



CYPRESS

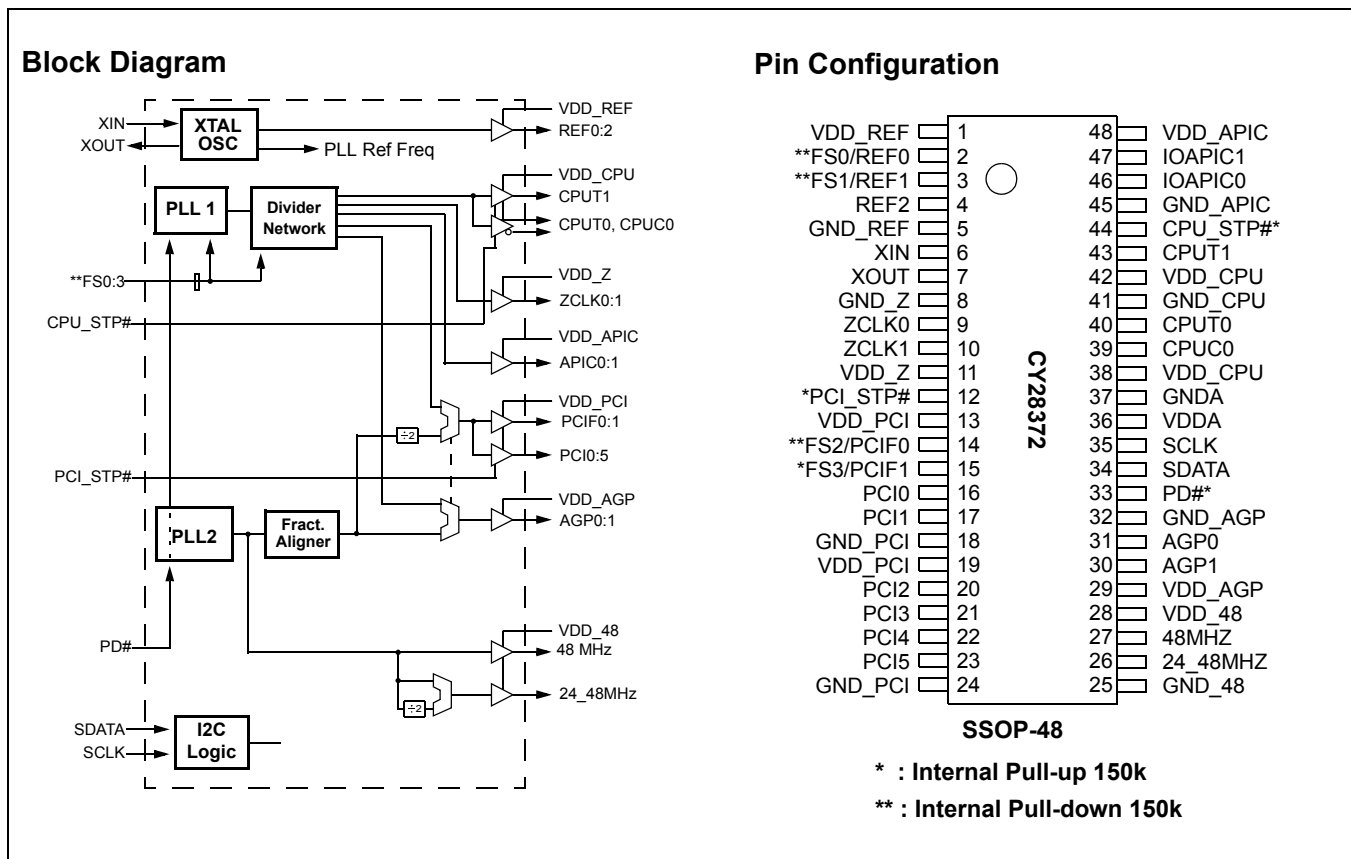
SiS 746 AMD Athlon™/AMD Duron™ Clock Synthesizer

CY28372

Features

- Supports AMD Athlon™/Duron™ CPU
- 3.3V and 2.5V power supply
- Eight copies of PCI clocks
- One 48-MHz USB clock
- Two copies of ZCLK clocks
- One 48-MHz/24-MHz programmable SIO clock
- One differential CPU clock (opendrain)
- One singled-ended CPU clock (opendrain)
- SMBus support with readback capabilities
- Spread Spectrum electromagnetic interference (EMI) reduction
- 48-pin SSOP package

CPU	ZCLK	REF	PCI	AGP	IOAPIC	48M	24_48M
x 2	x 2	x 3	x 8	x 2	x 2	x 1	x 1



Pin Description

Pin #.	Name	Type	Description
6	XIN	I	Crystal Connection or External Reference Frequency Input. This pin has dual functions. It can be used as an external 14.318-MHz crystal connection or as an external reference frequency input.
7	XOUT	O	Crystal Connection. Connection for an external 14.318-MHz crystal. If using an external reference, this pin must be left unconnected.
4	REF2	O	Reference Clock. 14.31818 reference outputs.
2, 3	REF[0:1]/ FS[0:1]	O	Reference Clock. 14.31818 reference outputs.
		I	Frequency Select. Sampled upon power-on to determine device operating frequency.
14, 15	PCIF[0:1]/ FS[2:3]	O	Free-running PCI. Independent of PCI_STP#.
		I	Frequency Select. Sampled upon power-on to determine device operating frequency.
16, 17, 20, 21, 22, 23	PCI [0:5]	O	PCI Clock.
12	PCI_STP#	I	PCI Stop. Stops all PCI clocks
40 39	CPUT0 CPUC0	O	Differential CPU Outputs.
43	CPUT1	O	“True” Clock of Differential CPU Outputs. For chipset host bus
44	CPU_STP#	I	CPU Stop. Stops all CPU clocks
9, 10	ZCLK[0:1]	O	MuTIOL Clock Outputs.
46, 47	IOAPIC[0:1]	O	IOAPIC. 2.5 V clock outputs
27	48MHz	O	48-MHz Clock. USB clock outputs
26	24_48MHz	O	24-MHz or 48-MHz Clock. Selectable SIO clock outputs. Default output frequency is 24 MHz, but can be configured for 48 MHz through I ² C.
31, 30	AGP[0:1]	O	AGP Clock.
34	SDATA	I/O	I²C Data. 5v tolerant
35	SCLK	I	I²C Clock. 5v tolerant
33	PD#	I	Power-down Control. Turns off all clock outputs and shuts down device
36	VDDA	PWR	3.3V Analog Power/Ground. Power supply for core logic, PLL circuitry
37	GNDA	PWR	
1, 5, 8, 11, 13, 18, 19, 24, 25, 28, 29, 32	VDD_REF, GND_REF, GND_Z, VDD_Z, VDD_PCI, GND_PCI, GND_48, VDD_48, VDD_AGP, GND_AGP	PWR	3.3V Power and Ground. Power supply for respective output buffers.
38, 41, 42 48, 45	VDD_CPU, GND_CPU, VDD_APIC, GND_APIC	PWR	2.5V Power and Ground. Power supply for respective output buffers.

