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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	Active
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 ~ 95°C (TA)
Security Features	-
Package / Case	357-BBGA
Supplier Device Package	357-PBGA (25x25)
Purchase URL	<a href="https://www.e-xfl.com/pro/item?MUrl=&amp;PartUrl=mpc859tvr100a">https://www.e-xfl.com/pro/item?MUrl=&amp;PartUrl=mpc859tvr100a</a>

- One serial peripheral interface (SPI)
  - Supports master and slave modes
  - Supports multiple-master operation on the same bus
- One inter-integrated circuit (I<sup>2</sup>C) port
  - Supports master and slave modes
  - Multiple-master environment support
- Time slot assigner (TSA) (MPC859DSL does not have TSA.)
  - Allows SCCs and SMCs to run in multiplexed and/or non-multiplexed operation
  - Supports T1, CEPT, PCM highway, ISDN basic rate, ISDN primary rate, user-defined
  - 1- or 8-bit resolution
  - Allows independent transmit and receive routing, frame synchronization, and clocking
  - Allows dynamic changes
  - On MPC866P and MPC866T, can be internally connected to six serial channels (four SCCs and two SMCs); on MPC859P and MPC859T, can be connected to three serial channels (one SCC and two SMCs).
- Parallel interface port (PIP)
  - Centronics interface support
  - Supports fast connection between compatible ports on MPC866/859 or MC68360
- PCMCIA interface
  - Master (socket) interface, compliant with PCI Local Bus Specification (Rev 2.1)
  - Supports one or two PCMCIA sockets whether ESAR functionality is enabled
  - Eight memory or I/O windows supported
- 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 breakpoint internally
- Normal high and normal low power modes to conserve power
- 1.8 V core and 3.3 V I/O operation with 5-V TTL compatibility; refer to [Table 6](#) for a listing of the 5-V tolerant pins.
- 357-pin plastic ball grid array (PBGA) package
- Operation up to 133 MHz

## 8 Power Supply and Power Sequencing

This section provides design considerations for the MPC866/859 power supply. The MPC866/859 has a core voltage (VDDL) and PLL voltage (VDDSYN) that operates at a lower voltage than the I/O voltage VDDH. The I/O section of the MPC866/859 is supplied with 3.3 V across VDDH and  $V_{SS}$  (GND).

Signals PA[0:15], PB[14:31], PC[4:15], PD[3:15], TDI, TDO, TCK, TRST\_B, TMS, MII\_TXEN, and MII\_MDIO are 5-V tolerant. All inputs cannot be more than 2.5 V greater than VDDH. In addition, 5-V tolerant pins cannot exceed 5.5 V and the remaining input pins cannot exceed 3.465 V. This restriction applies to power up/down and normal operation.

One consequence of multiple power supplies is that when power is initially applied the voltage rails ramp up at different rates. The rates depend on the nature of the power supply, the type of load on each power supply, and the manner in which different voltages are derived. The following restrictions apply:

- VDDL must not exceed VDDH during power up and power down.
- VDDL must not exceed 1.9 V and VDDH must not exceed 3.465 V.

These cautions are necessary for the long term reliability of the part. If they are violated, the electrostatic discharge (ESD) protection diodes are forward-biased and excessive current can flow through these diodes. If the system power supply design does not control the voltage sequencing, the circuit shown in [Figure 4](#) can be added to meet these requirements. The MUR420 Schottky diodes control the maximum potential difference between the external bus and core power supplies on powerup and the 1N5820 diodes regulate the maximum potential difference on powerdown.

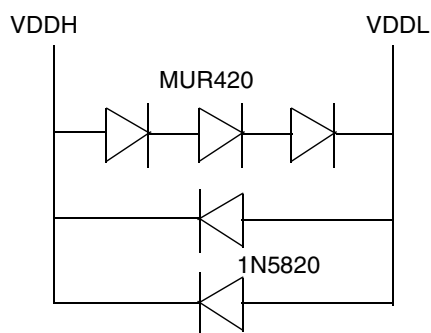


Figure 4. Example Voltage Sequencing Circuit

## 9 Layout Practices

Each  $V_{DD}$  pin on the MPC866/859 should be provided with a low-impedance path to the board's supply. Furthermore, each GND pin should be provided with a low-impedance path to ground. The power supply pins drive distinct groups of logic on chip. The  $V_{DD}$  power supply should be bypassed to ground using at least four 0.1  $\mu\text{F}$  bypass capacitors located as close as possible to the four sides of the package. Each board designed should be characterized and additional appropriate decoupling capacitors should be used if required. The capacitor leads and associated printed-circuit traces connecting to chip  $V_{DD}$  and GND should be kept to less than 1/2" per capacitor lead. At a minimum, a four-layer board employing two inner layers as  $V_{DD}$  and GND planes should be used.

All output pins on the MPC866/859 have fast rise and fall times. Printed-circuit (PC) trace interconnection length should be minimized in order to minimize undershoot and reflections caused by these fast output switching times.

Table 9. Bus Operation Timings (continued)

