NXP USA Inc. - MPC857TVR100B Datasheet

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	100MHz
Co-Processors/DSP	Communications; CPM
RAM Controllers	DRAM
Graphics Acceleration	No
Display & Interface Controllers	-
Ethernet	10Mbps (1), 10/100Mbps (1)
SATA	-
USB	-
Voltage - I/O	3.3V
Operating Temperature	0°C ~ 105°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/mpc857tvr100b

1 Overview

The MPC862/857T/857DSL is a derivative of Freescale's MPC860 PowerQUICC™ family of devices. It is a versatile single-chip integrated microprocessor and peripheral combination that can be used in a variety of controller applications and communications and networking systems. The MPC862/857T/857DSL provides enhanced ATM functionality over that of other ATM-enabled members of the MPC860 family.

Table 1 shows the functionality supported by the members of the MPC862/857T/857DSL family.

Table 1. MPC862 Family Functionality

Part	Cache		Ethernet		SCC	SMC
	Instruction Cache	Data Cache	10T	10/100		
MPC862P	16 Kbyte	8 Kbyte	Up to 4	1	4	2
MPC862T	4 Kbyte	4 Kbyte	Up to 4	1	4	2
MPC857T	4 Kbyte	4 Kbyte	1	1	1	2
MPC857DSL	4 Kbyte	4 Kbyte	1	1	1 [1]	1 [2]

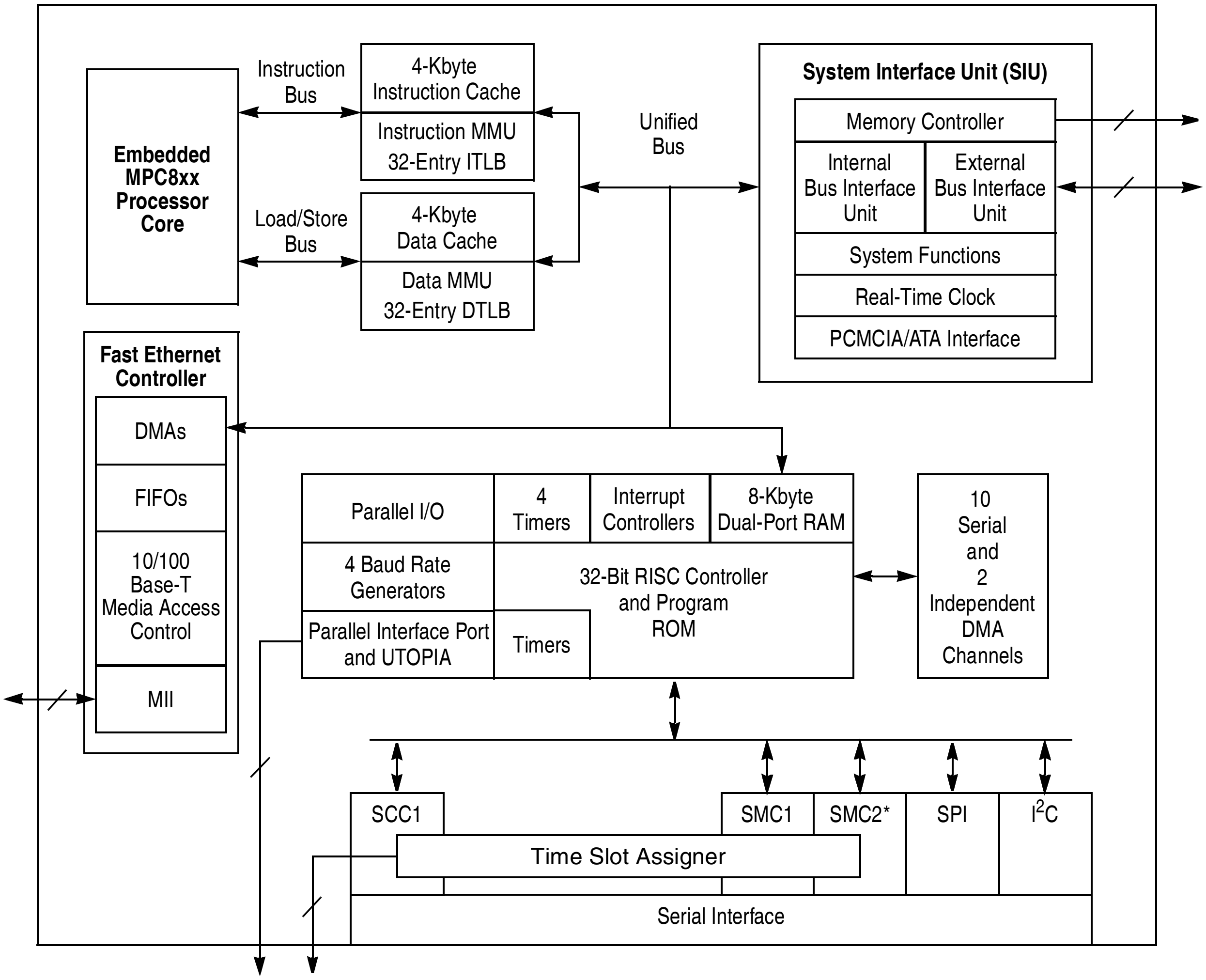
[1] On the MPC857DSL, the SCC (SCC1) is for ethernet only. Also, the MPC857DSL does not support the Time Slot Assigner (TSA).

[2] On the MPC857DSL, the SMC (SMC1) is for UART only.

2 Features

The following list summarizes the key MPC862/857T/857DSL features:

- Embedded single-issue, 32-bit MPC8xx core (implementing the PowerPC architecture) with thirty-two 32-bit general-purpose registers (GPRs)
  - The core performs branch prediction with conditional prefetch, without conditional execution
  - 4- or 8-Kbyte data cache and 4- or 16-Kbyte instruction cache (see Table 1).
    - 16-Kbyte instruction cache (MPC862P) is four-way, set-associative with 256 sets; 4-Kbyte instruction cache (MPC862T, MPC857T, and MPC857DSL) is two-way, set-associative with 128 sets.
    - 8-Kbyte data cache (MPC862P) is two-way, set-associative with 256 sets; 4-Kbyte data cache (MPC862T, MPC857T, and MPC857DSL) is two-way, set-associative with 128 sets.
    - Cache coherency for both instruction and data caches is maintained on 128-bit (4-word) cache blocks.
    - Caches are physically addressed, implement a least recently used (LRU) replacement algorithm, and are lockable on a cache block basis.
  - MMUs with 32-entry TLB, fully associative instruction and data TLBs
  - MMUs support multiple page sizes of 4, 16, and 512 Kbytes, and 8 Mbytes; 16 virtual address spaces and 16 protection groups
  - Advanced on-chip-emulation debug mode



*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	-

If the board temperature is known, an estimate of the junction temperature in the environment can be made using the following equation:

$$T_J = T_B + (R_{\theta JB} \times P_D)$$

where:

$R_{\theta JB}$ = junction-to-board thermal resistance (ºC/W)

T_B = board temperature (ºC)

P_D = power dissipation in package

If the board temperature is known and the heat loss from the package case to the air can be ignored, acceptable predictions of junction temperature can be made. For this method to work, the board and board mounting must be similar to the test board used to determine the junction-to-board thermal resistance, namely a 2s2p (board with a power and a ground plane) and vias attaching the thermal balls to the ground plane.

7.4 Estimation Using Simulation

When the board temperature is not known, a thermal simulation of the application is needed. The simple two resistor model can be used with the thermal simulation of the application [2], or a more accurate and complex model of the package can be used in the thermal simulation.

7.5 Experimental Determination

To determine the junction temperature of the device in the application after prototypes are available, the thermal characterization parameter (Ψ_{JT}) can be used to determine the junction temperature with a measurement of the temperature at the top center of the package case using the following equation:

$$T_J = T_T + (\Psi_{JT} \times P_D)$$

where:

Ψ_{JT} = thermal characterization parameter

T_T = thermocouple temperature on top of package

P_D = power dissipation in package

The thermal characterization parameter is measured per JESD51-2 specification published by JEDEC using a 40-gauge type T thermocouple epoxied to the top center of the package case. The thermocouple should be positioned so that the thermocouple junction rests on the package. A small amount of epoxy is placed over the thermocouple junction and over about 1 mm of wire extending from the junction. The thermocouple wire is placed flat against the package case to avoid measurement errors caused by cooling effects of the thermocouple wire.