Table 1. Frequency Selection Table

Input Conditions		Output Frequency				VCO Freq. (MHz)
I ² C Option (byte 4, bit 2)	FS(3:0)	CPU (MHz)	ZCLK (MHz)	AGP (MHz)	PCI (MHz)	
0	0000	133.3	66.7	66.7	33.3	400.0
0	0001	133.3	66.7	50.0	33.3	400.0
0	0010	133.3	100.0	66.7	33.3	400.0
0	0011	133.3	100.0	50.0	33.3	400.0
0	0100	133.3	133.3	66.7	33.3	400.0
0	0101	133.3	133.3	50.0	33.3	400.0
0	0110	133.3	166.6	66.7	33.3	666.5
0	0111	133.3	166.6	55.5	33.3	666.5
0	(default) 1000	100.0	66.7	66.7	33.3	400.0
0	1001	100.0	66.7	50.0	33.3	400.0
0	1010	100.0	100.0	66.7	33.3	400.0
0	1011	100.0	100.0	50.0	33.3	400.0
0	1100	100.0	133.3	66.7	33.3	400.0
0	1101	100.0	133.3	50.0	33.3	400.0
0	1110	111.0	166.5	66.6	33.3	666.1
0	1111	111.0	166.5	55.5	33.3	666.1
1	0000	114.5	95.4	63.6	31.8	572.5
1	0001	120.0	100.0	66.7	33.3	600.0
1	0010	133.3	83.3	66.7	33.3	666.5
1	0011	133.3	111.1	74.1	33.3	666.5
1	0100	133.3	133.3	83.3	33.3	666.5
1	0101	145.7	116.6	64.8	32.4	582.8
1	0110	150.0	100.0	66.7	33.3	600.0
1	0111	166.6	111.1	66.7	33.3	666.5
1	1000	111.1	133.3	66.7	33.3	666.5
1	1001	137.4	137.4	68.7	34.4	549.6
1	1010	144.9	144.9	64.4	32.2	579.5
1	1011	150.0	150.0	66.7	33.3	600.0
1	1100	155.1	124.1	68.9	34.5	620.3
1	1101	166.6	133.3	66.7	33.3	666.5
1	1110	180.1	135.1	67.6	33.8	540.4
1	1111	200.0	133.3	66.7	33.3	400.0

Serial Data Interface

To enhance the flexibility and function of the clock synthesizer, a two-signal serial interface is provided. Through the Serial Data Interface, various device functions, such as individual clock output buffers, can be individually enabled or disabled. The registers associated with the Serial Data Interface initialize to their default setting upon power-up, and therefore use of this interface is optional. Clock device register changes are normally made upon system initialization, if any are required. The interface can also be used during system operation for power management functions.

Data Protocol

The clock driver serial protocol accepts byte write, byte read, block write, and block read operations from the controller. For block write/read operation, the bytes must be accessed in sequential order from lowest to highest byte (most significant bit first) with the ability to stop after any complete byte has been transferred. For byte write and byte read operations, the system controller can access individually indexed bytes. The offset of the indexed byte is encoded in the command code, as described in *Table 2*.

The block write and block read protocol is outlined in *Table 3* while *Table 4* outlines the corresponding byte write and byte read protocol. The slave receiver address is 11010010 (D2h).

Table 2. Command Code Definition

Bit	Description
7	0 = Block read or block write operation, 1 = Byte read or byte write operation
(6:0)	Byte offset for byte read or byte write operation. For block read or block write operations, these bits should be '0000000'

Table 3. Block Read and Block Write Protocol

Block Write Protocol		Block Read Protocol	
Bit	Description	Bit	Description
1	Start	1	Start
2:8	Slave address – 7 bits	2:8	Slave address – 7 bits
9	Write = 0	9	Write = 0
10	Acknowledge from slave	10	Acknowledge from slave
11:18	Command Code – 8 bits '00000000' stands for block operation	11:18	Command Code – 8 bits '00000000' stands for block operation
19	Acknowledge from slave	19	Acknowledge from slave
20:27	Byte Count – 8 bits	20	Repeat start
28	Acknowledge from slave	21:27	Slave address – 7 bits
29:36	Data byte 1 – 8 bits	28	Read = 1
37	Acknowledge from slave	29	Acknowledge from slave
38:45	Data byte 2 – 8 bits	30:37	Byte count from slave – 8 bits
46	Acknowledge from slave	38	Acknowledge
....	.....	39:46	Data byte from slave – 8 bits
....	Data Byte (N-1) – 8 bits	47	Acknowledge
....	Acknowledge from slave	48:55	Data byte from slave – 8 bits
....	Data Byte N – 8 bits	56	Acknowledge
....	Acknowledge from slave	....	Data bytes from slave/Acknowledge
....	Stop	....	Data byte N from slave – 8 bits
		....	Not Acknowledge
		....	Stop

Table 4. Byte Read and Byte Write Protocol

Byte Write Protocol		Byte Read Protocol	
Bit	Description	Bit	Description
1	Start	1	Start
2:8	Slave address – 7 bits	2:8	Slave address – 7 bits
9	Write = 0	9	Write = 0
10	Acknowledge from slave	10	Acknowledge from slave
11:18	Command Code – 8 bits '1xxxxxxx' stands for byte operation, bits[6:0] of the command code represents the offset of the byte to be accessed	11:18	Command Code – 8 bits '1xxxxxxx' stands for byte operation, bits[6:0] of the command code represents the offset of the byte to be accessed
19	Acknowledge from slave	19	Acknowledge from slave
20:27	Data byte from master – 8 bits	20	Repeat start

Table 4. Byte Read and Byte Write Protocol (continued)

Byte Write Protocol		Byte Read Protocol	
Bit	Description	Bit	Description
28	Acknowledge from slave	21:27	Slave address – 7 bits
29	Stop	28	Read = 1
		29	Acknowledge from slave
		30:37	Data byte from slave – 8 bits
		38	Not Acknowledge
		39	Stop