Num	Characteristic	33 MHz		40 MHz		50 MHz		66 MHz		Unit
		Min	Max	Min	Max	Min	Max	Min	Max	
B1d	CLKOUT phase jitter peak-to-peak for OSCLK $\geq$ 15 MHz	—	4	—	4	—	4	—	4	ns
	CLKOUT phase jitter peak-to-peak for OSCLK $<$ 15 MHz	—	5	—	5	—	5	—	5	ns
B2	CLKOUT pulse width low (MIN = 0.4 x B1, MAX = 0.6 x B1)	12.1	18.2	10.0	15.0	8.0	12.0	6.1	9.1	ns
B3	CLKOUT pulse width high (MIN = 0.4 x B1, MAX = 0.6 x B1)	12.1	18.2	10.0	15.0	8.0	12.0	6.1	9.1	ns
B4	CLKOUT rise time	—	4.00	—	4.00	—	4.00	—	4.00	ns
B5	CLKOUT fall time	—	4.00	—	4.00	—	4.00	—	4.00	ns
B7	CLKOUT to A(0:31), BADDR(28:30), RD/WR, BURST, D(0:31), DP(0:3) output hold (MIN = 0.25 x B1)	7.60	—	6.30	—	5.00	—	3.80	—	ns
B7a	CLKOUT to TSIZ(0:1), REG, RSV, AT(0:3), BDIP, PTR output hold (MIN = 0.25 x B1)	7.60	—	6.30	—	5.00	—	3.80	—	ns
B7b	CLKOUT to BR, BG, FRZ, VFLS(0:1), VF(0:2), IWP(0:2), LWP(0:1), STS output hold (MIN = 0.25 x B1)	7.60	—	6.30	—	5.00	—	3.80	—	ns
B8	CLKOUT to A(0:31), BADDR(28:30) RD/WR, BURST, D(0:31), DP(0:3), valid (MAX = 0.25 x B1 + 6.3)	—	13.80	—	12.50	—	11.30	—	10.00	ns
B8a	CLKOUT to TSIZ(0:1), REG, RSV, AT(0:3), BDIP, PTR valid (MAX = 0.25 x B1 + 6.3)	—	13.80	—	12.50	—	11.30	—	10.00	ns
B8b	CLKOUT to BR, BG, VFLS(0:1), VF(0:2), IWP(0:2), FRZ, LWP(0:1), STS valid <sup>4</sup> (MAX = 0.25 x B1 + 6.3)	—	13.80	—	12.50	—	11.30	—	10.00	ns
B9	CLKOUT to A(0:31), BADDR(28:30), RD/WR, BURST, D(0:31), DP(0:3), TSIZ(0:1), REG, 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 TS, BB assertion (MAX = 0.25 x B1 + 6.0)	7.60	13.60	6.30	12.30	5.00	11.00	3.80	9.80	ns
B11a	CLKOUT to TA, BI assertion (when driven by the memory controller or PCMCIA interface) (MAX = 0.00 x B1 + 9.30 <sup>1</sup> )	2.50	9.30	2.50	9.30	2.50	9.30	2.50	9.80	ns
B12	CLKOUT to TS, 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

**Table 9. Bus Operation Timings (continued)**

Num	Characteristic	33 MHz		40 MHz		50 MHz		66 MHz		Unit
		Min	Max	Min	Max	Min	Max	Min	Max	
B12a	CLKOUT to $\overline{TA}$ , $\overline{BI}$ 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 $\overline{TS}$ , $\overline{BB}$ 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 $\overline{TA}$ , $\overline{BI}$ 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 $\overline{TEA}$ 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 $\overline{TEA}$ 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	$\overline{TA}$ , $\overline{BI}$ valid to CLKOUT (setup time) (MIN = 0.00 x B1 + 6.00)	6.00	—	6.00	—	6.00	—	6.00	—	ns
B16a	$\overline{TEA}$ , $\overline{KR}$ , $\overline{RETRY}$ , $\overline{CR}$ valid to CLKOUT (setup time) (MIN = 0.00 x B1 + 4.5)	4.50	—	4.50	—	4.50	—	4.50	—	ns
B16b	$\overline{BB}$ , $\overline{BG}$ , $\overline{BR}$ , valid to CLKOUT (setup time) <sup>2</sup> (4 MIN = 0.00 x B1 + 0.00)	4.00	—	4.00	—	4.00	—	4.00	—	ns
B17	CLKOUT to $\overline{TA}$ , $\overline{TEA}$ , $\overline{BI}$ , $\overline{BB}$ , $\overline{BG}$ , $\overline{BR}$ valid (hold time) (MIN = 0.00 x B1 + 1.00 <sup>3</sup> )	1.00	—	1.00	—	1.00	—	2.00	—	ns
B17a	CLKOUT to $\overline{KR}$ , $\overline{RETRY}$ , $\overline{CR}$ valid (hold time) (MIN = 0.00 x B1 + 2.00)	2.00	—	2.00	—	2.00	—	2.00	—	ns
B18	D(0:31), DP(0:3) valid to CLKOUT rising edge (setup time) <sup>4</sup> (MIN = 0.00 x B1 + 6.00)	6.00	—	6.00	—	6.00	—	6.00	—	ns
B19	CLKOUT rising edge to D(0:31), DP(0:3) valid (hold time) <sup>4</sup> (MIN = 0.00 x B1 + 1.00 <sup>5</sup> )	1.00	—	1.00	—	1.00	—	2.00	—	ns
B20	D(0:31), DP(0:3) valid to CLKOUT falling edge (setup time) <sup>6</sup> (MIN = 0.00 x B1 + 4.00)	4.00	—	4.00	—	4.00	—	4.00	—	ns
B21	CLKOUT falling edge to D(0:31), DP(0:3) valid (hold Time) <sup>6</sup> (MIN = 0.00 x B1 + 2.00)	2.00	—	2.00	—	2.00	—	2.00	—	ns
B22	CLKOUT rising edge to $\overline{CS}$ asserted GPCM ACS = 00 (MAX = 0.25 x B1 + 6.3)	7.60	13.80	6.30	12.50	5.00	11.30	3.80	10.00	ns
B22a	CLKOUT falling edge to $\overline{CS}$ asserted GPCM ACS = 10, TRLX = 0 (MAX = 0.00 x B1 + 8.00)	—	8.00	—	8.00	—	8.00	—	8.00	ns

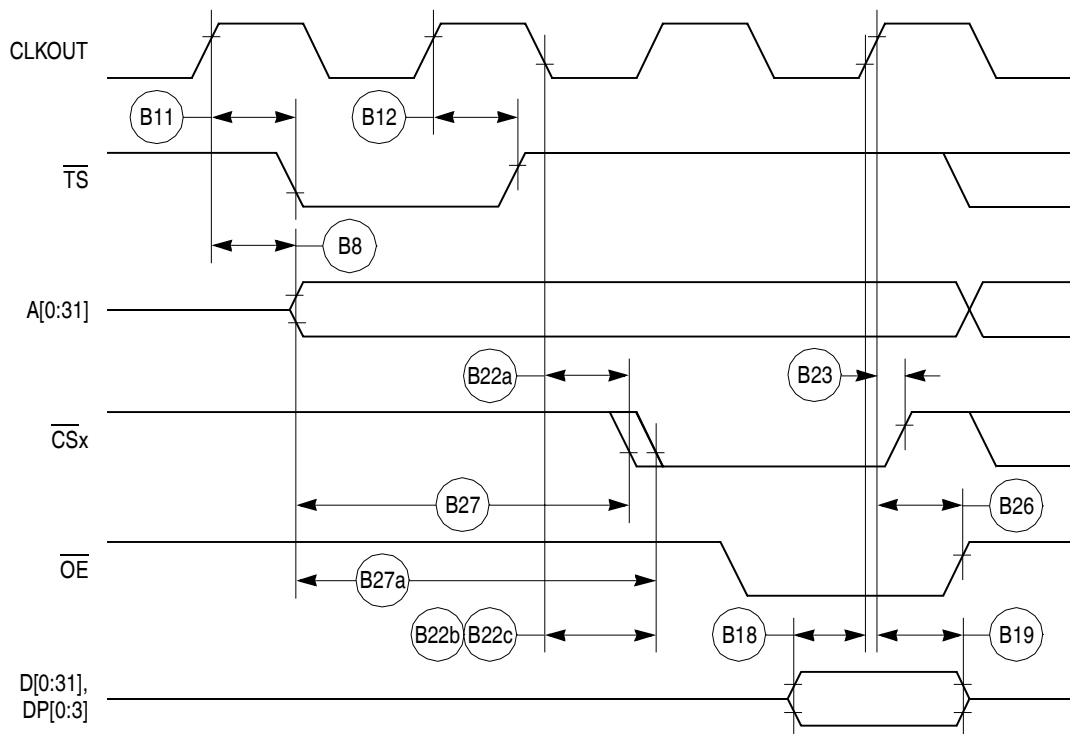
Table 9. Bus Operation Timings (continued)

