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Understanding Embedded - Microprocessors

Embedded microprocessors are specialized computing chips designed to perform specific tasks within an embedded system. Unlike general-purpose microprocessors found in personal computers, embedded microprocessors are tailored for dedicated functions within larger systems, offering optimized performance, efficiency, and reliability. These microprocessors are integral to the operation of countless electronic devices, providing the computational power necessary for controlling processes, handling data, and managing communications.

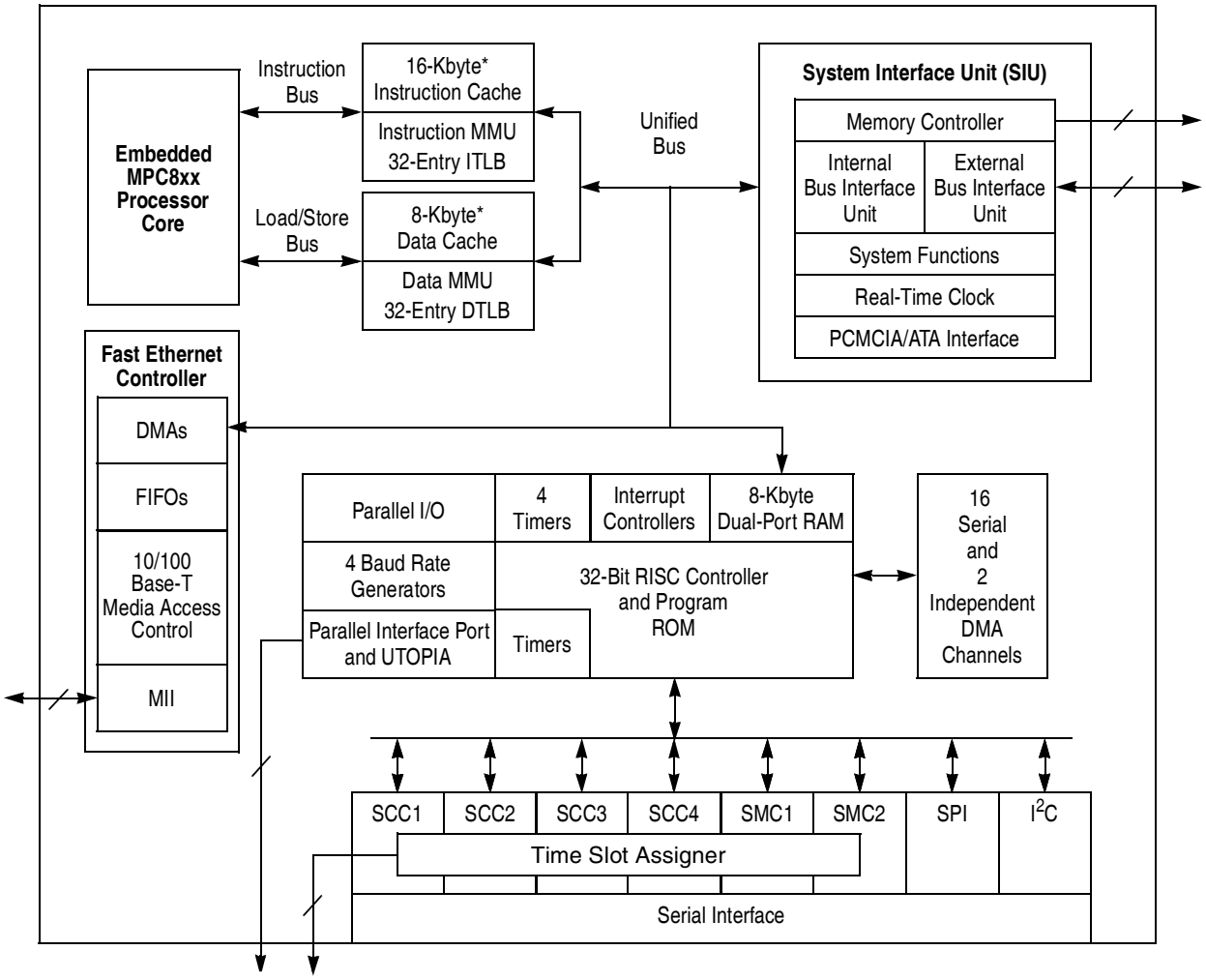
Applications of Embedded - Microprocessors

Embedded microprocessors are utilized across a broad spectrum of applications, making them indispensable in

Details	
Product Status	Obsolete
Core Processor	MPC8xx
Number of Cores/Bus Width	1 Core, 32-Bit
Speed	66MHz
Co-Processors/DSP	Communications; CPM
RAM Controllers	DRAM
Graphics Acceleration	No
Display & Interface Controllers	-
Ethernet	10Mbps (4), 10/100Mbps (1)
SATA	-
USB	-
Voltage - I/O	3.3V
Operating Temperature	-40°C ~ 115°C (TA)
Security Features	-
Package / Case	357-BBGA
Supplier Device Package	357-PBGA (25x25)
Purchase URL	https://www.e-xfl.com/product-detail/nxp-semiconductors/mpc862tczq66b

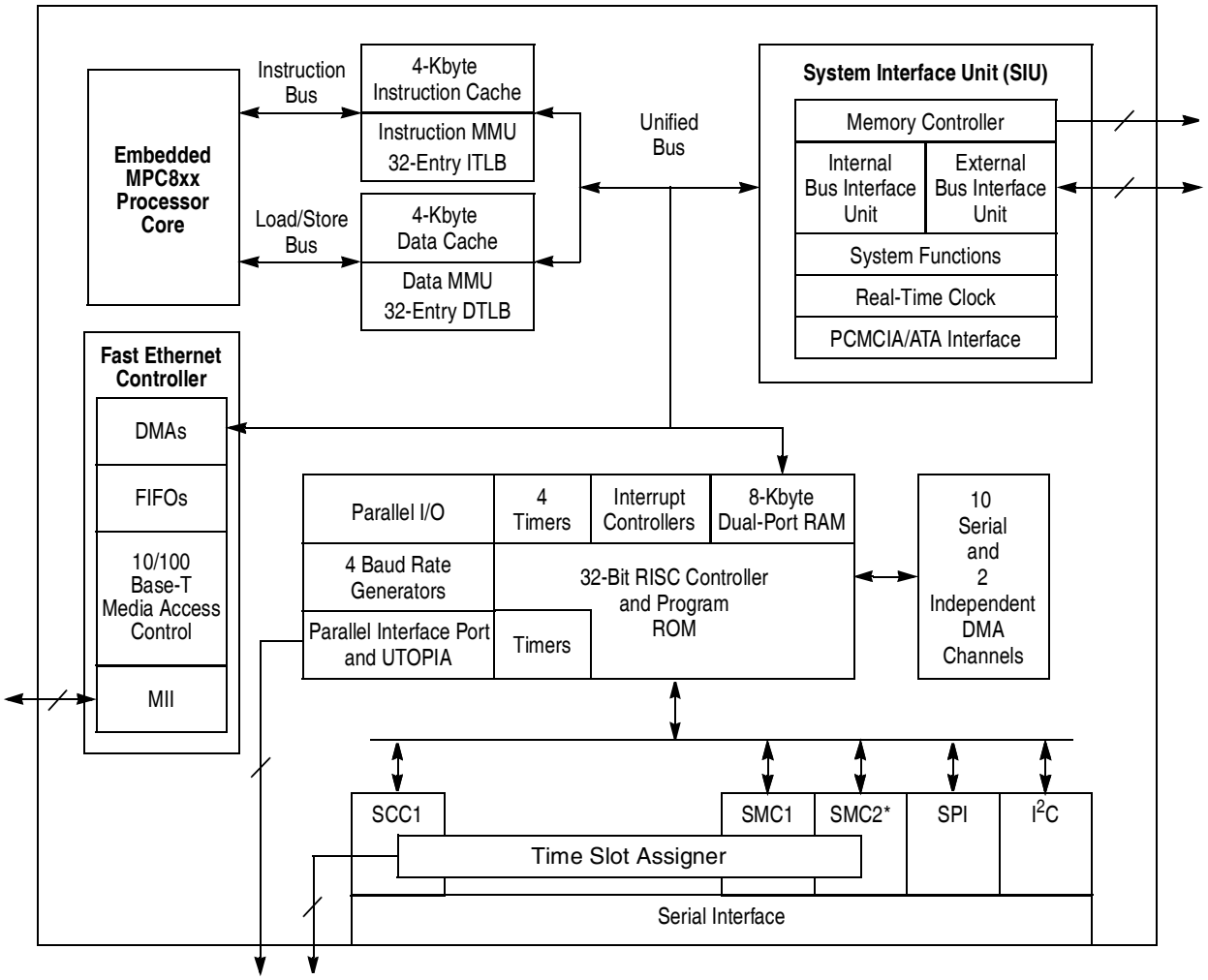
  - Sleep—All units disabled except RTC, PIT, time base, and decrementer with PLL active for fast wake up
  - Deep sleep—All units disabled including PLL except RTC, PIT, time base, and decrementer.
  - Power down mode— All units powered down except PLL, RTC, PIT, time base and decrementer
- Debug interface
  - Eight comparators: four operate on instruction address, two operate on data address, and two operate on data
  - Supports conditions: = ≠ < >
  - Each watchpoint can generate a break point internally
- 3.3 V operation with 5-V TTL compatibility except EXTAL and EXTCLK
- 357-pin plastic ball grid array (PBGA) package
- Operation up to 100MHz

