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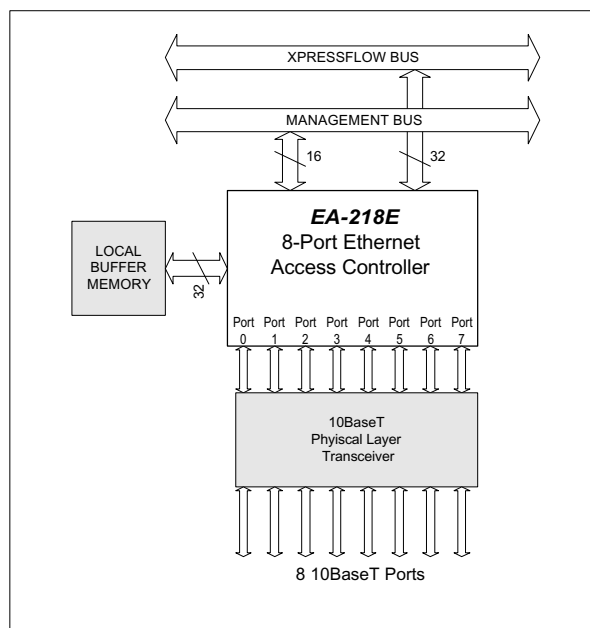
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### Distinctive Characteristics

- ◆ 8 10Mbps Ethernet Access Ports
  - ◇ Direct interface with 10BaseT transceiver
- ◆ 0.5 micron 3.3 Volt CMOS process
- ◆ 352-BGA package
- ◆ Operating frequency
  - ◇ -33 33 MHz maximum
  - ◇ -40 40 MHz maximum
  - ◇ -50 50 MHz maximum
  - ◇ -66 66.66 MHz maximum
- ◆ 32-bit Local Buffer Memory Interface
  - ◇ Supports 128k to 1M bytes
  - ◇ Utilize high performance 32-bit Synchronous Burst SRAM
- ◆ Hardware assisted Buffer and Queue Management
- ◆ 16-bit Management Bus I/O Interface
  - ◇ Allows host to access Control Registers & Local Buffer Memory
  - ◇ Big and Little Endian CPUs
  - ◇ Direct interface to standard micro-processors, including 386, 486 families and Motorola MPC series embedded processors
- ◆ 32-bit XpressFlow Bus Interface
  - ◇ Uses Granule for frame transferring between Access Controllers
- ◆ Unicast, multicast, and broadcast frames
  - ◇ Also detects IEEE 802.3X MAC Control frames
- ◆ Works together with SC-220 XpressFlow Engine
  - ◇ Forwards frames at full line-rate
  - ◇ Distributed Flow Caching™ to reduce frame forwarding latency
- ◆ Half and Full Duplex operation
- ◆ Programmable Flow Control
  - ◇ Jam Collision for Half Duplex Mode
  - ◇ Transmit Flow Control Frame for IEEE 802.3x Full Duplex Mode

Supports Store-&-Forward frame forward-

## EA218E – 8-Port Ethernet Access Controller XpressFlow 2020 Ethernet Routing Switch Chipset



**Block Diagram-  
EA218E 8-Port Ethernet Access Controller**

### General Description

The EA-218E provides eight 10Mbps Ethernet network access interface ports.

The EA-218E provides the Ethernet MAC protocols, handles the local buffer memory interface and management, arbitrates among multiple priority queues, and interfaces with the XpressFlow Engine and other Access Controllers through the XpressFlow message passing protocol.

### Related Components:

- ◆ SC220 – XpressFlow Engine
- ◆ EA218 – 6-port 10 + 2-port 10/100 Ethernet Access Controller
- ◆ EA234 – 4-port 10/100Mbps Ethernet Access Controller

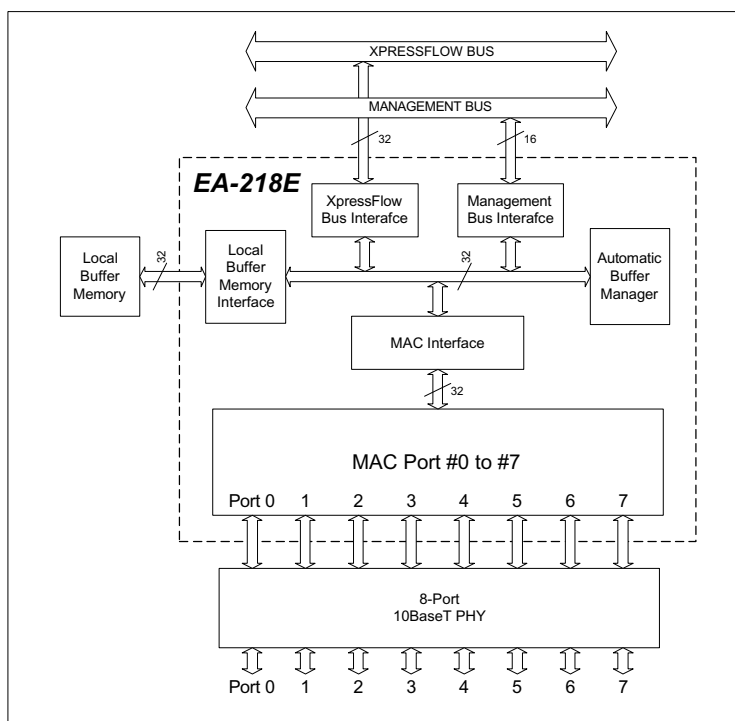
## XpressFlow-2020 Series – Ethernet Switch Chipset

## EA218E 8-Port 10Mb Ethernet Access Controller

ing mode

### Characteristics Continue

- ◇ Automatically selects the optimized mode for forwarding
- ◇ Allows manual frame forwarding mode selection override
- ◆ Multi-Media ready with QoS supports
  - ◇ Four frame transmission priority queues
- ◆ Complies with IEEE 802.1 Bridge Standard
  - ◇ Assigns one unique MAC Address for each port
- ◆ VLAN ID Tagging & Stripping
  - ◇ Auto padding if necessary after stripping
- ◆ Automatic retry frame transmission
  - ◇ Transmit collision
  - ◇ Transmit buffer under-run
- ◆ Automatic receive filtering for bad frames for Store & Forward Mode
  - ◇ Bad FCS
  - ◇ Short events or frames under 64 bytes
  - ◇ Long events or frames over 1518/1522 bytes
- ◆ Automatic statistic collection for RMON

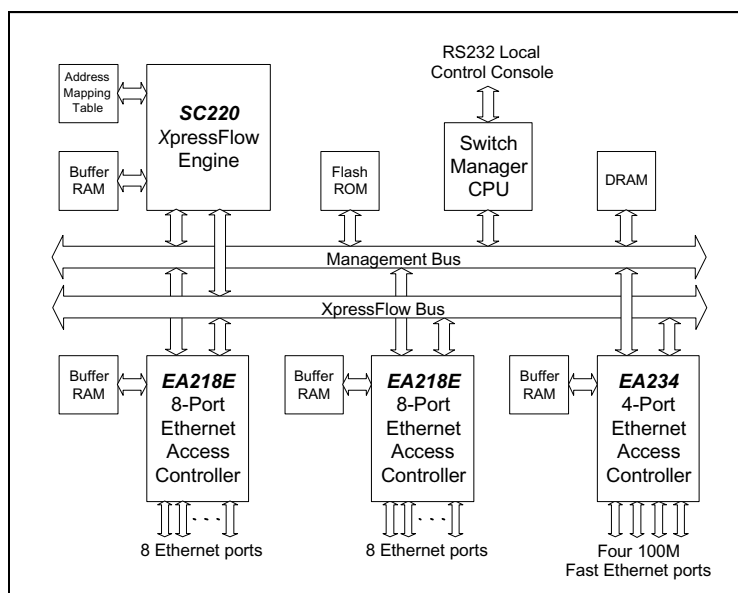


Block Diagram –

EA218E 8-Port Ethernet Access Controller

### Typical Application:

- ◇ A 16-port Ethernet Switch with 4-Fast Ethernet

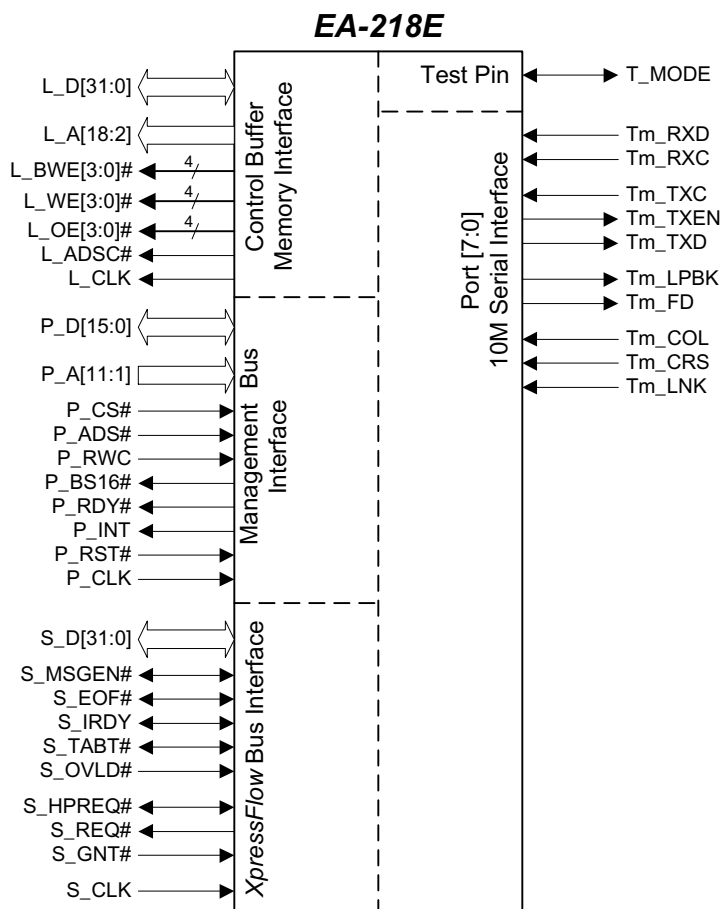


System Block Diagram --

16-Port Ethernet Switch with 4 Fast Ethernet Up-Links

## 1. PIN ASSIGNMENT

### 1.1 Logic Symbol



**XpressFlow-2020 Series –  
Ethernet Switch Chipset**
**EA218E  
8-Port 10Mb Ethernet Access Controller**
**1.2 Pin Assignment (Preliminary)**

|              |        |                                                                                   |
|--------------|--------|-----------------------------------------------------------------------------------|
| <b>Note:</b> | #      | Active low signal                                                                 |
|              | Input  | Input signal                                                                      |
|              | In-ST  | Input signal with Schmitt-Trigger                                                 |
|              | Output | Output signal (Tri-State driver)                                                  |
|              | Out-OD | Output signal with Open-Drain driver                                              |
|              | I/O-TS | Input & Output signal with Tri-State driver                                       |
|              | I/O-OD | Input & Output signal with Open-Drain driver                                      |
|              | 5VT    | Input with 5V Tolerance                                                           |
|              | ①      | Output signal with programmable polarity.                                         |
|              | ②      | Input or output pins with weak internal pull up resistors (50k to 100k Ohms each) |
|              | ③      | These pins are reserved for internal use only. They should be left unconnected.   |

