

Electrical Specifications

ABSOLUTE MAXIMUM CONDITIONS

Symbol	Parameter	Min	Typ	Max	Units
P_D	Power Dissipation	–	–	1	W
V_{CC}	Supply Voltage	–0.5	–	7.0	V
V_I	Input Voltage	–0.5	–	$V_{CC}+0.5$	V
V_O	Output Voltage	–0.5	–	$V_{CC}+0.5$	V
T_{OP}	Operating Temperature (Ambient)	–25	–	85	°C
T_{STG}	Storage Temperature	–40	–	125	°C

Note: Permanent device damage may occur if Absolute Maximum Ratings are exceeded.
Functional operation should be restricted to the conditions described under Normal Operating Conditions.

NORMAL OPERATING CONDITIONS

Symbol	Parameter	Min	Typ	Max	Units
V_{CC}	Supply Voltage (5V ±10%)	4.5	5	5.5	V
T_A	Ambient Temperature	0	–	70	°C

DC CHARACTERISTICS

(Under Normal Operating Conditions Unless Noted Otherwise)

Symbol	Parameter	Notes	Min	Typ	Max	Units
I_{CCDE}	Power Supply Current	0°C, 5.5V, 72 MHz MCLK	–	150	170	mA
I_{IL}	Input Leakage Current		–100	–	+100	µA
I_{OZ}	Output Leakage Current	High Impedance	–100	–	+100	µA
V_{IL}	Input Low Voltage	All input pins	–0.5	–	0.8	V
V_{IH}	Input High Voltage	All input pins except clocks	2.0	–	$V_{CC}+0.5$	V
		LCLK, (MCLK, VCLK if external)	2.8	–	$V_{CC}+0.5$	V
V_{OL}	Output Low Voltage	Under max load per table below (5V)	–	–	0.5	V
V_{OH}	Output High Voltage	Under max load per table below (5V)	$V_{CC}-0.5$	–	–	V
ESR	Equivalent Series Resistance	XTAL In, XTAL Out Crystal Oscillator	–	–	100	Ω

Note: Electrical specifications contained herein are preliminary and subject to change without notice.

DC DRIVE CHARACTERISTICS - VL-BUS

(Under Normal Operating Conditions Unless Noted Otherwise)

Parameter	Output Pins	DC Test Conditions	I_{OH}	I_{OL}	Units
			Min	Min	
Output Drive	LRDY#, LDEV#, IRQ9	$V_{OUT}=V_{OL}=2.4V, V_{CC}=5V, C_L=50pF$	-36	24	mA
	D0-31	$V_{OUT}=V_{OL}=2.4V, V_{CC}=5V, C_L=50pF$	-16	8	mA
	ROMCS#	$V_{OUT}=V_{OL}=2.4V, V_{CC}=5V, C_L=50pF$	-4	4	mA

DC DRIVE CHARACTERISTICS - PCI BUS

(Under Normal Operating Conditions Unless Noted Otherwise)

Parameter	Output Pins	DC Test Conditions	I_{OH}	I_{OL}	Units
			Min	Min	
Output Drive	LRDY#, LDEV#, SERR#, PERR#, D0-31	$V_{OUT}=V_{OL}=2.4V, V_{CC}=5V, C_L=50pF$	-36	24	mA
	STOP#, PAR	$V_{OUT}=V_{OL}=2.4V, V_{CC}=5V, C_L=50pF$	-36	8	mA
	IRQ9	$V_{OUT}=V_{OL}=2.4V, V_{CC}=5V, C_L=50pF$	-16	8	mA
	ROMCS#	$V_{OUT}=V_{OL}=2.4V, V_{CC}=5V, C_L=50pF$	-4	4	mA

DC DRIVE CHARACTERISTICS - MEMORY

(Under Normal Operating Conditions Unless Noted Otherwise)

