clock is a continuous clock that provides a timing reference for the reception of data. |
| MII0RXD[3:0] | I | Ethernet 0 MII Receive Data. This nibble wide data bus contains the data received by the ethernet PHY. |
| MII0RXDV | I | Ethernet 0 MII Receive Data Valid. The assertion of this signal indicates that valid receive data is in the MII receive data bus. |
| MII0RXER | I | Ethernet 0 MII Receive Error. The assertion of this signal indicates that an error was detected somewhere in the ethernet frame currently being sent in the MII receive data bus. |
| MII0TXCLK | I | Ethernet 0 MII Transmit Clock. This clock is a continuous clock that provides a timing reference for the transfer of transmit data. |
| MII0TXD[3:0] | O | Ethernet 0 MII Transmit Data. This nibble wide data bus contains the data to be transmitted. |
| MII0TXENP | O | Ethernet 0 MII Transmit Enable. The assertion of this signal indicates that data is present on the MII for transmission. |
| MII0TXER | O | Ethernet 0 MII Transmit Coding Error. When this signal is asserted together with MII0TXENP, the ethernet PHY will transmit symbols which are not valid data or delimiters. |
| MII1CL | I | Ethernet 1 MII Collision Detected. This signal is asserted by the ethernet PHY when a collision is detected. |
| MII1CRS | I | Ethernet 1 MII Carrier Sense. This signal is asserted by the ethernet PHY when either the transmit or receive medium is not idle. |
| MII1RXCLK | I | Ethernet 1 MII Receive Clock. This clock is a continuous clock that provides a timing reference for the reception of data. |

Table 1 Pin Description (Part 4 of 6)

| Signal | Type | Name/Description |
|---------------------|------|--|
| MII1RXD[3:0] | I | Ethernet 1 MII Receive Data. This nibble wide data bus contains the data received by the ethernet PHY. |
| MII1RXDV | I | Ethernet 1 MII Receive Data Valid. The assertion of this signal indicates that valid receive data is in the MII receive data bus. |
| MII1RXER | I | Ethernet 1 MII Receive Error. The assertion of this signal indicates that an error was detected somewhere in the ethernet frame currently being sent in the MII receive data bus. |
| MII1TXCLK | I | Ethernet 1 MII Transmit Clock. This clock is a continuous clock that provides a timing reference for the transfer of transmit data. |
| MII1TXD[3:0] | O | Ethernet 1 MII Transmit Data. This nibble wide data bus contains the data to be transmitted. |
| MII1TXENP | O | Ethernet 1 MII Transmit Enable. The assertion of this signal indicates that data is present on the MII for transmission. |
| MII1TXER | O | Ethernet 1 MII Transmit Coding Error. When this signal is asserted together with MIITXENP, the ethernet PHY will transmit symbols which are not valid data or delimiters. |
| MIIMDC | O | MII Management Data Clock. This signal is used as a timing reference for transmission of data on the management interface. |
| MIIMDIO | I/O | MII Management Data. This bidirectional signal is used to transfer data between the station management entity and the ethernet PHY. |
| EJTAG / JTAG | | |
| JTAG_TMS | I | JTAG Mode. The value on this signal controls the test mode select of the boundary scan logic or JTAG Controller. When using the EJTAG debug interface, this pin should be left disconnected (since there is an internal pull-up) or driven high. |
| EJTAG_TMS | I | EJTAG Mode. The value on this signal controls the test mode select of the EJTAG Controller. When using the JTAG boundary scan, this pin should be left disconnected (since there is an internal pull-up) or driven high. |
| JTAG_TRST_N | I | JTAG Reset. This active low signal asynchronously resets the boundary scan logic, JTAG TAP Controller, and the EJTAG Debug TAP Controller. An external pull-up on the board is recommended to meet the JTAG specification in cases where the tester can access this signal. However, for systems running in functional mode, one of the following should occur: 1) actively drive this signal low with control logic 2) statically drive this signal low with an external pull-down on the board 3) clock JTAG_TCK while holding EJTAG_TMS and/or JTAG_TMS high. |
| JTAG_TCK | I | JTAG Clock. This is an input test clock used to clock the shifting of data into or out of the boundary scan logic, JTAG Controller, or the EJTAG Controller. JTAG_TCK is independent of the system and the processor clock with a nominal 50% duty cycle. |
| JTAG_TDO | O | JTAG Data Output. This is the serial data shifted out from the boundary scan logic, JTAG Controller, or the EJTAG Controller. When no data is being shifted out, this signal is tri-stated. |
| JTAG_TDI | I | JTAG Data Input. This is the serial data input to the boundary scan logic, JTAG Controller, or the EJTAG Controller. |

Table 1 Pin Description (Part 5 of 6)

| Signal | Type | Name/Description |
|----------------------|------|---|
| Miscellaneous | | |
| CLK | I | Master Clock. This is the master clock input. The processor frequency is a multiple of this clock frequency. This clock is used as the system clock for all memory and peripheral bus operations except those associated with SDRAMs. |
| COLDRSTN | I | Cold Reset. The assertion of this signal initiates a cold reset. This causes the processor state to be initialized, boot configuration to be loaded, and the internal PLL to lock onto the master clock (CLK). |
| RSTN | I/O | Reset. The assertion of this bidirectional signal initiates a warm reset. This signal is asserted by the RC32365 during a warm reset. It can also be asserted by an external device to force the RC32365 to take a warm reset exception. |

Table 1 Pin Description (Part 6 of 6)

Pin Characteristics

| Pin Name | Type | Buffer | I/O Type | Internal Resistor | External Resistor ¹ |
|----------------------------------|------|--------|------------------|-------------------|--------------------------------|
| Memory and Peripheral Bus | | | | | |
| BDIRN | O | LVTTTL | High Drive | | |
| BOEN[1:0] | O | LVTTTL | High Drive | | |
| BWEN[3:0] | O | LVTTTL | High Drive | | |
| CSN[5:0] | O | LVTTTL | High Drive | | |
| MADDR[21:0] | O | LVTTTL | High Drive | | |
| MDATA[31:0] | I/O | LVTTTL | High Drive | | |
| OEN | O | LVTTTL | High Drive | | |
| RWN | O | LVTTTL | High Drive | | |
| WAITACKN | I | LVTTTL | STI ² | pull-up | |
| RASN | O | LVTTTL | High Drive | | |
| CASN | O | LVTTTL | High Drive | | |
| SDCSN[1:0] | O | LVTTTL | High Drive | | |
| SDWEN | O | LVTTTL | High Drive | | |
| SDCLKOUT | O | LVTTTL | High Drive | | |
| SDCLKINP | I | LVTTTL | STI | pull-up | |
| General Purpose I/O | | | | | |
| GPIO[15:13] | I/O | PCI | PCI | | |
| GPIO[12:0] | I/O | LVTTTL | Low Drive | pull-up | |
| Serial Interface | | | | | |
| SCK | I/O | LVTTTL | Low Drive | pull-up | pull-up on board |
| SDI | I/O | LVTTTL | Low Drive | pull-up | pull-up on board |
| SDO | I/O | LVTTTL | Low Drive | pull-up | pull-up on board |
| PCI Bus Interface | | | | | |
| PCIAD[31:0] | I/O | PCI | PCI | | |
| PCICBEN[3:0] | I/O | PCI | PCI | | |
| PCICLK | I | PCI | PCI | | |
| PCIDEVSELN | I/O | PCI | PCI | | pull-up on board |

Table 2 Pin Characteristics (Part 1 of 2)

| Pin Name | Type | Buffer | I/O Type | Internal Resistor | External Resistor ¹ |
|----------------------------|------|--------|---------------------|-------------------|---|
| PCIFRAMEN | I/O | PCI | PCI | | pull-up on board |
| PCIGNTN[1:0] | I/O | PCI | PCI | | pull-up on board |
| PCIIRDYN | I/O | PCI | PCI | | pull-up on board |
| PCILOCKN | I/O | PCI | PCI | | |
| PCIPAR | I/O | PCI | PCI | | |
| PCIPERRN | I/O | PCI | PCI | | |
| PCIREQN[1:0] | I/O | PCI | PCI | | pull-up on board |
| PCIRSTN | I/O | PCI | PCI | | pull-down on board |
| PCISERRN | I/O | PCI | Open Collector; PCI | | pull-up on board |
| PCISTOPN | I/O | PCI | PCI | | pull-up on board |
| PCITRDYN | I/O | PCI | PCI | | pull-up on board |
| Ethernet Interfaces | | | | | |
| MII0CL | I | LVTTTL | STI | pull-up | |
| MII0CRS | I | LVTTTL | STI | pull-up | |
| MII0RXCLK | I | LVTTTL | STI | pull-up | |
| MII0RXD[3:0] | I | LVTTTL | STI | pull-up | |
| MII0RXDV | I | LVTTTL | STI | pull-up | |
| MII0RXER | I | LVTTTL | STI | pull-up | |
| MII0TXCLK | I | LVTTTL | STI | pull-up | |
| MII0TXD[3:0] | O | LVTTTL | Low Drive | | |
| MII0TXENP | O | LVTTTL | Low Drive | | |
| MII0TXER | O | LVTTTL | Low Drive | | |
| MII1CL | I | LVTTTL | STI | pull-up | |
| MII1CRS | I | LVTTTL | STI | pull-up | |
| MII1RXCLK | I | LVTTTL | STI | pull-up | |
| MII1RXD[3:0] | I | LVTTTL | STI | pull-up | |
| MII1RXDV | I | LVTTTL | STI | pull-up | |
| MII1RXER | I | LVTTTL | STI | pull-up | |
| MII1TXCLK | I | LVTTTL | STI | pull-up | |
| MII1TXD[3:0] | O | LVTTTL | Low Drive | | |
| MII1TXENP | O | LVTTTL | Low Drive | | |
| MII1TXER | O | LVTTTL | Low Drive | | |
| MIIMDC | O | LVTTTL | Low Drive | | |
| MIIMDIO | I/O | LVTTTL | Low Drive | pull-up | |
| EJTAG / JTAG | | | | | |
| JTAG_TMS | I | LVTTTL | STI | pull-up | See Chapters 22 and 23 of the RC32365 User Reference Manual |
| EJTAG_TMS | I | LVTTTL | STI | pull-up | |
| JTAG_TRST_N | I | LVTTTL | STI | pull-up | |
| JTAG_TCK | I | LVTTTL | STI | pull-up | |
| JTAG_TDO | O | LVTTTL | Low Drive | | |
| JTAG_TDI | I | LVTTTL | STI | pull-up | |
| Miscellaneous | | | | | |
| CLK | I | LVTTTL | STI | | |
| COLDRSTN | I | LVTTTL | STI | | |
| RSTN | I/O | LVTTTL | Low Drive / STI | pull-up | pull-up on board |

Table 2 Pin Characteristics (Part 2 of 2)

¹ External pull-up required in most system applications. Some applications may require additional pull-ups not identified in this table.

² Schmidt Trigger Input (STI).

Boot Configuration Vector

The boot configuration vector is read into the RC32365 during cold reset. The vector defines parameters in the RC32365 that are essential to operation when cold reset is complete.

The encoding of boot configuration vector is described in Table 3, and the vector input is illustrated in Figure 4.

| Signal | Name/Description |
|--------------|--|
| MDATA[2:0] | CPU Clock Multiplier. This field specifies the value by which the PLL multiplies the master clock input (CLK) to obtain the processor clock frequency (PCLK). 0x0 - Multiply by 2 0x1 - 0x7 — Reserved |
| MDATA[3] | Endian. This bit specifies the endianness. 0x0 - little endian 0x1 - big endian |
| MDATA[4] | Reserved. This pin may be driven high or low during boot configuration and its state is recorded in the Boot Configuration Vector (BCV) field of the BCV register. This reserved bit may be used to pass boot configuration parameters to software. |
| MDATA[6:5] | Boot Device Width. This field specifies the width of the boot device (i.e., Device 0). 0x0 - 8-bit boot device width 0x1 - 16-bit boot device width 0x2 - 32-bit boot device width 0x3 - reserved |
| MDATA[7] | Reset Mode. This bit specifies the length of time the RSTN signal is driven. 0x0 - Normal reset: RSTN driven for minimum of 4096 clock cycles 0x1 - reserved |
| MDATA[8] | Disable Watchdog Timer. When this bit is set, the watchdog timer is disabled following a cold reset. 0x0 - Watchdog timer is enabled 0x1 - Watchdog timer is disabled |
| MDATA[11:9] | PCI Mode. This bit controls the operating mode of the PCI bus interface. The initial value of the EN bit in the PCIC register is determined by the PCI mode. 0x0 - Disabled (EN initial value is zero) 0x1 - PCI satellite mode with PCI target not ready (EN initial value is one) 0x2 - PCI satellite mode with suspended CPU execution (EN initial value is one) 0x3 - PCI host mode with external arbiter (EN initial value is zero) 0x4 - PCI host mode with internal arbiter using fixed priority arbitration algorithm (EN initial value is zero) 0x5 - PCI host mode with internal arbiter using round robin arbitration algorithm (EN initial value is zero) 0x6 - reserved 0x7 - reserved |
| MDATA[15:12] | Reserved. These pins may be driven high or low during boot configuration and their state is recorded in the Boot Configuration Vector (BCV) field of the BCV register. These reserved bits may be used to pass boot configuration parameters to software. |

Table 3 Boot Configuration Vector Encoding

Logic Diagram

The following Logic Diagram shows the primary pin functions of the RC32365.

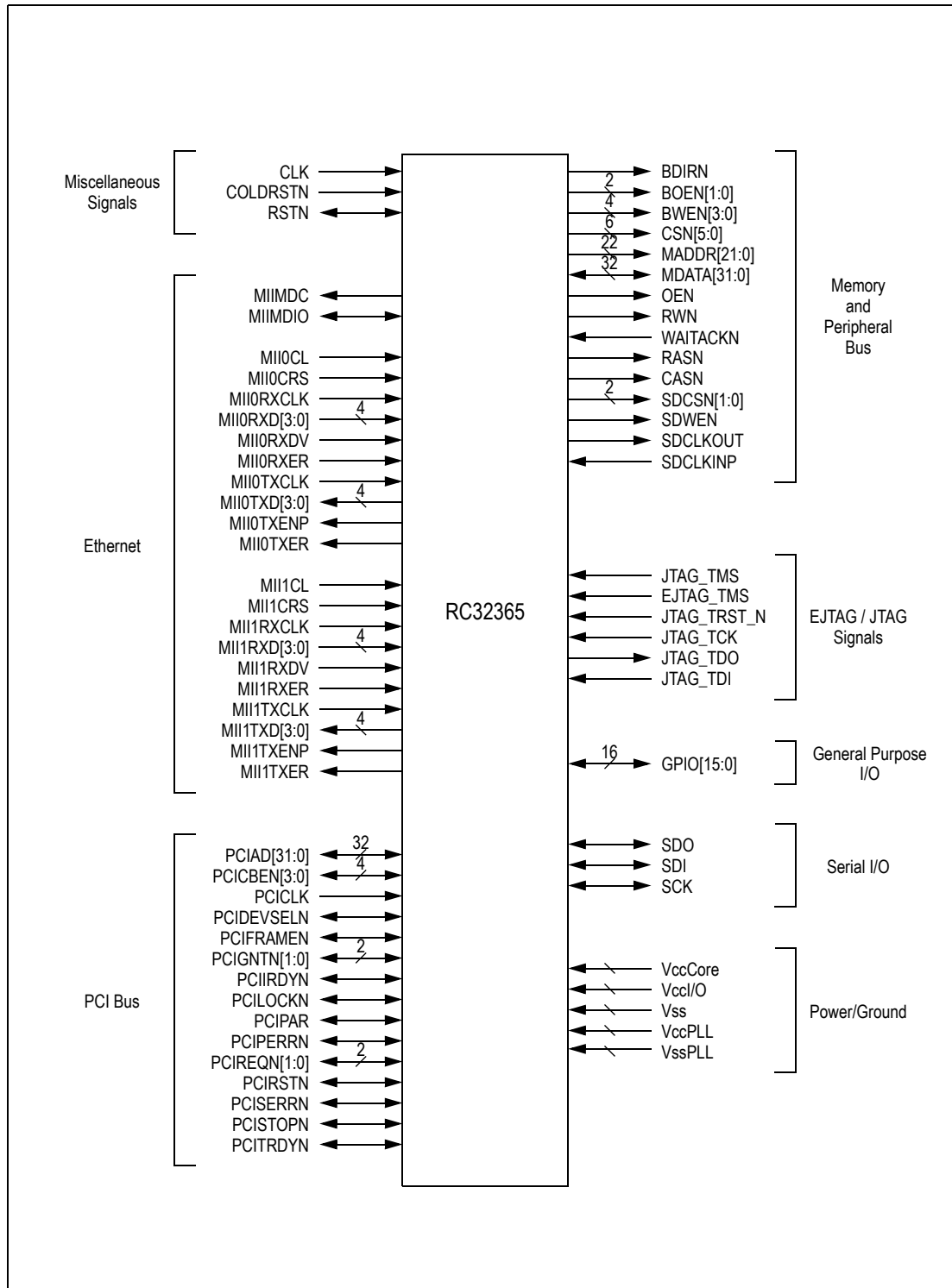


Figure 1 RC32365 Logic Diagram

AC Timing Definitions

Below are examples of the AC timing characteristics used throughout this document.

