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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	100MHz
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 ~ 100°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/mpc866pczp100a

Table 1 shows the functionality supported by the members of the MPC866/859 family.

2 Features

Table 1. MPC866 Family Functionality

Part	Cache		Ethernet		SCC	SMC
	Instruction	Data	10T	10/100		
MPC866P	16 Kbytes	8 Kbytes	Up to 4	1	4	2
MPC866T	4 Kbytes	4 Kbytes	Up to 4	1	4	2
MPC859P	16 Kbytes	8 Kbytes	1	1	1	2
MPC859T	4 Kbytes	4 Kbytes	1	1	1	2
MPC859DSL	4 Kbytes	4 Kbytes	1	1	1 [1]	1 [2]
MPC852T [3]	4 KBytes	4 Kbytes	2	1	2	1

1 On the MPC859DSL, the SCC (SCC1) is for ethernet only. Also, the MPC859DSL does not support the Time Slot Assigner (TSA).

2 On the MPC859DSL, the SMC (SMC1) is for UART only.

3 For more details on the MPC852T, please refer to the *MPC852T Hardware Specifications.*

The following list summarizes the key MPC866/859 features:

- Embedded single-issue, 32-bit PowerPC™ 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 (MPC866P and MPC859P) is four-way, set-associative with 256 sets; 4-Kbyte instruction cache (MPC866T, MPC859T, and MPC859DSL) is two-way, set-associative with 128 sets.
    - 8-Kbyte data cache (MPC866P and MPC859P) is two-way, set-associative with 256 sets; 4-Kbyte data cache(MPC866T, MPC859T, and MPC859DSL) 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 MPC866/859 provides enhanced ATM functionality over that of the MPC860SAR. The MPC866/859 adds major new features available in 'enhanced SAR' (ESAR) mode, including the following:
  - Improved operation, administration, and maintenance (OAM) support
  - OAM performance monitoring (PM) support
  - Multiple APC priority levels available to support a range of traffic pace requirements

The MPC866/859 is comprised of three modules that each use a 32-bit internal bus: MPC8xx core, system integration unit (SIU), and communication processor module (CPM). The MPC866P block diagram is shown in Figure 1. The MPC859P/859T/859DSL block diagram is shown in Figure 2.