Parameter	Output Pins	DC Test Conditions	I_{OH}	I_{OL}	Units
			Min	Min	
Output Drive	MA1-4, XA1-4	$V_{OUT}=V_{OL}=2.4V, V_{CC}=5V, C_L=50pF$	-16	16	mA
	CASAL0-1#, CASAH0-1#, WE#, OE#	$V_{OUT}=V_{OL}=2.4V, V_{CC}=5V, C_L=50pF$	-12	12	mA
	CASBL0-1#, CASBH0-1#	$V_{OUT}=V_{OL}=2.4V, V_{CC}=5V, C_L=50pF$	-12	12	mA
	MA0, MA5-8, RASA#, RASB#	$V_{OUT}=V_{OL}=2.4V, V_{CC}=5V, C_L=50pF$	-8	8	mA
	XCAS0-1#, XWE#, XOE#, XD0-3	$V_{OUT}=V_{OL}=2.4V, V_{CC}=5V, C_L=50pF$	-4	4	mA
	MAD0-15, MBD0-15	$V_{OUT}=V_{OL}=2.4V, V_{CC}=5V, C_L=50pF$	-4	4	mA

DC DRIVE CHARACTERISTICS - DISPLAY, GPIO

(Under Normal Operating Conditions Unless Noted Otherwise)

Parameter	Output Pins	DC Test Conditions	I_{OH}	I_{OL}	Units
			Min	Min	
Output Drive	HSYNC, VSYNC	$V_{OUT}=V_{OL}=2.4V, V_{CC}=5V, C_L=50pF$	-12	12	mA
	PCLK	$V_{OUT}=V_{OL}=2.4V, V_{CC}=5V, C_L=50pF$	-8	8	mA
	VID0-7, KEY, GPIO2-3, GPIO5-7	$V_{OUT}=V_{OL}=2.4V, V_{CC}=5V, C_L=50pF$	-4	4	mA

DC DRIVE CHARACTERISTICS - CLOCK

(Under Normal Operating Conditions Unless Noted Otherwise)

Parameter	Output Pins	DC Test Conditions	I_{OH}	I_{OL}	Units
			Min	Min	
Output Drive	MCLK	$V_{OUT}=V_{OL}=2.4V, V_{CC}=5V, C_L=50pF$	-2	2	mA
	XTALO	$V_{OUT}=V_{OL}=2.4V, V_{CC}=5V, C_L=25pF$	-1	1	mA

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DAC CHARACTERISTICS

(Under Normal Operating Conditions Unless Noted Otherwise)

Symbol	Parameter	Notes	Min	Typ	Max	Units
f_{MAX}	Clock Rate		–	–	85	MHz
	DAC-to-DAC Correlation	See Note 1	–	–	5	%
	DAC-to-DAC Crosstalk		–	TBD	–	dB
	Output Skew	See Note 2	–	–	2	ns
	Output Settling Time	See Note 3	–	13	–	ns
	Output Rise / Fall Time	10% to 90%	–	–	5	ns
	Comparator Sensitivity		–	50	–	mV
	Output Current	See Note 4				
	White referenced to Black		–	–	30	mA
	Black referenced to Blank		–	–	50	μ A
	Blank Level		0	–	50	μ A

Note: Monotonicity is guaranteed by design.
 Unless otherwise specified, Analog Output Load = 50 Ω , 30pF.

Note 1: Correlation is measured about the midpoint of the Red, Green, and Blue DAC outputs at full scale.

Note 2: Measured from the 50% point of the Red, Green, and Blue DAC outputs when switching from black level to full scale.

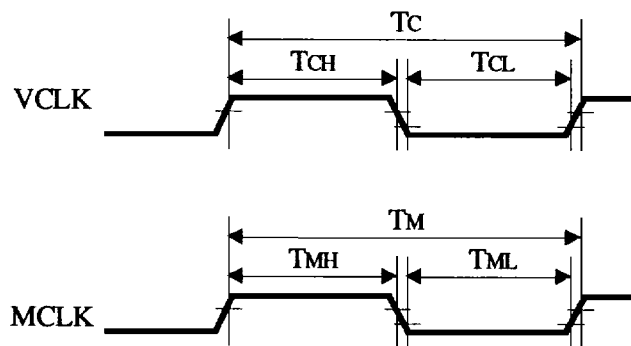
Note 3: Settling time is measured from 50% of the full scale transition to the output remaining within ± 1 LSB of the final value.