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	
B8a	CLKOUT to TSIZ(0:1), $\overline{\text{REG}}$, $\overline{\text{RSV}}$, AT(0:3) $\overline{\text{BDIP}}$, PTR valid (MAX = 0.25 x B1 + 6.3)	7.60	13.80	6.30	12.50	5.00	11.30	3.80	10.00	ns
B8b	CLKOUT to $\overline{\text{BR}}$, $\overline{\text{BG}}$, VFLS(0:1), VF(0:2), IWP(0:2), FRZ, LWP(0:1), $\overline{\text{STS}}$ Valid [4] (MAX = 0.25 x B1 + 6.3)	7.60	13.80	6.30	12.50	5.00	11.30	3.80	10.00	ns
B9	CLKOUT to A(0:31), BADDR(28:30), RD/$\overline{\text{WR}}$, $\overline{\text{BURST}}$, D(0:31), DP(0:3), TSIZ(0:1), $\overline{\text{REG}}$, $\overline{\text{RSV}}$, AT(0:3), PTR High-Z (MAX = 0.25 x B1 + 6.3)	7.60	13.80	6.30	12.50	5.00	11.30	3.80	10.00	ns
B11	CLKOUT to $\overline{\text{TS}}$, $\overline{\text{BB}}$ assertion (MAX = 0.25 x B1 + 6.0)	7.60	13.60	6.30	12.30	5.00	11.00	3.80	11.30	ns
B11a	CLKOUT to $\overline{\text{TA}}$, $\overline{\text{BI}}$ assertion (when driven by the memory controller or PCMCIA interface) (MAX = 0.00 x B1 + 9.30 [5])	2.50	9.30	2.50	9.30	2.50	9.30	2.50	9.80	ns
B12	CLKOUT to $\overline{\text{TS}}$, $\overline{\text{BB}}$ negation (MAX = 0.25 x B1 + 4.8)	7.60	12.30	6.30	11.00	5.00	9.80	3.80	8.50	ns
B12a	CLKOUT to $\overline{\text{TA}}$, $\overline{\text{BI}}$ negation (when driven by the memory controller or PCMCIA interface) (MAX = 0.00 x B1 + 9.00)	2.50	9.00	2.50	9.00	2.50	9.00	2.50	9.00	ns
B13	CLKOUT to $\overline{\text{TS}}$, $\overline{\text{BB}}$ High-Z (MIN = 0.25 x B1)	7.60	21.60	6.30	20.30	5.00	19.00	3.80	14.00	ns
B13a	CLKOUT to $\overline{\text{TA}}$, $\overline{\text{BI}}$ High-Z (when driven by the memory controller or PCMCIA interface) (MIN = 0.00 x B1 + 2.5)	2.50	15.00	2.50	15.00	2.50	15.00	2.50	15.00	ns
B14	CLKOUT to $\overline{\text{TEA}}$ assertion (MAX = 0.00 x B1 + 9.00)	2.50	9.00	2.50	9.00	2.50	9.00	2.50	9.00	ns
B15	CLKOUT to $\overline{\text{TEA}}$ High-Z (MIN = 0.00 x B1 + 2.50)	2.50	15.00	2.50	15.00	2.50	15.00	2.50	15.00	ns
B16	$\overline{\text{TA}}$, $\overline{\text{BI}}$ valid to CLKOUT (setup time) (MIN = 0.00 x B1 + 6.00)	6.00	—	6.00	—	6.00	—	6.00	—	ns
B16a	$\overline{\text{TEA}}$, $\overline{\text{KR}}$, $\overline{\text{RETRY}}$, $\overline{\text{CR}}$ valid to CLKOUT (setup time) (MIN = 0.00 x B1 + 4.5)	4.50	—	4.50	—	4.50	—	4.50	—	ns
B16b	$\overline{\text{BB}}$, $\overline{\text{BG}}$, $\overline{\text{BR}}$, valid to CLKOUT (setup time) [6] (4MIN = 0.00 x B1 + 0.00)	4.00	—	4.00	—	4.00	—	4.00	—	ns
B17	CLKOUT to $\overline{\text{TA}}$, $\overline{\text{TEA}}$, $\overline{\text{BI}}$, $\overline{\text{BB}}$, $\overline{\text{BG}}$, $\overline{\text{BR}}$ valid (hold time) (MIN = 0.00 x B1 + 1.00 [7])	1.00	—	1.00	—	1.00	—	2.00	—	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	
B29d	$\overline{\text{WE}}$(0:3) negated to D(0:31), DP(0:3) High-Z GPCM write access, TRLX = 1, CSNT = 1, EBDF = 0 (MIN = 1.50 x B1 - 2.00)	43.50	—	35.50	—	28.00	—	20.70	—	ns
B29e	$\overline{\text{CS}}$ negated to D(0:31), DP(0:3) High-Z GPCM write access, TRLX = 1, CSNT = 1, ACS = 10, or ACS = 11 EBDF = 0 (MIN = 1.50 x B1 - 2.00)	43.50	—	35.50	—	28.00	—	20.70	—	ns
B29f	$\overline{\text{WE}}$(0:3) negated to D(0:31), DP(0:3) High Z GPCM write access, TRLX = 0, CSNT = 1, EBDF = 1 (MIN = 0.375 x B1 - 6.30)	5.00	—	3.00	—	1.10	—	0.00	—	ns
B29g	$\overline{\text{CS}}$ negated to D(0:31), DP(0:3) High-Z GPCM write access, TRLX = 0, CSNT = 1 ACS = 10 or ACS = 11, EBDF = 1 (MIN = 0.375 x B1 - 6.30)	5.00	—	3.00	—	1.10	—	0.00	—	ns
B29h	$\overline{\text{WE}}$(0:3) negated to D(0:31), DP(0:3) High Z GPCM write access, TRLX = 1, CSNT = 1, EBDF = 1 (MIN = 0.375 x B1 - 3.30)	38.40	—	31.10	—	24.20	—	17.50	—	ns
B29i	$\overline{\text{CS}}$ negated to D(0:31), DP(0:3) High-Z GPCM write access, TRLX = 1, CSNT = 1, ACS = 10 or ACS = 11, EBDF = 1 (MIN = 0.375 x B1 - 3.30)	38.40	—	31.10	—	24.20	—	17.50	—	ns
B30	$\overline{\text{CS}}$, $\overline{\text{WE}}$(0:3) negated to A(0:31), BADDR(28:30) Invalid GPCM write access [11] (MIN = 0.25 x B1 - 2.00)	5.60	—	4.30	—	3.00	—	1.80	—	ns
B30a	$\overline{\text{WE}}$(0:3) negated to A(0:31), BADDR(28:30) Invalid GPCM, write access, TRLX = 0, CSNT = 1, $\overline{\text{CS}}$ negated to A(0:31) invalid 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
B30b	$\overline{\text{WE}}$(0:3) negated to A(0:31) Invalid GPCM BADDR(28:30) invalid GPCM write access, TRLX = 1, CSNT = 1. $\overline{\text{CS}}$ negated to A(0:31) Invalid GPCM write access TRLX = 1, CSNT = 1, ACS = 10, or ACS == 11 EBDF = 0 (MIN = 1.50 x B1 - 2.00)	43.50	—	35.50	—	28.00	—	20.70	—	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	
B30c	$\overline{WE}$(0:3) negated to A(0:31), BADDR(28:30) invalid GPCM write access, TRLX = 0, CSNT = 1. $\overline{CS}$ negated to A(0:31) invalid GPCM write access, TRLX = 0, CSNT = 1 ACS = 10, ACS == 11, EBDF = 1 (MIN = 0.375 x B1 - 3.00)	8.40	—	6.40	—	4.50	—	2.70	—	ns
B30d	$\overline{WE}$(0:3) negated to A(0:31), BADDR(28:30) invalid GPCM write access TRLX = 1, CSNT =1, $\overline{CS}$ negated to A(0:31) invalid GPCM write access TRLX = 1, CSNT = 1, ACS = 10 or 11, EBDF = 1	38.67	—	31.38	—	24.50	—	17.83	—	ns
B31	CLKOUT falling edge to $\overline{CS}$ valid - as requested by control bit CST4 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
B31a	CLKOUT falling edge to $\overline{CS}$ valid - as requested by control bit CST1 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
B31b	CLKOUT rising edge to $\overline{CS}$ valid - as requested by control bit CST2 in the corresponding word in the UPM (MAX = 0.00 x B1 + 8.00)	1.50	8.00	1.50	8.00	1.50	8.00	1.50	8.00	ns
B31c	CLKOUT rising edge to $\overline{CS}$ valid- as requested by control bit CST3 in the corresponding word in the UPM (MAX = 0.25 x B1 + 6.30)	7.60	13.80	6.30	12.50	5.00	11.30	3.80	10.00	ns
B31d	CLKOUT falling edge to $\overline{CS}$ valid, as requested by control bit CST1 in the corresponding word in the UPM EBDF = 1 (MAX = 0.375 x B1 + 6.6)	9.40	18.00	7.60	16.00	13.30	14.10	11.30	12.30	ns
B32	CLKOUT falling edge to $\overline{BS}$ valid- as requested by control bit BST4 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
B32a	CLKOUT falling edge to $\overline{BS}$ valid - as requested by control bit BST1 in the corresponding word in the UPM, 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
B32b	CLKOUT rising edge to $\overline{BS}$ valid - as requested by control bit BST2 in the corresponding word in the UPM (MAX = 0.00 x B1 + 8.00)	1.50	8.00	1.50	8.00	1.50	8.00	1.50	8.00	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	
B37	UPWAIT valid to CLKOUT falling edge [12] (MIN = 0.00 x B1 + 6.00)	6.00	—	6.00	—	6.00	—	6.00	—	ns
B38	CLKOUT falling edge to UPWAIT valid [12] (MIN = 0.00 x B1 + 1.00)	1.00	—	1.00	—	1.00	—	1.00	—	ns
B39	$\overline{\text{AS}}$ valid to CLKOUT rising edge [13] (MIN = 0.00 x B1 + 7.00)	7.00	—	7.00	—	7.00	—	7.00	—	ns
B40	A(0:31), TSIZ(0:1), RD/$\overline{\text{WR}}$, $\overline{\text{BURST}}$, valid to CLKOUT rising edge (MIN = 0.00 x B1 + 7.00)	7.00	—	7.00	—	7.00	—	7.00	—	ns
B41	$\overline{\text{TS}}$ valid to CLKOUT rising edge (setup time) (MIN = 0.00 x B1 + 7.00)	7.00	—	7.00	—	7.00	—	7.00	—	ns
B42	CLKOUT rising edge to $\overline{\text{TS}}$ valid (hold time) (MIN = 0.00 x B1 + 2.00)	2.00	—	2.00	—	2.00	—	2.00	—	ns
B43	$\overline{\text{AS}}$ negation to memory controller signals negation (MAX = TBD)	—	TBD	—	TBD	—	TBD	—	TBD	ns