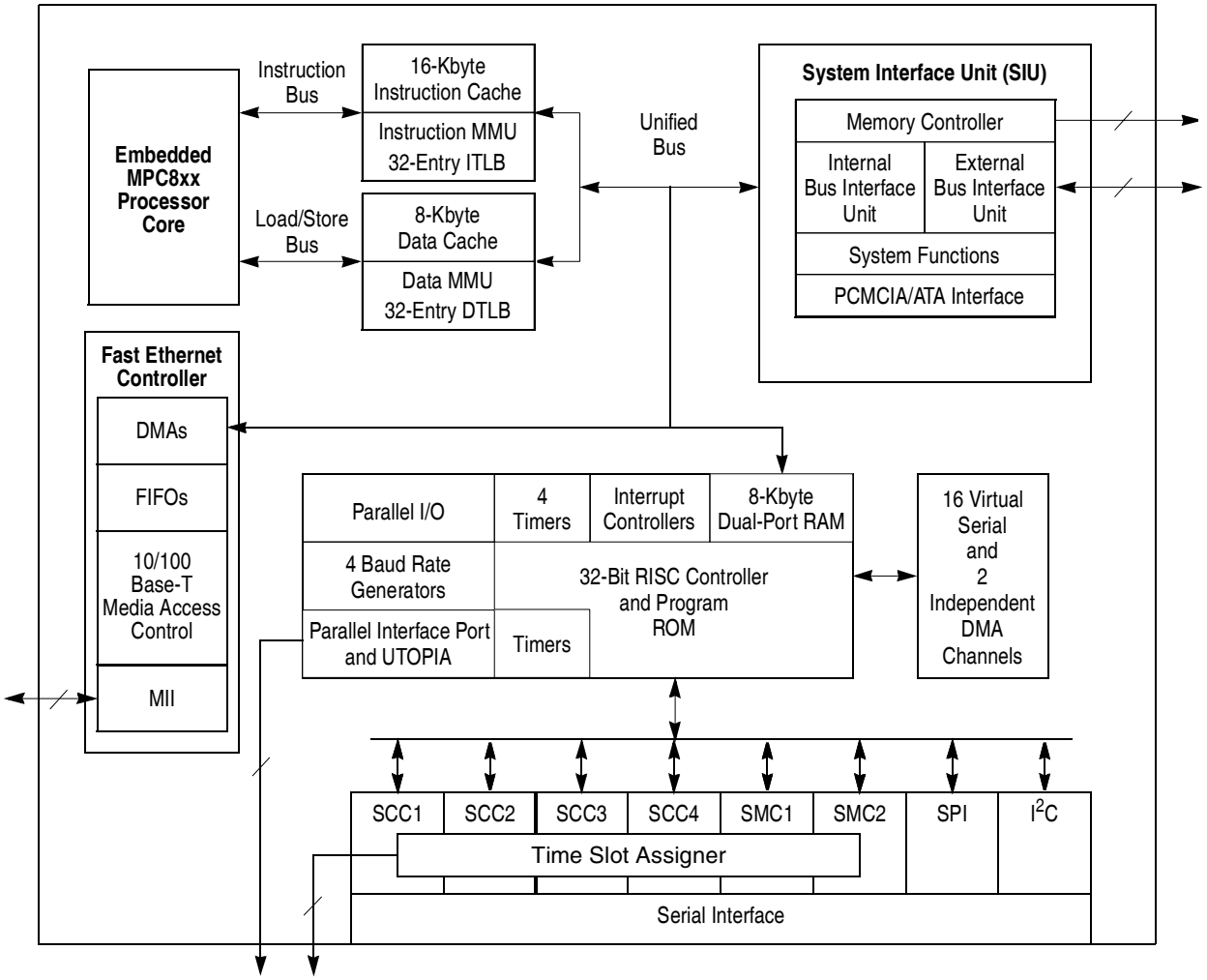
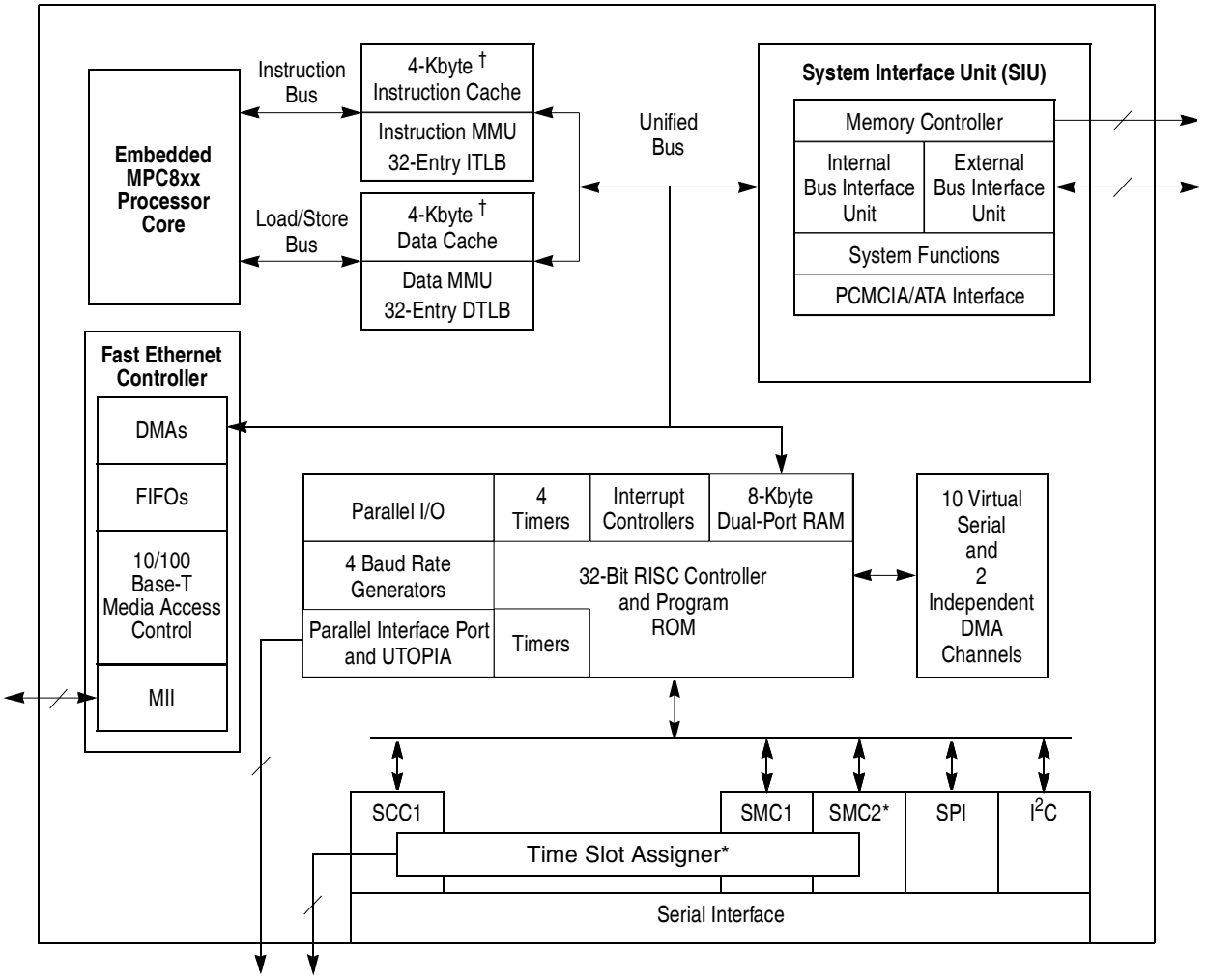


Figure 1. MPC866P Block Diagram



† The MPC859P has a 16-Kbyte instruction cache and a 8-Kbyte data cache.

* The MPC859DSL does not contain SMC2 nor the time slot assigner, and provides eight SDMA controllers.

Figure 2. MPC859P/859T/MPC859DSL Block Diagram

Table 6. DC Electrical Specifications (continued)

Characteristic	Symbol	Min	Max	Unit
Input low voltage	VIL	GND	0.8	V
EXTAL, EXTCLK input high voltage	VIHC	0.7*(VDDH)	VDDH	V
Input leakage current, Vin = 5.5V (except TMS, TRST, DSCK and DSDI pins) for 5 Volts Tolerant Pins [2]	I_{in}	—	100	µA
Input leakage current, Vin = VDDH (except TMS, TRST, DSCK, and DSDI)	I_{In}	—	10	µA
Input leakage current, Vin = 0 V (except TMS, TRST, DSCK and DSDI pins)	I_{In}	—	10	µA
Input capacitance [3]	C_{in}	—	20	pF
Output high voltage, IOH = – 2.0 mA, except XTAL, and Open drain pins	VOH	2.4	—	V
Output low voltage • IOL = 2.0 mA (CLKOUT) • IOL = 3.2 mA [4] • IOL = 5.3 mA [5] • IOL = 7.0 mA (TXD1/PA14, TXD2/PA12) • IOL = 8.9 mA (TS, TA, TEA, BI, BB, HRESET, SRESET)	VOL	—	0.5	V