Note 4: Measured with RSET = 383 Ω , LOAD = 50 Ω , ≤ 10 pF.

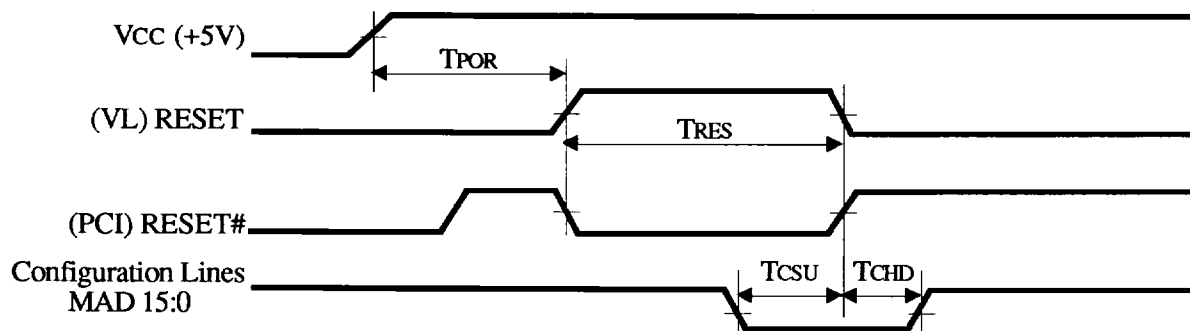
Note: Electrical specifications contained herein are preliminary and subject to change without notice.

AC TIMING CHARACTERISTICS - EXTERNAL CLOCK TIMING

Symbol	Parameter	Notes	Min	Typ	Max	Units
T_C	CLK Period	65 MHz external VCLK	15.38	–	–	nS
T_{CH}	CLK High Time		$0.45T_C$	–	$0.55T_C$	nS
T_{CL}	CLK Low Time		$0.45T_C$	–	$0.55T_C$	nS
T_M	MCLK Period	65 MHz external MCLK	15.38	–	–	nS
T_{MH}	MCLK High Time		$0.45T_M$	–	$0.55T_M$	nS
T_{ML}	MCLK Low Time		$0.45T_M$	–	$0.55T_M$	nS
T_{RF}	Clock Rise / Fall		–	–	4	nS
T_{REF}	Reference Clock Period	Reference clock for internal synthesizer	50	69.8	100	nS


External Clock Timing
AC TIMING CHARACTERISTICS - RESET TIMING

Symbol	Parameter	Notes	Min	Typ	Max	Units
$TPOR$	Power on to RESET / RESET# active delay		–	–	1	S
$TRES$	RESET / RESET# Pulse Width		$64T_M$	–	–	nS
$TCSU$	Configuration setup time		20	–	–	nS
$TCHD$	Configuration hold time		5	–	–	nS