The MPC862/857T/857DSL is comprised of three modules that each use the 32-bit internal bus: the MPC8xx core, the system integration unit (SIU), and the communication processor module (CPM). The MPC862P/862T block diagram is shown in Figure 1. The MPC857T/857DSL block diagram is shown in Figure 2.



*The MPC862T contains 4-Kbyte instruction cache and 4-Kbyte data cache.

Figure 1. MPC862P/862T Block Diagram



*The MPC857DSL does not contain SMC2 nor the Time Slot Assigner, and provides eight SDMA controllers.

Figure 2. MPC857T/MPC857DSL Block Diagram

3 Maximum Tolerated Ratings

This section provides the maximum tolerated voltage and temperature ranges for the MPC862/857T/857DSL. Table 2 provides the maximum ratings.

Table 2. Maximum Tolerated Ratings

(GND = 0 V)

Rating	Symbol	Value	Unit	Max Freq (MHz)
Supply voltage [1]	VDDH	-0.3 to 4.0	V	-
	VDDL	-0.3 to 4.0	V	-
	KAPWR	-0.3 to 4.0	V	-
	VDDSYN	-0.3 to 4.0	V	-

4 Thermal Characteristics

Table 3 shows the thermal characteristics for the MPC862/857T/857DSL.

Table 3. MPC862/857T/857DSL Thermal Resistance Data

Rating	Environment		Symbol	Value	Unit
Junction to ambient [1]	Natural Convection	Single layer board (1s)	$R_{\theta JA}$ [2]	37	°C/W
		Four layer board (2s2p)	$R_{\theta JMA}$ [3]	23	
	Air flow (200 ft/min)	Single layer board (1s)	$R_{\theta JMA}$ [3]	30	
		Four layer board (2s2p)	$R_{\theta JMA}$ [3]	19	
Junction to board [4]			$R_{\theta JB}$	13	
Junction to case [5]			$R_{\theta JC}$	6	
Junction to package top [6]	Natural Convection		Ψ_{JT}	2	
	Air flow (200 ft/min)		Ψ_{JT}	2	

1 Junction temperature is a function of on-chip power dissipation, package thermal resistance, mounting site (board) temperature, ambient temperature, air flow, power dissipation of other components on the board, and board thermal resistance.

2 Per SEMI G38-87 and JEDEC JESD51-2 with the single layer board horizontal.

3 Per JEDEC JESD51-6 with the board horizontal.

4 Thermal resistance between the die and the printed circuit board per JEDEC JESD51-8. Board temperature is measured on the top surface of the board near the package.

5 Indicates the average thermal resistance between the die and the case top surface as measured by the cold plate method (MIL SPEC-883 Method 1012.1) with the cold plate temperature used for the case temperature. For exposed pad packages where the pad would be expected to be soldered, junction to case thermal resistance is a simulated value from the junction to the exposed pad without contact resistance.

6 Thermal characterization parameter indicating the temperature difference between package top and the junction temperature per JEDEC JESD51-2.

5 Power Dissipation

Table 4 provides power dissipation information. The modes are 1:1, where CPU and bus speeds are equal, and 2:1 mode, where CPU frequency is twice bus speed.

Table 4. Power Dissipation (P_D)

Die Revision	Frequency	Typical [1]	Maximum [2]	Unit
0 (1:1 Mode)	50 MHz	656	735	mW
	66 MHz	TBD	TBD	mW
A.1, B.0 (1:1 Mode)	50 MHz	630	760	mW
	66 MHz	890	1000	mW

Table 7. Bus Operation Timings (continued)

Num	Characteristic	33 MHz		40 MHz		50 MHz		66 MHz		Unit
		Min	Max	Min	Max	Min	Max	Min	Max	
B27	A(0:31) and BADDR(28:30) to $\overline{CS}$ asserted GPCM ACS = 10, TRLX = 1 (MIN = 1.25 x B1 - 2.00)	35.90	—	29.30	—	23.00	—	16.90	—	ns
B27a	A(0:31) and BADDR(28:30) to $\overline{CS}$ asserted GPCM ACS = 11, TRLX = 1 (MIN = 1.50 x B1 - 2.00)	43.50	—	35.50	—	28.00	—	20.70	—	ns
B28	CLKOUT rising edge to $\overline{WE}$(0:3) negated GPCM write access CSNT = 0 (MAX = 0.00 x B1 + 9.00)	—	9.00	—	9.00	—	9.00	—	9.00	ns
B28a	CLKOUT falling edge to $\overline{WE}$(0:3) negated GPCM write access TRLX = 0, 1, CSNT = 1, EBDF = 0 (MAX = 0.25 x B1 + 6.80)	7.60	14.30	6.30	13.00	5.00	11.80	3.80	10.50	ns
B28b	CLKOUT falling edge to $\overline{CS}$ negated GPCM write access TRLX = 0,1, CSNT = 1 ACS = 10 or ACS = 11, EBDF = 0 (MAX = 0.25 x B1 + 6.80)	—	14.30	—	13.00	—	11.80	—	10.50	ns
B28c	CLKOUT falling edge to $\overline{WE}$(0:3) negated GPCM write access TRLX = 0, CSNT = 1 write access TRLX = 0,1, CSNT = 1, EBDF = 1 (MAX = 0.375 x B1 + 6.6)	10.90	18.00	10.90	18.00	7.00	14.30	5.20	12.30	ns
B28d	CLKOUT falling edge to $\overline{CS}$ negated GPCM write access TRLX = 0,1, CSNT = 1, ACS = 10, or ACS = 11, EBDF = 1 (MAX = 0.375 x B1 + 6.6)	—	18.00	—	18.00	—	14.30	—	12.30	ns
B29	$\overline{WE}$(0:3) negated to D(0:31), DP(0:3) High-Z GPCM write access, CSNT = 0, EBDF = 0 (MIN = 0.25 x B1 - 2.00)	5.60	—	4.30	—	3.00	—	1.80	—	ns
B29a	$\overline{WE}$(0:3) negated to D(0:31), DP(0:3) High-Z GPCM write access, TRLX = 0, CSNT = 1, EBDF = 0 (MIN = 0.50 x B1 - 2.00)	13.20	—	10.50	—	8.00	—	5.60	—	ns
B29b	$\overline{CS}$ negated to D(0:31), DP(0:3), High Z GPCM write access, ACS = 00, TRLX = 0,1 & CSNT = 0 (MIN = 0.25 x B1 - 2.00)	5.60	—	4.30	—	3.00	—	1.80	—	ns
B29c	$\overline{CS}$ negated to D(0:31), DP(0:3) High-Z GPCM write access, TRLX = 0, CSNT = 1, ACS = 10, or ACS = 11 EBDF = 0 (MIN = 0.50 x B1 - 2.00)	13.20	—	10.50	—	8.00	—	5.60	—	ns