1 The difference between VDDL and VDDSYN can not be more than 100 m V.

2 The signals PA[0:15], PB[14:31], PC[4:15], PD[3:15], TDI, TDO, TCK, TRST_B, TMS, MII_TXEN, MII_MDIO are 5 V tolerant.

3 Input capacitance is periodically sampled.

4 A(0:31), TSIZ0/REG, TSIZ1, D(0:31), DP(0:3)/IRQ(3:6), RD/WR, BURST, RSV/IRQ2, IP_B(0:1)/IWP(0:1)/VFLS(0:1), IP_B2/IOIS16_B/AT2, IP_B3/IWP2/VF2, IP_B4/LWP0/VF0, IP_B5/LWP1/VF1, IP_B6/DSDI/AT0, IP_B7/PTR/AT3, RXD1 /PA15, RXD2/PA13, L1TXDB/PA11, L1RXDB/PA10, L1TXDA/PA9, L1RXDA/PA8, TIN1/L1RCLKA/BRGO1/CLK1/PA7, BRGCLK1/TOUT1/CLK2/PA6, TIN2/L1TCLKA/BRGO2/CLK3/PA5, TOUT2/CLK4/PA4, TIN3/BRGO3/CLK5/PA3, BRGCLK2/L1RCLKB/TOUT3/CLK6/PA2, TIN4/BRGO4/CLK7/PA1, L1TCLKB/TOUT4/CLK8/PA0, REJCT1/SPISEL/PB31, SPICLK/PB30, SPIMOSI/PB29, BRGO4/SPIMISO/PB28, BRGO1/I2CSDA/PB27, BRGO2/I2CSCL/PB26, SMTXD1/PB25, SMRXD1/PB24, SMSYN1/SDACK1/PB23, SMSYN2/SDACK2/PB22, SMTXD2/L1CLKOB/PB21, SMRXD2/L1CLKOA/PB20, L1ST1/RTS1/PB19, L1ST2/RTS2/PB18, L1ST3/L1RQB/PB17, L1ST4/L1RQA/PB16, BRGO3/PB15, RSTRT1/PB14, L1ST1/RTS1/DREQ0/PC15, L1ST2/RTS2/DREQ1/PC14, L1ST3/L1RQB/PC13, L1ST4/L1RQA/PC12, CTS1/PC11, TGATE1/CD1/PC10, CTS2/PC9, TGATE2/CD2/PC8, CTS3/SDACK2/L1TSYNCB/PC7, CD3/L1RSYNCB/PC6, CTS4/SDACK1/L1TSYNCA/PC5, CD4/L1RSYNCA/PC4, PD15/L1TSYNCA, PD14/L1RSYNCA, PD13/L1TSYNCB, PD12/L1RSYNCB, PD11/RXD3, PD10/TXD3, PD9/RXD4, PD8/TXD4, PD5/REJECT2, PD6/RTS4, PD7/RTS3, PD4/REJECT3, PD3, MII_MDC, MII_TX_ER, MII_EN, MII_MDIO, MII_TXD[0:3].

5 BDIP/GPL_B(5), BR, BG, FRZ/IRQ6, CS(0:5), CS(6)/CE(1)_B, CS(7)/CE(2)_B, WE0/BS_B0/IORD, WE1/BS_B1/IOWR, WE2/BS_B2/PCOE, WE3/BS_B3/PCWE, BS_A(0:3), GPL_A0/GPL_B0, OE/GPL_A1/GPL_B1, GPL_A(2:3)/GPL_B(2:3)/CS(2:3), UPWAITA/GPL_A4, UPWAITB/GPL_B4, GPL_A5, ALE_A, CE1_A, CE2_A, ALE_B/DSCK/AT1, OP(0:1), OP2/MODCK1/STS, OP3/MODCK2/DSDO, BADDR(28:30).

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.

7.6 References

Semiconductor Equipment and Materials International(415) 964-5111
805 East Middlefield Rd.
Mountain View, CA 94043

MIL-SPEC and EIA/JESD (JEDEC) specifications800-854-7179 or
(Available from Global Engineering Documents)303-397-7956

JEDEC Specifications http://www.jedec.org

1. C.E. Triplett and B. Joiner, “An Experimental Characterization of a 272 PBGA Within an Automotive Engine Controller Module,” Proceedings of SemiTherm, San Diego, 1998, pp. 47-54.

2. B. Joiner and V. Adams, “Measurement and Simulation of Junction to Board Thermal Resistance and Its Application in Thermal Modeling,” Proceedings of SemiTherm, San Diego, 1999, pp. 212-220.

This recommendation particularly applies to the address and data buses. Maximum PC trace lengths of 6” are recommended. Capacitance calculations should consider all device loads as well as parasitic capacitances due to the PC traces. Attention to proper PCB layout and bypassing becomes especially critical in systems with higher capacitive loads because these loads create higher transient currents in the V_{DD} and GND circuits. Pull up all unused inputs or signals that will be inputs during reset. Special care should be taken to minimize the noise levels on the PLL supply pins. For more information, please refer to Section 14.4.3, Clock Synthesizer Power (VDDSYN, VSSSYN, VSSSYN1), in the *MPC866 User’s Manual*.

10 Bus Signal Timing

The maximum bus speed supported by the MPC866/859 is 66 MHz. Higher-speed parts must be operated in half-speed bus mode (for example, an MPC866/859 used at 100 MHz must be configured for a 50-MHz bus). Table 7 and Table 8 show the frequency ranges for standard part frequencies.

Table 7. Frequency Ranges for Standard Part Frequencies (1:1 Bus Mode)

Part Freq	50 MHz		66 MHz	
	Min	Max	Min	Max
Core	40	50	40	66.67
Bus	40	50	40	66.67

Table 8. Frequency Ranges for Standard Part Frequencies (2:1 Bus Mode)

Part Freq	50 MHz		66 MHz		100 MHz		133 MHz	
	Min	Max	Min	Max	Min	Max	Min	Max
Core	40	50	40	66.67	40	100	40	133.34
Bus	20	25	20	33.33	20	50	20	66.67

Table 9 shows the timings for the MPC866/859 at 33, 40, 50, and 66 MHz bus operation. The timing for the MPC866/859 bus shown in this table assumes a 50-pF load for maximum delays and a 0-pF load for minimum delays. CLKOUT assumes a 100-pF load maximum delay.