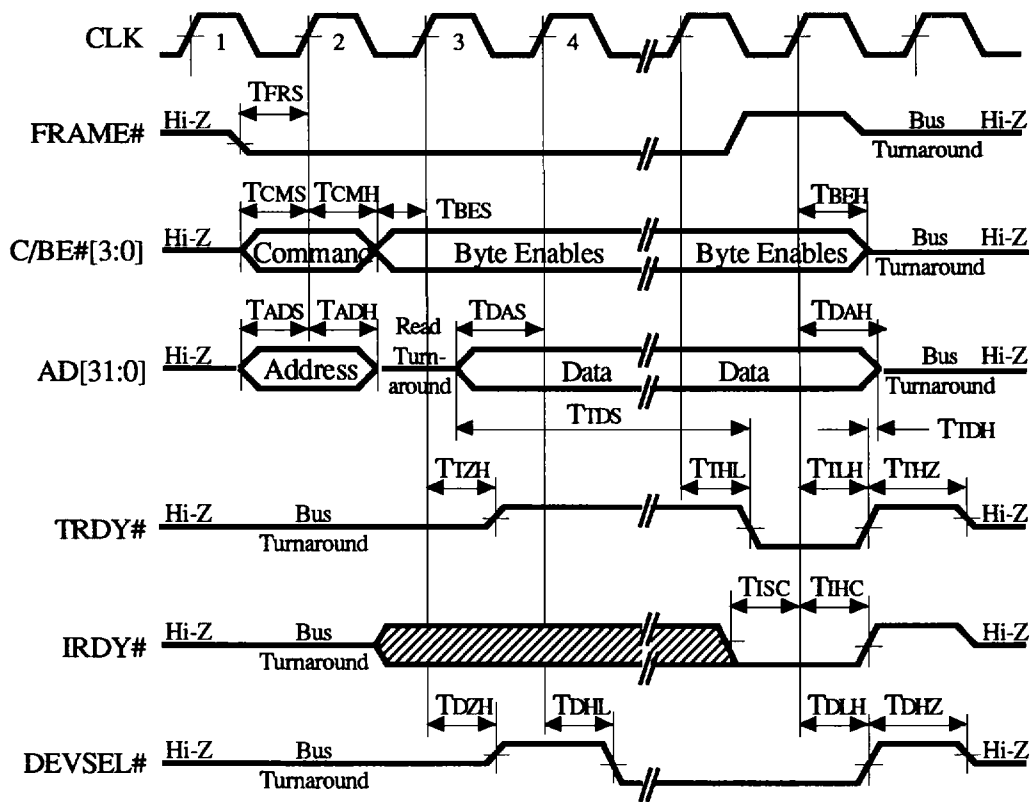

Reset Timing

Note: Electrical specifications contained herein are preliminary and subject to change without notice.

64310 AC TIMING CHARACTERISTICS - PCI BUS FRAME

Symbol	Parameter	Notes	Min	Max	Units
T _{FRS}	FRAME# Setup to CLK		7	–	nS
T _{CMS}	C/BE#[3:0] (Bus CMD) Setup to CLK		7	–	nS
T _{CMH}	C/BE#[31:0] (Bus CMD) Hold from CLK		2	–	nS
T _{BES}	C/BE#[3:0] (Byte Enable) Setup to CLK		7	–	nS
T _{BEH}	C/BE#[3:0] (Byte Enable) Hold from CLK		2	–	nS
T _{ADS}	AD[31:0] (Address) Setup to CLK		7	–	nS
T _{ADH}	AD[31:0] (Address) Hold from CLK		2	–	nS
T _{DAS}	AD[31:0] (Data) Setup to CLK		7	–	nS
T _{DAH}	AD[31:0] (Data) Hold from CLK		2	–	nS
T _{TZH}	TRDY# High Z to High from CLK		–	11	nS
T _{THL}	TRDY# Active from CLK		–	11	nS
T _{TLH}	TRDY# Inactive from CLK		–	11	nS
T _{THZ}	TRDY# High before High Z		1	1	CLK
T _{DZH}	DEVSEL# High Z to High from CLK		–	11	nS
T _{DHL}	DEVSEL# Active from CLK		–	11	nS
T _{DLH}	DEVSEL# Inactive from CLK		–	11	nS
T _{DHZ}	DEVSEL# High before High Z		1	1	CLK
T _{TDS}	Read Data Setup to TRDY# Active		7	–	nS
T _{TDH}	Read Data Hold from TRDY# Inactive		2	–	nS
T _{ISC}	IRDY# Setup to CLK		7	–	nS
T _{IHC}	IRDY# Hold from CLK		2	–	nS

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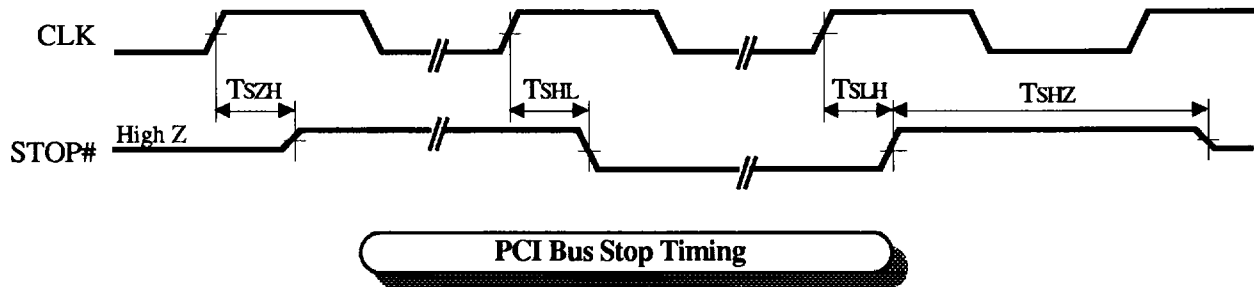
PCI Bus Frame Timing