| Pin No(s).                                                                                                                      | Symbol                   | Type             | Max<br>I <sub>OL</sub> / I <sub>OH</sub> | Name and Functions                                                                         |
|---------------------------------------------------------------------------------------------------------------------------------|--------------------------|------------------|------------------------------------------|--------------------------------------------------------------------------------------------|
| <b>Management Bus Interface</b>                                                                                                 |                          |                  |                                          |                                                                                            |
| J25,K26,L24,K25,L26,<br>M24,L25,M26,N24,M25,<br>P24,N26,N25,R24,P26, P25                                                        | P_D[15:0]                | TTL I/O-TS (5VT) | 16mA                                     | Management Bus – Data Bit [15:0]                                                           |
| C26,D24,C25,E24,D26,<br>D25,F24,E26,E25,G24, F26                                                                                | P_A[11:1]                | TTL In (5VT)     |                                          | Management Bus – Address Bit [11:1]                                                        |
| F25                                                                                                                             | P_ADS#                   | TTL In (5VT)     |                                          | Management Bus – Address Strobe                                                            |
| H25                                                                                                                             | P_RWC                    | TTL In (5VT)     |                                          | Management Bus – Read/Write Control                                                        |
| J24                                                                                                                             | P_RDY#                   | TTL Out-OD       | 16mA                                     | Management Bus – Data Ready                                                                |
| G25                                                                                                                             | P_BS16#                  | TTL Out-OD       | 16mA                                     | Management Bus – 16 bit Data Bus                                                           |
| G26                                                                                                                             | P_CS#                    | TTL In (5VT)     |                                          | Management Bus – Chip Select                                                               |
| H26                                                                                                                             | P_INT                    | ① CMOS Output    | 4mA                                      | Management Bus – Interrupt Request                                                         |
| J26                                                                                                                             | P_RST#                   | TTL In-ST (5VT)  |                                          | Management Bus – Master Reset                                                              |
| K24                                                                                                                             | P_CLK                    | TTL In (5VT)     |                                          | Management Bus – Bus Clock                                                                 |
| <b>XpressFlow Bus Interface</b>                                                                                                 |                          |                  |                                          |                                                                                            |
| C23,A23,B22,C22,A22                                                                                                             | S_D[31:27] /<br>P_C[0:4] | CMOS I/O-TS      | 12 mA                                    | XpressFlow Bus – Data Bit [31:27] or Manage-<br>ment Bus Interface Configuration bit [0:4] |
| B21,D20,C21,A21,B20,<br>A20,C20,B19,A19,C19,<br>B18,A18,B17,C18,A17,<br>D17,B16,C17,A16,B15,<br>A15,C16,B14,D15,A14,<br>C15,B13 | S_D[26:0]                | CMOS I/O-TS      | 12mA                                     | XpressFlow Bus – Data Bit [26:0]                                                           |
| B12                                                                                                                             | S_MSGEN#                 | CMOS I/O-TS      | 12 mA                                    | XpressFlow Bus – Message Envelope                                                          |
| A12                                                                                                                             | S_EOF#                   | CMOS I/O-TS      | 12mA                                     | XpressFlow Bus – End of Frame                                                              |
| C14                                                                                                                             | S_IRDY                   | CMOS I/O-TS      | 12 mA                                    | XpressFlow Bus – Initiator Ready                                                           |
| C13                                                                                                                             | S_TABT#                  | CMOS I/O-OD      | 12 mA                                    | XpressFlow Bus – Target Abort                                                              |
| B23                                                                                                                             | S_HPREQ#                 | CMOS I/O-OD      | 12mA                                     | XpressFlow Bus – High Priority Request                                                     |
| A24                                                                                                                             | S_REQ#                   | CMOS Output      | 4mA                                      | XpressFlow Bus – Bus Request to SC201                                                      |
| B24                                                                                                                             | S_GNT#                   | CMOS Input       |                                          | XpressFlow Bus – Bus Grant from SC201                                                      |
| A13                                                                                                                             | S_OVLD#                  | CMOS Input       |                                          | XpressFlow Bus – Bus Overload                                                              |
| D13                                                                                                                             | S_CLK                    | CMOS Input       |                                          | XpressFlow Bus – Clock                                                                     |

**XpressFlow-2020 Series –  
Ethernet Switch Chipset**
**EA218E  
8-Port 10Mb Ethernet Access Controller**

| Pin No(s).                                                                                                      | Symbol                | Type           |     | Name and Functions                                                    |
|-----------------------------------------------------------------------------------------------------------------|-----------------------|----------------|-----|-----------------------------------------------------------------------|
| <b>Control Buffer Memory Interface</b>                                                                          |                       |                |     |                                                                       |
| M4,N2,L3,M1,M2,L1,K3,<br>L2,K4,K1,J3,K2,J1,J2,<br>H3,H1,H2,G3,G1,G2,F1,F3,F<br>2,E1,E3,E2,D1,D3,D2,C1,C2,<br>B1 | L_D[31:0]             | TTL I/O-TS ②   | 8mA | Local Memory Bus – Data Bit [31:0]                                    |
| A6,B6,C8,A7,D8,D7,C9,<br>A8,B8,A9,C10,B9,D10,<br>A10,C11,B10,A11                                                | L_A[18:2]             | CMOS Output    | 8mA | Local Memory Bus – Address Bit [17:2]                                 |
| C7                                                                                                              | L_A[19] /<br>L_OE[3]# | CMOS Output    | 8mA | Local Memory Bus – Address Bit [19] or Memory<br>Read Chip Select [3] |
| D5,A5,A3                                                                                                        | L_OE[2:0]#            | CMOS Output    | 2mA | Local Memory Read Chip Select [2:0]                                   |
| D7,E4,B5,C4                                                                                                     | L_WE[3:0]#            | CMOS Output    | 2mA | Local Memory Write Chip Select [3:0]                                  |
| C6,B4,A4,C5                                                                                                     | L_BWE[3:0]#           | CMOS Output    | 8mA | Local Memory Byte Write Enable, Byte [3:0]                            |
| B3                                                                                                              | L_ADSC#               | CMOS Output    | 8mA | Local Memory Controller Address Status                                |
| G4                                                                                                              | L_CLK                 | CMOS Output    | 8mA | Local Memory Clock input                                              |
| <b>Ethernet Access Port cont. [7:0]</b>                                                                         |                       |                |     |                                                                       |
| AF20,AE17,AD12,AD9,<br>AC2,T25                                                                                  | T[7:2]_RXD            | TTL In (5VT) ② |     | Receive Data – (one for each 10Mbps Serial In-<br>terface Port)       |
| AC25,AF6                                                                                                        | T[1:0]_RXD            | TTL In (5VT)   |     |                                                                       |
| AD19,AD16,AE14,AF10,AC2<br>1U24                                                                                 | T[7:2]_RXC            | TTL In (5VT) ② |     | Receive Clock – (one for each 10Mbps Serial In-<br>terface Port)      |
| AC24,AE7                                                                                                        | T[1:0]_RXC            | TTL In (5VT)   |     |                                                                       |
| AF18,AD14,AE12,AF8,<br>W2,AA25,AE22,AD1                                                                         | T[7:0]_TXC            | TTL In (5VT)   |     | Transmit Clock – (one for each 10Mbps Serial In-<br>terface Port)     |
| AE19,AF15,AF12,AD8,<br>W1,AA24                                                                                  | T[7:2]_TXEN           | CMOS Out ②     |     |                                                                       |
| AF22,AF2                                                                                                        | T[1:0]_TXEN           | CMOS Output    | 4mA | Transmit Enable – (one for each 10Mbps Serial<br>Interface Port)      |
| AE20,AF16,AF13,AE10,<br>Y1,W25                                                                                  | T[7:2]_TXD            | CMOS Out ②     |     |                                                                       |
| AF23,AE4                                                                                                        | T[1:0]_TXD            | CMOS Output    | 2mA | Loop Back Enable – (one for each 10Mbps Serial<br>Interface Port)     |
| AD18,AD15,AE13,AF9,<br>Y2,Y26                                                                                   | T[7:2]_LPBK ①         | CMOS Out ②     |     |                                                                       |
| AE23,AF3                                                                                                        | T[1:0]_LPBK ①         | CMOS Output    | 2mA | Full Duplex Mode – (one for each 10Mbps Serial<br>Interface Port)     |
| AF19,AE16,AD11,AE9,<br>V3,AA26                                                                                  | T[7:2]_FD ①           | CMOS Out ②     |     |                                                                       |
| AD21,AE3                                                                                                        | T[1:0]_FD ①           | CMOS Output    |     | Collision Detected – (one for each 10Mbps Serial<br>Interface Port)   |
| AD17,AE15,AF11,AE8,<br>V1,AB26                                                                                  | T[7:2]_COL ②          | TTL In (5VT)   |     |                                                                       |
| AD20,AC23                                                                                                       | T[1:0]_COL            | TTL In (5VT)   |     | Carrier Sense – (one for each 10Mbps Serial In-<br>terface Port)      |
| AE18,AD13,AD10,AD7,<br>U3,AB24,                                                                                 | T[7:2]_CRS ②          | TTL In (5VT)   |     |                                                                       |
| AF21,AD2                                                                                                        | T[1:0]_CRS            | TTL In (5VT)   |     | Link Status – (one for each 10Mbps Serial Inter-<br>face Port)        |
| AF17,AF14,AE11,AF7,<br>V2,AB25,                                                                                 | T[7:2]_LNK ①          | TTL In (5VT) ② |     |                                                                       |
| AE21,AB3                                                                                                        | T[1:0]_LNK ①          | TTL In (5VT)   |     |                                                                       |

**XpressFlow-2020 Series –  
Ethernet Switch Chipset****EA218E  
8-Port 10Mb Ethernet Access Controller**

| Pin No(s).                                         | Symbol       | Type          | Max<br>I <sub>OL</sub> / I <sub>OH</sub> | Name & Functions                                                                      |
|----------------------------------------------------|--------------|---------------|------------------------------------------|---------------------------------------------------------------------------------------|
| <b>Test Facility</b>                               |              |               |                                          |                                                                                       |
| A25                                                | T_MODE       | CMOS I/O-TS ② | 2mA                                      | Test Pin – Set Test Mode upon Reset, and provides test status output during test mode |
| N1,M3,P2,P1,N3,R2,P3,R1,T<br>2R3,T1,R4,U2,T3,U1,U4 | T_D[15:10] ③ | CMOS Output   | 4mA                                      | Test Pins – Reserved for internal use only                                            |

| Pin No(s).                                                                                                                                    | Symbol | Type  | Name & Functions    |
|-----------------------------------------------------------------------------------------------------------------------------------------------|--------|-------|---------------------|
| <b>Power Pins</b>                                                                                                                             |        |       |                     |
| D6,D11,D16,D21,F4,<br>F23,L4,L23,T4,T23,AA4,AA23<br>AC6,AC11,AC16,AC21                                                                        | VDD    | Power | +3.3 Volt DC Supply |
| A1,A2,A26,B2,B25,B26,<br>C3,C24,D4,D9,D14,D19,D23,<br>H4,J23,N4,P23,V4,W23,AC4,<br>AC8,AC13,<br>AC18,AC23,AD3,AD24,<br>AE1,AE2,AE25,AF1, AF25 | VSS    | Power | Ground              |

**XpressFlow-2020 Series –  
Ethernet Switch Chipset**
**EA218E  
8-Port 10Mb Ethernet Access Controller**
**1.3 Pin Reference Table: (352 pin BGA)**