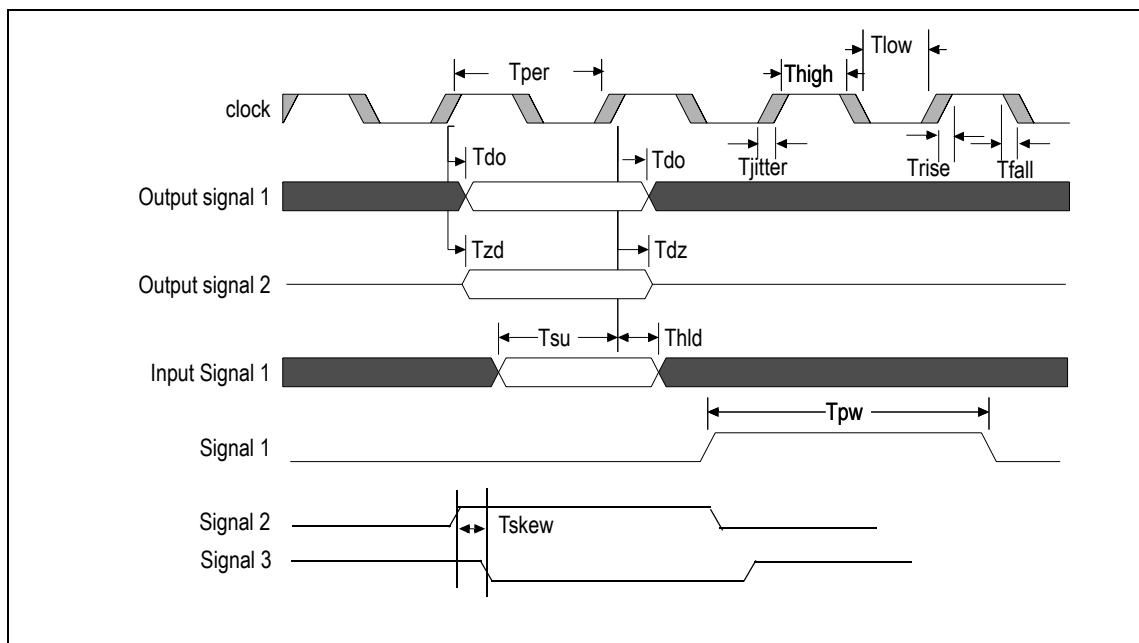


Figure 2 AC Timing Definitions Waveform

| Symbol | Definition |
|----------|---|
| Tper | Clock period. |
| Tlow | Clock low. Amount of time the clock is low in one clock period. |
| Thigh | Clock high. Amount of time the clock is high in one clock period. |
| Trise | Rise time. Low to high transition time. |
| Tfall | Fall time. High to low transition time. |
| Tjitter | Jitter. Amount of time the reference clock (or signal) edge can vary on either the rising or falling edges. |
| Tdo | Data out. Amount of time after the reference clock edge that the output will become valid. The minimum time represents the data output hold. The maximum time represents the earliest time the designer can use the data. |
| Tzd | Z state to data valid. Amount of time after the reference clock edge that the tri-stated output takes to become valid. |
| Tdz | Data valid to Z state. Amount of time after the reference clock edge that the valid output takes to become tri-stated. |
| Tsu | Input set-up. Amount of time before the reference clock edge that the input must be valid. |
| Thld | Input hold. Amount of time after the reference clock edge that the input must remain valid. |
| Tpw | Pulse width. Amount of time the input or output is active for asynchronous signals. |
| Tslew | Slew rate. The rise or fall rate for a signal to go from a high to low, or low to high. |
| X(clock) | Timing value. This notation represents a value of 'X' multiplied by the clock time period of the specified clock. Using 5(CLK) as an example: X = 5 and the oscillator clock (CLK) = 25MHz, then the timing value is 200. |
| Tskew | Skew. The amount of time two signal edges deviate from one another. |

Table 4 AC Timing Definitions

Clock Parameters

The values given below are based on systems running at recommended supply voltages and operating temperatures, as shown in Tables 14 and 15.

| Parameter | Symbol | Reference Edge | 150MHz | | Units | Timing Diagram Reference |
|--------------------|-----------------------|----------------|--------|-----|--------------|--------------------------|
| | | | Min | Max | | |
| PCLK ¹ | Frequency | none | 100 | 150 | MHz | See Figure 3 |
| CLK ^{2,3} | Frequency | none | 50 | 75 | MHz | |
| | Tper_5a | | 13.3 | 20 | ns | |
| | Thigh_5a, Tlow_5a | | 40 | 60 | % of Tper_5a | |
| | Trise_5a, Tfall_5a | | — | 3.0 | ns | |
| Tjitter_5a | — | ± 250 | ps | | | |

Table 5 RC32365 Clock Parameters

- ¹ The CPU pipeline clock (PCLK) speed is selected during cold reset by the boot configuration vector (see Table 3).
- ² Ethernet clock (MIxRXCLK and MIxTXCLK) frequency must be less than or equal to 1/2 CLK frequency.
- ³ PCI clock (PCICLK) frequency must be less than or equal to two times CLK.

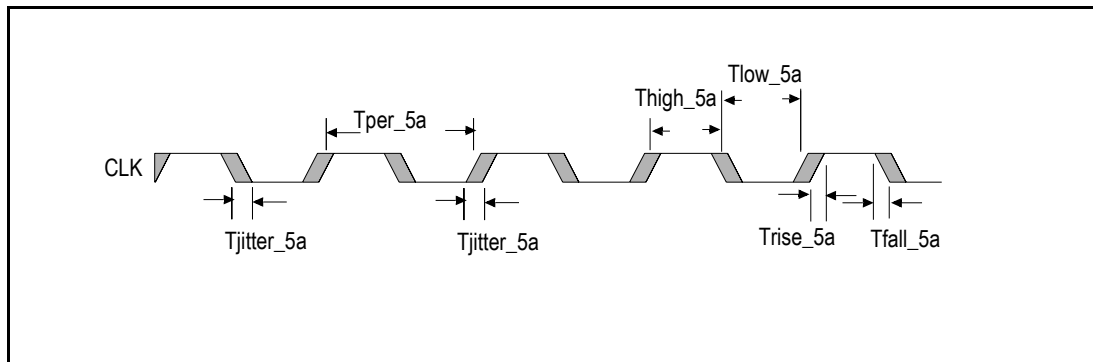


Figure 3 Clock Parameters Waveform

AC Timing Characteristics

The values given below are based on systems running at recommended operating supply voltages and temperatures as shown in Tables 14 and 15.

| Signal | Symbol | Reference Edge | 150MHz | | Unit | Conditions | Timing Diagram Reference |
|--|---------------------|------------------|--------|--------|------|------------|--------------------------|
| | | | Min | Max | | | |
| Reset and System | | | | | | | |
| COLDRSTN | Tpw_6a ¹ | none | 110 | — | ms | Cold reset | See Figures 4 and 5 |
| | Trise_6a | | — | 5.0 | ns | Cold reset | |
| RSTN ² (output) | Tdo_6b | CLK rising | 2.0 | 9.0 | ns | Cold reset | |
| RSTN ² (input) | Tpw_6c ¹ | none | 2(CLK) | — | ns | Cold reset | |
| MDATA[15:0] Boot Configuration Vector | Thld_6d | COLDRSTN rising | 3.0 | — | ns | Cold reset | |
| | Tdz_6d ¹ | COLDRSTN falling | — | 2(CLK) | ns | Cold reset | |
| | Tdz_6d ¹ | RSTN falling | — | 2(CLK) | ns | Warm reset | |
| | Tzd_6d ¹ | RSTN rising | 3.0 | — | ns | Warm reset | |

Table 6 Reset and System AC Timing Characteristics

¹. The values for this symbol were determined by calculation, not by testing.

². RSTN is a bidirectional signal. It is treated as an asynchronous input.

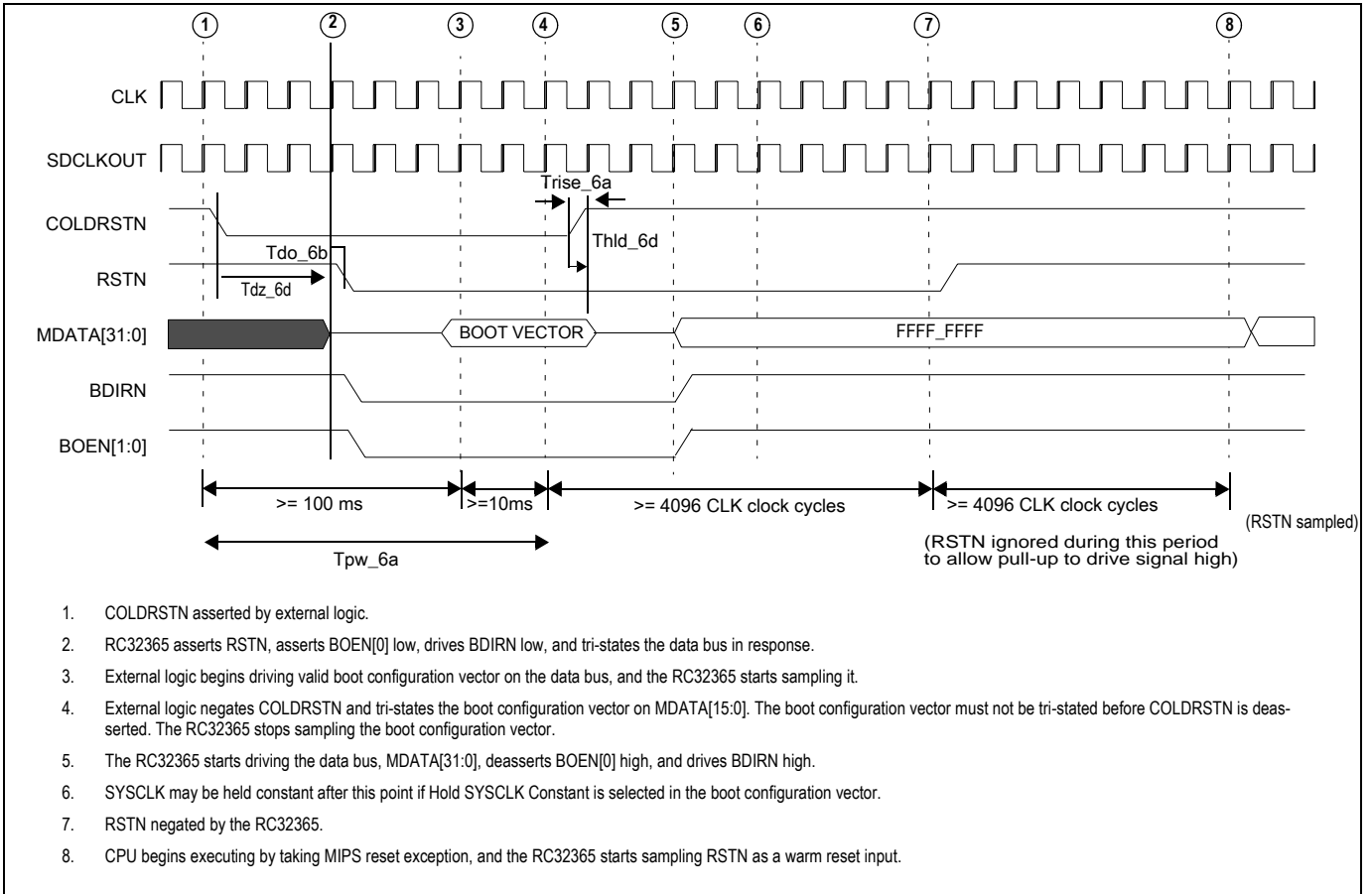


Figure 4 Cold Reset AC Timing Waveform

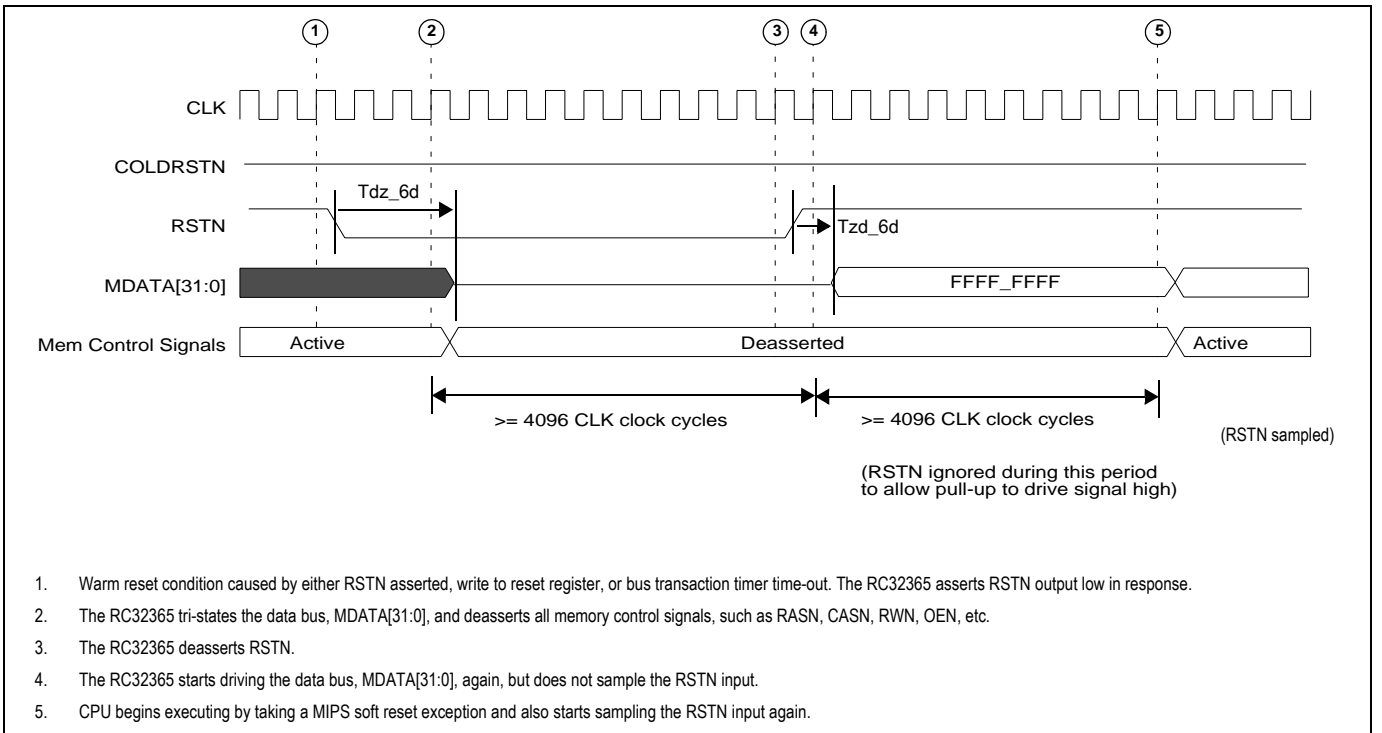


Figure 5 Warm Reset AC Timing Waveform

| Signal | Symbol | Reference Edge | 150MHz | | Unit | Conditions | Timing Diagram Reference |
|---|---------------------|-----------------|--------|-----|------|------------|--------------------------|
| | | | Min | Max | | | |
| Memory and Peripheral Bus - SDRAM Access | | | | | | | |
| MDATA[31:0] | Tsu_7a | SDCLKINP rising | 1.0 | — | ns | | See Figures 6 and 7 |
| | Thld_7a | | 1.7 | — | ns | | |
| | Tdo_7a | SDCLKOUT rising | 1.8 | 6.0 | ns | | |
| | Tdz_7a ¹ | | 1.8 | 7.0 | ns | | |
| | Tzd_7a ¹ | | 1.8 | 8.0 | ns | | |
| MADDR[20:2] | Tdo_7b | SDCLKOUT rising | 1.8 | 6.0 | ns | | |
| RASN | Tdo_7c | SDCLKOUT rising | 1.8 | 6.0 | ns | | |
| CASN | Tdo_7d | SDCLKOUT rising | 1.8 | 6.0 | ns | | |
| SDWEN | Tdo_7e | SDCLKOUT rising | 1.8 | 6.0 | ns | | |
| SDCSN[1:0] | Tdo_7f | SDCLKOUT rising | 1.8 | 6.0 | ns | | |
| BDIRN | Tdo_7g | SDCLKOUT rising | 1.8 | 6.0 | ns | | |
| BOEN[1:0] | Tdo_7h | SDCLKOUT rising | 1.8 | 6.0 | ns | | |
| BWEN[3:0] | Tdo_7i | SDCLKOUT rising | 1.8 | 6.0 | ns | | |
| SDCLKINP | Tdelay_7k | SDCLKOUT rising | 0.0 | 2.5 | ns | | See Figures 6 and 8 |
| SDCKENP | Tdo_7l | SDCLKOUT rising | 2.0 | 6.0 | ns | | |

Table 7 Memory and Peripheral Bus AC Timing Characteristics

¹. The values for this symbol were determined by calculation, not by testing.