Num	Characteristic	33 MHz		40 MHz		50 MHz		66 MHz		Unit
		Min	Max	Min	Max	Min	Max	Min	Max	
B22b	CLKOUT falling edge to $\overline{CS}$ asserted GPCM ACS = 11, TRLX = 0, EBDF = 0 (MAX = 0.25 x B1 + 6.3)	7.60	13.80	6.30	12.50	5.00	11.30	3.80	10.00	ns
B22c	CLKOUT falling edge to $\overline{CS}$ asserted GPCM ACS = 11, TRLX = 0, EBDF = 1 (MAX = 0.375 x B1 + 6.6)	10.90	18.00	10.90	16.00	7.00	14.10	5.20	12.30	ns
B23	CLKOUT rising edge to $\overline{CS}$ negated GPCM read access, GPCM write access ACS = 00, TRLX = 0 & CSNT = 0 (MAX = 0.00 x B1 + 8.00)	2.00	8.00	2.00	8.00	2.00	8.00	2.00	8.00	ns
B24	A(0:31) and BADDR(28:30) to $\overline{CS}$ asserted GPCM ACS = 10, TRLX = 0 (MIN = 0.25 x B1 - 2.00)	5.60	—	4.30	—	3.00	—	1.80	—	ns
B24a	A(0:31) and BADDR(28:30) to $\overline{CS}$ asserted GPCM ACS = 11, TRLX = 0 (MIN = 0.50 x B1 - 2.00)	13.20	—	10.50	—	8.00	—	5.60	—	ns
B25	CLKOUT rising edge to $\overline{OE}$ , $\overline{WE}(0:3)$ asserted (MAX = 0.00 x B1 + 9.00)	—	9.00	—	9.00	—	9.00	—	9.00	ns
B26	CLKOUT rising edge to $\overline{OE}$ negated (MAX = 0.00 x B1 + 9.00)	2.00	9.00	2.00	9.00	2.00	9.00	2.00	9.00	ns
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

**Table 9. Bus Operation Timings (continued)**

Num	Characteristic	33 MHz		40 MHz		50 MHz		66 MHz		Unit
		Min	Max	Min	Max	Min	Max	Min	Max	
B31d	CLKOUT falling edge to $\overline{CS}$ valid, as requested by control bit CST1 in the corresponding word in the UPM EBDF = 1 (MAX = $0.375 \times B1 + 6.6$ )	13.30	18.00	11.30	16.00	9.40	14.10	7.60	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 = $0.00 \times B1 + 6.00$ )	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 = $0.25 \times B1 + 6.80$ )	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 = $0.00 \times B1 + 8.00$ )	1.50	8.00	1.50	8.00	1.50	8.00	1.50	8.00	ns
B32c	CLKOUT rising edge to $\overline{BS}$ valid, as requested by control bit BST3 in the corresponding word in the UPM (MAX = $0.25 \times B1 + 6.80$ )	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 = $0.375 \times B1 + 6.60$ )	13.30	18.00	11.30	16.00	9.40	14.10	7.60	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 = $0.00 \times B1 + 6.00$ )	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 = $0.25 \times B1 + 6.80$ )	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 = $0.25 \times B1 - 2.00$ )	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 = $0.50 \times B1 - 2.00$ )	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 = $0.75 \times B1 - 2.00$ )	20.70	—	16.70	—	13.00	—	9.40	—	ns

### Bus Signal Timing



**Figure 15. External Bus Read Timing (GPCM Controlled—TRLX = 0 or 1, ACS = 10, ACS = 11)**



Figure 16 through Figure 18 show the timing for the external bus write controlled by various GPCM factors.