| Pin # | Signal Name |   | Pin # | Signal Name      |   | Pin # | Signal Name |    | Pin # | Signal Name |    |
|-------|-------------|---|-------|------------------|---|-------|-------------|----|-------|-------------|----|
| F26   | P_A[1]      |   | C18   | S_D[13]          |   | E3    | L_D[7]      | ②  | V1    | T3_COL      | ②  |
| G24   | P_A[2]      |   | B17   | S_D[14]          |   | E1    | L_D[8]      | ②  | V3    | T3_FD       | ①② |
| E25   | P_A[3]      |   | A18   | S_D[15]          |   | F2    | L_D[9]      | ②  | Y2    | T3_LPBK     | ①② |
| E26   | P_A[4]      |   | B18   | S_D[16]          |   | F3    | L_D[10]     | ②  | Y1    | T3_TXD      | ②  |
| F24   | P_A[5]      |   | C19   | S_D[17]          |   | F1    | L_D[11]     | ②  | W1    | T3_TXEN     | ②  |
| D25   | P_A[6]      |   | A19   | S_D[18]          |   | G2    | L_D[12]     | ②  | W2    | T3_TXC      |    |
| D26   | P_A[7]      |   | B19   | S_D[19]          |   | G1    | L_D[13]     | ②  | AC1   | T3_RXC      | ②  |
| E24   | P_A[8]      |   | C20   | S_D[20]          |   | G3    | L_D[14]     | ②  | AC2   | T3_RXD      | ②  |
| C25   | P_A[9]      |   | A20   | S_D[21]          |   | H2    | L_D[15]     | ②  | AF7   | T4_LNK      | ①② |
| D24   | P_A[10]     |   | B20   | S_D[22]          |   | H1    | L_D[16]     | ②  | AD7   | T4_CRS      | ②  |
| C26   | P_A[11]     |   | A21   | S_D[23]          |   | H3    | L_D[17]     | ②  | AE8   | T4_COL      | ②  |
| F25   | P_ADS#      |   | C21   | S_D[24]          |   | J2    | L_D[18]     | ②  | AE9   | T4_FD       | ①② |
| G26   | P_CS#       |   | D20   | S_D[25]          |   | J1    | L_D[19]     | ②  | AF9   | T4_LPBK     | ①② |
| H25   | P_RWC       |   | B21   | S_D[26]          |   | K2    | L_D[20]     | ②  | AE10  | T4_TXD      | ②  |
| G25   | P_BS16#     |   | A22   | S_D[27] / P_C[4] |   | J3    | L_D[21]     | ②  | AD8   | T4_TXEN     | ②  |
| J24   | P_RDY#      |   | C22   | S_D[28] / P_C[3] |   | K1    | L_D[22]     | ②  | AF8   | T4_TXC      |    |
| J26   | P_RST#      |   | B22   | S_D[29] / P_C[2] |   | K4    | L_D[23]     | ②  | AF10  | T4_RXC      | ②  |
| H26   | P_INT       | ① | A23   | S_D[30] / P_C[1] |   | L2    | L_D[24]     | ②  | AD9   | T4_RXD      | ②  |
| K24   | P_CLK       |   | C23   | S_D[31] / P_C[0] |   | K3    | L_D[25]     | ②  | AE11  | T5_LNK      | ①② |
| P25   | P_D[0]      |   |       |                  |   | L1    | L_D[26]     | ②  | AD10  | T5_CRS      | ②  |
| P26   | P_D[1]      |   | A11   | L_A[2]           |   | M2    | L_D[27]     | ②  | AF11  | T5_COL      | ②  |
| R24   | P_D[2]      |   | B10   | L_A[3]           |   | M1    | L_D[28]     | ②  | AD11  | T5_FD       | ①② |
| N25   | P_D[3]      |   | C11   | L_A[4]           |   | L3    | L_D[29]     | ②  | AE13  | T5_LPBK     | ①② |
| N26   | P_D[4]      |   | A10   | L_A[5]           |   | N2    | L_D[30]     | ②  | AF13  | T5_TXD      | ②  |
| P24   | P_D[5]      |   | D10   | L_A[6]           |   | M4    | L_D[31]     | ②  | AF12  | T5_TXEN     | ②  |
| M25   | P_D[6]      |   | B9    | L_A[7]           |   |       |             |    | AE12  | T5_TXC      |    |
| N24   | P_D[7]      |   | C10   | L_A[8]           |   | AB3   | T0_LNK      | ①  | AE14  | T5_RXC      | ②  |
| M26   | P_D[8]      |   | A9    | L_A[9]           |   | AD2   | T0_CRS      |    | AD12  | T5_RXD      | ②  |
| L25   | P_D[9]      |   | B8    | L_A[10]          |   | AC3   | T0_COL      |    | AF14  | T6_LNK      | ①② |
| M24   | P_D[10]     |   | A8    | L_A[11]          |   | AE3   | T0_FD       | ①  | AD13  | T6_CRS      | ②  |
| L26   | P_D[11]     |   | C9    | L_A[12]          |   | AF3   | T0_LPBK     | ①  | AE15  | T6_COL      | ②  |
| K25   | P_D[12]     |   | B7    | L_A[13]          |   | AE4   | T0_TXD      |    | AE16  | T6_FD       | ①② |
| L24   | P_D[13]     |   | D8    | L_A[14]          |   | AF2   | T0_TXEN     |    | AD15  | T6_LPBK     | ①② |
| K26   | P_D[14]     |   | A7    | L_A[15]          |   | AD1   | T0_TXC      |    | AF16  | T6_TXD      | ②  |
| J25   | P_D[15]     |   | C8    | L_A[16]          |   | AE7   | T0_RXC      |    | AF15  | T6_TXEN     | ②  |
|       |             |   | B6    | L_A[17]          |   | AF6   | T0_RXD      |    | AD14  | T6_TXC      |    |
| D13   | S_CLK       |   | A6    | L_A[18]          |   | AE21  | T1_LNK      | ①  | AD16  | T6_RXC      | ②  |
| A13   | S_OVLD#     |   | C7    | L_A[19] / OE[3]# |   | AF21  | T1_CRS      |    | AE17  | T6_RXD      | ②  |
| B23   | S_HPREQ#    |   | D5    | L_OE[2]#         |   | AD20  | T1_COL      |    | AF17  | T7_LNK      | ①② |
| A24   | S_REQ#      |   | A5    | L_OE[1]#         |   | AD21  | T1_FD       | ①  | AE18  | T7_CRS      | ②  |
| B24   | S_GNT#      |   | A3    | L_OE[0]          |   | AE23  | T1_LPBK     | ①  | AD17  | T7_COL      | ②  |
| B12   | S_MSGEN#    |   | D7    | L_WE[3]#         |   | AF23  | T1_TXD      |    | AF19  | T7_FD       | ①② |
| A12   | S_EOF#      |   | E4    | L_WE[2]#         |   | AF22  | T1_TXEN     |    | AD18  | T7_LPBK     | ①② |
| C14   | S_IRDY      |   | B5    | L_WE[1]#         |   | AE22  | T1_TXC      |    | AE20  | T7_TXD      | ②  |
| C13   | S_TABT#     |   | C4    | L_WE[0]#         |   | AC24  | T1_RXC      |    | AE19  | T7_TXEN     | ②  |
| B13   | S_D[0]      |   | C6    | L_BWE[3]#        |   | AC25  | T1_RXD      |    | AF18  | T7_TXC      |    |
| C15   | S_D[1]      |   | B4    | L_BWE[2]#        |   | AB25  | T2_LNK      | ①② | AD19  | T7_RXC      | ②  |
| A14   | S_D[2]      |   | A4    | L_BWE[1]#        |   | AB24  | T2_CRS      | ②  | AF20  | T7_RXD      | ②  |
| D15   | S_D[3]      |   | C5    | L_BWE[0]#        |   | AB26  | T2_COL      | ②  |       |             |    |
| B14   | S_D[4]      |   | B3    | L_ADSC#          |   | AA26  | T2_FD       | ①② | A25   | T_MODE      | ②  |
| C16   | S_D[5]      |   | G4    | L_CLK            |   | Y26   | T2_LPBK     | ①② |       |             |    |
| A15   | S_D[6]      |   | B1    | L_D[0]           | ② | W25   | T2_TXD      | ②  | U4    | T_D[0]      | ③  |
| B15   | S_D[7]      |   | C2    | L_D[1]           | ② | AA24  | T2_TXEN     | ②  | U1    | T_D[1]      | ③  |
| A16   | S_D[8]      |   | C1    | L_D[2]           | ② | AA25  | T2_TXC      |    | T3    | T_D[2]      | ③  |
| C17   | S_D[9]      |   | D2    | L_D[3]           | ② | U24   | T2_RXC      | ②  | U2    | T_D[3]      | ③  |
| B16   | S_D[10]     |   | D3    | L_D[4]           | ② | T25   | T2_RXD      | ②  | R4    | T_D[4]      | ③  |
| D17   | S_D[11]     |   | D1    | L_D[5]           | ② | V2    | T3_LNK      | ①② | T1    | T_D[5]      | ③  |
| A17   | S_D[12]     |   | E2    | L_D[6]           | ② | U3    | T3_CRS      | ②  | R3    | T_D[6]      | ③  |

- Note:**
- ① Output signals with programmable polarity.
  - ② Input or output pins with weak internal pull up resistors (50k to 100k Ohms each)
  - ③ These pins are reserved for internal use only. They should be left unconnected.



## 2. FUNCTIONAL DESCRIPTION

### 2.1 Local Memory (Local Buffer Memory) Interface

- ◆ Uses industry standard Synchronous Burst Mode SRAM up to 1M bytes
  - ◇ 32k x 32, 64k x 32, 128k x 32, or 256k x 32
- ◆ Provides separate Read and Write Chip Selects ( L\_OE[3:0]# and L\_WE[3:0]# ) for each memory chip
- ◆ Supports back to back Read or Write operations across memory chips

#### 2.1.1 Pin Description

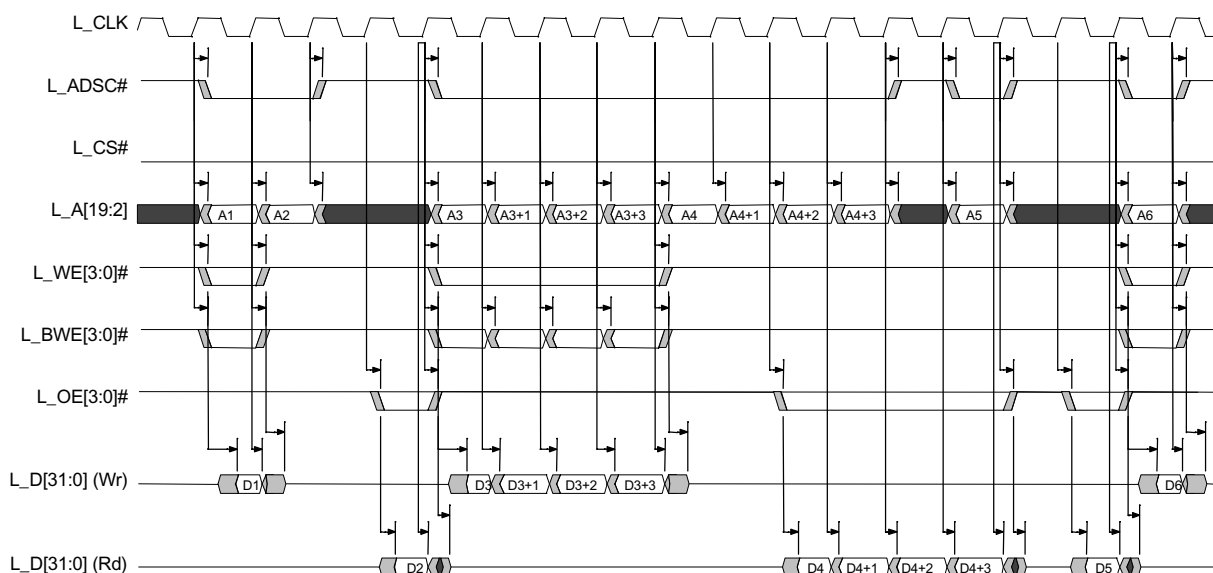
| Symbol                | Type        | Name and Functions                                                                                                                                                                                                        |
|-----------------------|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| L_D[31:0] ②           | TTL I/O-TS  | <b>Local Memory Data Bus Bit [31:0]</b> – a 32-bit synchronous data bus.                                                                                                                                                  |
| L_A[18:2]             | CMOS Output | <b>Local Memory Address Bus Bit [18:2]</b> – Bit [18:2] of a synchronous address bus. The memory address is sampled when L_CS# is enabled and L_ADSC# is asserted.                                                        |
| L_A[19] /<br>L_OE[3]# | CMOS Output | <b>Local Memory Address Bus Bit [19] or Local Memory Read Chip Select [3]</b> – Depends on memory configuration, this pin can be used as the Local Memory Address Bit [19] or as the Local Memory Read Chip Select [3].   |
| L_OE[2:0]#            | CMOS Output | <b>Local Memory Read Chip Select [2:0]</b> – allows up to read one of the 4 banks of memory.                                                                                                                              |
| L_WE[3:0]#            | CMOS Output | <b>Local Memory Write Chip Select [3:0]</b> – allows up to write one of the 4 banks of memory.                                                                                                                            |
| L_BWE[3:0]#           | CMOS Output | <b>Local Memory Byte Write Enable [3:0]</b> – use to write individual bytes.                                                                                                                                              |
| L_ADSC#               | CMOS Output | <b>Local Memory Controller Address Status</b> – to load a new address.                                                                                                                                                    |
| L_CLK                 | CMOS Output | <b>Local Memory Clock</b> – a synchronous clock to memory devices.                                                                                                                                                        |
| L_D[31:0]             | TTL I/O-TS  | <b>Local Memory Data Bus Bit [31:0]</b> – a 32-bit synchronous data bus.                                                                                                                                                  |
| L_A[18:2]             | CMOS Output | <b>Local Memory Address Bus Bit [18:2]</b> – Bit [17:2] of a synchronous address bus. The memory address is sampled when L_CS# is enabled and L_ADSC# is asserted.                                                        |
| L_A[19] /<br>L_WE[3]# | CMOS Output | <b>Local Memory Address Bus Bit [19] or Local Memory Write Chip Select [3]</b> – Depends on memory configuration, this pin can be used as the Local Memory Address Bit [19] or as the Local Memory Write Chip Select [3]. |
| L_WE[2:0]#            | CMOS Output | <b>Local Memory Write Chip Select [2:0]</b> – allows up to write one of the 4 banks of memory.                                                                                                                            |
| L_OE[3:0]#            | CMOS Output | <b>Local Memory Read Chip Select [3:0]</b> – allows up to read one of the 4 banks of memory.                                                                                                                              |
| L_BWE[3:0]#           | CMOS Output | <b>Local Memory Byte Write Enable [3:0]</b> – use to write individual bytes.                                                                                                                                              |
| L_ADSC#               | CMOS Output | <b>Local Memory Controller Address Status</b> – to load a new address.                                                                                                                                                    |
| L_CLK                 | CMOS Output | <b>Local Memory Clock</b> – a synchronous clock to memory devices.                                                                                                                                                        |