[1] Phase and frequency jitter performance results are only valid if the input jitter is less than the prescribed value.

[2] If the rate of change of the frequency of EXTAL is slow (I.e. it does not jump between the minimum and maximum values in one cycle) or the frequency of the jitter is fast (I.e., it does not stay at an extreme value for a long time) then the maximum allowed jitter on EXTAL can be up to 2%.

[3] The timings specified in B4 and B5 are based on full strength clock.

[4] The timing for $\overline{\text{BR}}$ output is relevant when the MPC862/857T/857DSL is selected to work with external bus arbiter. The timing for $\overline{\text{BG}}$ output is relevant when the MPC862/857T/857DSL is selected to work with internal bus arbiter.

[5] For part speeds above 50MHz, use 9.80ns for B11a.

[6] The timing required for $\overline{\text{BR}}$ input is relevant when the MPC862/857T/857DSL is selected to work with internal bus arbiter. The timing for $\overline{\text{BG}}$ input is relevant when the MPC862/857T/857DSL is selected to work with external bus arbiter.

[7] For part speeds above 50MHz, use 2ns for B17.

[8] The D(0:31) and DP(0:3) input timings B18 and B19 refer to the rising edge of the CLKOUT in which the $\overline{\text{TA}}$ input signal is asserted.

[9] For part speeds above 50MHz, use 2ns for B19.

[10] The D(0:31) and DP(0:3) input timings B20 and B21 refer to the falling edge of the CLKOUT. This timing is valid only for read accesses controlled by chip-selects under control of the UPM in the memory controller, for data beats where DLT3 = 1 in the UPM RAM words. (This is only the case where data is latched on the falling edge of CLKOUT.)

[11] The timing B30 refers to $\overline{\text{CS}}$ when ACS = 00 and to $\overline{\text{WE}}$(0:3) when CSNT = 0.

[12] The signal UPWAIT is considered asynchronous to the CLKOUT and synchronized internally. The timings specified in B37 and B38 are specified to enable the freeze of the UPM output signals as described in Figure 19.

[13] The $\overline{\text{AS}}$ signal is considered asynchronous to the CLKOUT. The timing B39 is specified in order to allow the behavior specified in Figure 22.

Figure 10 provides the timing for the input data controlled by the UPM for data beats where DLT3 = 1 in the UPM RAM words. (This is only the case where data is latched on the falling edge of CLKOUT.)

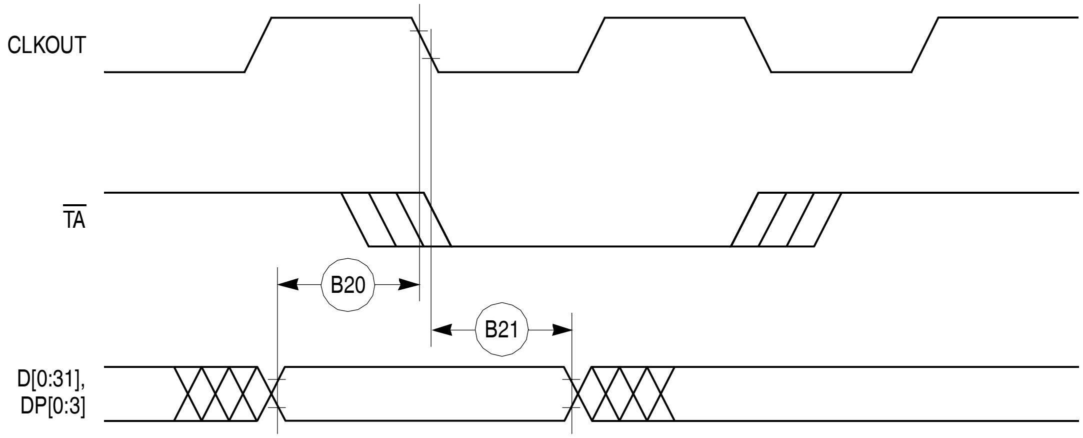


Figure 10. Input Data Timing when Controlled by UPM in the Memory Controller and DLT3 = 1

Figure 11 through Figure 14 provide the timing for the external bus read controlled by various GPCM factors.