Table 7. Bus Operation Timings (continued)

Num	Characteristic	33 MHz		40 MHz		50 MHz		66 MHz		Unit
		Min	Max	Min	Max	Min	Max	Min	Max	
B32c	CLKOUT rising edge to $\overline{BS}$ valid - as requested by control bit BST3 in the corresponding word in the UPM (MAX = 0.25 x B1 + 6.80)	7.60	14.30	6.30	13.00	5.00	11.80	3.80	10.50	ns
B32d	CLKOUT falling edge to $\overline{BS}$ valid- as requested by control bit BST1 in the corresponding word in the UPM, EBDF = 1 (MAX = 0.375 x B1 + 6.60)	9.40	18.00	7.60	16.00	13.30	14.10	11.30	12.30	ns
B33	CLKOUT falling edge to $\overline{GPL}$ valid - as requested by control bit GxT4 in the corresponding word in the UPM (MAX = 0.00 x B1 + 6.00)	1.50	6.00	1.50	6.00	1.50	6.00	1.50	6.00	ns
B33a	CLKOUT rising edge to $\overline{GPL}$ Valid - as requested by control bit GxT3 in the corresponding word in the UPM (MAX = 0.25 x B1 + 6.80)	7.60	14.30	6.30	13.00	5.00	11.80	3.80	10.50	ns
B34	A(0:31), BADDR(28:30), and D(0:31) to $\overline{CS}$ valid - as requested by control bit CST4 in the corresponding word in the UPM (MIN = 0.25 x B1 - 2.00)	5.60	—	4.30	—	3.00	—	1.80	—	ns
B34a	A(0:31), BADDR(28:30), and D(0:31) to $\overline{CS}$ valid - as requested by control bit CST1 in the corresponding word in the UPM (MIN = 0.50 x B1 - 2.00)	13.20	—	10.50	—	8.00	—	5.60	—	ns
B34b	A(0:31), BADDR(28:30), and D(0:31) to $\overline{CS}$ valid - as requested by CST2 in the corresponding word in UPM (MIN = 0.75 x B1 - 2.00)	20.70	—	16.70	—	13.00	—	9.40	—	ns
B35	A(0:31), BADDR(28:30) to $\overline{CS}$ valid - as requested by control bit BST4 in the corresponding word in the UPM (MIN = 0.25 x B1 - 2.00)	5.60	—	4.30	—	3.00	—	1.80	—	ns
B35a	A(0:31), BADDR(28:30), and D(0:31) to $\overline{BS}$ valid - As Requested by BST1 in the corresponding word in the UPM (MIN = 0.50 x B1 - 2.00)	13.20	—	10.50	—	8.00	—	5.60	—	ns
B35b	A(0:31), BADDR(28:30), and D(0:31) to $\overline{BS}$ valid - as requested by control bit BST2 in the corresponding word in the UPM (MIN = 0.75 x B1 - 2.00)	20.70	—	16.70	—	13.00	—	9.40	—	ns
B36	A(0:31), BADDR(28:30), and D(0:31) to $\overline{GPL}$ valid as requested by control bit GxT4 in the corresponding word in the UPM (MIN = 0.25 x B1 - 2.00)	5.60	—	4.30	—	3.00	—	1.80	—	ns

Figure 6 provides the timing for the synchronous output signals.

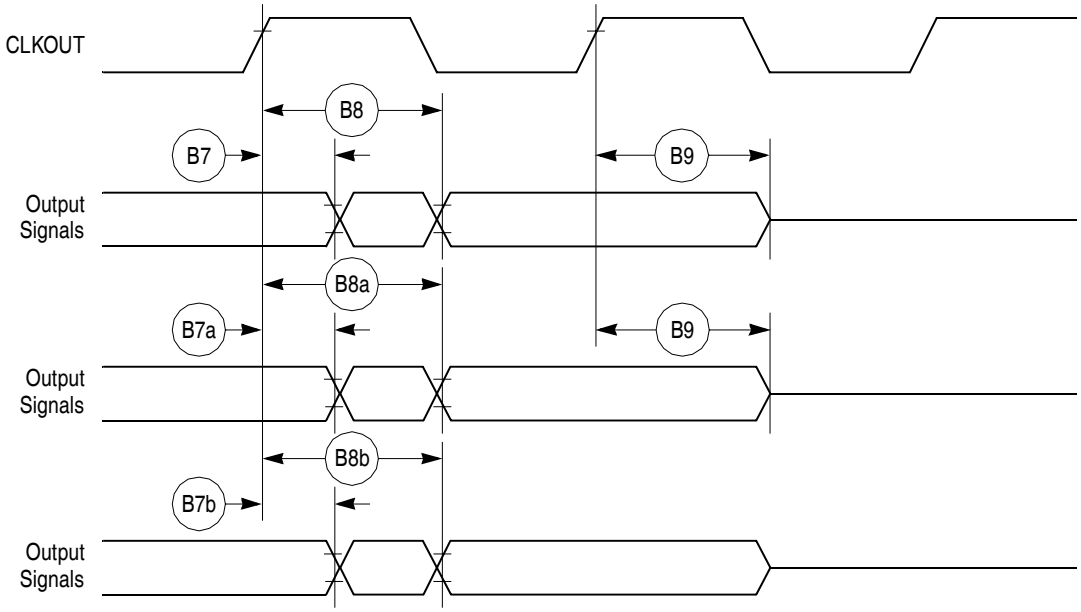


Figure 6. Synchronous Output Signals Timing

Figure 7 provides the timing for the synchronous active pull-up and open-drain output signals.

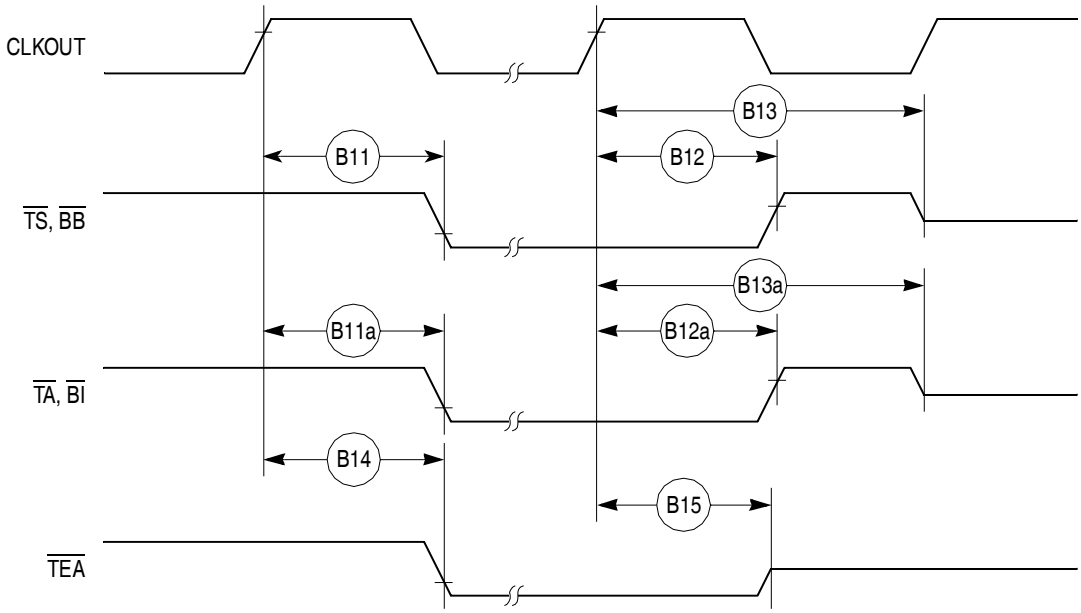


Figure 7. Synchronous Active Pull-Up Resistor and Open-Drain Outputs Signals Timing

Figure 15 through Figure 17 provide the timing for the external bus write controlled by various GPCM factors.