**Note:** ② These pins have weak internal pull up resistors (50k to 100k Ohms each).

## 2.1.2 Supported Memory Configurations

| RAM Chip Size | # of RAM Chips | Total Buffer Memory Size | Read/Write Chip Select and High Address Bits |                    |          |          |          |          |          |          |
|---------------|----------------|--------------------------|----------------------------------------------|--------------------|----------|----------|----------|----------|----------|----------|
|               |                |                          | Chip #3                                      |                    | Chip #2  |          | Chip #1  |          | Chip #0  |          |
|               |                |                          | L_WE[3]#                                     | L_A[19] / L_OE[3]# | L_WE[2]# | L_OE[2]# | L_WE[1]# | L_OE[1]# | L_WE[0]# | L_OE[0]# |
| 32k x 32      | 1              | 128k bytes               | ----                                         | ----               | ----     | ----     | ----     | ----     | L_WE[0]# | L_OE[0]# |
|               | 2              | 256k bytes               | ----                                         | ----               | ----     | ----     | L_WE[1]# | L_OE[1]# | L_WE[0]# | L_OE[0]# |
|               | 4              | 512k bytes               | L_WE[3]#                                     | L_OE[3]#           | L_WE[2]# | L_OE[2]# | L_WE[1]# | L_OE[1]# | L_WE[0]# | L_OE[0]# |
| 64k x 32      | 1              | 256k bytes               | ----                                         | ----               | ----     | ----     | ----     | ----     | L_WE[0]# | L_OE[0]# |
|               | 2              | 512k bytes               | ----                                         | ----               | ----     | ----     | L_WE[1]# | L_OE[1]# | L_WE[0]# | L_OE[0]# |
|               | 4              | 1M bytes                 | L_WE[3]#                                     | L_OE[3]#           | L_WE[2]# | L_OE[2]# | L_WE[1]# | L_OE[1]# | L_WE[0]# | L_OE[0]# |
| 128k x32      | 1              | 512k bytes               | ----                                         | ----               | ----     | ----     | ----     | ----     | L_WE[0]# | L_OE[0]# |
|               | 2              | 1M bytes                 | ----                                         | ----               | ----     | ----     | L_WE[1]# | L_OE[1]# | L_WE[0]# | L_OE[0]# |
| 256k x32      | 1              | 1M bytes                 | ----                                         | L_A[19]            | ----     | ----     | ----     | ----     | L_WE[0]# | L_OE[0]# |

## 2.1.3 Bus Cycle Waveforms



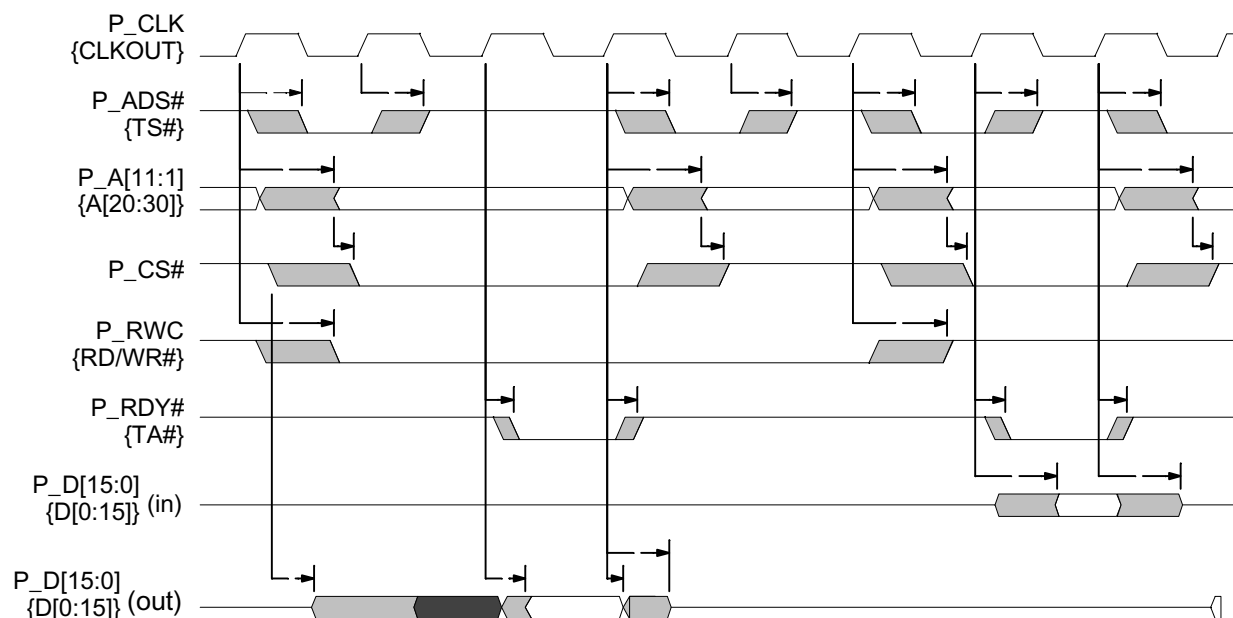
**Typical Local Memory Access Operations**

## 2.2 Processor Bus Interface

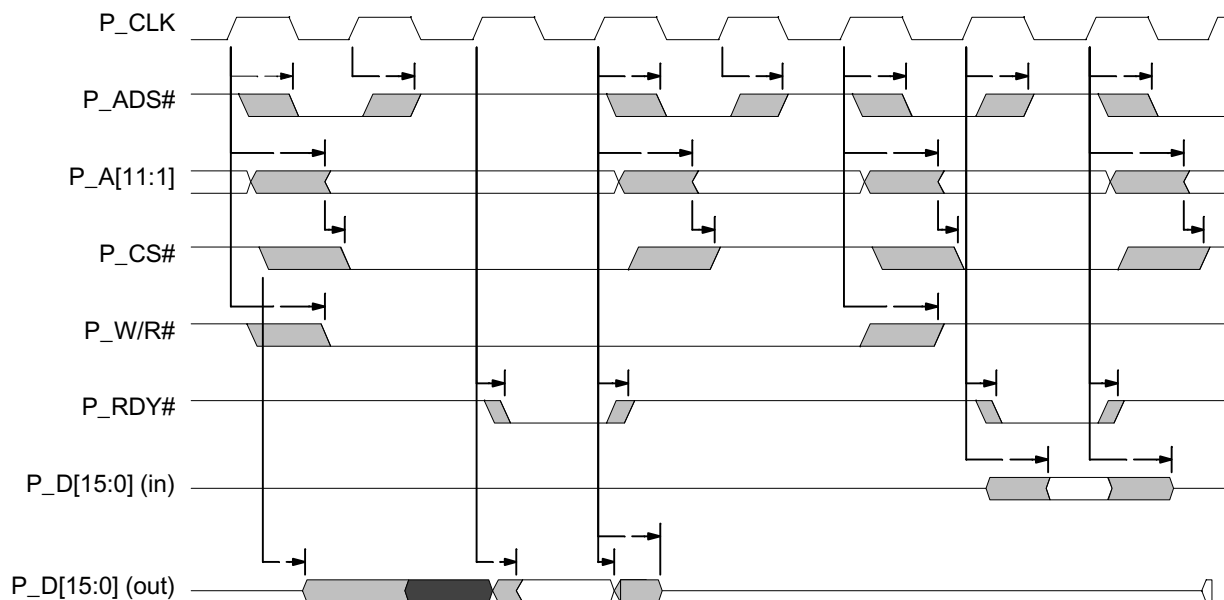
- ◆ Supports various industry standard micro-processors including:
  - ◇ Intel 186, 386, and 486 family or equivalent
  - ◇ Motorola MPC series embedded processors
- ◆ Easily adapts to other industry standard CPUs
- ◆ Provides separate Address and Data bus
- ◆ Supports Big & Little Endian byte ordering
- ◆ Supports 16-bit Data Bus
- ◆ Supports early RDY cycle
  - ◇ Meets timing requirement for Intel/AMD 186 family processors
- ◆ Supports 1X or 2X CPU Clock
  - ◇ 2X CPU Clock for 386 family processors
- ◆ Provides a single interrupt signal to Switch Manager CPU

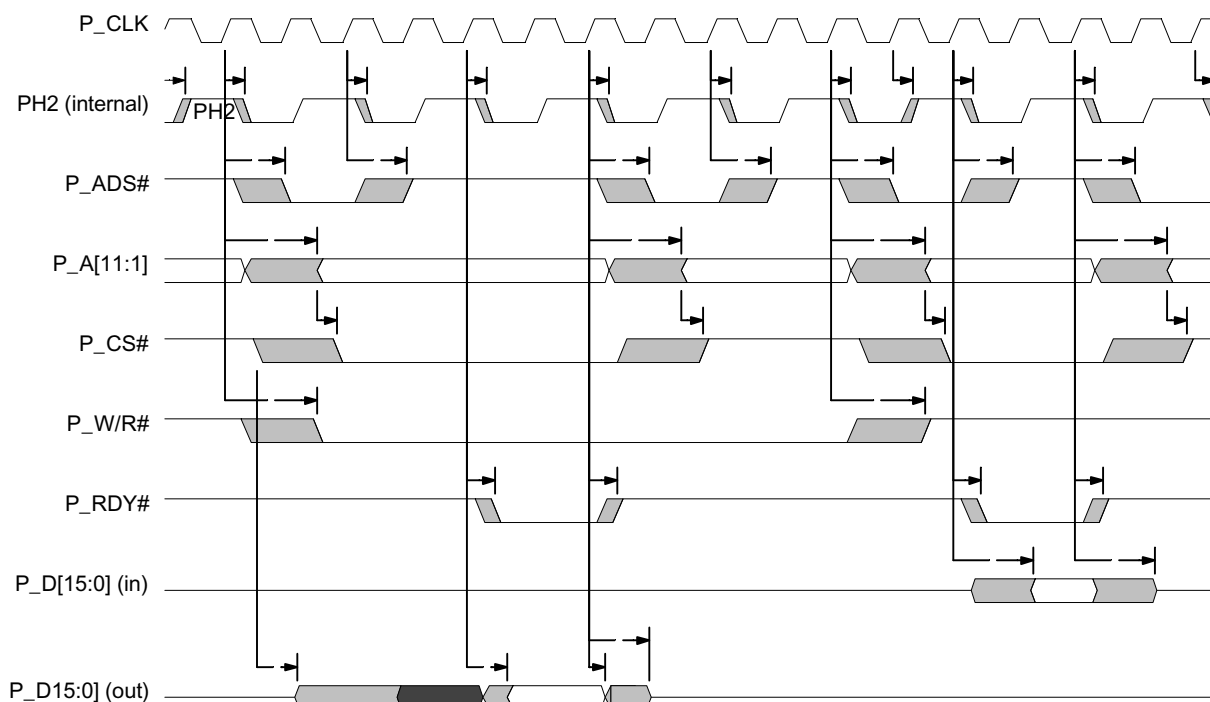
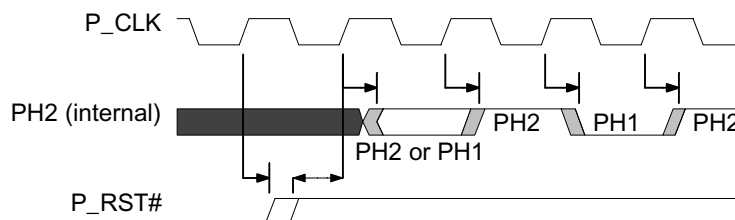
### 2.2.1 Pin Description