Device Configuration Map

Data Bytes 0 to 3: Reserved for ZDB Registers

Byte 4

Bit	@Pup	Name	Description
Bit 7	1	Frequency Select Register (FS3)	[7..4] CPU ZCLK AGPPCI
Bit 6	0	Frequency Select Register (FS2)	Bit2 = 0 0000 133.3 66.7 66.733.3 0001 133.3 66.7 50.033.3 0010 133.3 100.0 66.733.3 0011 133.3 100.0 50.033.3
Bit 5	0	Frequency Select Register (FS1)	0100 133.3 133.3 66.733.3 0101 133.3 133.3 50.033.3 0110 133.3 166.6 66.733.3
Bit 4	0	Frequency Select Register (FS0)	0111 133.3 166.6 55.533.3 1000 100.0 66.7 66.733.3 1001 100.0 66.7 50.033.3 1010 100.0 100.0 66.733.3 1011 100.0 100.0 50.033.3 1100 100.0 133.3 66.733.3 1101 100.0 133.3 50.033.3 1110 111.0 166.5 66.633.3 1111 111.0 166.5 55.533.3
Bit 3	0	FS_Override	Bit2 = 1 0000 114.5 95.4 63.631.8 0001 120.0 100.0 66.733.3 0010 133.3 83.3 66.733.3 0011 133.3 111.1 74.133.3 0100 133.3 133.3 83.333.3 0101 145.7 116.6 64.832.4 0110 150.0 100.0 66.733.3 0111 166.6 111.1 66.733.3 1000 111.1 133.3 66.733.3 1001 137.4 137.4 68.734.4 1010 144.9 144.9 64.432.2 1011 150.0 150.0 66.733.3 1100 155.1 124.1 68.934.5 1101 166.6 133.3 66.733.3 1110 180.1 135.1 67.633.8 1111 200.0 133.3 66.733.3
Bit 3	0	FS_Override	Frequency Selection Source: 0 = Select through hardware strapping, latched inputs 1 = Select through I ² C
Bit 2	0	Frequency Select Register	Most significant bit of I ² C Frequency Select Register
Bit 1	1	Spread Spectrum Control	0 = Normal, 1 = Spread Spectrum enable
Bit 0	0	Output Disable	0 = Normal, 1 = three-state all outputs

Byte 5

Bit	@Pup	Name	Description
Bit 7	0	Reserved	Reserved
Bit 6	0	Reserved	Reserved
Bit 5	0	Reserved	Reserved
Bit 4	0	Reserved	Reserved

Byte 5 (continued)

Bit	@Pup	Name	Description
Bit 3	HW	Latched FS3 input	Latched FS[3:0] inputs. These bits are read-only.
Bit 2	HW	Latched FS2 input	
Bit 1	HW	Latched FS1 input	
Bit 0	HW	Latched FS0 input	

Byte 6

Bit	@Pup	Name	Description
Bit 7	0	Reserved	Reserved
Bit 6	0	Reserved	Reserved
Bit 5	0	PCIF0	PCIF0 functionality when PCI_STP# is LOW 0: Free running, 1: Stop
Bit 4	0	PCIF1	PCIF1 functionality when PCI_STP# is LOW 0: Free running, 1: Stop
Bit 3	1	CPUT0/CPUC0	CPU[T/C]0 functionality when CPU_STP# is LOW 0: Free running, 1: Stop (three-state)
Bit 2	0	CPUT1	CPUT1 functionality when CPU_STP# is LOW 0: Free running, 1: Stop (three-state)
Bit 1	1	CPUT0/CPUC0	CPU[T/C]0 Output Enable/Disable
Bit 0	1	CPUT1	CPUT1 Output Enable/Disable

Byte 7

Bit	@Pup	Name	Description
Bit 7	1	PCIF1	PCIF1 Output Enable/Disable
Bit 6	1	PCIF0	PCIF0 Output Enable/Disable
Bit 5	1	PCI_5	PCI_5 Output Enable/Disable
Bit 4	1	PCI_4	PCI_4 Output Enable/Disable
Bit 3	1	PCI_3	PCI_3 Output Enable/Disable
Bit 2	1	PCI_2	PCI_2 Output Enable/Disable
Bit 1	1	PCI_1	PCI_1 Output Enable/Disable
Bit 0	1	PCI_0	PCI_0 Output Enable/Disable

Byte 8

Bit	@Pup	Name	Pin Description
Bit 7	1	Vendor_ID3	Bit[3] of Cypress Semiconductor's Vendor ID. This bit is read only.
Bit 6	0	Vendor_ID2	Bit[2] of Cypress Semiconductor's Vendor ID. This bit is read only.
Bit 5	0	Vendor_ID1	Bit[1] of Cypress Semiconductor's Vendor ID. This bit is read only.
Bit 4	0	Vendor_ID0	Bit[0] of Cypress Semiconductor's Vendor ID. This bit is read only.
Bit 3	0	Revision_ID3	Revision ID bit[3]
Bit 2	0	Revision_ID2	Revision ID bit[2]
Bit 1	0	Revision_ID1	Revision ID bit[1]
Bit 0	0	Revision_ID0	Revision ID bit[0]

Byte 9

Bit	@Pup	Name	Description
Bit 7	1	PD#	Power-down Enable
Bit 6	0	Reserved	Reserved
Bit 5	1	48MHz	48-MHz Output Control

Byte 9 (continued)

Bit	@Pup	Name	Description	
Bit 4	1	24_48MHz	24_48MHz Output Control	
Bit 3	0	24_48MHz	24-MHz or 48-MHz Select 0: 24MHz, 1: 48MHz	
Bit 2	0	SS2	Spread Spectrum control bit (0 = down spread, 1 = center spread)	
Bit 1	0	SS1		
Bit 0	0	SS0		
		SS[2:0]		Spread Mode
				Spread%

Byte 10

Bit	@Pup	Name	Description
Bit 7	1	IOAPIC_1	IOAPIC_1 Output Control
Bit 6	1	IOAPIC_0	IOAPIC_0 Output Control
Bit 5	1	REF_1	REF_1 Output Control
Bit 4	1	REF_0	REF_0 Output Control
Bit 3	1	ZCLK_1	ZCLK_1 Output Control
Bit 2	1	ZCLK_0	ZCLK_0 Output Control
Bit 1	1	AGP_1	AGP_1 Output Control
Bit 0	1	AGP_0	AGP_0 Output Control

Byte 11

Bit	@Pup	Name	Description	
Bit 7	0	Reserved	Vendor Test Mode (always program to 0)	
Bit 6	0	Reserved	Vendor Test Mode (always program to 0)	
Bit 5	0	Reserved	Vendor Test Mode (always program to 0)	
Bit 4	0	3V66 Fract_Align4	3V66 Frequency Fractional Aligner: These bits determine the 3V66 fixed frequency. This option does not incorporate spread spectrum. Fract_Align3V66 (MHz)PCI (MHz) 00000 Off Off(default)	
Bit 3	0	3V66 Fract_Align3		
Bit 2	0	3V66 Fract_Align2		
Bit 1	0	3V66 Fract_Align1		
Bit 0	0	3V66 Fract_Align0		
				0000166.533.2
				0001067.533.7
				0001168.534.3
			0010069.534.8	
			0010170.635.3	
			0011071.635.8	
			0011172.636.3	
			0100073.636.8	
			0100174.737.3	
			0101075.737.8	
			0101176.738.4	
			0110077.738.9	
			0110178.739.4	
			0111079.839.9	
			0111180.840.4	
			1000081.840.9	
			1000182.841.4	
			1001083.941.9	
			1001184.942.4	
			1010085.943.0	
			1010186.943.5	
			1011088.044.0	
			1011189.044.5	
			1100090.045.0	
			1100191.045.5	
			1101092.046.0	
			1101193.146.5	
			1110094.147.0	
			1110195.147.6	
			1111096.148.1	
			1111197.248.6	