Table 9. Bus Operation Timings

Num	Characteristic	33 MHz		40 MHz		50 MHz		66 MHz		Unit
		Min	Max	Min	Max	Min	Max	Min	Max	
B1	Bus Period (CLKOUT) See Table 7	—	—	—	—	—	—	—	—	ns
B1a	EXTCLK to CLKOUT phase skew	– 2	+2	– 2	+2	– 2	+2	– 2	+2	ns
B1b	CLKOUT frequency jitter peak-to-peak	—	1	—	1	—	1	—	1	ns
B1c	Frequency jitter on EXTCLK	—	0.50	—	0.50	—	0.50	—	0.50	%

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) [2] (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 [3])	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) [4] (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) [4] (MIN = 0.00 x B1 + 1.00 [5])	1.00	—	1.00	—	1.00	—	2.00	—	ns
B20	D(0:31), DP(0:3) valid to CLKOUT falling edge (setup time) [6](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) [6] (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

Figure 8 shows the timing for the synchronous active pull-up and open-drain output signals.

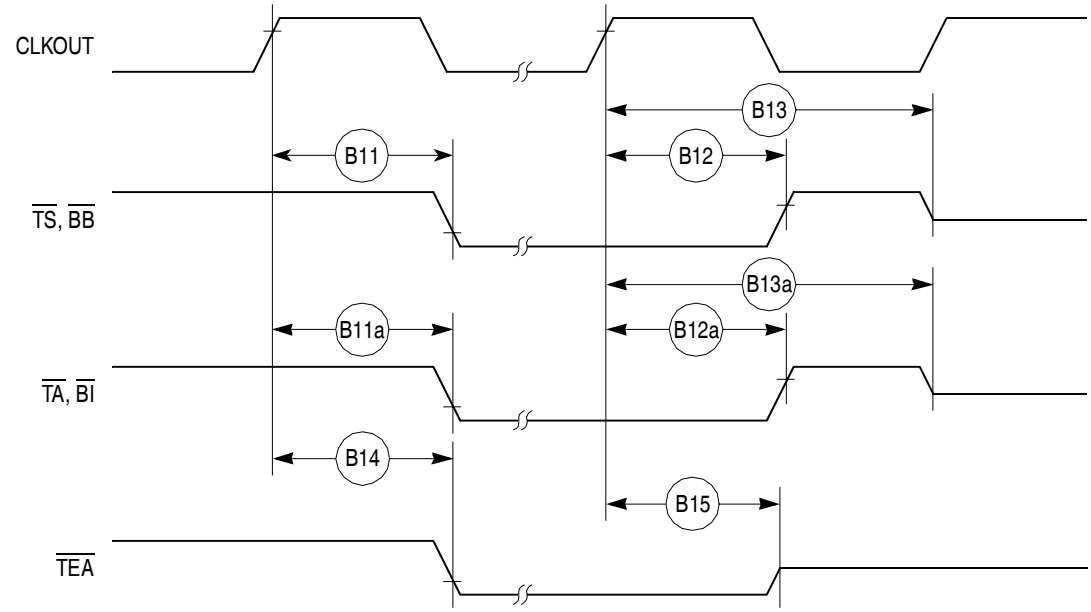


Figure 8. Synchronous Active Pull-Up Resistor and Open-Drain Output Signals Timing

Figure 9 shows the timing for the synchronous input signals.