| Symbol    | Type             | Name and Functions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |        |          |            |      |      |      |  |           |            |     |          |            |    |          |               |        |     |        |    |          |            |        |     |       |
|-----------|------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|----------|------------|------|------|------|--|-----------|------------|-----|----------|------------|----|----------|---------------|--------|-----|--------|----|----------|------------|--------|-----|-------|
| P_C[4:0]  | CMOS Input       | <p><b>Processor Configuration bit [4:0]:</b> – During the Reset Cycle, the P_C[4:0] pins provides the processor configuration. By using external weak pull-up or -down resistors, they define the External Management Bus Interface Configuration. These inputs are sampled at the trailing edge of the Reset cycle.</p> <p>C[0] – Defines the CPU Clock input is 1X or 2X clock<br/>C[1] – Selects either Big or Little Endian byte ordering<br/>C[2] – Defines the polarity of the P_RWC (Rd/Wr Control) input<br/>C[3] – Defines the CPU Bus width – For EA-208, it is default to 16-bit CPU Bus interface, and the setting of this bit is ignored.<br/>C[4] – Defines the timing relationship between P_RDY and P_D[15:0] valid. If C[4] is High, the P_D[15:0] are valid along in the same clock period as P_RDY is asserted. If C[4] is Low, the P_RDY is asserted one clock period <u>early</u> ahead of the P_D[15:0] are valid.</p> <table><tr><td></td><td>C[0]</td><td>C[1]</td><td>C[2]</td><td>C[3]</td><td>C[4]</td></tr><tr><td></td><td>CPU Clock</td><td>Byte Order</td><td>RWC</td><td>Bus Size</td><td>RDY Timing</td></tr><tr><td>Lo</td><td>1X Clock</td><td>Little Endian</td><td>P_R/W#</td><td>n/a</td><td>Normal</td></tr><tr><td>Hi</td><td>2x Clock</td><td>Big Endian</td><td>P_W/R#</td><td>n/a</td><td>Early</td></tr></table> <p>After RESET, these pins are used as <i>XpressFlow</i> Bus Data bit [31:27].</p> |        | C[0]     | C[1]       | C[2] | C[3] | C[4] |  | CPU Clock | Byte Order | RWC | Bus Size | RDY Timing | Lo | 1X Clock | Little Endian | P_R/W# | n/a | Normal | Hi | 2x Clock | Big Endian | P_W/R# | n/a | Early |
|           | C[0]             | C[1]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | C[2]   | C[3]     | C[4]       |      |      |      |  |           |            |     |          |            |    |          |               |        |     |        |    |          |            |        |     |       |
|           | CPU Clock        | Byte Order                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | RWC    | Bus Size | RDY Timing |      |      |      |  |           |            |     |          |            |    |          |               |        |     |        |    |          |            |        |     |       |
| Lo        | 1X Clock         | Little Endian                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | P_R/W# | n/a      | Normal     |      |      |      |  |           |            |     |          |            |    |          |               |        |     |        |    |          |            |        |     |       |
| Hi        | 2x Clock         | Big Endian                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | P_W/R# | n/a      | Early      |      |      |      |  |           |            |     |          |            |    |          |               |        |     |        |    |          |            |        |     |       |
| P_A[11:1] | TTL In (5VT)     | <b>Address Bus Bit [11:1]</b> – I/O port address                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |        |          |            |      |      |      |  |           |            |     |          |            |    |          |               |        |     |        |    |          |            |        |     |       |
| P_D[15:0] | TTL I/O-TS (5VT) | <b>Data Bus Bit [15:0]</b> – a 16-bit synchronous data bus.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |        |          |            |      |      |      |  |           |            |     |          |            |    |          |               |        |     |        |    |          |            |        |     |       |
| P_ADS#    | TTL In (5VT)     | <b>Address Strobe</b> – indicates valid address is on the bus                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |        |          |            |      |      |      |  |           |            |     |          |            |    |          |               |        |     |        |    |          |            |        |     |       |
| P_RWC     | TTL Input (5VT)  | <p><b>Read/Write Control</b> – indicates the current bus cycle is a read or write cycle. C[1] defines the polarity of this signal during the Reset cycle.</p> <p>C[1]=Low P_R/W# is used for PowerPC or other similar processors.<br/>C[1]=High P_W/R# is used for 386, 486 or other similar processors</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |        |          |            |      |      |      |  |           |            |     |          |            |    |          |               |        |     |        |    |          |            |        |     |       |
| P_RDY#    | TTL Out-OD       | <b>Data Ready</b> – timing indicates for bus data valid                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |        |          |            |      |      |      |  |           |            |     |          |            |    |          |               |        |     |        |    |          |            |        |     |       |
| P_BS16#   | TTL Out-OD       | <b>Bus Size 16</b> – response to bus master that the EA208 only supports 16-bit data bus width.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |        |          |            |      |      |      |  |           |            |     |          |            |    |          |               |        |     |        |    |          |            |        |     |       |
| P_CS#     | TTL Input (5VT)  | <b>Chip Select</b> – indicates the <i>XpressFlow</i> Engine is the target for the current bus operation.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |        |          |            |      |      |      |  |           |            |     |          |            |    |          |               |        |     |        |    |          |            |        |     |       |
| P_INT ①   | CMOS Output      | <b>Interrupt Request</b> to Switch Manager CPU <i>The polarity of this signal output is programmable via chip configuration register.</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |        |          |            |      |      |      |  |           |            |     |          |            |    |          |               |        |     |        |    |          |            |        |     |       |
| P_RST#    | TTL In-ST (5VT)  | <b>CPU Reset</b> – Synchronous reset Input from Switch Manager CPU                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |        |          |            |      |      |      |  |           |            |     |          |            |    |          |               |        |     |        |    |          |            |        |     |       |
| P_CLK     | TTL In (5VT)     | <b>CPU Clock</b> – 2X Clock for 386 family, and 1X Clock for the others                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |        |          |            |      |      |      |  |           |            |     |          |            |    |          |               |        |     |        |    |          |            |        |     |       |

**2.2.2 Motorola MPC801 Processor Interface**

Note: Mnemonics with in {} are the equivalent signals defined by MPC801

**Typical Motorola MPC801 CPU I/O Access Operations****2.2.3 Intel 486 Processor Interface****Typical 486 CPU I/O Access Operations**

**2.2.4 Intel 386 Processor Interface****Typical 386 CPU I/O Access Operations****Internal PH2 Clock Synchronization \*\*****Note:** \*\* See Intel 386 Processor Data Book for more details

**2.2.5 Register Map**

Note: All 32-bit registers are D-word aligned.

All 16-bit registers are also D-word aligned and right justified.

For the Little Endian CPUs, register offset bit [1,0] are always set to be 00.

For the Big Endian CPUs, register offset bit [1,0] are always set to be 10.

- ① This is a Global Register. CPU is allowed to write the Global Register of all devices by a single operation.
- ② These registers are reserved for system diagnostic usage only.

| Register                             | Description                                    | I/O Offset    |            | Reg. Size | W/R  | Note: |
|--------------------------------------|------------------------------------------------|---------------|------------|-----------|------|-------|
|                                      |                                                | Little Endian | Big Endian |           |      |       |
| Device Configuration Registers (DCR) |                                                |               |            |           |      |       |
| GCR                                  | Global Control Register                        | hF00          | hF02       | 16-bit    | W/-- | ①     |
| DCR0                                 | Device Status Register                         | hF00          | hF02       | 16-bit    | --/R |       |
| DCR1                                 | Signature & Revision Register                  | hF10          | hF12       | 16-bit    | --/R |       |
| DCR2                                 | ID Register                                    | hF20          | hF22       | 16-bit    | W/R  |       |
| DCR3                                 | Device Configuration Register                  | hF30          | hF32       | 16-bit    | W/R  |       |
| DCR4                                 | Interfaces Status Register                     | hF40          | hF42       | 16-bit    | --/R |       |
| DTSR                                 | Test Register                                  | hF70          | hF72       | 16-bit    | W/R  |       |
| Interrupt Controls                   |                                                |               |            |           |      |       |
| ISR                                  | Interrupt Status Register – Unmasked           | hF80          | hF82       | 16-bit    | --/R |       |
| ISRM                                 | Interrupt Status Register – Masked             | hF90          | hF92       | 16-bit    | --/R |       |
| IMSK                                 | Interrupt Mask Register                        | hFA0          | hFA2       | 16-bit    | W/R  |       |
| IAR                                  | Interrupt Acknowledgment Register              | hFB0          | hFB2       | 16-bit    | W/-- |       |
| Buffer Memory Interface              |                                                |               |            |           |      |       |
| MWAR                                 | Memory Write Address Reg. – Single Cycle       | hE08          | hE08       | 32-bit    | W/R  |       |
| MRAR                                 | Memory Read Address Reg. – Single Cycle        | hE18          | hE18       | 32-bit    | W/R  |       |
| MBAR                                 | Memory Address Register – Burst Mode           | hE28          | hE28       | 32-bit    | W/R  |       |
| MWBS                                 | Memory Write Burst Size (in D-words)           | hE40          | hE42       | 16-bit    | W/R  |       |
| MRBS                                 | Memory Read Burst Size (in D-words)            | hE50          | hE52       | 16-bit    | W/R  |       |
| MWDR                                 | Memory Write Data Register                     | hE68          | hE68       | 32-bit    | W/-- |       |
| MWDX                                 | Memory Write Data Reg. – Byte Swapping         | hE6C          | hE6C       | 32-bit    | W/-- |       |
| MRDR                                 | Memory Read Data Register                      | hE68          | hE68       | 32-bit    | --/R |       |
| MRDX                                 | Memory Read Data Reg. – Byte Swapping          | hE6C          | hE6C       | 32-bit    | --/R |       |
| FCB Buffer & Stack Management        |                                                |               |            |           |      |       |
| FCBBA                                | Frame Control Buffer – Base Address            | hD00          | hD02       | 16-bit    | W/R  |       |
| FCBAG                                | Frame Control Buffer – Buffer Aging Status     | hD30          | hD32       | 16-bit    | --/R | ②     |
| FCBSL                                | Frame Ctrl Buffer Stack – Size Limit           | hD90          | hD92       | 16-bit    | W/R  |       |
| FCBST                                | Frame Ctrl Buffer Stack – Buffer Low Threshold | hDA0          | hDA2       | 16-bit    | W/R  |       |
| FCBSS                                | Frame Ctrl Buffer Stack – Allocation Status    | hDB0          | hDB2       | 16-bit    | --/R | ②     |

**XpressFlow-2020 Series –  
Ethernet Switch Chipset**
**EA218E  
8-Port 10Mb Ethernet Access Controller**

| Register                                                                             | Description                                               | I/O Offset    |            | Reg. Size | W/R  | Note: |
|--------------------------------------------------------------------------------------|-----------------------------------------------------------|---------------|------------|-----------|------|-------|
|                                                                                      |                                                           | Little Endian | Big Endian |           |      |       |
| Access Control Function (Chip Level controls)                                        |                                                           |               |            |           |      |       |
| AVXR                                                                                 | VLAN Control Table (VCT) Index Register                   | hC00          | hC02       | 16-bit    | W/-- |       |
| AVDR                                                                                 | VCT Data Register                                         | hC10          | hC12       | 16-bit    | W/R  |       |
| AVTC                                                                                 | VLAN Type Code                                            | hC20          | hC22       | 16-bit    | W/R  |       |
| AXSC                                                                                 | Transmission Scheduling Control Register                  | hC30          | hC32       | 16-bit    | W/R  |       |
| AMIIC                                                                                | MII Command Register                                      | hC40          | hC40       | 32-bit    | W/-- |       |
| AMIIS                                                                                | MII Status Register                                       | hC40          | hC40       | 32-bit    | --/R |       |
| AFCR                                                                                 | Flow Control Register                                     | hC70          | hC72       | 16-bit    | W/R  |       |
| AMAR0                                                                                | Multicast Address. for MAC Control Frames      Byte [1,0] | hC80          | hC82       | 16-bit    | W/R  |       |
| AMAR1                                                                                | Byte [3,2]                                                | hC90          | hC92       | 16-bit    | W/R  |       |
| AMAR2                                                                                | Byte [5,4]                                                | hCA0          | hCA2       | 16-bit    | W/R  |       |
| AMCT                                                                                 | MAC Control FrameType Code Register                       | hCB0          | hCB2       | 16-bit    | W/R  |       |
| ADAR0                                                                                | Base MAC Address Register – Byte [1,0]                    | hCC0          | hCC2       | 16-bit    | W/R  |       |
| ADAR1                                                                                | Base MAC Address Register – Byte [3,2]                    | hCD0          | hCD2       | 16-bit    | W/R  |       |
| ADAR2                                                                                | Base MAC Address Register – Byte [5,4]                    | hCE0          | hCE2       | 16-bit    | W/R  |       |
| Ethernet MAC Port Control Registers – (substitute [n] with Port Number, n = {0..3} ) |                                                           |               |            |           |      |       |
| ECR0                                                                                 | MAC Port Control Register                                 | hn00          | hn02       | 16-bit    | W/R  |       |
| ECR1                                                                                 | MAC Port Configuration Register                           | hn10          | hn12       | 16-bit    | W/R  |       |
| ECR2                                                                                 | MAC Port Interrupt Mask Register                          | hn20          | hn22       | 16-bit    | W/R  |       |
| ECR3                                                                                 | MAC Port Interrupt Status Register                        | hn30          | hn32       | 16-bit    | --/R |       |
| EXSR                                                                                 | MAC Tx Status Register                                    | hn40          | hn42       | 16-bit    | --/R | ②     |
| EXEC                                                                                 | MAC Tx Error Counters                                     | hn50          | hn52       | 16-bit    | --/R | ②     |
| ERSR                                                                                 | MAC Rx Status Register                                    | hn68          | hn68       | 32-bit    | --/R | ②     |
| EREC                                                                                 | MAC Rx Error Counters                                     | hn78          | hn78       | 32-bit    | --/R | ②     |