Note: The above diagram shows a typical PCI bus read cycle which requires a bus turn-around cycle between address output and data input on AD31:0. PCI bus write cycles do not require this bus turnaround cycle so the write data is available from the bus master immediately after address output (in clock cycle 2 instead of clock cycle 3).

Note: Unless otherwise specified, specifications above apply to both 5V & 3.3V operation & memory clock is assumed to be 65MHz. Electrical specifications contained herein are preliminary and subject to change without notice.

64310 AC TIMING CHARACTERISTICS - PCI BUS STOP

Symbol	Parameter	Notes	Min	Max	Units
T_{SZH}	STOP# High Z to High from CLK		–	11	nS
T_{SHL}	STOP# Active from CLK		–	11	nS
T_{SLH}	STOP# Inactive from CLK		–	11	nS
T_{SHZ}	STOP# High before High Z		1	1	CLK

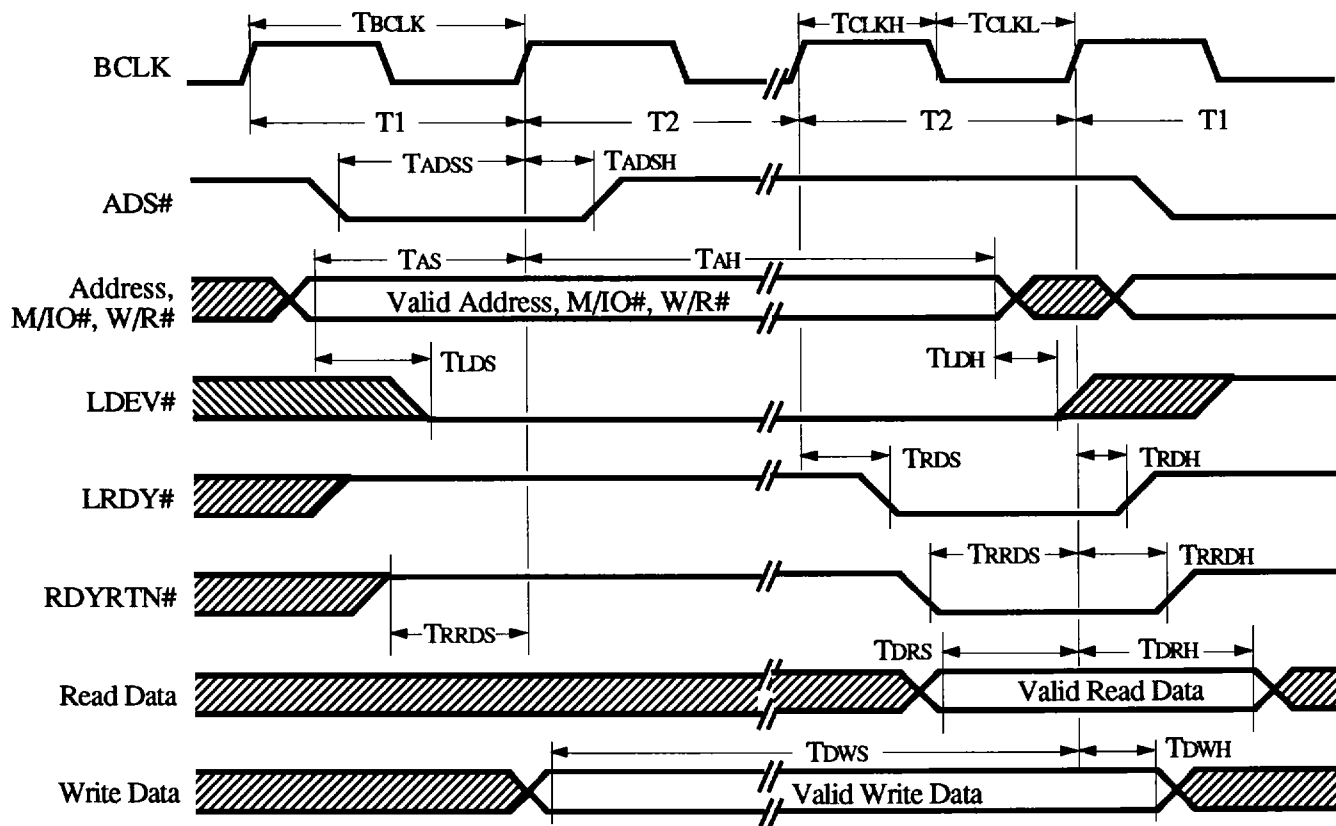


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DC TIMING CHARACTERISTICS - 486 LOCAL BUS TIMING

Symbol	Parameter	Notes	Min	Typ	Max	Units
T _{BCLK}	Local Bus Clock Cycle Time	50MHz	20			ns
T _{CLKL}	Local Bus Clock Low Time	Duty Cycle 45/55	9	10	11	ns
T _{CLKH}	Local Bus Clock High Time	Duty Cycle 45/55	9	10	11	ns