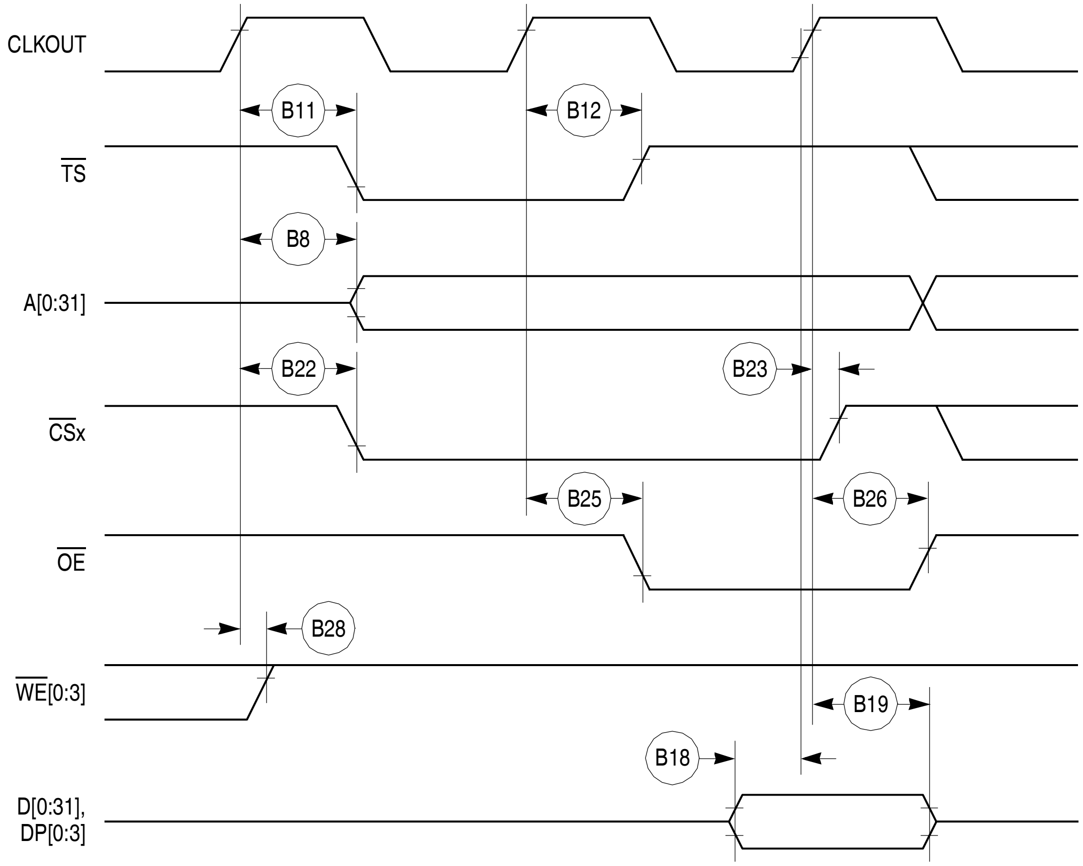


Figure 11. External Bus Read Timing (GPCM Controlled—ACS = 00)

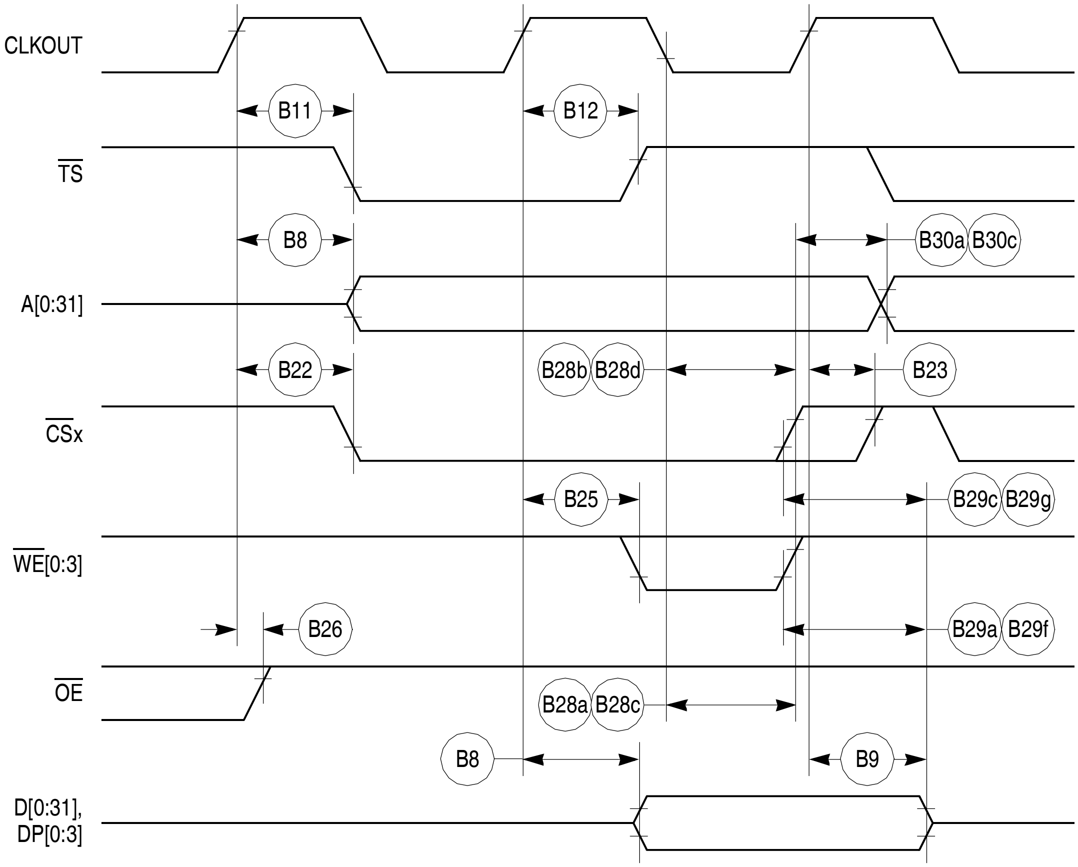


Figure 16. External Bus Write Timing (GPCM Controlled—TRLX = 0,1 CSNT = 1)

Table 8 provides interrupt timing for the MPC862/857T/857DSL.

Table 8. Interrupt Timing

Num	Characteristic [1]	All Frequencies		Unit
		Min	Max	
I39	$\overline{\text{IRQ}}$x valid to CLKOUT rising edge (set up time)	6.00		ns
I40	$\overline{\text{IRQ}}$x hold time after CLKOUT	2.00		ns
I41	$\overline{\text{IRQ}}$x pulse width low	3.00		ns
I42	$\overline{\text{IRQ}}$x pulse width high	3.00		ns
I43	$\overline{\text{IRQ}}$x edge-to-edge time	$4xT_{\text{CLOCKOUT}}$		—

[1] The timings I39 and I40 describe the testing conditions under which the $\overline{\text{IRQ}}$ lines are tested when being defined as level sensitive. The $\overline{\text{IRQ}}$ lines are synchronized internally and do not have to be asserted or negated with reference to the CLKOUT.
The timings I41, I42, and I43 are specified to allow the correct function of the $\overline{\text{IRQ}}$ lines detection circuitry, and has no direct relation with the total system interrupt latency that the MPC862/857T/857DSL is able to support.

Figure 24 provides the interrupt detection timing for the external level-sensitive lines.

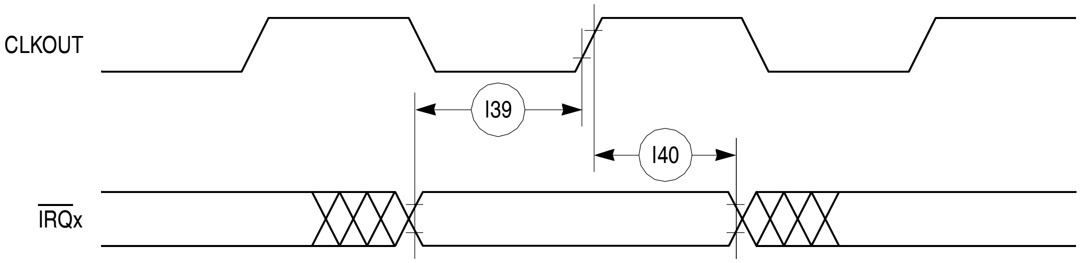


Figure 24. Interrupt Detection Timing for External Level Sensitive Lines

Figure 25 provides the interrupt detection timing for the external edge-sensitive lines.

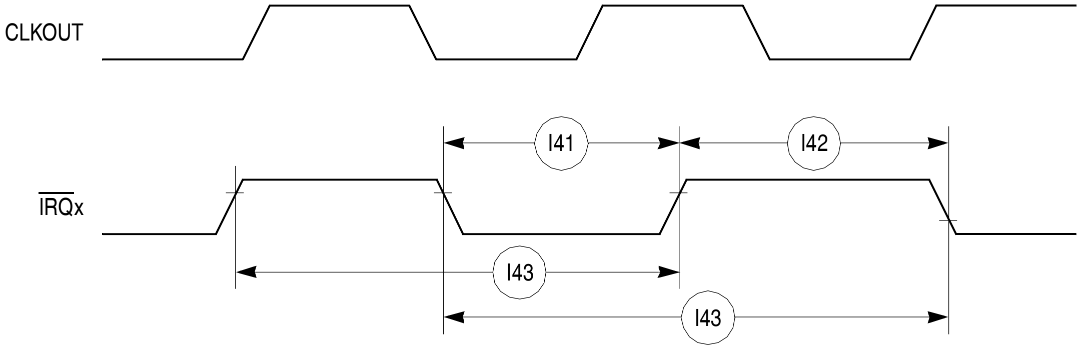


Figure 25. Interrupt Detection Timing for External Edge Sensitive Lines

Table 11 shows the debug port timing for the MPC862/857T/857DSL.