Byte 12

Bit	@Pup	Name	Description	
Bit 7	0	REF_2	REF_2 Output Control (default: off)	
Bit 6	0	Reserved	Reserved	
Bit 5	0	Reserved	Reserved	
Bit 4	0	DARAG2	Dial-a-Ratio™ AGP[0:1]. Programming these bits allow modifying the frequency ratio of the AGP(1:0), PCI(5:0) and PCIF(0:1) clocks relative to the VCO. (the ratio of AGP to PCI is retained at 2:1)	
Bit 3	0	DARAG1		
Bit 2	0	DARAG0		
		DARAG[2:0]		VC0/AGP Ratio
		000		- (Frequency Selection Default)
		001	6	
		010	8	
		011	9	
		100	10	
		101	12	
		110	12	
		111	12	
Bit 1	0	Fixed_PCI_SEL	PCI output frequency select mode (valid only when Fixed_3V66_SEL = 1) 0 = Use Frequency Selection Table settings 1 = Use Fractional Aligner settings (default)	
Bit 0	0	Fixed_3V66_SEL	3V66 and PCI output frequency select mode 0 = Use Frequency Selection Table settings (default) 1 = Use Fractional Aligner settings	

Byte 13

Bit	@Pup	Name	Description
Bit 7	0	Reserved	Reserved
Bit 6	0	N6 (MSB)	Dial-a-Frequency® Control Register N. These bits are for programming the PLL's internal N register. This access allows the user to modify the CPU frequency with great accuracy. All other synchronous clocks (clocks that are generated from the same PLL, such as PCI, remain at their existing ratios relative to the CPU clock. (should be written together with Control Register R)
Bit 5	0	N5	
Bit 4	0	N4	
Bit 3	0	N3	
Bit 2	0	N2	
Bit 1	0	N1	
Bit 0	0	N0 (LSB)	

Byte 14

Bit	@Pup	Name	Pin Description
Bit 7	0	Reserved	Reserved
Bit 6	0	R5 (MSB)	Dial-a-Frequency Control Register R These bits are for programming the PLL's internal R register. This access allows the user to modify the CPU frequency with great accuracy. All other synchronous clocks (clocks that are generated from the same PLL, such as PCI, remain at their existing ratios relative to the CPU clock. (should be written together with Control Register N)
Bit 5	0	R4	
Bit 4	0	R3	
Bit 3	0	R2	
Bit 2	0	R1	
Bit 1	0	R0 (LSB)	
Bit 0	0	R & N Select	R and N register mux selection. 0 = R and N values come from the ROM. 1 = data is loaded from the DAF registers into R and N.

Dial-A-Frequency Feature

SMBus Dial-a-Frequency feature is available in this device via Byte13 and Byte14. P is a large value PLL constant that depends on the frequency selection achieved through the hardware selectors (FS). P value may be determined from the following table.

FS(4:0)	P
00000, 00001, 00010, 00011, 00100, 00101, 11110	127993333
00110, 00111, 10000, 10001, 10010, 10011, 10100	76796000
01000, 01001, 01010, 01011, 01100, 01101, 10101, 10110, 10111, 11001, 11010, 11011, 11100, 11101	95995000
01110, 01111, 11000	63996667
11111	191990000

Table 5. Maximum Lumped Capacitive Output Loads

Clock	Max Load	Unit
PCI, PCIF	20	pF
AGP	30	pF
24_48MHz, 48MHz	20	pF
REF	30	pF
IOAPIC	20	pF
CPUT0/CPUC0	See Figure 7	
CPUT1	See Figure 7	

PD# (Power-down) Clarification

The PD# (Power-down) pin is used to shut off ALL clocks prior to shutting off power to the device. PD# is an asynchronous active LOW input. This signal is synchronized internally to the device powering down the clock synthesizer. PD# is an asynchronous function for powering up the system. When PD# is low, all clocks are driven to a LOW value and held there and the VCO and PLLs are also powered down. All clocks are shut down in a synchronous manner so has not to cause glitches while transitioning to the low 'stopped' state.

PD# – Assertion

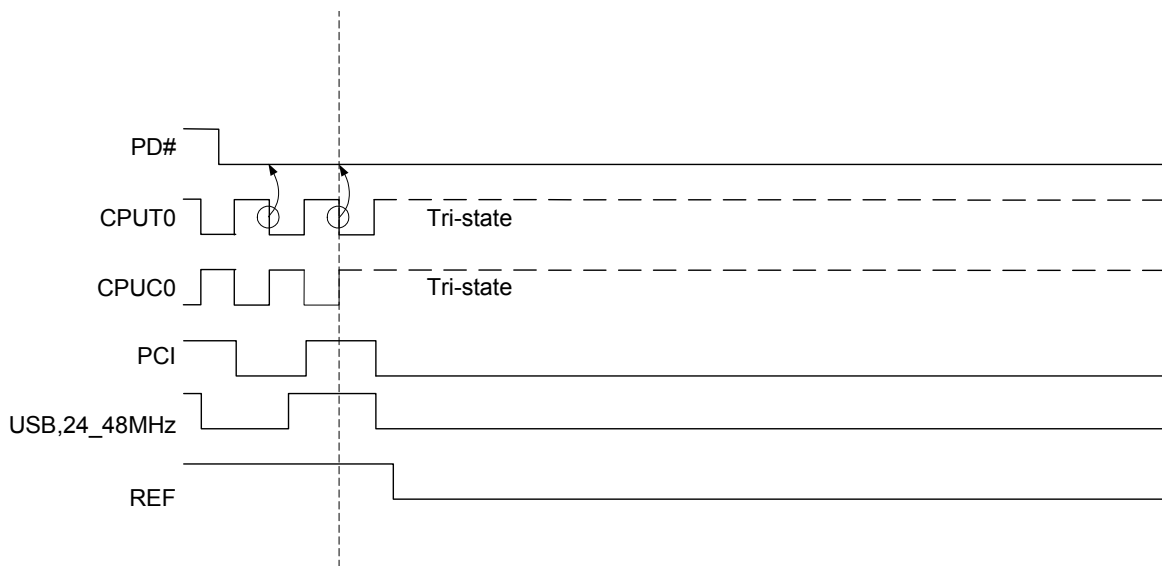


Figure 1. Power-down Assertion Timing Waveforms

PD# – Deassertion

After the clock chip internal PLL is powered up and locked, all outputs will be enabled within a few clock cycles of each other, with the first to last active clock taking no more than two full PCI clock cycles.

