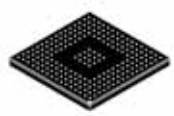
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RoHS

MPC5125



324 TEPBGA
23 mm x 23 mm

MPC5125 Microcontroller Data Sheet

The MPC5125 integrates a high performance e300 CPU core based on the Power Architecture® Technology with a rich set of peripheral functions focused on communications and systems integration.

Major features of the MPC5125 are as follows:

- e300 Power Architecture processor core (enhanced version of the MPC603e core), operates as fast as 400 MHz
- Low power design
- Display interface unit (DIU)
- DDR1, DDR2, low-power mobile DDR (LPDDR), and 1.8 V/3.3 V SDR DRAM memory controllers
- 32 KB on-chip SRAM
- USB 2.0 OTG controller with ULPI interface
- DMA subsystem
- Flexible multi-function external memory bus (EMB) interface
- NAND flash controller (NFC)
- LocalPlus interface (LPC)
- 10/100Base Ethernet
- MMC/SD/SDIO card host controller (SDHC)
- Programmable serial controller (PSC)
- Inter-integrated circuit (I^2C) communication interfaces
- Controller area network (CAN)
- J1850 byte data link controller (BDLC) interface
- On-chip real-time clock (RTC)
- On-chip temperature sensor
- IC Identification module (IIM)

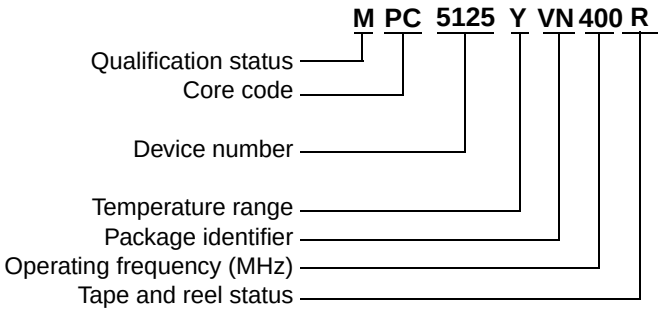
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Table of Contents

1 Ordering Information 3
2 MPC5125 Block Diagrams 4
3 Pin Assignments 5
3.1 324-ball TEPBGA Pin Assignments 5
3.2 Pin Muxing and Reset States 6
3.2.1 Power and Ground Supply Summary 35
4 Electrical and Thermal Characteristics 36
4.1 DC Electrical Characteristics 36
4.1.1 Absolute Maximum Ratings 36
4.1.2 Recommended Operating Conditions 36
4.1.3 DC Electrical Specifications 37
4.1.4 Electrostatic Discharge 40
4.1.5 Power Dissipation 41
4.1.6 Thermal Characteristics 42
4.2 Oscillator and PLL Electrical Characteristics 43
4.2.1 System Oscillator Electrical Characteristics . . . 44
4.2.2 RTC Oscillator Electrical Characteristics 44
4.2.3 System PLL Electrical Characteristics 45
4.2.4 e300 Core PLL Electrical Characteristics 45
4.3 AC Electrical Characteristics 46
4.3.1 Overview 46
4.3.2 AC Operating Frequency Data 46
4.3.3 Resets 47
4.3.4 External Interrupts 50
4.3.5 SDRAM (DDR) 50
4.3.6 LPC 55
4.3.7 NFC 61
4.3.8 FEC 63
4.3.9 USB ULPI 66
4.3.10 MMC/SD/SDIO Card Host Controller (SDHC) . 67
4.3.11 DIU 68
4.3.12 CAN 71
4.3.13 I^2C 71
4.3.14 J1850 72
4.3.15 PSC 72
4.3.16 GPIOs and Timers 79
4.3.17 Fusebox 79
4.3.18 IEEE 1149.1 (JTAG) 80
5 System Design Information 82
5.1 Power Up/Down Sequencing 82
5.2 System and CPU Core AV_{DD} Power Supply Filtering . 82
5.3 Connection Recommendations 82
5.4 Pullup/Pulldown Resistor Requirements 83
5.4.1 Pulldown Resistor Requirements for TEST Pin 83
5.5 JTAG 83
5.5.1 JTAG_TRST 83
5.5.2 e300 COP/BDM Interface 83
6 Package Information 87
6.1 Package Parameters 87
6.2 Mechanical Dimensions 88
7 Product Documentation 91
8 Revision History 91

1 Ordering Information



Temperature Range
Y = –40 °C to 125 °C, junction

Package Identifier
VN = 324 TEPBGA Pb-free

Operating Frequency
400 = 400 MHz

Tape and Reel Status
R = Tape and reel
(blank) = Trays

Qualification Status
P = Pre qualification
M = Fully spec. qualified, general market flow
S = Fully spec. qualified, automotive flow

Note: Not all options are available on all devices. Refer to Table 1.

Figure 1. MPC5125 Orderable Part Number Description

Table 1 shows the orderable part numbers for the MPC5125.

Table 1. MPC5125 Orderable Part Numbers

Freescale Part Number[1]	Package Description	Speed (MHz)	Operating Temperature[2]	
		Max[3] (f_{MAX})	Min (T_L)	Max (T_H)
MPC5125YVN400	MPC5125 324TEPBGA package Lead-free (PbFree)	400 MHz core 200 MHz bus	–40 °C	125 °C

NOTES:
1 All packaged devices are PPC5125, rather than MPC125, until product qualifications are complete.
2 The lowest ambient operating temperature (T_A) is referenced by T_L; the highest junction temperature is referenced by T_H.
3 Maximum speed is the maximum frequency allowed including frequency modulation (FM).

2 MPC5125 Block Diagrams

Figure 2 shows a simplified MPC5125 block diagram.

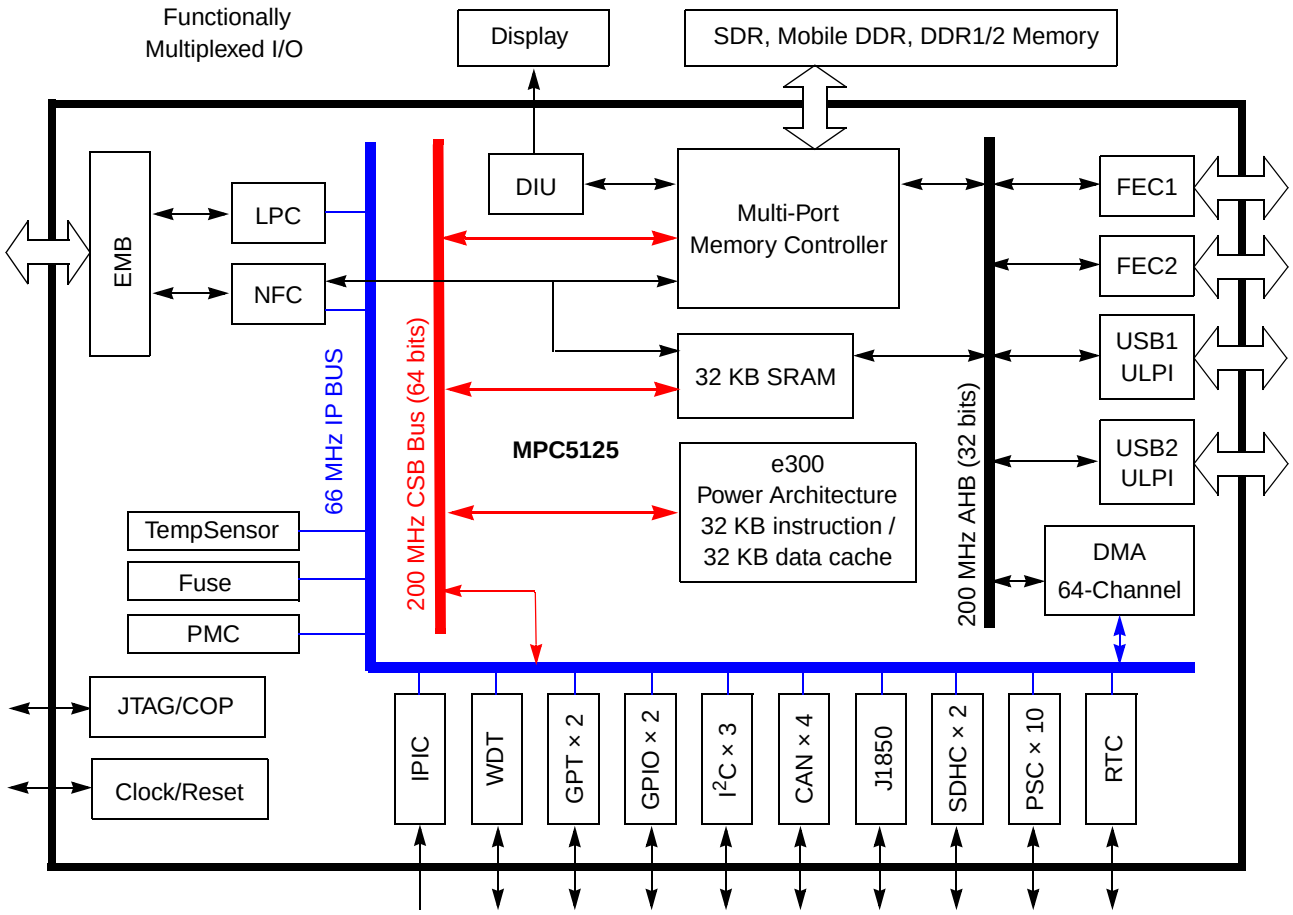


Figure 2. Simplified MPC5125 Block Diagram

3 Pin Assignments

This section details pin assignments.

3.1 324-ball TEPBGA Pin Assignments

Figure 3 shows the 324-ball TEPBGA pin assignments.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
A	VSS	VSS	EMB_AD01	EMB_AD00	GPIO01	GPIO02	RTC_XTALO	RTC_XTALI	SYS_XTALI	SYS_XTALO	AVDD_SPLL	PSC0_1	PSC0_2	VDD_IO	PSC1_4	CAN2_TX	HRESET_B	SRESET_B	I2C1_SDA	MCAS_B	MWE_B	VSS
B	VSS	EMB_AD05	EMB_AD03	EMB_AD02	J1850_TX	GPIO00	VSS	CAN2_RX	VDD_IO	AVSS_OSC_TMPS_SPLL	AVSS_CPLL	VDD_IO	PSC0_3	PSC1_2	CAN1_TX	TDO	VDD_IO	I2C1_SCL	VDD_IO_MEM	MA15	MA14	MA11
C	EMB_AD11	EMB_AD09	EMB_AD07	EMB_AD06	VDD_IO	J1850_RX	GPIO03	HIB_MODE_B	CAN1_RX	AVDD_OSC_TMPS	PSC0_0	PSC1_0	PSC1_1	VDD_IO	TDI	TCK	PORESET_B	MCKE	MRAS_B	MA12	VDD_IO_MEM	MA09
D	TMPS_ANAVIZ	EMB_AD10	VDD_IO	AVDD_FUSEWR	EMB_AD04	PSC_MCLK_IN	VSS	VBAT	SPLL_ANAVIZ	AVDD_CPLL	PSC0_4	VSS	PSC1_3	TEST	TMS	TRST_B	VDD_IO_MEM	MCS_B	VDD_IO_MEM	MA13	MA08	MA06
E	EMB_AD15	EMB_AD13	EMB_AD12	EMB_AD08															MA10	MA07	MA04	MA03
F	EMB_AD21	VDD_IO	EMB_AD16	VSS															MA02	MA05	VSS	MA01
G	EMB_AD25	EMB_AD18	EMB_AD17	VDD_IO						TOP DOWN VIEW									VDD_IO_MEM	MA00	MBA2	MCK_B
H	EMB_AD28	VDD_IO	EMB_AD20	EMB_AD14															MBA0	MBA1	VDD_IO_MEM	MCK
J	EMB_AD31	EMB_AD26	EMB_AD23	EMB_AD19					VSS	VDD	VDD	VDD	VDD	VSS					MODT	MDQ31	MDQ30	MDQ29
K	EMB_AX00	VSS	EMB_AD24	EMB_AD22					VSS	VSS	VSS	VSS	VSS	VDD					MVTT3	MDQ28	VSS	MDM3
L	LPC_AX03	EMB_AX02	EMB_AD29	VSS					VDD	VSS	VSS	VSS	VSS	VDD					VSS	MDQ26	MDQ27	MDQS3
M	LPC_CS0_B	VDD_IO	EMB_AD30	EMB_AD27					VDD	VSS	VSS	VSS	VSS	VDD					MVTT2	MDQ23	MDQ24	MDQ25
N	NFC_RB	LPC_OE_B	LPC_RWB	EMB_AX01					VSS	VSS	VSS	VSS	VSS	VDD					MVREF	MDQ20	VSS	MDQ22
P	NFC_CE0_B	VSS	LPC_ACK_B	VSS					VSS	VDD	VDD	VDD	VDD	VSS					VDD_IO_MEM	MDQ18	MDQS2	MDQ21
R	SDHC1_D2	SDHC1_D3	VDD_IO	LPC_CLK															MVTT1	MDQ16	VDD_IO_MEM	MDM2
T	SDHC1_CLK	SDHC1_CMD	SDHC1_D0	SDHC1_D1															VDD_IO_MEM	MDQ13	MDQ17	MDQ19
U	FEC1_CRS	VSS	FEC1_COL	I2C2_SDA															MDQ07	MDQS1	VSS	MDQ15
V	FEC1_MDC	FEC1_MDIO	VDD_IO	I2C2_SCL															VDD_IO_MEM	MDQ10	MDM1	MDQ14
W	FEC1_TX_CLK	FEC1_TX_ER	FEC1_TXD_1	FEC1_TXD_0	VDD_IO	USB1_STOP	USB1_DIR	VSS	USB1_DATA1	VSS	DIU_HSYNC	VSS	DIU_LD08	DIU_LD13	VDD_IO	DIU_LD21	VSS	MVTT0	VDD_IO_MEM	MDQ06	MDQ11	MDQ12
Y	FEC1_TXD_3	VSS	FEC1_TX_EN	FEC1_RXD_2	FEC1_RX_ER	USB1_DATA6	USB1_DATA5	USB1_CLK	USB1_DATA0	DIU_LD01	DIU_LD03	DIU_LD07	DIU_LD10	DIU_LD14	DIU_LD17	DIU_LD22	DIU_VSYNC	MDQ01	MDM0	MDQ05	VDD_IO_MEM	MDQ09
AA	FEC1_TXD_2	FEC1_RXD_3	FEC1_RXD_1	VDD_IO	USB1_NEXT	VSS	USB1_DATA4	DIU_DE	VDD_IO	DIU_LD02	DIU_LD04	VDD_IO	DIU_LD11	VDD_IO	DIU_LD16	VDD_IO	DIU_LD23	VSS	MDQ02	MDQS0	MDQ04	MDQ08
AB	VSS	FEC1_RXD_0	FEC1_RX_DV	FEC1_RX_CLK	USB1_DATA7	USB1_DATA3	USB1_DATA2	DIU_CLK	DIU_LD00	DIU_LD05	DIU_LD06	DIU_LD09	DIU_LD12	DIU_LD15	DIU_LD18	DIU_LD19	DIU_LD20	VDD_IO	MDQ00	VDD_IO_MEM	MDQ03	VSS

Figure 3. Ball Map for the MPC5125 324 TEPBGA Package

3.2 Pin Muxing and Reset States

Table 2 provides the pinout listing for the MPC5125.

Table 2. MPC5125 Pin Multiplexing

Pin	Pad I/O Control Register[1] and Offset[2]	Alternate Function[3]	Functions[4]	Peripheral[5]	I/O Direction	Power Domain	Notes	Pin
GPIO00	—	ALT0 ALT1 ALT2 ALT3	GPIO00 — — —	GPIO1 — — —	I — — —	VBAT	Dedicated input can be used to receive an external wakeup.	B6
GPIO01	—	ALT0 ALT1 ALT2 ALT3	GPIO01 — — —	GPIO1 — — —	I — — —	VBAT	Dedicated input can be used to receive an external wakeup.	A5
GPIO02	—	ALT0 ALT1 ALT2 ALT3	GPIO02 — — —	GPIO1 — — —	I — — —	VBAT	Dedicated input can be used to receive an external wakeup.	A6
GPIO03	—	ALT0 ALT1 ALT2 ALT3	GPIO03 — — —	GPIO1 — — —	I — — —	VBAT	Dedicated input can be used to receive an external wakeup.	C7
RTC_XTALI	—	ALT0 ALT1 ALT2 ALT3	RTC_XTALI — — —	RTC — — —	I — — —	VBAT	—	A8
RTC_XTALO	—	ALT0 ALT1 ALT2 ALT3	RTC_XTALO — — —	RTC — — —	O — — —	VBAT	—	A7
$\overline{\text{HIB_MODE}}$	—	ALT0 ALT1 ALT2 ALT3	$\overline{\text{HIB_MODE}}$ — — —	RTC — — —	O — — —	VBAT	In Hibernation mode , this pin provides a signal to shut down an external power supply.	C8
Analog Visible Signal								

Table 2. MPC5125 Pin Multiplexing (continued)

Pin	Pad I/O Control Register[1] and Offset[2]	Alternate Function[3]	Functions[4]	Peripheral[5]	I/O Direction	Power Domain	Notes	Pin
SPLL_ANAVIZ	—	ALT0 ALT1 ALT2 ALT3	SPLL_ANAVIZ — — —	 — — —	 — — —	—	—	D9
TMPS_ANAVIZ	—	ALT0 ALT1 ALT2 ALT3	TMPS_ANAVIZ — — —	 — — —	 — — —	—	—	D1
SYS_XTALI	—	ALT0 ALT1 ALT2 ALT3	SYS_XTALI — — —	SysClock — — —	I — — —	SYS_PLL _AVDD	—	A9
SYS_XTALO	—	ALT0 ALT1 ALT2 ALT3	SYS_XTALO — — —	SysClock — — —	O — — —	SYS_PLL _AVDD	—	A10
$\overline{\text{MCS}}$	0x00 IO_CON- TROL_MEM	ALT0 ALT1 ALT2 ALT3	$\overline{\text{MCS0}}$ — — —	DRAM — — —	O — — —	VDD_IO_MEM	—	D18
$\overline{\text{MCAS}}$	0x00 IO_CON- TROL_MEM	ALT0 ALT1 ALT2 ALT3	$\overline{\text{MCAS}}$ — — —	DRAM — — —	O — — —	VDD_IO_MEM	—	A20
$\overline{\text{MRAS}}$	0x00 IO_CON- TROL_MEM	ALT0 ALT1 ALT2 ALT3	$\overline{\text{MRAS}}$ — — —	DRAM — — —	O — — —	VDD_IO_MEM	—	C19
MVREF	—	ALT0 ALT1 ALT2 ALT3	MVREF — — —	DRAM — — —	I — — —	VDD_IO_MEM	—	N19

Table 2. MPC5125 Pin Multiplexing (continued)

Pin	Pad I/O Control Register[1] and Offset[2]	Alternate Function[3]	Functions[4]	Peripheral[5]	I/O Direction	Power Domain	Notes	Pin
MVTT0	—	ALT0 ALT1 ALT2 ALT3	MVTT0 — — —	DRAM — — —	I — — —	VDD_IO_MEM	—	W18
MVTT1	—	ALT0 ALT1 ALT2 ALT3	MVTT1 — — —	DRAM — — —	I — — —	VDD_IO_MEM	—	R19
MVTT2	—	ALT0 ALT1 ALT2 ALT3	MVTT2 — — —	DRAM — — —	I — — —	VDD_IO_MEM	—	M19
MVTT3	—	ALT0 ALT1 ALT2 ALT3	MVTT3 — — —	DRAM — — —	I — — —	VDD_IO_MEM	—	K19
$\overline{\text{MWE}}$	0x00 IO_CON- TROL_MEM	ALT0 ALT1 ALT2 ALT3	$\overline{\text{MWE}}$ — — —	DRAM — — —	O — — —	VDD_IO_MEM	—	A21
MDQ00	0x00 IO_CON- TROL_MEM	ALT0 ALT1 ALT2 ALT3	MDQ00 — — —	DRAM — — —	I/O — — —	VDD_IO_MEM	—	AB19
MDQ01	0x00 IO_CON- TROL_MEM	ALT0 ALT1 ALT2 ALT3	MDQ01 — — —	DRAM — — —	I/O — — —	VDD_IO_MEM	—	Y18
MDQ02	0x00 IO_CON- TROL_MEM	ALT0 ALT1 ALT2 ALT3	MDQ02 — — —	DRAM — — —	I/O — — —	VDD_IO_MEM	—	AA19

Table 2. MPC5125 Pin Multiplexing (continued)

Pin	Pad I/O Control Register[1] and Offset[2]	Alternate Function[3]	Functions[4]	Peripheral[5]	I/O Direction	Power Domain	Notes	Pin
MDQ03	0x00 IO_CON- TROL_MEM	ALT0 ALT1 ALT2 ALT3	MDQ03 — — —	DRAM — — —	I/O — — —	VDD_IO_MEM	—	AB21
MDQ04	0x00 IO_CON- TROL_MEM	ALT0 ALT1 ALT2 ALT3	MDQ04 — — —	DRAM — — —	I/O — — —	VDD_IO_MEM	—	AA21
MDQ05	0x00 IO_CON- TROL_MEM	ALT0 ALT1 ALT2 ALT3	MDQ05 — — —	DRAM — — —	I/O — — —	VDD_IO_MEM	—	Y20
MDQ06	0x00 IO_CON- TROL_MEM	ALT0 ALT1 ALT2 ALT3	MDQ06 — — —	DRAM — — —	I/O — — —	VDD_IO_MEM	—	W20
MDQ07	0x00 IO_CON- TROL_MEM	ALT0 ALT1 ALT2 ALT3	MDQ07 — — —	DRAM — — —	I/O — — —	VDD_IO_MEM	—	U19
MDQ08	0x00 IO_CON- TROL_MEM	ALT0 ALT1 ALT2 ALT3	MDQ08 — — —	DRAM — — —	I/O — — —	VDD_IO_MEM	—	AA22
MDQ09	0x00 IO_CON- TROL_MEM	ALT0 ALT1 ALT2 ALT3	MDQ09 — — —	DRAM — — —	I/O — — —	VDD_IO_MEM	—	Y22
MDQ10	0x00 IO_CON- TROL_MEM	ALT0 ALT1 ALT2 ALT3	MDQ10 — — —	DRAM — — —	I/O — — —	VDD_IO_MEM	—	V20

Table 2. MPC5125 Pin Multiplexing (continued)

Pin	Pad I/O Control Register[1] and Offset[2]	Alternate Function[3]	Functions[4]	Peripheral[5]	I/O Direction	Power Domain	Notes	Pin
MDQ11	0x00 IO_CON- TROL_MEM	ALT0 ALT1 ALT2 ALT3	MDQ11 — — —	DRAM — — —	I/O — — —	VDD_IO_MEM	—	W21
MDQ12	0x00 IO_CON- TROL_MEM	ALT0 ALT1 ALT2 ALT3	MDQ12 — — —	DRAM — — —	I/O — — —	VDD_IO_MEM	—	W22
MDQ13	0x00 IO_CON- TROL_MEM	ALT0 ALT1 ALT2 ALT3	MDQ13 — — —	DRAM — — —	I/O — — —	VDD_IO_MEM	—	T20
MDQ14	0x00 IO_CON- TROL_MEM	ALT0 ALT1 ALT2 ALT3	MDQ14 — — —	DRAM — — —	I/O — — —	VDD_IO_MEM	—	V22
MDQ15	0x00 IO_CON- TROL_MEM	ALT0 ALT1 ALT2 ALT3	MDQ15 — — —	DRAM — — —	I/O — — —	VDD_IO_MEM	—	U22
MDQ16	0x00 IO_CON- TROL_MEM	ALT0 ALT1 ALT2 ALT3	MDQ16 — — GPT1[0]	DRAM — — GPT1	I/O — — I/O	VDD_IO_MEM	—	R20
MDQ17	0x00 IO_CON- TROL_MEM	ALT0 ALT1 ALT2 ALT3	MDQ17 — — GPT1[1]	DRAM — — GPT1	I/O — — I/O	VDD_IO_MEM	—	T21
MDQ18	0x00 IO_CON- TROL_MEM	ALT0 ALT1 ALT2 ALT3	MDQ18 — — GPT1[2]	DRAM — — GPT1	I/O — — I/O	VDD_IO_MEM	—	P20

Table 2. MPC5125 Pin Multiplexing (continued)

Pin	Pad I/O Control Register[1] and Offset[2]	Alternate Function[3]	Functions[4]	Peripheral[5]	I/O Direction	Power Domain	Notes	Pin
MDQ19	0x00 IO_CON-TROL_MEM	ALT0 ALT1 ALT2 ALT3	MDQ19 — — GPT1[3]	DRAM — — GPT1	I/O — — I/O	VDD_IO_MEM	—	T22
MDQ20	0x00 IO_CON-TROL_MEM	ALT0 ALT1 ALT2 ALT3	MDQ20 — — GPT1[4]	DRAM — — GPT1	I/O — — I/O	VDD_IO_MEM	—	N20
MDQ21	0x00 IO_CON-TROL_MEM	ALT0 ALT1 ALT2 ALT3	MDQ21 — — GPT1[5]	DRAM — — GPT1	I/O — — I/O	VDD_IO_MEM	—	P22
MDQ22	0x00 IO_CON-TROL_MEM	ALT0 ALT1 ALT2 ALT3	MDQ22 — — GPT1[6]	DRAM — — GPT1	I/O — — I/O	VDD_IO_MEM	—	N22
MDQ23	0x00 IO_CON-TROL_MEM	ALT0 ALT1 ALT2 ALT3	MDQ23 — — GPT1[7]	DRAM — — GPT1	I/O — — I/O	VDD_IO_MEM	—	M20
MDQ24	0x00 IO_CON-TROL_MEM	ALT0 ALT1 ALT2 ALT3	MDQ24 — — GPIO21	DRAM — — GPIO1	I/O — — I/O	VDD_IO_MEM	—	M21
MDQ25	0x00 IO_CON-TROL_MEM	ALT0 ALT1 ALT2 ALT3	MDQ25 — — GPIO22	DRAM — — GPIO1	I/O — — I/O	VDD_IO_MEM	—	M22
MDQ26	0x00 IO_CON-TROL_MEM	ALT0 ALT1 ALT2 ALT3	MDQ26 — — GPIO23	DRAM — — GPIO1	I/O — — I/O	VDD_IO_MEM	—	L20

Table 2. MPC5125 Pin Multiplexing (continued)

Pin	Pad I/O Control Register[1] and Offset[2]	Alternate Function[3]	Functions[4]	Peripheral[5]	I/O Direction	Power Domain	Notes	Pin
MDQ27	0x00 IO_CON- TROL_MEM	ALT0 ALT1 ALT2 ALT3	MDQ27 — — GPIO24	DRAM — — GPIO1	I/O — — I/O	VDD_IO_MEM	—	L21
MDQ28	0x00 IO_CON- TROL_MEM	ALT0 ALT1 ALT2 ALT3	MDQ28 — — GPIO25	DRAM — — GPIO1	I/O — — I/O	VDD_IO_MEM	—	K20
MDQ29	0x00 IO_CON- TROL_MEM	ALT0 ALT1 ALT2 ALT3	MDQ29 — — GPIO26	DRAM — — GPIO1	I/O — — I/O	VDD_IO_MEM	—	J22
MDQ30	0x00 IO_CON- TROL_MEM	ALT0 ALT1 ALT2 ALT3	MDQ30 — — GPIO27	DRAM — — GPIO1	I/O — — I/O	VDD_IO_MEM	—	J21
MDQ31	0x00 IO_CON- TROL_MEM	ALT0 ALT1 ALT2 ALT3	MDQ31 — — GPIO28	DRAM — — GPIO1	I/O — — I/O	VDD_IO_MEM	—	J20
MDM0	0x00 IO_CON- TROL_MEM	ALT0 ALT1 ALT2 ALT3	MDM0 — — —	DRAM — — —	O — — —	VDD_IO_MEM	—	Y19
MDM1	0x00 IO_CON- TROL_MEM	ALT0 ALT1 ALT2 ALT3	MDM1 — — —	DRAM — — —	O — — —	VDD_IO_MEM	—	V21
MDM2	0x00 IO_CON- TROL_MEM	ALT0 ALT1 ALT2 ALT3	MDM2 — — GPIO29	DRAM — — GPIO1	O — — I/O	VDD_IO_MEM	—	R22

Table 2. MPC5125 Pin Multiplexing (continued)

Pin	Pad I/O Control Register[1] and Offset[2]	Alternate Function[3]	Functions[4]	Peripheral[5]	I/O Direction	Power Domain	Notes	Pin
MDM3	0x00 IO_CON- TROL_MEM	ALT0 ALT1 ALT2 ALT3	MDM3 — — GPIO30	DRAM — — GPIO1	O — — I/O	VDD_IO_MEM	—	K22
MDQS0	0x00 IO_CON- TROL_MEM	ALT0 ALT1 ALT2 ALT3	MDQS0 — — —	DRAM — — —	I/O — — —	VDD_IO_MEM	—	AA20
MDQS1	0x00 IO_CON- TROL_MEM	ALT0 ALT1 ALT2 ALT3	MDQS1 — — —	DRAM — — —	I/O — — —	VDD_IO_MEM	—	U20
MDQS2	0x00 IO_CON- TROL_MEM	ALT0 ALT1 ALT2 ALT3	MDQS2 — — GPIO31	DRAM — — GPIO1	I/O — — I/O	VDD_IO_MEM	—	P21
MDQS3	0x00 IO_CON- TROL_MEM	ALT0 ALT1 ALT2 ALT3	MDQS3 — — GPIO32	DRAM — — GPIO2	I/O — — I/O	VDD_IO_MEM	—	L22
MBA0	0x00 IO_CON- TROL_MEM	ALT0 ALT1 ALT2 ALT3	MBA0 — — —	DRAM — — —	O — — —	VDD_IO_MEM	—	H19
MBA1	0x00 IO_CON- TROL_MEM	ALT0 ALT1 ALT2 ALT3	MBA1 — — —	DRAM — — —	O — — —	VDD_IO_MEM	—	H20
MBA2	0x00 IO_CON- TROL_MEM	ALT0 ALT1 ALT2 ALT3	MBA2 — — —	DRAM — — —	O — — —	VDD_IO_MEM	—	G21

Table 2. MPC5125 Pin Multiplexing (continued)

Pin	Pad I/O Control Register[1] and Offset[2]	Alternate Function[3]	Functions[4]	Peripheral[5]	I/O Direction	Power Domain	Notes	Pin
MA00	0x00 IO_CON- TROL_MEM	ALT0 ALT1 ALT2 ALT3	MA00 — — —	DRAM — — —	O — — —	VDD_IO_MEM	—	G20
MA01	0x00 IO_CON- TROL_MEM	ALT0 ALT1 ALT2 ALT3	MA01 — — —	DRAM — — —	O — — —	VDD_IO_MEM	—	F22
MA02	0x00 IO_CON- TROL_MEM	ALT0 ALT1 ALT2 ALT3	MA02 — — —	DRAM — — —	O — — —	VDD_IO_MEM	—	F19
MA03	0x00 IO_CON- TROL_MEM	ALT0 ALT1 ALT2 ALT3	MA03 — — —	DRAM — — —	O — — —	VDD_IO_MEM	—	E22
MA04	0x00 IO_CON- TROL_MEM	ALT0 ALT1 ALT2 ALT3	MA04 — — —	DRAM — — —	O — — —	VDD_IO_MEM	—	E21
MA05	0x00 IO_CON- TROL_MEM	ALT0 ALT1 ALT2 ALT3	MA05 — — —	DRAM — — —	O — — —	VDD_IO_MEM	—	F20
MA06	0x00 IO_CON- TROL_MEM	ALT0 ALT1 ALT2 ALT3	MA06 — — —	DRAM — — —	O — — —	VDD_IO_MEM	—	D22
MA07	0x00 IO_CON- TROL_MEM	ALT0 ALT1 ALT2 ALT3	MA07 — — —	DRAM — — —	O — — —	VDD_IO_MEM	—	E20

Table 2. MPC5125 Pin Multiplexing (continued)

Pin	Pad I/O Control Register[1] and Offset[2]	Alternate Function[3]	Functions[4]	Peripheral[5]	I/O Direction	Power Domain	Notes	Pin
MA08	0x00 IO_CON- TROL_MEM	ALT0 ALT1 ALT2 ALT3	MA08 — — —	DRAM — — —	O — — —	VDD_IO_MEM	—	D21
MA09	0x00 IO_CON- TROL_MEM	ALT0 ALT1 ALT2 ALT3	MA09 — — —	DRAM — — —	O — — —	VDD_IO_MEM	—	C22
MA10	0x00 IO_CON- TROL_MEM	ALT0 ALT1 ALT2 ALT3	MA10 — — —	DRAM — — —	O — — —	VDD_IO_MEM	—	E19
MA11	0x00 IO_CON- TROL_MEM	ALT0 ALT1 ALT2 ALT3	MA11 — — —	DRAM — — —	O — — —	VDD_IO_MEM	—	B22
MA12	0x00 IO_CON- TROL_MEM	ALT0 ALT1 ALT2 ALT3	MA12 — — —	DRAM — — —	O — — —	VDD_IO_MEM	—	C20
MA13	0x00 IO_CON- TROL_MEM	ALT0 ALT1 ALT2 ALT3	MA13 — — —	DRAM — — —	O — — —	VDD_IO_MEM	—	D20
MA14	0x00 IO_CON- TROL_MEM	ALT0 ALT1 ALT2 ALT3	MA14 — — —	DRAM — — —	O — — —	VDD_IO_MEM	—	B21
MA15	0x00 IO_CON- TROL_MEM	ALT0 ALT1 ALT2 ALT3	MA15/MCS1 — — —	DRAM — — —	O — — —	VDD_IO_MEM	—	B20

Table 2. MPC5125 Pin Multiplexing (continued)