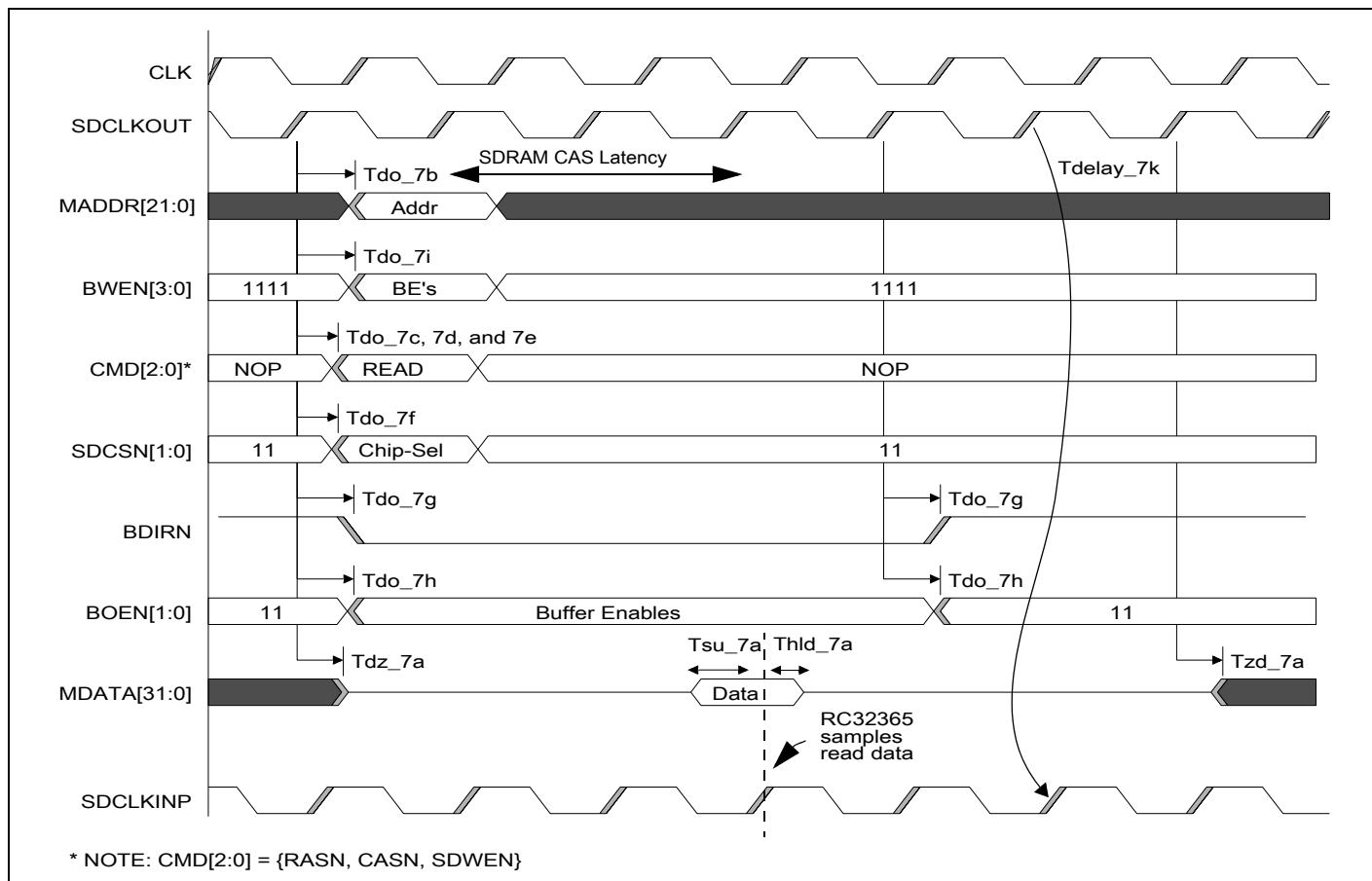


Figure 6 Memory and Peripheral Bus AC Timing Waveform - SDRAM Read Access

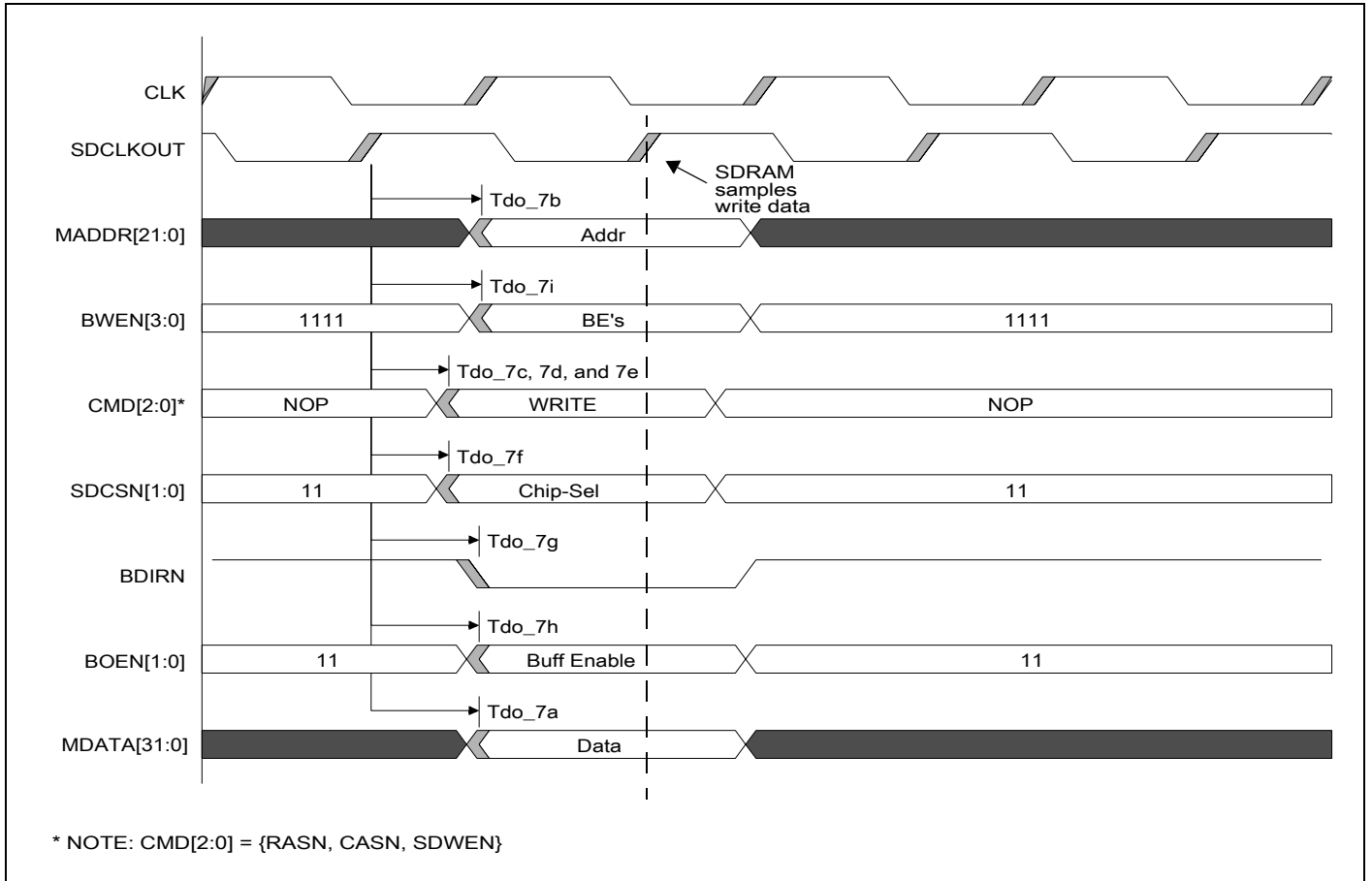


Figure 7 Memory and Peripheral Bus AC Timing Waveform - SDRAM Write Access

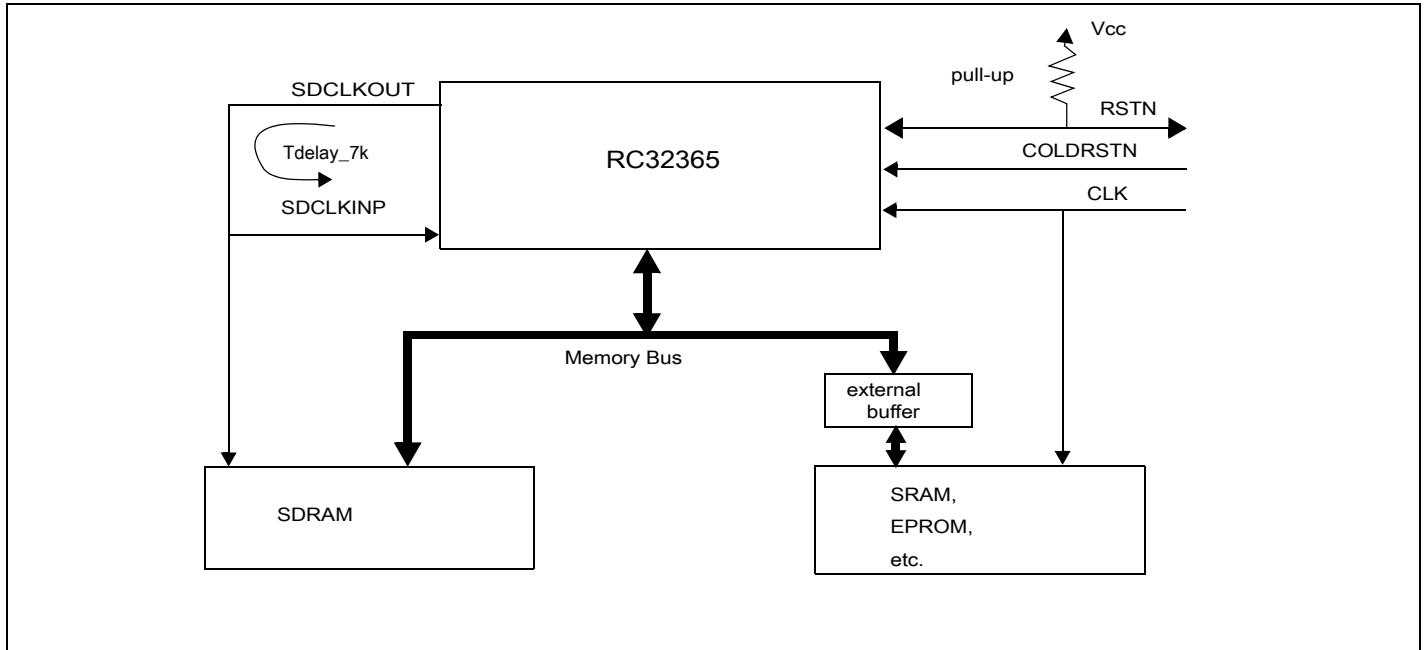


Figure 8 SDCLKOUT - SDCLKINP Relationship

| Signal | Symbol | Reference Edge | 150MHz | | Unit | Conditions | Timing Diagram Reference |
|--|---------------------|----------------|--------|------|------|------------|--------------------------|
| | | | Min | Max | | | |
| Memory and Peripheral Bus¹ — Device Access | | | | | | | |
| MDATA[31:0] | Tsu_8a | CLK rising | 2.5 | — | ns | | See Figures 9 and 10 |
| | Thld_8a | | 1.0 | — | ns | | |
| | Tdo_8a | | 2.0 | 6.5 | ns | | |
| | Tdz_8a ² | | 2.0 | 9.5 | ns | | |
| | Tzd_8a ² | | 2.0 | 10.5 | ns | | |
| MADDR[21:0] | Tdo_8b | CLK rising | 2.0 | 6.5 | ns | | |
| MADDR[25:22] | Tdo_8c | CLK rising | 3.0 | 7.5 | ns | | |
| CSN[5:0] | Tdo_8d | CLK rising | 2.0 | 6.5 | ns | | |
| RWN | Tdo_8e | CLK rising | 2.0 | 6.5 | ns | | |
| OEN | Tdo_8f | CLK rising | 2.0 | 6.5 | ns | | |
| BWEN[1:0] | Tdo_8g | CLK rising | 2.0 | 6.5 | ns | | |
| BDIRN | Tdo_8h | CLK rising | 2.0 | 6.5 | ns | | |
| BOEN[1:0] | Tdo_8i | CLK rising | 2.0 | 6.5 | ns | | |
| WAITACKN ³ | Tsu_8j | CLK rising | 2.0 | — | ns | | |
| | Thld_8j | | 0.5 | — | ns | | |
| | Tpw_8j ² | none | 2(CLK) | — | ns | | |

Table 8 Memory and Peripheral Bus AC Timing Characteristics — Device Access (Part 1 of 2)

| Signal | Symbol | Reference Edge | 150MHz | | Unit | Conditions | Timing Diagram Reference |
|---------------------------------------|--------|----------------|--------|-----|------|------------|------------------------------|
| | | | Min | Max | | | |
| CEN1 ⁴ , CEN2 ⁴ | Tdo_8k | CLK rising | 3.0 | 7.5 | ns | | See Figures 9 and 10 (cont.) |
| REGN ⁴ | Tdo_8l | CLK rising | 3.0 | 7.5 | ns | | |
| IORDN ⁴ | Tdo_8m | CLK rising | 3.0 | 7.5 | ns | | |
| IOWRN ⁴ | Tdo_8n | CLK rising | 3.0 | 7.5 | ns | | |

Table 8 Memory and Peripheral Bus AC Timing Characteristics — Device Access (Part 2 of 2)

1. The RC32365 provides bus turnaround cycles to prevent bus contention when going from a read to write and write to read. For example, there are no cycles where an external device and the RC32365 are both driving. See Chapter 6, Device Controller, in the RC32365 User Reference Manual.
2. The values for this symbol were determined by calculation, not by testing.
3. WAITACKN must meet the setup and hold times if it is synchronous or the minimum pulse width if it is asynchronous.
4. CEN1, CEN2, REGN, IORDN, and IOWRN are alternate functions of GPIO[12:8].