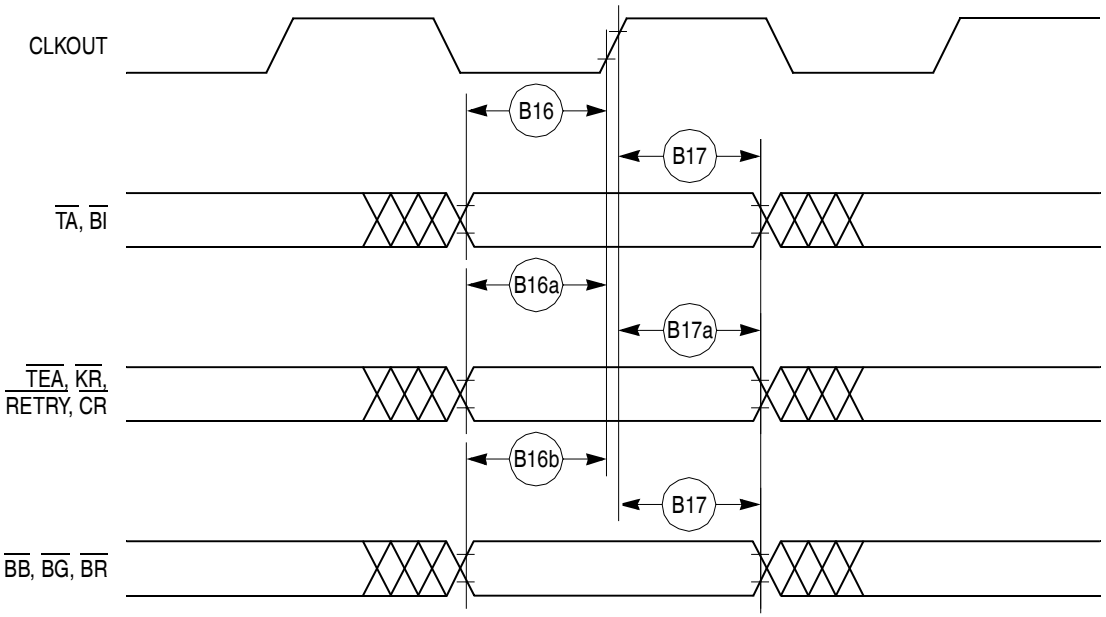


Figure 9. Synchronous Input Signals Timing

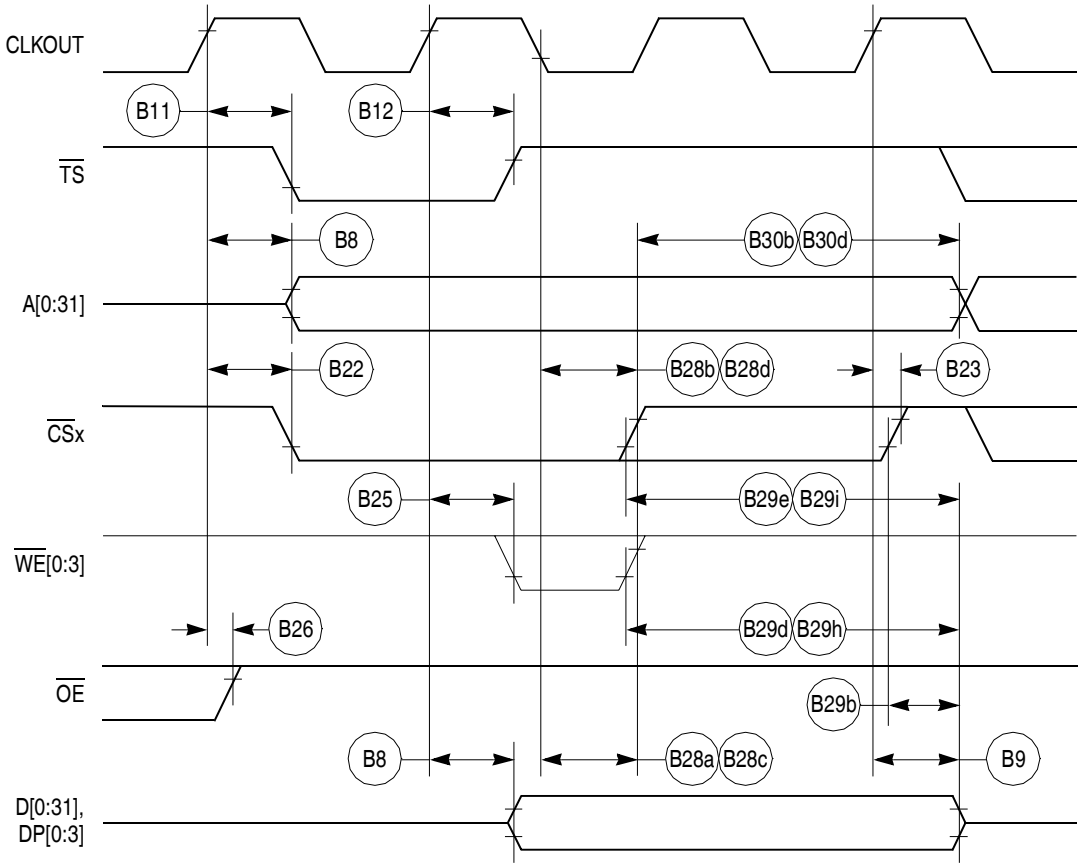


Figure 18. External Bus Write Timing (GPCM Controlled—TRLX = 1, CSNT = 1)

Figure 27 shows the PCMCIA access cycle timing for the external bus read.

