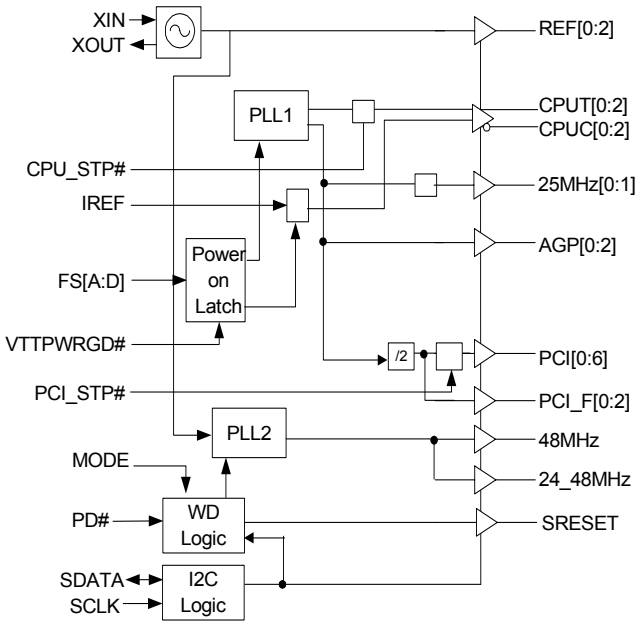
CY28326

FTG for VIA PT880 Serial Chipset

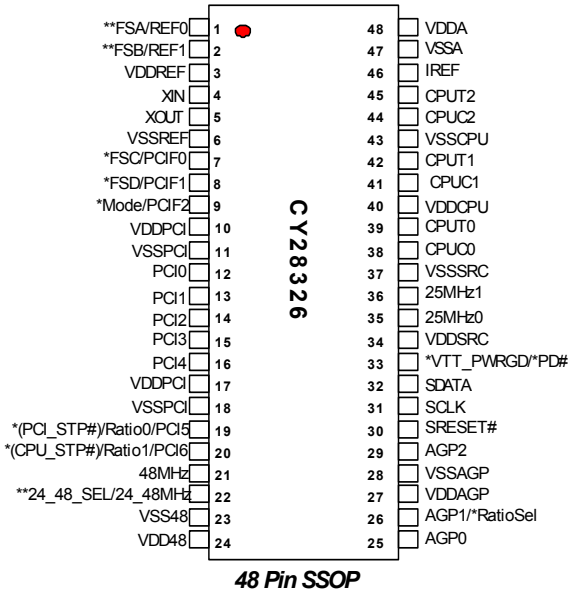
Features

- **Supports P4® CPUs**
- **3.3V power supply**
- **Ten copies of PCI clocks**
- **One 48 MHz USB clock**
- **Two copies of 25 MHz for SRC/LAN clocks**
- **One 48 MHz/24 MHz programmable SIO clock**
- **Three differential CPU clock pairs**
- **SMBus support with Byte Write/Block Read/Write capabilities**
- **Spread Spectrum EMI reduction**
- **Dial-A-Frequency® features**
- **Auto Ratio features**
- **48-pin SSOP package**

Block Diagram



Pin Configuration[1]



48 Pin SSOP

Note:

1. Pins marked with [*] have internal 150kΩ pull-up resistors. Pins marked with [**] have internal 150kΩ pull-down resistors.