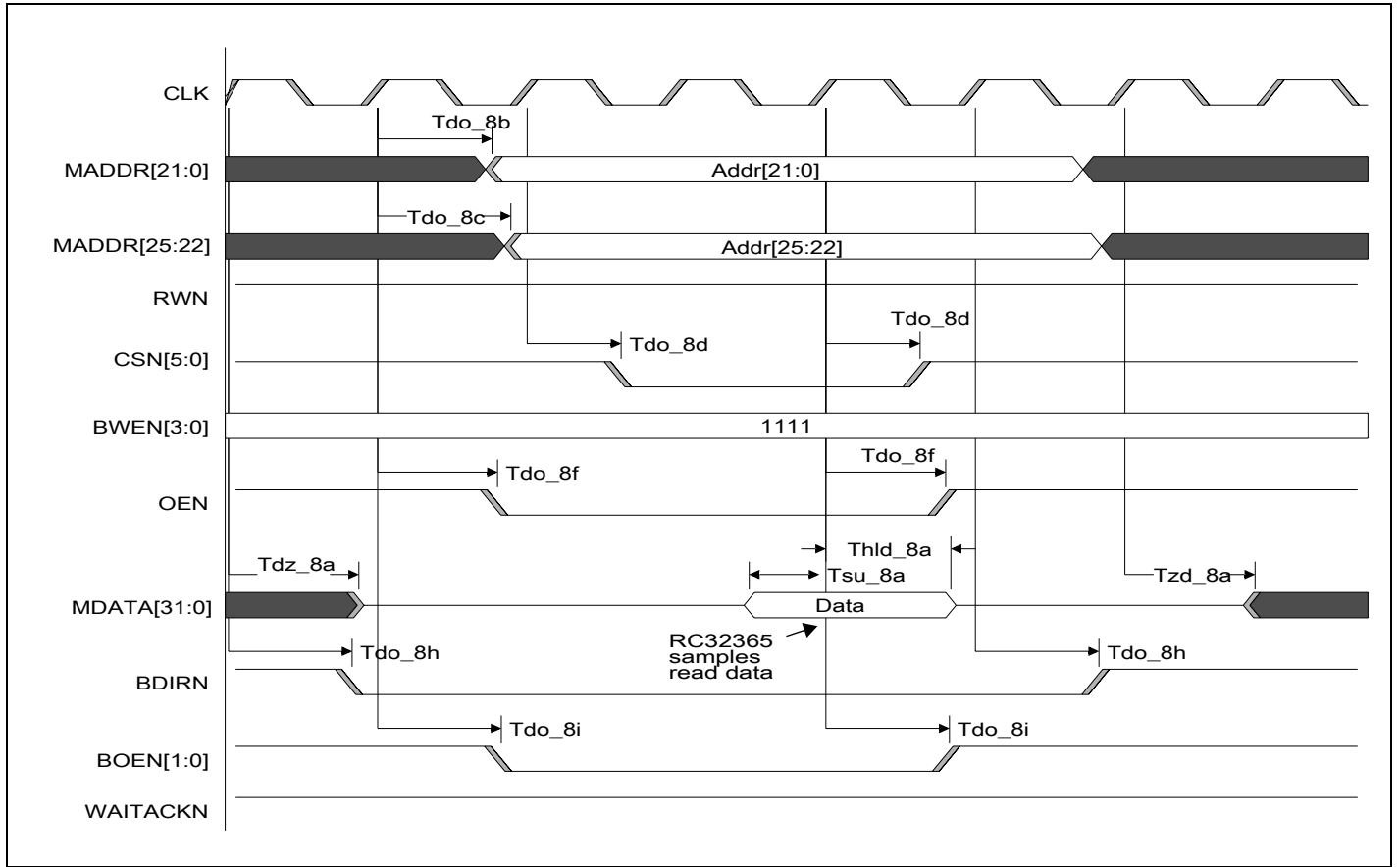


Figure 9 Memory and Peripheral Bus AC Timing Waveform - Device Read Access

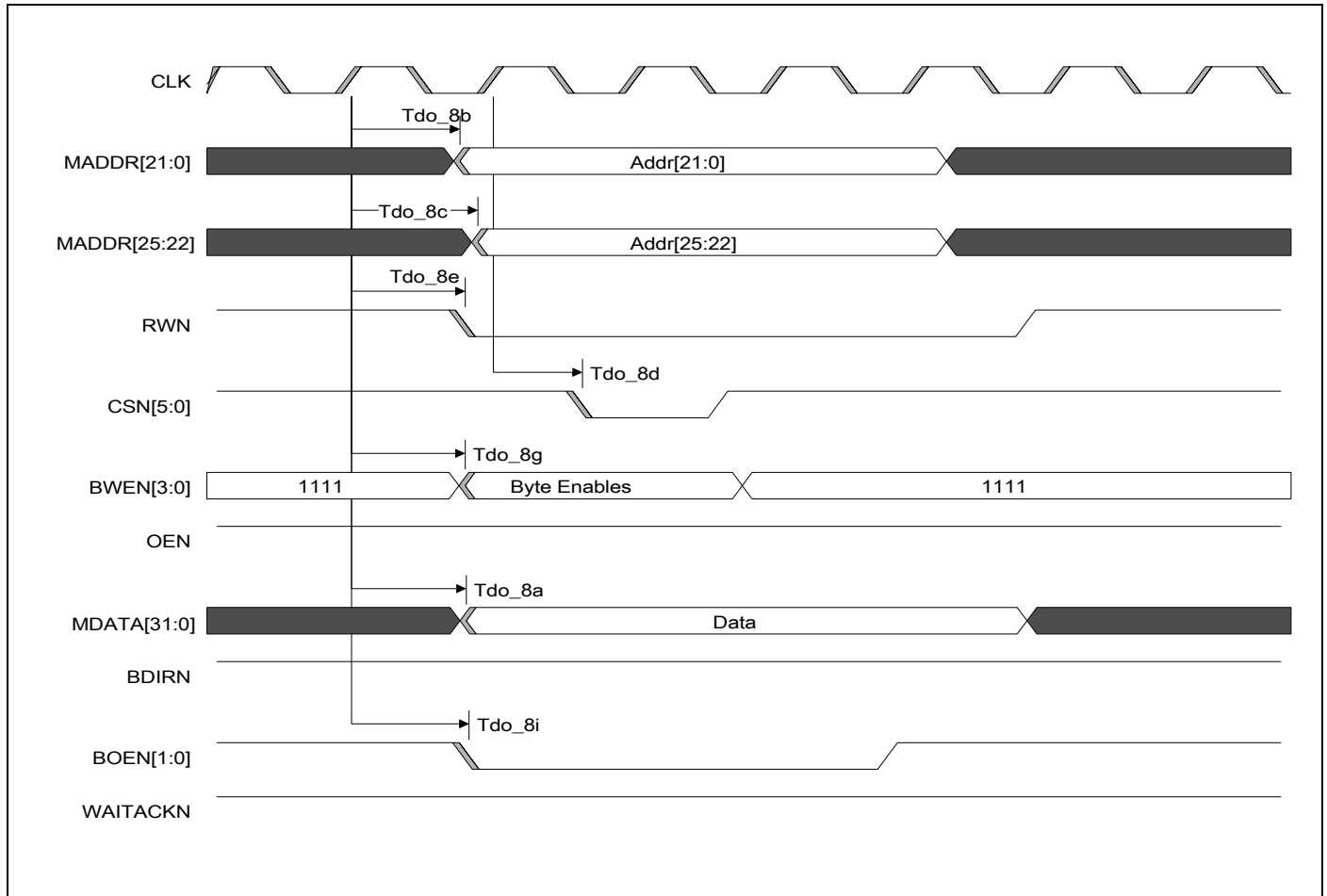


Figure 10 Memory AC and Peripheral Bus Timing Waveform - Device Write Access

| Signal | Symbol | Reference Edge | 150MHz | | Unit | Conditions | Timing Diagram Reference |
|-----------------------------------|--------------------|------------------|---------|---------|------|------------|--------------------------|
| | | | Min | Max | | | |
| Ethernet¹ | | | | | | | |
| MIIMDC | Tper_9a | None | 53.3 | — | ns | | See Figure 11 |
| | Thigh_9a, Tlow_9a | | 23.0 | — | ns | | |
| MIIMDIO | Tsu_9b | MIIMDC rising | 10.0 | — | ns | | |
| | Thld_9b | | 1.0 | — | ns | | |
| | Tdo_9b | | 1(ICLK) | 3(ICLK) | ns | | |
| MIIXRXCLK, MIIXTXCLK ² | Tper_9c | None | 399.96 | 400.4 | ns | 10 Mbps | |
| | Thigh_9c, Tlow_9c | | 180 | 220 | ns | | |
| | Trise_9c, Tfall_9c | | — | 3.0 | ns | | |
| MIIXRXCLK, MIIXTXCLK ² | Tper_9d | None | 39.9 | 40.0 | ns | 100 Mbps | |
| | Thigh_9d, Tlow_9d | | 18.0 | 22.0 | ns | | |
| | Trise_9d, Tfall_9d | | — | 2.0 | ns | | |
| MIIXRXD[3:0], MIIXRXDV, MIIXRXER | Tsu_9e | MIIXRXCLK rising | 3.0 | — | ns | | |
| | Thld_9e | | 2.0 | — | ns | | |
| MIIXTXD[3:0], MIIXTXENP, MIIXTXER | Tdo_9f | MIIXTXCLK rising | 5.0 | 13.0 | ns | | |

Table 9 Ethernet AC Timing Characteristics

¹. There are two MII interfaces and the timing is the same for each. "x" represents interface 0 or 1 (For example, MIIXRXCLK can be either MII0RXCLK or MII1RXCLK).

². The ethernet clock (MIIXRXCLK and MIIXTXCLK) frequency must be equal to or less than 1/2 CLK (MIIXRXCLK and MIIXTXCLK <= 1/2(CLK)).

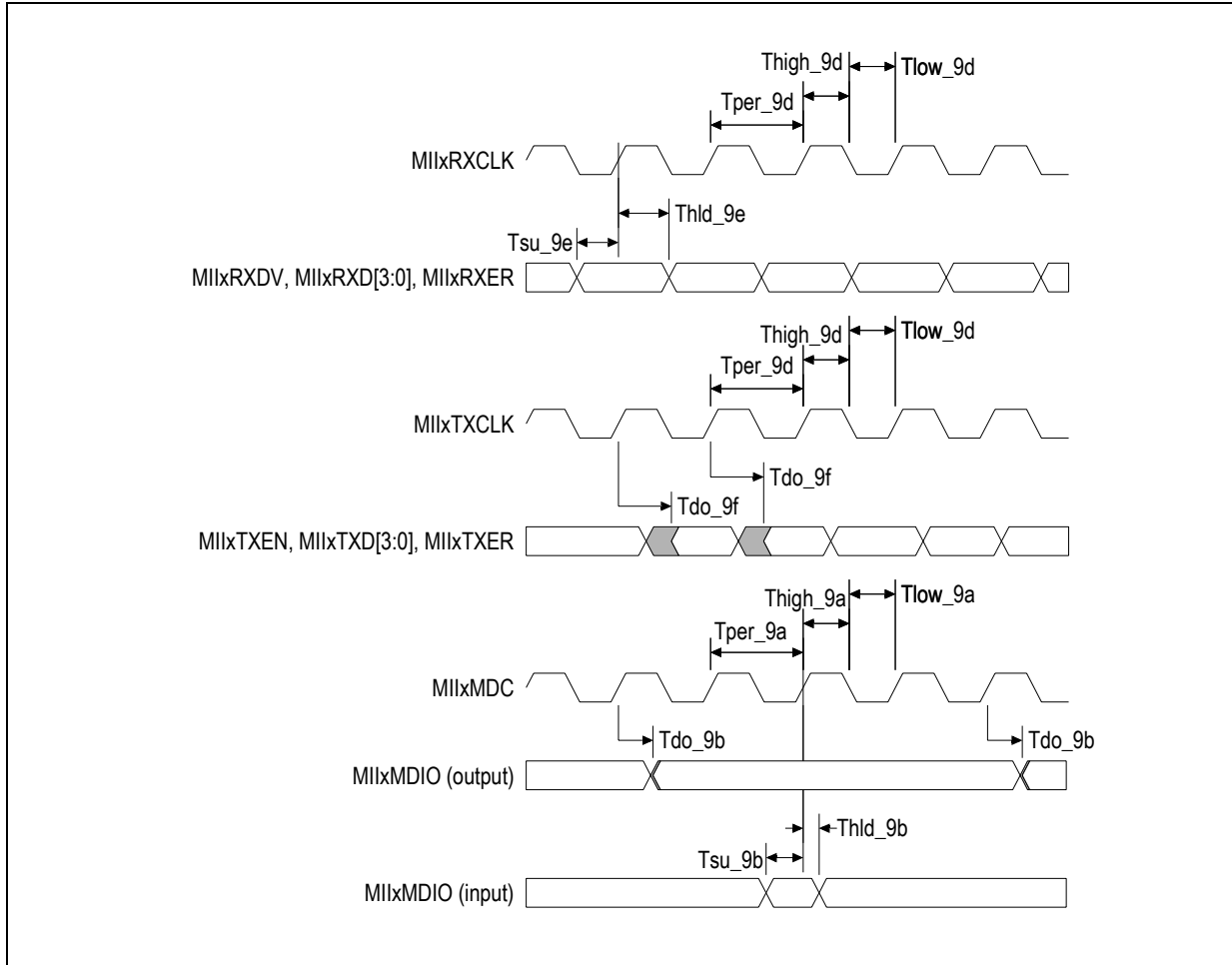


Figure 11 Ethernet AC Timing Waveform

| Signal | Symbol | Reference Edge | 150MHz | | Unit | Conditions | Timing Diagram Reference |
|---|------------------------|--------------------|---------------|------|------|------------|--------------------------|
| | | | Min | Max | | | |
| PCI ¹ | | | | | | | |
| PCICLK ² | Tper_10a | none | 15.0 | 30.0 | ns | 66 MHz PCI | See Figure 12 |
| | Thigh_10a, Tlow_10a | | 6.0 | — | ns | | |
| | Tslew_10a | | 1.5 | 4.0 | V/ns | | |
| PCIAD[31:0] | Tsu_10b | PCICLK rising | 3.0 | — | ns | | |
| | Thld_10b | | 0 | — | ns | | |
| | Tdo_10b | | 2.0 | 6.0 | ns | | |
| | Tdz_10b ³ | | — | 14.0 | ns | | |
| | Tzd_10b ³ | | 2.0 | — | ns | | |
| PCIBEN[3:0], PCIDEVSELN, PCIFRAMEN,PCIIRDYN, PCILOCKN, PCIPAR, PCIPERRN, PCISTOPN, PCITRDY | Tsu_10b ⁴ | PCICLK rising | 5.0 | — | ns | | |
| | Thld_10b | | 0 | — | ns | | |
| | Tdo_10b | | 2.0 | 6.0 | ns | | |
| PCIGNTN[2:0], PCIREQN[2:0] ⁵ | Tsu_10c | PCICLK rising | 5.0 | — | ns | | |
| | Thld_10c | | 0 | — | ns | | |
| | Tdo_10c | | 2.0 | 6.0 | ns | | |
| PCIRSTN (output) ⁶ | Tpw_10d ³ | None | 4000 (CLK) | — | ns | | See Figure 13 |
| PCIRSTN (input) ^{6,7} | Tpw_10e ³ | None | 2(CLK) | — | ns | | See Figure 14 |
| | Tdz_10e ³ | PCIRSTN falling | 6(CLK) | — | ns | | |
| PCISERRN ⁸ | Tsu_10f | PCICLK rising | 3.0 | — | ns | | See Figure 12 |
| | Thld_10f | | 0 | — | ns | | |
| | Tzd_10f ³ | | 2.0 | 6.0 | ns | | |
| PCIMUINTN ⁹ | Tzd_10g ³ | PCICLK rising | 4.7 | 11.1 | ns | | |

Table 10 PCI AC Timing Characteristics

- ¹ This PCI interface conforms to the PCI Local Bus Specification, Rev 2.2 at 33MHz.
- ² PCICLK must be equal to or less than two times CLK (PCICLK <= 2(CLK)).
- ³ The values for this symbol were determined by calculation, not by testing.
- ⁴ The 5ns minimum set-up time conforms to the PCI Local Bus Specification, Rev 2.2 at 33MHz. At 66MHz, the 5ns minimum set-up time provides a wide margin of 4ns, which is sufficient to ensure a working design at such frequency.
- ⁵ PCIGNTN[2] and PCIREQN[2] are alternate functions of GPIO[14] and GPIO[13] respectively.
- ⁶ PCIRSTN is an output in host mode and an input in satellite mode.
- ⁷ To meet the PCI delay specification from reset asserted to outputs floating, the PCI reset should be logically combined with the COLDRSTN input, instead of input on PCIRSTN.
- ⁸ PCISERRN uses open collector I/O types.
- ⁹ PCIMUINTN is an alternate function of GPIO[15].