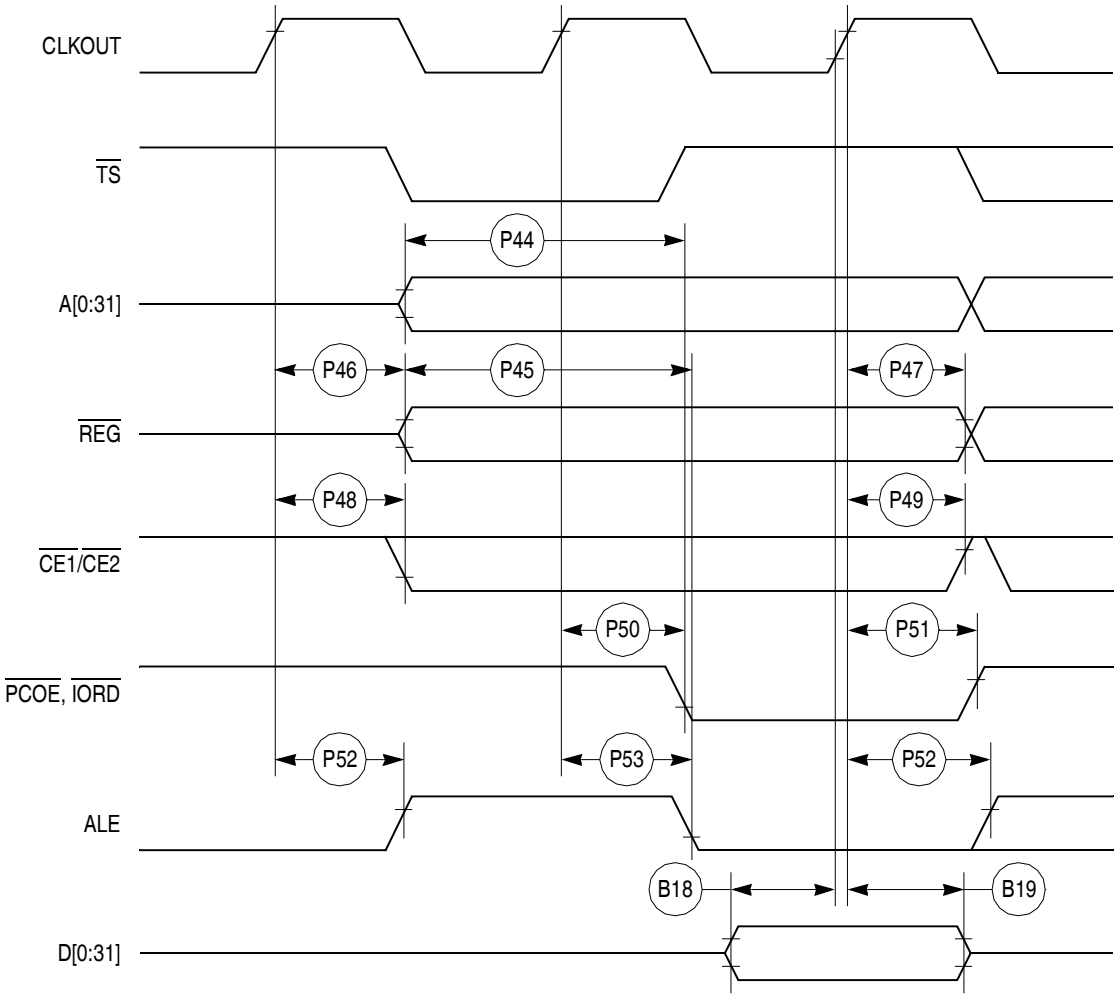


Figure 27. PCMCIA Access Cycles Timing External Bus Read

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 [1](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

1 OP2 and OP3 only.

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

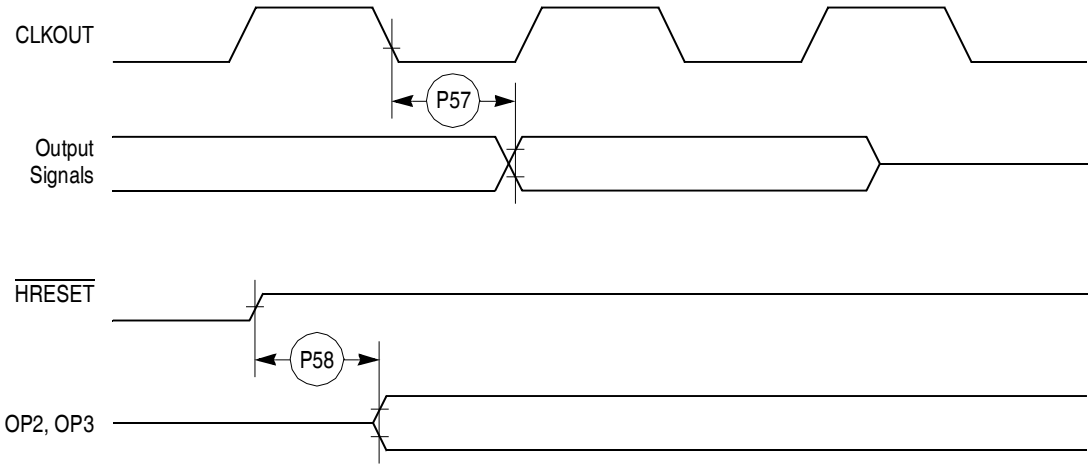


Figure 30. PCMCIA Output Port Timing

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

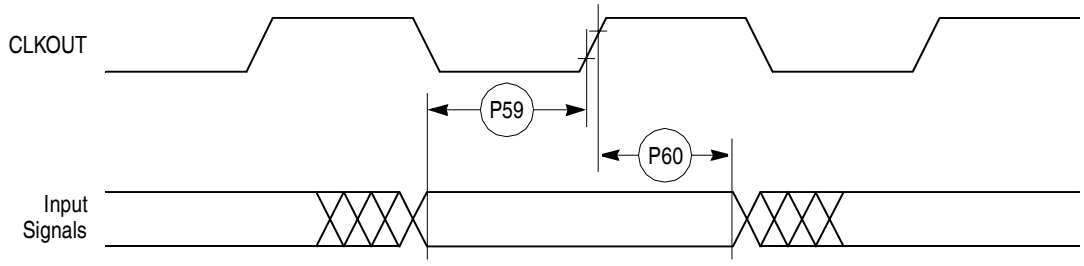


Figure 31. PCMCIA Input Port Timing

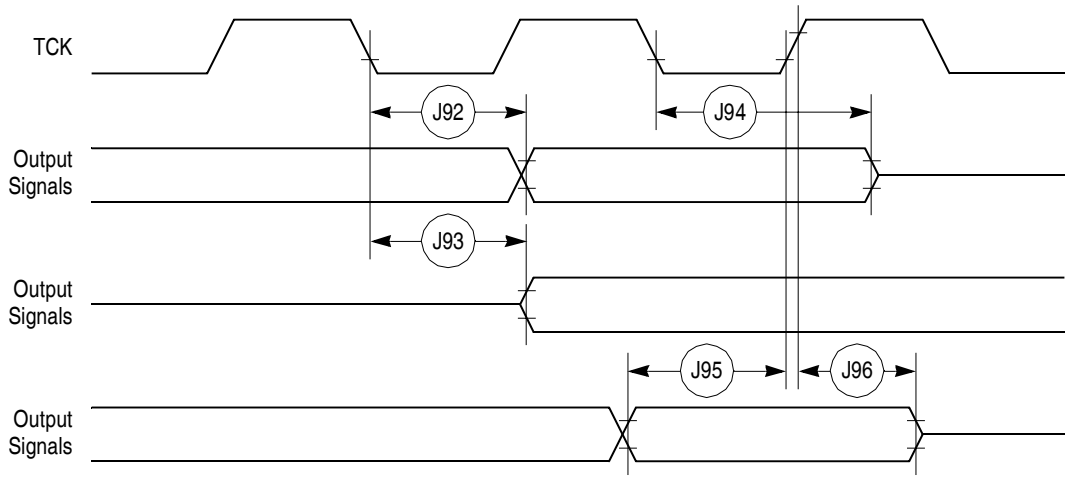


Figure 40. Boundary Scan (JTAG) Timing Diagram

12 CPM Electrical Characteristics

This section provides the AC and DC electrical specifications for the communications processor module (CPM) of the MPC866/859.

12.1 PIP/PIO AC Electrical Specifications

Table 16 shows the PIP/PIO AC timings as shown in Figure 41 through Figure 45.