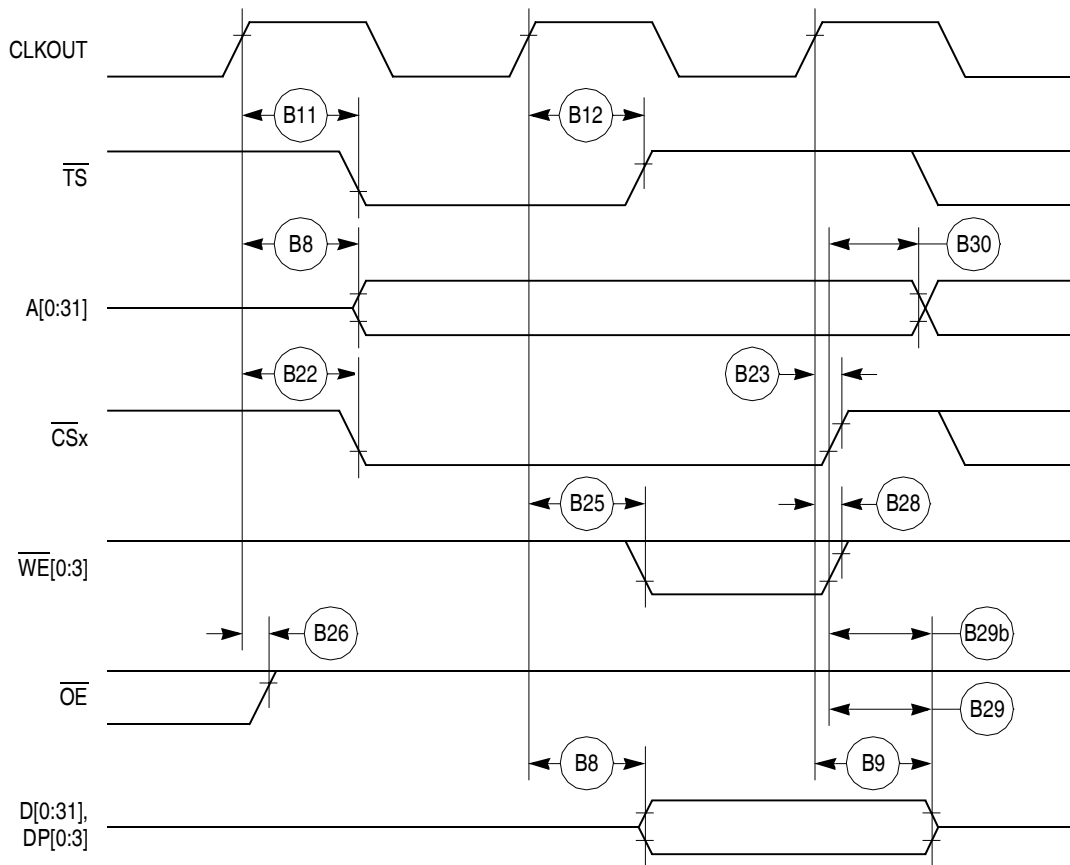


Figure 16. External Bus Write Timing (GPCM Controlled—TRLX = 0 or 1, CSNT = 0)

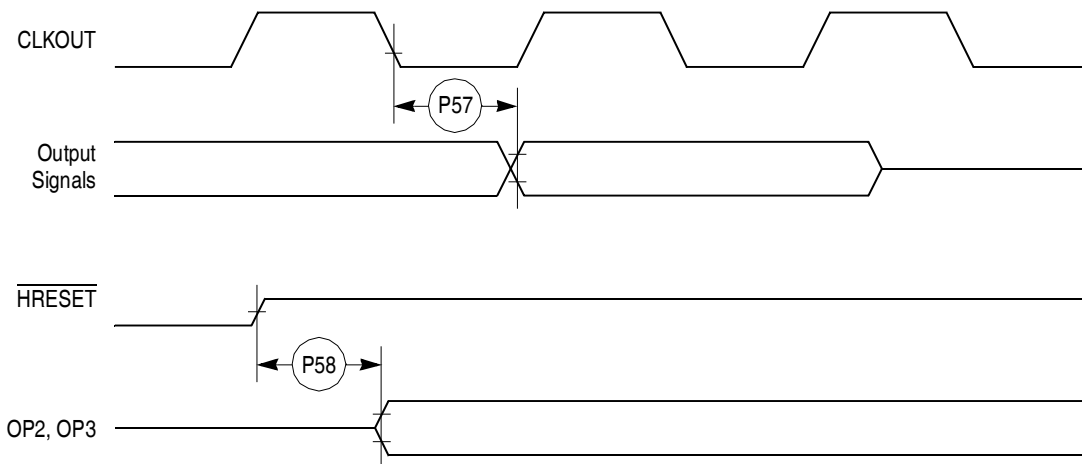
Table 12 shows the PCMCIA port timing for the MPC866/859.

**Table 12. PCMCIA Port Timing**

Num	Characteristic	33 MHz		40 MHz		50 MHz		66 MHz		Unit
		Min	Max	Min	Max	Min	Max	Min	Max	
P57	CLKOUT to OPx, valid (MAX = 0.00 x B1 + 19.00)	—	19.00	—	19.00	—	19.00	—	19.00	ns
P58	$\overline{\text{HRESET}}$ negated to OPx drive <sup>1</sup> (MIN = 0.75 x B1 + 3.00)	25.70	—	21.70	—	18.00	—	14.40	—	ns
P59	IP_Xx valid to CLKOUT rising edge (MIN = 0.00 x B1 + 5.00)	5.00	—	5.00	—	5.00	—	5.00	—	ns
P60	CLKOUT rising edge to IP_Xx invalid (MIN = 0.00 x B1 + 1.00)	1.00	—	1.00	—	1.00	—	1.00	—	ns

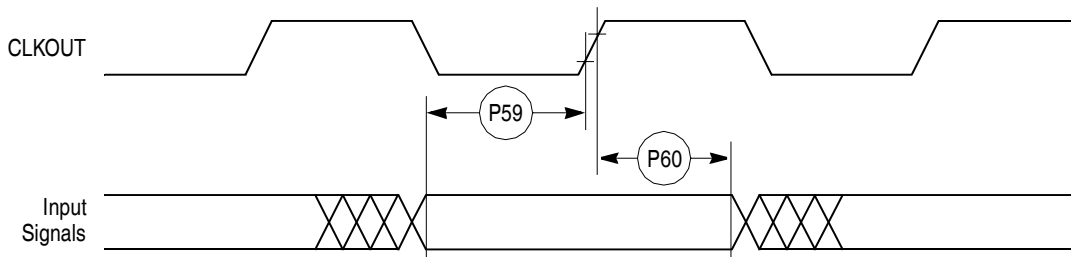
<sup>1</sup> OP2 and OP3 only.

Figure 30 shows the PCMCIA output port timing for the MPC866/859.



**Figure 30. PCMCIA Output Port Timing**

Figure 31 shows the PCMCIA output port timing for the MPC866/859.