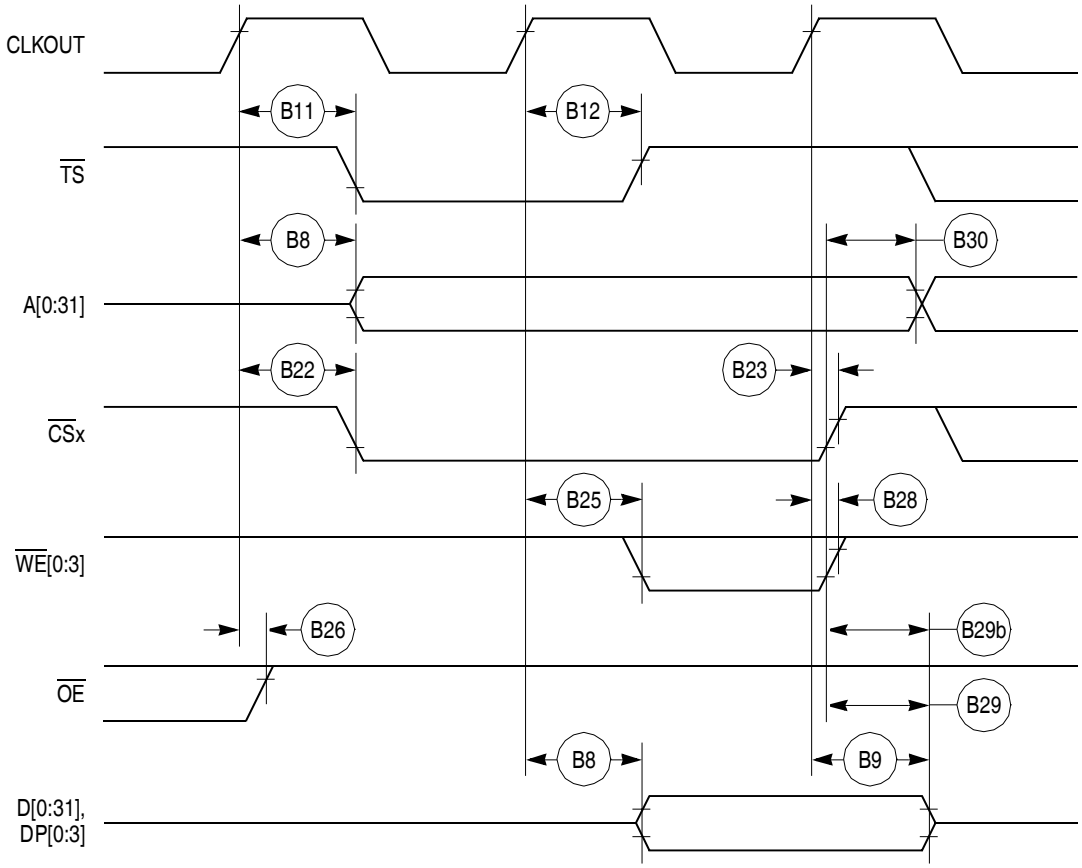


Figure 15. External Bus Write Timing (GPCM Controlled—TRLX = 0,1 CSNT = 0)

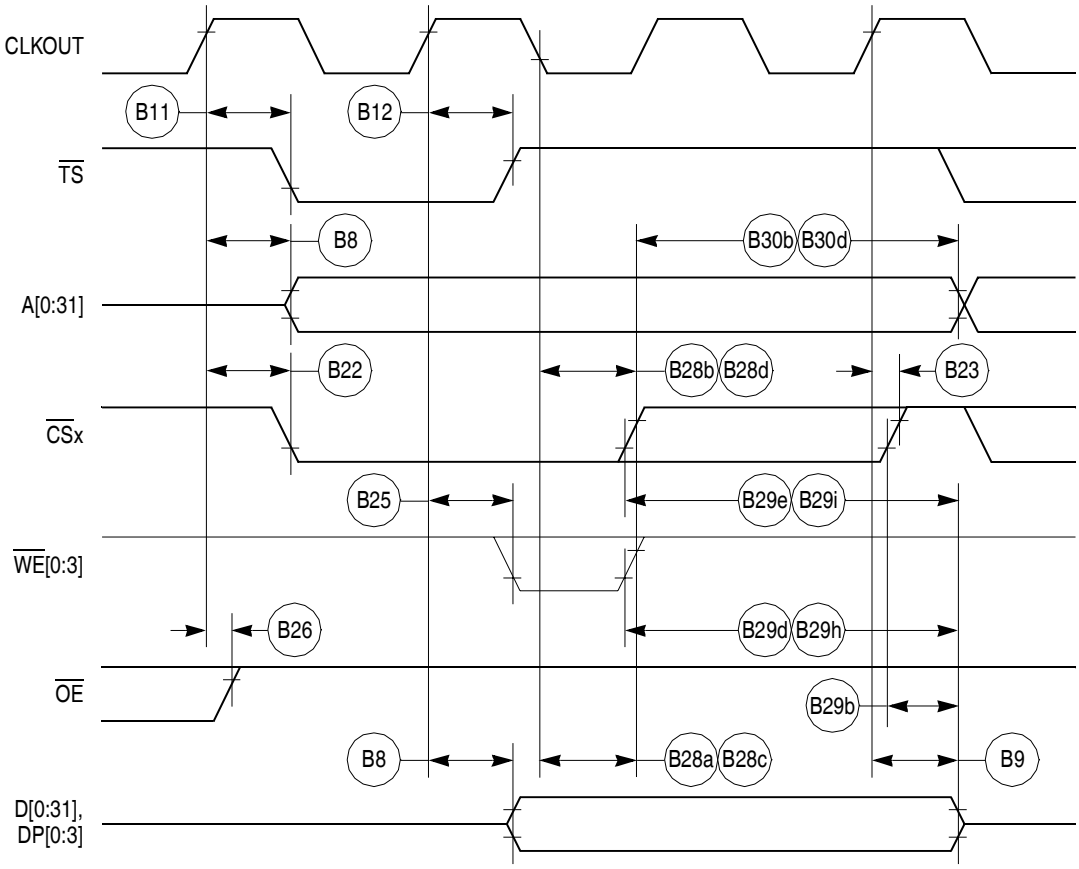


Figure 17. External Bus Write Timing (GPCM Controlled—TRLX = 0,1, CSNT = 1)

Figure 19 provides the timing for the asynchronous asserted UPWAIT signal controlled by the UPM.

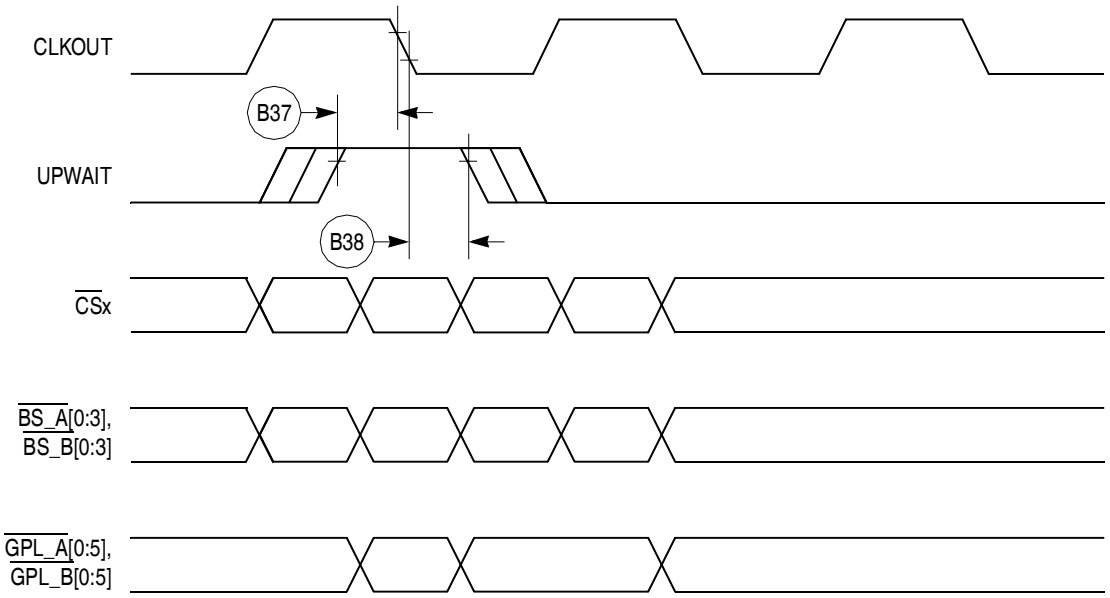


Figure 19. Asynchronous UPWAIT Asserted Detection in UPM Handled Cycles Timing

Figure 20 provides the timing for the asynchronous negated UPWAIT signal controlled by the UPM.