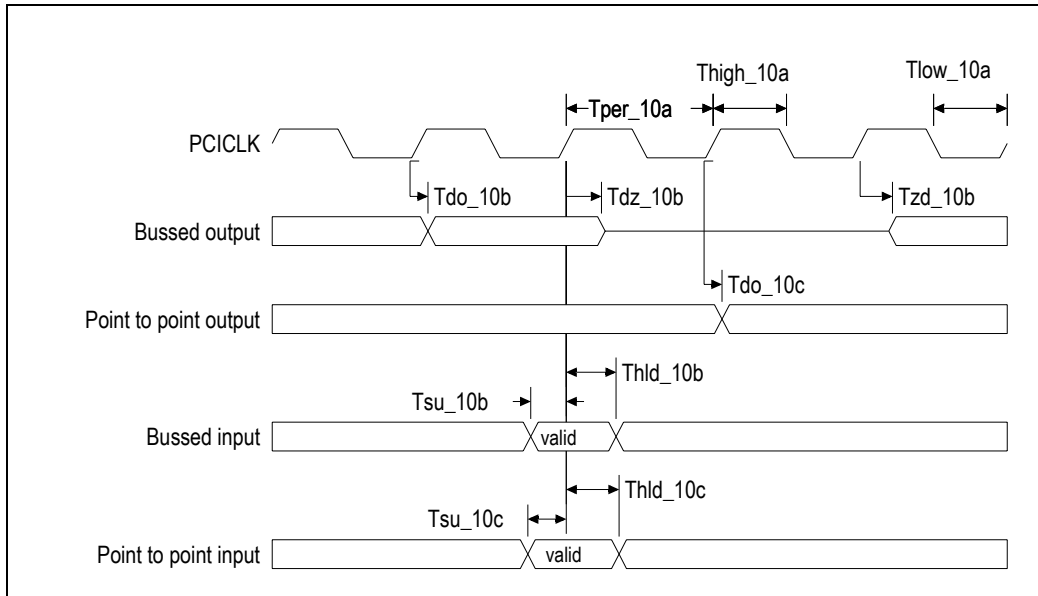
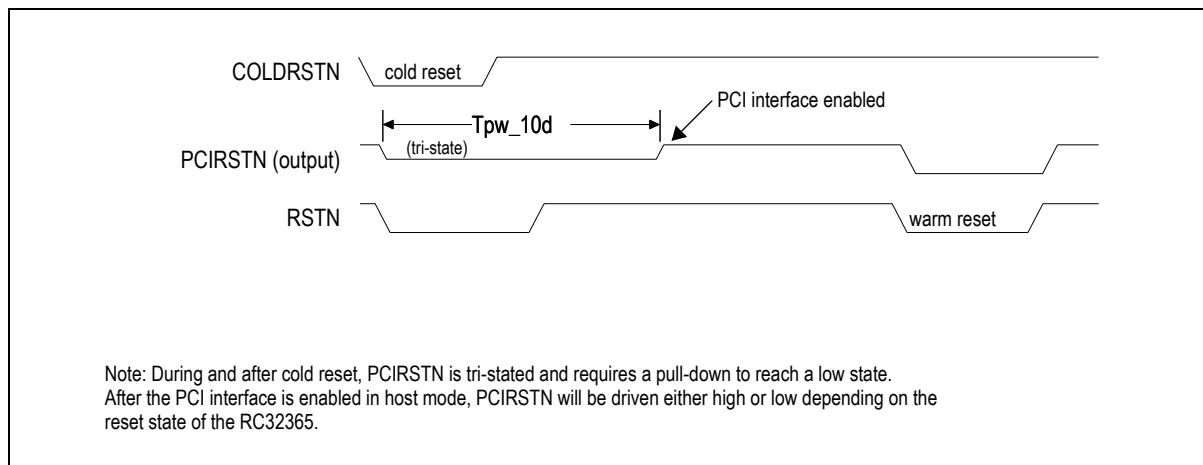


Figure 12 PCI AC Timing Waveform



Note: During and after cold reset, PCIRSTN is tri-stated and requires a pull-down to reach a low state. After the PCI interface is enabled in host mode, PCIRSTN will be driven either high or low depending on the reset state of the RC32365.

Figure 13 PCI AC Timing Waveform — PCI Reset in Host Mode

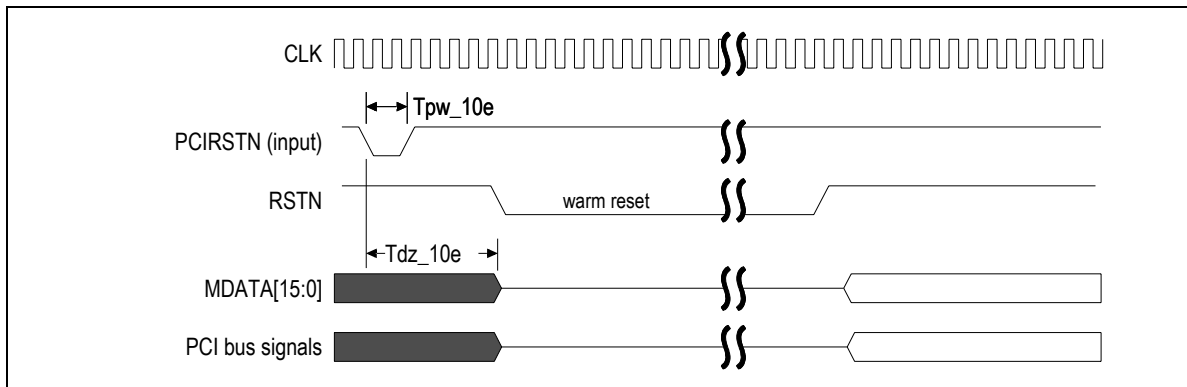


Figure 14 PCI AC Timing Waveform — PCI Reset in Satellite Mode

| Signal | Symbol | Reference Edge | 150MHz | | Unit | Conditions | Timing Diagram Reference |
|----------------------------|---------------------|-----------------------|--------|--------|------|------------|---------------------------|
| | | | Min | Max | | | |
| SPI ¹ | | | | | | | |
| SCK | Tper_12a | None | — | 1920 | ns | 33 MHz PCI | See Figures 15 through 18 |
| | Tper_12a | | — | 960 | ns | 66 MHz PCI | |
| | Tper_12a | | 100 | 166667 | ns | SPI | |
| | Thigh_12a, Tlow_12a | | 930 | 990 | ns | 33 MHz PCI | |
| | Thigh_12a, Tlow_12a | | 465 | 495 | ns | 66 MHz PCI | |
| | Thigh_12a, Tlow_12a | | 40 | 83353 | ns | SPI | |
| SDI | Tsu_12b | SCK rising or falling | 60 | — | ns | SPI or PCI | |
| | Thld_12b | | 60 | — | ns | | |
| SDO | Tdo_12c | SCK rising or falling | 0 | 60 | ns | SPI or PCI | |
| PCIEECS ² | Tdo_12d | SCK rising or falling | 0 | 60 | ns | PCI | |
| SCK, SDI, SDO ³ | Tpw_12e | None | 2(CLK) | — | ns | | |

Table 11 SPI AC Timing Characteristics

¹ In SPI mode, the SCK period and sampling edge are programmable. In PCI mode, the SCK period is fixed and the sampling edge is rising.

² PCIEECS is the PCI serial EEPROM chip select. It is an alternate function of PCIGNTN[1].

³ In Bit I/O mode, SCK, SDI, and SDO must meet the setup and hold times if they are synchronous or the minimum pulse width if they are asynchronous.

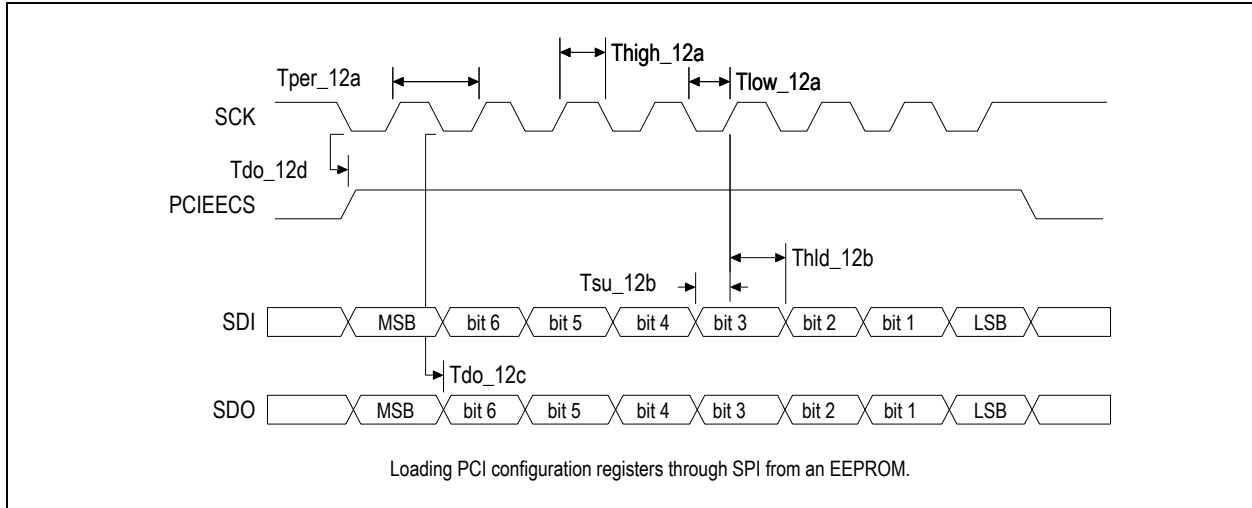


Figure 15 SPI AC Timing Waveform — PCI Configurations Load

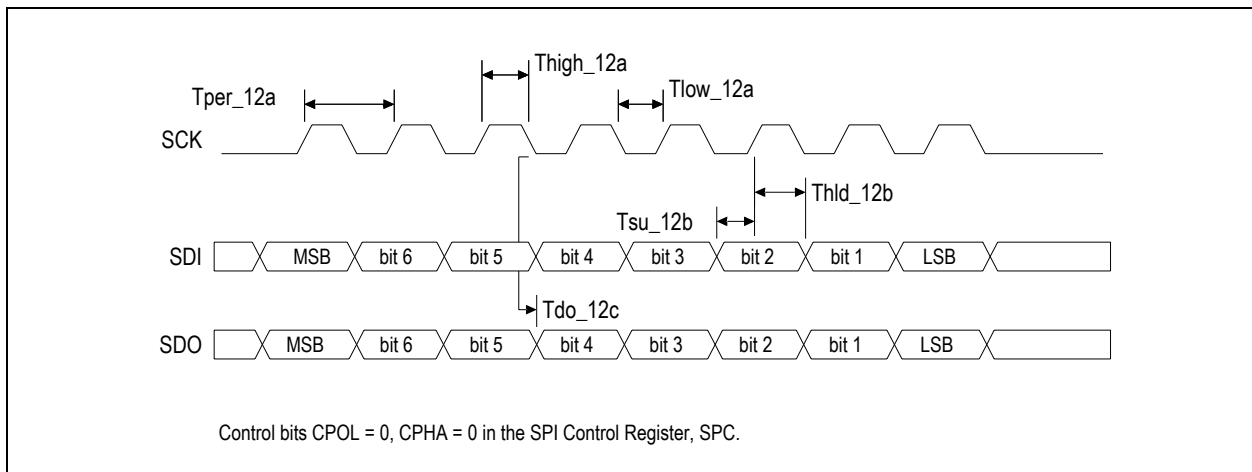


Figure 16 SPI AC Timing Waveform — Clock Polarity 0, Clock Phase 0

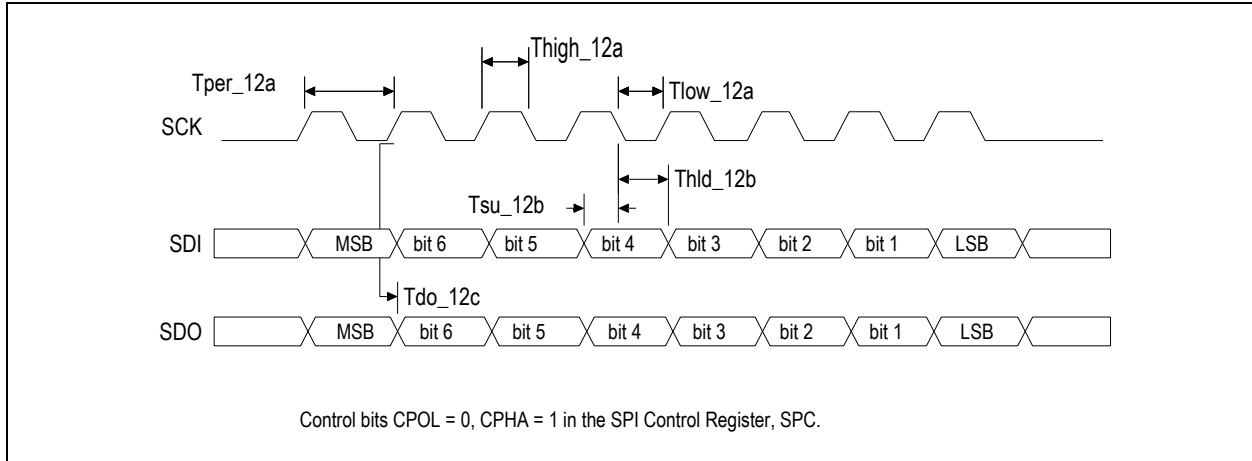


Figure 17 SPI AC Timing Waveform — Clock Polarity 0, Clock Phase 1

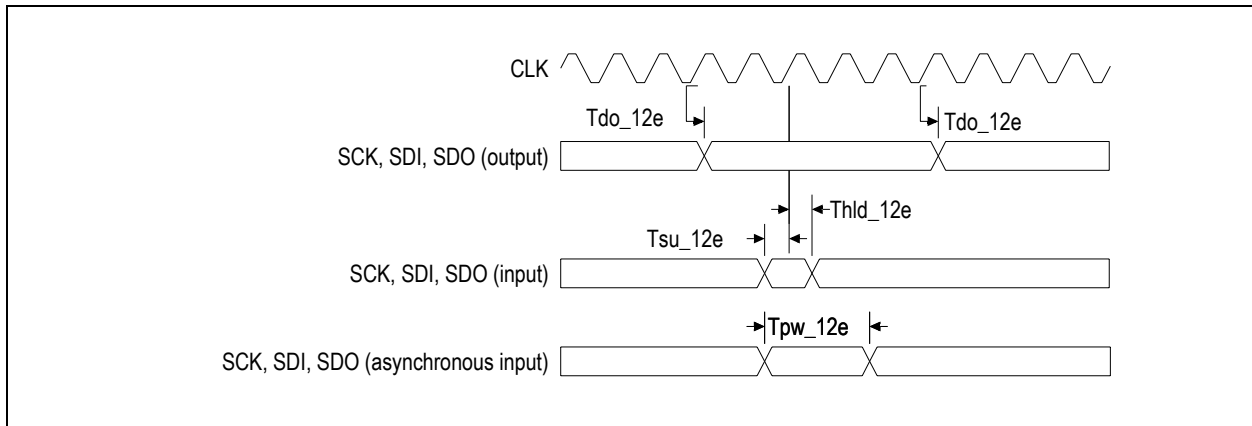


Figure 18 SPI AC Timing Waveform — Bit I/O Mode

| Signal | Symbol | Reference Edge | 150MHz | | Unit | Conditions | Timing Diagram Reference |
|-------------------------|----------------------|----------------|--------|------|------|------------|--------------------------|
| | | | Min | Max | | | |
| GPIO | | | | | | | |
| GPIO[15:0] ¹ | Tsu_13a | CLK rising | 4.0 | — | ns | | See Figure 19 |
| | Thld_13a | | 2.0 | — | ns | | |
| | Tdo_13a | | 2.0 | 14.0 | ns | | |
| | Tpw_13b ² | None | 2(CLK) | — | ns | | |

Table 12 GPIO AC Timing Characteristics

¹ GPIO signals must meet the setup and hold times if they are synchronous or the minimum pulse width if they are asynchronous.

² The values for this symbol were determined by calculation, not by testing.