Pin	Pad I/O Control Register[1] and Offset[2]	Alternate Function[3]	Functions[4]	Peripheral[5]	I/O Direction	Power Domain	Notes	Pin
MCK	0x00 IO_CON- TROL_MEM	ALT0 ALT1 ALT2 ALT3	MCK — — —	DRAM — — —	O — — —	VDD_IO_MEM	—	H22
$\overline{\text{MCK}}$	0x00 IO_CON- TROL_MEM	ALT0 ALT1 ALT2 ALT3	$\overline{\text{MCK}}$ — — —	DRAM — — —	O — — —	VDD_IO_MEM	—	G22
MCKE	0x00 IO_CON- TROL_MEM	ALT0 ALT1 ALT2 ALT3	MCKE — — —	DRAM — — —	O — — —	VDD_IO_MEM	—	C18
MODT	0x00 IO_CON- TROL_MEM	ALT0 ALT1 ALT2 ALT3	MODT — — —	DRAM — — —	O — — —	VDD_IO_MEM	—	J19
LPC_CLK	0x04 STD_PU	ALT0 ALT1 ALT2 ALT3	LPC_CLK TPA1 — GPIO04	LPC — — GPIO1	O — I/O	VDD_IO	—	R4
LPC_OE_B	0x05 STD_PU	ALT0 ALT1 ALT2 ALT3	LPC_OE PSC3_3 — GPIO05	LPC PSC3 — GPIO1	O I/O — I/O	VDD_IO	—	N2
LPC_RWB	0x06 STD_PU	ALT0 ALT1 ALT2 ALT3	LPC_R/$\overline{\text{W}}$ PSC3_4 — GPIO06	LPC PSC3 — GPIO1	O I/O — I/O	VDD_IO	—	N3
LPC_CS0_B	0x07 STD_PU	ALT0 ALT1 ALT2 ALT3	LPC_CS0 — — GPIO07	LPC — — GPIO1	O — — I/O	VDD_IO	—	M1

Table 2. MPC5125 Pin Multiplexing (continued)

Pin	Pad I/O Control Register[1] and Offset[2]	Alternate Function[3]	Functions[4]	Peripheral[5]	I/O Direction	Power Domain	Notes	Pin
LPC_ACK_B	0x08 STD_PU	ALT0 ALT1 ALT2 ALT3	$\overline{\text{LPC_ACK}}$/$\overline{\text{LPC_BURST}}$ NFC_CE1 LPC_CS1 GPIO08	LPC NFC LPC GPIO1	I/O O O I/O	VDD_IO	—	P3
LPC_AX03	0x09 STD_PU	ALT0 ALT1 ALT2 ALT3	LPC_AX03/LPC_TS NFC_CE2 LPC_CS2 —	LPC NFC LPC —	O O O —	VDD_IO	—	L1
EMB_AD00	0x2C STD_PU	ALT0 ALT1 ALT2 ALT3	LPC_AD00/NFC_AD00 — RST_CONF_LOC0 —	LPC — —	I/O — —	VDD_IO	ALT2: Reset configuration Boot ROM Location 0	A4
EMB_AD01	0x2B STD_PU	ALT0 ALT1 ALT2 ALT3	LPC_AD01/NFC_AD01 — RST_CONF_LOC1 —	LPC — —	I/O — —	VDD_IO	ALT2: Reset configuration Boot ROM Location 1	A3
EMB_AD02	0x2A STD_PU	ALT0 ALT1 ALT2 ALT3	LPC_AD02/NFC_AD02 — RST_CONF_BMS —	LPC — —	I/O — —	VDD_IO	ALT2: Reset configuration Boot Mode Select	B4
EMB_AD03	0x29 STD_PU	ALT0 ALT1 ALT2 ALT3	LPC_AD03/NFC_AD03 — RST_CONF_LPCDBW0 —	LPC — —	I/O — —	VDD_IO	ALT2: Reset configuration LPC Port Size 0	B3
EMB_AD04	0x28 STD_PU	ALT0 ALT1 ALT2 ALT3	LPC_AD04/NFC_AD04 — RST_CONF_LPCDBW1 —	LPC — —	I/O — —	VDD_IO	ALT2: Reset configuration LPC Port Size 1	D5

Table 2. MPC5125 Pin Multiplexing (continued)

Pin	Pad I/O Control Register[1] and Offset[2]	Alternate Function[3]	Functions[4]	Peripheral[5]	I/O Direction	Power Domain	Notes	Pin
EMB_AD05	0x27 STD_PU	ALT0 ALT1 ALT2 ALT3	LPC_AD05/NFC_AD05 — RST_CONF_COREPLL6 —	LPC — —	I/O — —	VDD_IO	ALT2: Reset configuration Core PLL Multiplication Factor 0	B2
EMB_AD06	0x26 STD_PU	ALT0 ALT1 ALT2 ALT3	LPC_AD06/NFC_AD06 — RST_CONF_COREPLL5 —	LPC — —	I/O — —	VDD_IO	ALT2: Reset configuration Core PLL Multiplication Factor 1	C4
EMB_AD07	0x25 STD_PU	ALT0 ALT1 ALT2 ALT3	LPC_AD07/NFC_AD07 — RST_CONF_COREPLL4 —	LPC — —	I/O — —	VDD_IO	ALT2: Reset configuration Core PLL Multiplication Factor 2	C3
EMB_AD08	0x24 STD_PU	ALT0 ALT1 ALT2 ALT3	LPC_AD08/NFC_AD08 PSC3_2 RST_CONF_SPMF0 GPIO28	LPC PSC3 GPIO1	I/O I/O I/O	VDD_IO	ALT2: Reset configuration System PLL Multiplication Factor 0	E4
EMB_AD09	0x23 STD_PU	ALT0 ALT1 ALT2 ALT3	LPC_AD09/NFC_AD09 PSC3_1 RST_CONF_SPMF1 GPIO27	LPC PSC3 GPIO1	I/O I/O I/O	VDD_IO	ALT2: Reset configuration System PLL Multiplication Factor 1	C2
EMB_AD10	0x22 STD_PU	ALT0 ALT1 ALT2 ALT3	LPC_AD10/NFC_AD10 PSC3_0 RST_CONF_SPMF2 GPIO26	LPC PSC3 GPIO1	I/O I/O I/O	VDD_IO	ALT2: Reset configuration System PLL Multiplication Factor 2	D2
EMB_AD11	0x21 STD_PU	ALT0 ALT1 ALT2 ALT3	LPC_AD11/NFC_AD11 PSC2_4 RST_CONF_SPMF3 GPIO25	LPC PSC2 GPIO1	I/O I/O I/O	VDD_IO	ALT2: Reset configuration	C1
EMB_AD12	0x20 STD_PU	ALT0 ALT1 ALT2 ALT3	LPC_AD12/NFC_AD12 PSC2_3 RST_CONF_PREDIV0 GPIO24	LPC PSC2 GPIO1	I/O I/O I/O	VDD_IO	ALT2: Reset configuration	E3

Table 2. MPC5125 Pin Multiplexing (continued)

Pin	Pad I/O Control Register[1] and Offset[2]	Alternate Function[3]	Functions[4]	Peripheral[5]	I/O Direction	Power Domain	Notes	Pin
EMB_AD13	0x1F STD_PU	ALT0 ALT1 ALT2 ALT3	LPC_AD13/NFC_AD13 PSC2_2 RST_CONF_PREDIV1 GPIO23	LPC PSC2 GPIO1	I/O I/O I/O	VDD_IO	ALT2: Reset configuration	E2
EMB_AD14	0x1E STD_PU	ALT0 ALT1 ALT2 ALT3	LPC_AD14/NFC_AD14 PSC2_1 RST_CONF_PREDIV2 GPIO22	LPC PSC2 GPIO1	I/O I/O I/O	VDD_IO	ALT2: Reset configuration	H4
EMB_AD15	0x1D STD_PU	ALT0 ALT1 ALT2 ALT3	LPC_AD15/NFC_AD15 PSC2_0 RST_CONF_SYSOSCEN GPIO21	LPC PSC2 GPIO1	I/O I/O I/O	VDD_IO	ALT2: Reset configuration	E1
EMB_AD16	0x1C STD_PU	ALT0 ALT1 ALT2 ALT3	LPC_AD16/LPC_A01/$\overline{\text{NFC_WE}}$ — — —	LPC — —	I/O — —	VDD_IO	—	F3
EMB_AD17	0x1B STD_PU	ALT0 ALT1 ALT2 ALT3	LPC_AD17/LPC_A02/$\overline{\text{NFC_RE}}$ — RST_CONF_PLL_LOCK —	LPC — —	I/O — —	VDD_IO	ALT2: Reset configuration	G3
EMB_AD18	0x1A STD_PU	ALT0 ALT1 ALT2 ALT3	LPC_AD18/LPC_A03/NFC_CLE — RST_CONF_LPCMX —	LPC — —	I/O — —	VDD_IO	ALT2: Reset configuration	G2

Table 2. MPC5125 Pin Multiplexing (continued)

Pin	Pad I/O Control Register[1] and Offset[2]	Alternate Function[3]	Functions[4]	Peripheral[5]	I/O Direction	Power Domain	Notes	Pin
EMB_AD19	0x19 STD_PU	ALT0 ALT1 ALT2 ALT3	LPC_AD19/LPC_A04/NFC_ALE — RST_CONF_LPCWA —	LPC — —	I/O — —	VDD_IO	ALT2: Reset configuration	J4
EMB_AD20	0x18 STD_PU	ALT0 ALT1 ALT2 ALT3	LPC_AD20/LPC_A05 — — GPIO20	LPC GPIO1	I/O — — I/O	VDD_IO	—	H3
EMB_AD21	0x17 STD_PU	ALT0 ALT1 ALT2 ALT3	LPC_AD21/LPC_A06 — — GPIO19	LPC GPIO1	I/O — — I/O	VDD_IO	—	F1
EMB_AD22	0x16 STD_PU	ALT0 ALT1 ALT2 ALT3	LPC_AD22/LPC_A07 — RST_CONF_LPC_TS GPIO18	LPC GPIO1	I/O — I/O	VDD_IO	ALT2: Reset configuration	K4
EMB_AD23	0x15 STD_PU	ALT0 ALT1 ALT2 ALT3	LPC_AD23/LPC_A08 — — GPIO17	LPC GPIO1	I/O — — I/O	VDD_IO	—	J3
EMB_AD24	0x14 STD_PU	ALT0 ALT1 ALT2 ALT3	LPC_AD24/LPC_A09 — — GPIO16	LPC GPIO1	I/O — — I/O	VDD_IO	—	K3
EMB_AD25	0x13 STD_PU	ALT0 ALT1 ALT2 ALT3	LPC_AD25/LPC_A10 — — GPIO15	LPC GPIO1	I/O — — I/O	VDD_IO	—	G1
EMB_AD26	0x12 STD_PU	ALT0 ALT1 ALT2 ALT3	LPC_AD26/LPC_A11 — — GPIO14	LPC GPIO1	I/O — — I/O	VDD_IO	—	J2

Table 2. MPC5125 Pin Multiplexing (continued)

Pin	Pad I/O Control Register[1] and Offset[2]	Alternate Function[3]	Functions[4]	Peripheral[5]	I/O Direction	Power Domain	Notes	Pin
EMB_AD27	0x11 STD_PU	ALT0 ALT1 ALT2 ALT3	LPC_AD27/LPC_A12 — — GPIO13	LPC GPIO1	I/O — — I/O	VDD_IO	—	M4
EMB_AD28	0x10 STD_PU	ALT0 ALT1 ALT2 ALT3	LPC_AD28/LPC_A13 — — GPIO12	LPC GPIO1	I/O — — I/O	VDD_IO	—	H1
EMB_AD29	0x0F STD_PU	ALT0 ALT1 ALT2 ALT3	LPC_AD29/LPC_A14 — — GPIO11	LPC GPIO1	I/O — — I/O	VDD_IO	—	L3
EMB_AD30	0x0E STD_PU_ST	ALT0 ALT1 ALT2 ALT3	LPC_AD30/LPC_A15 CAN_CLK — GPIO10	LPC GPIO1	I/O O — I/O	VDD_IO	—	M3
EMB_AD31	0x0D STD_PU_ST	ALT0 ALT1 ALT2 ALT3	LPC_AD31/LPC_A16 PSC_MCLK_IN — GPIO09	LPC GPIO1	I/O I — I/O	VDD_IO	—	J1
EMB_AX00	0x0C STD_PU	ALT0 ALT1 ALT2 ALT3	LPC_AX00/LPC_ALE — — —	LPC — — —	O — — —	VDD_IO	—	K1
EMB_AX01	0x0B STD_PU	ALT0 ALT1 ALT2 ALT3	LPC_AX01/LPC_TSIZ0 — LPC_CS4 —	LPC — LPC —	O — O —	VDD_IO	—	N4

Table 2. MPC5125 Pin Multiplexing (continued)

Pin	Pad I/O Control Register[1] and Offset[2]	Alternate Function[3]	Functions[4]	Peripheral[5]	I/O Direction	Power Domain	Notes	Pin
EMB_AX02	0x0A STD_PU	ALT0 ALT1 ALT2 ALT3	LPC_AX02/LPC_TSIZ1 NFC_CE3 LPC_CS3 —	LPC LPC —	O O O —	VDD_IO	—	L2
NFC_CE0_B	0x02D STD_PU	ALT0 ALT1 ALT2 ALT3	NFC_CE0 — — GPIO29	NFC — — GPIO1	O — — I/O	VDD_IO	—	P1
NFC_RB	0x02E STD_PU_ST	ALT0 ALT1 ALT2 ALT3	NFC_R/B0 — — GPIO30	NFC — — GPIO1	I — — I/O	VDD_IO	When booting from the NFC, the NFC_RB pin needs an external pullup resistor.	N1
DIU_CLK	0x02F STD_PU	ALT0 ALT1 ALT2 ALT3	DIU_CLK PSC4_0 USB1_DATA0 LPC_AX04	DIU PSC4 USB1 LPC	O I/O I/O O	VDD_IO	—	AB8
DIU_DE	0x030 STD_PU	ALT0 ALT1 ALT2 ALT3	DIU_DE PSC4_1 USB1_DATA1 LPC_AX05	DIU PSC4 USB1 LPC	O I/O I/O O	VDD_IO	—	AA8
DIU_HSYNC	0x031 STD_PU	ALT0 ALT1 ALT2 ALT3	DIU_HSYNC PSC4_2 USB1_DATA2 LPC_AX06	DIU PSC4 USB1 LPC	O I/O I/O O	VDD_IO	—	W11
DIU_VSYNC	0x032 STD_PU	ALT0 ALT1 ALT2 ALT3	DIU_VSYNC PSC4_3 USB1_DATA3 GPIO31	DIU PSC4 USB1 GPIO1	I/O I/O I/O I/O	VDD_IO	—	Y17
DIU_LD00	0x033 STD_PU_ST	ALT0 ALT1 ALT2 ALT3	CAN3_RX CLK_OUT2 DIU_LD00 GPIO32	CAN3 DIU DIU GPIO2	I O I/O I/O	VDD_IO	—	AB9

Table 2. MPC5125 Pin Multiplexing (continued)

Pin	Pad I/O Control Register[1] and Offset[2]	Alternate Function[3]	Functions[4]	Peripheral[5]	I/O Direction	Power Domain	Notes	Pin
DIU_LD01	0x034 STD_PU	ALT0 ALT1 ALT2 ALT3	CAN3_TX CLK_OUT3 DIU_LD01 GPIO33	CAN3 DIU DIU GPIO2	O O I/O I/O	VDD_IO	—	Y10
DIU_LD02	0x035 STD_PU	ALT0 ALT1 ALT2 ALT3	DIU_LD02 PSC4_4 USB1_DATA4 LPC_AX07	DIU PSC4 USB1 LPC	 I/O I/O O	VDD_IO	—	AA10
DIU_LD03	0x036 STD_PU	ALT0 ALT1 ALT2 ALT3	DIU_LD03 PSC5_0 USB1_DATA5 LPC_AX08	DIU PSC5 USB1 LPC	I/O I/O I/O O	VDD_IO	—	Y11
DIU_LD04	0x037 STD_PU	ALT0 ALT1 ALT2 ALT3	DIU_LD04 PSC5_1 USB1_DATA6 LPC_AX09	DIU PSC5 USB1 LPC	I/O I/O I/O O	VDD_IO	—	AA11
DIU_LD05	0x038 STD_PU	ALT0 ALT1 ALT2 ALT3	DIU_LD05 PSC5_2 USB1_DATA7 GPIO34	DIU PSC5 USB1 GPIO2	I/O I/O I/O I/O	VDD_IO	—	AB10
DIU_LD06	0x039 STD_PU	ALT0 ALT1 ALT2 ALT3	DIU_LD06 PSC5_3 USB1_STOP GPIO35	DIU PSC5 USB1 GPIO2	I/O I/O O I/O	VDD_IO	—	AB11
DIU_LD07	0x03A STD_PU_ST	ALT0 ALT1 ALT2 ALT3	DIU_LD07 PSC5_4 USB1_CLK GPIO36	DIU PSC5 USB1 GPIO2	I/O I/O I I/O	VDD_IO	—	Y12
DIU_LD08	0x03B STD_PU_ST	ALT0 ALT1 ALT2 ALT3	CAN4_RX PSC6_0 DIU_LD08 GPIO37	CAN4 PSC6 DIU GPIO2	I I/O I/O I/O	VDD_IO	—	W13

Table 2. MPC5125 Pin Multiplexing (continued)

Pin	Pad I/O Control Register[1] and Offset[2]	Alternate Function[3]	Functions[4]	Peripheral[5]	I/O Direction	Power Domain	Notes	Pin
DIU_LD09	0x03C STD_PU	ALT0 ALT1 ALT2 ALT3	CAN4_TX PSC6_1 DIU_LD09 GPIO38	CAN4 PSC6 DIU GPIO2	O I/O I/O I/O	VDD_IO	—	AB12
DIU_LD10	0x03D STD_PU	ALT0 ALT1 ALT2 ALT3	DIU_LD10 PSC6_2 USB1_NEXT GPIO39	DIU PSC6 USB1 GPIO2	I/O I/O O I/O	VDD_IO	—	Y13
DIU_LD11	0x03E STD_PU	ALT0 ALT1 ALT2 ALT3	DIU_LD11 PSC6_3 USB1_DIR GPIO40	DIU PSC6 USB1 GPIO2	I/O I/O I I/O	VDD_IO	—	AA13
DIU_LD12	0x03F STD_PU	ALT0 ALT1 ALT2 ALT3	DIU_LD12 PSC6_4 USB2_DATA0 GPT2[0]	DIU PSC6 USB2 GPT2	I/O I/O I/O I/O	VDD_IO	—	AB13
DIU_LD13	0x040 STD_PU	ALT0 ALT1 ALT2 ALT3	DIU_LD13 PSC7_0 USB2_DATA1 GPT2[1]	DIU PSC7 USB2 GPT2	I/O I/O I/O I/O	VDD_IO	—	W14
DIU_LD14	0x041 STD_PU	ALT0 ALT1 ALT2 ALT3	DIU_LD14 PSC7_1 USB2_DATA2 GPT2[2]	DIU PSC7 USB2 GPT2	I/O I/O I/O I/O	VDD_IO	—	Y14
DIU_LD15	0x042 STD_PU	ALT0 ALT1 ALT2 ALT3	DIU_LD15 PSC7_2 USB2_DATA3 GPT2[3]	DIU PSC7 USB2 GPT2	I/O I/O I/O I/O	VDD_IO	—	AB14
DIU_LD16	0x043 STD_PU_ST	ALT0 ALT1 ALT2 ALT3	CLK_OUT0 I2C3_SCL DIU_LD16 GPIO41	DIU I^2C2 DIU GPIO2	O I/O I/O I/O	VDD_IO	—	AA15

Table 2. MPC5125 Pin Multiplexing (continued)

Pin	Pad I/O Control Register[1] and Offset[2]	Alternate Function[3]	Functions[4]	Peripheral[5]	I/O Direction	Power Domain	Notes	Pin
DIU_LD17	0x044 STD_PU_ST	ALT0 ALT1 ALT2 ALT3	CLK_OUT1 I2C3_SDA DIU_LD17 GPIO42	DIU I^2C3 DIU GPIO2	O I/O I/O I/O	VDD_IO	—	Y15
DIU_LD18	0x045 STD_PU	ALT0 ALT1 ALT2 ALT3	DIU_LD18 PSC7_3 USB2_DATA4 GPT2[4]	DIU PSC7 USB2 GPT2	I/O I/O I/O I/O	VDD_IO	—	AB15
DIU_LD19	0x046 STD_PU	ALT0 ALT1 ALT2 ALT3	DIU_LD19 PSC7_4 USB2_DATA5 GPT2[5]	DIU PSC7 USB2 GPT2	I/O I/O I/O I/O	VDD_IO	—	AB16
DIU_LD20	0x047 STD_PU	ALT0 ALT1 ALT2 ALT3	DIU_LD20 PSC8_0 USB2_DATA6 GPT2[6]	DIU PSC8 USB2 GPT2	I/O I/O I/O I/O	VDD_IO	—	AB17
DIU_LD21	0x048 STD_PU	ALT0 ALT1 ALT2 ALT3	DIU_LD21 PSC8_1 USB2_DATA7 GPT2[7]	DIU PSC8 USB2 GPT2	I/O I/O I/O I/O	VDD_IO	—	W16
DIU_LD22	0x049 STD_PU	ALT0 ALT1 ALT2 ALT3	DIU_LD22 PSC8_2 USB2_DIR GPIO43	DIU PSC8 USB2 GPIO2	I/O I/O I I/O	VDD_IO	—	Y16
DIU_LD23	0x04A STD_PU	ALT0 ALT1 ALT2 ALT3	DIU_LD23 PSC8_3 USB2_NEXT GPIO44	DIU PSC8 USB2 GPIO2	I/O I/O I I/O	VDD_IO	—	AA17
I2C2_SCL	0x4B STD_PU_ST	ALT0 ALT1 ALT2 ALT3	I2C2_SCL PSC8_4 USB2_CLK GPIO45	I^2C2 PSC8 USB2 GPIO2	I/O I/O I I/O	VDD_IO	—	V4

Table 2. MPC5125 Pin Multiplexing (continued)

Pin	Pad I/O Control Register[1] and Offset[2]	Alternate Function[3]	Functions[4]	Peripheral[5]	I/O Direction	Power Domain	Notes	Pin
I2C2_SDA	0x4C STD_PU_ST	ALT0 ALT1 ALT2 ALT3	I2C2_SDA PSC9_4 USB2_STOP GPIO46	I^2C2 PSC9 USB2 GPIO2	I/O I/O O I/O	VDD_IO	—	U4
I2C1_SCL	0x4F STD_PU_ST	ALT0 ALT1 ALT2 ALT3	I2C1_SCL PSC9_2 CAN3_RX GPIO49	I^2C1 PSC9 CAN3 GPIO2	I/O I/O I I/O	VDD_IO	—	B18
I2C1_SDA	0x50 STD_PU_ST	ALT0 ALT1 ALT2 ALT3	I2C1_SDA PSC9_3 CAN3_TX GPIO50	I^2C1 PSC9 CAN3 GPIO2	I/O I/O O I/O	VDD_IO	—	A19
CAN1_RX	—	ALT0 ALT1 ALT2 ALT3	CAN1_RX — — —	CAN1 — — —	I — — —	VBAT	Dedicated input can be used to receive an external wakeup.	C9
CAN2_RX	—	ALT0 ALT1 ALT2 ALT3	CAN2_RX — — —	CAN2 — — —	I — — —	VBAT	Dedicated input can be used to receive an external wakeup.	B8
CAN1_TX	0x4D STD_PU_ST	ALT0 ALT1 ALT2 ALT3	CAN1_TX PSC9_0 I2C2_SCL GPIO47	CAN1 PSC9 I^2C2 GPIO2	O I/O I/O I/O	VDD_IO	—	B15
CAN2_TX	0x4E STD_PU_ST	ALT0 ALT1 ALT2 ALT3	CAN2_TX PSC9_1 I2C2_SDA GPIO48	CAN2 PSC9 I^2C2 GPIO2	O I/O I/O I/O	VDD_IO	—	A16
FEC1_TXD_2	0x51 STD_PU	ALT0 ALT1 ALT2 ALT3	FEC1_TXD_2 PSC2_0 USB2_DATA0 GPIO51	FEC1 PSC2 USB2 GPIO2	O I/O I/O I/O	VDD_IO	—	AA1

Table 2. MPC5125 Pin Multiplexing (continued)

Pin	Pad I/O Control Register[1] and Offset[2]	Alternate Function[3]	Functions[4]	Peripheral[5]	I/O Direction	Power Domain	Notes	Pin
FEC1_TXD_3	0x52 STD_PU	ALT0 ALT1 ALT2 ALT3	FEC1_TXD_3 PSC2_1 USB2_DATA1 GPIO52	FEC1 PSC2 USB2 GPIO2	O I/O I/O I/O	VDD_IO	—	Y1
FEC1_RXD_2	0x53 STD_PU	ALT0 ALT1 ALT2 ALT3	FEC1_RXD_2 PSC2_2 USB2_DATA2 GPIO53	FEC1 PSC2 USB2 GPIO2	I I/O I/O I/O	VDD_IO	—	Y4
FEC1_RXD_3	0x54 STD_PU	ALT0 ALT1 ALT2 ALT3	FEC1_RXD_3 PSC2_3 USB2_DATA3 GPIO54	FEC1 PSC2 USB2 GPIO2	I I/O I/O I/O	VDD_IO	—	AA2
FEC1_CRS	0x55 STD_PU	ALT0 ALT1 ALT2 ALT3	FEC1_CRS PSC2_4 USB2_DATA4 GPIO55	FEC1 PSC2 USB2 GPIO2	I I/O I/O I/O	VDD_IO	—	U1
FEC1_TX_ER	0x56 STD_PU	ALT0 ALT1 ALT2 ALT3	FEC1_TX_ER PSC3_0 USB2_DATA5 GPIO56	FEC1 PSC3 USB2 GPIO2	O I/O I/O I/O	VDD_IO	—	W2
FEC1_RXD_1	0x57 STD_PU	ALT0 ALT1 ALT2 ALT3	FEC1_RXD_1/RMII_RX1 PSC3_1 USB2_DATA6 GPIO57	FEC1 PSC3 USB2 GPIO2	I I/O I/O I/O	VDD_IO	—	AA3
FEC1_TXD_1	0x58 STD_PU	ALT0 ALT1 ALT2 ALT3	FEC1_TXD_1/RMII_TX1 PSC3_2 USB2_DATA7 GPIO58	FEC1 PSC3 USB2 GPIO2	O I/O I/O I/O	VDD_IO	—	W3
FEC1_MDC	0x59 STD_PU	ALT0 ALT1 ALT2 ALT3	FEC1_MDC/RMII_MDC PSC3_3 USB2_DIR GPIO59	FEC1 PSC3 USB2 GPIO2	O I/O I I/O	VDD_IO	—	V1

Table 2. MPC5125 Pin Multiplexing (continued)

Pin	Pad I/O Control Register[1] and Offset[2]	Alternate Function[3]	Functions[4]	Peripheral[5]	I/O Direction	Power Domain	Notes	Pin
FEC1_RX_ER	0x5A STD_PU	ALT0 ALT1 ALT2 ALT3	FEC1_RX_ER/RMII_RX_ER PSC3_4 USB2_NEXT GPIO60	FEC1 PSC3 USB2 GPIO2	I I/O I I/O	VDD_IO	—	Y5
FEC1_MDIO	0x5B STD_PU_ST	ALT0 ALT1 ALT2 ALT3	FEC1_MDIO/RMII_MDIO — USB2_CLK GPIO61	FEC1 — USB2 GPIO2	I/O — I I/O	VDD_IO	—	V2
FEC1_RXD_0	0x5C STD_PU	ALT0 ALT1 ALT2 ALT3	FEC1_RXD_0/RMII_RX0 — USB2_STOP GPIO62	FEC1 — USB2 GPIO2	I — O I/O	VDD_IO	—	AB2
FEC1_TXD_0	0x5D STD_PU_ST	ALT0 ALT1 ALT2 ALT3	FEC1_TXD_0/RMII_TX0 — NFC_R/$\overline{B}$1 GPIO63	FEC1 — NFC GPIO2	O — I I/O	VDD_IO	—	W4
FEC1_TX_CLK	0x5E STD_PU_ST	ALT0 ALT1 ALT2 ALT3	FEC1_TX_CLK/RMII_REF_CLK PSC0_0 — GPIO04	FEC1 PSC0 — GPIO1	I I/O — I/O	VDD_IO	—	W1
FEC1_RX_CLK	0x5F STD_PU_ST	ALT0 ALT1 ALT2 ALT3	FEC1_RX_CLK PSC0_1 NFC_R/$\overline{B}$2 GPIO05	FEC1 PSC0 — GPIO1	I I/O I I/O	VDD_IO	—	AB4
FEC1_RX_DV	0x60 STD_PU_ST	ALT0 ALT1 ALT2 ALT3	FEC1_RX_DV/RMII_CRS_DV PSC0_2 NFC_R/$\overline{B}$3 GPIO06	FEC1 PSC0 NFC GPIO1	I I/O I I/O	VDD_IO	—	AB3

Table 2. MPC5125 Pin Multiplexing (continued)

Pin	Pad I/O Control Register[1] and Offset[2]	Alternate Function[3]	Functions[4]	Peripheral[5]	I/O Direction	Power Domain	Notes	Pin
FEC1_TX_EN	0x61 STD_PU	ALT0 ALT1 ALT2 ALT3	FEC1_TX_EN/RMII_TX_EN PSC0_3 — GPIO07	FEC1 PSC0 — GPIO1	O I/O — I/O	VDD_IO	—	Y3
FEC1_COL	0x62 STD_PU_ST	ALT0 ALT1 ALT2 ALT3	FEC1_COL PSC0_4 — GPIO08	FEC1 PSC0 GPIO1	I I/O — I/O	VDD_IO	—	U3
USB1_DATA0	0x63 STD_PU	ALT0 ALT1 ALT2 ALT3	USB1_DATA0 PSC1_0 FEC2_RXD_1/RMII_RX1 —	USB2 PSC1 FEC2	I/O I/O I —	VDD_IO	—	Y9
USB1_DATA1	0x64 STD_PU	ALT0 ALT1 ALT2 ALT3	USB1_DATA1 PSC1_1 FEC2_TXD_1/RMII_TX1 —	USB2 PSC1 FEC2	I/O I/O O —	VDD_IO	—	W9
USB1_DATA2	0x65 STD_PU	ALT0 ALT1 ALT2 ALT3	USB1_DATA2 PSC1_2 FEC2_MDC/RMII_MDC —	USB2 PSC1 FEC2	I/O I/O O —	VDD_IO	—	AB7
USB1_DATA3	0x66 STD_PU	ALT0 ALT1 ALT2 ALT3	USB1_DATA3 PSC1_3 FEC2_RX_ER/RMII_RX_ER —	USB2 PSC1 FEC2	I/O I/O I —	VDD_IO	—	AB6
USB1_DATA4	0x67 STD_PU	ALT0 ALT1 ALT2 ALT3	USB1_DATA4 PSC1_4 FEC2_MDIO/RMII_MDIO —	USB2 PSC1 FEC2	I/O I/O I/O —	VDD_IO	—	AA7
USB1_DATA5	0x68 STD_PU	ALT0 ALT1 ALT2 ALT3	USB1_DATA5 PSC4_0 FEC2_RXD_0/RMII_RX0 —	USB2 PSC4 FEC2	I/O I/O I —	VDD_IO	—	Y7

Table 2. MPC5125 Pin Multiplexing (continued)

Pin	Pad I/O Control Register[1] and Offset[2]	Alternate Function[3]	Functions[4]	Peripheral[5]	I/O Direction	Power Domain	Notes	Pin
USB1_DATA6	0x69 STD_PU	ALT0 ALT1 ALT2 ALT3	USB1_DATA6 PSC4_1 FEC2_TXD_0/RMII_TX0 —	USB2 PSC4 FEC2	I/O I/O O —	VDD_IO	—	Y6
USB1_DATA7	0x6A STD_PU_ST	ALT0 ALT1 ALT2 ALT3	USB1_DATA7 PSC4_2 FEC2_TX_CLK/RMII_REF_CLK —	USB2 PSC4 FEC2	I/O I/O I —	VDD_IO	—	AB5
USB1_STOP	0x6B STD_PU_ST	ALT0 ALT1 ALT2 ALT3	USB1_STOP PSC4_3 FEC2_RX_CLK —	USB2 PSC4 FEC2	O I/O I —	VDD_IO	—	W6
USB1_CLK	0x6C STD_PU_ST	ALT0 ALT1 ALT2 ALT3	USB1_CLK PSC4_4 FEC2_RX_DV/RMII_CRS_DV —	USB2 PSC4 FEC2	I I/O I —	VDD_IO	—	Y8
USB1_NEXT	0x6D STD_PU	ALT0 ALT1 ALT2 ALT3	USB1_NEXT — FEC2_TX_EN/RMII_TX_EN GPIO09	USB2 — FEC2 GPIO1	I — O I/O	VDD_IO	—	AA5
USB1_DIR	0x6E STD_PU_ST	ALT0 ALT1 ALT2 ALT3	USB1_DIR — FEC2_COL GPIO10	USB2 — FEC2 GPIO1	I — I I/O	VDD_IO	—	W7
SDHC								
SDHC1_CLK	0x6F STD_PU	ALT0 ALT1 ALT2 ALT3	SDHC1_CLK NFC_CE1 FEC2_TXD_2 GPIO11	SDHC1 NFC FEC2 GPIO1	O O O I/O	VDD_IO	—	T1

Table 2. MPC5125 Pin Multiplexing (continued)