T _{LDS}	Delay from Address Valid to LDEV#		0	–	20	ns
T _{LDH}	LDEV# Inactive from Address Not Valid		0	–	20	ns
T _{ADSS}	ADS# Setup to BCLK rising edge		4	–	–	ns
T _{ADSH}	ADS# Hold from BCLK rising edge		5	–	–	ns
T _{AS}	Address, M/IO#, R/W# Setup to End of T1		4	–	–	ns
T _{AH}	Address, M/IO#, R/W# Hold from End of T1		T _{CLKH} +8	–	–	ns
T _{RDS}	LRDY# Setup Time from Start of final T2		18	–	–	ns
T _{RDH}	LRDY# Hold Time from End of T2		0	–	15	ns
T _{RRDS}	RDYRTN# Setup Time to End of final T2		18	–	–	ns
T _{RRDH}	RDYRTN# Hold Time from End of final T2		0	–	15	ns
T _{DRS}	Read Data Setup Time to End of final T2		18	–	–	ns
T _{DRH}	Read Data hold Time from End of final T2		0	–	15	ns
T _{DWS}	Write Data Setup Time to End of first T2		18	–	–	ns
T _{DWH}	Write Data hold Time from End of final T2		0	–	15	ns

Note: Electrical specifications contained herein are preliminary and subject to change without notice.



64310 VL Bus (486 Local Bus) Timing

Note: Electrical specifications contained herein are preliminary and subject to change without notice.

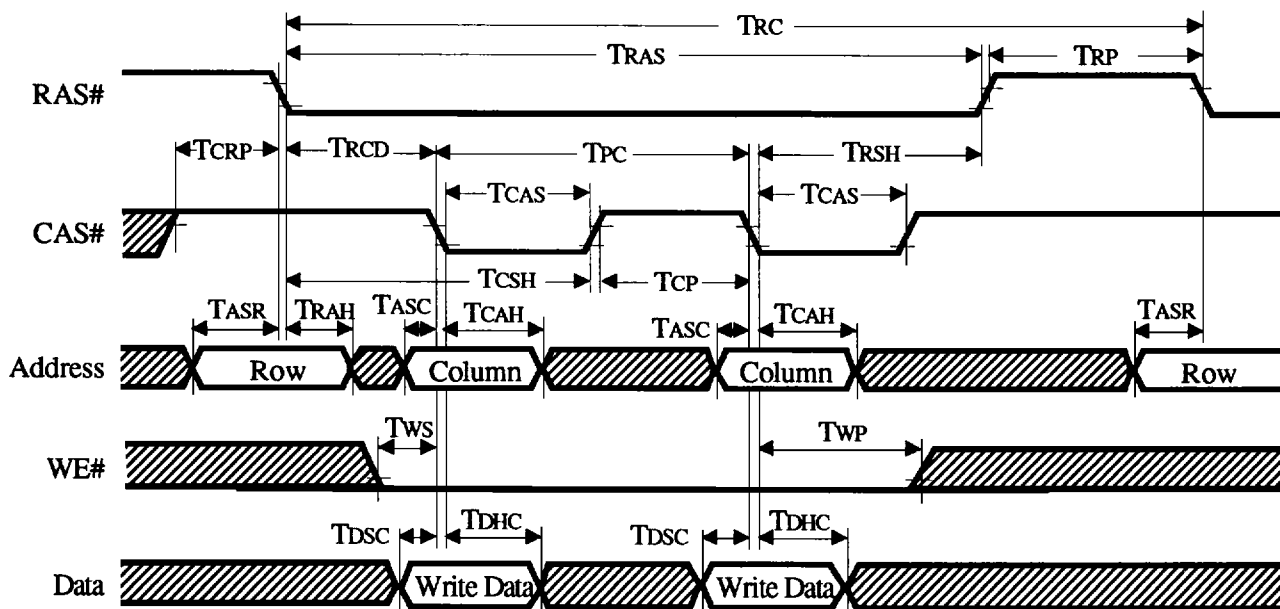
AC TIMING CHARACTERISTICS - DRAM READ/WRITE TIMING