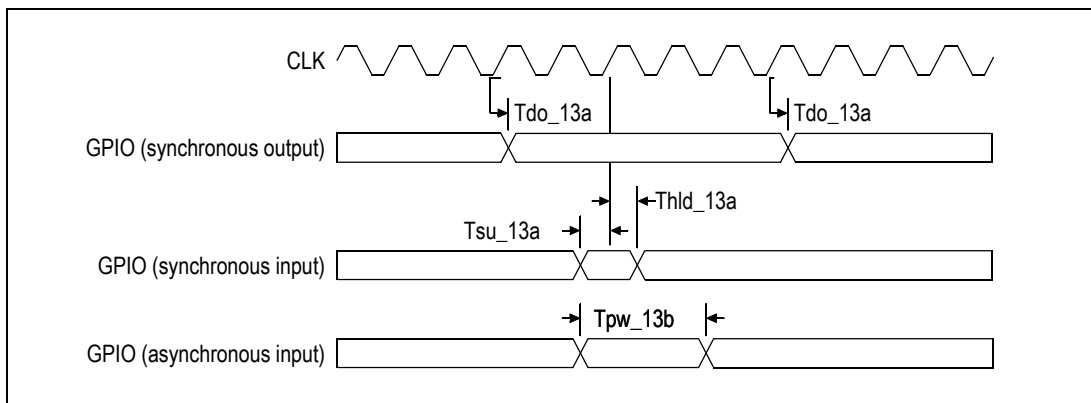


Figure 19 GPIO AC Timing Waveform

| Signal | Symbol | Reference Edge | 150MHz | | Unit | Conditions | Timing Diagram Reference |
|-----------------------|----------------------|------------------|--------|------|------|---|--------------------------|
| | | | Min | Max | | | |
| EJTAG and JTAG | | | | | | | |
| JTAG_TCK | Tper_14a | none | 100 | — | ns | | See Figure 20 |
| | Thigh_14a, Tlow_14a | | 40 | — | ns | | |
| | Trise_14a, Tfall_14a | | — | 5.0 | ns | | |
| JTAG_TDI | Tsu_14b | JTAG_TCK rising | 4.0 | — | ns | | |
| | Thld_14b | | 4.0 | — | ns | | |
| JTAG_TMS | Tsu_14c | | 4.0 | — | ns | | |
| | Thld_14c | | 4.0 | — | ns | | |
| EJTAG_TMS | Tsu_14d | | 4.0 | — | ns | | |
| | Thld_14d | | 4.0 | — | ns | | |
| JTAG_TDO | Tdo_14e | JTAG_TCK falling | — | 12.5 | ns | | |
| | Tdz_14e ¹ | | — | 15.0 | ns | | |
| JTAG_TRST_N | Tpw_14f ¹ | none | 100 | — | ns | | |
| VSENSE | Trise_16f | none | — | 2 | sec | Measured from 0.5V (T _{active}) | See Figure 22 |

Table 13 EJTAG/JTAG AC Timing Characteristics

¹. The values for this symbol were determined by calculation, not by testing.

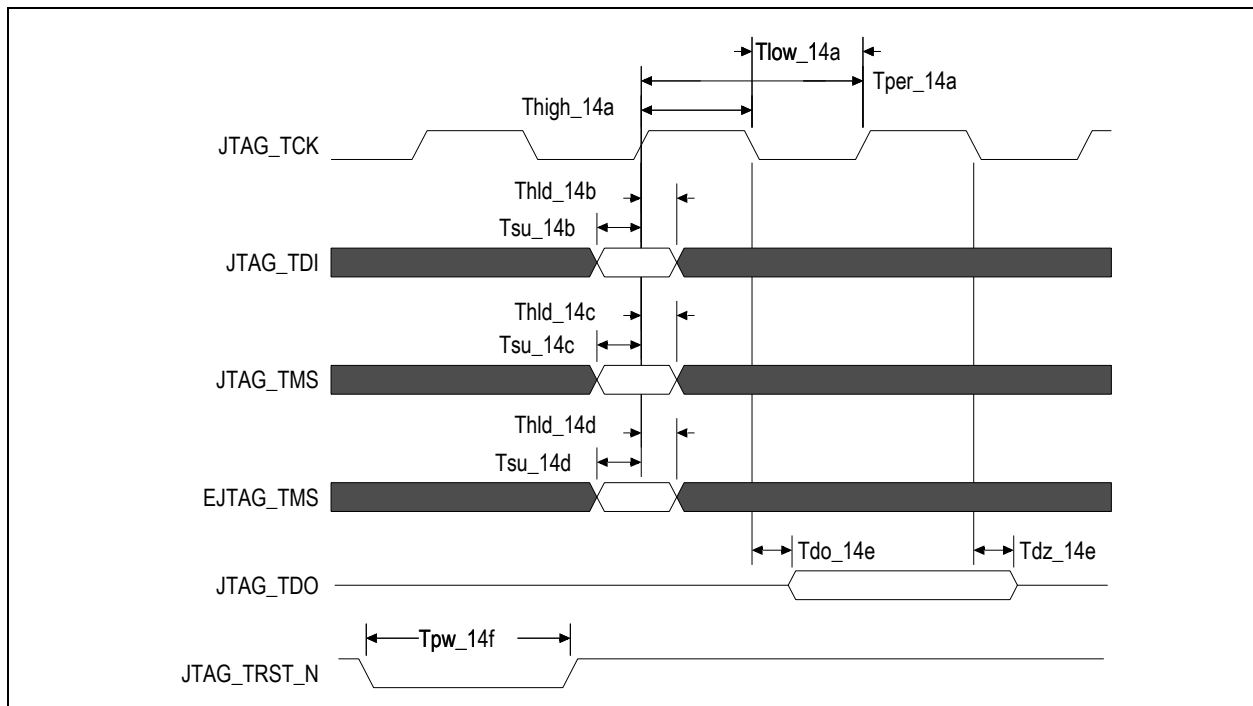


Figure 20 EJTAG/JTAG AC Timing Waveform

The IEEE 1149.1 specification requires that the JTAG and EJTAG TAP controllers be reset at power-up whether or not the interfaces are used for a boundary scan or a probe. Reset can occur through a pull-down resistor on JTAG_TRST_N if the probe is not connected. However, on-chip pull-up resistors are implemented on the RC32365 due to an IEEE 1149.1 requirement. Having on-chip pull-up and external pull-down resistors for the JTAG_TRST_N signal requires special care in the design to ensure that a valid logical level is provided to JTAG_TRST_N, such as using a small external pull-down resistor to ensure this level overrides the on-chip pull-up. An alternative is to use an active power-up reset circuit for JTAG_TRST_N, which drives JTAG_TRST_N low only at power-up and then holds JTAG_TRST_N high afterwards with a pull-up resistor.

Figure 21 shows the electrical connection of the EJTAG probe target system connector.

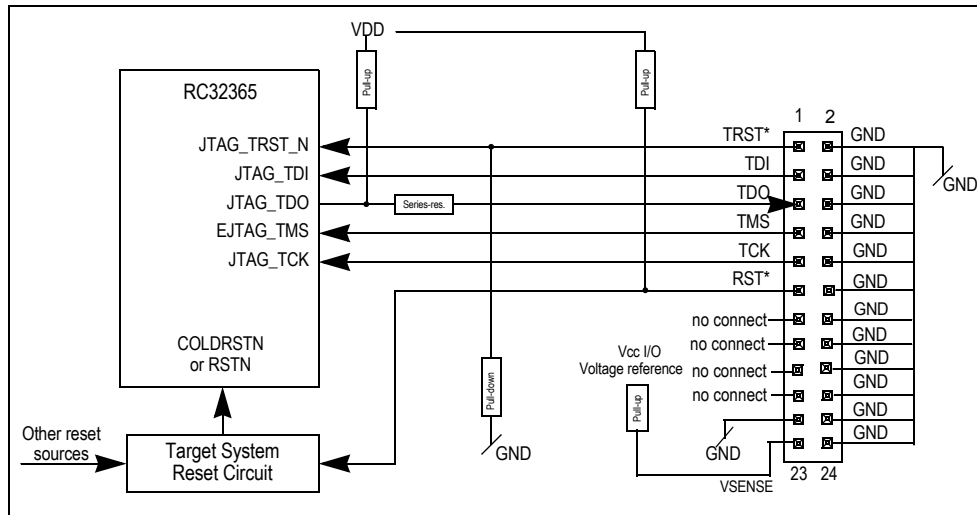


Figure 21 Target System Electrical EJTAG Connection

Using the EJTAG Probe

In Figure 21, the pull-up resistors for JTAG_TDO and RST*, the pull-down resistor for JTAG_TRST_N, and the series resistor for JTAG_TDO must be adjusted to the specific design. However, the recommended pull-up/down resistor is 1.0 k Ω because a low value reduces crosstalk on the cable to the connector, allowing higher JTAG_TCK frequencies. A typical value for the series resistor is 33 Ω . Recommended resistor values have $\pm 5\%$ tolerance.

If a probe is used, the pull-up resistor on JTAG_TDO must ensure that the JTAG_TDO level is high when no probe is connected and the JTAG_TDO output is tri-stated. This requirement allows reliable connection of the probe if it is hooked-up when the power is already on (hot plug). The pull-up resistor value of around 47 k Ω should be sufficient. Optional diodes to protect against overshoot and undershoot voltage can be added on the signals of the chip with EJTAG.

If a probe is used, the RST* signal must have a pull-up resistor because it is controlled by an open-collector (OC) driver in the probe, and thus is actively pulled low only. The pull-up resistor is responsible for the high value when not driven by the probe of 25pF. The input on the target system reset circuit must be able to accept the rise time when the pull-up resistor charges the capacitance to a high logical level. Vcc I/O must connect to a voltage reference that drops rapidly to below 0.5V when the target system loses power, even with a capacitive load of 25pF. The probe can thus detect the lost power condition.

For additional information on EJTAG, refer to Chapter 23 of the RC32365 User Reference Manual.

Voltage Sense Signal Timing

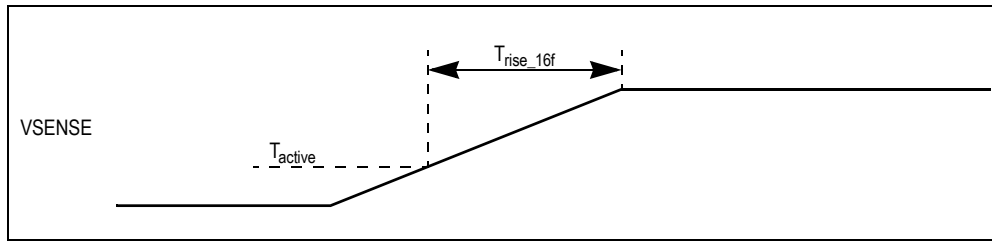


Figure 22 Voltage Sense Signal Timing

The target system must ensure that T_{rise} is obeyed after the system reaches 0.5V (T_{active}), so the probe can use this value to determine when the target has powered-up. The probe is allowed to measure the T_{rise} time from a higher value than T_{active} (but lower than Vcc I/O minimum) because the stable indication in this case comes later than the time when target power is guaranteed to be stable. If JTAG_TRST_N is asserted by a pulse at power-up, this reset must be completed after T_{rise} . If JTAG_TRST_N is asserted by a pull-down resistor, the probe will control JTAG_TRST_N. At power-down, no power is indicated to the probe when Vcc I/O drops under the T_{active} value, which the probe uses to stop driving the input signals, except for the probe RST*.

AC Test Conditions

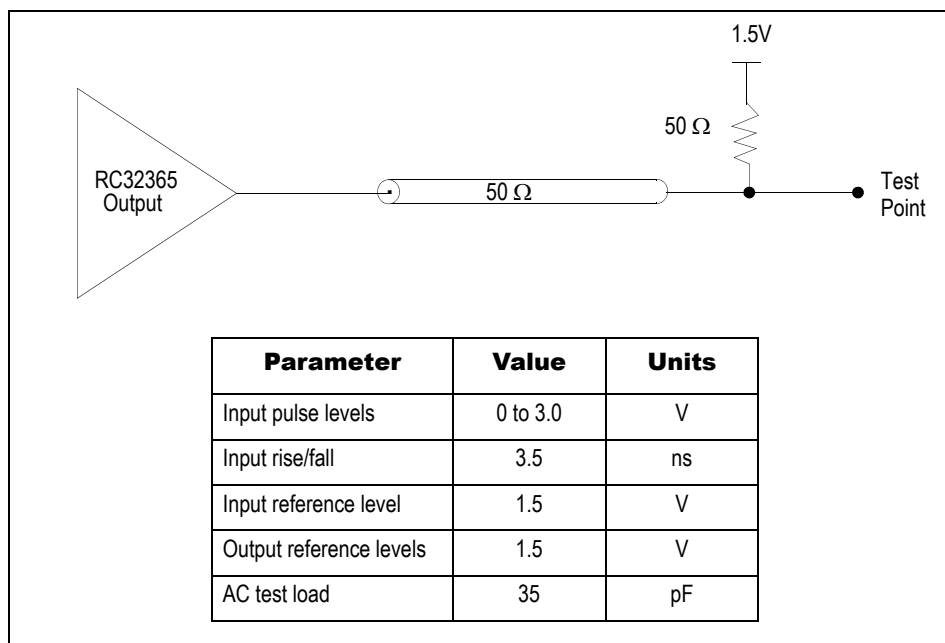


Figure 23 Output Loading for AC Timing

Phase-Locked Loop (PLL)

The processor aligns the pipeline clock, PClock, to the master input clock (CLK) by using an internal phase-locked loop (PLL) circuit that generates aligned clocks. Inherently, PLL circuits are only capable of generating aligned clocks for master input clock (CLK) frequencies within a limited range.

PLL Analog Filter

The storage capacitor required for the Phase-Locked Loop circuit is contained in the RC32365. However, it is recommended that the system designer provide a filter network of passive components for the PLL power supply.

V_{CC_PLL} (circuit power) and V_{SS_PLL} (circuit ground) should be isolated from V_{CC} Core (core power) and V_{SS} (common ground) with a filter circuit such as the one shown in Figure 24.

Because the optimum values for the filter components depend upon the application and the system noise environment, these values should be considered as starting points for further experimentation within your specific application.

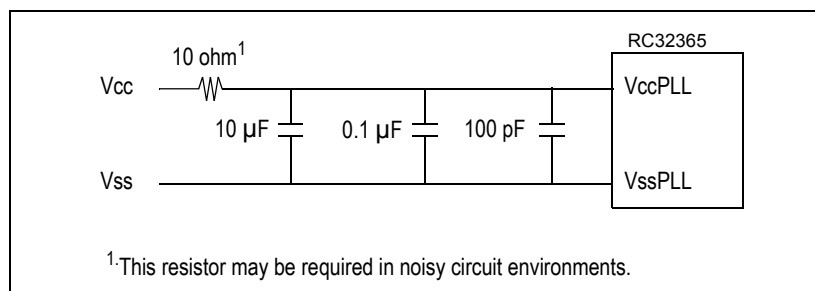


Figure 24 PLL Filter Circuit for Noisy Environments

Recommended Operating Supply Voltages

| Symbol | Parameter | Minimum | Typical | Maximum | Unit |
|----------------------|-----------------------|---------|---------|---------|------|
| V _{ss} | Common ground | 0 | 0 | 0 | V |
| V _{ss} PLL | PLL ground | | | | |
| V _{cc} I/O | I/O supply | 3.135 | 3.3 | 3.465 | |
| V _{cc} Core | Internal logic supply | 2.375 | 2.5 | 2.625 | |
| V _{cc} PLL | PLL supply | | | | |

Table 14 RC32365 Operating Supply Voltages

Recommended Operating Temperatures

| Grade | Temperature |
|------------|---------------------|
| Commercial | 0°C+ 70°C Ambient |
| Industrial | -40°C+ 85°C Ambient |

Table 15 RC32365 Operating Temperature

Capacitive Load Deration

Refer to the [RC32365 IBIS Model](#) which can be found at the IDT web site (www.idt.com).

Power-on RampUp

The 2.5V V_{cc}Core and V_{cc}PLL supplies can be fully powered without the 3.3V V_{cc}I/O supply. However, the V_{cc}I/O supply cannot exceed the V_{cc}Core and V_{cc}PLL supplies by more than 1 volt during power up. A sustained large power difference could potentially damage the part. Inputs should not be driven until the part is fully powered. Specifically, the input high voltages should not be applied until the V_{cc}I/O supply is powered.

There is no special requirement for how fast V_{cc}I/O ramps up to 3.3V. However, all timing references are based on a stable V_{cc}I/O.

DC Electrical Characteristics

The values given below are based on systems running at recommended supply voltages, as shown in Table 14.