Pin	Pad I/O Control Register[1] and Offset[2]	Alternate Function[3]	Functions[4]	Peripheral[5]	I/O Direction	Power Domain	Notes	Pin
SDHC1_CMD	0x70 STD_PU	ALT0 ALT1 ALT2 ALT3	SDHC1_CMD PSC5_0 FEC2_TXD_3 GPIO12	SDHC1 PSC5 FEC2 GPIO1	I/O I/O O I/O	VDD_IO	—	T2
SDHC1_D0	0x71 STD_PU	ALT0 ALT1 ALT2 ALT3	SDHC1_D0 PSC5_1 FEC2_RXD_2 GPIO13	SDHC1 PSC5 FEC2 GPIO1	I/O I/O I I/O	VDD_IO	—	T3
SDHC1_D1	0x72 STD_PU	ALT0 ALT1 ALT2 ALT3	SDHC1_D1_IRQ PSC5_2 FEC2_RXD_3 LPC_CS5	SDHC1 PSC5 FEC2 LPC	I/O I/O I O	VDD_IO	—	T4
SDHC1_D2	0x73 STD_PU	ALT0 ALT1 ALT2 ALT3	SDHC1_D2 PSC5_3 FEC2_CRS LPC_CS6	SDHC1 PSC5 FEC2 LPC	I/O I/O I O	VDD_IO	—	R1
SDHC1_D3	0x74 STD_PU	ALT0 ALT1 ALT2 ALT3	SDHC1_D3_CD PSC5_4 FEC2_TX_ER LPC_CS7	SDHC1 PSC5 FEC2 LPC	I/O I/O O O	VDD_IO	—	R2
PSC_MCLK_IN	0x75 STD_PU_ST	ALT0 ALT1 ALT2 ALT3	PSC_MCLK_IN — — GPIO14	 — — GPIO1	I — — I/O	VDD_IO	—	D6
PSC0_0	0x76 STD_PU	ALT0 ALT1 ALT2 ALT3	PSC0_0 SDHC2_CMD GPT1[0] GPIO15	PSC0 SDHC2 GPT1 GPIO1	I/O I/O I/O I/O	VDD_IO	—	C11
PSC0_1	0x77 STD_PU	ALT0 ALT1 ALT2 ALT3	PSC0_1 SDHC2_D0 GPT1[1] GPIO16	PSC0 SDHC2 GPT1 GPIO1	I/O I/O I/O I/O	VDD_IO	—	A12

Table 2. MPC5125 Pin Multiplexing (continued)

Pin	Pad I/O Control Register[1] and Offset[2]	Alternate Function[3]	Functions[4]	Peripheral[5]	I/O Direction	Power Domain	Notes	Pin
PSC0_2	0x78 STD_PU	ALT0 ALT1 ALT2 ALT3	PSC0_2 SDHC2_D1_IRQ GPT1[2] GPIO17	PSC0 SDHC2 GPT1 GPIO1	I/O I/O I/O I/O	VDD_IO	—	A13
PSC0_3	0x79 STD_PU	ALT0 ALT1 ALT2 ALT3	PSC0_3 SDHC2_D2 GPT1[3] GPIO18	PSC0 SDHC2 GPT1 GPIO1	I/O I/O I/O I/O	VDD_IO	—	B13
PSC0_4	0x7A STD_PU	ALT0 ALT1 ALT2 ALT3	PSC0_4 SDHC2_D3_CD GPT1[4] CAN1_TX	PSC0 SDHC2 GPT1 CAN1	I/O I/O I/O O	VDD_IO	—	D11
PSC1_0	0x7B STD_PU	ALT0 ALT1 ALT2 ALT3	PSC1_0 SDHC2_CLK GPT1[5] CAN2_TX	PSC1 SDHC2 GPT1 CAN2	I/O O O O	VDD_IO	—	C12
PSC1_1	0x7C STD_PU	ALT0 ALT1 ALT2 ALT3	PSC1_1 CAN_CLK GPT1[6] IRQ0	PSC1 GPT1	I/O I/O I	VDD_IO	—	C13
PSC1_2	0x7D STD_PU	ALT0 ALT1 ALT2 ALT3	PSC1_2 TPA2 GPT1[7] IRQ1	PSC1 GPT1	I/O I/O I	VDD_IO	—	B14
PSC1_3	0x7E STD_PU	ALT0 ALT1 ALT2 ALT3	PSC1_3 CKSTP_IN NFC_R/$\overline{B}$2 GPIO19	PSC1 NFC GPIO1	I/O I I/O	VDD_IO	—	D13
PSC1_4	0x7F STD_PU	ALT0 ALT1 ALT2 ALT3	PSC1_4 CKSTP_OUT NFC_CE2 GPIO20	PSC1 MFC GPIO1	I/O O I/O	VDD_IO	—	A15

Table 2. MPC5125 Pin Multiplexing (continued)

Pin	Pad I/O Control Register[1] and Offset[2]	Alternate Function[3]	Functions[4]	Peripheral[5]	I/O Direction	Power Domain	Notes	Pin
J1850_TX	0x80 STD_PU_ST	ALT0 ALT1 ALT2 ALT3	J1850_TX — NFC_CE3 I2C1_SCL	J1850 — NFC I^2C1	O — O I/O	VDD_IO	—	B5
J1850_RX	0x81 STD_PU_ST	ALT0 ALT1 ALT2 ALT3	J1850_RX — NFC_R/$\overline{B}$3 I2C1_SDA	J1850 — NFC I^2C1	I — I I/O	VDD_IO	—	C6
JTAG								
TCK	—	ALT0 ALT1 ALT2 ALT3	TCK — — —	JTAG — — —	I — — —	VDD_IO	5. This pin contains an enabled internal Schmitt trigger.	C16
TDI	—	ALT0 ALT1 ALT2 ALT3	TDI — — —	JTAG — — —	I — — —	VDD_IO	3. This JTAG pin has an internal pullup P-FET, and cannot be configured.	C15
TDO	—	ALT0 ALT1 ALT2 ALT3	TDO — — —	JTAG — — —	O — — —	VDD_IO	—	B16
TMS	—	ALT0 ALT1 ALT2 ALT3	TMS — — —	JTAG — — —	I — — —	VDD_IO	3. This JTAG pin has an internal pullup P-FET, and cannot be configured.	D15
$\overline{TRST}$	—	ALT0 ALT1 ALT2 ALT3	$\overline{TRST}$ — — —	JTAG — — —	I — — —	VDD_IO	3. This JTAG pin has an internal pullup P-FET, and cannot be configured.	D16
System Control								

Table 2. MPC5125 Pin Multiplexing (continued)

Pin	Pad I/O Control Register[1] and Offset[2]	Alternate Function[3]	Functions[4]	Peripheral[5]	I/O Direction	Power Domain	Notes	Pin
$\overline{\text{HRESET}}$	—	ALT0 ALT1 ALT2 ALT3	$\overline{\text{HRESET}}$ — — —	 — — —	I — — —	VDD_IO	1. This pin is an input or open-drain output, and have internal pull-up P-FETs. This pin can not be configured. 5. This pin contains an enabled internal schmitt-trigger.	A17
$\overline{\text{PORESET}}$	—	ALT0 ALT1 ALT2 ALT3	$\overline{\text{PORESET}}$ — — —	 — — —	I — — —	VDD_IO	1. This pin is an input or open-drain output, and have internal pull-up P-FETs. This pin can not be configured. 2. This pin is an input only. This pin cannot be configured. 5. This pin contains an enabled internal schmitt-trigger.	C17
$\overline{\text{SRESET}}$	—	ALT0 ALT1 ALT2 ALT3	$\overline{\text{SRESET}}$ — — —	 — — —	I — — —	VDD_IO	1. This pin is an input or open-drain output, and have internal pull-up P-FETs. This pin can not be configured. 5. This pin contains an enabled internal schmitt-trigger.	A18
Test/Debug								
TEST	—	ALT0 ALT1 ALT2 ALT3	TEST — — —	 — — —	I — — —	VDD_IO	2. This pin is an input only. This pin cannot be configured. 4. This test pin must be tied to VSS.	D14

NOTES:

1 Pins controlled by the STD_PU_ST register have a Schmitt trigger input; pins controlled by the STD_PU register do not. Pins controlled by the IO_CONTROL_MEM register access their alternate function ALT3 by setting the IO_CONTROL_MEM[16BIT] bit. This setting applies to all pins controlled by IO_CONTROL_MEM. Pins not controlled by these registers are indicated with a "—".

2 Offset from IOCONTROL_BASE (default is 0xFF40_A000).

3 Except where noted in the Notes column, ALT0 is the primary (default) function for each pin after reset.

4 Alternate functions are chosen by setting the values of the STD_PU[FUNCMUX] bitfields inside the I/O Control module.
– STD_PU[FUNCMUX] = 00 → ALT0 (default)
– STD_PU[FUNCMUX] = 01 → ALT1
– STD_PU[FUNCMUX] = 10 → ALT2
– STD_PU[FUNCMUX] = 11→ ALT3
For selecting alternate functions, the STD_PU and STD_PU_ST registers function the same. When no function is available on a pin's given ALT*n* function (value of STD_PU[FUNCMUX]), it is shown as "—".

5 Module included on the MCU.

3.2.1 Power and Ground Supply Summary

Table 3. MPC5125 324 TEPBGA Power/Ground

Pin Name	Function Description	Voltage[1]	Package Pin Locations
V_{DD}	Supply voltage — e300 core and peripheral logic	1.4 V	J10, J11, J12, J13, K14, L9, L14, M9, M14, N14, P10, P11, P12, P13
V_{DD_IO}	Supply voltage — I/O buffers	3.3 V	A14, B9, B12, B17, C5, C14, D3, F2, G4, H2, M2, R3, V3, W5, W15, AA4, AA9, AA12, AA14, AA16, AB18
$V_{DD_IO_MEM}$	Supply voltage — memory	—[2]	B19, C21, D17, D19, G19, H21, P19, R21, T19, V19, W19, Y21, AB20
AV_{DD_FUSEWR}	Power	3.3 V	D4
AV_{DD_CPLL}	Analog power	3.3 V	D10
AV_{DD_SPLL}	Analog power	3.3 V	A11
$AV_{DD_OSC_TMPS}$	Analog power	3.3 V	C10
V_{BAT}	Power	3.3 V	D8
AV_{SS_CPLL}	Analog ground	0 V	B11
$AV_{SS_OSC_TMPS_SPLL}$	Analog ground—Double-bonded AVSS_OSC_TMPS and AVSS_SPLL	0 V	B10
MV_{REF}	Analog input —Voltage reference for SSTL input pads	—[2]	N19
MV_{TT0}	Analog input —SSTL(DDR2) termination (ODT) voltage	—[2]	W18
MV_{TT1}	Analog input —SSTL(DDR2) termination (ODT) voltage	—[2]	R19
MV_{TT2}	Analog input —SSTL(DDR2) termination (ODT) voltage	—[2]	M19
MV_{TT3}	Analog input —SSTL(DDR2) termination (ODT) voltage	—[2]	K19
V_{SS}	Ground	0 V	A1, A2, A22, B1, B7, D7, D12, F4, F21, J9, J14, K2, K[9:13], K21, L4, L[10:13], L19, M[10:13], N[9:13], N21, P2, P4, P9, P14, U2, U21, W8, W10, W12, W17, Y2, AA6, AA18, AB1, AB22

NOTES:
1 Nominal voltages.

2 Dependent on external memory type. See Table 3

NOTE

This table indicates only the pins with a permanently enabled internal pullup, pulldown, or Schmitt trigger. Most digital I/O pins can be configured to enable internal pullup, pulldown, or Schmitt trigger. See the *MPC5125 Reference Manual (MPC5125RM)*, “I/O Control” chapter.

4 Electrical and Thermal Characteristics

4.1 DC Electrical Characteristics

4.1.1 Absolute Maximum Ratings

The tables in this section describe the MPC5125 DC electrical characteristics. Table 4 gives the absolute maximum ratings.

Table 4. Absolute Maximum Ratings[1]

Characteristic	Sym	Min	Max	Unit	SpecID
Supply voltage — e300 core and peripheral logic	V_{DD}	–0.3	1.47	V	D1.1
Supply voltage — I/O buffers	V_{DD_IO}, $V_{DD_IO_MEM}$	–0.3	3.6	V	D1.2
Input reference voltage (DDR/DDR2)	MV_{REF}	–0.3	3.6	V	D1.15
Termination Voltage (DDR2)	MV_{TT}	–0.3	3.6	V	D1.16
Supply voltage — system APLL	AV_{DD_SPLL}	–0.3	3.6	V	D1.3
Supply voltage — system oscillator and temperature sensor	$AV_{DD_OSC_TMPS}$	–0.3	3.6	V	D1.4
Supply voltage — e300 APLL	AV_{DD_CPLL}	–0.3	3.6	V	D1.5
Supply voltage — RTC (hibernation)	V_{BAT}	–0.3	3.6	V	D1.6
Supply voltage — FUSE programming	AV_{DD_FUSEWR}	–0.3	3.6	V	D1.7
Input voltage (V_{DD_IO})	V_{in}	–0.3	V_{DD_IO} + 0.3	V	D1.9
Input voltage ($V_{DD_IO_MEM}$)	V_{in}	–0.3	$V_{DD_IO_MEM}$ + 0.3	V	D1.10
Input voltage (V_{BAT})	V_{in}	–0.3	V_{BAT} + 0.3	V	D1.11
Input voltage overshoot	V_{inos}	—	1	V	D1.12
Input voltage undershoot	V_{inus}	—	1	V	D1.13
Storage temperature range	T_{stg}	–55	150	°C	D1.14

NOTES:
1 Absolute maximum ratings are stress ratings only, and functional operation at the maximums is not guaranteed. Stresses beyond those listed may affect device reliability or cause permanent damage.

4.1.2 Recommended Operating Conditions

Table 5 gives the recommended operating conditions.

Table 5. Recommended Operating Conditions

Characteristic	Sym	Min[1]	Typ	Max[1]	Unit	SpecID
Supply voltage — e300 core and peripheral logic	V_{DD}	1.33	1.4	1.47	V	D2.1
State retention voltage — e300 core and peripheral logic [2]		1.08	—	—	V	D2.2

Table 5. Recommended Operating Conditions (continued)

Characteristic	Sym	Min[1]	Typ	Max[1]	Unit	SpecID
Supply voltage — standard I/O buffers	V_{DD_IO}	3.0	3.3	3.6	V	D2.3
Supply voltage — memory I/O buffers (DDR)	$V_{DD_IO_MEM_DDR}$	2.3	2.5	2.7	V	D2.4
Supply voltage — memory I/O buffers (DDR2, LPDDR, Mobile SDR)	$V_{DD_IO_MEM_DDR2}$ $V_{DD_IO_MEM_LPDDR}$	1.7	1.8	1.9	V	D2.5
Supply voltage — memory I/O buffers (SDR)	$V_{DD_IO_MEM_SDR}$	3.0	3.3	3.6	V	D2.19
Input reference voltage (DDR/DDR2)	MV_{REF}	0.49 × $V_{DD_IO_MEM}$	0.50 × $V_{DD_IO_MEM}$	0.51 × $V_{DD_IO_MEM}$	V	D2.6
Termination voltage (DDR2)	MV_{TT}	MV_{REF} – 0.04	MV_{REF}	MV_{REF} + 0.04	V	D2.7
Supply voltage — system APLL	AV_{DD_SPLL}	3.0	3.3	3.6	V	D2.8
Supply voltage — system oscillator and temperature sensor	$AV_{DD_OSC_TMPS}$	3.0	3.3	3.6	V	D2.9
Supply voltage — e300 APLL	AV_{DD_CPLL}	3.0	3.3	3.6	V	D2.10
Supply voltage — RTC (hibernation)	V_{BAT}[3]	3.0	3.3	3.6	V	D2.11
Supply voltage — FUSE programming	AV_{DD_FUSEWR}	3.0	3.3	3.6	V	D2.12
Input voltage — standard I/O buffers	V_{in}	0	—	V_{DD_IO}	V	D2.14
Input voltage — memory I/O buffers (DDR)	V_{in_DDR}	0	—	$V_{DD_IO_MEM_DDR}$	V	D2.15
Input voltage — memory I/O buffers (DDR2)	V_{in_DDR2}	0	—	$V_{DD_IO_MEM_DDR2}$	V	D2.16
Input voltage — memory I/O buffers (SDR)	V_{in_SDR}	0	—	$V_{DD_IO_MEM_SDR}$	V	D2.20
Input voltage — memory I/O buffers (LPDDR)	V_{in_LPDDR}	0	—	$V_{DD_IO_MEM_LPDDR}$	V	D2.18
Ambient operating temperature range	T_A	–40	—	+85	°C	D2.17

NOTES:
1 These are recommended and tested operating conditions. Proper device operation outside these conditions is not guaranteed.
2 The State Retention voltage can be applied to VDD after the device is placed in deep-sleep mode.
3 VBAT should not be supplied by a battery of voltage less than 3.0 V.

4.1.3 DC Electrical Specifications

Table 6 gives the DC electrical characteristics for the MPC5125 at recommended operating conditions.

Table 6. DC Electrical Specifications

Characteristic	Condition	Sym	Min	Max	Unit	SpecID
Input high voltage	Input type = TTL V_{DD_IO}	V_{IH}	0.51 × V_{DD_IO}	—	V	D3.1
Input high voltage	Input type = TTL $V_{DD_IO_MEM_DDR}$	V_{IH}	MV_{REF} + 0.15	—	V	D3.2

Table 6. DC Electrical Specifications (continued)

Characteristic	Condition	Sym	Min	Max	Unit	SpecID
Input high voltage	Input type = TTL $V_{DD_IO_MEM_DDR2}$	V_{IH}	MVREF + 0.125	—	V	D3.3
Input high voltage	Input type = TTL $V_{DD_IO_MEM_LPDDR}$	V_{IH}	$0.7 \times V_{DD_IO_MEM_LPDDR}$	—	V	D3.4
Input high voltage	Input type = TTL $V_{DD_IO_MEM_SDR}$	V_{IH}	$0.7 \times V_{DD_IO_MEM_SDR}$	—	V	D3.33
Input high voltage	Input type = Schmitt V_{DD_IO}	V_{IH}	$0.65 \times V_{DD_IO}$	—	V	D3.5
Input high voltage	SYS_XTALI crystal mode[1] bypass mode[2]	CV_{IH}	Vxtal + 0.4 $(V_{DD_IO} / 2) + 0.4$	—	V	D3.6
Input high voltage	RTC_XTALI crystal mode[3] bypass mode[4]	RV_{IH}	$(V_{BAT} / 5) + 0.5$ $(V_{BAT} / 2) + 0.4$	—	V	D3.7
Input low voltage	Input type = TTL V_{DD_IO}	V_{IL}	—	$0.42 \times V_{DD_IO}$	V	D3.8
Input low voltage	Input type = TTL $V_{DD_IO_MEM_DDR}$	V_{IL}	—	$MV_{REF} – 0.15$	V	D3.9
Input low voltage	Input type = TTL $V_{DD_IO_MEM_DDR2}$	V_{IL}	—	$MV_{REF} – 0.125$	V	D3.10
Input low voltage	Input type = TTL $V_{DD_IO_MEM_LPDDR}$	V_{IL}	—	$0.3 \times V_{DD_IO_MEM_LPDDR}$	V	D3.11
Input low voltage	Input type = TTL $V_{DD_IO_MEM_SDR}$	V_{IL}	—	$0.3 \times V_{DD_IO_MEM_SDR}$	V	D3.34
Input low voltage	Input type = Schmitt V_{DD_IO}	V_{IL}	—	$0.35 \times V_{DD_IO}$	V	D3.12
Input low voltage	SYS_XTALI crystal mode bypass mode	CV_{IL}	—	Vxtal – 0.4 × $(V_{DD_IO}/2) – 0.4$	V	D3.13
Input low voltage	RTC_XTALI crystal mode bypass mode	RV_{IL}	—	$(V_{BAT}/5) – 0.5$ $(V_{BAT}/2) – 0.4$	V	D3.14
Input leakage current	Vin = 0 or $V_{DD_IO}/V_{DD_IO_MEM_DDR/2}$ (depending on input type)[5]	I_{IN}	–2.5	2.5	µA	D3.15
Input leakage current	SYS_XTAL_IN V_{in} = 0 or V_{DD_IO}	I_{IN}	—	20	µA	D3.16
Input leakage current	RTC_XTAL_IN V_{in} = 0 or V_{DD_IO}	I_{IN}	—	1.0	µA	D3.17
Input current, pullup resistor[6]	PULLUP V_{DD_IO} $V_{in} = V_{IL}$	I_{INpu}	25	150	µA	D3.18
Input current, pulldown resistor [8]	PULLDOWN V_{DD_IO} $V_{in} = V_{IH}$	I_{INpd}	25	150	µA	D3.19
Output high voltage	IOH is driver dependent[7] V_{DD_IO}	V_{OH}	$0.8 \times V_{DD_IO}$	—	V	D3.20
Output high voltage	IOH is driver dependent[7] $V_{DD_IO_MEM_DDR}$	V_{OHDDR}	1.94	—	V	D3.21
Output high voltage	IOH is driver dependent[7] $V_{DD_IO_MEM_DDR2}$	V_{OHDDR2}	VDD_IO_MEM – 0.28	—	V	D3.22
Output high voltage	IOH is driver dependent[7] $V_{DD_IO_MEM_LPDDR}$	$V_{OHLPDDR}$	VDD_IO_MEM – 0.28	—	V	D3.23

Table 6. DC Electrical Specifications (continued)

Characteristic	Condition	Sym	Min	Max	Unit	SpecID
Output high voltage	IOH is driver dependent[7] $V_{DD_IO_MEM_SDR}$	V_{OHSDR}	0.8 × VDD_IO_MEM	—	V	D3.35
Output low voltage	IOL is driver dependent[7] V_{DD_IO}	V_{OL}	—	$0.2 \times V_{DD_IO}$	V	D3.24
Output low voltage	IOL is driver dependent[7] $V_{DD_IO_MEM_DDR}$	V_{OLDDR}	—	0.36	V	D3.25
Output low voltage	IOL is driver dependent[7] $V_{DD_IO_MEM_DDR2}$	V_{OLDDR2}	—	0.28	V	D3.26
Output low voltage	IOL is driver dependent[7] $V_{DD_IO_MEM_LPDDR}$	$V_{OLLPDDR}$	—	0.28	V	D3.27
Output low voltage	IOL is driver dependent[7] $V_{DD_IO_MEM_SDR}$	V_{OLSDR}	—	$0.2 \times V_{DD_IO_MEM}$	V	D3.36
DC injection current per pin[8]	—	I_{CS}	−1.0	1.0	mA	D3.29
Input capacitance (digital pins)	—	C_{in}	—	7	pF	D3.30
Input capacitance (analog pins)	—	C_{in}	—	10	pF	D3.31
On-die termination (DDR2)	—	R_{ODT}	120	180	Ω	D3.32

NOTES:

1 This parameter is meant for those who do not use quartz crystals or resonators, but instead use CAN oscillators in crystal mode. In that case, $V_{extal} - V_{xtal} \geq 400$ mV criteria has to be met for oscillator's comparator to produce the output clock.

2 This parameter is meant for those who do not use quartz crystals or resonators, but instead use a signal generator clock to drive the clock in bypass mode. In this case, for the oscillator's comparator to produce the output clock, drive only the EXTAL pin. Do not connect anything to any other oscillator pin.

3 This parameter is meant for those who do not use quartz crystals or resonators, but instead use CAN oscillators in crystal mode to drive the clock. In that case, for the oscillator's comparator to produce the output clock, drive one of the XTAL_IN or XTAL_OUT pins. Do not connect anything to the other oscillator pins.

4 This parameter is meant for those who do not use quartz crystals or resonators, but instead use a signal generator clock to drive the clock in bypass mode. In that case, for the oscillator's comparator to produce the output clock, drive only the XTAL_IN pin. Do not connect anything to any other oscillator pin.

5 Leakage current is measured with output drivers disabled and with pullups and pulldowns inactive.

6 Pullup current is measured at V_{IL} and pulldown current is measured at V_{IH}.

7 See Table 7 for the typical drive capability of a specific signal pin based on the type of output driver associated with that pin as listed in Table 2.

8 All injection current is transferred to $V_{DD_IO}/V_{DD_IO_MEM}$. An external load is required to dissipate this current to maintain the power supply within the specified voltage range.
Total injection current for all digital input-only and all digital input/output pins must not exceed 10 mA. Exceeding this limit can cause disruption of normal operation.

Table 7. General I/O Pads[1] — Drive Current, Slew Rate

Pad Type	Supply Voltage	Drive Select/Slew Rate Control	Rise time max (ns)	Fall time max (ns)	Current Ioh (mA)	Current Iol (mA)	SpecID
General IO	V_{DD_IO} = 3.3 V	Configuration 3 (11)	1.4	1.6	35	35	D3.41
		Configuration 2 (10)	9.8	12			D3.42
		Configuration 1 (01)	19	24			D3.43
		Configuration 0 (00)	140	183			D3.44

NOTES:
1 General I/O—rise and fall times at drive load 50 pF.

Table 8. DDR I/O Pads[1] — Drive Current, Slew Rate

Pad Type	Supply Voltage	Drive Select/ Slew Rate Control	Rising slew max (ns)[2]	Falling slew max (ns)[3]	Current Ioh (mA)	Current Iol (mA)	SpecID
DDR	$V_{DD_IO_MEM}$ = 2.5 V (DDR)	Configuration 3 (011)	0.45	0.45	16.2	16.2	D3.45
	$V_{DD_IO_MEM}$ = 1.8 V (LPDDR and SDR)	Configuration 0 (000)	0.8	0.8	4.6	4.6	D3.46
		Configuration 1 (001)			8.1	8.1	D3.47
	$V_{DD_IO_MEM}$ = 1.8 V (DDR2)	Configuration 2 (010)	0.7	0.7	5.3	5.3	D3.48
		Configuration 6 (110)			13.4	13.4	D3.49
	$V_{DD_IO_MEM}$ = 3.3 V (SDR)	Configuration 7 (111)	0.45	0.45	8	8	D3.50

NOTES:
1 DDR—rise and fall times at 50 Ω transmission line impedance terminated to MV_{TT} (0.5 × $V_{DD_IO_MEM}$) + 4 pF load.
2 Rising slew rate measured between 0.5 × $V_{DD_IO_MEM}$ – 450 mV and 0.5 × $V_{DD_IO_MEM}$ + 50 mV for all modes.
3 Falling slew rate measured between 0.5 × $V_{DD_IO_MEM}$ + 50 mV and 0.5 × $V_{DD_IO_MEM}$ – 450 mV for all modes.

4.1.4 Electrostatic Discharge

CAUTION

This device contains circuitry that protects against damage due to high-static voltage or electrical fields. However, it is advised that normal precautions be taken to avoid application of any voltages higher than maximum-rated voltages. Operational reliability is enhanced if unused inputs are tied to an appropriate logic voltage level (GND or V_{DD}). Table 11 gives package thermal characteristics for this device.

Table 9. ESD and Latch-Up Protection Characteristics

Sym	Rating	Min	Max	Unit	SpecID
V_{HBM}	Human body model (HBM) — JEDEC JESD22-A114-B	2000	—	V	D4.1
V_{MM}	Machine model (MM) — JEDEC JESD22-A115	200	—	V	D4.2
V_{CDM}	Charge device model (CDM) — JEDEC JESD22-C101	250	—	V	D4.3

4.1.5 Power Dissipation

Power dissipation of the MPC5125 is caused by three different components:

- Dissipation of the internal or core digital logic (supplied by V_{DD})
- Dissipation of the analog circuitry (supplied by AV_{DD_SPLL} and AV_{DD_CPLL})
- Dissipation of the IO logic (supplied by $V_{DD_IO_MEM}$ and V_{DD_IO})

Table 10 details typical measured core and analog power dissipation figures for a range of operating modes. However, the dissipation due to the switching of the IO pins cannot be given in general, but must be calculated for each application case using the following formula:

$$P_{IO} = P_{IOint} + \sum_{M} N \times C \times VDD_IO^2 \times f \qquad \textbf{Eqn. 1}$$

where N is the number of output pins switching in a group M, C is the capacitance per pin, V_{DD_IO} is the IO voltage swing, f is the switching frequency, and P_{IOint} is the power consumed by the unloaded IO stage. The total power consumption of the MPC5125 device must not exceed this value, which would cause the maximum junction temperature to be exceeded.

$$P_{total} = P_{core} + P_{analog} + P_{IO} \qquad \textbf{Eqn. 2}$$

Table 10. Power Dissipation

Core Power Supply (V_{DD_core})[1]				
Mode	High-Performance e300 = 400 MHz, CSB = 200 MHz		**Unit**	**SpecID**
Operational[2]	620		mW	D5.1
Doze[3]	580		mW	D5.3
Nap[3]	235		mW	D5.2
Sleep[3]	230		mW	D5.4
Deep-sleep[4]	38		mW	D5.5
RTC Power Supply (V_{BAT})				
Hibernation	20		µW	D5.6
PLL/OSC Power Supplies (AV_{DD_SPLL}, AV_{DD_CPLL}, $AV_{DD_OSC_TMPS}$)[5]				
Operational	18		mW	D5.7
Deep-sleep	55		µW	D5.8
Unloaded I/O Power Supplies (V_{DD_IO}, $V_{DD_IO_MEM}$)[6]				
	V_{DD_IO}	**$V_{DD_IO_MEM}$**		
Operational	180	40	mW	D5.9
Deep-sleep	5	1	mW	D5.10

NOTES:
1. Typical core power is measured at V_{DD_core} = 1.4 V, T_J = 25 °C.
2. Operational power is measured while running an entirely cache-resident program with floating-point multiplication instructions in parallel with DDR write operation.

[3] Doze, Nap, and Sleep power are measured with the e300 core in Doze/Nap/Sleep mode; the system oscillator, system PLL, and core PLL active; and all other system modules inactive.

[4] Deep-sleep power is measured with the e300 core in Sleep mode. The system oscillator, system PLL, core PLL, and other system modules are inactive.

[5] PLL power is measured at AV_{DD_SPLL} = AV_{DD_CPLL} = $AV_{DD_OSC_TMPS}$ = 3.3 V, T_J = 25 °C.

[6] Unloaded typical I/O power is measured at V_{DD_IO} = 3.3 V, $V_{DD_MEM_IO}$ = 1.8 V, T_J = 25 °C.

NOTE

The maximum power depends on the supply voltage, process corner, junction temperature, and the concrete application and clock configurations.

4.1.6 Thermal Characteristics

Table 11. Thermal Resistance Data[1]

Rating	Conditions	Sym	Value	Unit	SpecID
Thermal resistance junction-to-ambient natural convection[2]	Single layer board – 1s	$R_{\theta JA}$	35	°C/W	D6.1
Thermal resistance junction-to-ambient natural convection[2]	Four layer board – 2s2p	$R_{\theta JA}$	25	°C/W	D6.2
Thermal resistance junction-to-moving-air ambient[2]	@ 200 ft./min., single layer board – 1s	$R_{\theta JMA}$	29	°C/W	D6.3
Thermal resistance junction-to-moving-air ambient[2]	@ 200 ft./min., four layer board 2s2p	$R_{\theta JMA}$	22	°C/W	D6.4
Thermal resistance junction-to-board[3]	—	$R_{\theta JB}$	16	°C/W	D6.5
Thermal resistance junction-to-case[4]	—	$R_{\theta JC}$	11	°C/W	D6.6
Junction-to-package-top natural convection[5]	Natural convection	Ψ_{JT}	3	°C/W	D6.7

NOTES:

[1] Thermal characteristics are targets based on simulation that are subject to change per device characterization.

[2] Junction-to-Ambient thermal resistance determined per JEDEC JESD51-3 and JESD51-6. Thermal test board meets JEDEC specification for this package.

[3] Junction-to-Board thermal resistance determined per JEDEC JESD51-8. Thermal test board meets JEDEC specification for the specified package.

[4] Junction-to-Case at the top of the package determined using MIL-STD 883 Method 1012.1. The cold plate temperature is used for the case temperature. Reported value includes the thermal resistance of the interface layer.

[5] Thermal characterization parameter indicating the temperature difference between the package top and the junction temperature per JEDEC JESD51-2. When Greek letters are not available, the thermal characterization parameter is written as Psi-JT.

4.1.6.1 Heat Dissipation

An estimation of the chip-junction temperature, T_J, can be obtained from the following equation:

$$T_J = T_A + (R_{\theta JA} \times P_D) \qquad \textit{Eqn. 3}$$

where:

T_A = ambient temperature for the package (°C)
$R_{\theta JA}$ = junction to ambient thermal resistance (°C/W)
P_D = power dissipation in package (W)

The junction to ambient thermal resistance is an industry standard value, which provides a quick and easy estimation of thermal performance. Unfortunately, there are two values in common usage: the value determined on a single-layer board, and the value obtained on a board with two planes. For packages such as the PBGA, these values can be different by a factor of two. Which value is correct depends on the power dissipated by other components on the board. The value obtained on a single-layer board is appropriate for the tightly packed printed circuit board. The value obtained on the board with the internal planes is usually appropriate if the board has low power dissipation and the components are well separated.

Historically, the thermal resistance has frequently been expressed as the sum of a junction to case thermal resistance and a case to ambient thermal resistance:

$$R_{\theta JA} = R_{\theta JC} + R_{\theta CA} \qquad \textit{Eqn. 4}$$

where:

$R_{\theta JA}$ = junction to ambient thermal resistance (°C/W)
$R_{\theta JC}$ = junction to case thermal resistance (°C/W)
$R_{\theta CA}$ = case to ambient thermal resistance (°C/W)

$R_{\theta JC}$ is device related and cannot be influenced by the user. You control the thermal environment to change the case to ambient thermal resistance, $R_{\theta CA}$. For instance, you can change the air flow around the device, add a heat sink, change the mounting arrangement on printed circuit board, or change the thermal dissipation on the printed circuit board surrounding the device. This description is most useful for ceramic packages with heat sinks where some 90% of the heat flow is through the case to the heat sink to ambient. For most packages, a better model is required.