Table 16. 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 – 5ns	—	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

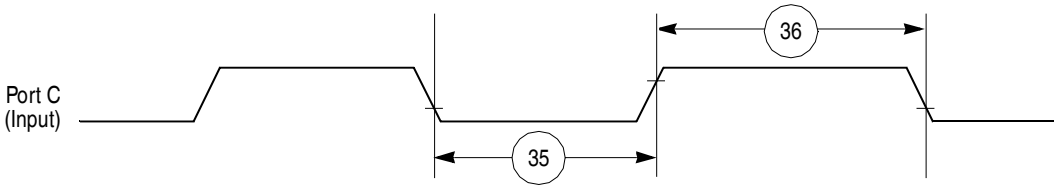


Figure 46. Port C Interrupt Detection Timing

12.3 IDMA Controller AC Electrical Specifications

Table 18 shows the IDMA controller timings as shown in Figure 47 through Figure 50.

Table 18. 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
43	$\overline{\text{SDACK}}$ negation delay from clock low	—	12	ns
44	$\overline{\text{SDACK}}$ negation delay from $\overline{\text{TA}}$ low	—	20	ns
45	$\overline{\text{SDACK}}$ negation delay from clock high	—	15	ns
46	$\overline{\text{TA}}$ assertion to falling edge of the clock setup time (applies to external $\overline{\text{TA}}$)	7	—	ns

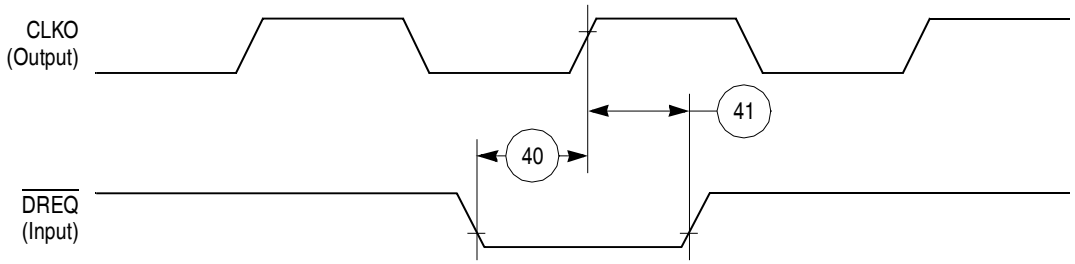


Figure 47. IDMA External Requests Timing Diagram

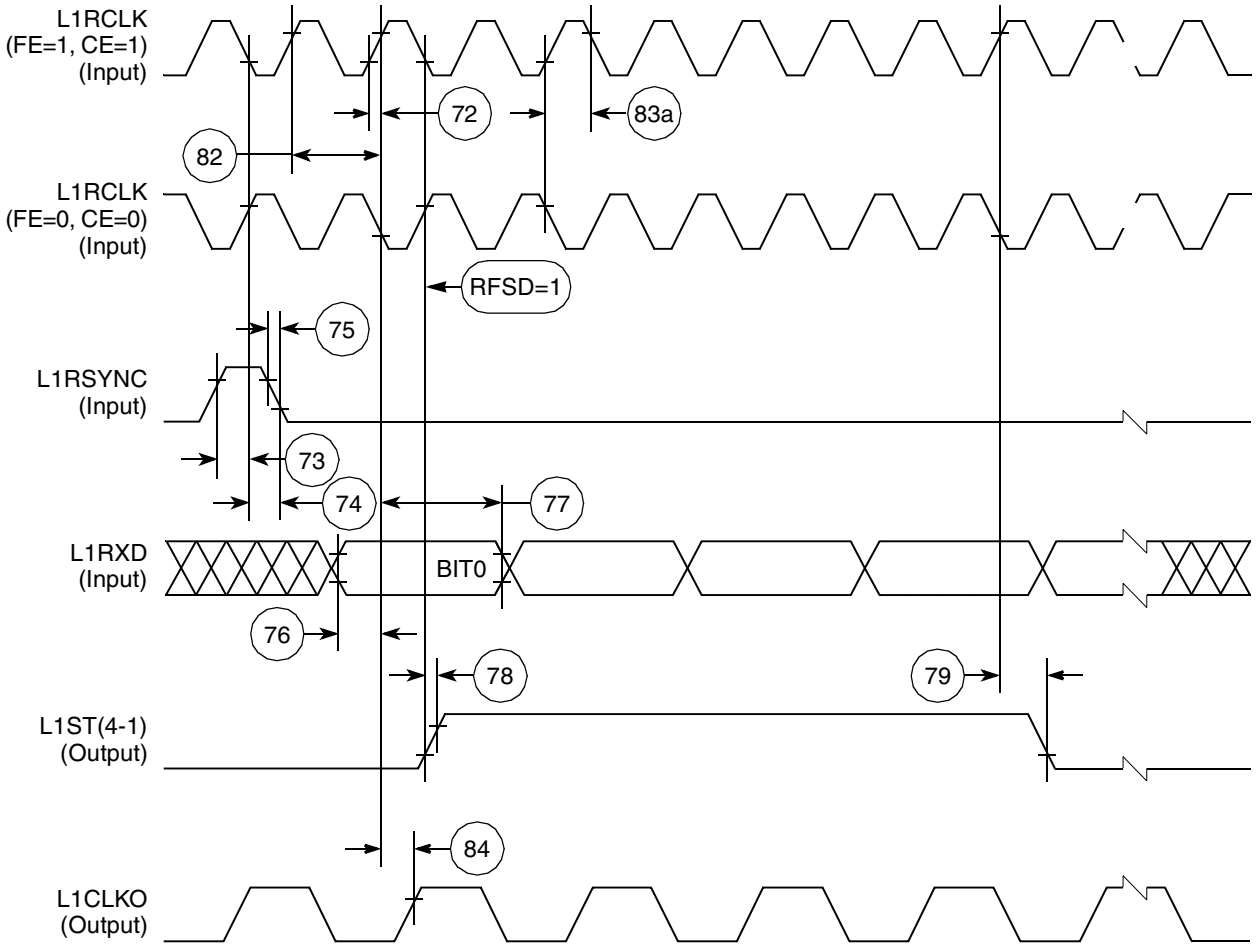


Figure 54. SI Receive Timing with Double-Speed Clocking (DSC = 1)

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 [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 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 [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.