Note: For a complete list of I/O types, see Table 2.

| | Parameter | Min | Max | Unit | Conditions |
|---|------------------------|-----------------------------|--------------------|---------|---|
| LOW Drive Output with Schmitt Trigger Input (STI) | I_{OL} | — | 7.3 | mA | $V_{OL} = 0.4V$ |
| | I_{OH} | — | -8.0 | mA | $V_{OH} = (V_{CC}/O - 0.4)$ |
| | V_{IL} | — | 0.8 | V | — |
| | V_{IH} | 2.0 | $(V_{CC}/O + 0.5)$ | V | — |
| HIGH Drive Output with Standard Input | I_{OL} | — | 9.4 | mA | $V_{OL} = 0.4V$ |
| | I_{OH} | — | -15 | mA | $V_{OH} = (V_{CC}/O - 0.4)$ |
| | V_{IL} | — | 0.8 | V | — |
| | V_{IH} | 2.0 | $(V_{CC}/O + 0.5)$ | V | — |
| Clock Drive Output | I_{OL} | 39 | — | mA | $V_{OL} = 0.4V$ |
| | I_{OH} | -24 | — | mA | $V_{OH} = (V_{CC}/O - 0.4)$ |
| PCI | $I_{OH}(AC)$ Switching | $-12(V_{CC}/O)$ | — | mA | $0 < V_{OUT} < 0.3(V_{CC}/O)$ |
| | | $-17.1(V_{CC}/O - V_{OUT})$ | — | mA | $0.3(V_{CC}/O) < V_{OUT} < 0.9(V_{CC}/O)$ |
| | | — | $-32(V_{CC}/O)$ | mA | $0.7(V_{CC}/O)$ |
| | $I_{OL}(AC)$ Switching | $+16(V_{CC}/O)$ | — | mA | $V_{CC}/O > V_{OUT} > 0.6(V_{CC}/O)$ |
| | | $+26.7(V_{OUT})$ | — | mA | $0.6(V_{CC}/O) > V_{OUT} > 0.1(V_{CC}/O)$ |
| | | — | $+38(V_{CC}/O)$ | mA | $V_{OUT} = 0.18(V_{CC}/O)$ |
| | V_{IL} | -0.3 | $0.3(V_{CC}/O)$ | V | — |
| V_{IH} | $0.5(V_{CC}/O)$ | 5.5 | V | — | |
| Capacitance | C_{IN} | — | 10 | pF | — |
| Leakage | I/O_{LEAK} | — | 20 | μA | — |

Table 16 DC Electrical Characteristics

Power Consumption

| Parameter | | 150MHz | | Unit | Conditions |
|-------------------|---------------------------|---------|------|------|--|
| | | Typical | Max. | | |
| I_{CC}/O | | 60 | 80 | mA | $C_L = 25pF$ (affects I/O) $T_a = 25^\circ C$ Maximum values use the maximum voltages listed in Table 14. Typical values use the typical voltages listed in Table 14. |
| $I_{CC}Core$ | Normal mode | 670 | 710 | mA | |
| | Standby mode ¹ | 580 | 620 | mA | |
| Power Dissipation | Normal mode | 1.97 | 2.14 | W | |
| | Standby mode ¹ | 1.7 | 1.9 | W | |

Table 17 RC32365 Power Consumption

¹. RISCcore 32300 CPU core enters Standby mode by executing WAIT instructions; however, other logic continues to function. Standby mode reduces power consumption by 0.6 mA per MHz of the CPU pipeline clock, PCLK.

Power Curve

The following graph contains a power curve that shows power consumption at various bus frequencies.

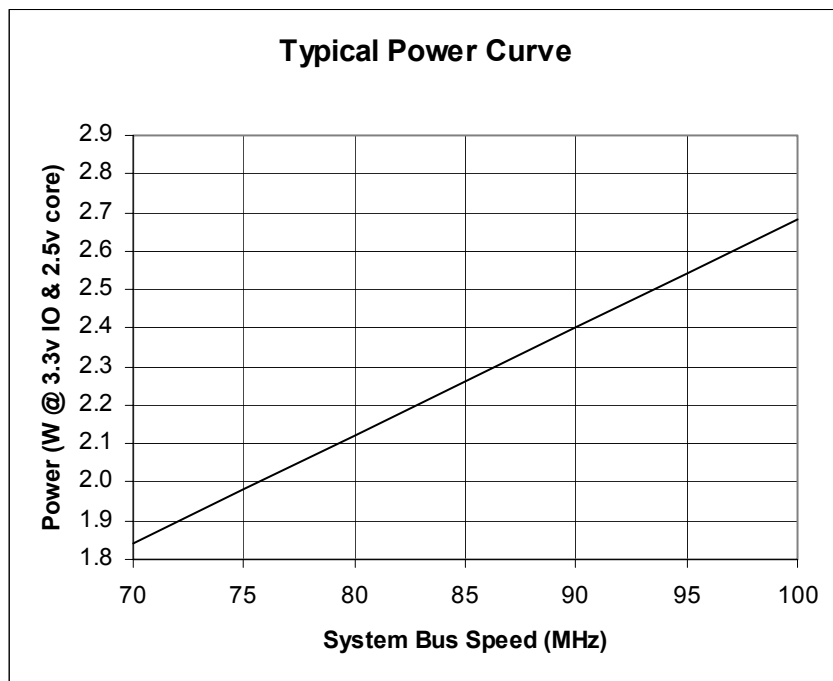


Figure 25 Typical Power Usage

Absolute Maximum Ratings

| Symbol | Parameter | Min ¹ | Max ¹ | Unit |
|-----------------------------|-------------------------------|------------------|-------------------------|------|
| V _{cc} I/O | I/O Supply Voltage | -0.6 | 4.0 | V |
| V _{cc} Core | Core Supply Voltage | -0.3 | 3.0 | V |
| V _{cc} PLL | PLL Supply Voltage | -0.3 | 3.0 | V |
| V _{imin} | Input Voltage - undershoot | -0.6 | — | V |
| V _i | I/O Input Voltage | Gnd | V _{cc} I/O+0.6 | V |
| T _a , Industrial | Ambient Operating Temperature | -40 | +85 | °C |
| T _a , Commercial | Ambient Operating Temperature | 0 | +70 | °C |
| T _{stg} | Storage Temperature | -40 | +125 | °C |

Table 18 Absolute Maximum Ratings

¹ Functional and tested operating conditions are given in Table 14. Absolute maximum ratings are stress ratings only, and functional operation at the maximums is not guaranteed. Stresses beyond those listed may affect device reliability or cause permanent damage to the device.

Package Pin-out — 256-Pin CABGA

The following table lists the pin numbers and signal names for the RC32365.

| Pin | Function | Alt | Pin | Function | Alt | Pin | Function | Alt | Pin | Function | Alt |
|-----|---------------------|-----|-----|----------------------|-----|-----|----------------------|-----|-----|-----------|-----|
| A1 | MII0RXD[0] | | E1 | GPIO[15] | 1 | J1 | PCIGNTN[1] | | N1 | PCIAD[4] | |
| A2 | MII0RXDV | | E2 | JTAG_TRST_N | | J2 | PCIDEVSELN | | N2 | PCIAD[20] | |
| A3 | MII0RXER | | E3 | JTAG_TDO | | J3 | PCIGNTN[0] | | N3 | PCIAD[19] | |
| A4 | MII0TXCLK | | E4 | JTAG_TDI | | J4 | PCIFRAMEN | | N4 | PCIAD[11] | |
| A5 | MII0TXD[2] | | E5 | V _{cc} CORE | | J5 | V _{cc} I/O | | N5 | PCIAD[13] | |
| A6 | MII0CRS | | E6 | V _{cc} I/O | | J6 | V _{ss} | | N6 | PCIAD[15] | |
| A7 | V _{ss} PLL | | E7 | V _{cc} I/O | | J7 | V _{ss} | | N7 | BOEN[0] | |
| A8 | MII1RXCLK | | E8 | V _{cc} I/O | | J8 | V _{ss} | | N8 | CSN[2] | |
| A9 | MII1TXD[2] | | E9 | V _{cc} I/O | | J9 | V _{ss} | | N9 | CSN[3] | |
| A10 | MII1CL | | E10 | V _{cc} I/O | | J10 | V _{ss} | | N10 | RWN | |
| A11 | JTAG_TCK | | E11 | V _{cc} I/O | | J11 | V _{ss} | | N11 | MDATA[1] | |
| A12 | GPIO[9] | 1 | E12 | V _{cc} CORE | | J12 | V _{cc} I/O | | N12 | MDATA[3] | |
| A13 | GPIO[5] | 1 | E13 | MADDR[5] | | J13 | SDWEN | | N13 | MDATA[12] | |
| A14 | GPIO[3] | 1 | E14 | MADDR[16] | | J14 | SDCLKINP | | N14 | MDATA[30] | |
| A15 | GPIO[1] | 1 | E15 | MADDR[17] | | J15 | BWEN[2] | | N15 | MDATA[11] | |
| A16 | MADDR[10] | | E16 | MADDR[6] | | J16 | BWEN[3] | | N16 | MDATA[27] | |
| B1 | MII0RXD[3] | | F1 | GPIO[14] | 1 | K1 | PCICBEN[1] | | P1 | PCIAD[5] | |
| B2 | MII0RXD[1] | | F2 | GPIO[13] | 1 | K2 | PCICBEN[2] | | P2 | PCIAD[21] | |
| B3 | MII0RXCLK | | F3 | PCITRDYN | | K3 | PCICBEN[0] | | P3 | PCIAD[23] | |
| B4 | MII0TXER | | F4 | PCISTOPN | | K4 | PCICLK | | P4 | PCIAD[10] | |
| B5 | MII0TXD[3] | | F5 | V _{cc} CORE | | K5 | V _{cc} I/O | | P5 | PCIAD[28] | |
| B6 | MII0CL | | F6 | V _{cc} I/O | | K6 | V _{ss} | | P6 | PCIAD[30] | |
| B7 | V _{cc} PLL | | F7 | V _{ss} | | K7 | V _{ss} | | P7 | BDIRN | |
| B8 | MII1RXDV | | F8 | V _{ss} | | K8 | V _{ss} | | P8 | CSN[1] | |
| B9 | MII1TXD[3] | | F9 | V _{ss} | | K9 | V _{ss} | | P9 | CSN[4] | |
| B10 | MII1CRS | | F10 | V _{ss} | | K10 | V _{ss} | | P10 | WAITACKN | |
| B11 | GPIO[12] | 1 | F11 | V _{cc} I/O | | K11 | V _{ss} | | P11 | MDATA[17] | |
| B12 | GPIO[8] | 1 | F12 | V _{cc} CORE | | K12 | V _{cc} CORE | | P12 | MDATA[19] | |
| B13 | GPIO[4] | 1 | F13 | MADDR[3] | | K13 | BWEN[1] | | P13 | MDATA[5] | |
| B14 | GPIO[2] | 1 | F14 | MADDR[14] | | K14 | RASN | | P14 | MDATA[9] | |
| B15 | MADDR[21] | | F15 | MADDR[15] | | K15 | CASN | | P15 | MDATA[10] | |
| B16 | MADDR[20] | | F16 | MADDR[4] | | K16 | BWEN[0] | | P16 | MDATA[26] | |
| C1 | MIIMDC | | G1 | PCIRSTN | | L1 | PCIAD[16] | | R1 | PCIAD[6] | |
| C2 | MIIMDIO | | G2 | PCISERRN | | L2 | PCIAD[1] | | R2 | PCIAD[7] | |

Table 19: 256-pin CABGA Package Pin-Out (Part 1 of 2)

| Pin | Function | Alt | Pin | Function | Alt | Pin | Function | Alt | Pin | Function | Alt |
|-----|------------|-----|-----|----------------------|-----|-----|----------------------|-----|-----|-----------|-----|
| C3 | MII0RXD[2] | | G3 | PCIPERRN | | L3 | PCIAD[0] | | R3 | PCIAD[24] | |
| C4 | MII0TXENP | | G4 | PCIREQN[0] | | L4 | PCICBEN[3] | | R4 | PCIAD[25] | |
| C5 | MII0TXD[1] | | G5 | V _{cc} CORE | | L5 | V _{cc} CORE | | R5 | PCIAD[27] | |
| C6 | MII1RXD[3] | | G6 | V _{ss} | | L6 | V _{cc} I/O | | R6 | PCIAD[29] | |
| C7 | MII1RXD[0] | | G7 | V _{ss} | | L7 | V _{ss} | | R7 | PCIAD[31] | |
| C8 | MII1RXER | | G8 | V _{ss} | | L8 | V _{ss} | | R8 | BOEN[1] | |
| C9 | MII1TXENP | | G9 | V _{ss} | | L9 | V _{ss} | | R9 | OEN | |
| C10 | MII1TXD[0] | | G10 | V _{ss} | | L10 | V _{ss} | | R10 | MDATA[16] | |
| C11 | EJTAG_TMS | | G11 | V _{ss} | | L11 | V _{cc} I/O | | R11 | MDATA[18] | |
| C12 | GPIO[10] | 1 | G12 | V _{cc} I/O | | L12 | V _{cc} CORE | | R12 | MDATA[20] | |
| C13 | GPIO[6] | 1 | G13 | MADDR[1] | | L13 | CLK | | R13 | MDATA[21] | |
| C14 | GPIO[0] | 1 | G14 | MADDR[12] | | L14 | SDCLKOUT | | R14 | MDATA[7] | |
| C15 | MADDR[9] | | G15 | MADDR[13] | | L15 | MDATA[15] | | R15 | MDATA[24] | |
| C16 | MADDR[19] | | G16 | MADDR[2] | | L16 | MDATA[31] | | R16 | MDATA[25] | |
| D1 | SDI | | H1 | PCIPAR | | M1 | PCIAD[18] | | T1 | PCIAD[22] | |
| D2 | COLDRSTN | | H2 | PCIREQN[1] | | M2 | PCIAD[3] | | T2 | PCIAD[8] | |
| D3 | SDO | | H3 | PCILOCKN | | M3 | PCIAD[2] | | T3 | PCIAD[9] | |
| D4 | SCK | | H4 | PCIRDYN | | M4 | PCIAD[17] | | T4 | PCIAD[26] | |
| D5 | MII0TXD[0] | | H5 | V _{cc} I/O | | M5 | V _{cc} CORE | | T5 | PCIAD[12] | |
| D6 | MII1RXD[2] | | H6 | V _{ss} | | M6 | V _{cc} I/O | | T6 | PCIAD[14] | |
| D7 | MII1RXD[1] | | H7 | V _{ss} | | M7 | V _{cc} I/O | | T7 | RSTN | |
| D8 | MII1TXER | | H8 | V _{ss} | | M8 | V _{cc} I/O | | T8 | CSN[0] | |
| D9 | MII1TXCLK | | H9 | V _{ss} | | M9 | V _{cc} I/O | | T9 | CSN[5] | |
| D10 | MII1TXD[1] | | H10 | V _{ss} | | M10 | V _{cc} I/O | | T10 | MDATA[0] | |
| D11 | JTAG_TMS | | H11 | V _{ss} | | M11 | V _{cc} I/O | | T11 | MDATA[2] | |
| D12 | GPIO[11] | 1 | H12 | V _{cc} I/O | | M12 | V _{cc} CORE | | T12 | MDATA[4] | |
| D13 | GPIO[7] | 1 | H13 | SDCSN[0] | | M13 | MDATA[14] | | T13 | MDATA[6] | |
| D14 | MADDR[7] | | H14 | SDCSN[1] | | M14 | MDATA[13] | | T14 | MDATA[22] | |
| D15 | MADDR[18] | | H15 | MADDR[11] | | M15 | MDATA[28] | | T15 | MDATA[23] | |
| D16 | MADDR[8] | | H16 | MADDR[0] | | M16 | MDATA[29] | | T16 | MDATA[8] | |

Table 19: 256-pin CABGA Package Pin-Out (Part 2 of 2)

RC32365 Power Pins

| $V_{CC}I/O$ | $V_{CC}I/O$ | $V_{CC}Core$ | $V_{CC}PLL$ |
|-------------|-------------|--------------|-------------|
| E6 | J5 | E5 | B7 |
| E7 | J12 | E12 | |
| E8 | K5 | F5 | |
| E9 | L6 | F12 | |
| E10 | L11 | G5 | |
| E11 | M6 | K12 | |
| F6 | M7 | L5 | |
| F11 | M8 | L12 | |
| G12 | M9 | M5 | |
| H5 | M10 | M12 | |
| H12 | M11 | | |

Table 20 RC32365 Power Pins

RC32365 Ground Pins

| V_{SS} | V_{SS} | V_{SS} | $V_{SS}PLL$ |
|----------|----------|----------|-------------|
| F7 | H7 | K6 | A7 |
| F8 | H8 | K7 | |
| F9 | H9 | K8 | |
| F10 | H10 | K9 | |
| G6 | H11 | K10 | |
| G7 | J6 | K11 | |
| G8 | J7 | L7 | |
| G9 | J8 | L8 | |
| G10 | J9 | L9 | |
| G11 | J10 | L10 | |
| H6 | J11 | | |