A more accurate thermal model can be constructed from the junction to board thermal resistance and the junction to case thermal resistance. The junction to case covers the situation where a heat sink is used or where a substantial amount of heat is dissipated from the top of the package. The junction to board thermal resistance describes the thermal performance when most of the heat is conducted to the printed circuit board. This model can be used for hand estimations or for a computational fluid dynamics (CFD) thermal model.

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:

$$T_J = T_T + (\Psi_{JT} \times P_D) \qquad \textit{Eqn. 5}$$

where:

T_T = thermocouple temperature on top of package (°C)
Ψ_{JT} = thermal characterization parameter (°C/W)
P_D = power dissipation in package (W)

The thermal characterization parameter is measured per JESD51-2 specification 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 approximately one 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.

4.2 Oscillator and PLL Electrical Characteristics

The MPC5125 system requires a system-level clock input SYS_XTALI. This clock input may be driven directly from an external oscillator or with a crystal using the internal oscillator.

There is a separate oscillator for the independent real-time clock (RTC) system.

The MPC5125 clock generation uses two phase-locked loop (PLL) blocks.

- The system PLL (SYS_PLL) takes an external reference frequency and generates the internal system clock. The system clock frequency is determined by the external reference frequency and the settings of the SYS_PLL configuration.
- The e300 core PLL (CORE_PLL) generates a master clock for all of the CPU circuitry. The e300 core clock frequency is determined by the system clock frequency and the settings of the CORE_PLL configuration.

4.2.1 System Oscillator Electrical Characteristics

Table 12. System Oscillator Electrical Characteristics

Characteristic	Sym	Min	Typical	Max	Unit	SpecID
SYS_XTAL frequency	f_{sys_xtal}	15.6	33.3	35.0	MHz	O1.1

The system oscillator can work in oscillator mode or in bypass mode to support an external input clock as clock reference.

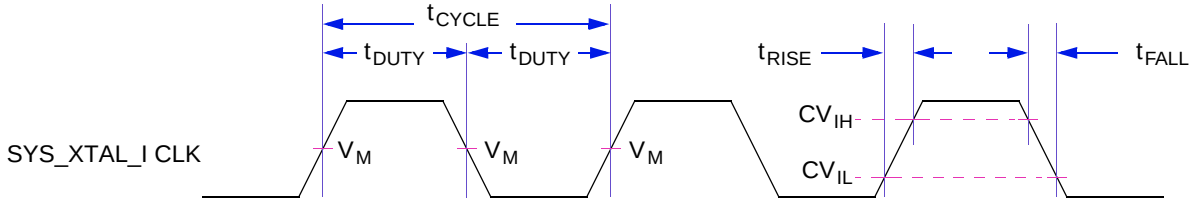


Figure 4. Timing Diagram — SYS_XTAL_IN

Table 13. SYS_XTAL_IN Timing

Sym	Description	Min	Max	Units	SpecID
t_{CYCLE}	SYS_XTALI cycle time[1,2]	64.1	28.57	ns	O.1.2
t_{RISE}	SYS_XTALI rise time[3]	1	4	ns	O.1.3
t_{FALL}	SYS_XTALI fall time[4]	1	4	ns	O.1.4
t_{DUTY}	SYS_XTALI duty cycle (measured at V_M)[5]	40	60	%	O.1.5

NOTES:
1 The SYS_XTALI frequency and system PLL settings must be chosen such that the resulting system frequencies do not exceed their respective maximum or minimum operating frequencies. See the *MPC5125 Reference Manual* (MPC5125RM).
2 The min/max cycle times are calculated using $1/f_{sys_xtal\ (MIN/MAX)}$ where the $f_{sys_xtal\ (MIN/MAX)}$ (15.6 / 35 MHz) are taken from Table 12 (system oscillator electrical characteristics).
3 Rise time is measured from 20% of VDD to 80% of VDD.
4 Fall time is measured from 20% of VDD to 80% of VDD.
5 SYS_XTALI duty cycle is measured at V_M.

4.2.2 RTC Oscillator Electrical Characteristics

Table 14. RTC Oscillator Electrical Characteristics

Characteristic	Sym	Min	Typical	Max	Unit	SpecID
RTC_XTAL frequency	f_{rtc_xtal}	—	32.768	—	kHz	O2.1

4.2.3 System PLL Electrical Characteristics

Table 15. System PLL Specifications

Characteristic	Sym	Min	Typical	Max	Unit	SpecID
Sys PLL input clock frequency[1]	f_{sys_xtal}	16	33.3	67	MHz	O3.1
Sys PLL input clock jitter[2]	t_{jitter}	—	—	10	ps	O3.2
Sys PLL VCO frequency[1]	f_{VCOsys}	400	—	800	MHz	O3.3
Sys PLL VCO output jitter (Dj), peak to peak / cycle	$f_{VCOjitterDj}$	—	—	40	ps	O3.4
Sys PLL VCO output jitter (Rj), RMS 1 sigma	$f_{VCOjitterRj}$	—	—	12	ps	O3.5
Sys PLL relock time — after power up[3]	t_{lock1}	—	—	200	µs	O3.6
Sys PLL relock time — when power was on[4]	t_{lock2}	—	—	170	µs	O3.7

NOTES:
1 The SYS_XTAL frequency and PLL configuration bits must be chosen such that the resulting system frequency, CPU (core) frequency, and PLL (VCO) frequency do not exceed their respective maximum or minimum operating frequencies.

2 This represents total input jitter — short term and long term combined. Two different types of jitter can exist on the input to CORE_SYSCLK, systemic and true random jitter. True random jitter is rejected. Systemic jitter is passed into and through the PLL to the internal clock circuitry.

3 PLL-relock time is the maximum amount of time required for the PLL lock after a stable VDD and CORE_SYSCLK are reached during the power-on reset sequence.

4 PLL-relock time is the maximum amount of time required for the PLL lock after the PLL has been disabled and subsequently re-enabled during sleep modes.

4.2.4 e300 Core PLL Electrical Characteristics

The internal clocking of the e300 core is generated from and synchronized to the system clock by means of a voltage-controlled core PLL.

Table 16. e300 PLL Specifications

Characteristic	Sym	Min	Typical	Max	Unit	SpecID
e300 frequency[1, 2]	f_{core}	200	—	400	MHz	O4.1
e300 PLL VCO frequency[1]	$f_{VCOcore}$	400	—	800	MHz	O4.3
e300 PLL input clock frequency	f_{CSB_CLK}	50	—	200	MHz	O4.4
e300 PLL input clock cycle time	t_{CSB_CLK}	5	—	20	ns	O4.5
e300 PLL relock time[3]	t_{lock}	—	—	200	µs	O4.6

NOTES:
1 The frequency and e300 PLL configuration bits must be chosen such that the resulting system frequencies, CPU (core) frequency, and e300 PLL (VCO) frequency do not exceed their respective maximum or minimum operating frequencies in Table 17.

2 The following hard-coded relationship exists between f_{core} and $f_{VCOcore}$: ($f_{core} = f_{VCOcore}$).

3 PLL-relock time is the maximum amount of time required for the PLL lock after a stable V_{DD} and CORE_SYSCLK are reached during the power-on reset sequence. This specification also applies when the PLL has been disabled and subsequently re-enabled during sleep modes.

4.3 AC Electrical Characteristics

4.3.1 Overview

The following list provides hyperlinks to the indicated timing specification sections.

- AC Operating Frequency Data
- Resets
- SDRAM (DDR)
- LPC
- NFC
- FEC
- USB ULPI
- MMC/SD/SDIO Card Host Controller (SDHC)
- DIU
- CAN
- I^2C
- J1850
- PSC
- GPIOs and Timers
- Fusebox
- IEEE 1149.1 (JTAG)

AC test timing conditions:

Unless otherwise noted, all test conditions are as follows:

- T_A = –40 to 85 ^oC
- V_{DD} = 1.33 to 1.47 V
  V_{DD_IO} = 3.0 to 3.6 V
- Input conditions:
  All inputs: t_{rise}, $t_{fall} \leq 1$ ns
- Output Loading:
  All outputs: 50 pF

4.3.2 AC Operating Frequency Data

Table 17 provides the operating frequency information for the MPC5125.

Table 17. Clock Frequencies

	Min	Max	Units	SpecID
e300 Processor Core	200	400	MHz	A1.1
SDRAM clock	50	200	MHz	A1.2
CSB bus clock	50	200	MHz	A1.3
IP bus clock	8.3	66	MHz	A1.4
LPC clock	2.08	66	MHz	A1.6
NFC clock	3.13	50	MHz	A1.7
DIU clock	0.78	66	MHz	A1.8
SDHC clock	0.78	50	MHz	A1.9
CLKx	0.78	66	MHZ	A1.10

NOTES:

1. The SYS_XTAL_IN frequency, Sys PLL, and Core PLL settings must be chosen so that the resulting e300 clk, csb_clk, and MCK frequencies do not exceed their respective maximum or minimum operating frequencies.
2. The values are valid for the user-operation mode. There can be deviations for test modes.
3. When selecting the peripheral clock frequencies, care needs to be taken about requirements for baud rates and minimum frequency limitation.

4.The DDR data rate is 2x the DDR memory bus frequency.

SYS_XTAL_IN is the input clock multiplied by the system phase-locked loop (Sys PLL) and the clock unit to create the coherent system bus clock (csb_clk), the internal clock for the DDR controller (ddr_clk), and the clocks for the peripherals.The csb_clk serves as the clock input to the e300 core. A second PLL inside the e300 core multiplies the csb_clk frequency to create the internal clock for the e300 core (core_clk). The system and core PLL multipliers are selected by the SPMF and COREPLL fields in the reset configuration word, which is loaded at power-on reset.

See the *MPC5125 Reference Manual (MPC5125RM*), for more information on the clock subsystem.

4.3.3 Resets

The MPC5125 has three reset pins:

- $\overline{\text{PORESET}}$ — Power-on reset
- $\overline{\text{HRESET}}$ — Hard reset
- $\overline{\text{SRESET}}$ — Software reset

These signals are asynchronous I/O signals and can be asserted at any time. The input side uses a Schmitt trigger and requires the same input characteristics as other MPC5125 inputs, as specified in Section 4.1, "DC Electrical Characteristics."

As long as VDD is not stable the $\overline{\text{HRESET}}$ output is not stable.

Table 18. Reset Rise / Fall Timing

Description	Min	Max	Unit	SpecID
$\overline{\text{PORESET}}$[1] fall time	—	1	ms	A3.4
$\overline{\text{PORESET}}$ rise time	—	1	ms	A3.5
$\overline{\text{HRESET}}$[2,3] fall time	—	1	ms	A3.6
$\overline{\text{HRESET}}$ rise time	—	1	ms	A3.7
$\overline{\text{SRESET}}$ fall time	—	1	ms	A3.8
$\overline{\text{SRESET}}$ rise time	—	1	ms	A3.9

NOTES:
1 Make sure that the $\overline{\text{PORESET}}$ does not carry any glitches. The MPC5125 has no filter to prevent them from getting into the chip.
2 $\overline{\text{HRESET}}$ and $\overline{\text{SRESET}}$ must have a monotonous rise time.
3 The assertion of $\overline{\text{HRESET}}$ becomes active at power-on reset without any SYS_XTAL clock.

The timing relationship can be seen in the following figures.

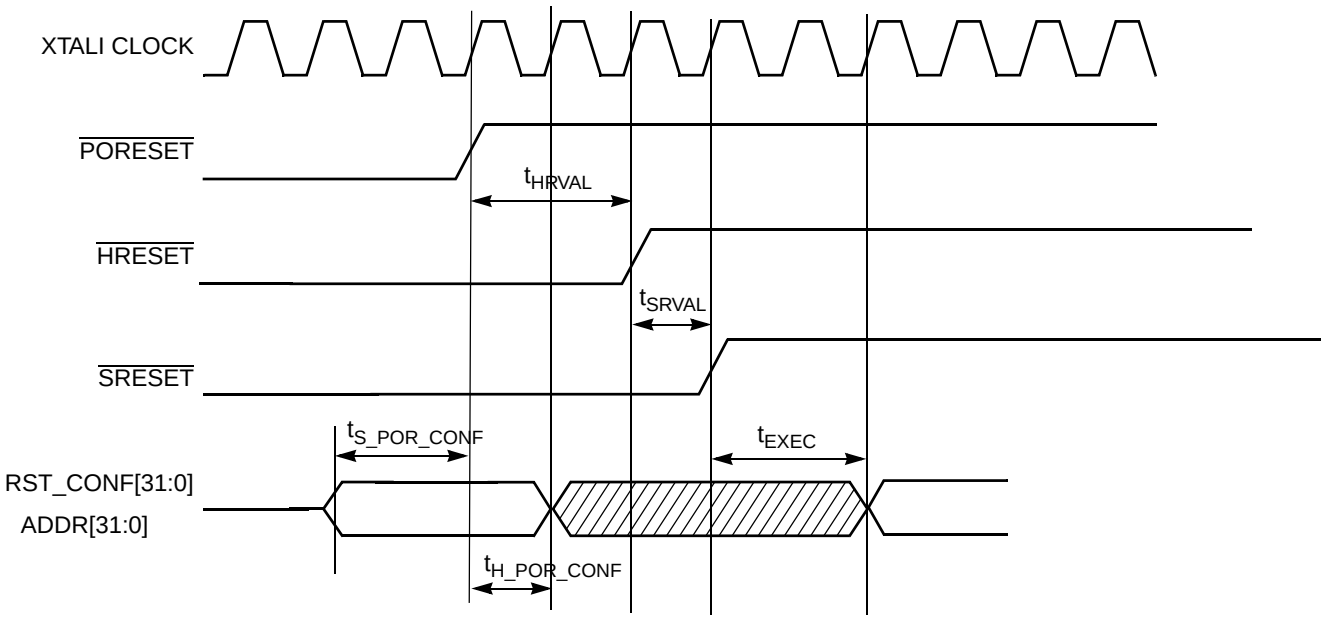


Figure 5. Power-Up Behavior

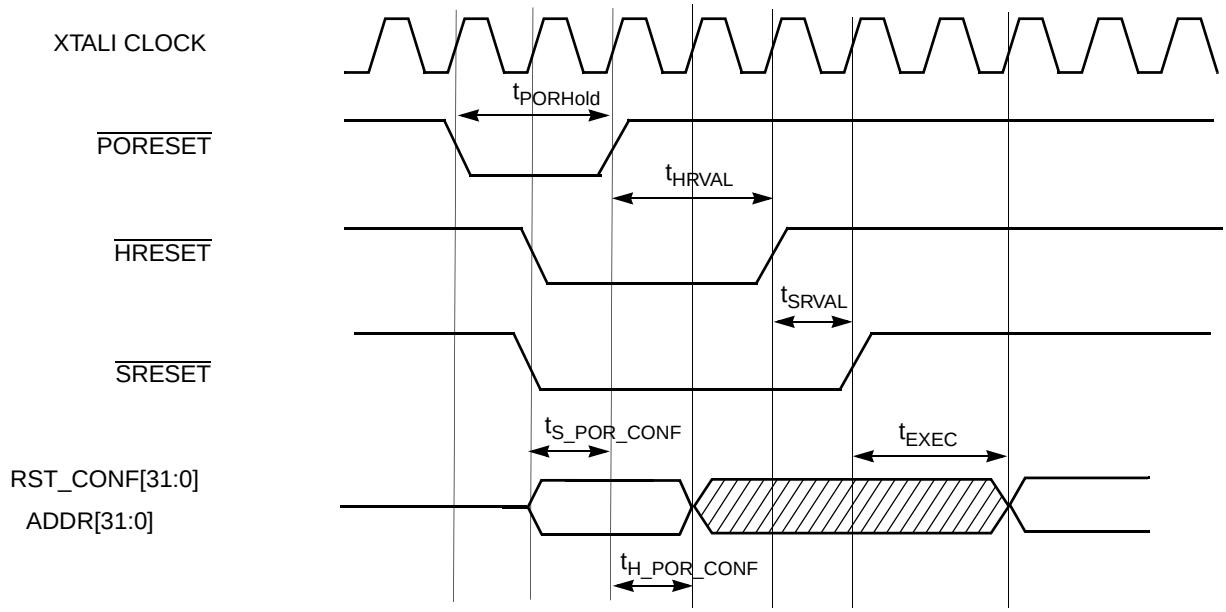


Figure 6. Power-On Reset Behavior

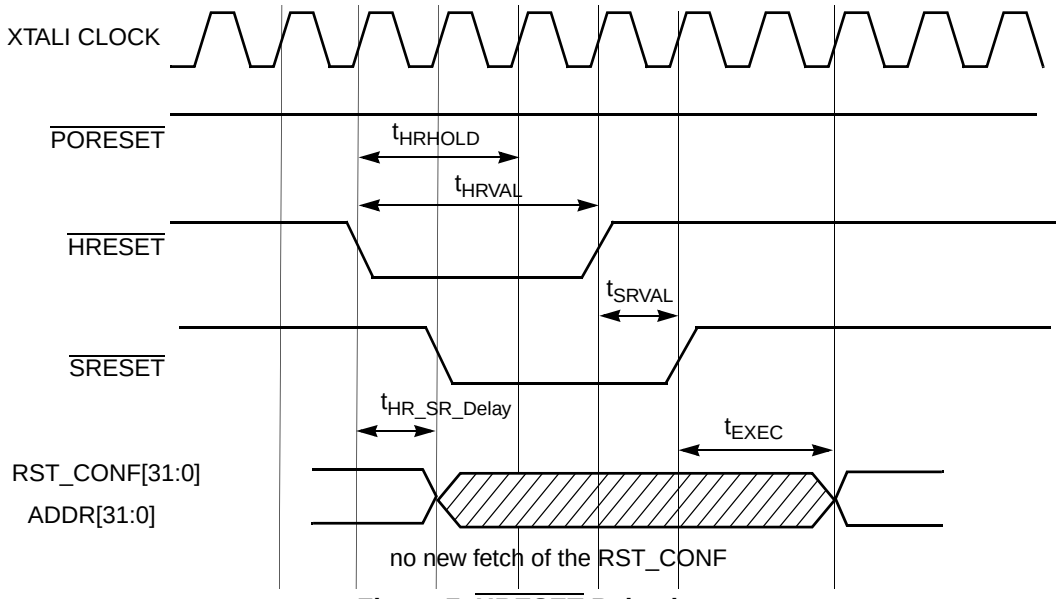


Figure 7. $\overline{\text{HRESET}}$ Behavior

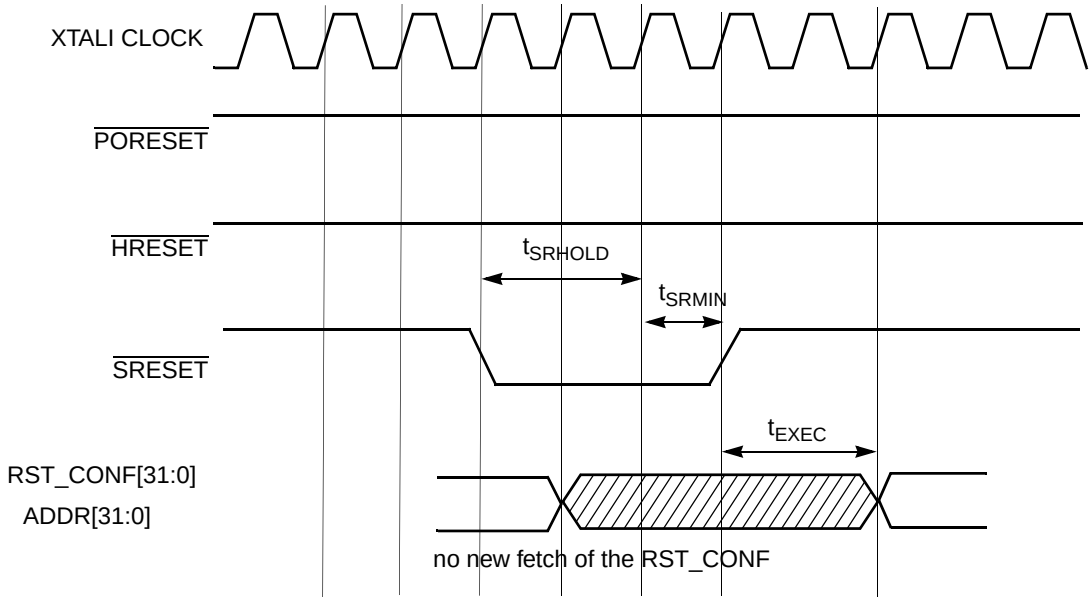


Figure 8. $\overline{\text{SRESET}}$ Behavior

Table 19. Reset Timing

Symbol	Description	Value (XTALI CLOCK)	SpecID
$t_{PORHOLD}$	Time $\overline{\text{PORESET}}$ must be held low before a qualified reset occurs.	4 cycles	A3.10
t_{HRVAL}	Time $\overline{\text{HRESET}}$ is asserted after a qualified reset occurs.	26810 cycles[1]	A3.11
t_{SRVAL}	Time $\overline{\text{SRESET}}$ is asserted after assertion of $\overline{\text{HRESET}}$.	21 cycles	A3.12
t_{EXEC}	Time between $\overline{\text{SRESET}}$ assertion and first core instruction fetch.	4 cycles	A3.13
$t_{S_POR_CONF}$	Reset configuration setup time before assertion of $\overline{\text{PORESET}}$.	1 cycle	A3.14

Table 19. Reset Timing (continued)

Symbol	Description	Value (XTALI CLOCK)	SpecID
$t_{H_POR_CONF}$	Reset configuration hold time after assertion of $\overline{\text{PORESET}}$.	1 cycle	A3.15
$t_{HR_SR_DELAY}$	Time from falling edge of $\overline{\text{HRESET}}$ to falling edge of $\overline{\text{SRESET}}$.	4 cycles	A3.16
t_{HRHOLD}	Time $\overline{\text{HRESET}}$ must be held low before a qualified reset occurs.	4 cycles	A3.17
t_{SRHOLD}	Time $\overline{\text{SRESET}}$ must be held low before a qualified reset occurs.	4 cycles	A3.18
t_{SRMIN}	Time $\overline{\text{SRESET}}$ is asserted after it has been qualified.	1 cycles	A3.19

NOTES:
1 The timings will change when using the PLL lock detection circuit.

4.3.4 External Interrupts

The MPC5125 provides three different kinds of external interrupts:

- IRQ interrupts
- GPIO interrupts with simple interrupt capability (not available in power-down mode)
- Wakeup interrupts

Table 20. IPIC Input AC Timing Specifications

Descriptions	Symbol	Min	Unit	Spec ID
IPIC inputs — minimum pulse width	t_{PICWID}	2T	ns	A4.1

IPIC inputs must be valid for at least t_{PICWID} to ensure proper operation in edge-triggered mode.

4.3.5 SDRAM (DDR)

The MPC5125 memory controller supports these types of DDR devices:

- DDR-1 (SSTL_2 class II interface)
- DDR-2 (SSTL_18 interface)
- LPDDR (1.8V I/O supply voltage)
- SDR D-RAM

JEDEC standards define the minimum set of requirements for compliant memory devices:

- JEDEC standard, DDR2 SDRAM specification, JESD79-2C, May 2006
- JEDEC standard, Double Data Rate (DDR) SDRAM specification, JESD79E, May 2005
- JEDEC standard, Low Power Double Data Rate (LPDDR) SDRAM specification, JESD79-4, May 2006

The MPC5125 supports the configuration of two output drive strengths for DDR2 and LPDDR:

- Full drive strength
- Half drive strength (intended for lighter loads or point-to-point environments)

The MPC5125 memory controller supports dynamic on-die termination in the host device and in the DDR2 memory device.

This section includes AC specifications for all DDR SDRAM pins. The DC parameters are specified in Section 4.1, “DC Electrical Characteristics.”

4.3.5.1 DDR SDRAM AC Timing Specifications

Table 21. DDR SDRAM Timing Specifications

At recommended operating conditions with $V_{DD_IO_MEM}$ of ±5%

Parameter	Symbol	Min	Max	Unit	Notes	SpecID
Clock cycle time, CL = x	t_{CK}	6000	—	ps		A5.1
MCK AC differential crosspoint voltage	V_{OX-AC}	($V_{DD_IO_MEM}$ × 0.5)– 0.15	($V_{DD_IO_MEM}$ × 0.5) + 0.15	V	1	A5.2
CK HIGH pulse width	t_{CH}	0.47	0.53	t_{CK}	1,3	A5.3
CK LOW pulse width	t_{CL}	0.47	0.53	t_{CK}	1,3	A5.4
Skew between MCK and DQS transitions	t_{DQSS}	–0.25	0.25	t_{CK}	2,3	A5.5
Address and control output setup time relative to MCK rising edge	$t_{OS(base)}$	t_{CK}/2 – 1000	—	ps	2,3	A5.6
Address and control output hold time relative to MCK rising edge	$t_{OH(base)}$	t_{CK}/2 – 1000	—	ps	2,3	A5.7
DQ and DM output setup time relative to DQS	$t_{DS1(base)}$	t_{CK}/4 – 750	—	ps	2,3	A5.8
DQ and DM output hold time relative to DQS	$t_{DH1(base)}$	t_{CK}/4 – 750	—	ps	2,3	A5.9
DQS-DQ skew for DQS and associated DQ inputs	t_{DQSQ}	– (t_{CK}/4 – 600)	t_{CK}/4 – 600	ps	3	A5.10
DQS window position related to CAS read command	t_{DQSEN}	2t_{CK} + 1500	3t_{CK} – 1000	ps	1,2,3,4, 5	A5.11

NOTES:
1. Measured with clock pin loaded with differential 100 Ω termination resistor.
2. Measured with all outputs except the clock loaded with 50 Ω termination resistor to $V_{DD_IO_MEM}$/2.
3. All transitions measured at mid-supply ($V_{DD_IO_MEM}$/2).
4. In this window, the first rising edge of DQS should occur. From the start of the window to DQS rising edge, DQS should be low.
5. The window position is given for t_{DQSEN} = 2.0 t_{CK} (RDLY = 2, HALF DQS DLY = QUART DQS DLY = 0) with CL = 3 DDR SDRAM device. For other values of t_{DQSEN}, the window position is shifted accordingly.

4.3.5.2 MobileDDR/LPDDR SDRAM AC Timing Specifications

Table 22. MobileDDR/LPDDR SDRAM Timing Specifications

At recommended operating conditions with $V_{DD_IO_MEM}$ of ±5%

Parameter	Symbol	Min	Max	Unit	Notes	SpecID
Clock cycle time, CL = x	t_{CK}	6000	—	ps		A5.1
MCK AC differential crosspoint voltage	V_{OX-AC}	($V_{DD_IO_MEM}$ × 0.5) – 0.1	($V_{DD_IO_MEM}$ × 0.5) + 0.1	V	1	A5.2
CK HIGH pulse width	t_{CH}	0.47	0.53	t_{CK}	1,3	A5.3
CK LOW pulse width	t_{CL}	0.47	0.53	t_{CK}	1,3	A5.4
Skew between MCK and DQS transitions	t_{DQSS}	–0.25	0.25	t_{CK}	2,3	A5.5
Address and control output setup time relative to MCK rising edge	$t_{OS(base)}$	t_{CK}/2 – 1000	—	ps	2,3	A5.6

Table 22. MobileDDR/LPDDR SDRAM Timing Specifications (continued)

At recommended operating conditions with $V_{DD_IO_MEM}$ of ±5%

Parameter	Symbol	Min	Max	Unit	Notes	SpecID
Address and control output hold time relative to MCK rising edge	$t_{OH(base)}$	$t_{CK}/2 - 1000$	—	ps	2,3	A5.7
DQ and DM output setup time relative to DQS	$t_{DS1(base)}$	$t_{CK}/4 - 750$	—	ps	2,3	A5.8
DQ and DM output hold time relative to DQS	$t_{DH1(base)}$	$t_{CK}/4 - 750$	—	ps	2,3	A5.9
DQS-DQ skew for DQS and associated DQ inputs	t_{DQSQ}	$-(t_{CK}/4 - 600)$	$t_{CK}/4 - 600$	ps	3	A5.10
DQS window position related to CAS read command	t_{DQSEN}	$2t_{CK} - 500$	$3t_{CK} - 1000$	ps	1,2,3,4,5	A5.11

NOTES:
1 Measured with clock pin loaded with differential 100 Ω termination resistor.
2 Measured with all outputs except the clock loaded with 50 Ω termination resistor to $V_{DD_IO_MEM}/2$.
3 All transitions measured at mid-supply ($V_{DD_IO_MEM}/2$).
4 In this window, the first rising edge of DQS should occur. From the start of the window to DQS rising edge, DQS should be low.
5 The window position is given for $t_{DQSEN} = 2.0\ t_{CK}$ (RDLY = 2, HALF DQS DLY = QUART DQS DLY = 0) with CL = 3 MobileDDR/LPDDR SDRAM device. For other values of t_{DQSEN}, the window position is shifted accordingly.

4.3.5.3 DDR2 SDRAM AC Timing Specifications

Table 23. DDR2 (DDR2-400) SDRAM Timing Specifications

At recommended operating conditions with $V_{DD_IO_MEM}$ of ±5%

Parameter	Symbol	Min	Max	Unit	Notes	SpecID
Clock cycle time, CL = x	t_{CK}	5000	—	ps		A5.1
MCK AC differential crosspoint voltage	V_{OX-AC}	$(V_{DD_IO_MEM} \times 0.5) - 0.1$	$(V_{DD_IO_MEM} \times 0.5) + 0.1$	V	1	A5.2
CK HIGH pulse width	t_{CH}	0.47	0.53	t_{CK}	1,3	A5.3
CK LOW pulse width	t_{CL}	0.47	0.53	t_{CK}	1,3	A5.4
Skew between MCK and DQS transitions	t_{DQSS}	–0.25	0.25	t_{CK}	2,3	A5.5
Address and control output setup time relative to MCK rising edge	$t_{OS(base)}$	$t_{CK}/2 - 750$	—	ps	2,3	A5.6
Address and control output hold time relative to MCK rising edge	$t_{OH(base)}$	$t_{CK}/2 - 750$	—	ps	2,3	A5.7
DQ and DM output setup time relative to DQS	$t_{DS1(base)}$	$t_{CK}/4 - 500$	—	ps	2,3	A5.8
DQ and DM output hold time relative to DQS	$t_{DH1(base)}$	$t_{CK}/4 - 500$	—	ps	2,3	A5.9
DQS-DQ skew for DQS and associated DQ inputs	t_{DQSQ}	$-(t_{CK}/4 - 600)$	$t_{CK}/4 - 600$	ps	3	A5.10
DQS window position related to CAS read command	t_{DQSEN}	$2.5t_{CK}$	$3t_{CK} + 1500$	ps	1,2,3,4,5	A5.11

NOTES:
1. Measured with clock pin loaded with differential 100 Ω termination resistor.
2. Measured with all outputs except the clock loaded with 50 Ω termination resistor to $V_{DD_IO_MEM}/2$.
3. All transitions measured at mid-supply ($V_{DD_IO_MEM}/2$).
4. In this window, the first rising edge of DQS should occur. From the start of the window to DQS rising edge, DQS should be low.
5. The window position is given for t_{DQSEN} = 2.5 t_{CK} (RDLY = 2, HALF DQS DLY = 1, QUART DQS DLY = 0) with CL = 3 DDR2 SDRAM device. For other values of t_{DQSEN}, the window position is shifted accordingly.

4.3.5.4 SDR SDRAM AC Timing Specifications

Table 24. SDR SDRAM Timing Specifications

At recommended operating conditions with $V_{DD_IO_MEM}$ of ±5%

Parameter	Symbol	Min	Max	Unit	Notes	SpecID
Clock cycle time, CL = x	t_{CK}	7500	—	ps		A5.1
CK HIGH pulse width	t_{CH}	0.43	0.57	t_{CK}	1,3	A5.3
CK LOW pulse width	t_{CL}	0.43	0.57	t_{CK}	1,3	A5.4
Address, control, and data output setup time relative to MCK rising edge	$t_{OS(base)}$	$t_{CK}/2 – 1000$	—	ps	2,3	A5.6
Address, control, and data output hold time relative to MCK rising edge	$t_{OH(base)}$	$t_{CK}/2 – 1000$	—	ps	2,3	A5.7
Input data set-up time, relative to MCK	t_{IS}	1000	—	ps	3	A5.15
Input data hold time, relative to MCK	t_{IH}	1000	—	ps	3	A5.16

NOTES:
1. Measured with clock pin loaded with 50 Ω termination resistor to mid-supply.
2. Measured with all outputs except the clock loaded with 50 Ω termination resistor to $V_{DD_IO_MEM}/2$.
3. All transitions measured at mid-supply ($V_{DD_IO_MEM}/2$).

NOTE

To achieve better timing, balance the loading of DQS as MCK although DQS is not used in SDR mode.

Figure 9 shows the DDR SDRAM write timing.

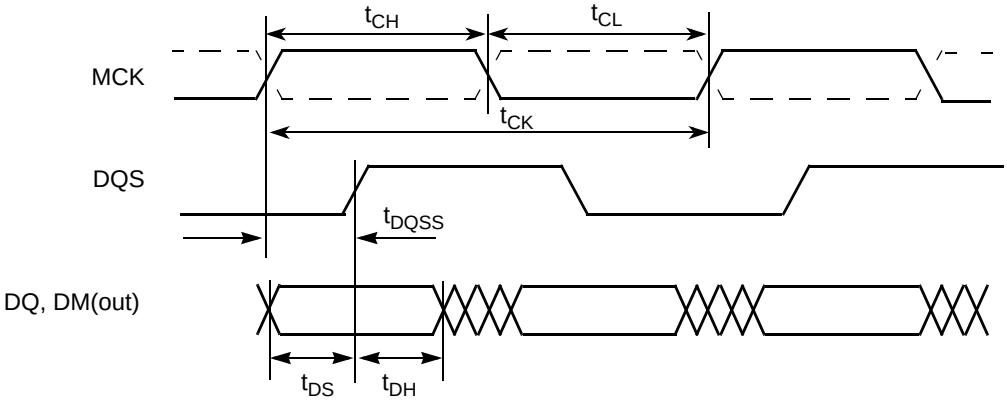


Figure 9. DDR Write Timing

Figure 10 and Figure 11 show the DDR SDRAM read timing.