Table 11. Debug Port Timing

Num	Characteristic	All Frequencies		Unit
		Min	Max	
D61	DSCK cycle time	3 x $T_{CLOCKOUT}$		-
D62	DSCK clock pulse width	1.25 x $T_{CLOCKOUT}$		-
D63	DSCK rise and fall times	0.00	3.00	ns
D64	DSDI input data setup time	8.00		ns
D65	DSDI data hold time	5.00		ns
D66	DSCK low to DSDO data valid	0.00	15.00	ns
D67	DSCK low to DSDO invalid	0.00	2.00	ns

Figure 31 provides the input timing for the debug port clock.

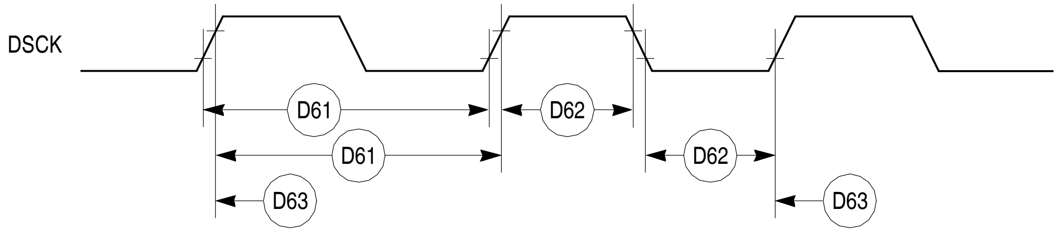


Figure 31. Debug Port Clock Input Timing

Figure 32 provides the timing for the debug port.

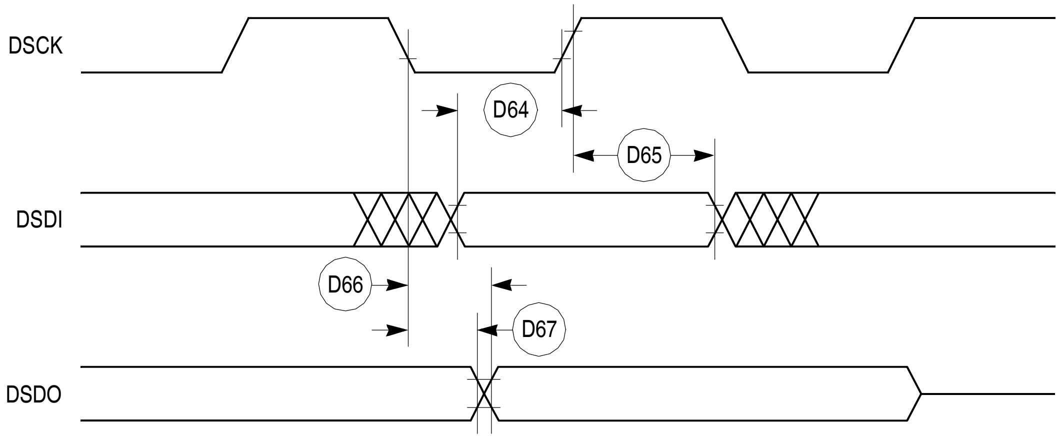


Figure 32. Debug Port Timings

11 CPM Electrical Characteristics

This section provides the AC and DC electrical specifications for the communications processor module (CPM) of the MPC862/857T/857DSL.

11.1 PIP/PIO AC Electrical Specifications

Table 14 provides the PIP/PIO AC timings as shown in Figure 40 though Figure 44.

Table 14. PIP/PIO Timing

Num	Characteristic	All Frequencies		Unit
		Min	Max	
21	Data-in setup time to STBI low	0	—	ns
22	Data-in hold time to STBI high	2.5 – t3 [1]	—	clk
23	STBI pulse width	1.5	—	clk
24	STBO pulse width	1 clk – 5 ns	—	ns
25	Data-out setup time to STBO low	2	—	clk
26	Data-out hold time from STBO high	5	—	clk
27	STBI low to STBO low (Rx interlock)	—	2	clk
28	STBI low to STBO high (Tx interlock)	2	—	clk
29	Data-in setup time to clock high	15	—	ns
30	Data-in hold time from clock high	7.5	—	ns
31	Clock low to data-out valid (CPU writes data, control, or direction)	—	25	ns