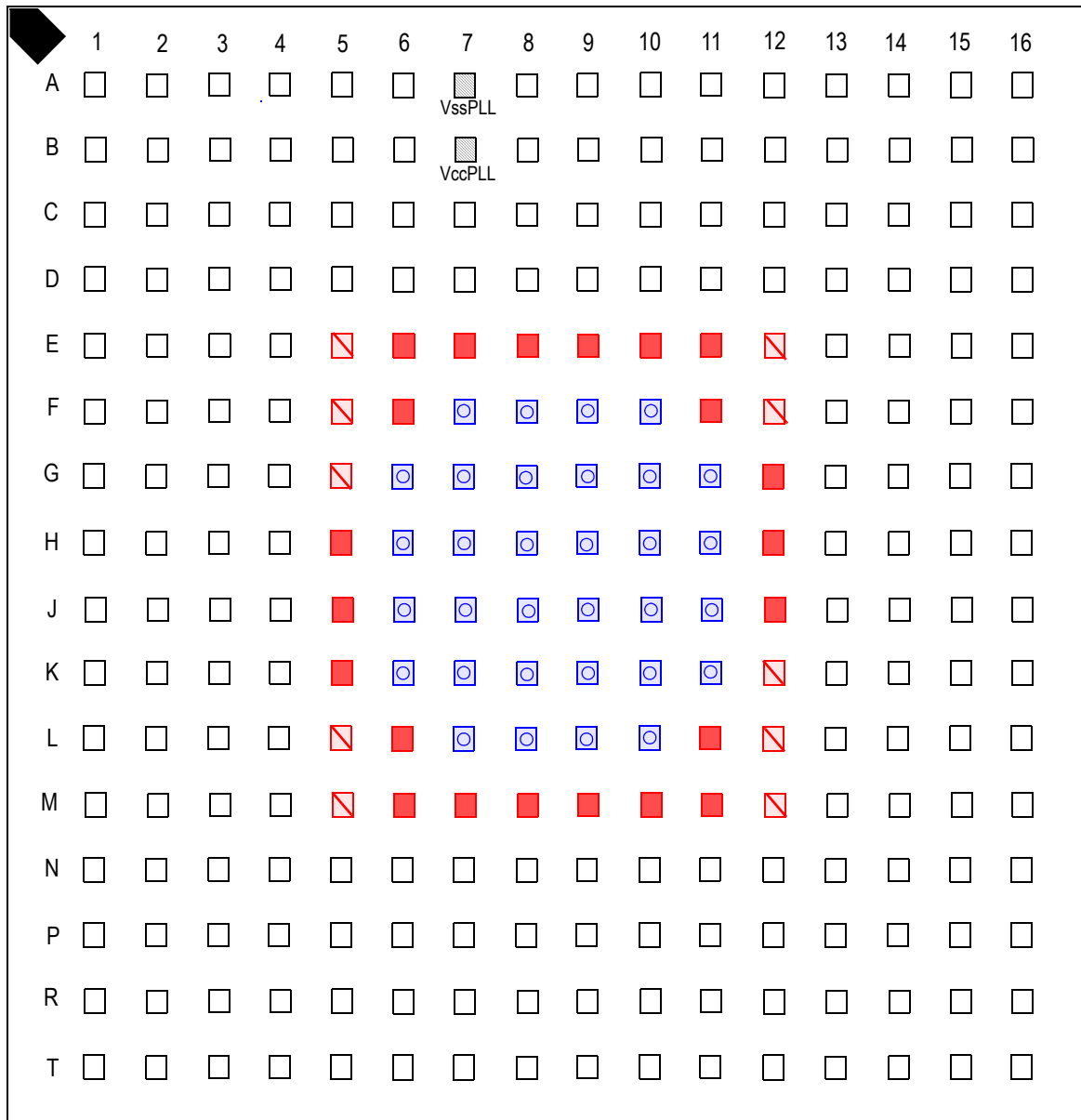
Table 21 RC32365 Ground Pins




Alternate Pin Functions

| Pin | Primary | Alt #1 |
|-----|----------|------------|
| C14 | GPIO[0] | U0SOUT |
| A15 | GPIO[1] | U0SINP |
| B14 | GPIO[2] | MADDR[22] |
| A14 | GPIO[3] | MADDR[23] |
| B13 | GPIO[4] | MADDR[24] |
| A13 | GPIO[5] | MADDR[25] |
| C13 | GPIO[6] | RNGCLK |
| D13 | GPIO[7] | SDCKENP |
| B12 | GPIO[8] | CEN1 |
| A12 | GPIO[9] | CEN2 |
| C12 | GPIO[10] | REGN |
| D12 | GPIO[11] | IORDN |
| B11 | GPIO[12] | IOWRN |
| F2 | GPIO[13] | PCIREQN[2] |
| F1 | GPIO[14] | PCIGNTN[2] |
| E1 | GPIO[15] | PCIMUNITN |

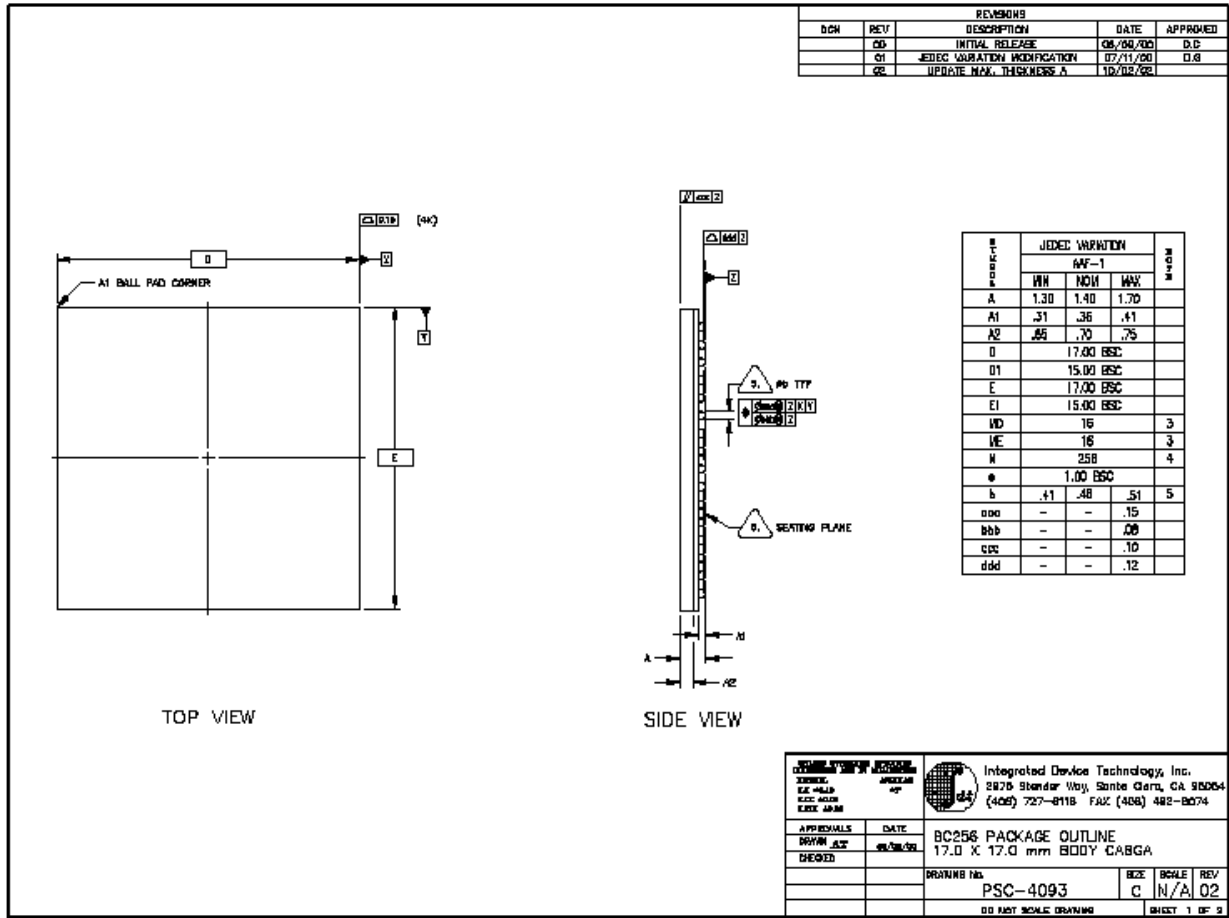
Table 22 Alternate Pin Functions

RC32365 Pinout — Top View



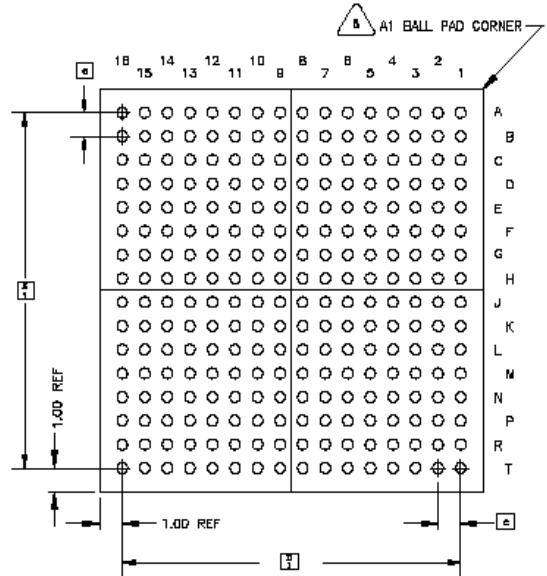
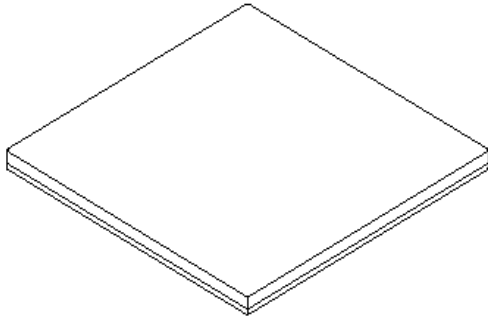
-  V_{SS} (Ground)
-  V_{CC}I/O (Power)
-  V_{CC}Core (Power)

Package Drawing - 256-pin CABGA



Package Drawing - page two

| REVISIONS | | | | |
|-----------|-----|------------------------------|----------|----------|
| DCN | REV | DESCRIPTION | DATE | APPROVED |
| | 00 | INITIAL RELEASE | 06/09/00 | D.G |
| | 01 | JEDEC VARIATION MODIFICATION | 07/31/00 | D.G |
| | 02 | UPDATE MAX. THICKNESS A | 10/02/02 | |



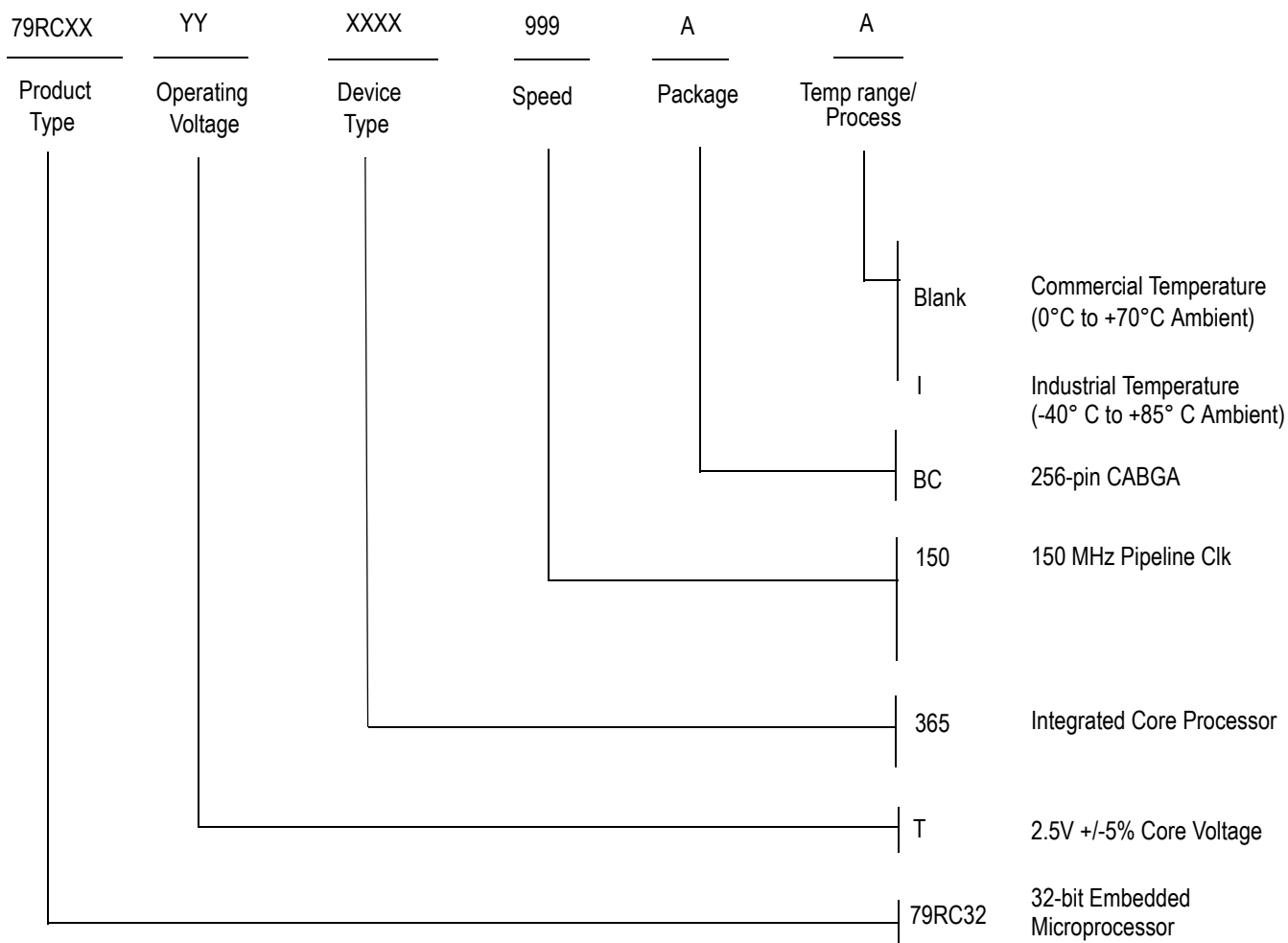
NOTES: UNLESS OTHERWISE SPECIFIED

1. ALL DIMENSIONS AND TOLERANCES CONFORM TO ASME Y14.5M-1994.
2. "a" REPRESENTS THE BASIC SOLDER BALL GRID PITCH.
3. "MD" IS THE MAXIMUM SOLDER BALL MATRIX SIZE IN THE "D" DIRECTION.
"ME" IS THE MAXIMUM SOLDER BALL MATRIX SIZE IN THE "E" DIRECTION.
"N" IS THE MAXIMUM ALLOWABLE NUMBER OF SOLDER BALLS.
4. DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM Z.
5. PRIMARY DATUM Z AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.
6. "A1" ID CORNER MUST BE IDENTIFIED. IDENTIFICATION MAY BE BY MEANS OF CHAMFER, METALLIZED OR INK MARK, INDENTATION OR OTHER FEATURE OF THE PACKAGE BODY.
7. ALL DIMENSIONS ARE IN MILLIMETERS.
8. THIS DRAWING CONFORMS TO JEDEC PUBLICATION 95 REGISTRATION MO-192 VARIATION A4F-1
EXCEPTIONS:
b MIN-0.41 NOM-0.45 MAX-0.51

BOTTOM VIEW
289 SOLDER BALLS

| | | |
|---|--|--|
| <small>TOLERANCE UNLESS OTHERWISE SPECIFIED</small> <small>DIMENSIONS ARE IN MILLIMETERS</small> DECIMAL ANGULAR 0.25 0.125 0.075 0.125 0.075 0.050 | | Integrated Device Technology, Inc. 2875 Stander Way, Santa Clara, CA 95054 (408) 727-6118 FAX (408) 492-8074 |
| APPROVALS DRAWN: <i>AG</i> CHECKED: | DATE: 06/09/00 BC256 PACKAGE OUTLINE 17.0 X 17.0 mm BODY CABGA | |
| DRAWING No. PSC-4093 | | SIZE: C SCALE: N/A REV: 02 |
| DO NOT SCALE DRAWING | | SHEET 2 OF 2 |

Ordering Information



Valid Combinations

- 79RC32T365 -150BC 256-pin CABGA package, Commercial Temperature
- 79RC32T365 -150BCI 256-pin CABGA package, Industrial Temperature



CORPORATE HEADQUARTERS
 2975 Stender Way
 Santa Clara, CA 95054

for SALES:
 800-345-7015 or 408-727-6116
 fax: 408-330-1748
 www.idt.com

for Tech Support:
 email: rischelp@idt.com
 phone: 408-492-8208