Pin Definition

Pin No.	Name	PWR	Type	Description
1	**FSA/REF0	VDDREF	I/O	**Power-on Bi-directional Input/Output.** At power-up, FSA is the input. when VTT_PWRGD transitions to a logic high, FSA state is latched and this pin becomes REF0, buffered output copy of the device's XIN clock. Default Internal pull down.
2	**FSB/REF1	VDDREF	I/O	**Power-on Bi-directional Input/Output.** At power-up, FSB is the input. when VTT_PWRGD transitions to a logic high, FSB state is latched and this pin becomes REF1, buffered output copy of the device's XIN clock. Default Internal pull down.
3	VDDREF		I	**3.3V Power supply for REF clock output.**
4	XIN	VDDREF	I	**Oscillator Buffer Input.** Connect to a crystal or to an external clock.
5	XOUT	VDDREF	O	**Oscillator Buffer Input.** Connect to a crystal. Do not connect when an external clock is applied at XIN.
6	VSSREF		PWR	**Ground for REF clock outputs**
7	*FSC/PCIF0	VDDPCI	I/O	**Power-on Bi-directional Input/ Output.** At power up, FSC is the input. When the VTT_PWRGD transitions to a logic high, FSC state is latched and this pin becomes PCIF0. Default Internal pull up.
8	*FSD/PCIF1	VDDPCI	I/O	**Power-on Bi-directional Input/ Output.** At power up, FSD is the input. When the VTT_PWRGD transitions to a logic high, FSD state is latched and this pin becomes PCIF. Default Internal pull up.
9	*MODE/ PCIF2	VDDPCI	I/O	**Power-on Bi-directional Input/ Output.** At power up, MODE/PCIF2 is the input. When the power up, MODE state is latched and then pin9 becomes PCIF2, PCI clock output for PCI Device.Default pull-up, See *Table 2*
10,17	VDDPCI		I	**3.3V power supply for PCI clock output.**
11,18	VSSPCI		I	**Ground for PCI clock output.**
12,13,14,15,16	PCI[0:4]		O	**PCI clock outputs.**
19	*(PCI_STP#) Ratio0/PCI5	VDDPCI	O	**Ratio0 Output/PCI5 Output.** At power up when RatioSel (pin 26) strapping = "High" & MODE (pin 9) strapping="High", (PCI_STP#) Ratio0/PCI5 becomes PCI5 clock output. At power up when RatioSel (pin 26) strapping = "low" & MODE (pin 9) strapping ="High", (PCI_STP#)Ratio0/PCI5 becomes Ratio0 output to support North bridge over freq strapping function. Once MODE(pin 9) strapping="Low", then (PCI_STP#)Ratio0/PCI5 becomes PCI_STP#, Default = "PCI5" see *Table 2*, Default Internal pull up.
20	*(CPU_STP#) Ratio1/PCI6	VDDPCI	O	**Ratio1 Output/PCI6 Output.** At power up when RatioSel(pin 26) strapping = "High" & MODE(pin 9) strapping="High", (CPU_STP#) Ratio1/PCI6 becomes PCI6 clock output. At power up when RatioSel (pin 26) strapping = "low" & MODE(pin 9) strapping ="High", (PCI_STP#)Ratio1/PCI6 becomes Ratio1 output to support North bridge over freq strapping function. Once MODE(pin 9) strapping="Low", then (PCI_STP#)Ratio1/PCI6 becomes CPU_STP#, Default = "PCI6" see *Table 2*, Default Internal pull up.
21	48 MHz	VDD48	O	**48 MHz Clock Output.**
22	**24_48_SEL/ 24_48 MHz	VDD48	I/O	**Power-on Bi-directional Input/output.** At power up 24_48_SEL is the input. When VTT_PWRGD is transited to logic high, 24_48_SEL state is latched and this pin becomes 24/48 MHz output, Default 24_48_SEL= "0", 48 MHz output.Default Internal pull down.
23	VSS48		I	**Ground for 48 MHz clock output.**

Pin Definition (continued)

Pin No.	Name	PWR	Type	Description
24	VDD48		I	**Power for 48MHz clock output.**
25,29	AGP0/AGP2	VDDAGP	O	**AGP Clock Output.**
26	*RatioSEL /AGP1	VDDAGP	I/O	**Power-on Bi-directional Input/output.** At power up, RatioSel is the input. when the power supply voltage crosses the input threshold voltage, RatioSel state is latched and this pin becomes AGP clock output. Default pull-up.
27	VDDAGP		I	**3.3V power supply for AGP clock output.**
28	VSSAGP		I	**Ground for AGP clock output.**
30	SRESET#		O	**System Reset Control Output.**
31	SCLK		I	**Serial clock input.** Conforms to the Philips I^2C specification.
32	SDATA		I/O	**Serial clock input.** Conforms to the Philips I^2C specification of a Slave Receive/Transmit device. it is an input when receiving data. It is open drain output when acknowledging or transmitting data.
33	*VTT_PWRGD/PD#		I	VTT_PWRGD: 3.3V LVTTL input to determine when FS[D:A], MODE, RatioSEL and 24_48_SEL inputs are valid and ready to be sampled. PD#: Invokes powerdown mode. Default Internal pull up.
34	VDDSRC		I	**Power for 25 MHz clock output. 3.3V Power Supply.**
35,36	25MHz[0:1]	VDDSRC	O	**25 MHz Clock Output.**
37	VSSSRC		I	**Ground for 25 MHz clock output.**
39,38,42,41,45,44	CPU[T/C][0:2]	VDDCPU	O	**CPU Clock outputs.**
40	VDDCPU		I	**Power for CPU clock output.**
43	VSSCPU		I	**Ground for CPU clock output.**
46	IREF		I	**Current Reference.** A precision resistor is attached to this pin, which is connected to the internal current reference.
47	VSSA		I	**Ground for output.**
48	VDDA		I	**3.3V Power Supply for output**