[1] t3 = Specification 23

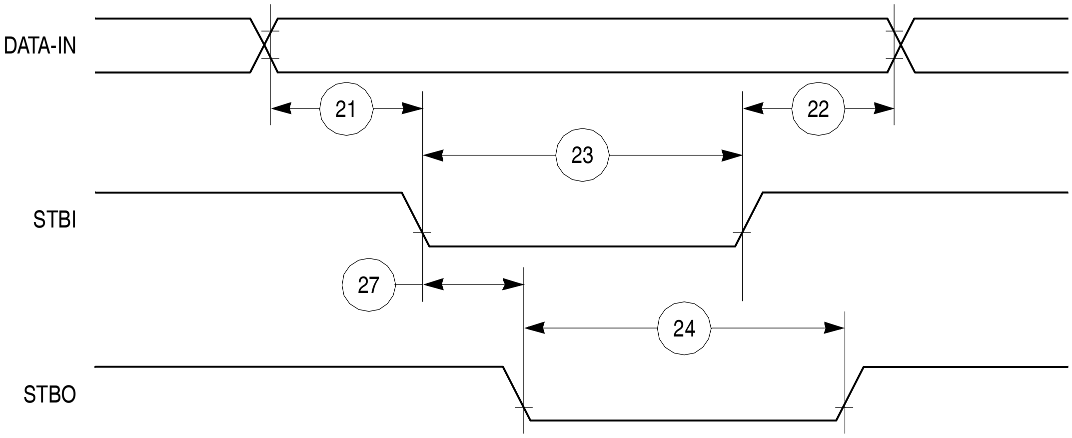


Figure 40. PIP Rx (Interlock Mode) Timing Diagram

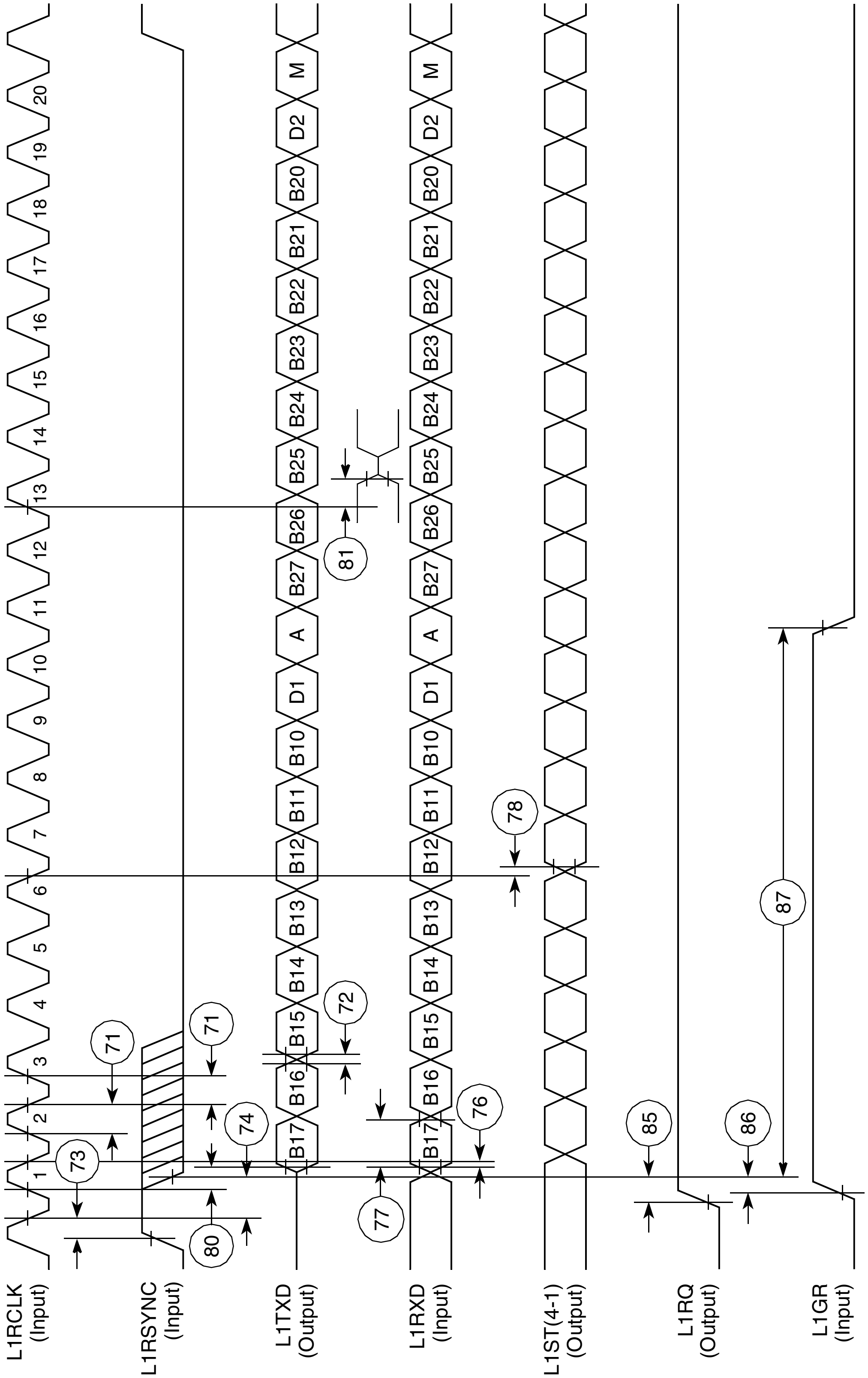


Figure 56. IDL Timing

11.7 SCC in NMSI Mode Electrical Specifications

Table 20 provides the NMSI external clock timing.

Table 20. NMSI External Clock Timing

Num	Characteristic	All Frequencies		Unit
		Min	Max	
100	RCLK1 and TCLK1 width high [1]	1/SYNCCLK	—	ns
101	RCLK1 and TCLK1 width low	1/SYNCCLK +5	—	ns
102	RCLK1 and TCLK1 rise/fall time	—	15.00	ns
103	TXD1 active delay (from TCLK1 falling edge)	0.00	50.00	ns
104	$\overline{\text{RTS1}}$ active/inactive delay (from TCLK1 falling edge)	0.00	50.00	ns
105	$\overline{\text{CTS1}}$ setup time to TCLK1 rising edge	5.00	—	ns
106	RXD1 setup time to RCLK1 rising edge	5.00	—	ns
107	RXD1 hold time from RCLK1 rising edge [2]	5.00	—	ns
108	$\overline{\text{CD1}}$ setup Time to RCLK1 rising edge	5.00	—	ns

[1] The ratios SyncCLK/RCLK1 and SyncCLK/TCLK1 must be greater than or equal to 2.25/1.

[2] Also applies to $\overline{\text{CD}}$ and $\overline{\text{CTS}}$ hold time when they are used as an external sync signal.

Table 21 provides the NMSI internal clock timing.

Table 21. NMSI Internal Clock Timing

Num	Characteristic	All Frequencies		Unit
		Min	Max	
100	RCLK1 and TCLK1 frequency [1]	0.00	SYNCCLK/3	MHz
102	RCLK1 and TCLK1 rise/fall time	—	—	ns
103	TXD1 active delay (from TCLK1 falling edge)	0.00	30.00	ns
104	$\overline{\text{RTS1}}$ active/inactive delay (from TCLK1 falling edge)	0.00	30.00	ns
105	$\overline{\text{CTS1}}$ setup time to TCLK1 rising edge	40.00	—	ns
106	RXD1 setup time to RCLK1 rising edge	40.00	—	ns
107	RXD1 hold time from RCLK1 rising edge [2]	0.00	—	ns
108	$\overline{\text{CD1}}$ setup time to RCLK1 rising edge	40.00	—	ns

[1] The ratios SyncCLK/RCLK1 and SyncCLK/TCLK1 must be greater or equal to 3/1.

[2] Also applies to $\overline{\text{CD}}$ and $\overline{\text{CTS}}$ hold time when they are used as an external sync signals.

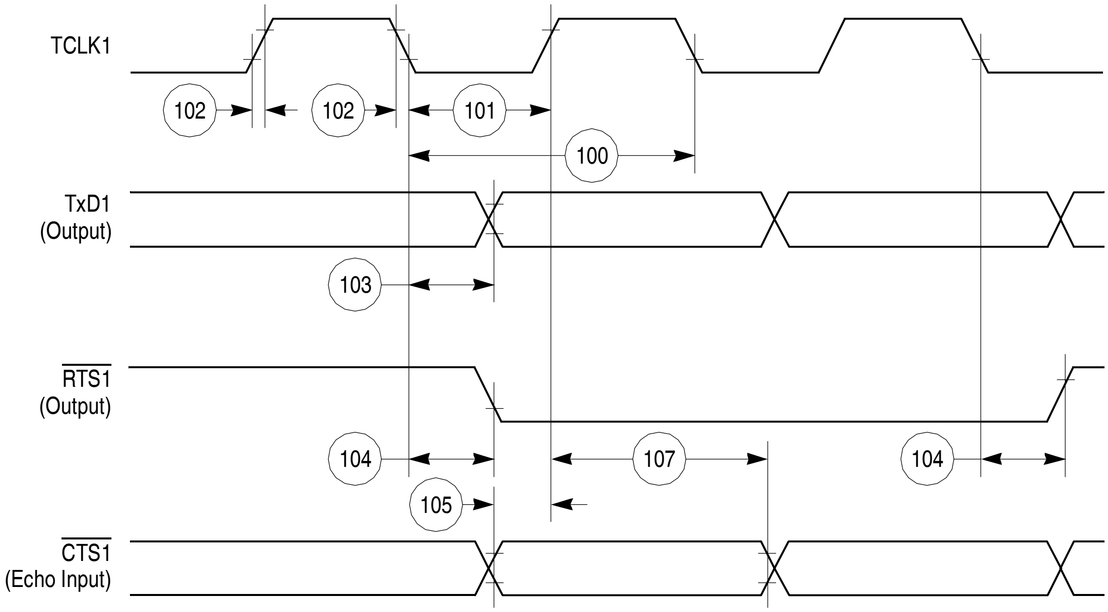


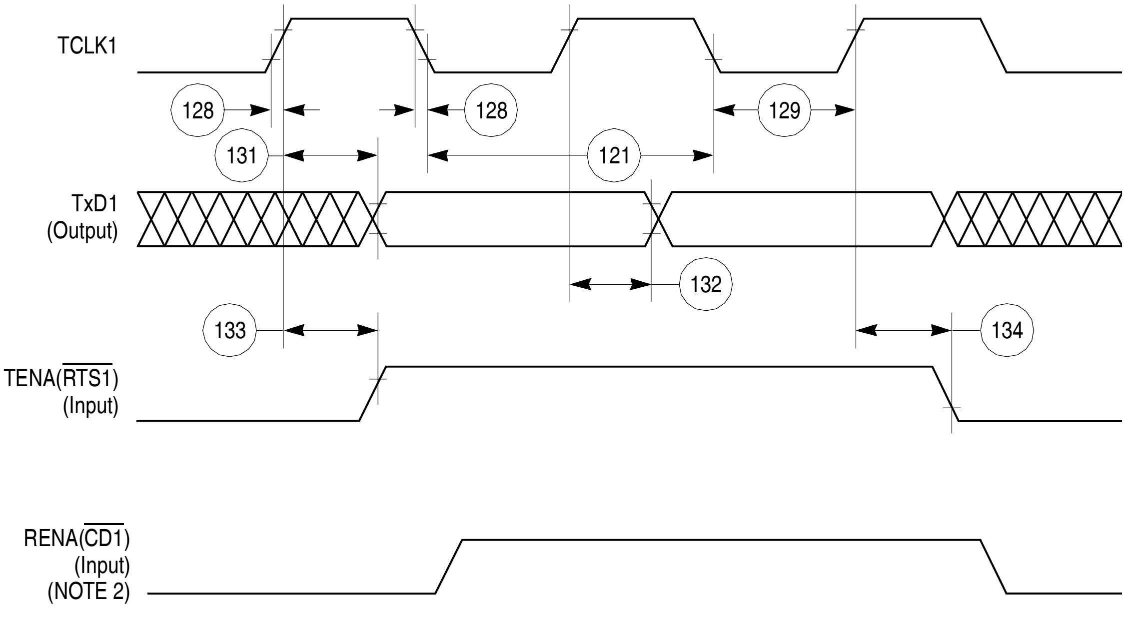
Figure 59. HDLC Bus Timing Diagram

11.8 Ethernet Electrical Specifications

Table 22 provides the Ethernet timings as shown in Figure 60 though Figure 64.