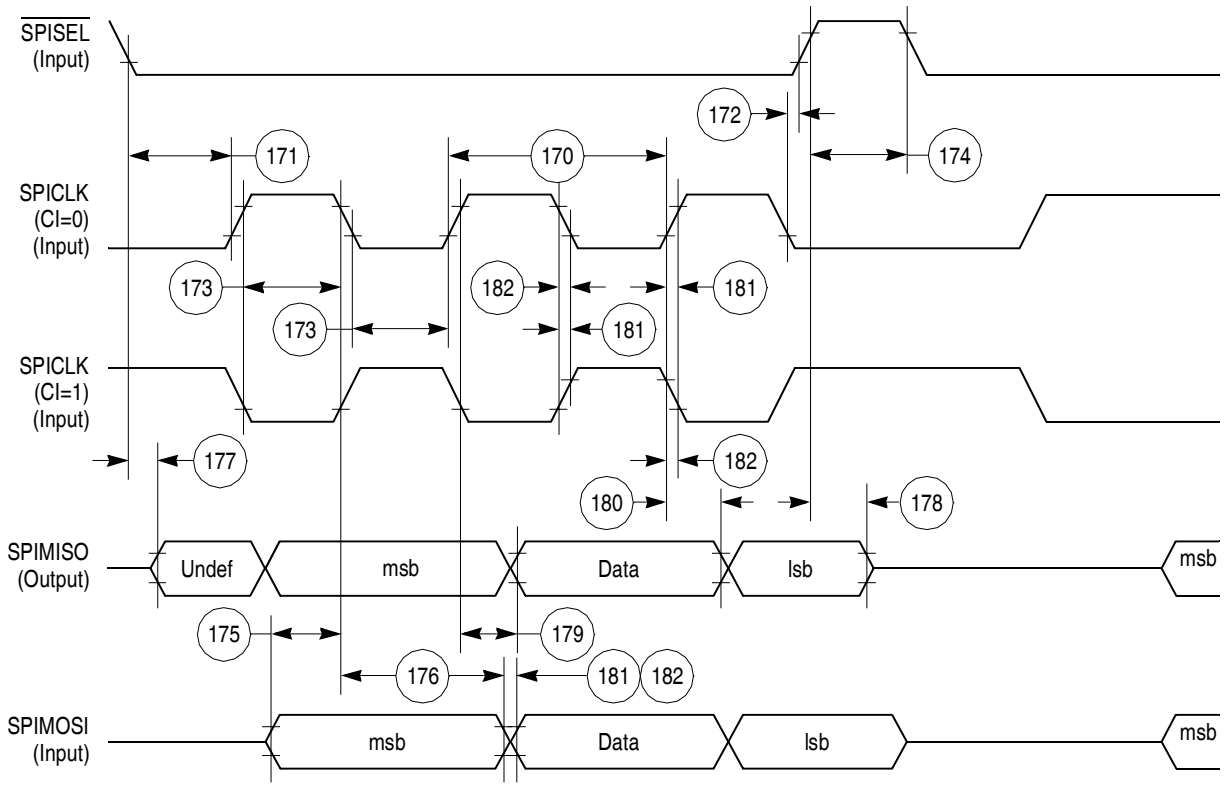


Figure 70. SPI Slave (CP = 1) Timing Diagram

12.12 I²C AC Electrical Specifications

Table 38. MPC866/859 Package/Frequency Orderable (continued)

Plastic ball grid array (VR suffix) Lead free	0° to 95°C	50	MPC859DSLVR50A
		66	MPC859DSLVR66A
		100	MPC859PVR100A MPC859TVR100A MPC866PVR100A MPC866TVR100A
		133	MPC859PVR133A MPC859TVR133A MPC866PVR133A MPC866TVR133A
Plastic ball grid array (CVR suffix) Lead free	–40° to 100°C	50	MPC859DSLCVR50A
		66	MPC859DSLCVR66A
		100	MPC859PCVR100A MPC859TCVR100A MPC866PCVR100A MPC866TCVR100A

Table 39. 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

Table 39. Pin Assignments (continued)

Name	Pin Number	Type
PB16 $\overline{\text{L1RQa}}$ L1ST4 $\overline{\text{RTS4}}$ PHREQ0[1] RXADDR0[2]	N16	Bidirectional (Optional: Open-drain)
PB15 BRGO3 TxClav RxClav	R17	Bidirectional
PB14 RXADDR2[2] $\overline{\text{RSTRT1}}$	U18	Bidirectional
PC15 $\overline{\text{DREQ0}}$ $\overline{\text{RTS1}}$ L1ST1 RxClav TxClav	D16	Bidirectional
PC14 $\overline{\text{DREQ1}}$ $\overline{\text{RTS2}}$ L1ST2	D18	Bidirectional
PC13 $\overline{\text{L1RQb}}$ L1ST3 RTS3	E18	Bidirectional
PC12 $\overline{\text{L1RQa}}$ L1ST4 RTS4	F18	Bidirectional
PC11 $\overline{\text{CTS1}}$	J19	Bidirectional
PC10 $\overline{\text{CD1}}$ $\overline{\text{TGATE1}}$	K19	Bidirectional
PC9 $\overline{\text{CTS2}}$	L18	Bidirectional
PC8 $\overline{\text{CD2}}$ $\overline{\text{TGATE2}}$	M18	Bidirectional