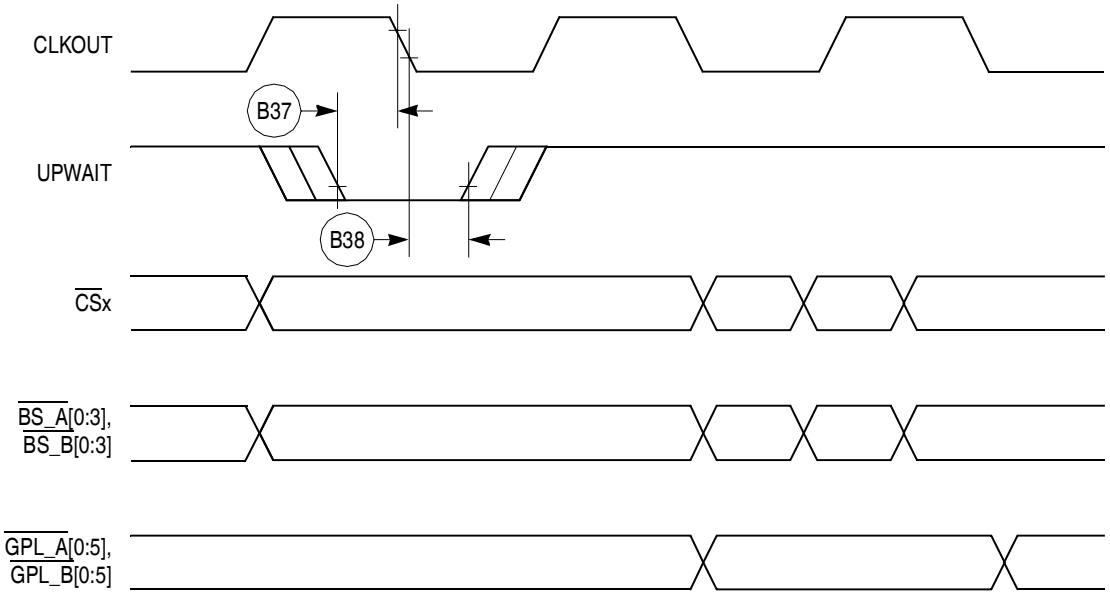


Figure 20. Asynchronous UPWAIT Negated Detection in UPM Handled Cycles Timing

Figure 33 shows the reset timing for the data bus configuration.

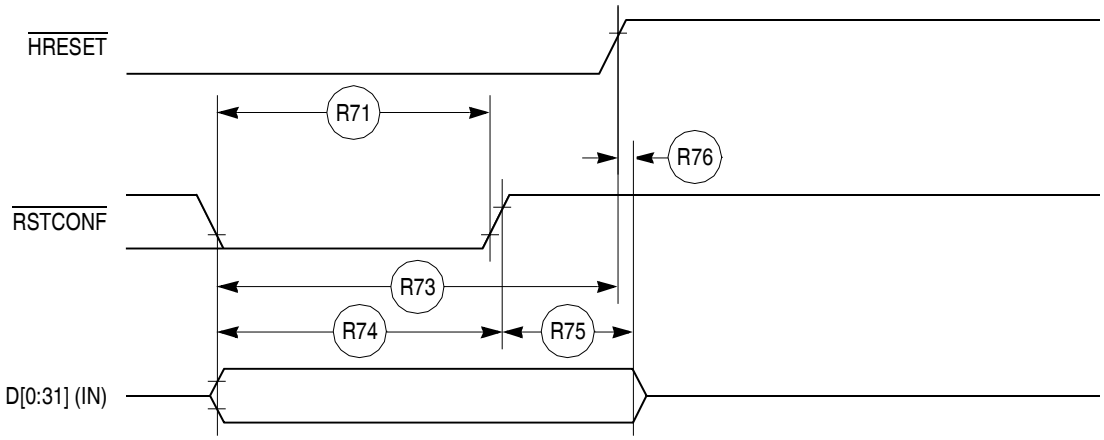


Figure 33. Reset Timing—Configuration from Data Bus

Figure 34 provides the reset timing for the data bus weak drive during configuration.