**Figure 31. PCMCIA Input Port Timing**

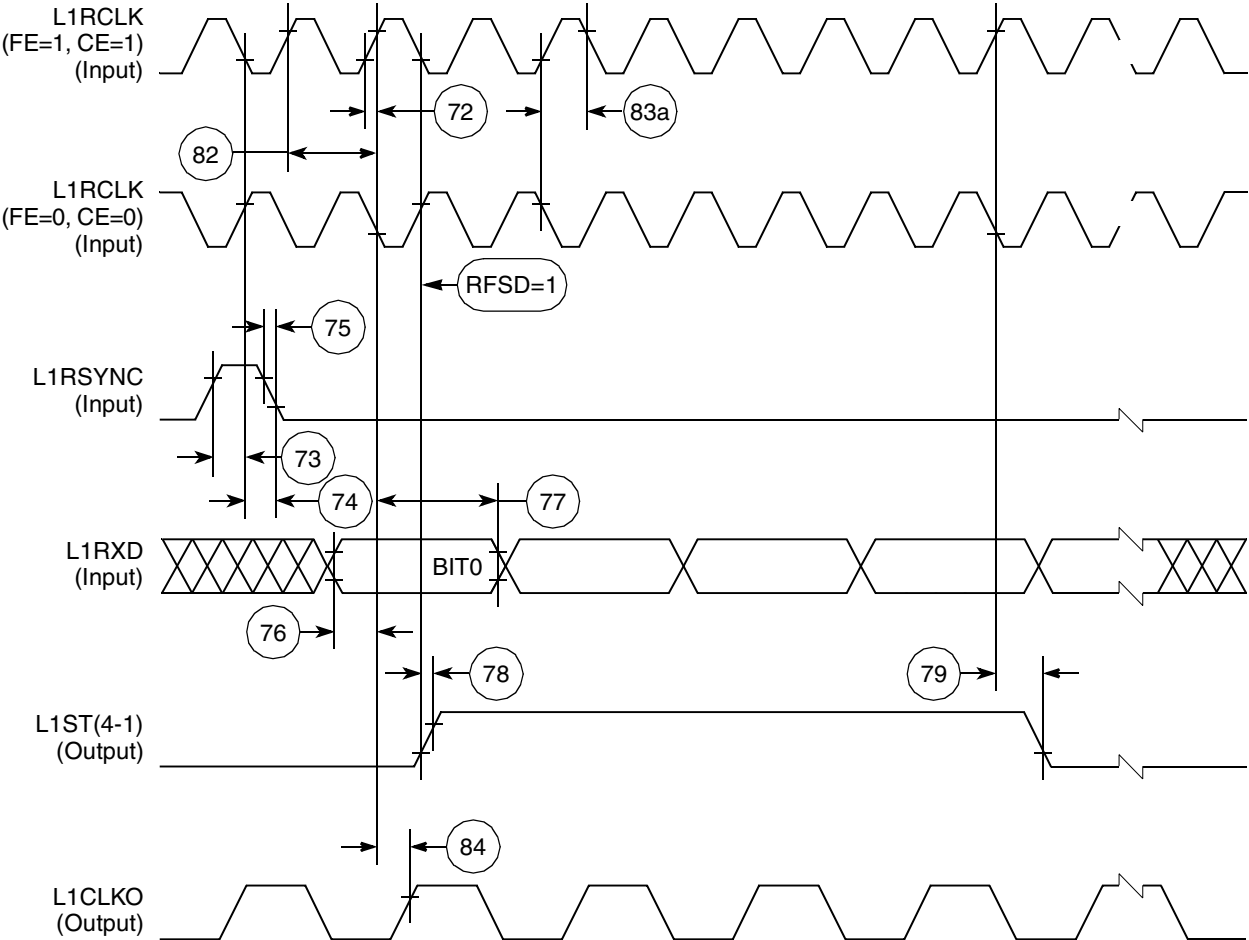


Figure 54. SI Receive Timing with Double-Speed Clocking (DSC = 1)

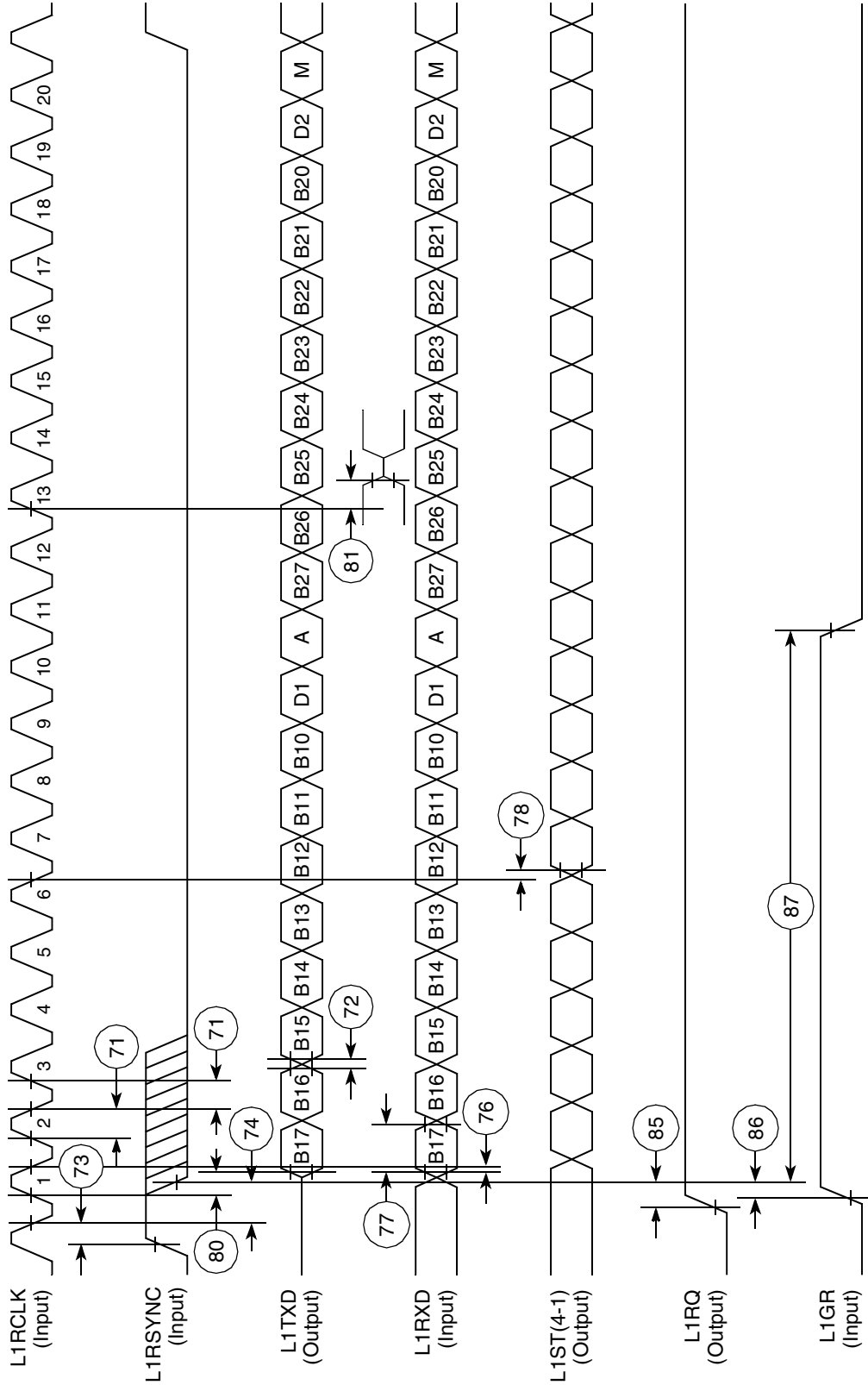


Figure 57. IDL Timing

## 12.7 SCC in NMSI Mode Electrical Specifications

Table 22 shows the NMSI external clock timings.