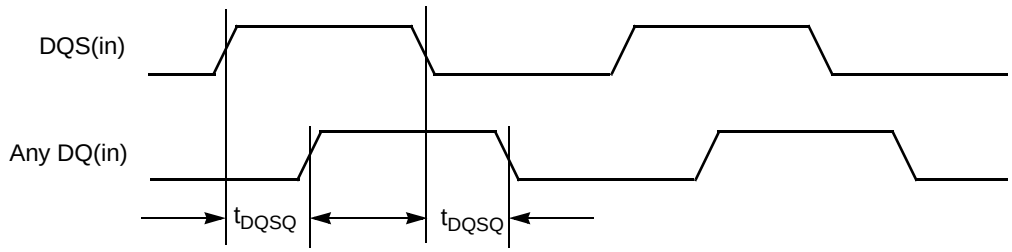


Figure 10. DDR Read Timing, DQ vs DQS

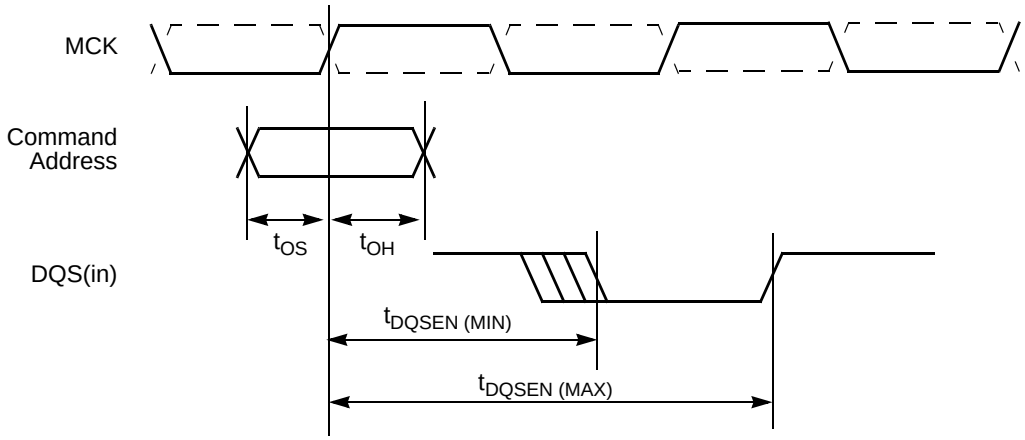


Figure 11. DDR Read Timing, DQSEN

Figure 12 shows the SDR AC timing.

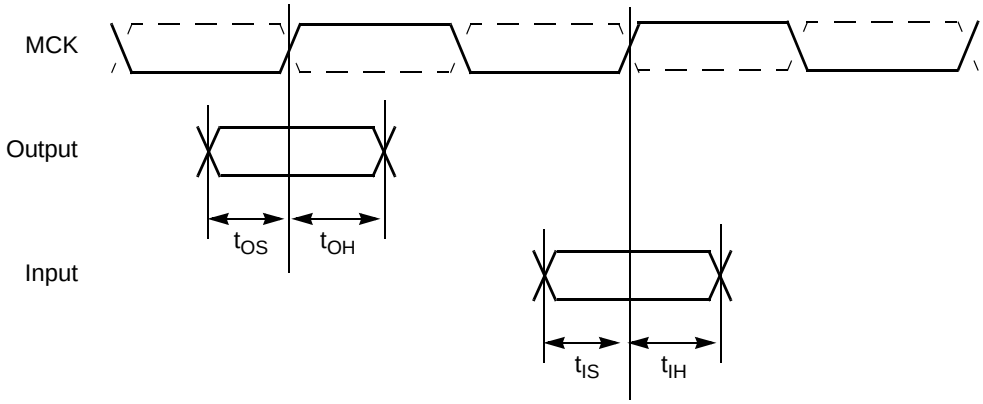


Figure 12. SDR AC Timing

Figure 13 provides the AC test load for the DDR bus.

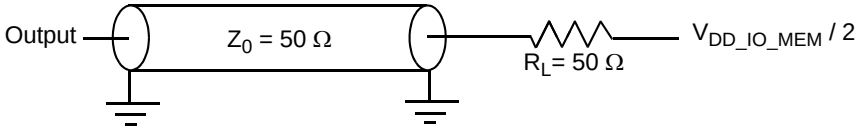


Figure 13. DDR AC Test Load

4.3.6 LPC

The local-plus bus is the external bus interface of the MPC5125. A maximum of eight configurable chip selects (CS) are provided. There are two main modes of operation: non-MUXed and MUXed. The reference clock is the LPC CLK. The maximum bus frequency is 66 MHz.

Definition of terms:

WS = Wait state
DC = Dead cycle
HC = Hold cycle
DS = Data size in bytes
BBT =Burst bytes per transfer
AL = Address latch enable length
ALT = Chip select/Address Latch Timing
t_{LPCck} = LPC clock period

Table 25. LPC Timing

Sym	Description	Min	Max	Units	SpecID
t_{OD}	$\overline{CS}$[x], ADDR, R/$\overline{W}$, TSIZ, DATA (wr), $\overline{TS}$, $\overline{OE}$ valid after LPC CLK (Output delay related to LPC CLK)	0	5	ns	A7.1
t_1	Non-burst $\overline{CS}$[*x*] pulse width	(2 + WS) × t_{LPCck}	(2 + WS) × t_{LPCck}	ns	A7.2
t_2	ADDR, R/$\overline{W}$, TSIZ, DATA (wr) valid before $\overline{CS}$[*x*] assertion	t_{LPCck} – t_{OD}	t_{LPCck} + t_{OD}	ns	A7.3
t_3	$\overline{OE}$ assertion after $\overline{CS}$[*x*] assertion	t_{LPCck} – t_{OD}	t_{LPCck} + t_{OD}	ns	A7.4
t_4	ADDR, R/$\overline{W}$, TSIZ, data (wr) hold after $\overline{CS}$[*x*] negation	t_{LPCck} – t_{OD}	(HC + 1) × t_{LPCck} + t_{OD}	ns	A7.5
t_5	$\overline{TS}$ pulse width	t_{LPCck}	t_{LPCck}	ns	A7.6
t_6	DATA (rd) setup before LPC CLK	5	—	ns	A7.7
t_7	DATA (rd) input hold	0	(DC + 1) × t_{LPCck}	ns	A7.8
t_8	Read burst $\overline{CS}$[*x*] pulse width	(2 + WS + BBT/DS) × t_{LPCck}	(2 +WS + BBT/DS) × t_{LPCck}	ns	A7.9
t_9	Burst $\overline{ACK}$ pulse width	(BBT/DS) × t_{LPCck}	(BBT/DS) × t_{LPCck}	ns	A7.10
t_{10}	Burst DATA (rd) input hold	0	—	ns	A7.11
t_{11}	Read burst $\overline{ACK}$ assertion after $\overline{CS}$[*x*] assertion	(2+WS) × t_{LPCck}	(2+WS) × t_{LPCck}	ns	A7.12
t_{12}	Non-MUXed write burst $\overline{CS}$[*x*] pulse width	(2.5 + WS + BBT/DS) × t_{LPCck}	(2.5 + WS + BBT/DS) × t_{LPCck}	ns	A7.13
t_{13}	Write burst ADDR, R/$\overline{W}$, TSIZ, DATA (wr) hold after $\overline{CS}$[x] negation	0.5 × t_{LPCck} – t_{OD}	(HC + 0.5) × t_{LPCck} + t_{OD}	ns	A7.14
t_{14}	Write burst $\overline{ACK}$ assertion after $\overline{CS}$[*x*] assertion	(2.5 + WS) × t_{LPCck} – t_{OD}	(2.5 + WS) × t_{LPCck} + t_{OD}	ns	A7.15
t_{15}	Write burst DATA valid	t_{LPCck} – t_{OD}	—	ns	A7.16
t_{16}	Non-MUXed mode: asynchronous write burst ADDR valid before write DATA valid	0.5 × t_{LPCck} – t_{OD}	0.5 × t_{LPCck} + t_{OD}	ns	A7.17
t_{17}	MUXed mode: ADDR cycle	AL × 2 × t_{LPCck} – t_{OD}	AL × 2 × t_{LPCck}	ns	A7.18
t_{18}	MUXed mode: $\overline{ALE}$ cycle	AL × t_{LPCck}	AL × t_{LPCck}	ns	A7.19

Table 25. LPC Timing (continued)

Sym	Description	Min	Max	Units	SpecID
t_{19}	Non-MUXed mode page burst: ADDR cycle	$t_{LPCck} - t_{OD}$	t_{LPCck}	ns	A7.20
t_{20}	Non-MUXed mode page burst: burst DATA (rd) input setup before next ADDR cycle	$t_{OD} + t_6$	—	ns	A7.21
t_{21}	Non-MUXed mode page burst: burst DATA (rd) input hold after next ADDR cycle	0	—	ns	A7.22
t_{22}	MUXed mode: non-burst $\overline{CS}[x]$ pulse width	(ALT × (AL × 2) + WS) × t_{LPCck}	(ALT × (AL × 2) + WS) × t_{LPCck}	ns	A7.23
t_{23}	MUXed mode: read-burst $\overline{CS}[x]$ pulse width	(ALT × (AL × 2) + WS) + BBT/DS) × t_{LPCck}	(ALT × (AL × 2) + WS) + BBT/DS) × t_{LPCck}	ns	A7.23
t_{24}	MUXed mode: write-burst $\overline{CS}[x]$ pulse width	(ALT × (AL × 2) + 2.5 WS) + BBT/DS)× t_{LPCck}	(ALT × (AL × 2) + 2.5 WS) + BBT/DS)× t_{LPCck}	ns	A7.23

4.3.6.1 Non-MUXed Mode

4.3.6.1.1 Non-MUXed Non-Burst Mode

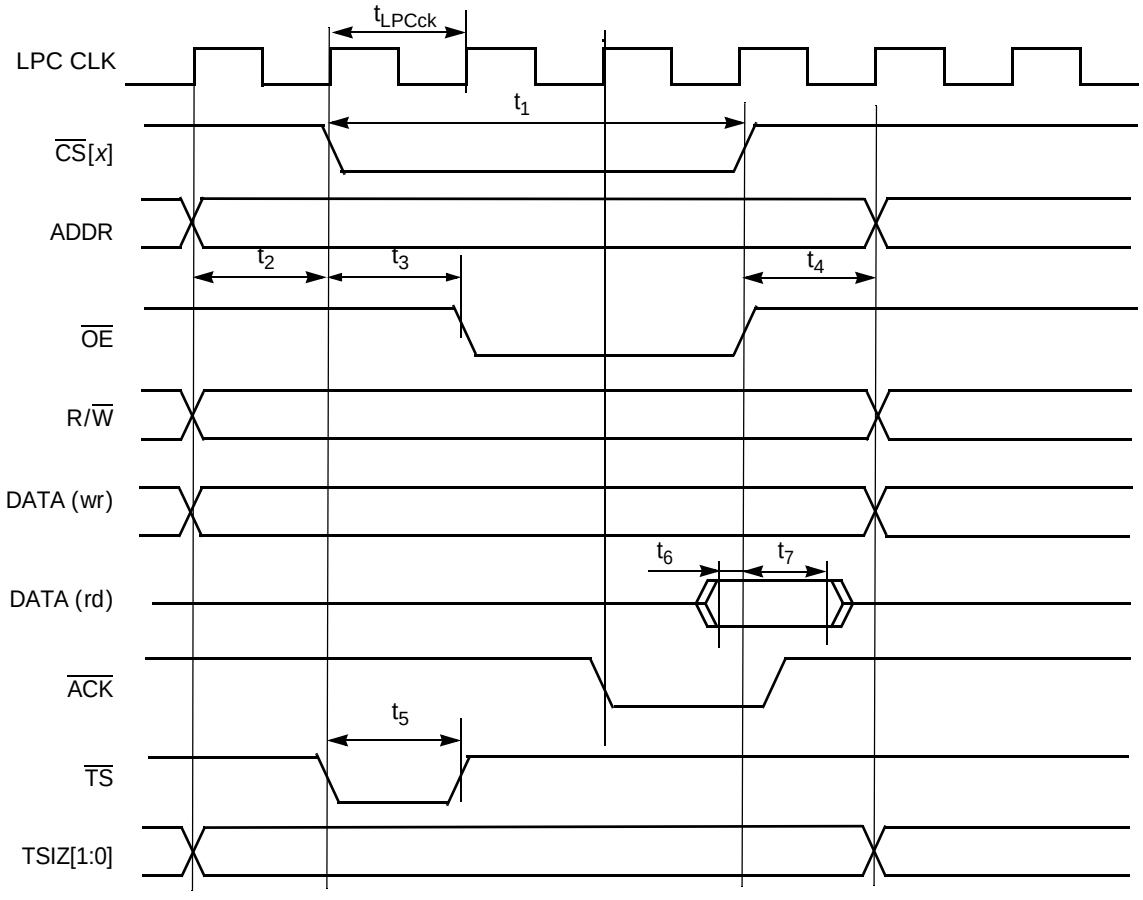


Figure 14. Timing Diagram — Non-MUXed non-Burst Mode

NOTE

$\overline{\text{ACK}}$ is asynchronous input signal and has no timing requirements. $\overline{\text{ACK}}$ needs to be deasserted after $\overline{\text{CS}}[x]$ is deasserted.

4.3.6.1.2 Non-MUXed Synchronous Read Burst Mode

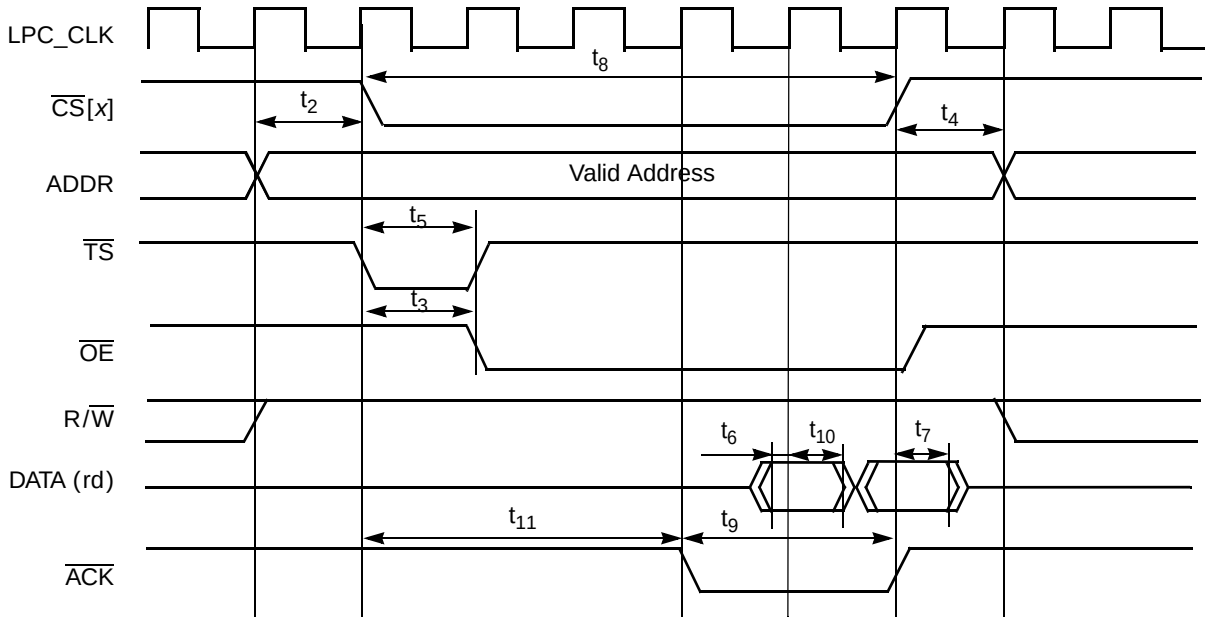


Figure 15. Timing Diagram — Non-MUXed Synchronous Read Burst Mode

4.3.6.1.3 Non-MUXed Synchronous Write Burst Mode

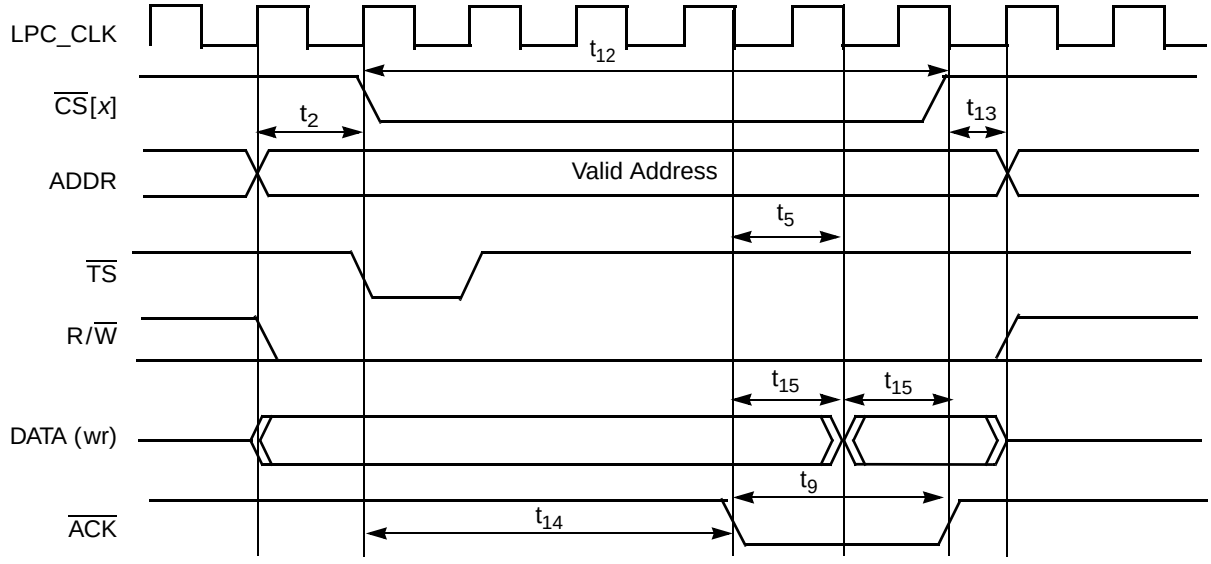


Figure 16. Timing Diagram — Non-MUXed Synchronous Write Burst

4.3.6.1.4 Non-MUXed Asynchronous Read Burst Mode (Page Mode)

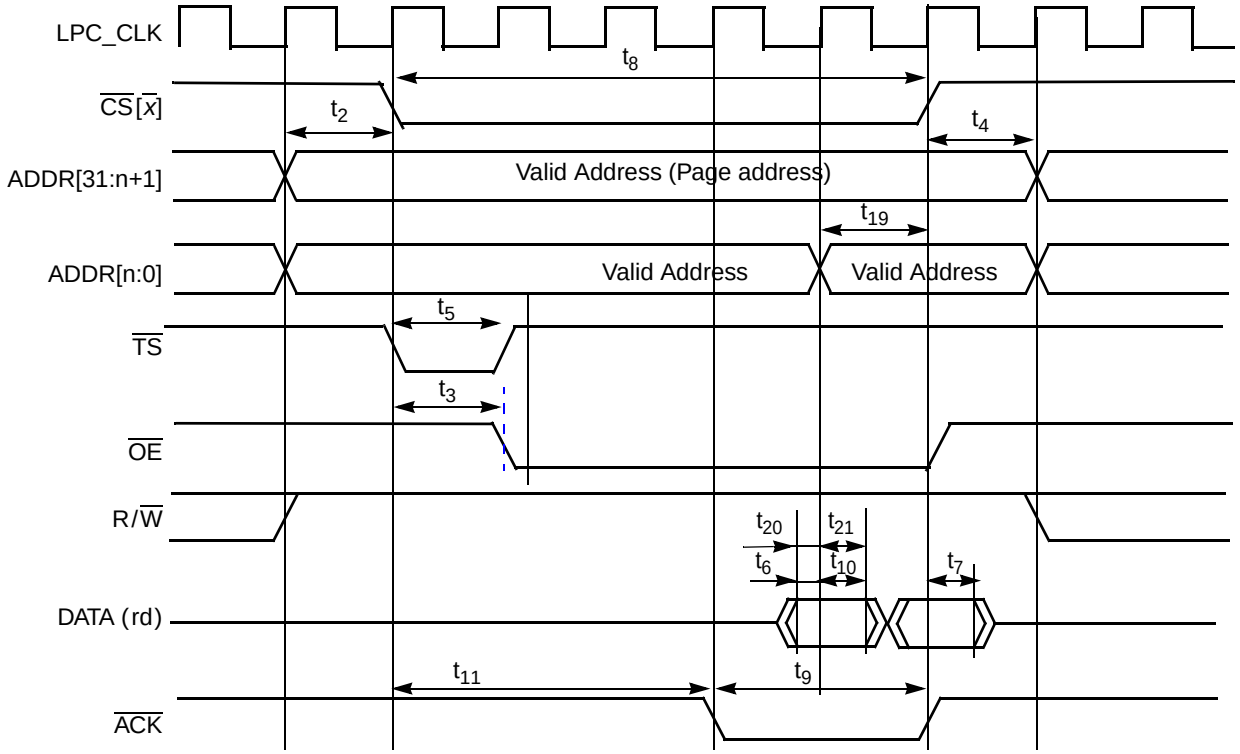


Figure 17. Timing Diagram — Non-MUXed Asynchronous Read Burst

4.3.6.1.5 Non-MUXed Asynchronous Write Burst Mode

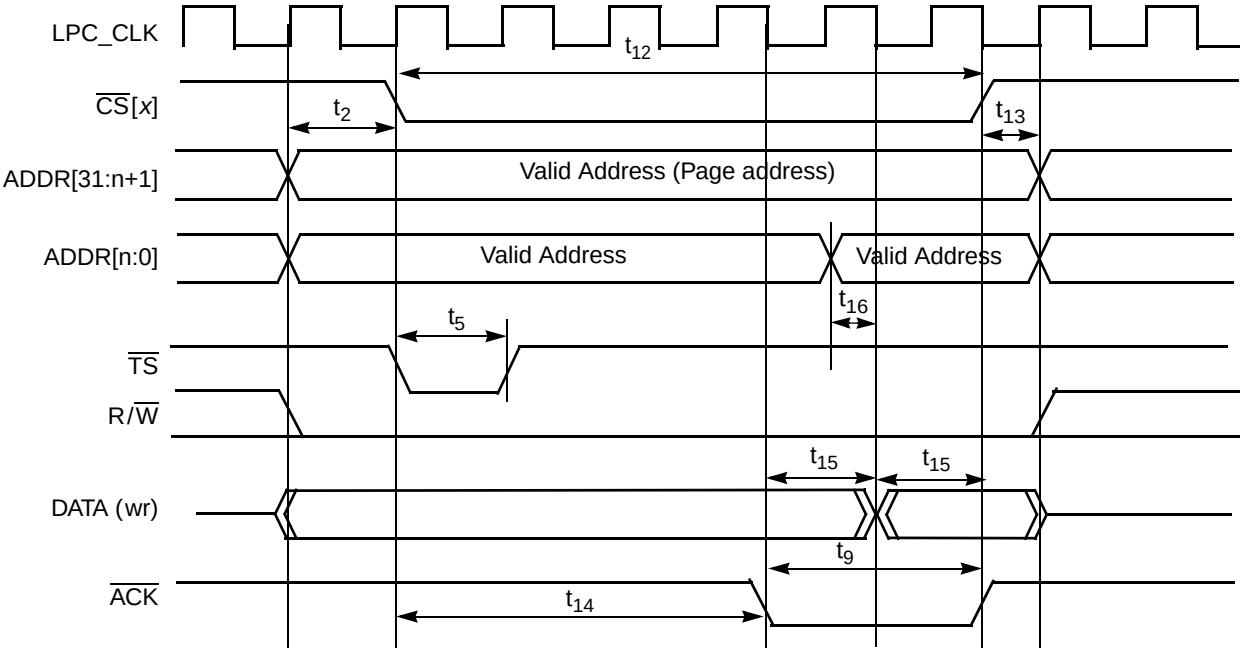


Figure 18. Timing Diagram — Non-MUXed Asynchronous Write Burst

4.3.6.2 MUXed Mode

4.3.6.2.1 MUXed Non-Burst Mode

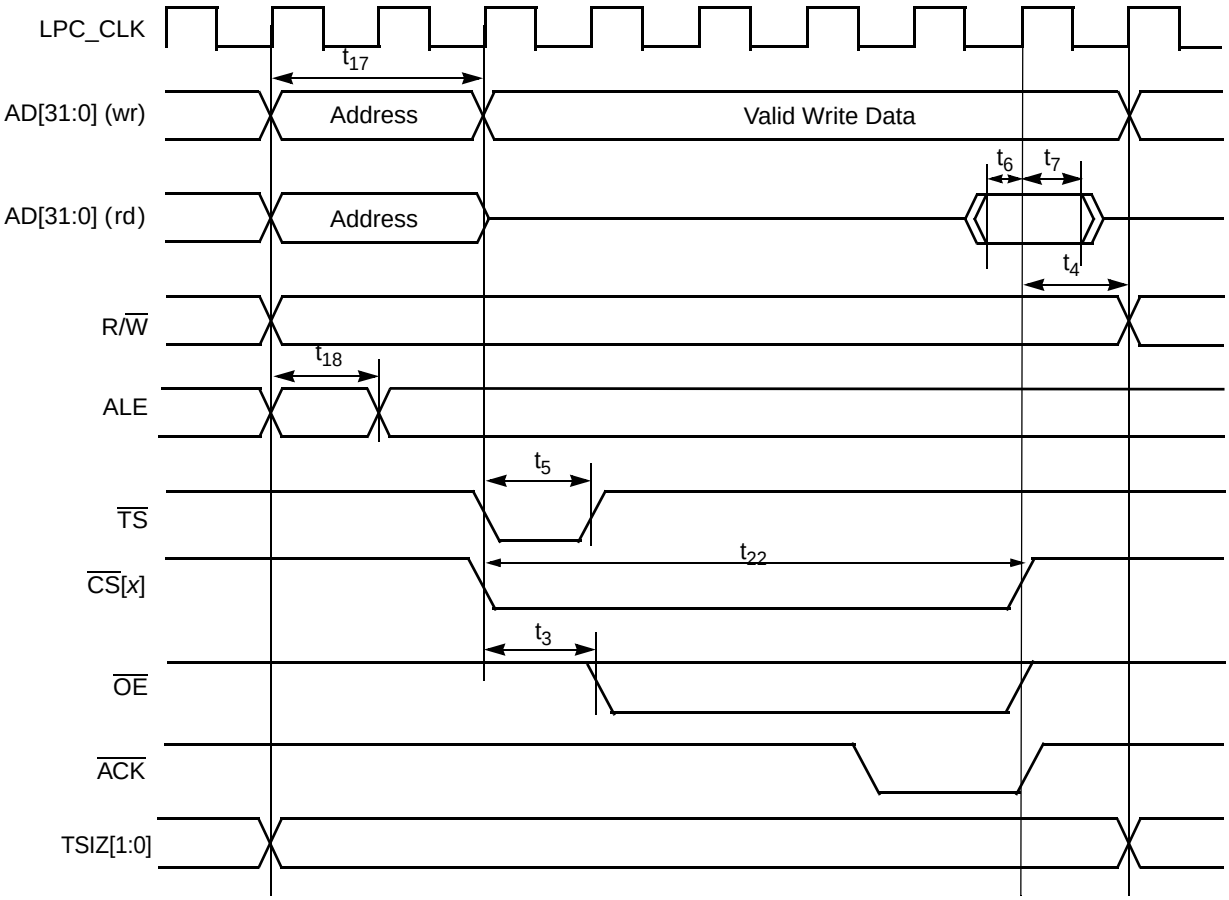


Figure 19. Timing Diagram — MUXed non-Burst Mode

NOTE

ACK is asynchronous input signal and has no timing requirements. ACK needs to be deasserted after CS[*x*] is deasserted.

4.3.6.2.2 MUXed Synchronous Read Burst Mode

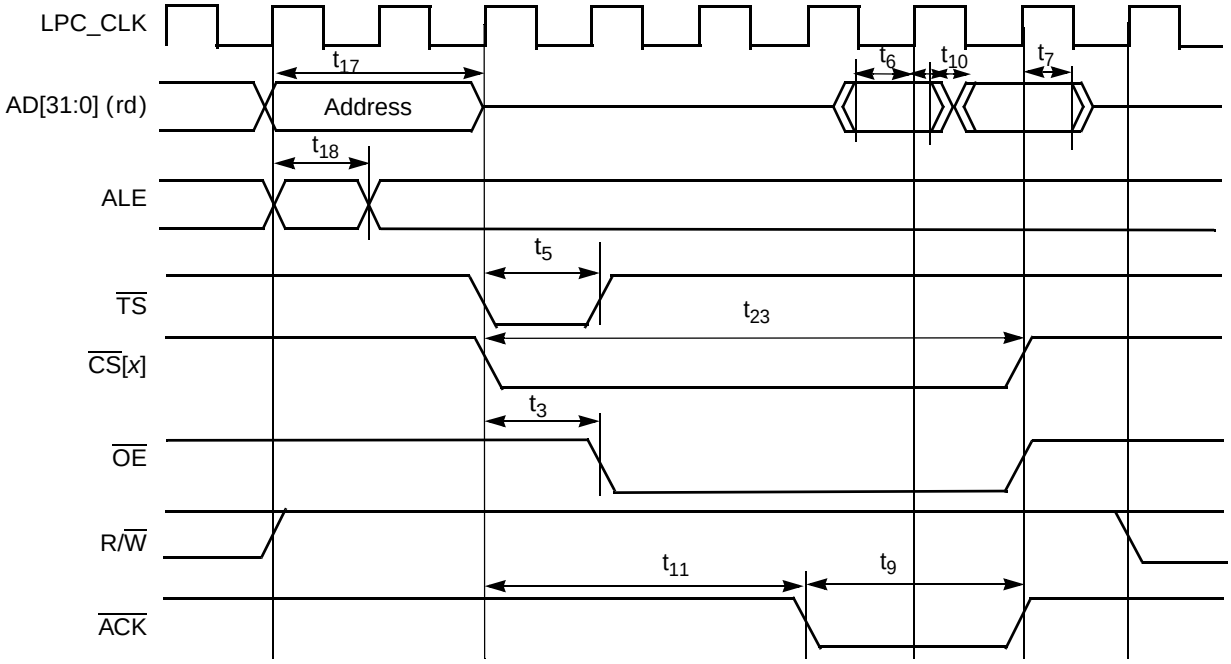


Figure 20. Timing Diagram — MUXed Synchronous Read Burst

4.3.6.2.3 MUXed Synchronous Write Burst Mode

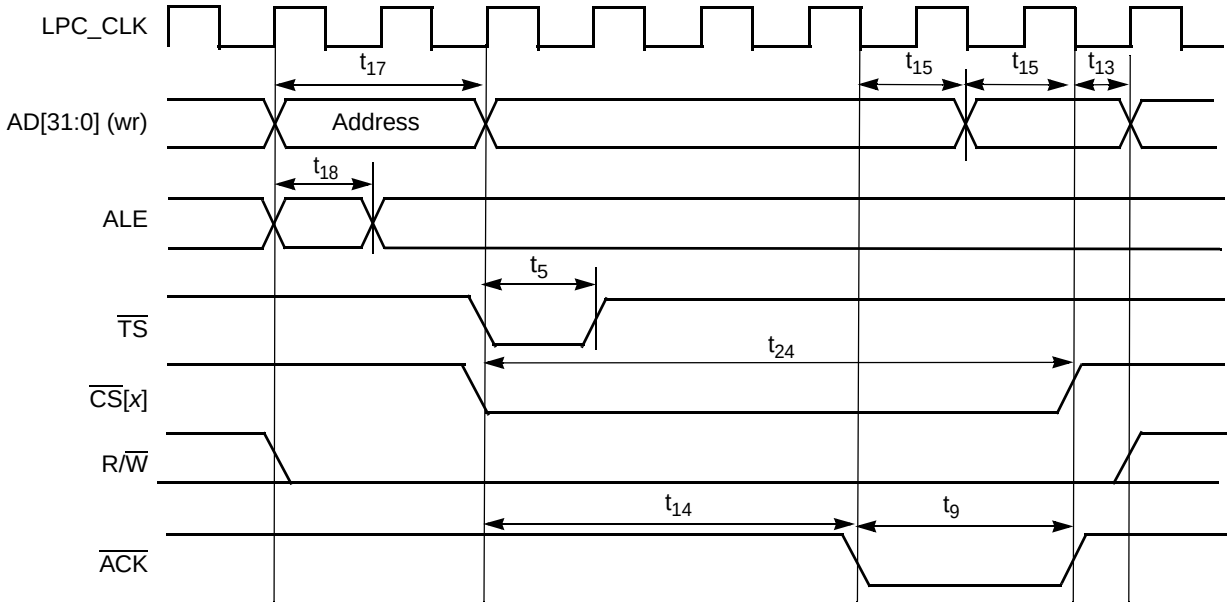


Figure 21. Timing Diagram — MUXed Synchronous Write Burst

4.3.7 NFC

The NAND flash controller (NFC) implements the interface to standard NAND flash memory devices. This section describes the timing parameters of the NFC.

TH is the flash clock high time, TL is flash clock low time, where

$$TH = 5 \times NFC_RATIO_H / 8 \text{ (ns)} \qquad \textit{Eqn. 6}$$

$$TL = 5 \times NFC_RATIO_L / 8 \text{ (ns)} \qquad \textit{Eqn. 7}$$

Refer to the *MPC5125 Reference Manual (MPC5125RM)* for more information about NFC_RATIO_H and NFC_RATIO_L.