Table 1. Frequency Table

FS(D:A) FS(3:0)	CPU (MHz)	AGP (MHz)	PCI (MHz)	SATA (MHz)	VCO (MHz)	PLL Gear Constant (Million)
0000	110.0	73.3	36.6	25.0	660.00	25.00258122
0001	146.6	73.3	36.6	25.0	586.68	37.50387182
0010	220.0	73.3	36.6	25.0	440.00	75.00774365
0011	183.3	73.3	36.6	25.0	733.33	37.50387182
0100	233.3	66.7	33.3	25.0	466.67	75.00774365
0101	266.6	66.7	33.3	25.0	533.33	75.00774365
0110	333.3	66.7	33.3	25.0	666.67	75.00774365
0111	300.0	66.7	33.3	25.0	600.00	75.00774365
1000	100.9	67.3	33.6	25.0	807.2	18.75193591
1001	133.9	67.0	33.5	25.0	803.4	25.00258122
1010	200.9	67.0	33.5	25.0	803.6	37.50387182
1011	166.9	66.8	33.4	25.0	667.6	37.50387182
1100	100.0	66.7	33.3	25.0	800.00	18.75193591
1101	133.3	66.7	33.3	25.0	800.00	25.00258122
1110	200.0	66.7	33.3	25.0	800.00	37.50387182
1111	166.6	66.7	33.3	25.0	666.67	37.50387182

Table 2. Mode Ratio Setting

Power-up Condition		Pin I/O Setting	
Mode	**RatioSel**	**Pin 19**	**Pin 20**
0	x	PCI_STP#	CPU_STP#
0	x	PCI_STP#	CPU_STP#
1	0	Ratio0	Ratio1
1	1	PCI5	PCI6

Table 3. Ratio mapping Table

Power-up Frequency value		FS[1:0]		Ratio pin mapping	
CPU	**AGP**	**FS1**	**FS0**	**Pin 20**	**Pin 19**
100	66.6	0	0	0	0
133	66.6	0	1	0	1
200	66.6	1	0	1	0
166	66.6	1	1	1	1

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 initializes to their default setting upon power-up, and therefore use of this interface is optional. The interface can also be accessed during power down operation.

Data Protocol

The clock driver serial protocol accepts byte write, byte read, block write and block read operation from any external I^2C 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 individual indexed bytes. The offset of the indexed byte is encoded in the command code, as described in *Table 4*. The block write and block read protocol is outlined in *Table 5* while *Table 6* outlines the corresponding byte write and byte read protocol.The slave receiver address is 11010010 (D2h).

Table 4. Command Code Definition

Bit	Description
7	0 = Block read or block write operation 1 = Byte read or byte write operation
(6:5)	Device selection bits. Set = 00
(4:0)	Byte offset for byte read or byte write operation. For block read or block write operations, these bits should be '0000000'

Table 5. Block Read and Block Write protocol

Block Write Protocol		Block Read Protocol	
Bit	**Description**	**Bit**	**Description**
1	Start	1	Start
8:2	Slave address – 7 bits	8:2	Slave address – 7 bits
9	Write	9	Write
10	Acknowledge from slave	10	Acknowledge from slave
18:11	Command Code – 8 Bits	18:11	Command Code – 8 Bits
19	Acknowledge from slave	19	Acknowledge from slave
27:20	Byte Count – 8 bits (Skip this step if I^2C_EN bit set)	20	Repeat start
28	Acknowledge from slave	27:21	Slave address – 7 bits
36:29	Data byte 1 – 8 bits	28	Read = 1
37	Acknowledge from slave	29	Acknowledge from slave
45:38	Data byte 2 – 8 bits	37:30	Byte Count from slave – 8 bits