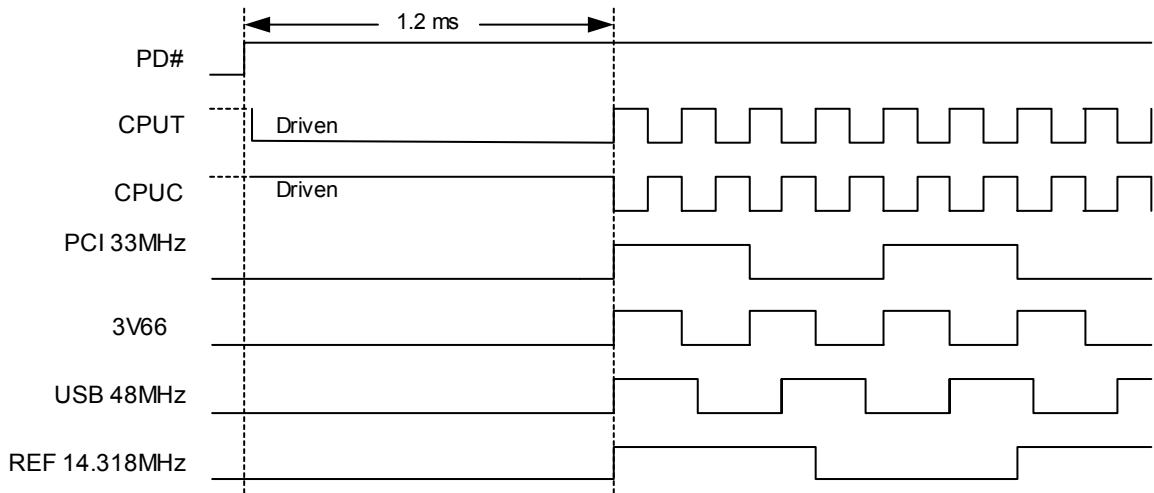


Figure 2. Power Down Deassertion Timing Waveforms

Table 6. PD# Functionality

PD#	CPUT	CPUC	AGP	PCIF/PCI	48MHz
1	Normal	Normal	Normal	Normal	Normal
0	Float	Float	Low	Low	Low

CPU_STP# Clarification

The CPU_STP# signal is an active LOW input used for synchronous stopping and starting the CPU output clocks while the rest of the clock generator continues to function.

CPU_STP# – Assertion

When CPU_STP# pin is asserted, all CPUT/C outputs that are set with the SMBus configuration to be stoppable via assertion of CPU_STP# will be stopped after being sampled by two rising CPUC clock edges. The final state of the stopped CPU signals is CPUT = CPUC = three-state.

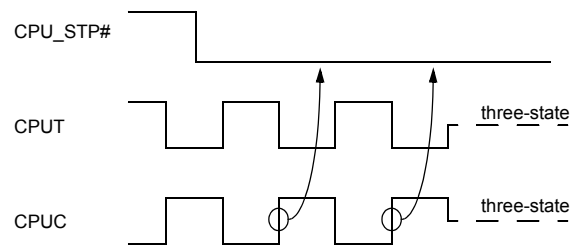
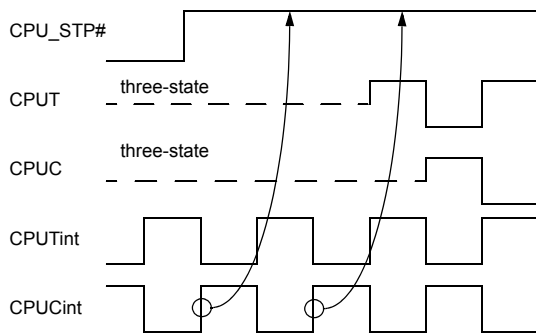


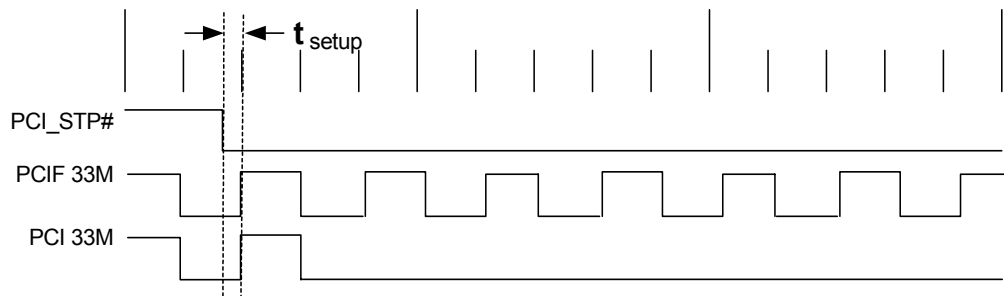
Figure 3. CPU_STP# Assertion Waveform

CPU_STP# Deassertion

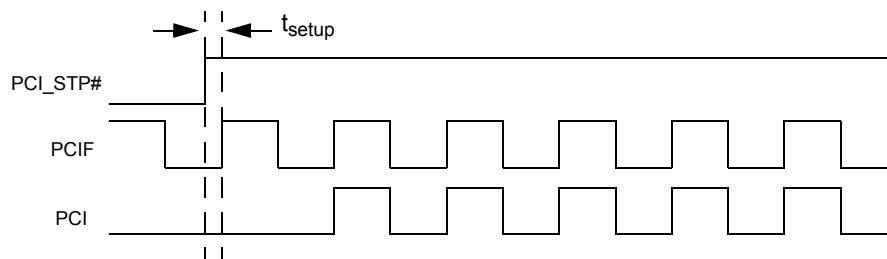
The deassertion of the CPU_STP# signal will cause all CPUT/C outputs that were stopped to resume normal operation in a synchronous manner. Synchronous manner meaning that no short or stretched clock pulses will be produced when the clock resumes. The maximum latency from the deassertion to active outputs is no more than two CPUC clock cycles.


Figure 4. CPU_STP# Deassertion Waveform
PCI_STP# Assertion

The PCI_STP# signal is an active LOW input used for synchronous stopping and starting the PCI outputs while the rest of the clock generator continues to function. The set-up time for capturing PCI_STP# going LOW is 10 ns (t_{setup}). The PCIF clocks will not be affected by this pin if their control bits in the SMBus register are set to allow them to be free running.


Figure 5. PCI_STP# Assertion Waveform
PCI_STP# - Deassertion

The deassertion of the PCI_STP# signal will cause all PCI and stoppable PCIF clocks to resume running in a synchronous manner within two PCI clock periods after PCI_STP# transitions to a high level.