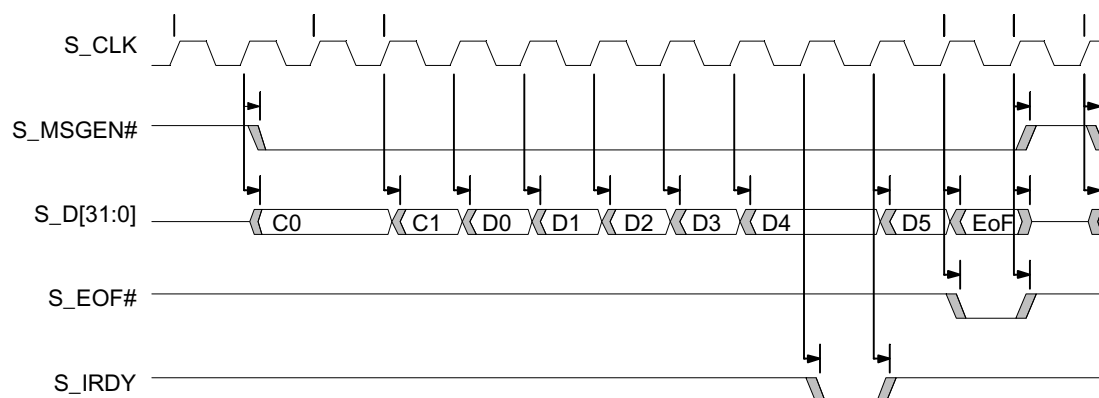
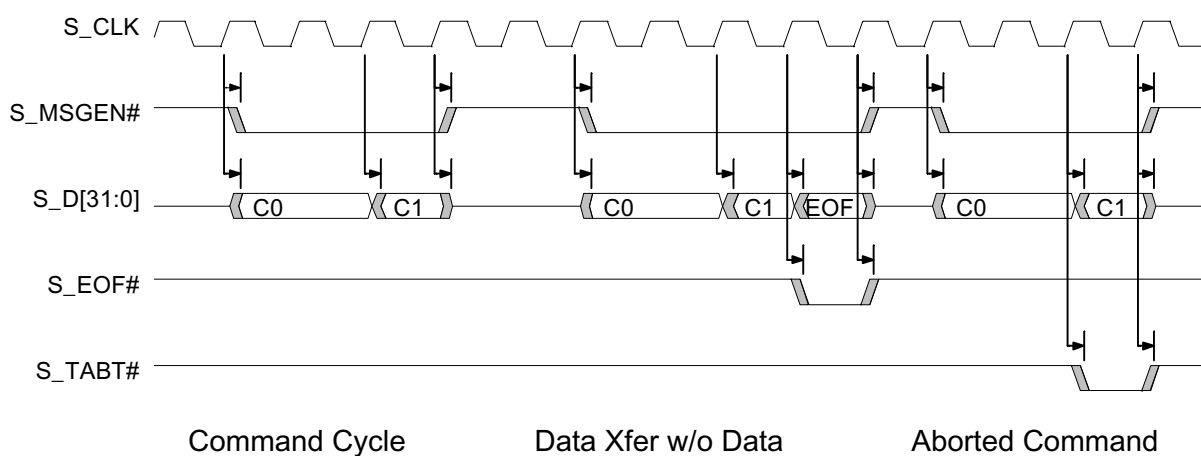
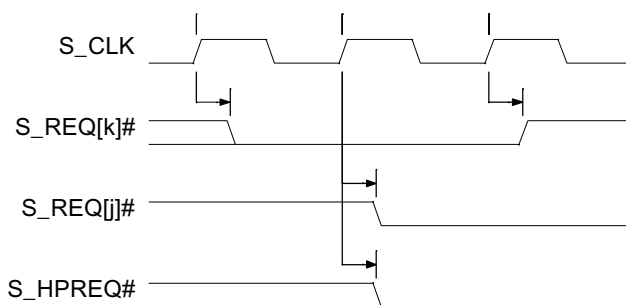
## 2.3 XpressFlow Bus Operation

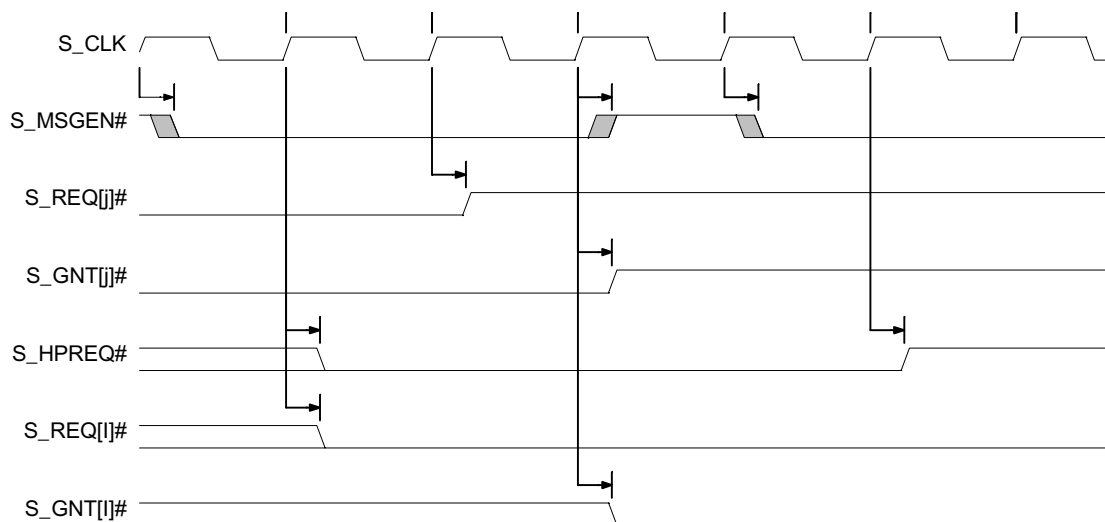
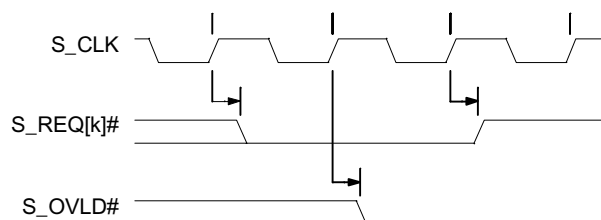
- ◆ Zarlink's optimized XpressFlow Bus architecture
- ◆ Provides 1.6G bps switching bandwidth
  - ◇ -33            1.07G bps
  - ◇ -40            1.28G bps
  - ◇ -50            1.6G bps
- ◆ Full multi bus master structure
- ◆ Allows XpressFlow Engine to communicate with Access Controllers via a message passing protocol
  - ◇ Command Messages for passing control information between devices
  - ◇ Data Messages for forwarding an Ethernet frame from receiving port to transmission port
  - ◆ Built-in intelligent bus load regulator for data traffic balancing
  - ◆ Provides centralized bus arbitration with two level request priorities
    - ◇ High priority for Data Messages
    - ◇ Low priority for Command Messages

### 2.3.1 Pin Description

| Symbol    | Type            | Name and Functions                                                                                                                                                                                                                     |
|-----------|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| S_D[31:0] | CMOS<br>I/O-TS  | <b>Data Bus Bit [31:0]</b> – a 32-bit synchronous data bus.<br><b>Note:</b> During the system RESET period, Data Bit [31:28] are used as Processor Interface Configuration bit [0:3]                                                   |
| S_MSGEN#  | CMOS<br>I/O-TS  | <b>Message Envelope</b> – encompasses the entire period of a message transfer. Targets use the leading edge of this signal to detect the beginning of a message transfer, and to decode the message header for the intended target(s). |
| S_EOF#    | CMOS<br>I/O-TS  | <b>End of Frame</b> – only used by frame data transfer messages to identify the end of frame condition. This signal is synchronous with the Rx Frame Status word appended to the end of the message.                                   |
| S_IRDY    | CMOS<br>I/O-TS  | <b>Initiator Ready</b> – a normal true signal. When negated, it indicates the initiator had asserted wait state(s) in between command words. Target should use this signal as enable signal for latching the data from the bus.        |
| S_TABT#   | CMOS<br>I/O-OD  | <b>Target Abort</b> – when asserted, the target had aborted the reception of current message on the bus.                                                                                                                               |
| S_HPREQ#  | CMOS<br>I/O-OD  | <b>High Priority Request</b> – indicates one or more Bus Requester is requesting for high priority message transfer.                                                                                                                   |
| S_REQ#    | CMOS<br>Output  | <b>Bus Request</b> – Bus Request signals from Access Controller to Bus Access Arbitrator in XpressFlow Engine                                                                                                                          |
| S_GNT#    | CMOS In-<br>put | <b>Bus Grant</b> – Bus Grant signals from Bus Arbitrator to Bus Requester                                                                                                                                                              |
| S_OVLD#   | CMOS<br>Output  | <b>Bus Overload</b> – when asserted, all data forwarding bus bandwidth has been allocated. Cannot support additional load for data forwarding traffic.                                                                                 |
| S_CLK     | CMOS<br>Input   | <b>XpressFlow Bus Clock</b> – 33MHz system clock                                                                                                                                                                                       |



**2.3.2 Bus Cycle Waveforms*****XpressFlow Bus Data Transfer Cycle******Other XpressFlow Bus Cycles******High Priority Request pre-empts the low priority request.***

***XpressFlow Bus arbitration******Bus Overload pre-empts the data transfer request***

**2.4 10Mb Serial Interface for Port 0 through 7**

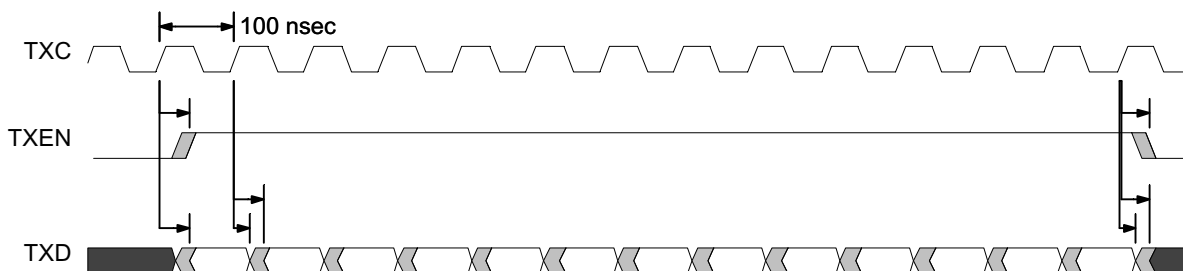
- ◆ Fully compliant with IEEE 802.3 10M bit Serial Interface Standard for connecting with external 10Mbps Ethernet Physical Layer Transceiver
- ◆ Supports 10Mbps 10BaseT serial interface
- ◆ Supports both half and full duplex operation

**2.4.1 Pin Description**

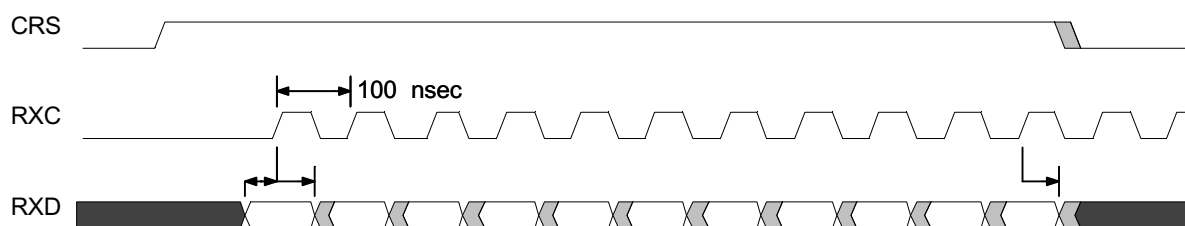
| Symbol    | Type         | Name and Functions                                                                                                                                 |
|-----------|--------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| Tn_RXD    | TTL In (5VT) | <b>Receive Data</b> – (one for each 10M bit Serial Interface Port) a receive data stream.                                                          |
| Tn_RXC    | TTL In (5VT) | <b>Receive Clock</b> – (one for each 10M bit Serial Interface Port) from external phy for sampling the receive data from Tn_RXD input              |
| Tn_TXC    | TTL In (5VT) | <b>Transmit Clock</b> – (one for each 10M bit Serial Interface Port) a continuous clock input with 35% to 65% duty cycles.                         |
| Tn_TXEN   | CMOS Output  | <b>Transmit Enable</b> – (one for each 10M bit Serial Interface Port)                                                                              |
| Tn_TXD    | CMOS Output  | <b>Transmit Data</b> – (one for each 10M bit Serial Interface Port) a transmit data stream.                                                        |
| Tn_LPBK ① | CMOS Output  | <b>Loop Back Enable</b> – (one for each 10M bit Serial Interface Port) The polarity of this signal is programmable via Port Configuration Register |
| Tn_FD ①   | CMOS Output  | <b>Full Duplex Mode</b> – (one for each 10M bit Serial Interface Port) The polarity of this signal is programmable via Port Configuration Register |
| Tn_COL    | TTL In (5VT) | <b>Collision Detected</b> – (one for each 10M bit Serial Interface Port)                                                                           |
| Tn_CRS    | TTL In (5VT) | <b>Carrier Sense</b> – (one for each 10M bit Serial Interface Port)                                                                                |
| Tn_LNK ①  | TTL In (5VT) | <b>Link Status</b> – (one for each 10M bit Serial Interface Port) The polarity of this signal is programmable via Port Configuration Register      |

**Note:** “n” is the port number [7:0]

① These signals have programmable output polarity.