Table 22. Ethernet Timing

Num	Characteristic	All Frequencies		Unit
		Min	Max	
120	CLSN width high	40	—	ns
121	RCLK1 rise/fall time	—	15	ns
122	RCLK1 width low	40	—	ns
123	RCLK1 clock period [1]	80	120	ns
124	RXD1 setup time	20	—	ns
125	RXD1 hold time	5	—	ns
126	RENA active delay (from RCLK1 rising edge of the last data bit)	10	—	ns
127	RENA width low	100	—	ns
128	TCLK1 rise/fall time	—	15	ns
129	TCLK1 width low	40	—	ns
130	TCLK1 clock period[1]	99	101	ns
131	TXD1 active delay (from TCLK1 rising edge)	10	50	ns
132	TXD1 inactive delay (from TCLK1 rising edge)	10	50	ns
133	TENA active delay (from TCLK1 rising edge)	10	50	ns



NOTES:
1. Transmit clock invert (TCI) bit in GSMR is set.
2. If RENA is deasserted before TENA, or RENA is not asserted at all during transmit, then the CSL bit is set in the buffer descriptor at the end of the frame transmission.

Figure 62. Ethernet Transmit Timing Diagram

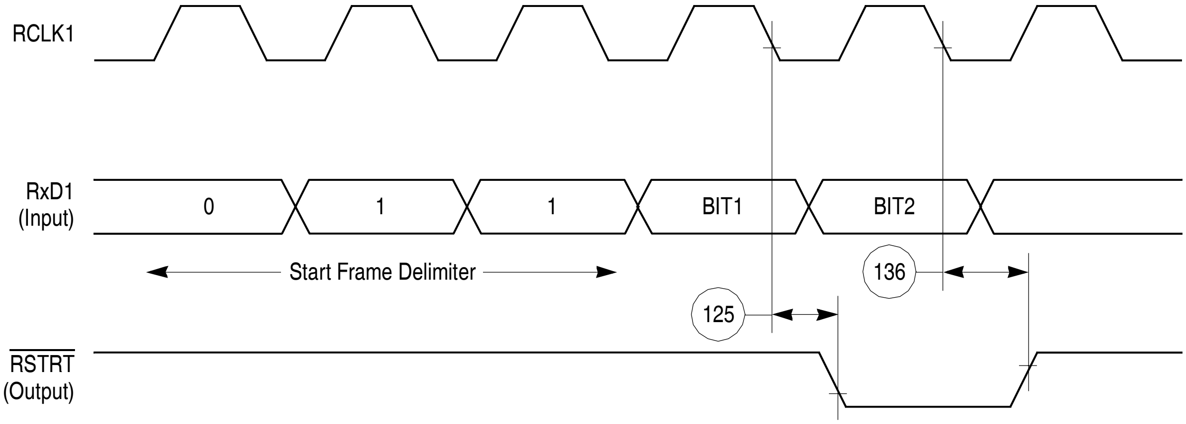


Figure 63. CAM Interface Receive Start Timing Diagram

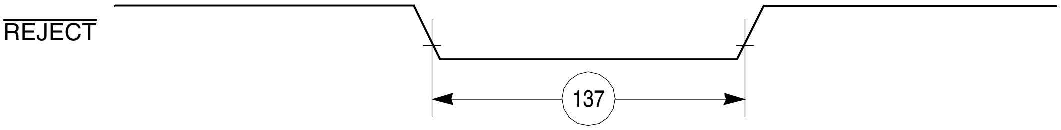


Figure 64. CAM Interface REJECT Timing Diagram

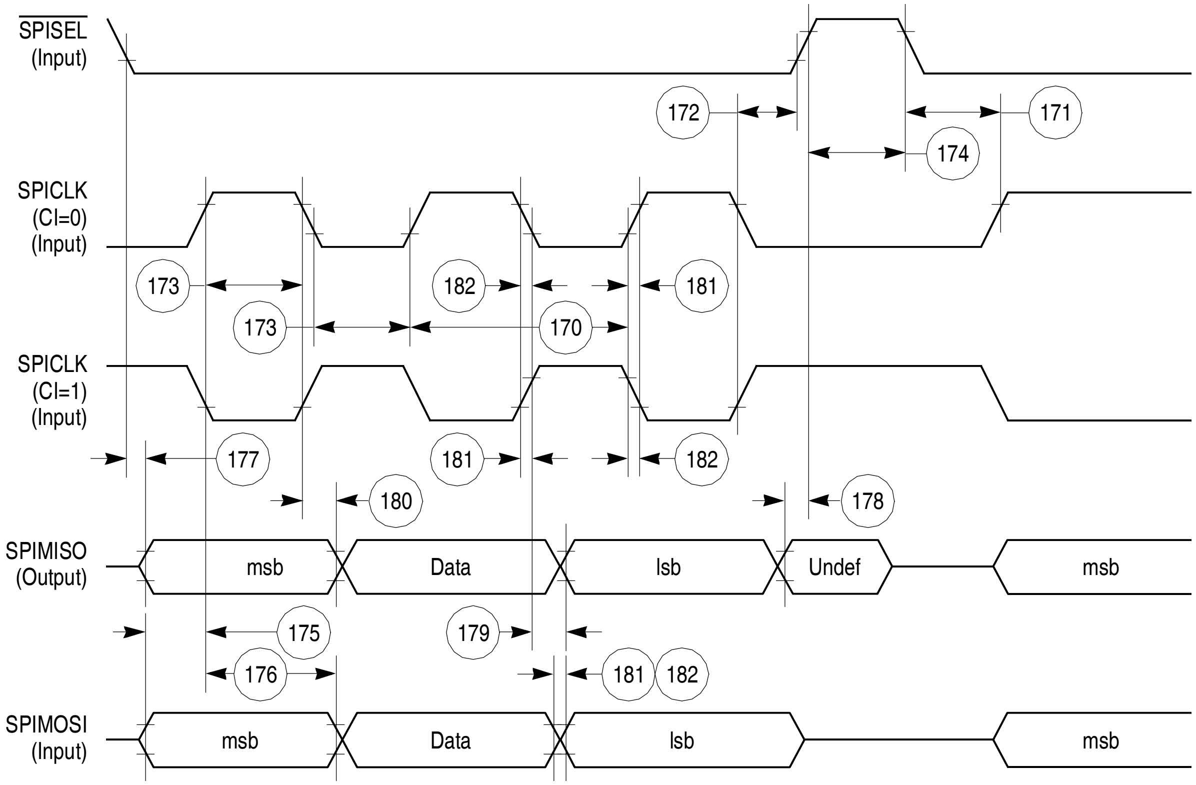


Figure 68. SPI Slave (CP = 0) Timing Diagram

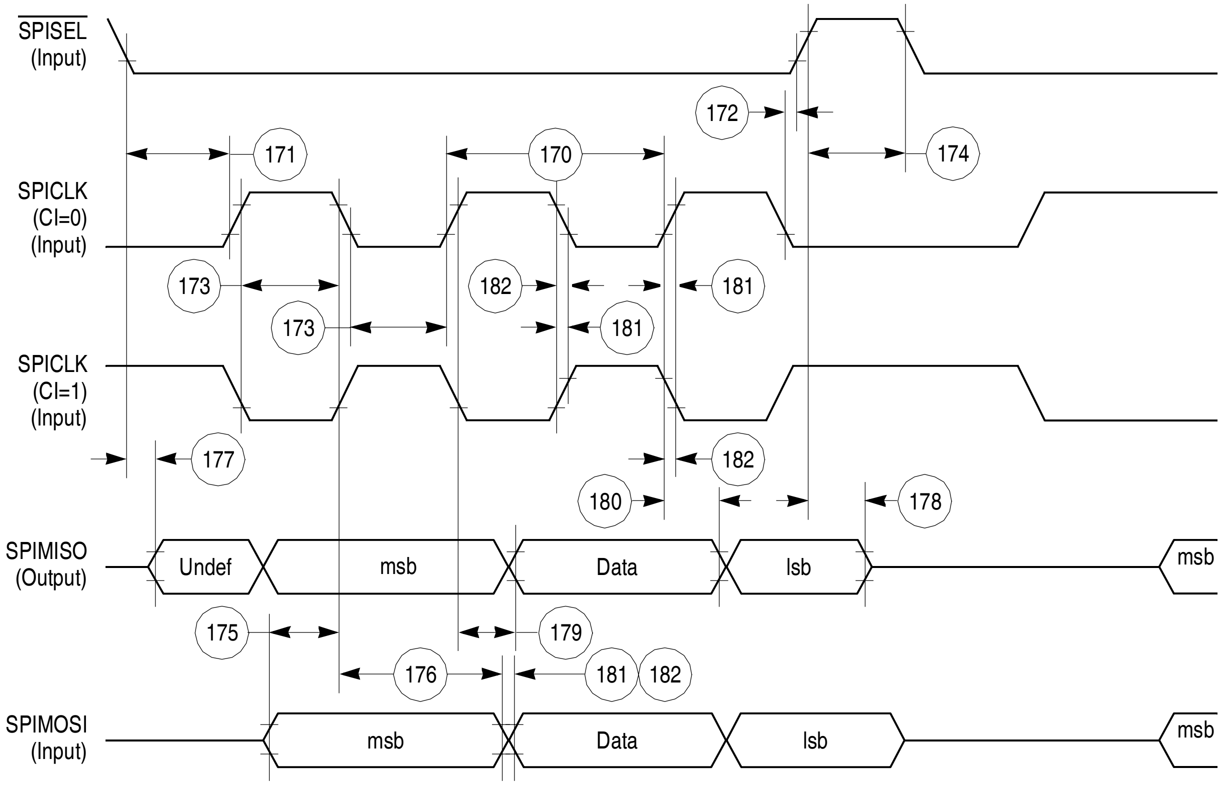


Figure 69. SPI Slave (CP = 1) Timing Diagram

13.1 MII Receive Signal Timing (MII_RXD[3:0], MII_RX_DV, MII_RX_ER, MII_RX_CLK)

The receiver functions correctly up to a MII_RX_CLK maximum frequency of 25MHz +1%. There is no minimum frequency requirement. In addition, the processor clock frequency must exceed the MII_RX_CLK frequency - 1%.

Table 29 provides information on the MII receive signal timing.

Table 29. MII Receive Signal Timing

Num	Characteristic	Min	Max	Unit
M1	MII_RXD[3:0], MII_RX_DV, MII_RX_ER to MII_RX_CLK setup	5	—	ns
M2	MII_RX_CLK to MII_RXD[3:0], MII_RX_DV, MII_RX_ER hold	5	—	ns
M3	MII_RX_CLK pulse width high	35%	65%	MII_RX_CLK period