Table 26. NFC Target Timing Characteristics

Timing Parameter	Description	Min. value	Max. value	Unit	SpecID
t_{CLS}	NFC_CLE setup time	2TH + TL – 1	—	ns	A8.1
t_{CLH}	NFC_CLE hold time	TH + TL – 1	—	ns	A8.2
t_{CS}	$\overline{\text{NFC_CE[3:0]}}$ setup time	2TH + TL – 1	—	ns	A8.3
t_{CH}	$\overline{\text{NFC_CE[3:0]}}$ hold time	TH + TL	—	ns	A8.4
t_{WP}	$\overline{\text{NFC_WP}}$ pulse width	TL – 1	—	ns	A8.5
t_{ALS}	NFC_ALE setup time	2TH + TL	—	ns	A8.6
t_{ALH}	NFC_ALE hold time	TH + TL	—	ns	A8.7
t_{DS}	Data setup time	TL – 1	—	ns	A8.8
t_{DH}	Data hold time	TH – 1	—	ns	A8.9
t_{WC}	Write cycle time	TH + TL – 1	—	ns	A8.10
t_{WH}	$\overline{\text{NFC_WE}}$ hold time	TH – 1	—	ns	A8.11
t_{RR}	Ready to $\overline{\text{NFC_RE}}$ low	4TH + 3TL + 90	—	ns	A8.12
t_{RP}	$\overline{\text{NFC_RE}}$ pulse width	TL + 1	—	ns	A8.13
t_{RC}	READ cycle time	TL + TH – 1	—	ns	A8.14
t_{REH}	$\overline{\text{NFC_RE}}$ high hold time	TH – 1	—	ns	A8.15
t_{IS}	Data input setup time	6	—	ns	A8.16

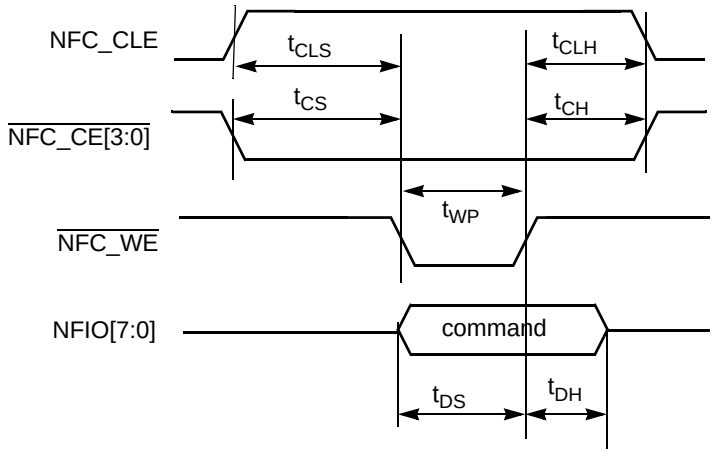


Figure 22. Command Latch Cycle Timing

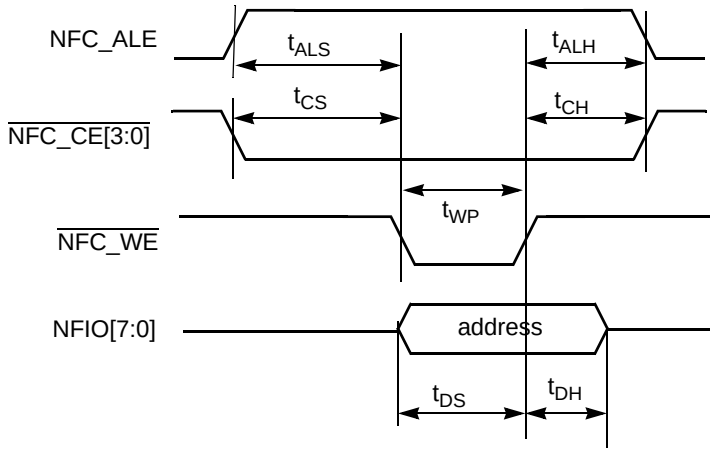


Figure 23. Address Latch Cycle Timing

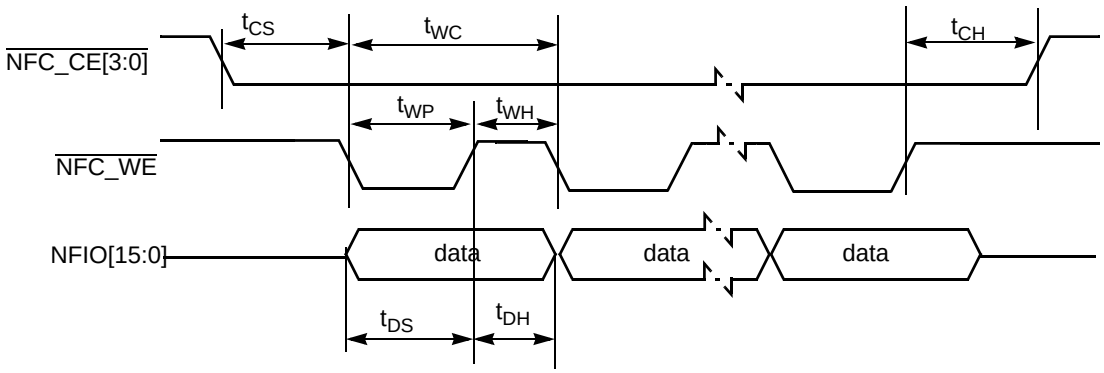


Figure 24. Write Data Latch Timing

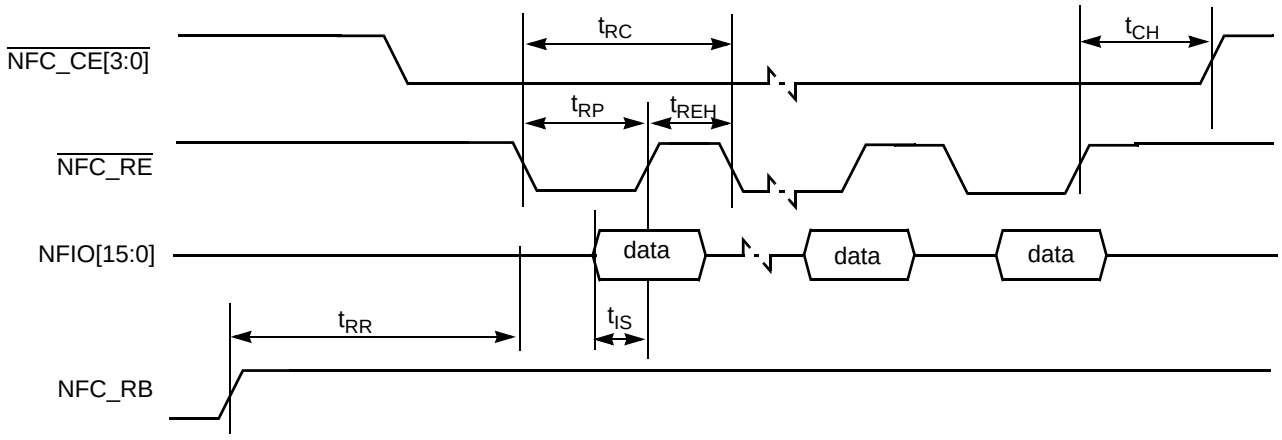


Figure 25. Read Data Latch Timing in Non-Fast Mode

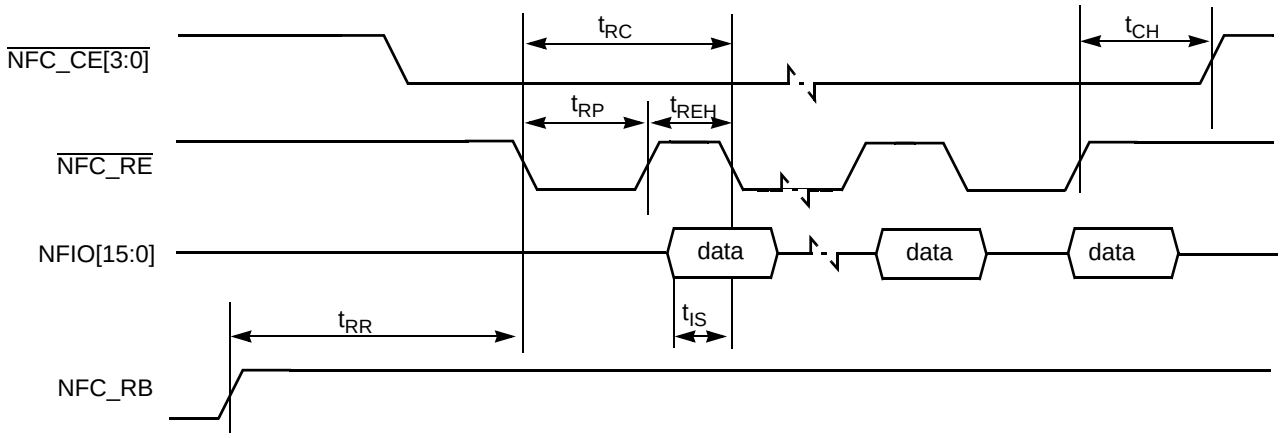


Figure 26. Read Data Latch Timing in Fast Mode

4.3.8 FEC

AC test timing conditions:

- Output Loading
  All Outputs: 25 pF

Table 27. MII Rx Signal Timing

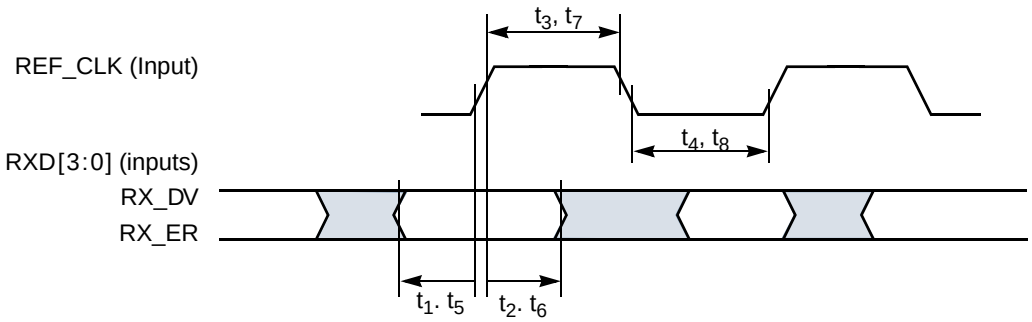
Sym	Description	Min	Max	Unit	SpecID
t_1	RXD[3:0], RX_DV, RX_ER to RX_CLK setup	5	—	ns	A11.1
t_2	RX_CLK to RXD[3:0], RX_DV, RX_ER hold	5	—	ns	A11.2
t_3	RX_CLK pulse width high	35%	65%	RX_CLK period[1]	A11.3
t_4	RX_CLK pulse width low	35%	65%	RX_CLK period[1]	A11.4

NOTES:
1 RX_CLK shall have a frequency of 25% of the data rate of the received signal. See the IEEE 802.3 specification.

Table 28. RMII Rx Signal Timing

Sym	Description	Min	Max	Unit	SpecID
t_5	RXD[1:0], RX_DV, RX_ER to TX_CLK setup	4	—	ns	A11.5
t_6	TX_CLK to RXD[1:0], RX_DV, RX_ER hold	2	—	ns	A11.6
t_7	TX_CLK pulse width high	35%	65%	TX_CLK period[1]	A11.7
t_8	TX_CLK pulse width low	35%	65%	TX_CLK period[1]	A11.8

NOTES:
1 TX_CLK frequency shall be 50 MHz regardless of the data rate. See the RMII specification.



REF_CLK is TX_CLK in RMII mode, and is RX_CLK in non-RMII mode

Figure 27. Ethernet Timing Diagram — MII and RMII Rx Signal

Table 29. MII Tx Signal Timing

Sym	Description	Min	Max	Unit	SpecID
t_9	TX_CLK rising edge to TXD[3:0], TX_EN, TX_ER invalid	3	—	ns	A11.9
t_{10}	TX_CLK rising edge to TXD[3:0], TX_EN, TX_ER valid	—	25	ns	A11.10
t_{11}	TX_CLK pulse width high	35%	65%	TX_CLK Period[1]	A11.11
t_{12}	TX_CLK pulse width low	35%	65%	TX_CLK Period[1]	A11.12

NOTES:
1 The TX_CLK frequency shall be 25% of the nominal transmit frequency, for example, a PHY operating at 100 Mb/s must provide a TX_CLK frequency of 25 MHz and a PHY operating at 10 Mb/s must provide a TX_CLK frequency of 2.5 MHz. See the IEEE 802.3 specification.

Table 30. RMII Tx Signal Timing

Sym	Description	Min	Max	Unit	SpecID
t_{13}	TX_CLK rising edge to TXD[1:0], TX_EN, TX_ER invalid	3	—	ns	A11.13
t_{14}	TX_CLK rising edge to TXD[1:0], TX_EN, TX_ER valid	—	14	ns	A11.14
t_{15}	TX_CLK pulse width high	35%	65%	TX_CLK Period[1]	A11.15
t_{16}	TX_CLK pulse width low	35%	65%	TX_CLK Period[1]	A11.16

NOTES:
1 TX_CLK frequency shall be 50 MHz regardless of the data rate. See the RMII specification.

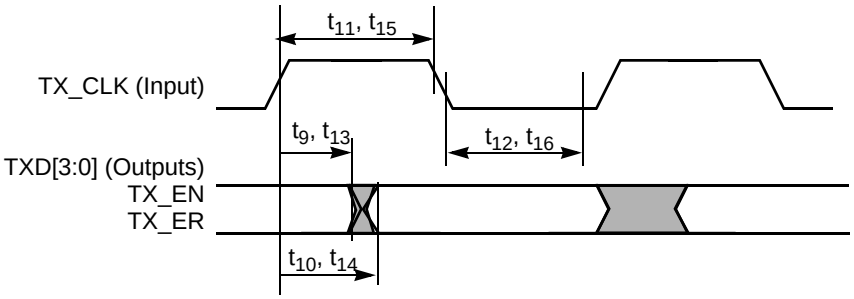


Figure 28. Ethernet Timing Diagram — MII Tx Signal

Table 31. MII Async Signal Timing

Sym	Description	Min	Max	Unit	SpecID
t_{17}	CRS, COL minimum pulse width	1.5	—	TX_CLK Period	A11.17

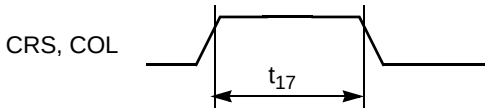


Figure 29. Ethernet Timing Diagram — MII Async

Table 32. MII Serial Management Channel Signal Timing

Sym	Description	Min	Max	Unit	SpecID
t_{18}	MDC falling edge to MDIO output delay	0	25	ns	A11.18
t_{19}	MDIO (input) to MDC rising edge setup	10	—	ns	A11.19
t_{20}	MDIO (input) to MDC rising edge hold	0	—	ns	A11.20
t_{21}	MDC pulse width high[1]	160	—	ns	A11.21
t_{22}	MDC pulse width low[1]	160	—	ns	A11.22
t_{23}	MDC period[2]	400	—	ns	A11.23

NOTES:
1 MDC is generated by the MPC5125 with a duty cycle of 50% except when MII_SPEED in the FEC MII_SPEED control register is changed during operation. See the *MPC5125 Reference Manual (MPC5125RM*).

2 The MDC period must be set to a value of less than or equal to 2.5 MHz (to be compliant with the IEEE MII characteristic) by programming the FEC MII_SPEED control register. See the *MPC5125 Reference Manual (MPC5125RM*).

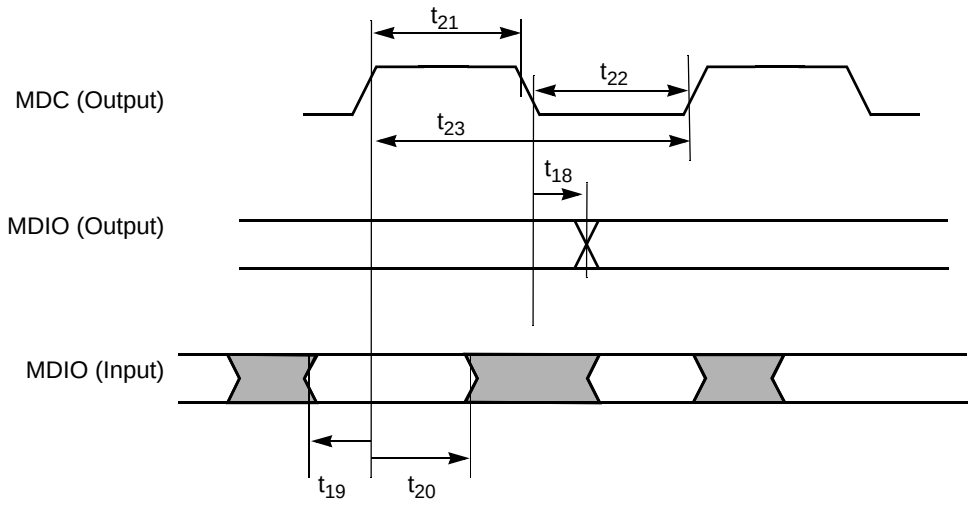


Figure 30. Ethernet Timing Diagram — MII Serial Management

4.3.9 USB ULPI

This section specifies the USB ULPI timing.

For more information refer to *UTMI+ Low Pin Interface (ULPI) Specification*, Revision 1.1, October 20, 2004.

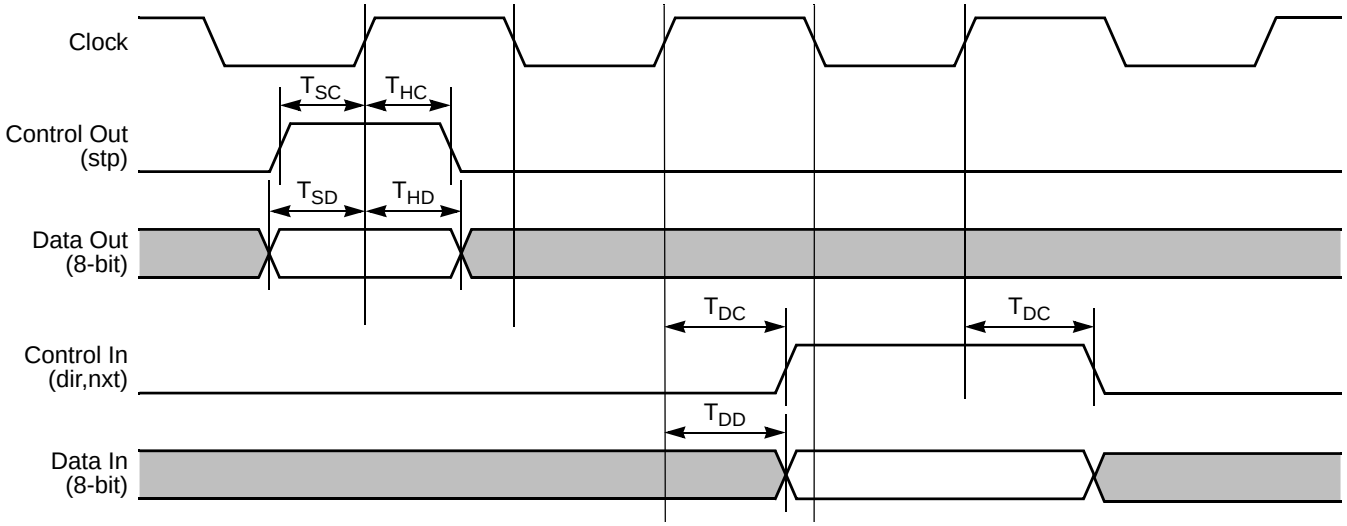


Figure 31. ULPI Timing Diagram

Table 33. Timing Specifications — USB Output Line [1]

Sym	Description	Min	Max	Units	SpecID
T_{CK}	Clock period	15	—	ns	A12.1
T_{SC}, T_{SD}	Setup time (control in, 8-bit data in)	—	6.0	ns	A12.2
T_{HC}, T_{HD}	Hold time (control in, 8-bit data in)	0.0	—	ns	A12.3
T_{DC}, T_{DD}	Output delay (control out, 8-bit data out)	—	9.0	ns	A12.4

NOTES:
1 Output timing is specified at a nominal 50 pF load.

4.3.10 MMC/SD/SDIO Card Host Controller (SDHC)

Figure 32 depicts the timings of the SDHC.

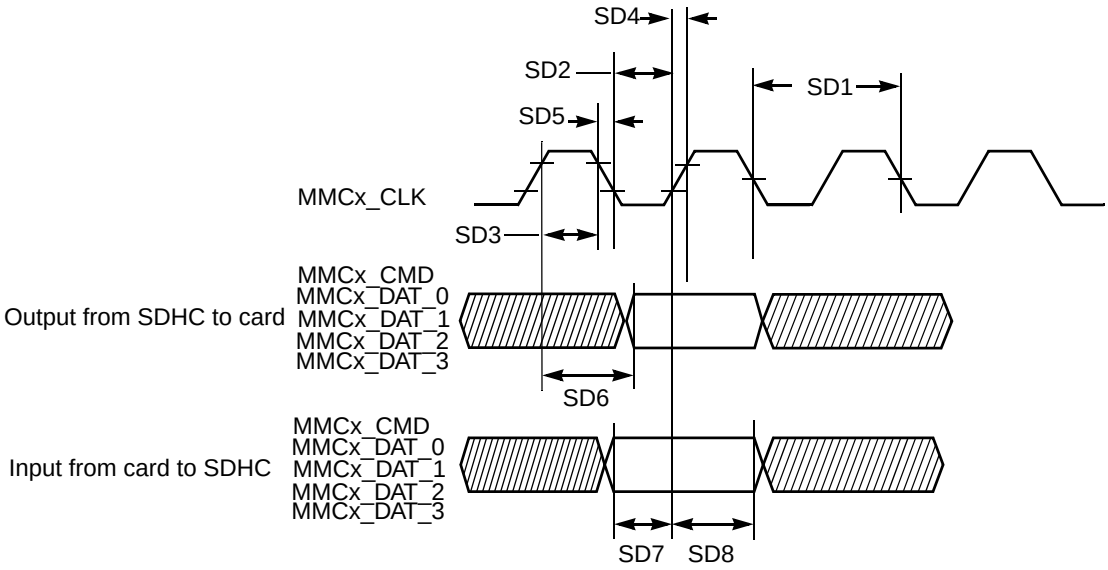


Figure 32. SDHC Timing Diagram

Table 34 lists the timing parameters.

Table 34. MMC/SD Interface Timing Parameters

ID	Parameter	Symbols	Min	Max	Unit	SpecID
Card Input Clock						
SD1	Clock frequency (low speed)	f_{PP} [1]	0	400	kHz	A14.1
	Clock frequency (SD/SDIO full speed/high speed)	f_{PP} [2]	0	25/50	MHz	A14.2
	Clock frequency (MMC full speed/high speed)	f_{PP} [3]	0	20/52	MHz	A14.3
	Clock frequency (identification mode)	f_{OD} [4]	100	400	kHz	A14.4
SD2	Clock low time (full speed/high speed)	t_{WL}	10/7		ns	A14.5
SD3	Clock high time (full speed/high speed)	t_{WH}	10/7		ns	A14.6
SD4	Clock rise time (full speed/high speed)	t_{TLH}		10/3	ns	A14.7
SD5	Clock fall time (full speed/high speed)	t_{THL}		10/3	ns	A14.8
SDHC Output / Card Inputs CMD, DAT (Reference to CLK)						
SD6	SDHC output delay	t_{OD}	TH – 3 [5]	TH + 3	ns	A14.9
SDHC Input / Card Outputs CMD, DAT (Reference to CLK)						
SD7	SDHC input setup time	t_{ISU}	2.5		ns	A14.10
SD8	SDHC input hold time	t_{IH}	2.5		ns	A14.11

NOTES:
1 In low speed mode, card clock must be lower than 400 kHz, voltage ranges from 2.7 to 3.6 V.
2 In normal data transfer mode for SD/SDIO card, clock frequency can be any value between 0–25 MHz.
3 In normal data transfer mode for MMC card, clock frequency can be any value between 0–20 MHz.

[4] In card identification mode, card clock must be 100 kHz ~ 400 kHz, voltage ranges from 2.7 to 3.6 V.

[5] Suggested Clock Period = T, CLK_DIVIDER (in SDHC Clock Rate register) = D, then TH = [(D + 1)/2] / (D + 1) × T where [] is round.

4.3.11 DIU

The DIU is a display controller designed to manage the TFT LCD display.

4.3.11.1 Interface to TFT LCD Panels, Functional Description

Figure 33 depicts the LCD interface timing for a generic active matrix color TFT panel. In this figure signals are shown with positive polarity. The sequence of events for active matrix interface timing is:

- DIU_CLK latches data into the panel on its positive edge (when positive polarity is selected). In active mode, DIU_CLK runs continuously. This signal frequency could be from 5 to 66 MHz depending on the panel type.
- DIU_HSYNC causes the panel to start a new line. It always encompasses at least one DIU_CLK pulse.
- DIU_VSYNC causes the panel to start a new frame. It always encompasses at least one DIU_HSYNC pulse.
- DIU_DE acts like an output enable signal to the LCD panel. This output enables the data to be shifted onto the display. When disabled, the data is invalid and the trace is off.

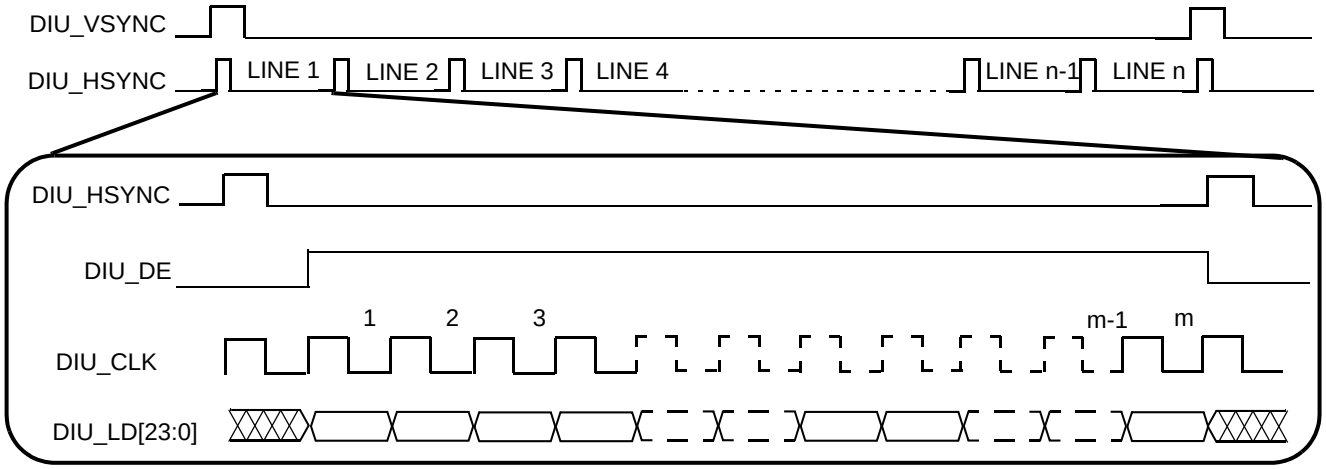


Figure 33. Interface Timing Diagram for TFT LCD Panels

4.3.11.2 Interface to TFT LCD Panels, Electrical Characteristics

Figure 34 depicts the horizontal timing (timing of one line), including the horizontal sync pulse and the data. All parameters shown in the diagram are programmable. This timing diagram corresponds to positive polarity of the DIU_CLK signal (meaning the data and sync signals change at its rising edge) and active-high polarity of the DIU_HSYNC, DIU_VSYNC, and DIU_DE signal. Signal polarity of DIU_HSYNC and DIU_VSYNC are selectable via the SYN_POL register, whether active-high or active-low. The default is active-high. The DIU_DE signal is always active-high. Also, pixel clock inversion and a flexible programmable pixel clock delay are also supported, programmed via the DIU Clock Config register (DCCR) in the system clock module.

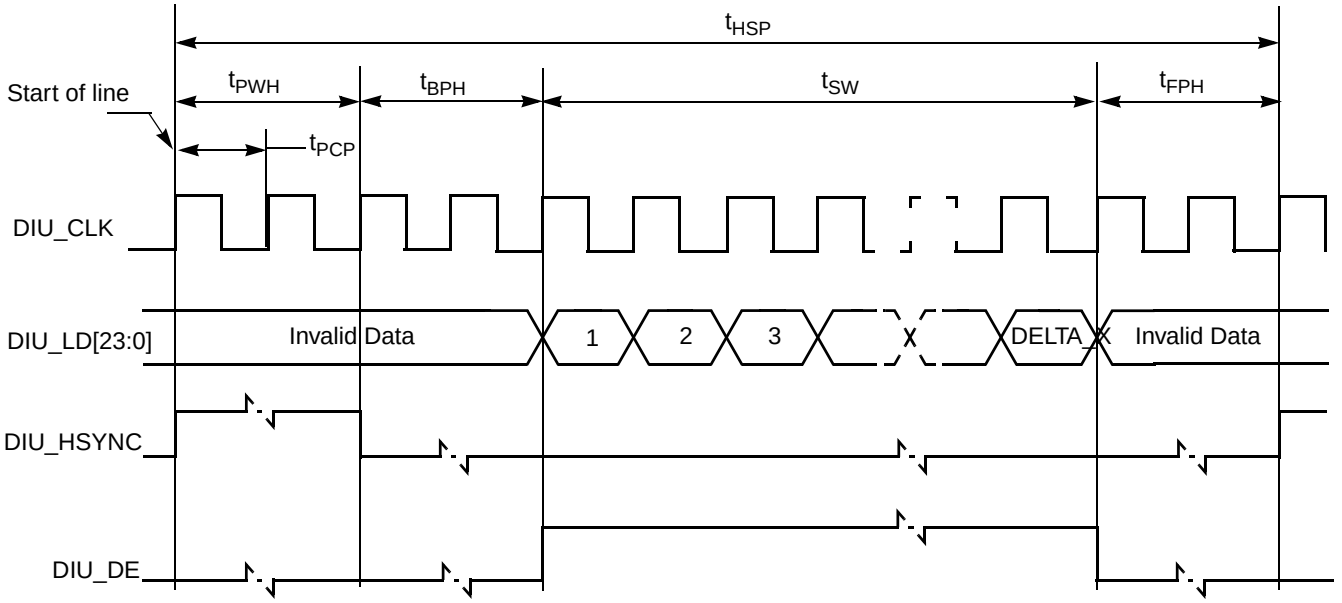


Figure 34. TFT LCD Interface Timing Diagram — Horizontal Sync Pulse

Figure 35 depicts the vertical timing (timing of one frame), including the vertical sync pulse and the data. All parameters shown in the diagram are programmable.

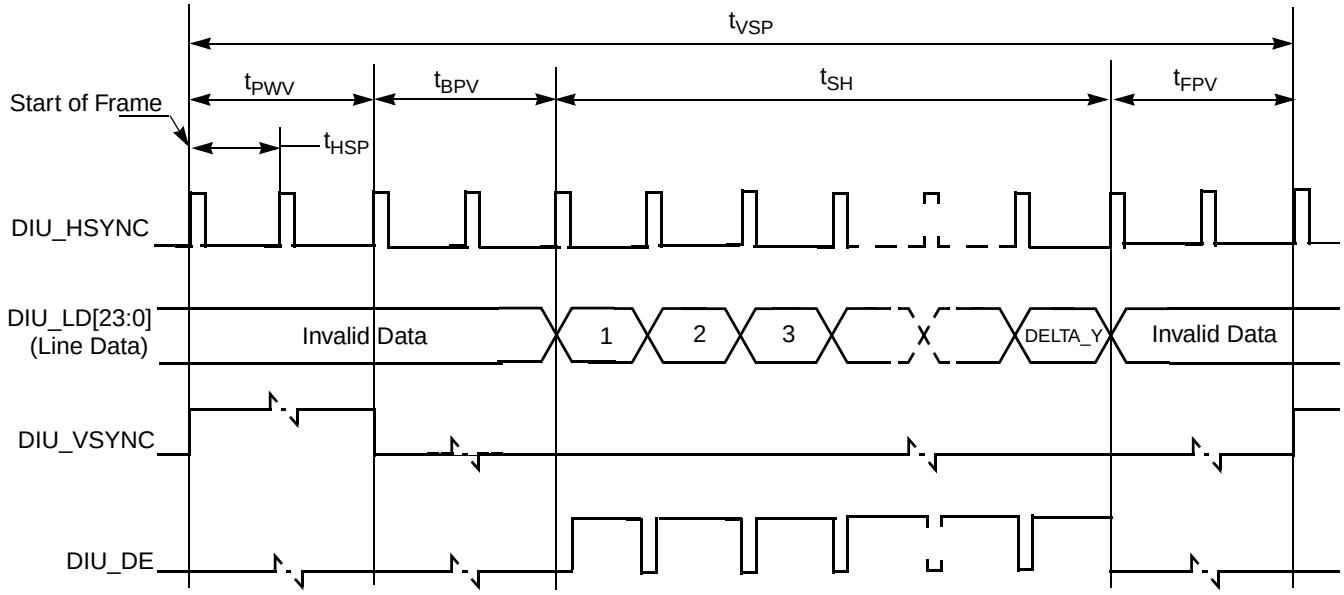


Figure 35. TFT LCD Interface Timing Diagram — Vertical Sync Pulse

Table 35 shows timing parameters of signals.