Figure 6. PCI_STP# Deassertion Waveform

Absolute Maximum Conditions

Parameter	Description	Condition	Min.	Max.	Unit
V _{DD}	Core Supply Voltage		-0.5	4.6	V
V _{DDA}	Analog Supply Voltage		-0.5	4.6	V
V _{IN}	Input Voltage	Relative to V _{SS}	-0.5	V _{DD} + 0.5	VDC
T _S	Temperature, Storage	Non-functional	-65	+150	°C
T _A	Temperature, Operating Ambient	Functional	0	70	°C
T _J	Temperature, Junction	Functional	-	150	°C
ESD _{HBM}	ESD Protection (Human Body Model)	MIL-STD-883, Method 3015	2000	-	V
∅ _{JC}	Dissipation, Junction to Case	Mil-Spec 883E Method 1012.1	15		°C/W
∅ _{JA}	Dissipation, Junction to Ambient	JEDEC (JESD 51)	45		°C/W
UL-94	Flammability Rating	At 1/8 in.	V-0		
MSL	Moisture Sensitivity Level		1		

Multiple Supplies: The voltage on any input or I/O pin cannot exceed the power pin during power-up. Power supply sequencing is NOT required.

DC Electrical Specifications

Parameter	Description	Conditions	Min.	Max.	Unit
V _{DD} , V _{DDA}	3.3 Operating Voltage	3.3V ± 5%	3.135	3.465	V
C _{IN}	Input Pin Capacitance		2	5	pF
C _{OUT}	Output Pin Capacitance		3	6	pF
L _{IN}	Pin Inductance		-	7	nH
I _{DD}	Dynamic Supply Current	All frequencies at maximum value	-	280	mA
I _{PD}	Power-down Supply Current	PD# Asserted	-	1	mA
C _{XTAL}	Crystal Pin Capacitance	Measured from the XIN or XOUT pin to ground	30	42	pF
V _{XIH}	XIN High Voltage		0.7V _{DD}	V _{DD}	V
V _{XIL}	XIN Low Voltage		0	0.3V _{DD}	V

AC Electrical Specifications

Parameter	Description	Conditions	Min.	Max.	Unit
Crystal					
T _{DC}	XIN Duty Cycle	The device will operate reliably with input duty cycles up to 30/70 but the REF clock duty cycle will not be within specification	47.5	52.5	%
T _{PERIOD}	XIN Period	When Xin is driven from an external clock source	69.841	71.0	ns
T _R / T _F	XIN Rise and Fall Times	Measured between 0.3V _{DD} and 0.7V _{DD}	-	10.0	ns
T _{CCJ}	XIN Cycle to Cycle Jitter	As an average over 1-μs duration	-	500	ps
CPUT0/CPUC0					
T _{DC}	CPUT0 and CPUC0 Duty Cycle	Measured at crossing point V _{OX}	45	55	%
T _{PERIOD}	100-MHz CPUT and CPUC Period	Measured at crossing point V _{OX}	9.8	10.2	ns
T _{PERIOD}	133-MHz CPUT and CPUC Period	Measured at crossing point V _{OX}	7.35	7.65	ns
T _{SKEW}	Any CPU to CPU Clock Skew	Measured at crossing point V _{OX}	-	150	ps
T _{CCJ}	CPU Cycle to Cycle Jitter	Measured at crossing point V _{OX}	-	150	ps

AC Electrical Specifications (continued)

Parameter	Description	Conditions	Min.	Max.	Unit
T_R / T_F	CPUT and CPUC Rise and Fall Times	Measured from $V_{OL} = 0.175$ to $V_{OH} = 0.525V$	0.5	2.0	V/ns
V_{OX}	Crossing Point Voltage at 0.7V Swing		600	800	mv
CPUT1					
T_{DC}	CPUT1 Duty Cycle	Measured at crossing point V_{OX}	45	55	%
T_{PERIOD}	100MHz CPUT1 Period	Measured at crossing point V_{OX}	9.8	10.2	ns
T_{PERIOD}	133MHz CPUT1 Period	Measured at crossing point V_{OX}	7.35	7.65	ns
T_{CCJ}	CPUT1 Cycle to Cycle Jitter	Measured at crossing point V_{OX}	–	150	ps
T_R / T_F	CPUT and CPUC Rise and Fall Times	Measured from $V_{OL} = 0.175$ to $V_{OH} = 0.525V$	0.5	2.0	V/ns
IOAPIC					
T_{DC}	IOAPIC Duty Cycle	Measured at crossing point V_{OX}	45	55	%
T_{PERIOD}	100MHz IOAPIC Period	Measured at crossing point V_{OX}	69	70	ns
T_{PERIOD}	133MHz IOAPIC Period	Measured at crossing point V_{OX}	69	70	ns
T_{SKEW}	Any IOAPIC clock to any IOAPIC Clock Skew	Measured at crossing point V_{OX}	–	250	ps
T_{HIGH}	IOAPIC High Time		25.5	–	
T_{LOW}	IOAPIC Low Time		25.3	–	
T_{CCJ}	IOAPIC Cycle to Cycle Jitter	Measured at crossing point V_{OX}	–	500	ps
T_R / T_F	IOAPIC Rise and Fall Times	Measured from $V_{OL} = 0.175$ to $V_{OH} = 0.525V$	0.4	1.6	V/ns
AGP					
T_{DC}	AGP Duty Cycle	Measured at crossing point V_{OX}	45	55	%
T_{PERIOD}	100-MHz AGP Period	Measured at crossing point V_{OX}	15.0	15.3	ns
T_{PERIOD}	133-MHz AGP Period	Measured at crossing point V_{OX}	15.0	15.3	ns
$T_{SKEW(UNBUFFERED)}$	Any AGP clock to any AGP Clock Skew	Measured at crossing point V_{OX}	–	250	ps
T_{HIGH}	AGP High Time		5.25	–	ns
T_{LOW}	AGP Low Time		5.25	–	ns
T_{CCJ}	AGP Cycle to Cycle Jitter	Measured at crossing point V_{OX}	–	250	ps
T_R / T_F	AGP Rise and Fall Times	Measured from $V_{OL} = 0.175$ to $V_{OH} = 0.525V$	0.5	1.6	ns
ZCLK					
T_{DC}	ZCLK Duty Cycle	Measured at crossing point V_{OX}	45	55	%
T_{SKEW}	Any ZCLK clock to any ZCLK Clock Skew	Measured at crossing point V_{OX}	–	175	ps
T_{CCJ}	ZCLK Cycle to Cycle Jitter	Measured at crossing point V_{OX}	–	250	ps
T_R / T_F	ZCLK Rise and Fall Times	Measured from $V_{OL} = 0.175$ to $V_{OH} = 0.525V$	0.5	1.6	ns
PCI/PCIF					
T_{DC}	PCI and PCIF Duty Cycle	Measured at crossing point V_{OX}	45	55	%
T_{PERIOD}	100-MHz PCI and PCIF Period	Measured at crossing point V_{OX}	30.0	–	ns
T_{PERIOD}	133-MHz PCI and PCIF Period	Measured at crossing point V_{OX}	30.0	–	ns
T_{SKEW}	Any PCI and PCIF clock to any PCI and PCIF Clock Skew	Measured at crossing point V_{OX}	–	500	ps
T_{HIGH}	PCI and PCIF High Time		12.0	–	ns
T_{LOW}	PCI and PCIF Low Time		12.0	–	ns