				MCLK Frequency (MHz)			
				72.0	64.3	52.9	
				DRAM Access Time			
Symbol	Parameter	Min	Max	-6	-7	-8	Units
T_{RC}	Read/Write Cycle Time	$9T_M-5$	–	120.0	135.1	165.1	ns
T_{RAS}	RAS# Pulse Width (Min)	$5T_M-5$	See Note 1	64.4	72.8	89.5	ns
T_{RP}	RAS# Precharge	$4T_M-5$	–	50.6	57.3	70.6	ns
T_{CRP}	CAS# to RAS# precharge	$4T_M-7$	–	48.6	55.3	68.6	ns
T_{CSH}	CAS# Hold from RAS#	$5T_M-5$	–	63.4	72.8	88.5	ns
T_{RCD}	RAS# to CAS# delay	$3T_M-5$		36.7	41.7	51.7	ns
			$3T_M+5$	46.7	51.7	61.7	ns
T_{RSH}	RAS# Hold from CAS#	$2T_M-5$	–	22.8	26.1	32.8	ns
T_{CP}	CAS# Precharge	$T_M-3.9$	–	10.0	11.7	15.0	ns
T_{CAS}	CAS# Pulse Width	$2T_M-5$	–	22.8	26.1	32.8	ns
T_{WP}	WE# Pulse Width	$2T_M-5$	–	22.8	26.1	32.8	ns
T_{ASR}	Row Address Setup to RAS#	$(3T_M/2)-15$	–	-15.0	-15.0	-15.0	ns
T_{ASC}	Column Address Setup to CAS#	$(3T_M/2)-15$	–	-15.0	-15.0	-15.0	ns
T_{RAH}	Row Address Hold from RAS#	$T_M-3.9$	–	-3.9	-3.9	-3.9	ns
T_{CAH}	Column Address Hold from CAS#	$(3T_M/2)-5.8$	–	-5.8	-5.8	-5.8	ns
T_{CAC}	Data Access Time from CAS#	–	$2T_M-7.8$	-7.8	-7.8	-7.8	ns
T_{AA}	Data Access Time from Column Address	–	$3T_M-11.7$	-11.7	-11.7	-11.7	ns
T_{RAC}	Data Access time from RAS#	–	$5T_M-5$	-5.0	-5.0	-5.0	ns
T_{DSC}	Write Data Setup to CAS#	T_M-7	–	-7.0	-7.0	-7.0	ns
T_{DHC}	Write Data Hold from CAS#	$(3T_M/2)-5.8$	–	-5.8	-5.8	-5.8	ns
T_{PC}	CAS# Cycle Time	$3T_M-1.7$	–	-1.7	-1.7	-1.7	ns

Note: Parameters printed in bold are the limiting cases for industry standard DRAM specifications.

Note 1: Maximum RAS pulse width may be as high as $2+(256*3)$ memory clock cycles = $770T_M$ if the BitBlt Engine is given full memory bandwidth. This depends on other events which have higher priority including refresh cycles and display update.