**Table 22. NMSI External Clock Timings**

Num	Characteristic	All Frequencies		Unit
		Min	Max	
100	RCLK1 and TCLK1 width high <sup>1</sup>	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 <sup>2</sup>	5.00	—	ns
108	$\overline{\text{CD1}}$ setup time to RCLK1 rising edge	5.00	—	ns

<sup>1</sup> The ratios SyncCLK/RCLK1 and SyncCLK/TCLK1 must be greater than or equal to 2.25/1.

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

Table 23 shows the NMSI internal clock timings.

**Table 23. NMSI Internal Clock Timings**

Num	Characteristic	All Frequencies		Unit
		Min	Max	
100	RCLK1 and TCLK1 frequency <sup>1</sup>	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 <sup>2</sup>	0.00	—	ns
108	$\overline{\text{CD1}}$ setup time to RCLK1 rising edge	40.00	—	ns

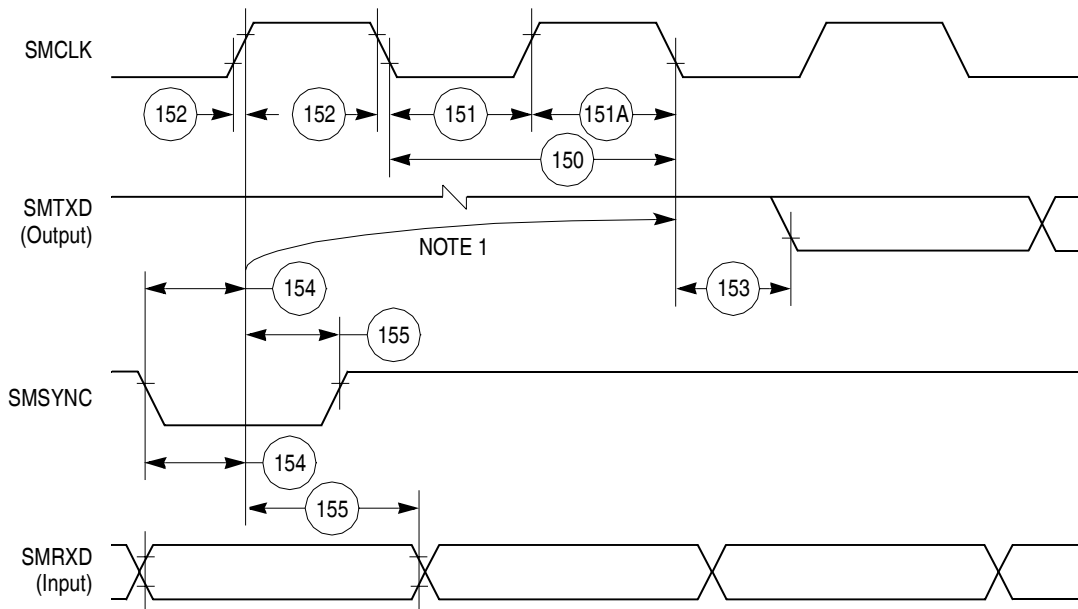
<sup>1</sup> The ratios SyncCLK/RCLK1 and SyncCLK/TCLK1 must be greater or equal to 3/1.

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

**Table 25. SMC Transparent Timing**

Num	Characteristic	All Frequencies		Unit
		Min	Max	
150	SMCLK clock period <sup>1</sup>	100	—	ns
151	SMCLK width low	50	—	ns
151A	SMCLK width high	50	—	ns
152	SMCLK rise/fall time	—	15	ns
153	SMTXD active delay (from SMCLK falling edge)	10	50	ns
154	SMRXD/SMSYNC setup time	20	—	ns
155	RXD1/SMSYNC hold time	5	—	ns

<sup>1</sup> Sync CLK must be at least twice as fast as SMCLK.



NOTE:  
1. This delay is equal to an integer number of character-length clocks.

**Figure 66. SMC Transparent Timing Diagram**

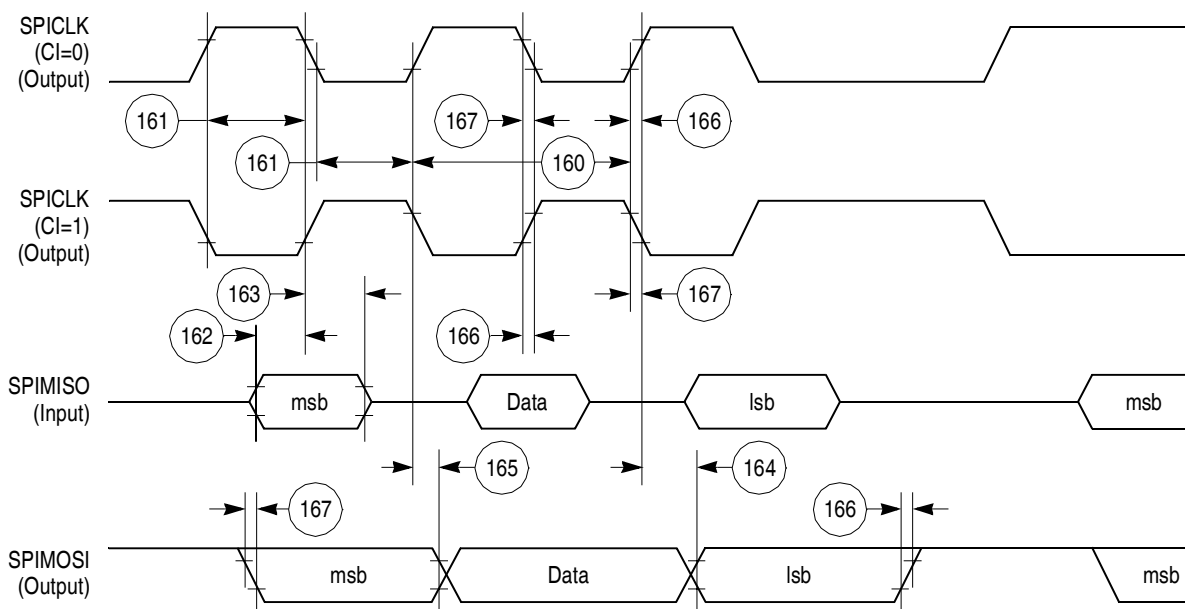


Figure 68. SPI Master (CP = 1) Timing Diagram

## 12.11 SPI Slave AC Electrical Specifications

Table 27 shows the SPI slave timings as shown in Figure 69 and Figure 70.