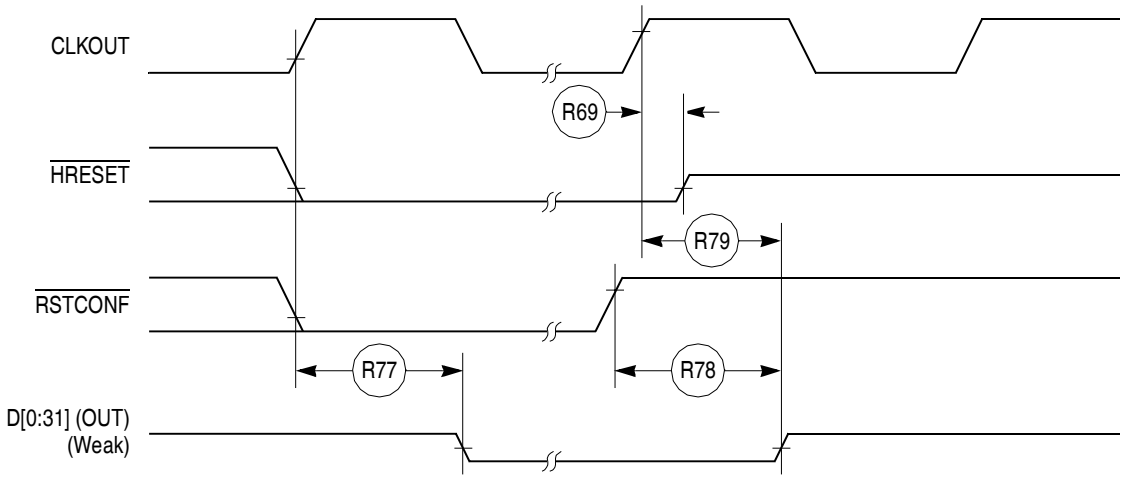


Figure 34. Reset Timing—Data Bus Weak Drive during Configuration

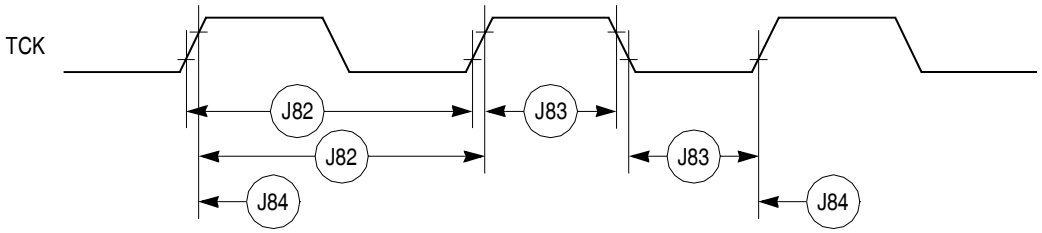


Figure 36. JTAG Test Clock Input Timing

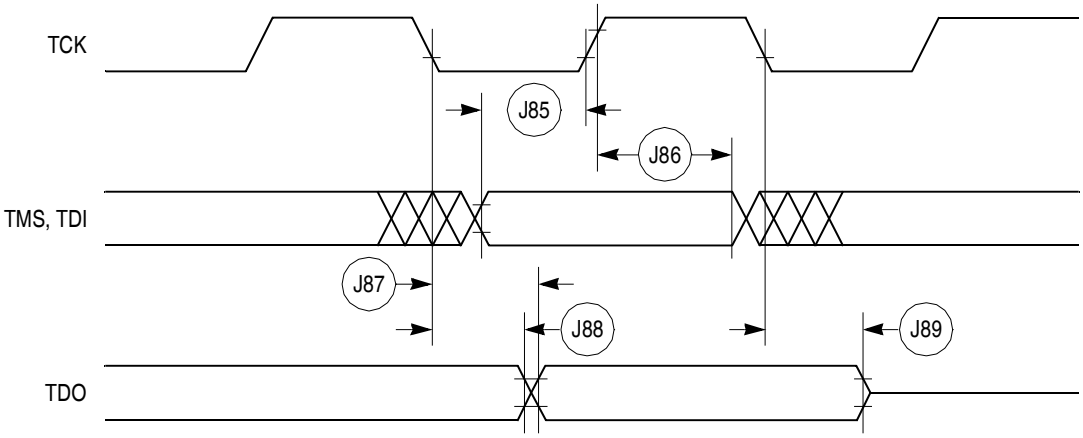


Figure 37. JTAG Test Access Port Timing Diagram

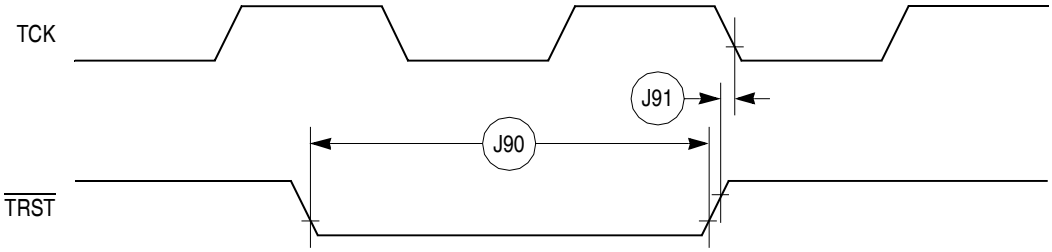


Figure 38. JTAG $\overline{\text{TRST}}$ Timing Diagram

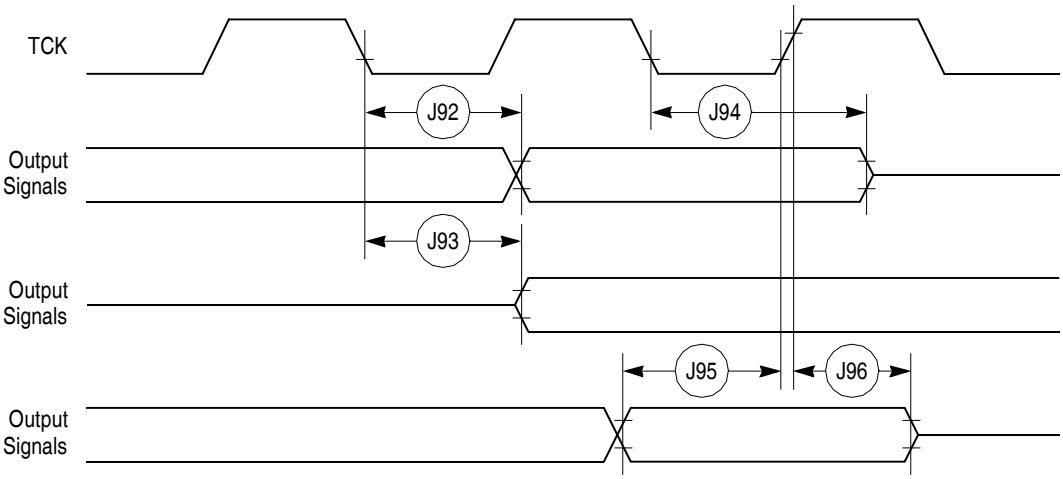


Figure 39. Boundary Scan (JTAG) Timing Diagram

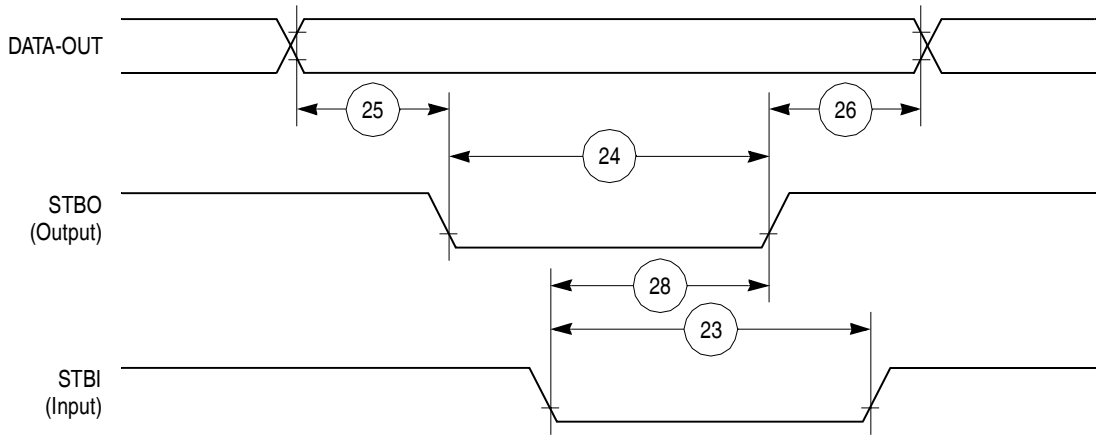


Figure 41. PIP Tx (Interlock Mode) Timing Diagram

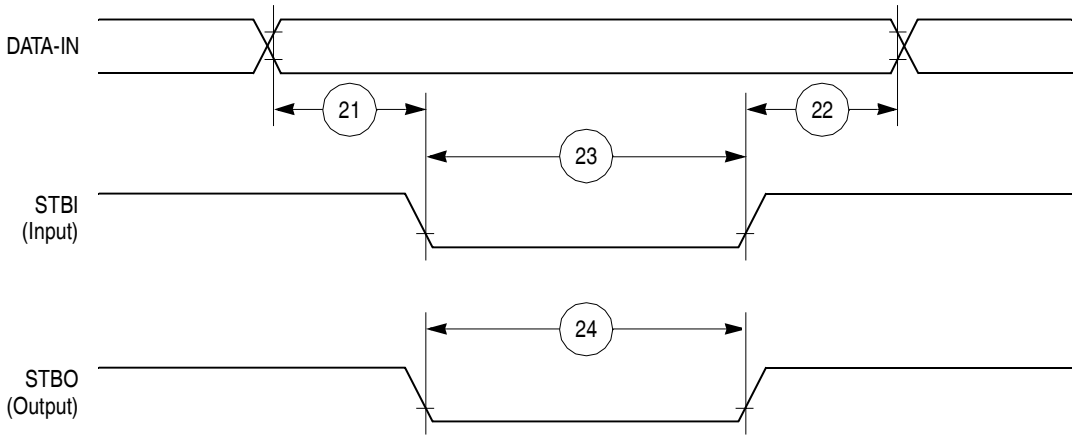


Figure 42. PIP Rx (Pulse Mode) Timing Diagram

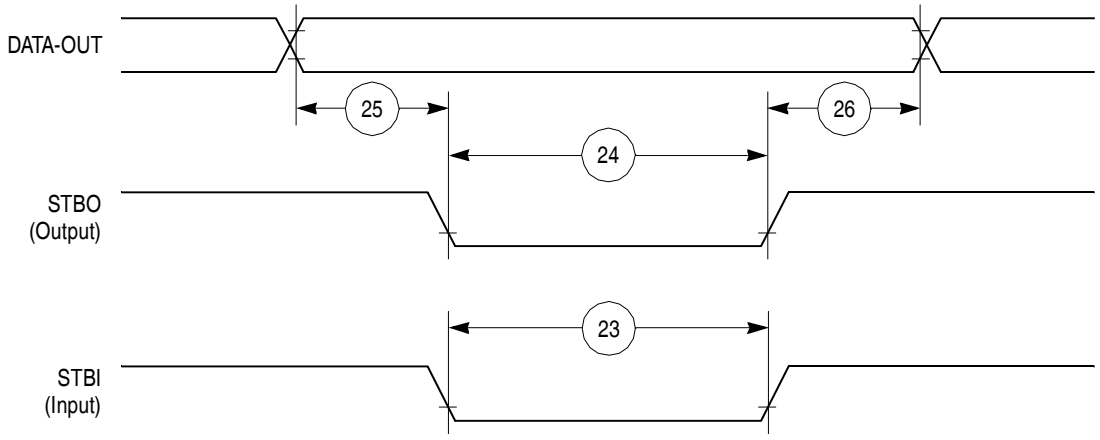


Figure 43. PIP TX (Pulse Mode) Timing Diagram

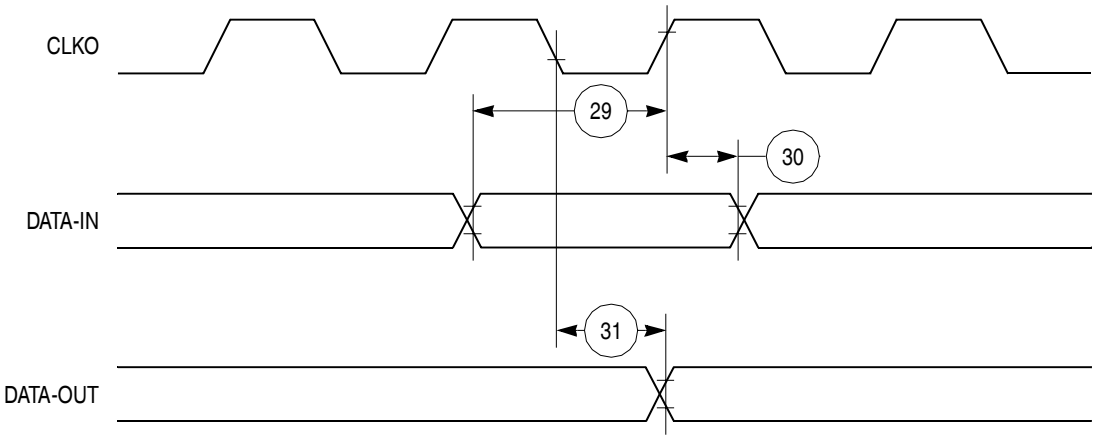


Figure 44. Parallel I/O Data-In/Data-Out Timing Diagram

11.2 Port C Interrupt AC Electrical Specifications