**10M bit Serial Interface – Transmit Timing**



**10M bit Serial Interface – Receive Timing**

## 2.5 Test Pins

| Symbol | Type           | Name and Functions                                                                                                        |
|--------|----------------|---------------------------------------------------------------------------------------------------------------------------|
| T_MODE | CMOS<br>I/O-TS | <b>Test Mode Selection &amp; Test Output</b> – Set Test Mode upon Reset, and provides test status output during test mode |

### 3. DC SPECIFICATION

#### 3.1 ABSOLUTE MAXIMUM RATINGS

|                                                  |                               |
|--------------------------------------------------|-------------------------------|
| Storage Temperature                              | -50°C to +125°C               |
| Operating Temperature                            | 0°C to +70°C                  |
| Supply Voltage $V_{DD}$ with Respect to $V_{SS}$ | +3.0 V to +3.6 V              |
| Voltage on 5V Tolerant Input Pins                | -0.5 V to ( $V_{DD} + 1.8$ V) |
| Voltage on Other Input Pins                      | -0.5 V to ( $V_{DD} + 10\%$ ) |

Stresses above those listed may cause permanent device failure. Functionality at or above these limits is not implied. Exposure to Absolute Maximum Ratings for extended periods may affect device reliability.

#### 3.2 DC CHARACTERISTICS

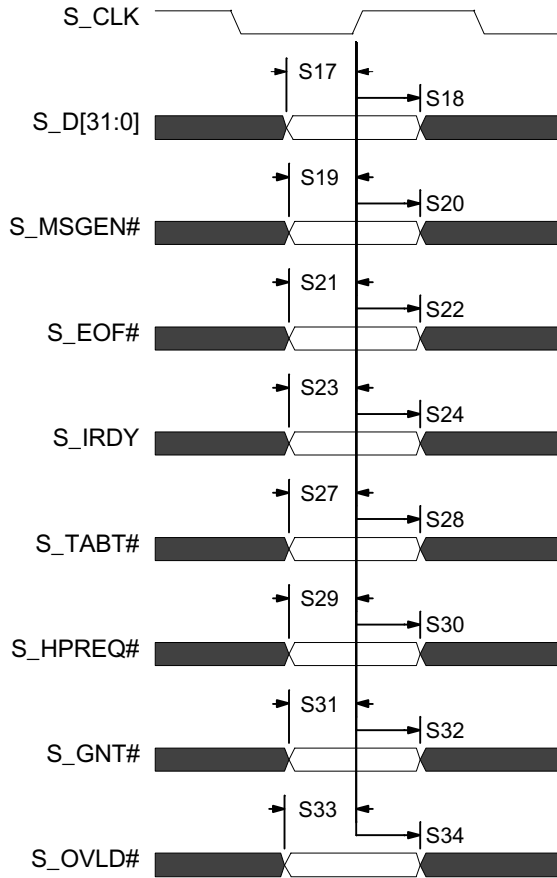
$V_{DD} = +3.0$  V to +3.6 V     $T_{AMBIENT} = 0^{\circ}\text{C}$  to +70°C

| Symbol        | Parameter Description                                                                                                                  | Preliminary          |      |                      | Unit          |
|---------------|----------------------------------------------------------------------------------------------------------------------------------------|----------------------|------|----------------------|---------------|
|               |                                                                                                                                        | Min                  | Type | Max                  |               |
| $f_{osc}$     | Frequency of Operation (-40)                                                                                                           | 20                   |      | 40.0000              | MHz           |
|               | Frequency of Operation (-50)                                                                                                           | 20                   |      | 50.0000              | MHz           |
|               | Frequency of Operation (-66)                                                                                                           | 20                   |      | 66.6667              | MHz           |
| $I_{DD}$      | Supply Power – @ 40 MHz ( $V_{DD} = 3.3$ V)                                                                                            |                      | 300  | 500                  | mA            |
|               | Supply Power – @ 50 MHz ( $V_{DD} = 3.3$ V)                                                                                            |                      | 300  | 500                  | mA            |
|               | Supply Power – @ 66.67 MHz ( $V_{DD} = 3.3$ V)                                                                                         |                      | 360  | 600                  | mA            |
| $V_{OH-CMOS}$ | Output High Voltage (CMOS) $I_{OH} = \text{maximum}$                                                                                   | $V_{DD} - 0.5$       |      |                      | V             |
| $V_{OL-CMOS}$ | Output Low Voltage (CMOS) $I_{OL} = \text{maximum}$                                                                                    |                      |      | 0.45                 | V             |
| $V_{OH-TTL}$  | Output High Voltage (TTL) $I_{OH} = \text{maximum}$                                                                                    | 2.4                  |      |                      | V             |
| $V_{OL-TTL}$  | Output Low Voltage (TTL) $I_{OL} = \text{maximum}$                                                                                     |                      |      | 0.45                 | V             |
| $V_{IH-CMOS}$ | Input High Voltage (CMOS)                                                                                                              | $V_{DD} \times 70\%$ |      | $V_{DD} + 10\%$      | V             |
| $V_{IL-CMOS}$ | Input Low Voltage (CMOS)                                                                                                               | -0.5                 |      | $V_{DD} \times 30\%$ | V             |
| $V_{IH-TTL}$  | Input High Voltage (TTL)                                                                                                               | 2.0                  |      | $V_{DD} + 10\%$      | V             |
| $V_{IL-TTL}$  | Input Low Voltage (TTL)                                                                                                                | -0.3                 |      | +0.8                 | V             |
| $V_{IH-5VT}$  | Input High Voltage (TTL 5V tolerant)                                                                                                   | 2.0                  |      | $V_{DD} + 1.8$       | V             |
| $V_{IL-5VT}$  | Input Low Voltage (TTL 5V tolerant)                                                                                                    | -0.3                 |      | +0.8                 | V             |
| $I_{LI}$      | Input Leakage Current ( $0.1 \text{ V} \leq V_{IN} \leq V_{DD}$ )<br>(all pins except those with internal pull-up/pull-down resistors) |                      |      | $\pm 10$             | $\mu\text{A}$ |
| $I_{LO}$      | Output Leakage Current ( $0.1 \text{ V} \leq V_{OUT} \leq V_{DD}$ )                                                                    |                      |      | $\pm 15$             | $\mu\text{A}$ |
| $I_{IH}$      | Input Leakage Current $V_{IH} = V_{DD} - 0.1 \text{ V}$<br>(pins with internal pull-down resistors)                                    |                      |      | 60                   | $\mu\text{A}$ |
| $I_{IL}$      | Input Leakage Current $V_{IL} = 0.1 \text{ V}$<br>(pins with internal pull-up resistors)                                               |                      |      | -60                  | $\mu\text{A}$ |
| $C_{IN}$      | Input Capacitance                                                                                                                      |                      | 8    |                      | pF            |
| $C_{OUT}$     | Output Capacitance                                                                                                                     |                      | 8    |                      | pF            |
| $C_{I/O}$     | I/O Capacitance                                                                                                                        |                      | 10   |                      | pF            |

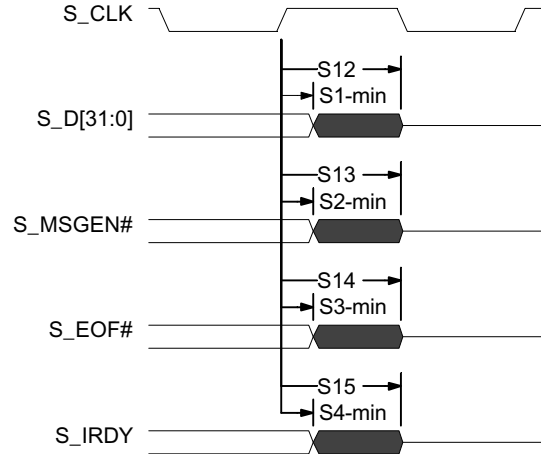
**Notes:**

## 4. AC SPECIFICATION

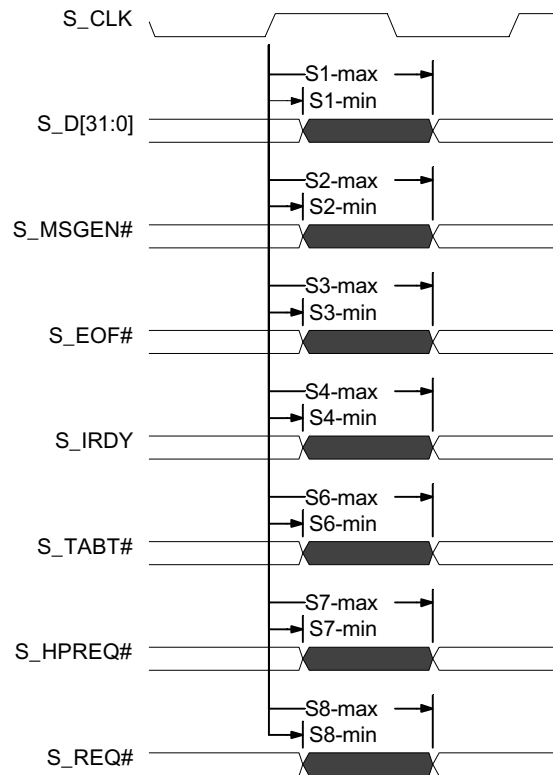
### 4.1 XpressFlow Bus Interface:



**XpressFlow Bus Interface –  
Input setup and hold timing**



**XpressFlow Bus Interface –  
Output float delay timing**



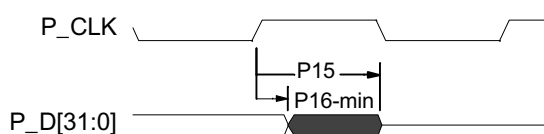
**XpressFlow Bus Interface –  
Output valid delay timing**

**XpressFlow-2020 Series –  
Ethernet Switch Chipset****EA218E  
8-Port 10Mb Ethernet Access Controller**

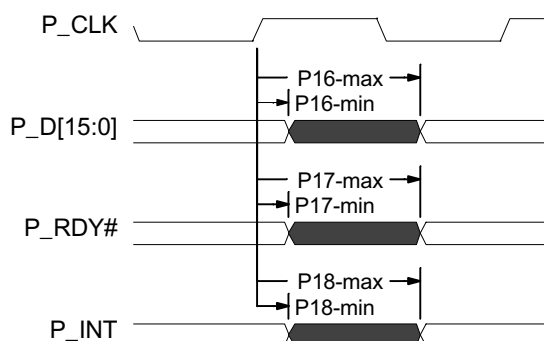
| Symbol | Parameter                    | -40         |             | -50         |             | -66         |             | Note:                 |
|--------|------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-----------------------|
|        |                              | Min<br>(ns) | Max<br>(ns) | Min<br>(ns) | Max<br>(ns) | Min<br>(ns) | Max<br>(ns) |                       |
| S1     | S_D[31:0] output valid delay | 6           | 14          | 5           | 11          | 4           | 8.5         | C <sub>L</sub> = 50pf |
| S2     | S_MSGEN# output valid delay  | 6           | 14          | 5           | 11          | 4           | 8.5         | C <sub>L</sub> = 50pf |
| S3     | S_EOF# output valid delay    | 6           | 14          | 5           | 11          | 4           | 8.5         | C <sub>L</sub> = 50pf |
| S4     | S_IRDY output valid delay    | 6           | 14          | 5           | 11          | 4           | 8.5         | C <sub>L</sub> = 50pf |
| S6     | S_TABT# output valid delay   | 6           | 14          | 5           | 11          | 4           | 8.5         | C <sub>L</sub> = 50pf |
| S7     | S_HPREQ# output valid delay  | 6           | 14          | 5           | 11          | 4           | 8.5         | C <sub>L</sub> = 50pf |
| S8     | S_REQ# output valid delay    | 6           | 14          | 5           | 11          | 4           | 8.5         | C <sub>L</sub> = 20pf |
| S12    | S_D[31:0] output float delay |             | 18          |             | 15          |             | 12          |                       |
| S13    | S_MSGEN# output float delay  |             | 18          |             | 15          |             | 12          |                       |
| S14    | S_EOF# output float delay    |             | 18          |             | 15          |             | 12          |                       |
| S15    | S_IRDY output float delay    |             | 18          |             | 15          |             | 12          |                       |
| S17    | S_D[31:0] input set-up time  | 2           |             | 1.5         |             | 1           |             |                       |
| S18    | S_D[31:0] input hold time    | 5.5         |             | 4.5         |             | 3.5         |             |                       |
| S19    | S_MSGEN# input set-up time   | 2           |             | 1.5         |             | 1           |             |                       |
| S20    | S_MSGEN# input hold time     | 5.5         |             | 4.5         |             | 3.5         |             |                       |
| S21    | S_EOF# input set-up time     | 2           |             | 1.5         |             | 1           |             |                       |
| S22    | S_EOF# input hold time       | 5.5         |             | 4.5         |             | 3.5         |             |                       |
| S23    | S_IRDY input set-up time     | 2           |             | 1.5         |             | 1           |             |                       |
| S24    | S_IRDY input hold time       | 5.5         |             | 4.5         |             | 3.5         |             |                       |
| S27    | S_TABT# input set-up time    | 13          |             | 10          |             | 8           |             |                       |
| S28    | S_TABT# input hold time      | 5.5         |             | 4.5         |             | 3.5         |             |                       |
| S29    | S_HPREQ# input set-up time   | 2           |             | 1.5         |             | 1           |             |                       |
| S30    | S_HPREQ# input hold time     | 5.5         |             | 4.5         |             | 3.5         |             |                       |
| S31    | S_GNT# input set-up time     | 13          |             | 10          |             | 8           |             |                       |
| S32    | S_GNT# input hold time       | 5.5         |             | 4.5         |             | 3.5         |             |                       |
| S33    | S_OVLD# input set-up time    | 15          |             | 12          |             | 9           |             |                       |
| S34    | S_OVLD# input hold time      | 5.5         |             | 4.5         |             | 3.5         |             |                       |