Table 35. LCD Interface Timing Parameters — Pixel Level

Sym	Description	Value	Unit	SpecID
t_{PCP}	Display Pixel Clock Period	15[1]	ns	A15.1
t_{PWH}	HSYNC Pulse Width	PW_H × t_{PCP}	ns	A15.2
t_{BPH}	HSYNC Back Porch Width	BP_H × t_{PCP}	ns	A15.3

Table 35. LCD Interface Timing Parameters — Pixel Level

Sym	Description	Value	Unit	SpecID
t_{FPH}	HSYNC Front Porch Width	FP_H × t_{PCP}	ns	A15.4
t_{SW}	Screen Width	DELTA_X × t_{PCP}	ns	A15.5
t_{HSP}	HSYNC (Line) Period	(PW_H + BP_H + DELTA_X + FP_H) × t_{PCP}	ns	A15.6
t_{PWV}	VSYNC Pulse Width	PW_V × t_{HSP}	ns	A15.7
t_{BPV}	VSYNC Back Porch Width	BP_V × t_{HSP}	ns	A15.8
t_{FPV}	VSYNC Front Porch Width	FP_V × t_{HSP}	ns	A15.9
t_{SH}	Screen Height	DELTA_Y × t_{HSP}	ns	A15.10
t_{VSP}	VSYNC (Frame) Period	(PW_V + BP_V + DELTA_Y + FP_H) × t_{HSP}	ns	A15.11

NOTES:
1 Display interface pixel clock period immediate value (in nanoseconds).

The DELTA_X and DELTA_Y parameters are programmed via the DISP_SIZE register; The PW_H, BP_H, and FP_H parameters are programmed via the HSYN_PARA register; and the PW_V, BP_V, and FP_V parameters are programmed via the VSYN_PARA register. See appropriate section in the reference manual for detailed descriptions of these parameters.

Figure 36 depicts the synchronous display interface timing for access level, and Table 36 lists the timing parameters.

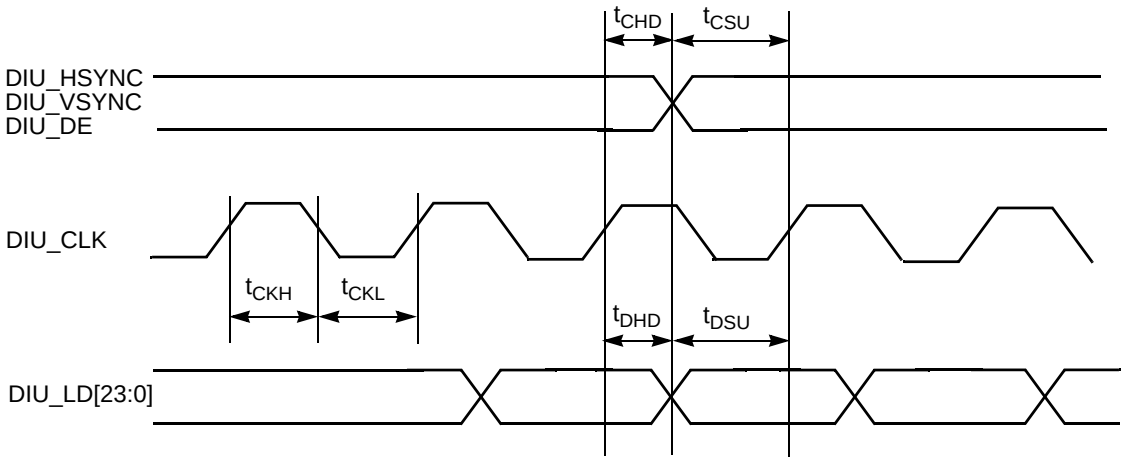


Figure 36. LCD Interface Timing Diagram — Access Level

Table 36. LCD Interface Timing Parameters — Access Level

Parameter	Description	Min	Typ	Max	Unit	SpecID
t_{CKH}	LCD interface pixel clock high time	t_{PCP} × 0.4	t_{PCP} × 0.5	t_{PCP} × 0.6	ns	A15.12
t_{CKL}	LCD interface pixel clock low time	t_{PCP} × 0.4	t_{PCP} × 0.5	t_{PCP} × 0.6	ns	A15.13
t_{DSU}	LCD interface data setup time	5.0	—	—	ns	A15.14
t_{DHD}	LCD interface data hold time	6.0	—	—	ns	A15.15
t_{CSU}	LCD interface control signal setup time	5.0	—	—	ns	A15.16
t_{CHD}	LCD interface control signal hold time	6.0	—	—	ns	A15.17

4.3.12 CAN

The CAN functions are available as TX pins at normal IO pads and as RX pins at the VBAT domain. There is no filter for the wakeup dominant pulse. Any high-to-low edge can cause wakeup, if configured.

4.3.13 I²C

This section specifies the timing parameters of the inter-integrated circuit (I^2C) interface. Refer to the I^2C bus specification.

Table 37. I^2C Input Timing Specifications — SCL and SDA

Sym	Description	Min	Max	Units	SpecID
1	Start condition hold time	2	—	IP bus cycle[1]	A18.1
2	Clock low time	8	—	IP bus cycle[1]	A18.2
4	Data hold time	0.0	—	ns	A18.3
6	Clock high time	4	—	IP bus cycle[1]	A18.4
7	Data setup time	0.0	—	ns	A18.5
8	Start condition setup time (for repeated start condition only)	2	—	IP bus cycle[1]	A18.6
9	Stop condition setup time	2	—	IP bus cycle[1]	A18.7

NOTES:
1 Inter-peripheral clock is defined in the *MPC5125 Reference Manual (MPC5125RM*)

Table 38. I^2C Output Timing Specifications — SCL and SDA [1]

Sym	Description	Min	Max	Units	SpecID
1[2]	Start condition hold time	6	—	IP bus cycle[3]	A18.8
2[2]	Clock low time	10	—	IP bus cycle[3]	A18.9
3[4]	SCL/SDA rise time	—	7.9	ns	A18.10
4[2]	Data hold time	7	—	IP bus cycle[3]	A18.11
5[2]	SCL/SDA fall time	—	7.9	ns	A18.12
6[2]	Clock high time	10	—	IP bus cycle[3]	A18.13
7[2]	Data setup time	2	—	IP bus cycle[3]	A18.14
8[2]	Start condition setup time (for repeated start condition only)	20	—	IP bus cycle[3]	A18.15
9[2]	Stop condition setup time	10	—	IP bus cycle[3]	A18.16

NOTES:
1 Output timing is specified at a nominal 50 pF load.

2 Programming IFDR with the maximum frequency results in the minimum output timings listed. The I^2C interface is designed to scale the data transition time, moving it to the middle of the SCL low period. The actual position is affected by the prescale and division values programmed in IFDR.

3 Because SCL and SDA are open-drain-type outputs, which the processor can only actively drive low, the time that SCL or SDA takes to reach a high level depends on external signal capacitance and pullup resistor values.

4 Inter -peripheral Clock is defined in the *MPC5125 Reference Manual (MPC5125RM*).

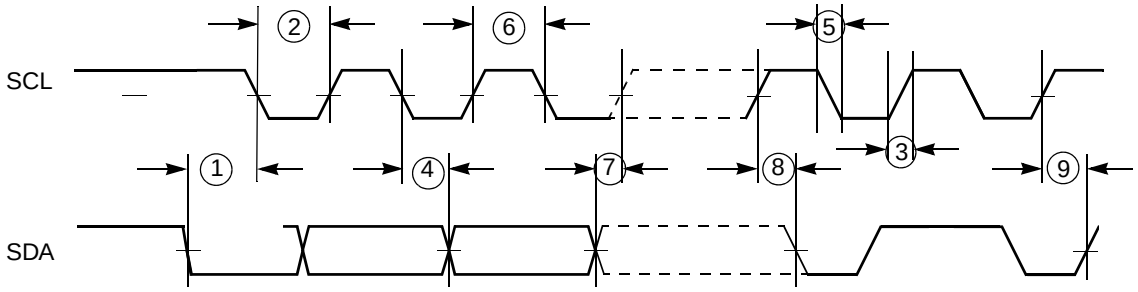


Figure 37. Timing Diagram — I²C Input/Output

4.3.14 J1850

See the *MPC5125 Reference Manual (MPC5125RM)*.

4.3.15 PSC

The programmable serial controllers (PSC) support different modes of operation (UART, codec, AC97, SPI).

All the timing numbers specified for different PSC modes are design targets.

4.3.15.1 Codec Mode (8-, 16-, 24-, and 32-Bit) / I²S Mode

Table 39. Timing Specifications — 8-, 16-, 24-, and 32-Bit CODEC/I²S Master Mode[1]

Sym	Description	Min	Typ	Max	Units	SpecID
1	Bit clock cycle time, programmed in CCS register	40.0	—	—	ns	A20.1
2	Clock duty cycle	45	50	55	%[2]	A20.2
3	Bit clock fall time	—	—	7.9	ns	A20.3
4	Bit clock rise time	—	—	7.9	ns	A20.4
5	FrameSync valid after clock edge	—	—	8.4	ns	A20.5
6	FrameSync invalid after clock edge	—	—	8.4	ns	A20.6
7	Output data valid after clock edge	—	—	9.3	ns	A20.7
8	Input data setup time	6.0	—	—	ns	A20.8

NOTES:
1 Output timing is specified at a nominal 50 pF load.
2 Bit clock cycle time.

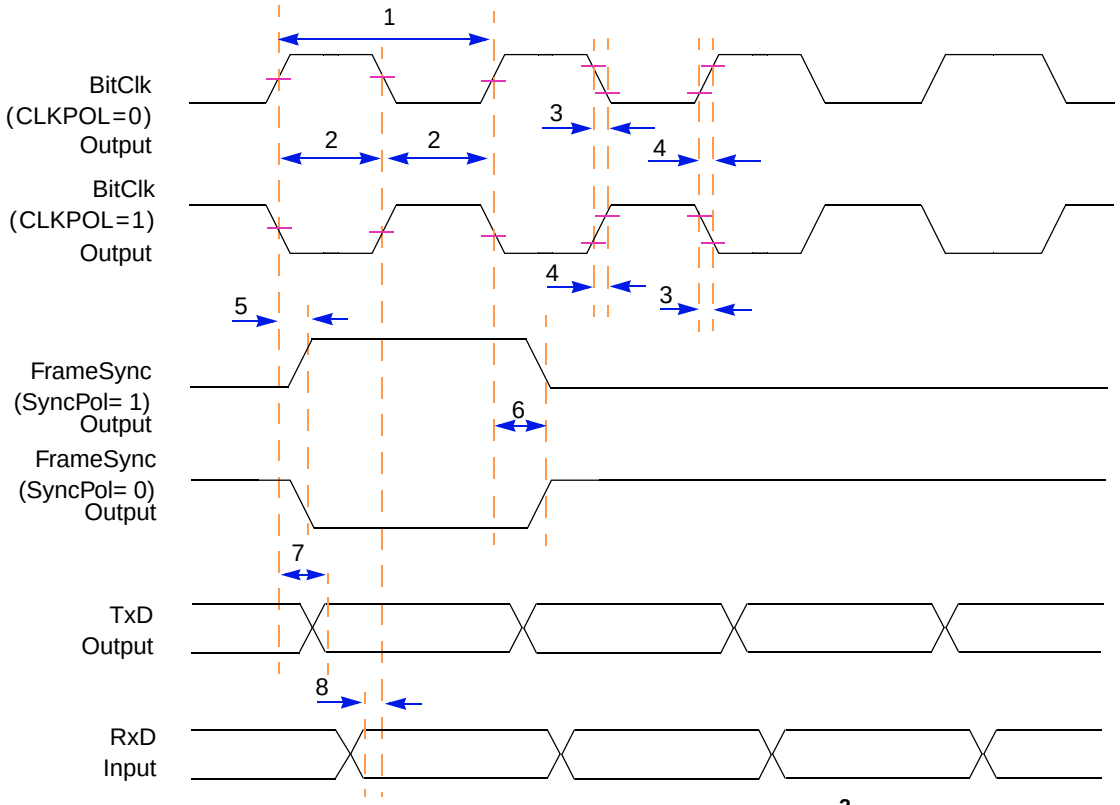


Figure 38. Timing Diagram — 8-,16-, 24-, and 32-bit CODEC/I²S Master Mode

Table 40. Timing Specifications — 8-,16-, 24-, and 32-bit CODEC/I²S Slave Mode [1]

Sym	Description	Min	Typ	Max	Units	SpecID
1	Bit clock cycle time	40.0	—	—	ns	A20.9
2	Clock duty cycle	—	50	—	%[2]	A20.10
3	Frame sync setup time	1.0	—	—	ns	A20.11
4	Output data valid after clock edge	—	—	14.0	ns	A20.12
5	Input data setup time	1.0	—	—	ns	A20.13
6	Input data hold time	1.0	—	—	ns	A20.14

NOTES:
1 Output timing is specified at a nominal 50 pF load.
2 Bit clock cycle time.

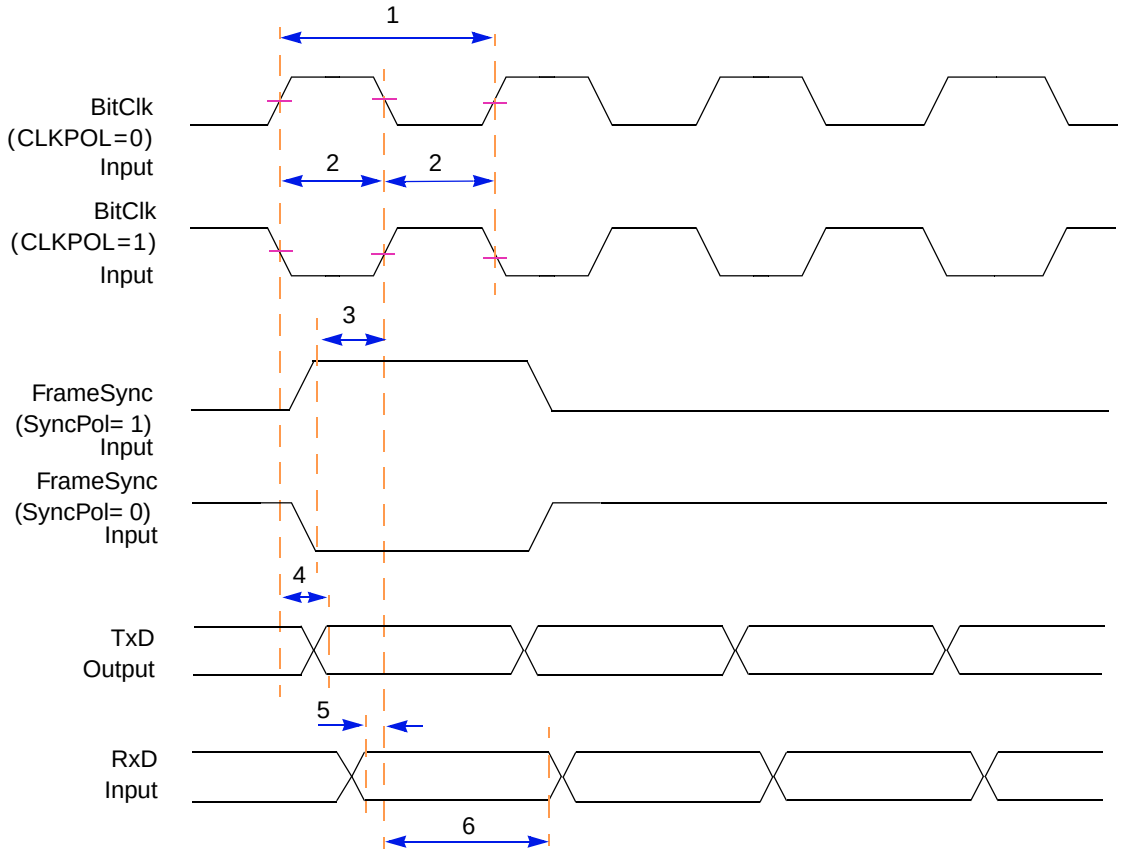


Figure 39. Timing Diagram — 8-,16-, 24-, and 32-bit CODEC/I^{2}S Slave Mode

4.3.15.2 AC97 Mode

Table 41. Timing Specifications — AC97 Mode [1]

Sym	Description	Min	Typ	Max	Units	SpecID
1	Bit clock cycle time	—	81.4	—	ns	A20.15
2	Clock pulse high time	—	40.7	—	ns	A20.16
3	Clock pulse low time	—	40.7	—	ns	A20.17
4	Frame sync valid after rising clock edge	—	—	13.0	ns	A20.18
5	Output data valid after rising clock edge	—	—	14.0	ns	A20.19
6	Input data setup time	1.0	—	—	ns	A20.20
7	Input data hold time	1.0	—	—	ns	A20.21

NOTES:
1 Output timing is specified at a nominal 50 pF load.

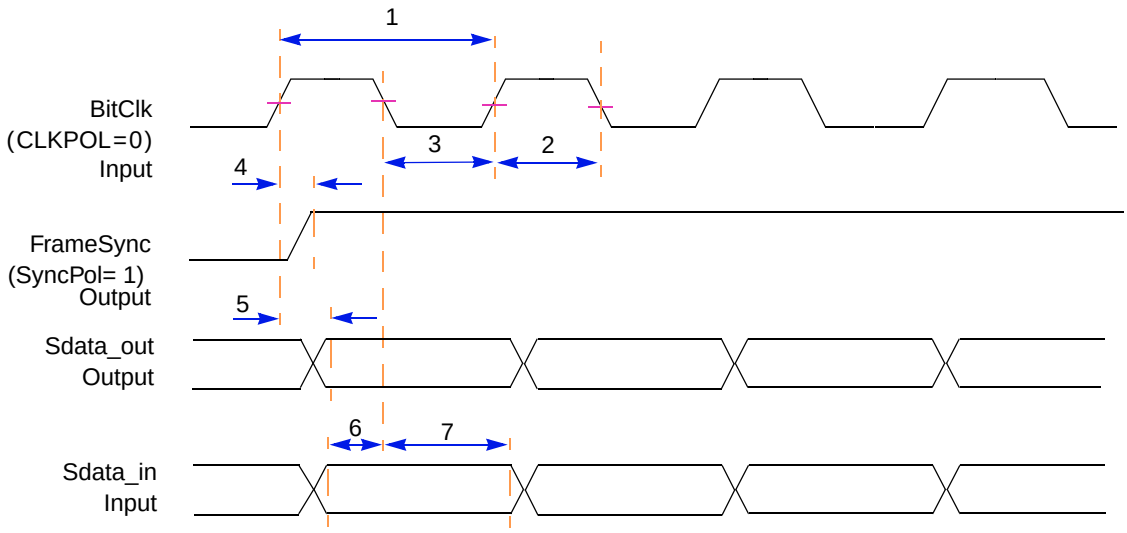


Figure 40. Timing Diagram — AC97 Mode

4.3.15.3 SPI Mode

Table 42. Timing Specifications — SPI Master Mode, Format 0 (CPHA = 0) [1]

Sym	Description	Min	Max	Units	SpecID
1	SCK cycle time, programable in the PSC CCS register	30.0	—	ns	A20.26
2	SCK pulse width, 50% SCK duty cycle	15.0	—	ns	A20.27
3	Slave select clock delay, programable in the PSC CCS register	30.0	—	ns	A20.28
4	Output data valid after slave select ($\overline{SS}$)	—	8.9	ns	A20.29
5	Output data valid after SCK	—	8.9	ns	A20.30
6	Input data setup time	6.0	—	ns	A20.31
7	Input data hold time	1.0	—	ns	A20.32
8	Slave disable lag time	—	TSCK	ns	A20.33
9	Sequential transfer delay, programable in the PSC CTUR / CTLR register	15.0	—	ns	A20.34
10	Clock falling time	—	7.9	ns	A20.35
11	Clock rising time	—	7.9	ns	A20.36

NOTES:
1 Output timing is specified at a nominal 50 pF load.

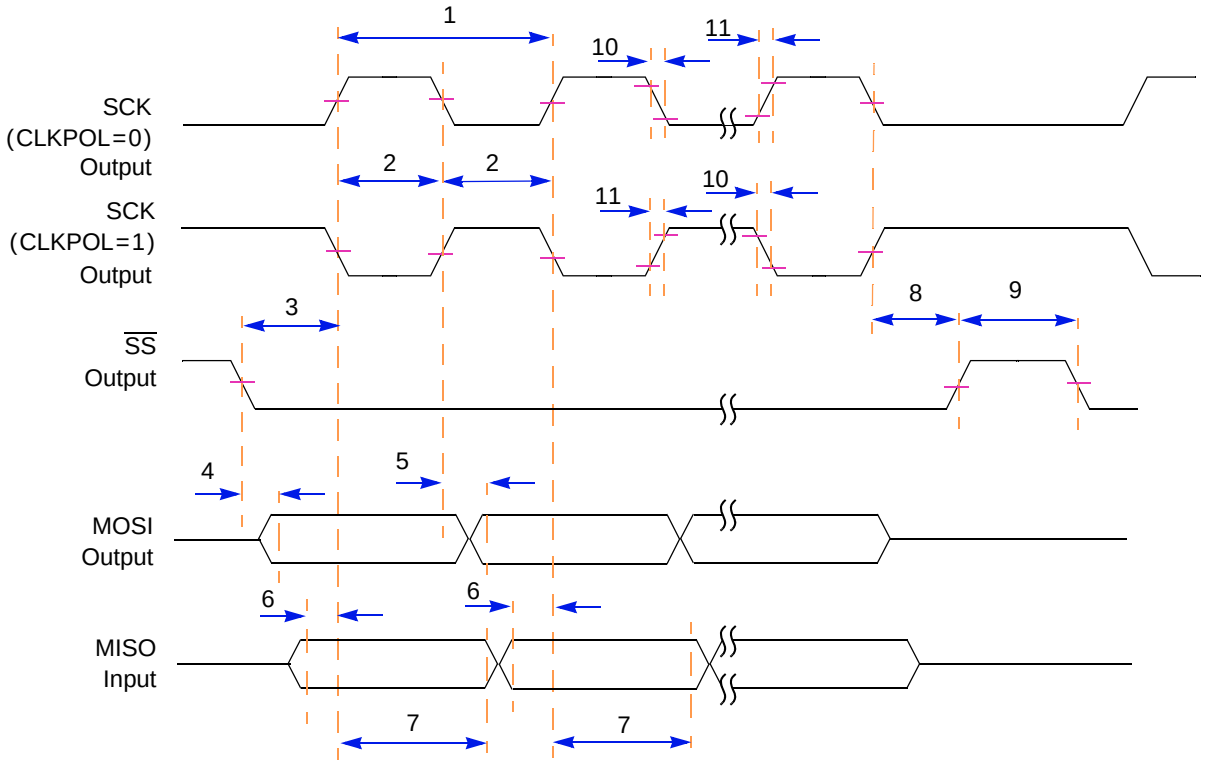


Figure 41. Timing Diagram — SPI Master Mode, Format 0 (CPHA = 0)

Table 43. Timing Specifications — SPI Slave Mode, Format 0 (CPHA = 0) [1]

Sym	Description	Min	Max	Units	SpecID
1	SCK cycle time, programable in the PSC CCS register	30.0	—	ns	A20.37
2	SCK pulse width, 50% SCK duty cycle	15.0	—	ns	A20.38
3	Slave select clock delay	1.0	—	ns	A20.39
4	Input data setup time	1.0	—	ns	A20.40
5	Input data hold time	1.0	—	ns	A20.41
6	Output data valid after $\overline{SS}$	—	14.0	ns	A20.42
7	Output data valid after SCK	—	14.0	ns	A20.43
8	Slave disable lag time	0.0	—	ns	A20.44
9	Minimum sequential transfer delay = 2 × IP bus clock cycle time	30.0	—	—	A20.45

NOTES:
1 Output timing is specified at a nominal 50 pF load.

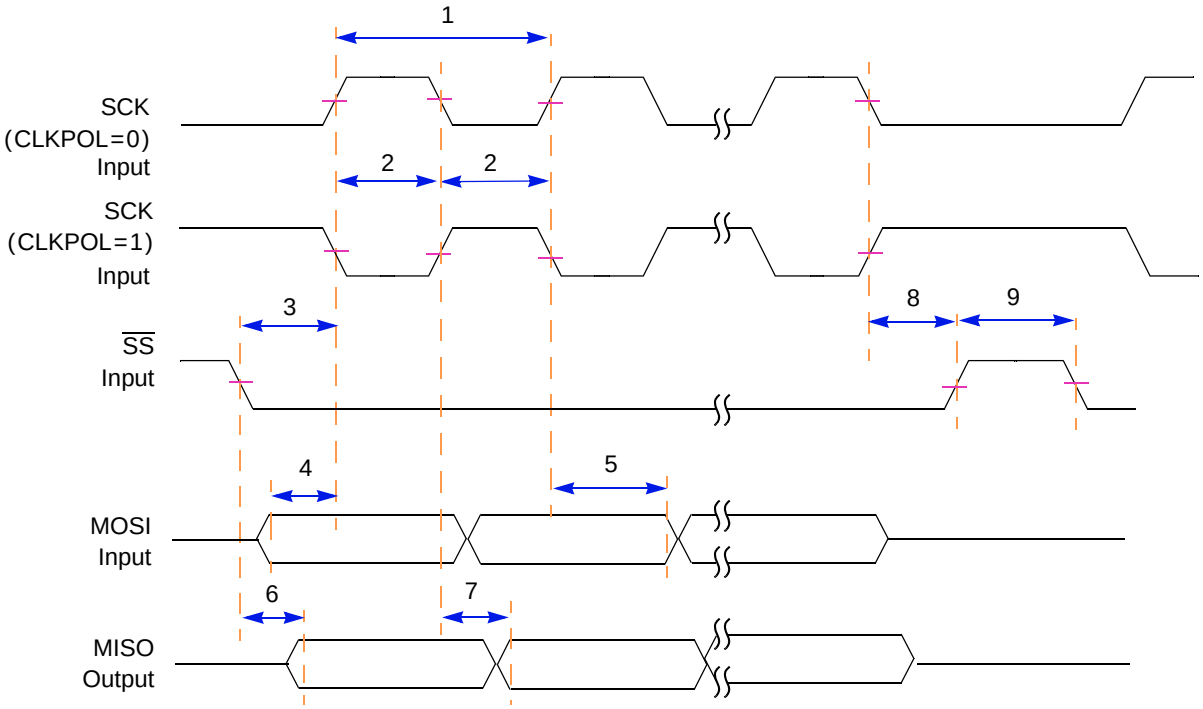


Figure 42. Timing Diagram — SPI Slave Mode, Format 0 (CPHA = 0)

Table 44. Timing Specifications — SPI Master Mode, Format 1 (CPHA = 1) [1]

Sym	Description	Min	Max	Units	SpecID
1	SCK cycle time, programable in the PSC CCS register	30.0	—	ns	A20.46
2	SCK pulse width, 50% SCK duty cycle	15.0	—	ns	A20.47
3	Slave select clock delay, programmable in the PSC CCS register	30.0	—	ns	A20.48
4	Output data valid	—	8.9	ns	A20.49
5	Input data setup time	6.0	—	ns	A20.50
6	Input data hold time	1.0	—	ns	A20.51
7	Slave disable lag time	—	TSCK	ns	A20.52
8	Sequential transfer delay, programable in the PSC CTUR / CTLR register	15.0	—	ns	A20.53
9	Clock falling time	—	7.9	ns	A20.54
10	Clock rising time	—	7.9	ns	A20.55

NOTES:
1 Output timing is specified at a nominal 50 pF load.

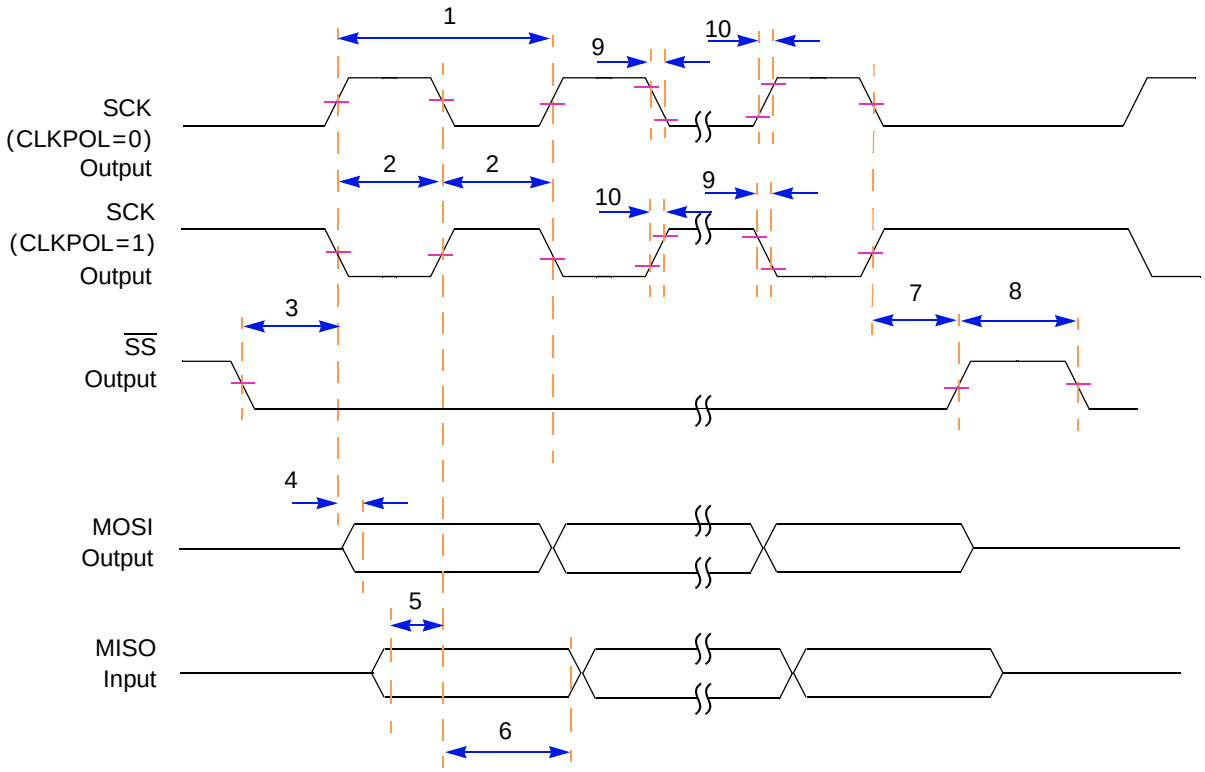


Figure 43. Timing Diagram — SPI Master Mode, Format 1 (CPHA = 1)

Table 45. Timing Specifications — SPI Slave Mode, Format 1 (CPHA = 1) [1]

Sym	Description	Min	Max	Units	SpecID
1	SCK cycle time, programmable in the PSC CCS register	30.0	—	ns	A20.56
2	SCK pulse width, 50% SCK duty cycle	15.0	—	ns	A20.57
3	Slave select clock delay	0.0	—	ns	A20.58
4	Output data valid	—	14.0	ns	A20.59
5	Input data setup time	2.0	—	ns	A20.60
6	Input data hold time	1.0	—	ns	A20.61
7	Slave disable lag time	0.0	—	ns	A20.62
8	Minimum sequential transfer delay = 2 × IP bus clock cycle time	30.0	—	ns	A20.63

NOTES:
1 Output timing is specified at a nominal 50 pF load.

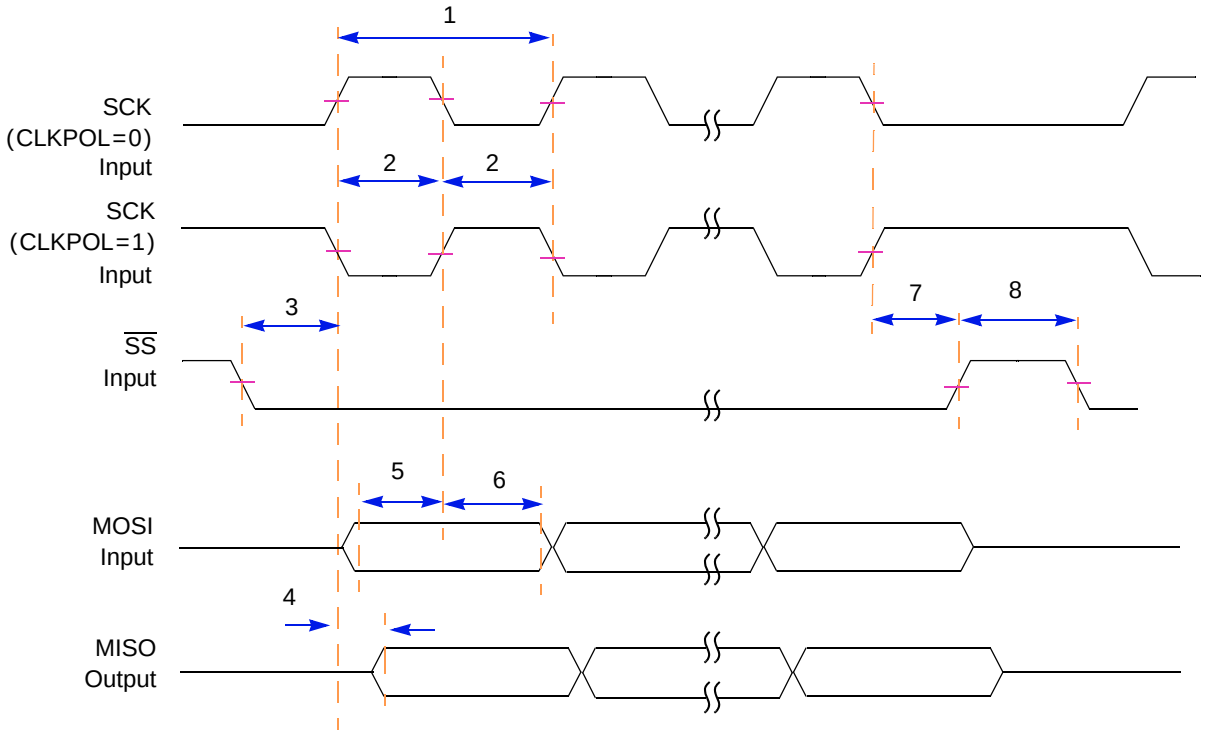


Figure 44. Timing Diagram — SPI Slave Mode, Format 1 (CPHA = 1)

4.3.16 GPIOs and Timers

The MPC5125 contains several sets of I/Os that do not require special setup, hold, or valid requirements. The external events (GPIO or timer inputs) are asynchronous to the system clock. The inputs must be valid for at least t_{IOWID} to ensure proper capture by the internal IP clock.