Note: Electrical specifications contained herein are preliminary and subject to change without notice.



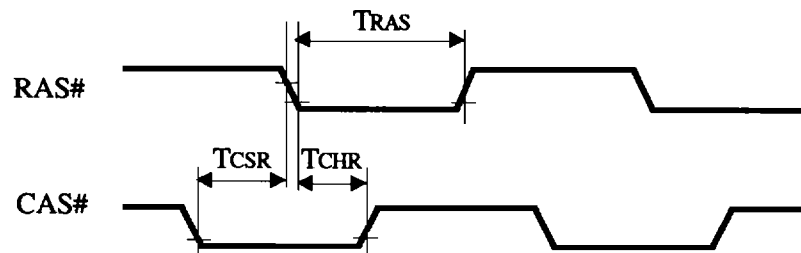
DRAM Page Mode Write Cycle Timing

Note: The above diagram represents a typical page mode write cycle.

Note: Electrical specifications contained herein are preliminary and subject to change without notice.

AC TIMING CHARACTERISTICS - REFRESH TIMING

				MCLK Frequency (MHz)			
				72.0	64.3	52.9	
				DRAM Access Time			
Symbol	Parameter	Min	Max	-6	-7	-8	Units
T_{CHR}	RAS to CAS delay	$5T_M-6$	–	63.4	71.8	88.5	ns
T_{CSR}	CAS to RAS delay	$2T_M-7.5$	–	20.3	23.6	30.3	ns
$TRAS$	RAS pulse width	$5T_M-5$	–	64.4	72.8	89.5	ns



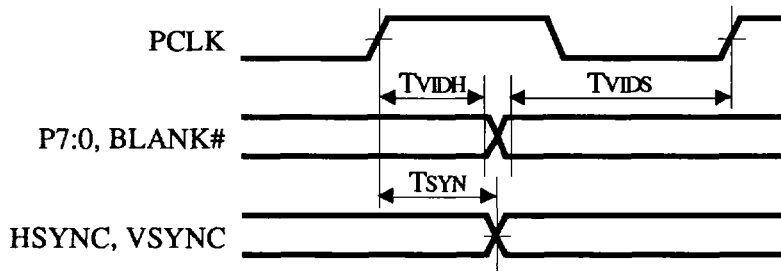
CAS-Before-RAS (CBR) DRAM Refresh Cycle Timing

Note: Electrical specifications contained herein are preliminary and subject to change without notice.

AC TIMING CHARACTERISTICS - CRT VIDEO TIMING

Symbol	Parameter	Notes	Min	Typ	Max	Units
T_{VIDS}	PCLK Setup to P7:0, BLANK#	PCLK = 45MHz	3	–	19.2	ns
T_{VIDH}	PCLK Hold from P7:0, BLANK#	PCLK = 45MHz	3	–	19.2	ns
T_{SYN}	HSYNC, VSYNC delay from PCLK		–	–	40	ns

Note: Output load on PCLK, P7:0, and BLANK# = 30pF

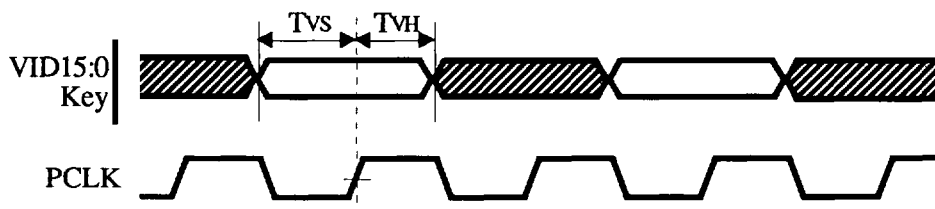


CRT Video Data and Control Signal Timing

AC TIMING CHARACTERISTICS - VIDEO OVERLAY INPUT TIMING

Symbol	Parameter	Notes	Min	Typ	Max	Units
T_{VS}	KEY, VID15:0 Setup to PCLK rising edge		15	–	–	ns
T_{VH}	KEY, VID15:0 Hold from PCLK rising edge		0	–	–	ns

Note: Output load on PCLK = 30pF



Video Overlay Timing

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