Table 27. SPI Slave Timing

Num	Characteristic	All Frequencies		Unit
		Min	Max	
170	Slave cycle time	2	—	$t_{cyc}$
171	Slave enable lead time	15	—	ns
172	Slave enable lag time	15	—	ns
173	Slave clock (SPICLK) high or low time	1	—	$t_{cyc}$
174	Slave sequential transfer delay (does not require deselect)	1	—	$t_{cyc}$
175	Slave data setup time (inputs)	20	—	ns
176	Slave data hold time (inputs)	20	—	ns
177	Slave access time	—	50	ns

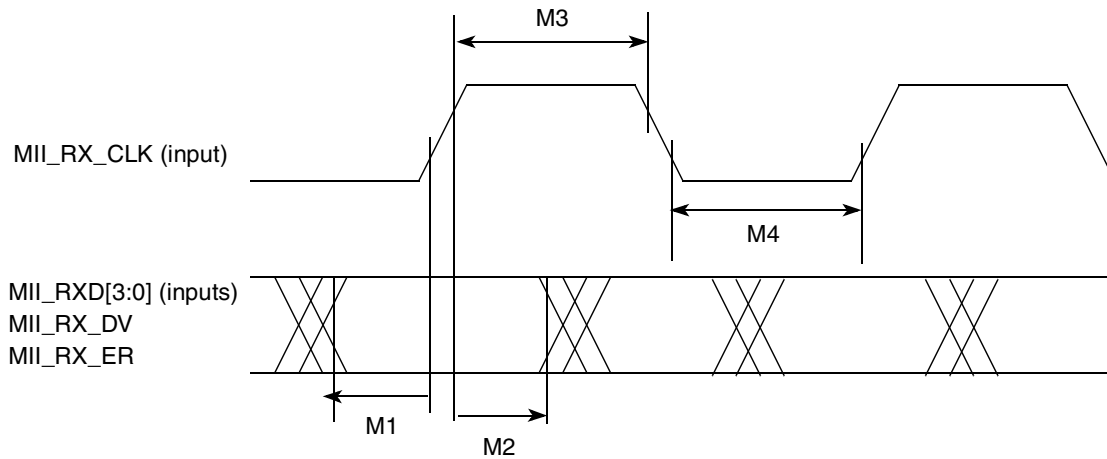


Figure 74. MII Receive Signal Timing Diagram

## 14.2 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 34 shows information on the MII transmit signal timing.

Table 34. MII Transmit Signal Timing

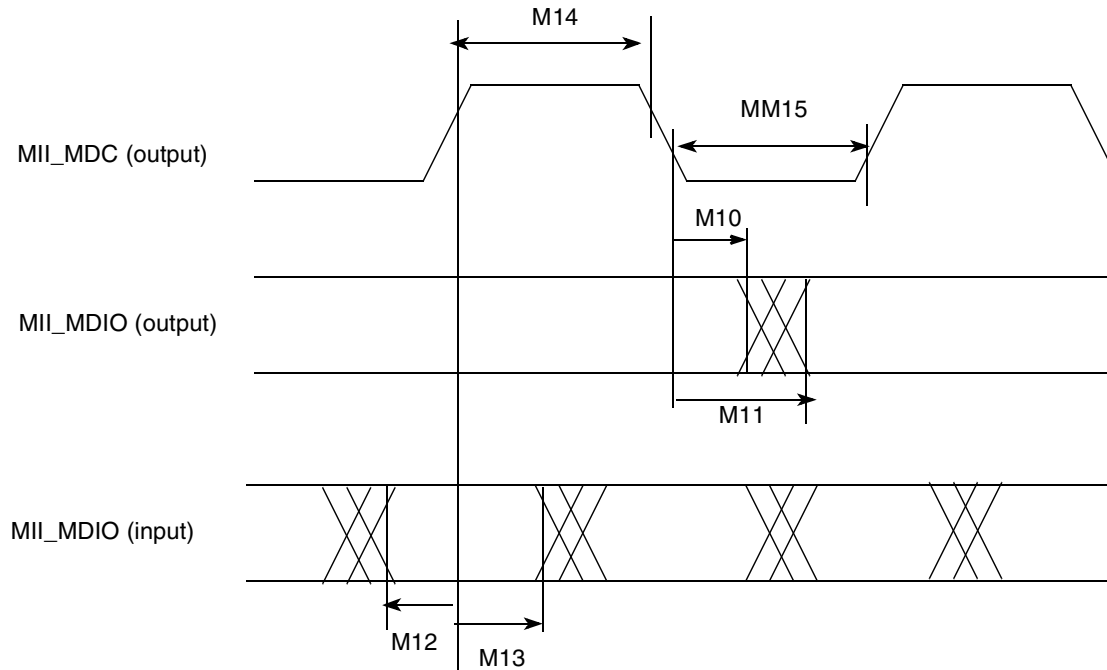
Num	Characteristic	Min	Max	Unit
M5	MII_TX_CLK to MII_TXD[3:0], MII_TX_EN, MII_TX_ER invalid	5	—	ns
M6	MII_TX_CLK to MII_TXD[3:0], MII_TX_EN, MII_TX_ER valid	—	25	—
M7	MII_TX_CLK pulse width high	35%	65%	MII_TX_CLK period
M8	MII_TX_CLK pulse width low	35%	65%	MII_TX_CLK period



**Table 36. MII Serial Management Channel Timing**

Num	Characteristic	Min	Max	Unit
M13	MII_MDIO (input) to MII_MDC rising edge hold	0	—	ns
M14	MII_MDC pulse width high	40%	60%	MII_MDC period
M15	MII_MDC pulse width low	40%	60%	MII_MDC period

Figure 77 shows the MII serial management channel timing diagram.