Table 15 provides the timings for port C interrupts.

Table 15. Port C Interrupt Timing

Num	Characteristic	33.34 MHz		Unit
		Min	Max	
35	Port C interrupt pulse width low (edge-triggered mode)	55	—	ns
36	Port C interrupt minimum time between active edges	55	—	ns

Figure 45 shows the port C interrupt detection timing.

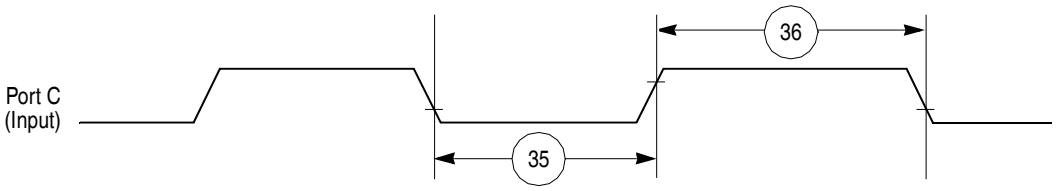


Figure 45. Port C Interrupt Detection Timing

11.3 IDMA Controller AC Electrical Specifications

Table 16 provides the IDMA controller timings as shown in Figure 46 though Figure 49.

Table 16. IDMA Controller Timing

Num	Characteristic	All Frequencies		Unit
		Min	Max	
40	$\overline{\text{DREQ}}$ setup time to clock high	7	—	ns
41	$\overline{\text{DREQ}}$ hold time from clock high	3	—	ns
42	$\overline{\text{SDACK}}$ assertion delay from clock high	—	12	ns

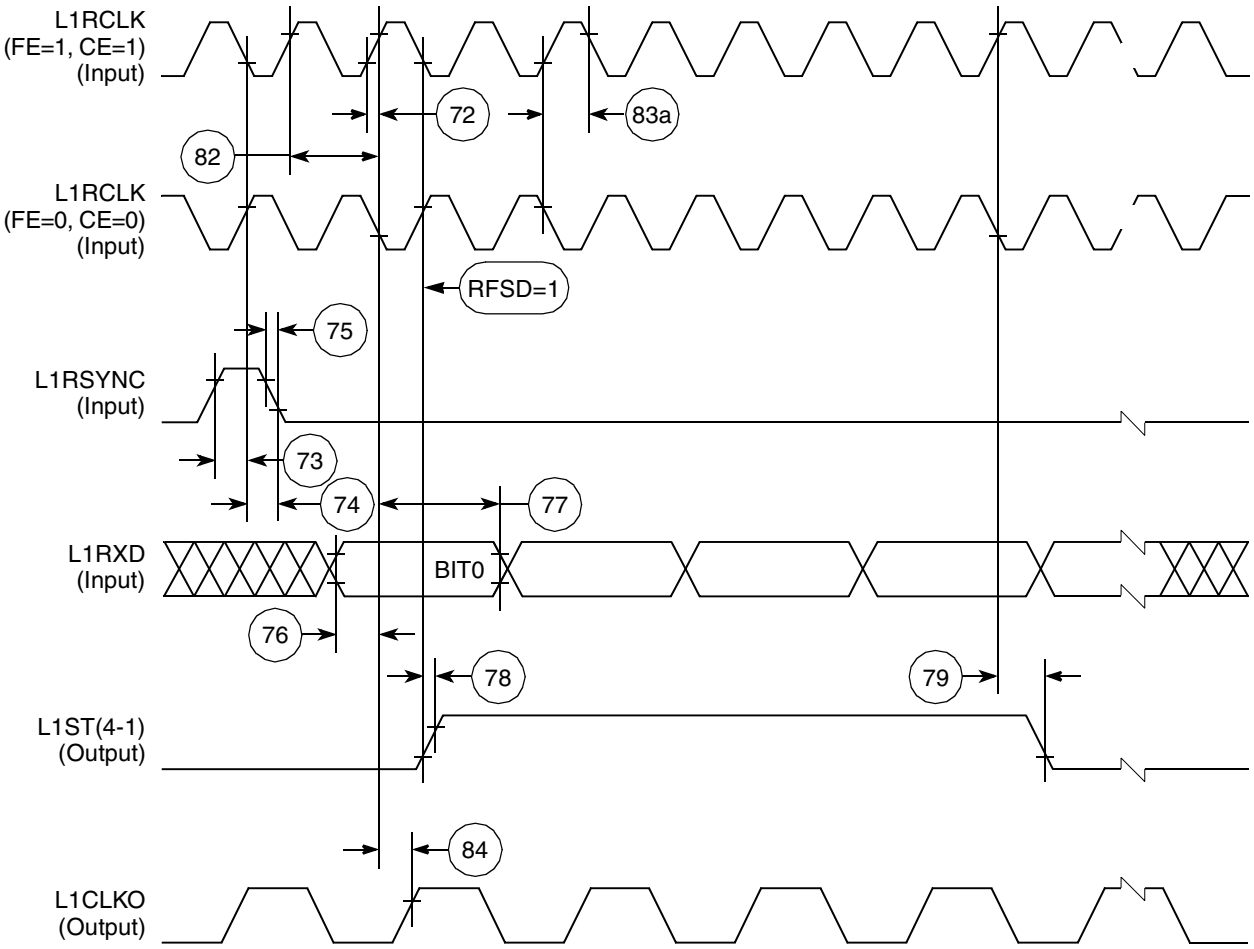


Figure 53. SI Receive Timing with Double-Speed Clocking (DSC = 1)