M4	MII_RX_CLK pulse width low	35%	65%	MII_RX_CLK period

Figure 73 shows MII receive signal timing.

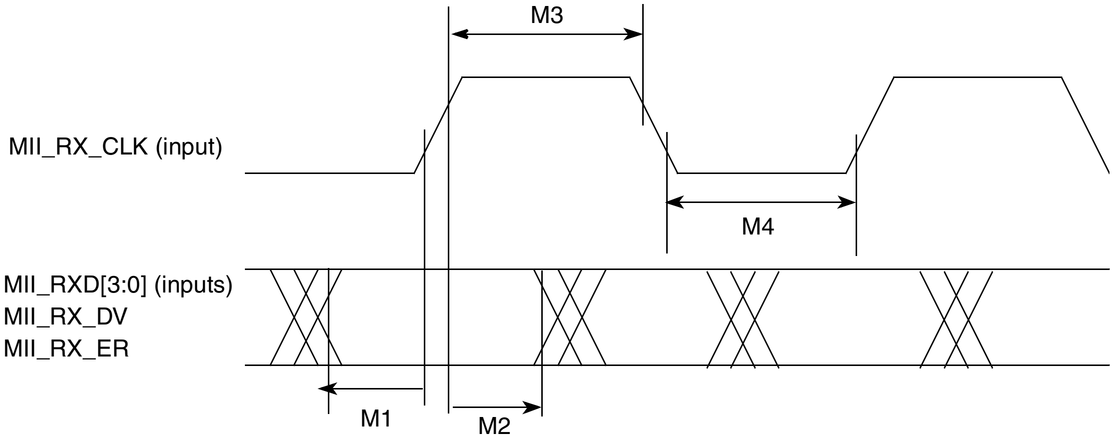


Figure 73. MII Receive Signal Timing Diagram

13.2 MII Transmit Signal Timing (MII_TXD[3:0], MII_TX_EN, MII_TX_ER, MII_TX_CLK)

The transmitter functions correctly up to a MII_TX_CLK maximum frequency of 25 MHz +1%. There is no minimum frequency requirement. In addition, the processor clock frequency must exceed the MII_TX_CLK frequency - 1%.

Table 30 provides information on the MII transmit signal timing.

Table 30. MII Transmit Signal Timing

Num	Characteristic	Min	Max	Unit
M5	MII_TX_CLK to MII_TXD[3:0], MII_TX_EN, MII_TX_ER invalid	5	—	ns
M6	MII_TX_CLK to MII_TXD[3:0], MII_TX_EN, MII_TX_ER valid	—	25	

Table 30. MII Transmit Signal Timing (continued)

Num	Characteristic	Min	Max	Unit
M7	MII_TX_CLK pulse width high	35%	65%	MII_TX_CLK period
M8	MII_TX_CLK pulse width low	35%	65%	MII_TX_CLK period

Figure 74 shows the MII transmit signal timing diagram.

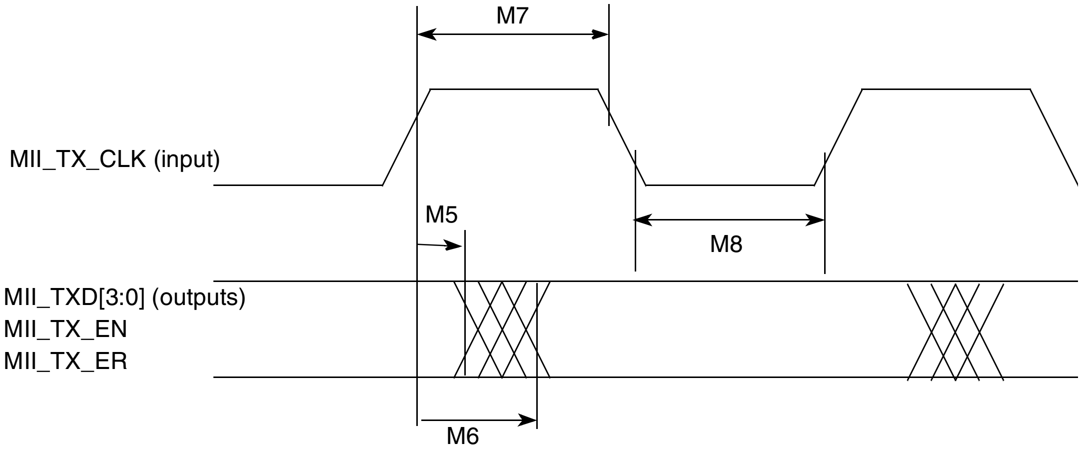


Figure 74. MII Transmit Signal Timing Diagram

13.3 MII Async Inputs Signal Timing (MII_CRS, MII_COL)

Table 31 provides information on the MII async inputs signal timing.

Table 31. MII Async Inputs Signal Timing

Num	Characteristic	Min	Max	Unit
M9	MII_CRS, MII_COL minimum pulse width	1.5	—	MII_TX_CLK period

Figure 75 shows the MII asynchronous inputs signal timing diagram.

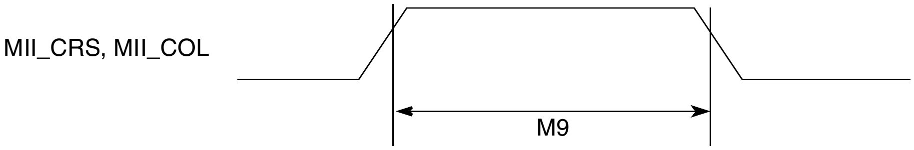


Figure 75. MII Async Inputs Timing Diagram

13.4 MII Serial Management Channel Timing (MII_MDIO, MII_MDC)

Table 32 provides information on the MII serial management channel signal timing. The FEC functions correctly with a maximum MDC frequency in excess of 2.5 MHz. The exact upper bound is under investigation.

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