Table 46. GPIO/Timers Input AC Timing Specifications

Symbol	Description	Min	Unit	SpecID
t_{IOWID}	GPIO/Timers inputs — minimum pulse width	2T[1]	ns	A21.1

NOTES:
1 T is the IP bus clock cycle. T = 15 ns is the minimum value (for the maximum IP bus frequency of 66 MHz).

4.3.17 Fusebox

Table 47 gives the Fusebox timing specification.

Table 47. Fusebox Timing Characteristics

Sym	Description	Min	Max	Units	SpecID
t_{FUSEWR}	Program time[1] for fuse	62.5	—	µs	A22.1
I_{FUSEWR}	Program current to program one fuse bit	—	10	mA	A22.2

NOTES:
1 The program length is defined by the value defined in the EPM_PGM_LENGTH bits of the IIM module.

4.3.18 IEEE 1149.1 (JTAG)

Table 48. JTAG Timing Specification

Sym	Characteristic	Min	Max	Unit	SpecID
—	TCK frequency of operation	0	25	MHz	A23.1
1	TCK cycle time	40	—	ns	A23.2
2	TCK clock pulse width measured at 1.5 V	1.08	—	ns	A23.3
3	TCK rise and fall times	0	3	ns	A23.4
4	$\overline{\text{TRST}}$ setup time to TCK falling edge[1]	10	—	ns	A23.5
5	$\overline{\text{TRST}}$ assert time	5	—	ns	A23.6
6	Input data setup time[2]	5	—	ns	A23.7
7	Input data hold time[2]	15	—	ns	A23.8
8	TCK to output data valid[3]	0	30	ns	A23.9
9	TCK to output high impedance[3]	0	30	ns	A23.10
10	TMS, TDI data setup time	5	—	ns	A23.11
11	TMS, TDI data hold time	4.5	—	ns	A23.12
12	TCK to TDO data valid	0	15	ns	A23.13
13	TCK to TDO high impedance	0	15	ns	A23.14

NOTES:
1 $\overline{\text{TRST}}$ is an asynchronous signal. The setup time is for test purposes only.
2 Non-test, other than TDI and TMS, signal input timing with respect to TCK.
3 Non-test, other than TDO, signal output timing with respect to TCK.

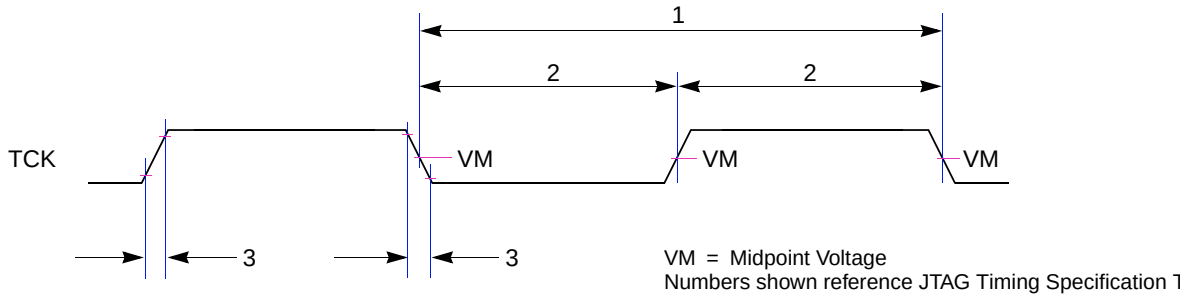


Figure 45. Timing Diagram — JTAG Clock Input

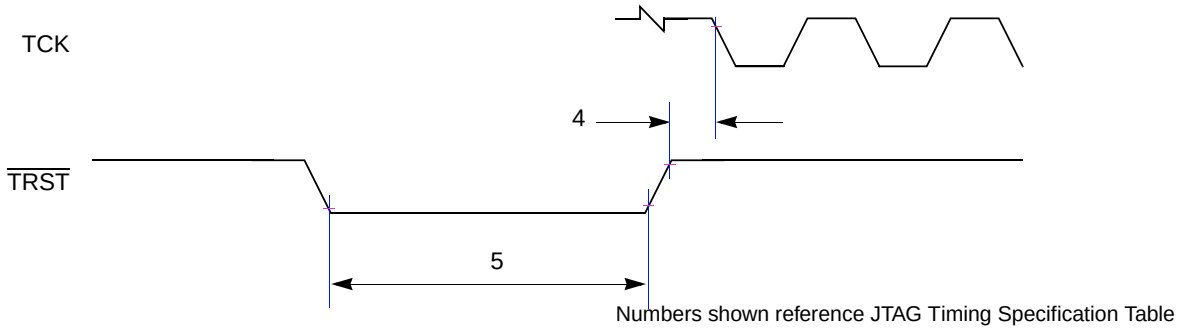


Figure 46. Timing Diagram — JTAG TRST

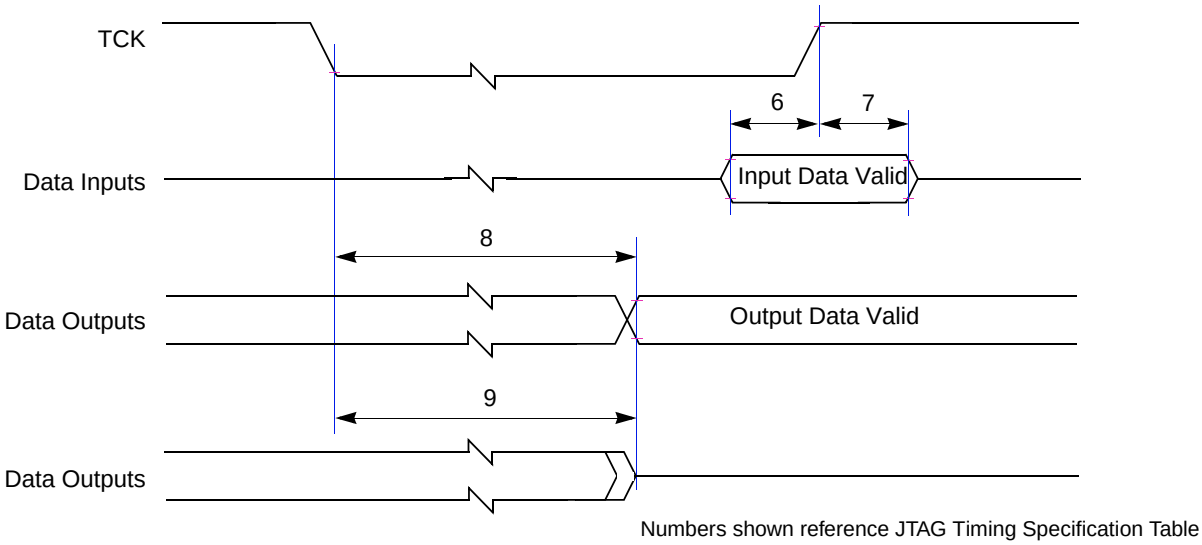


Figure 47. Timing Diagram — JTAG Boundary Scan

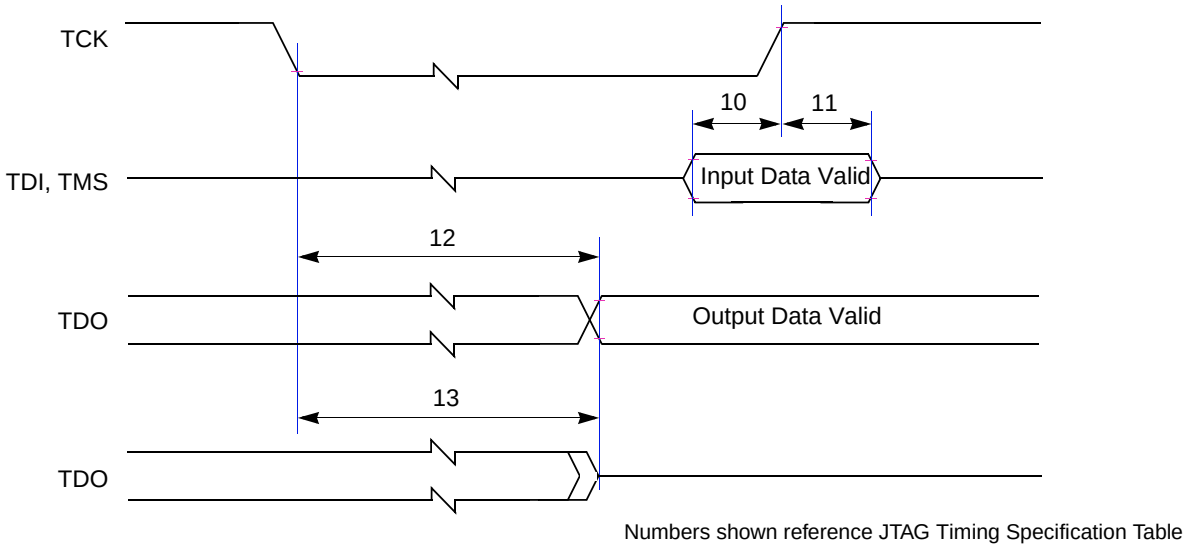


Figure 48. Timing Diagram — Test Access Port

5 System Design Information

5.1 Power Up/Down Sequencing

Power sequencing between the 1.4 V power supply V_{DD} and the remaining supplies is required to prevent excessive current during power-up phase.

The required power sequence is as follows:

- Use 12 V/ms or slower time for all supplies.
- Power up V_{DD_IO}, AV_{DD_PLL}s, V_{BAT} (if not applied permanently), and $V_{DD_IO_MEM}$ supplies first in any order, and then power up V_{DD}. If required AV_{DD_FUSEWR} should be powered up afterwards.
- All the supplies must reach the specified operating conditions before the $\overline{\text{PORESET}}$ can be released.
- For power down, drop AV_{DD_FUSEWR} to 0 V first, drop V_{DD} to 0 V, and then drop all other supplies.
- V_{DD} should not exceed V_{DD_IO}, $V_{DD_IO_MEM}$, V_{BAT}, or AV_{DD_PLL}s by more than 0.4 V at any time, including power-up.

5.2 System and CPU Core AV_{DD} Power Supply Filtering

Each of the independent PLL power supplies require filtering external to the device. Figure 49 shows a recommendation for the required filter circuit.

Each circuit should be placed as close as possible to the specific AV_{DD} pin being supplied to minimize noise coupled from nearby circuits.

All traces should be as low impedance as possible, especially ground pins to the ground plane.

The filter for system/core PLLVDD to V_{SS} should be connected to the power and ground planes, respectively, not fingers of the planes.

In addition to keeping the filter components for system/core PLLVDD as close as practical to the body of the MPC5125 as previously mentioned, special care should be taken to avoid coupling switching power supply noise or digital switching noise onto the portion of that supply between the filter and the MPC5125.

The capacitors for C2 in the figure below should be rated X5R or better due to temperature performance. It is recommended to add a bypass capacitance of at least 1 µF for the VBAT pin.

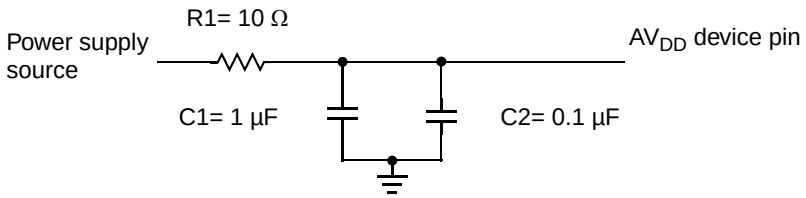


Figure 49. Power Supply Filtering

5.3 Connection Recommendations

To ensure reliable operation, connect unused inputs to an appropriate signal level. Unused active low inputs should be tied to V_{DD_IO}. Unused active high inputs should be connected to V_{SS}. All NC (no-connect) signals must remain unconnected.

Power and ground connections must be made to all external V_{DD} and V_{SS} pins of the MPC5125.

The unused AV_{DD_FUSEWR} power should be connected to V_{SS} directly or via a resistor.

For DDR or LPDDR modes, the unused pins VTT[3:0] for DDR2 termination voltage can be unconnected.

5.4 Pullup/Pulldown Resistor Requirements

The MPC5125 requires external pullup or pulldown resistors on certain pins.

5.4.1 Pulldown Resistor Requirements for TEST Pin

The MPC5125 requires a pulldown resistor on the test pin TEST.

5.5 JTAG

The MPC5125 has an IEEE 1149.1 JTAG interface to facilitate board/system testing. It also provides a common on-chip processor (COP) interface, which shares the IEEE 1149.1 JTAG port.

The COP interface provides access to the MPC5125's embedded e300 processor and to other on-chip resources. This interface provides a means for executing test routines and for performing software development and debug functions.

5.5.1 JTAG_TRST

Boundary scan testing is enabled through the JTAG interface signals. The JTAG_TRST signal is optional in the IEEE 1149.1 specification but is provided on all processors that implement the Power Architecture. To obtain a reliable power-on reset performance, the JTAG_TRST signal must be asserted during power-on reset.

5.5.1.1 TRST and PORESET

The JTAG interface can control the direction of the MPC5125 I/O pads via the boundary scan chain. The JTAG module must be reset before the MPC5125 comes out of power-on reset; do this by asserting TRST before PORESET is released.

For more details, see the Reset and JTAG Timing Specification.



Figure 50. PORESET vs. TRST

5.5.2 e300 COP/BDM Interface

There are two possibilities to connect the JTAG interface: using it with a COP connector and without a COP connector.

5.5.2.1 Boards Interfacing the JTAG Port via a COP Connector

The MPC5125 functional pin interface and internal logic provides access to the embedded e300 processor core through the Freescale standard COP/BDM interface. Table 49 gives the COP/BDM interface signals. The pin order shown reflects only the COP/BDM connector order.

Table 49. COP/BDM Interface Signals

BDM Pin #	I/O Pin	BDM Connector	Internal Pullup/Pulldown	External Pullup/Pulldown	I/O[1]
16	—	GND	—	—	—
15	$\overline{\text{CKSTP_OUT}}$	ckstp_out	—	10 kΩ Pullup	I
14	—	KEY	—	—	—
13	$\overline{\text{HRESET}}$	hreset	Pullup	10 kΩ Pullup	O
12	—	GND	—	—	—
11	$\overline{\text{SRESET}}$	sreset	Pullup	10 kΩ Pullup	O
10	—	N/C	—	—	—
9	TMS	tms	Pullup	10 kΩ Pullup	O
8	$\overline{\text{CKSTP_IN}}$	ckstp_in	—	10 kΩ Pullup	O
7	TCK	tck	Pullup	10 kΩ Pullup	O
6	—	VDD[2]	—	—	—
5	See Note[3]	halted[3]	—	—	I
4	$\overline{\text{TRST}}$	trst	Pullup	10 kΩ Pullup	O
3	TDI	tdi	Pullup	10 kΩ Pullup	O
2	See Note$^{\text{pci_frame}}$	qack[4]	—	—	O
1	TDO	tdo	—	—	I

NOTES:
1. With respect to the emulator tool's perspective:
   Input is really an output from the embedded e300 core.
   Output is really an input to the core.
2. From the board under test, power sense for chip power.
3. HALTED is not available from e300 core.

For a board with a COP (common on-chip processor) connector that accesses the JTAG interface and needs to reset the JTAG module, it is not recommended to wire only $\overline{\text{TRST}}$ and $\overline{\text{PORESET}}$.

To reset the MPC5125 via the COP connector, the $\overline{\text{HRESET}}$ pin of the COP should be connected to the $\overline{\text{HRESET}}$ pin of the MPC5125. The circuitry shown in Figure 51 allows the COP to assert $\overline{\text{HRESET}}$ or $\overline{\text{TRST}}$ separately, while any other board sources can drive $\overline{\text{PORESET}}$.

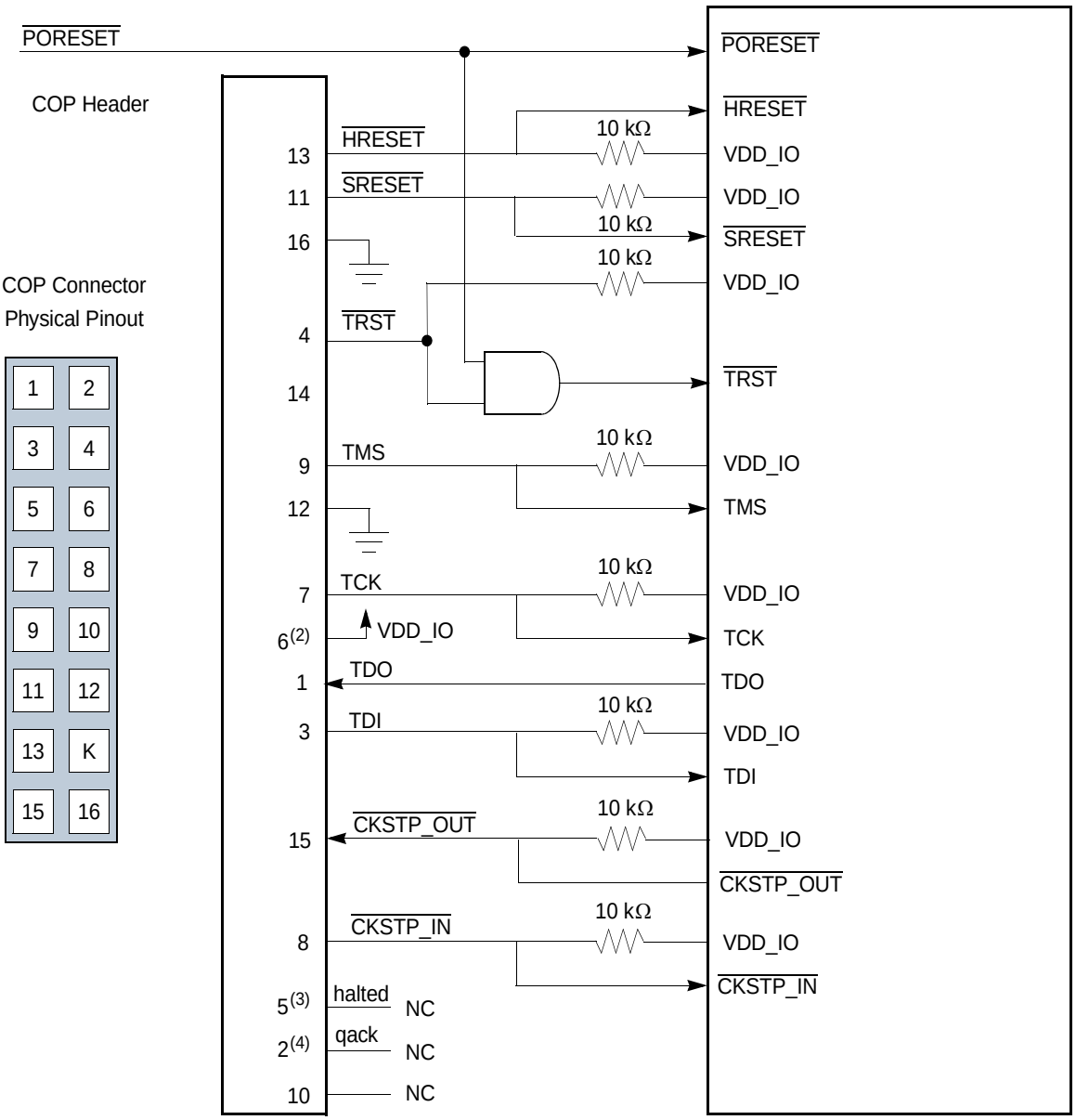


Figure 51. COP Connector Diagram

5.5.2.2 Boards Without COP Connector

If the JTAG interface is not used, $\overline{\text{TRST}}$ should be tied to $\overline{\text{PORESET}}$, so that it is asserted when the system reset signal ($\overline{\text{PORESET}}$) is asserted. This ensures that the JTAG scan chain is initialized during power on. Figure 52 shows the connection of the JTAG interface without COP connector.

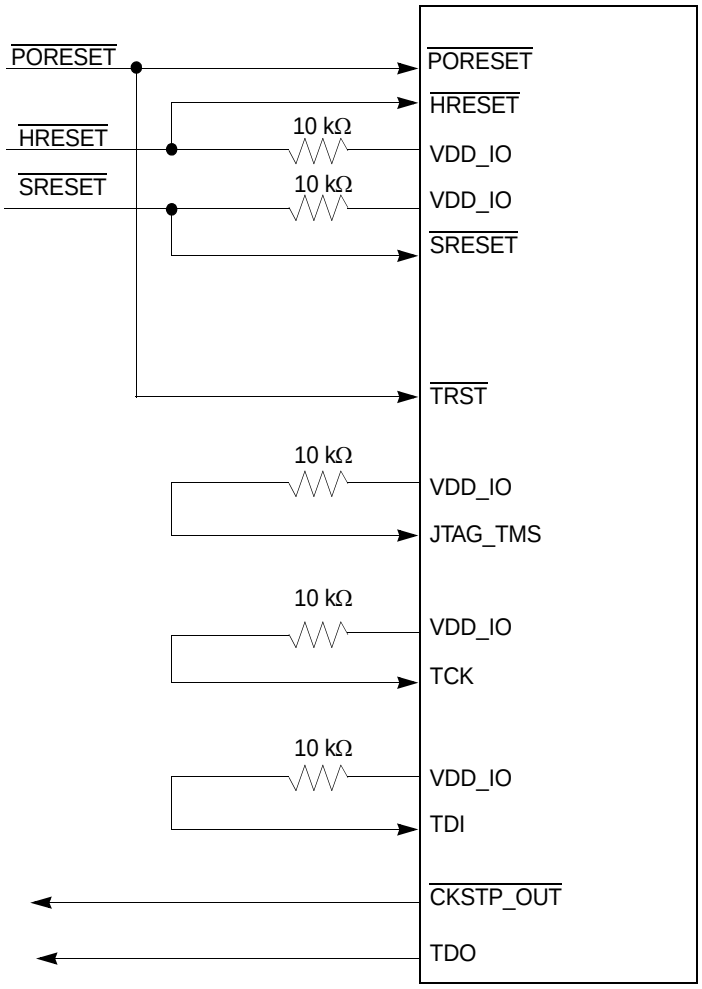


Figure 52. $\overline{\text{TRST}}$ Wiring for Boards without COP Connector

6 Package Information

This section details package parameters and dimensions. The MPC5125 is available in a thermally enhanced plastic ball grid array (TEPBGA). Section 6.1, “Package Parameters,” and Section 6.2, “Mechanical Dimensions,” provide information on the TEPBGA.

6.1 Package Parameters

Table 50. TEPBGA Parameters

Package outline	23 mm × 23 mm
Interconnects	324
Pitch	1.00 mm
Module height (typical)	2.25 mm
Solder balls	96.5 Sn/3.5Ag (VN *package)*
Ball diameter (typical)	0.6 mm

6.2 Mechanical Dimensions

Figure 3 shows the mechanical dimensions and bottom surface nomenclature of the MPC5125 324 TEPBGA package.

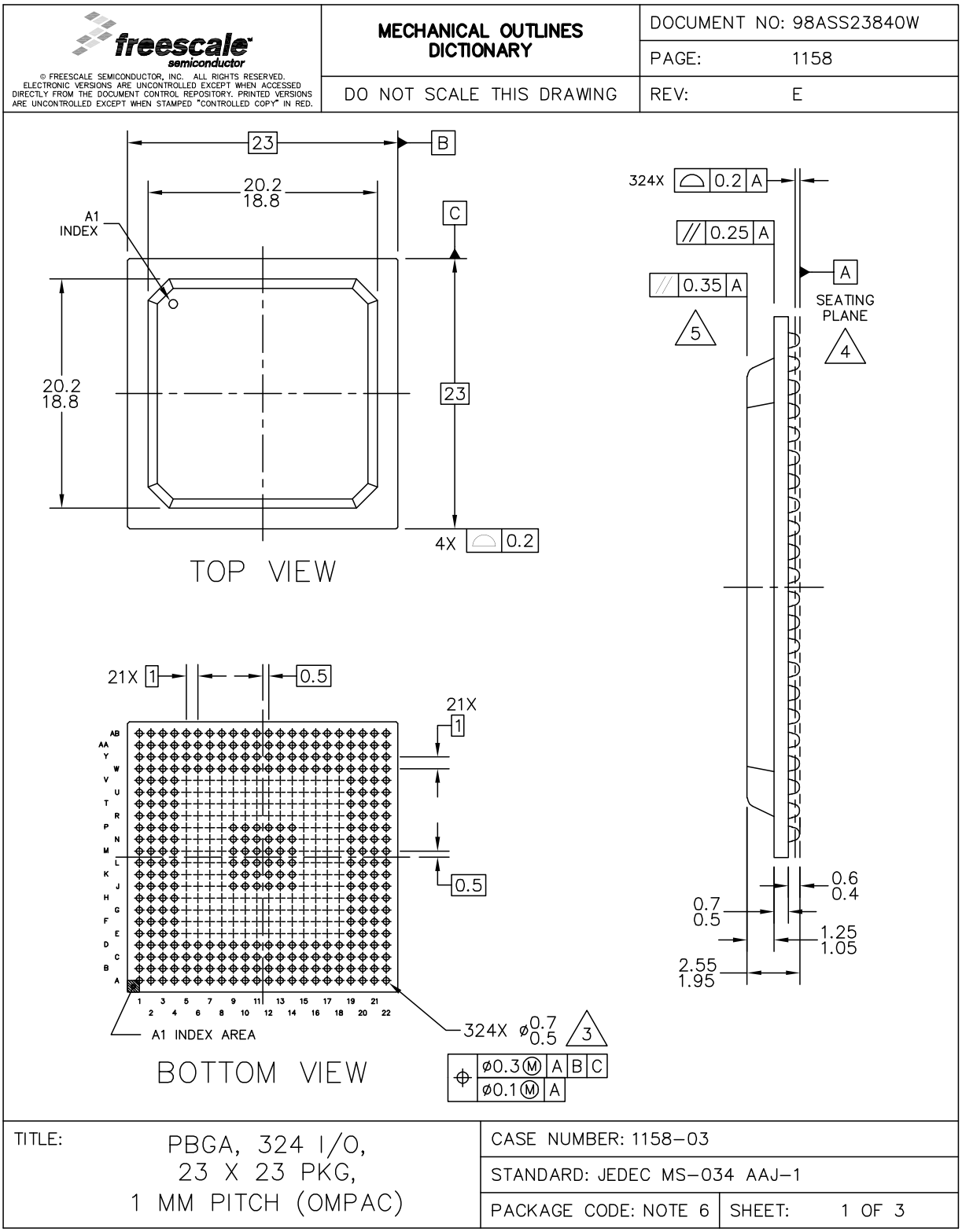


Figure 53. Mechanical Drawing of MPC5125 PBGA (1 of 3)

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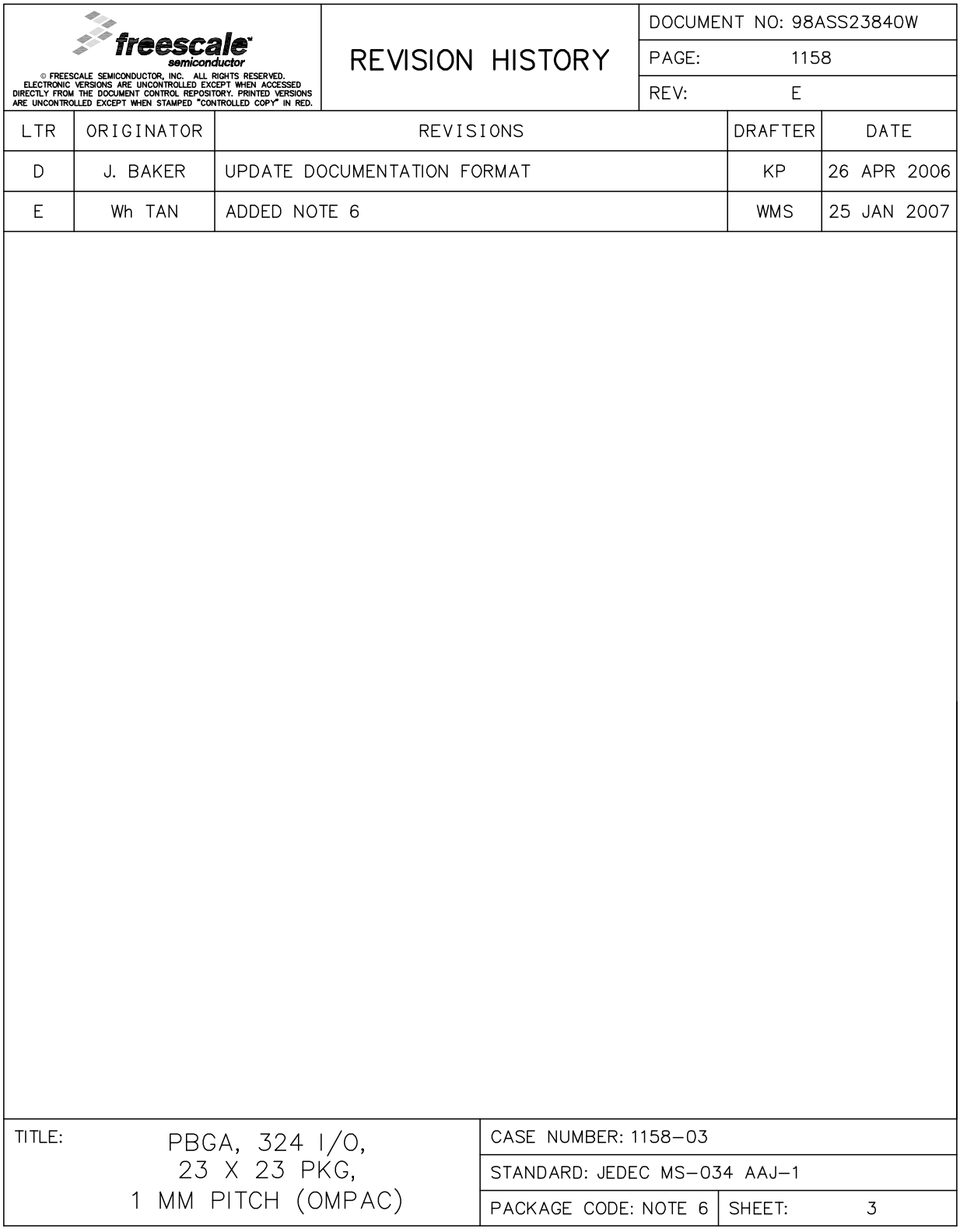
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		PAGE: 1158
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NOTES:

1. ALL DIMENSIONS IN MILLIMETERS.
2. DIMENSIONING AND TOLERANCING PER ASME Y14.5M–1994.
3. MAXIMUM SOLDER BALL DIAMETER MEASURED PARALLEL TO DATUM A.
4. DATUM A, THE SEATING PLANE, IS DETERMINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.
5. PARALLELISM MEASUREMENT SHALL EXCLUDE ANY EFFECT OF MARK ON TOP SURFACE OF PACKAGE.
6. PACKAGE CODES:
   5241: 2 LAYER 324 PBGA
   5366: 4 LAYER 324 TEPBGA PGE

TITLE:	PBGA, 324 I/O, 23 X 23 PKG, 1 MM PITCH (OMPAC)	CASE NUMBER: 1158–03	
		STANDARD: JEDEC MS–034 AAJ–1	
		PACKAGE CODE: NOTE 6	SHEET: 2

Figure 54. Mechanical Drawing of MPC5125 PBGA (2 of 3)



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PAGE: 1158
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D	J. BAKER	UPDATE DOCUMENTATION FORMAT	KP	26 APR 2006
E	Wh TAN	ADDED NOTE 6	WMS	25 JAN 2007

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CASE NUMBER: 1158–03
STANDARD: JEDEC MS–034 AAJ–1
PACKAGE CODE: NOTE 6
SHEET: 3

Figure 55. Mechanical Drawing of MPC5125 PBGA (3 of 3)

7 Product Documentation

This data sheet is labeled as a particular type: Product Preview, Advance Information, or Technical Data. Definitions of these types are available at: http://www.freescale.com .

The following documents are required for a complete description of the device and are necessary to design properly with the parts:

- *MPC5125 Microprocessor Reference Manual* (document number MPC5125RM)
- *MPC5125 (0M01S) Errata* (document number MSE5125_0M01S)

8 Revision History

Table 51 describes the changes made to this document between revisions.

Table 51. Revision History

Revision	Date	Description
1	October 2008	Initial public release, NDA required, Advance Information.
2	October 2009	Public release, Technical Data. — Updated specifications according to characterized data. — Updated Table 1, orderable part numbers. — Updated Table 2, pin multiplexing. — Editorial updates.
3	November 2009	Public release, Technical Data. — Corrected part number.
4	August 2011	Public release, Technical Data. —Incorporated TKT052929. Updated Table 2, “pin multiplexing”.FEC1_TX_CLK I/O direction changed from O to I. —Incorporated TKT052932. Updated Table 2, “pin multiplexing”. NFC_R/B changed to NFC_R/B0 for ALT0 of NFC_RB ; the ALT2 function of the PSC1_3 signal lists NFC_R/B2 signal direction changed as an input; the ALT2 function of the J1850_RX signal lists NFC_R/B3 signal direction changed as an input. —Incorporated TKT068361.Updated Table 2, “pin multiplexing”. FEC1_TX_ER I/O direction changed from I to O, FEC1_MDC I/O direction changed from I to O,FEC2_TX_ER changed from I to O,FEC2_MDC I/O direction changed from I to O. —Updated Table 2, “pin multiplexing”. "ALT3" replaced with "ALT2" for "RST_CONF" (reset configuration);FEC1_MDIO/RMII_MDIO I/O direction changed from I to I/O ; FEC_TX_EN I/O direction changed to O from I;USB1_DATA1and USB1_NEXT I/O direction changed to O from I —Updated Table 6, ”DC Electrical Specifications”.The unit of “RODT” changed to ‘ohm’ from ‘W’.

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