AC Electrical Specifications (continued)

Parameter	Description	Conditions	Min.	Max.	Unit
T _{CCJ}	PCI and PCIF Cycle to Cycle Jitter	Measured at crossing point V _{OX}	–	500	ps
T _R / T _F	PCI and PCIF Rise and Fall Times	Measured from Vol= 0.175 to Voh = 0.525V	0.5	2.0	ns
48M					
T _{DC}	48M Duty Cycle	Measurement at 1.5V	45	55	%
T _{PERIOD}	133-MHz 48M Period	Measurement at 1.5V	20.829	20.834	ns
T _{PERIOD}	133-MHz 48 M Period	Measurement at 1.5V	20.829	20.834	ns
T _R / T _F	48M Rise and Fall Times	Measured between 0.4V and 2.4V	1.0	2.0	ns
T _{CCJ}	48M Cycle to Cycle Jitter	Measurement at 1.5V	–	350	ps
24M					
T _{DC}	24M Duty Cycle	Measurement at 1.5V	45	55	%
T _{PERIOD}	100-MHz 24M Period	Measurement at 1.5V	41.66	41.67	ns
T _{PERIOD}	133-MHz 24M Period	Measurement at 1.5V	41.66	41.67	ns
T _R / T _F	24M Rise and Fall Times	Measured between 0.4V and 2.4V	1.0	2.0	ns
T _{CCJ}	24M Cycle to Cycle Jitter	Measurement at 1.5V	–	500	ps
REF					
T _{DC}	REF Duty Cycle	Measurement at 1.5V	45	55	%
T _{PERIOD}	REF Period	Measurement at 1.5V	69.841	71.0	ns
T _R / T _F	REF Rise and Fall Times	Measured between 0.4V and 2.4V	1.0	4.0	ns
T _{CCJ}	REF Cycle to Cycle Jitter	Measurement at 1.5V	–	1000	ps
ENABLE/DISABLE and SETUP					
T _{STABLE}	All Clock Stabilization from Power-up		–	1.5	ms
T _{SS}	Stopclock Set-up Time		10.0	–	ns
T _{SH}	Stopclock Hold Time		0	–	ns
T _{ODIS}	Output Disable Delay (all outputs)		1.0	10.00	ns
T _{OENB}	Output Enable Delay (all outputs)		1.0	10.00	ns

Test and Measurement Set-up

For Differential CPU Output Signals

The following diagram shows lumped test load configurations for the differential Host Clock Outputs.