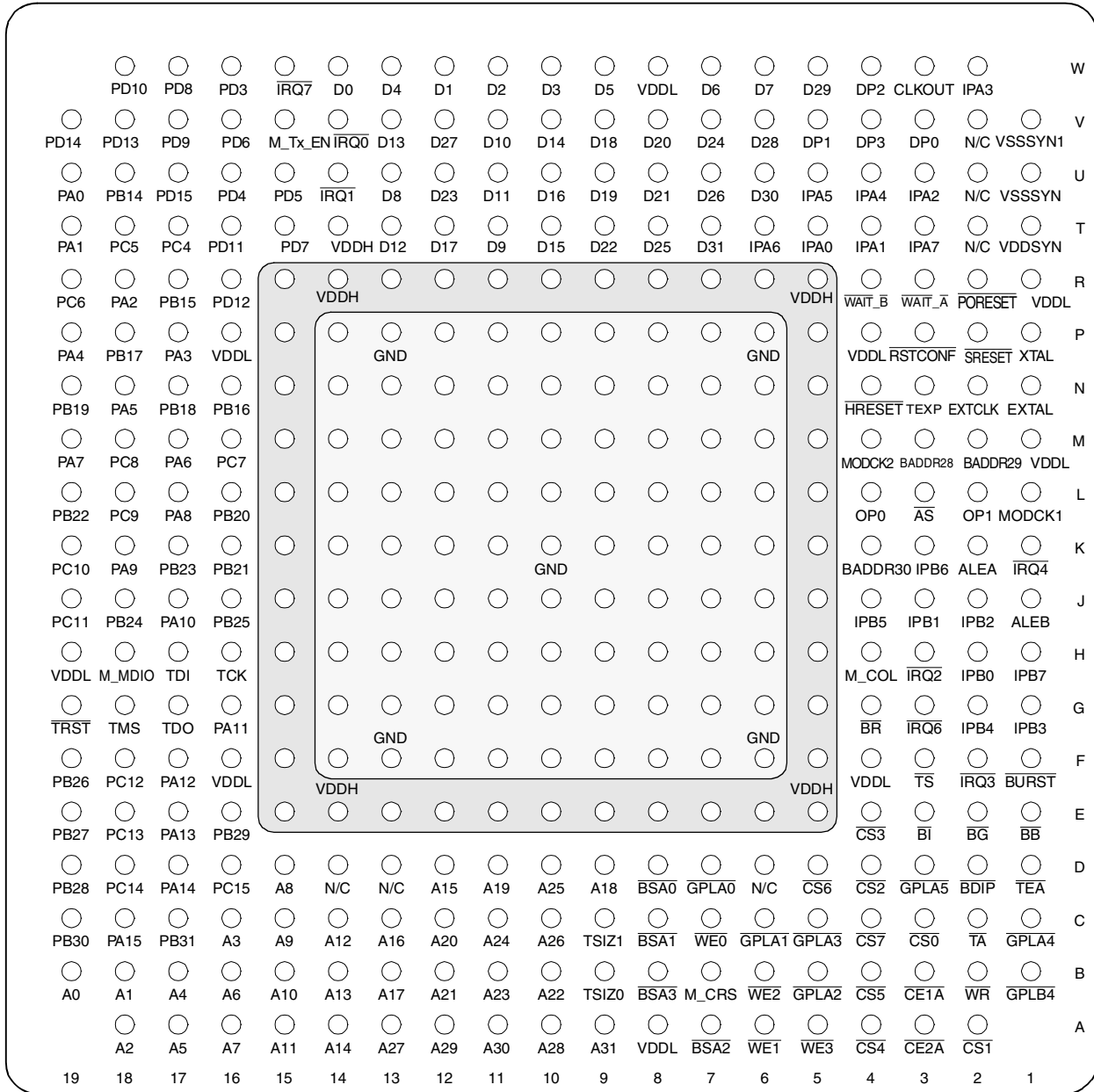


**Figure 77. MII Serial Management Channel Timing Diagram**

# 15.1 Pin Assignments

Figure 78 shows the top view pinout of the PBGA package. For additional information, see the *MPC866 PowerQUICC Family User's Manual*.

**NOTE: This is the top view of the device.**



**Figure 78. Pinout of the PBGA Package**

Table 39. Pin Assignments (continued)

Name	Pin Number	Type
PC7 $\overline{\text{CTS3}}$ L1TSYNCB $\overline{\text{SDACK2}}$	M16	Bidirectional
PC6 $\overline{\text{CD3}}$ L1RSYNCB	R19	Bidirectional
PC5 $\overline{\text{CTS4}}$ L1TSYNCA SDACK1	T18	Bidirectional
PC4 $\overline{\text{CD4}}$ L1RSYNCA	T17	Bidirectional
PD15 L1TSYNCA MII-RXD3 UTPB0	U17	Bidirectional
PD14 L1RSYNCA MII-RXD2 UTPB1	V19	Bidirectional
PD13 L1TSYNCB MII-RXD1 UTPB2	V18	Bidirectional
PD12 L1RSYNCB MII-MDC UTPB3	R16	Bidirectional
PD11 RXD3 MII-TXERR $\overline{\text{RXENB}}$	T16	Bidirectional
PD10 TXD3 MII-RXD0 $\overline{\text{TXENB}}$	W18	Bidirectional

# 16 Document Revision History

Table 40 lists significant changes between revisions of this document.

**Table 40. Document Revision History**

Revision Number	Date	Substantive Changes
0	5/2002	Initial revision
1	11/2002	Added the 5-V tolerant pins, new package dimensions, and other changes.
1.1	4/2003	Added the Spec. B1d and changed spec. B1a. Added the Note Solder sphere composition for MPC866XZP, MPC859DSLZP, and MPC859TZP is 62%Sn 36%Pb 2%Ag to Figure 15-79.
1.2	4/2003	Added the MPC859P.
1.3	5/2003	Changed the SPI Master Timing Specs. 162 and 164.
1.4	7-8/2003	<ul style="list-style-type: none"> <li>• Added TxClav and RxClav to PB15 and PC15. Changed B28a through B28d and B29b to show that TRLX can be 0 or 1.</li> <li>• Added nontechnical reformatting.</li> </ul>
1.5	3/14/2005	<ul style="list-style-type: none"> <li>• Updated document template.</li> </ul>
2	2/10/2006	<ul style="list-style-type: none"> <li>• Updated orderable parts table.</li> </ul>

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