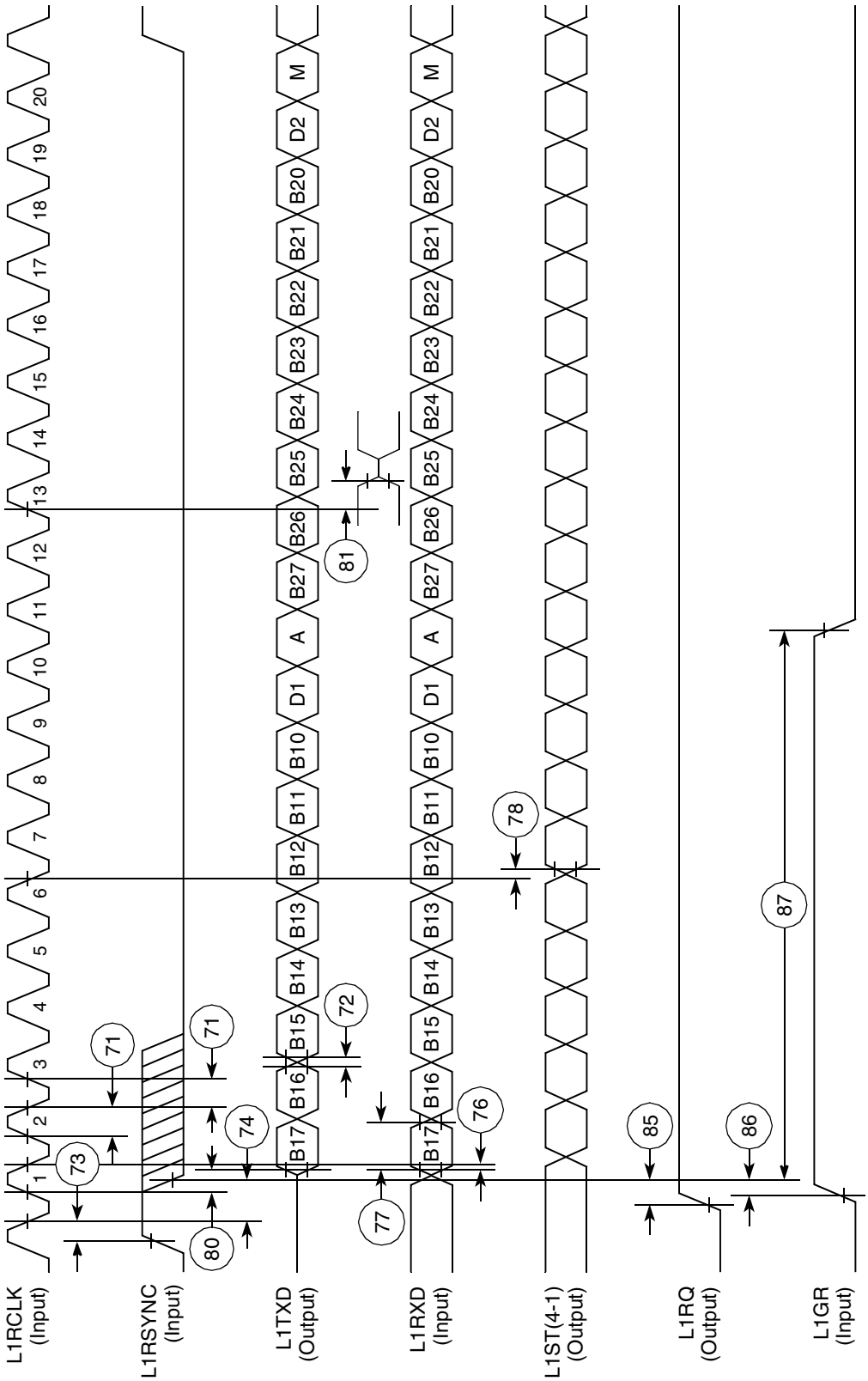


Figure 56. IDL Timing

Table 33. MPC862/857T/857DSL Derivatives (continued)

Device	Number of SCCs [1]	Ethernet Support	Multi-Channel HDLC Support	ATM Support	Cache Size	
					Instruction	Data
MPC857T	One (SCC1)	10/100 Mbps	Yes	Yes	4 Kbytes	4 Kbytes
MPC857DSL	One (SCC1)	10/100 Mbps	No	Up to 4 addresses	4 Kbytes	4 Kbytes

1 Serial communications controller (SCC)

Table 34 identifies the packages and operating frequencies orderable for the MPC862/857T/857DSL derivative devices.

Table 34. MPC862/857T/857DSL Package/Frequency Orderable

Package Type	Temperature (Tj)	Frequency (MHz)	Order Number
Plastic ball grid array (ZP suffix)	0°C to 105°C	50	XPC862PZP50B XPC862TZP50B XPC857TZP50B XPC857DSLZP50B
		66	XPC862PZP66B XPC862TZP66B XPC857TZP66B XPC857DSLZP66B
		80	XPC862PZP80B XPC862TZP80B XPC857TZP80B
		100	XPC862PZP100B XPC862TZP100B XPC857TZP100B
Plastic ball grid array (CZP suffix)	-40°C to 115°C	66 [1]	XPC862PCZP66B XPC857TCZP66B

1 Additional extended temperature devices can be made available at 50MHz, 66MHz, and 80MHz

14.1 .Pin Assignments

Figure 77 shows the top view pinout of the PBGA package. For additional information, see the *MPC862 PowerQUICC Family User s Manual*.

Table 35. Pin Assignments (continued)

Name	Pin Number	Type
$\overline{BR}$	G4	Bidirectional
$\overline{BG}$	E2	Bidirectional
$\overline{BB}$	E1	Bidirectional Active Pull-up
FRZ $\overline{IRQ6}$	G3	Bidirectional
$\overline{IRQ0}$	V14	Input
$\overline{IRQ1}$	U14	Input
M_TX_CLK $\overline{IRQ7}$	W15	Input
$\overline{CS}$[0:5]	C3, A2, D4, E4, A4, B4	Output
$\overline{CS6}$ $\overline{CE1\_B}$	D5	Output
$\overline{CS7}$ $\overline{CE2\_B}$	C4	Output
$\overline{WE0}$ $\overline{BS\_B0}$ $\overline{IORD}$	C7	Output
$\overline{WE1}$ $\overline{BS\_B1}$ $\overline{IOWR}$	A6	Output
$\overline{WE2}$ $\overline{BS\_B2}$ $\overline{PCOE}$	B6	Output
$\overline{WE3}$ $\overline{BS\_B3}$ $\overline{PCWE}$	A5	Output
$\overline{BS\_A}$[0:3]	D8, C8, A7, B8	Output
$\overline{GPL\_A0}$ $\overline{GPL\_B0}$	D7	Output
$\overline{OE}$ $\overline{GPL\_A1}$ $\overline{GPL\_B1}$	C6	Output
$\overline{GPL\_A}$[2:3] $\overline{GPL\_B}$[2:3] $\overline{CS}$[2–3]	B5, C5	Output
UPWAITA $\overline{GPL\_A4}$	C1	Bidirectional
UPWAITB $\overline{GPL\_B4}$	B1	Bidirectional

Table 35. Pin Assignments (continued)

Name	Pin Number	Type
PC13 L1RQb L1ST3 RTS3	E18	Bidirectional
PC12 L1RQa L1ST4 RTS4	F18	Bidirectional
PC11 CTS1	J19	Bidirectional
PC10 CD1 TGATE1	K19	Bidirectional
PC9 CTS2	L18	Bidirectional
PC8 CD2 TGATE2	M18	Bidirectional
PC7 CTS3 L1TSYNCB SDACK2	M16	Bidirectional
PC6 CD3 L1RSYNCB	R19	Bidirectional
PC5 CTS4 L1TSYNCA SDACK1	T18	Bidirectional
PC4 CD4 L1RSYNCA	T17	Bidirectional
PD15 L1TSYNCA MII-RXD3 UTPB0	U17	Bidirectional
PD14 L1RSYNCA MII-RXD2 UTPB1	V19	Bidirectional
PD13 L1TSYNCB MII-RXD1 UTPB2	V18	Bidirectional

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Document Number: MPC862EC
Rev. 3
2/2006