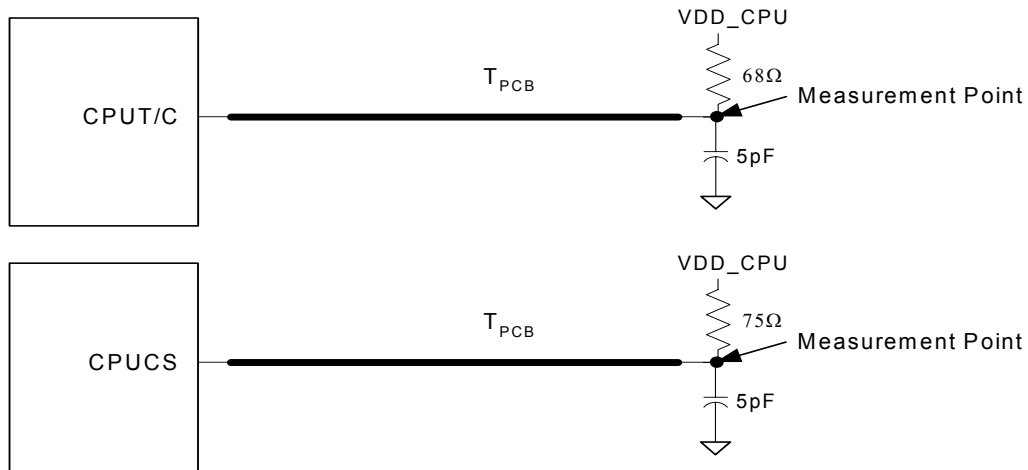


Figure 7. CPUCLK Test Load Configuration

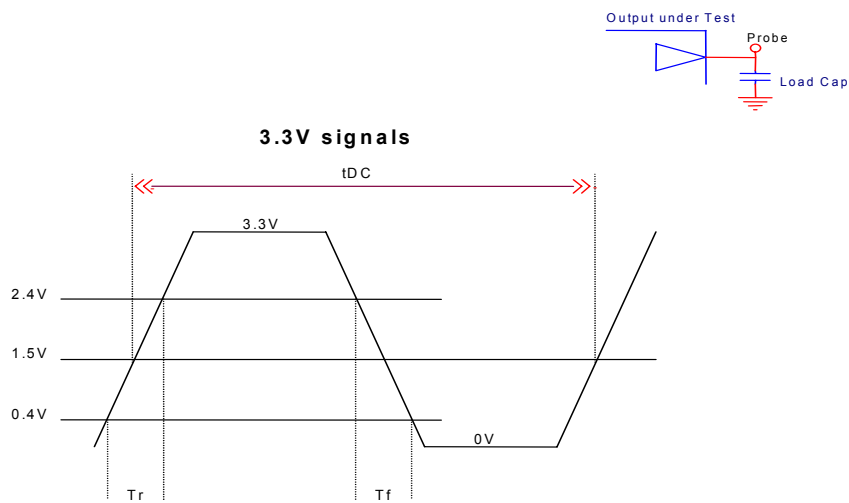


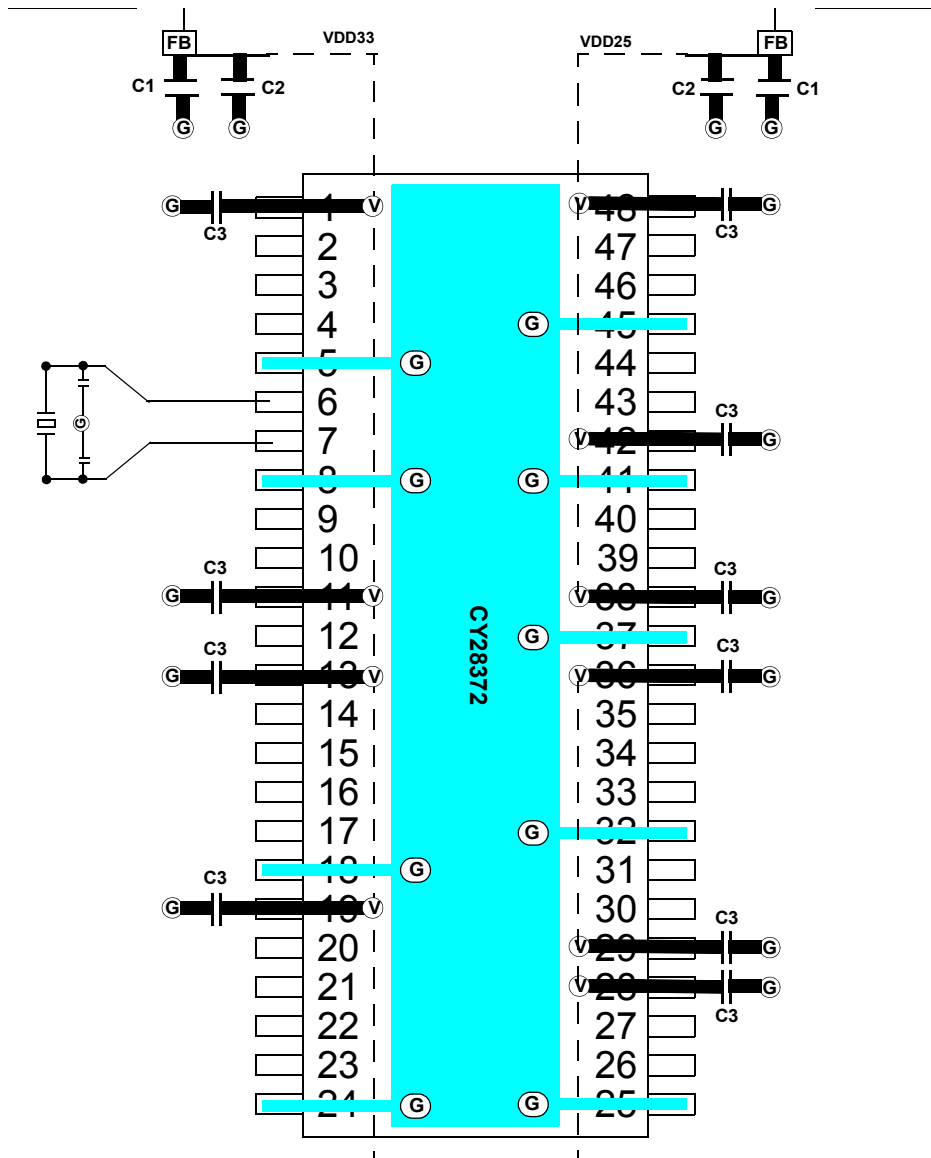
Figure 8. Lumped Load For Single-Ended Output Signals (for AC Parameters Measurement)

Table 7. Group Timing Relationship and Tolerances

	Offset (Typical)	Tolerance (or Range)	Conditions	Notes
CPU to AGP	2 ns	1 – 4 ns	CPU leads	–
CPU to Z	2 ns	1 – 4 ns	CPU leads	–
CPU to PCI	2 ns	1 – 4 ns	CPU leads	–

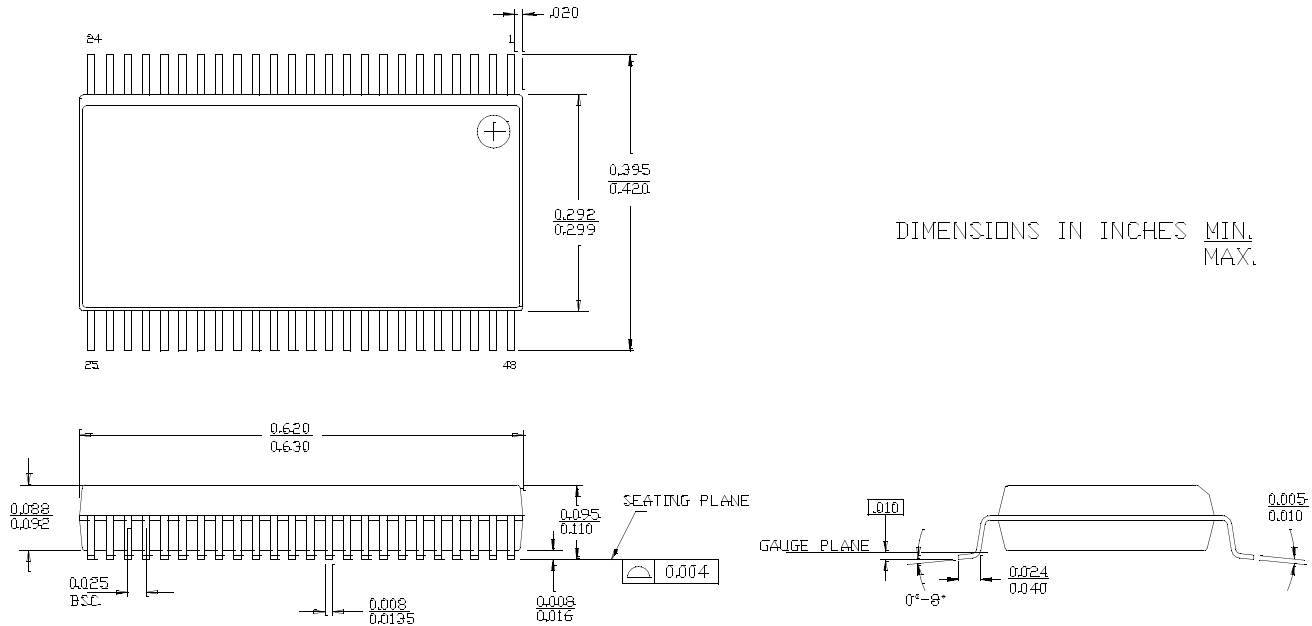
Ordering Information

Ordering Code	Package Type	Operating Range
CY28372OC	48-pin Small Shrink Outline Package (SSOP)	Commercial, 0°C to 70°C
CY28372OCT	48-pin Small Shrink Outline Package (SSOP) – Tape and Reel	Commercial, 0°C to 70°C
Lead Free		
CY28372OXC	48-pin Small Shrink Outline Package (SSOP)	Commercial, 0°C to 70°C
CY28372OXCT	48-pin Small Shrink Outline Package (SSOP) – Tape and Reel	Commercial, 0°C to 70°C

Layout Example


FB = Dale ILB1206 - 300 (300 Ω @ 100 MHz)
 Cermaic Caps C1 = 10 - 22 μF C2 = .005 μF C3 = .1μF
 (G) = VIA to GND plane layer (V) = VIA to respective supply plane layer

Note: Each supply plane or strip should have a ferrite bead and capacitors
 All bypass caps = .1-μf ceramic
 * For use with onboard video using 48 MHz for Dot Clock or connect to VDDQ3

Package Diagram
48-lead Shrink Small Outline Package O48


51-85061-°C

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Document History Page

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REV.	ECN NO.	Issue Date	Orig. of Change	Description of Change
**	125162	04/25/03	RGL	New data sheet
*A	266732	See ECN	RGL	Added Lead-Free devices