**AC Characteristics – XpressFlow Bus Interface**

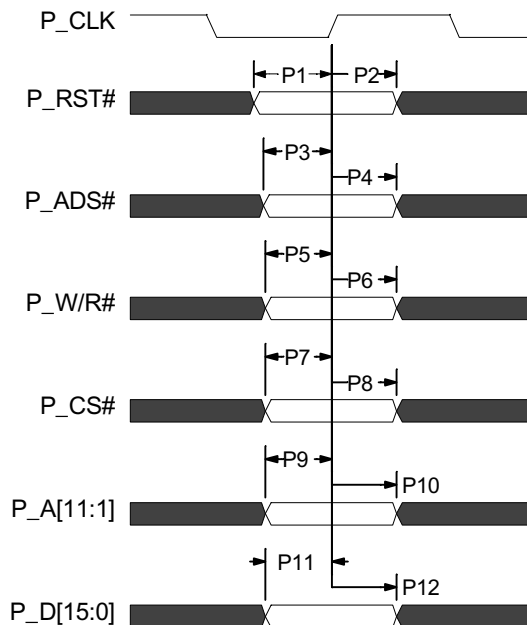
## 4.2 CPU Bus Interface:



**CPU Bus Interface –  
Output float delay timing**



**CPU Bus Interface –  
Output valid delay timing**

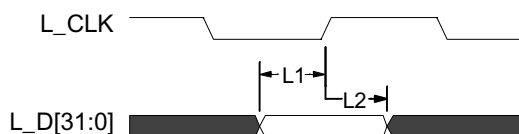
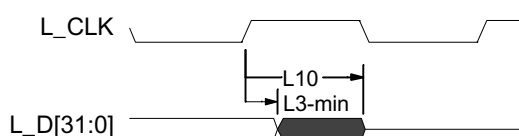
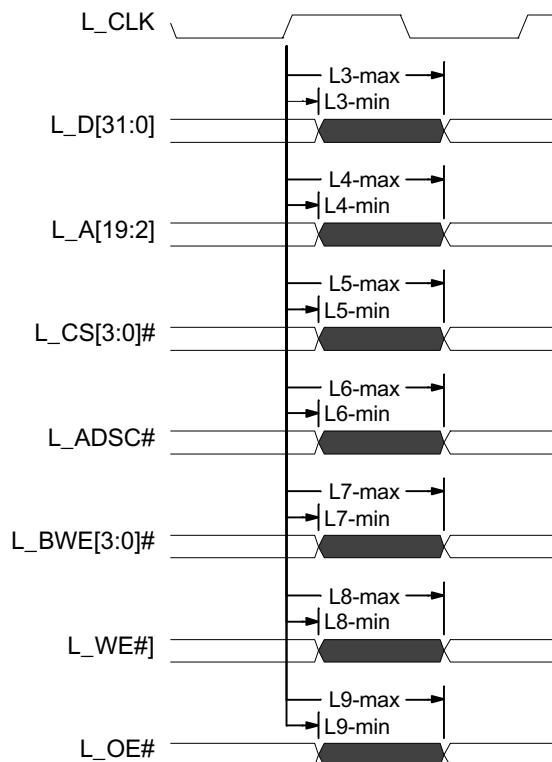


**CPU Bus Interface –  
Input setup and hold timing**

| Symbol | Parameter                       | -40      |          | -50      |          | -66      |          | Note:                 |
|--------|---------------------------------|----------|----------|----------|----------|----------|----------|-----------------------|
|        |                                 | Min (ns) | Max (ns) | Min (ns) | Max (ns) | Min (ns) | Max (ns) |                       |
| P1     | P_RST# input setup time         | 13       |          | 10       |          | 8        |          |                       |
| P2     | P_RST# input hold time          | 3.5      |          | 2.5      |          | 2        |          |                       |
| P3     | P_ADS# input set-up time        | 13       |          | 10       |          | 8        |          |                       |
| P4     | P_ADS# input hold time          | 3.5      |          | 2.5      |          | 2        |          |                       |
| P5     | P_W/R# input set-up time        | 13       |          | 10       |          | 8        |          |                       |
| P6     | P_W/R# input hold time          | 3.5      |          | 2.5      |          | 2        |          |                       |
| P7     | P_CS# input set-up time         | 13       |          | 10       |          | 8        |          |                       |
| P8     | P_CS# input hold time           | 3.5      |          | 2.5      |          | 2        |          |                       |
| P9     | P_A[11:1] input set-up time     | 13       |          | 10       |          | 8        |          |                       |
| P10    | P_A[11:1] input hold time       | 3.5      |          | 2.5      |          | 2        |          |                       |
| P11    | P_D[31:0]# input set-up time    | 13       |          | 10       |          | 8        |          |                       |
| P12    | P_D[31:0]# input hold time      | 3.5      |          | 2.5      |          | 2        |          |                       |
| P15    | P_D[31:0]# output float delay   |          | 17       |          | 13       |          | 10       |                       |
| P16    | P_D[31:0]# # output valid delay |          | 8.5      |          | 6.5      |          | 5        | C <sub>L</sub> = 60pf |
| P17    | P_RDY# output valid delay       |          | 8.5      |          | 6.5      |          | 5        | C <sub>L</sub> = 60pf |
| P18    | P_INT# output valid delay       |          | 17       |          | 13       |          | 10       | C <sub>L</sub> = 20pf |

**AC Characteristics -- CPU Bus Interface**

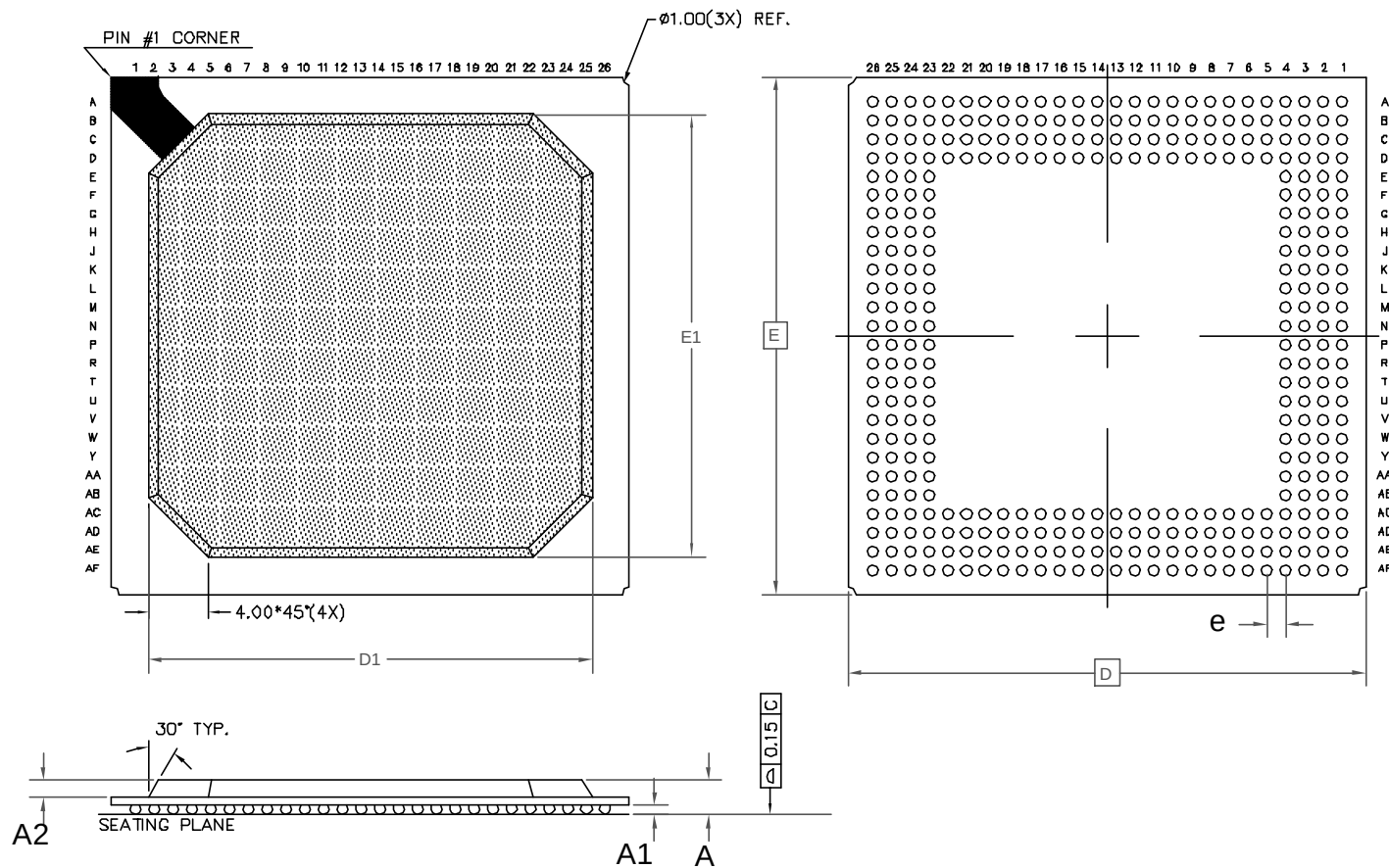


**4.3 Local Memory Interface:****Local Memory Interface –  
Input setup and hold timing****Local Memory Interface –  
Output float delay timing****Local Memory Interface –  
Output valid delay timing**

| Symbol | Parameter                      | -40      |          | -50      |          | -66      |          | Note:                 |
|--------|--------------------------------|----------|----------|----------|----------|----------|----------|-----------------------|
|        |                                | Min (ns) | Max (ns) | Min (ns) | Max (ns) | Min (ns) | Max (ns) |                       |
| L1     | L_D[31:0]# input set-up time   | 6.5      |          | 5.5      |          | 4        |          |                       |
| L2     | L_D[31:0]# input hold time     | 3        |          | 2.5      |          | 2        |          |                       |
| L3     | L_D[31:0]# output valid delay  |          | 17       |          | 13       |          | 10       | C <sub>L</sub> = 30pf |
| L4     | L_A[19:2] output valid delay   |          | 17       |          | 13       |          | 10       | C <sub>L</sub> = 30pf |
| L6     | L_ADSC# output valid delay     |          | 17       |          | 13       |          | 10       | C <sub>L</sub> = 30pf |
| L7     | L_BWE[3:0]# output valid delay |          | 17       |          | 13       |          | 10       | C <sub>L</sub> = 30pf |
| L8     | L_WE# output valid delay       |          | 17       |          | 13       |          | 10       | C <sub>L</sub> = 10pf |
| L9     | L_OE# output valid delay       |          | 17       |          | 13       |          | 10       | C <sub>L</sub> = 10pf |
| L10    | L_D[31:0]# output float delay  |          | 22       |          | 18       |          | 14       |                       |

**AC Characteristics – Local Memory Interface**





| DIMENSION                  | MIN       | MAX   |
|----------------------------|-----------|-------|
| A                          | 2.20      | 2.46  |
| A1                         | 0.50      | 0.70  |
| A2                         | 1.17 REF  |       |
| D                          | 34.80     | 35.20 |
| D1                         | 30.00 REF |       |
| E                          | 34.80     | 35.20 |
| E1                         | 30.00 REF |       |
| b                          | 0.60      | 0.90  |
| e                          | 1.27      |       |
| N                          | 352       |       |
| Conforms to JEDEC MS - 034 |           |       |

1. CONTROLLING DIMENSIONS ARE IN MM
2. DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER
3. SEATING PLANE IS DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.
4. N IS THE NUMBER OF SOLDER BALLS
5. NOT TO SCALE.
6. SUBSTRATE THICKNESS IS 0.56 MM

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| ISSUE  | 1       |  |  |  |
| ACN    | 213933  |  |  |  |
| DATE   | 20Jan03 |  |  |  |
| APPRD. |         |  |  |  |



Previous package codes:

BP / G

Package Code GA

Package Outline for 352 Ball PBGA (35x35x2.33mm)

GPD00819



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