Table 5. Block Read and Block Write protocol (continued)

46	Acknowledge from slave	38	Acknowledge
....	Data Byte /Slave Acknowledges	46:39	Data byte 1 from slave – 8 bits
....	Data Byte N –8 bits	47	Acknowledge
....	Acknowledge from slave	55:48	Data byte 2 from slave – 8 bits
....	Stop	56	Acknowledge
		....	Data bytes from slave / Acknowledge
		....	Data Byte N from slave – 8 bits
		....	NOT Acknowledge
		...	Stop

Table 6. Byte Read and Byte Write protocol

Byte Write Protocol		Byte Read Protocol	
Bit	**Description**	**Bit**	**Description**
1	Start	1	Start
8:2	Slave address – 7 bits	8:2	Slave address – 7 bits
9	Write	9	Write
10	Acknowledge from slave	10	Acknowledge from slave
18:11	Command Code – 8 bits	18:11	Command Code – 8 bits
19	Acknowledge from slave	19	Acknowledge from slave
27:20	Data byte – 8 bits	20	Repeated start
28	Acknowledge from slave	27:21	Slave address – 7 bits
29	Stop	28	Read
		29	Acknowledge from slave
		37:30	Data from slave – 8 bits
		38	NOT Acknowledge
		39	Stop

Byte Configuration Map

Byte 0: Control Register

Bit	@Pup	Name/Pin Affected	Description
7	HW	FSD	HW Frequency selection bits [3:0]. See table 2. Power up latched value
6	HW	FSC	
5	HW	FSB	
4	HW	FSA	
3	0	Test bit	Don't change, Default =0
2	1	CPU[T/C]2	CPU[T/C]2 Output Enable 0 = Disabled (tri-sate), 1 = Enabled
1	1	CPU[T/C]1	CPU[T/C]1 Output Enable 0 = Disabled (tri-sate), 1 = Enabled
0	1	CPU[T/C]0	CPU[T/C]0 Output Enable 0 = Disabled (tri-sate), 1 = Enabled

Byte 1: Control Register

Bit	@Pup	Name/Pin Affected	Description
7	1	FS3	SW frequency selection bits [3:0]. See table 2.
6	1	FS2	
5	0	FS1	
4	0	FS0	
3	0	FS_Override/FS(D:A)	FS_Override 0 = Select operating frequency by FS(D:A) (HW Strapping) input bits, 1 = Select operating frequency by FSEL[3:0](SW Strapping) settings.
2	0	CPU[T/C]2	CPU[T/C]2 **Powerdown/CPUSTP#** drive mode 0 = Driven in powerdown, 1 = Tri-state
1	0	CPU[T/C]1	CPU[T/C]1 **Powerdown/CPUSTP#** drive mode 0 = Driven in powerdown, 1 = Tri-state
0	0	CPU[T/C]0	CPU[T/C]0 **Powerdown/CPUSTP#** drive mode 0 = Driven in powerdown, 1 = Tri-state

Byte 2: Control Register

Bit	@Pup	Name/Pin Affected	Description
7	0	PCIF[2:0]	PCIF Clock Output Drive Strength 0 = Low drive strength, 1 = High drive strength
6	0	PCI[6:0]	PCI Clock Output Drive Strength 0 = Low drive strength, 1 = High drive strength
5	0	AGP[2:0]	AGP Clock Output Drive Strength 0 = Low drive strength, 1 = High drive strength
4	0	Test bit	Don't change, Default =0
3	0	48 MHz, 24/48 MHz	48 MHz Clock Output Drive Strength 0 = Low drive strength, 1 = High drive strength
2	0	Reserved	Reserved
1	0	REF[1:0]	REF Clock Output Drive Strength 0 = Low drive strength, 1 = High drive strength
0	0	Test bit	Don't change, Default =0

Byte 3: Control Register

Bit	@Pup	Name/Pin Affected	Description
7	0	Spread Spectrum Sel CPU AGP PCIF PCI	Spread Spectrum Selection '000' = –1.25 ~ 0.25% '001' = –1.0% '010' = –0.75% '011' = –0.5% (default) '100' = ± 0.75% '101' = ± 0.5% '110' = ± 0.35% '111' = ± 0.25%
6	1		
5	1		
4	0	AGP_SKEW1	AGP Skew control, relative to PCICLK
3	0	AGP_SKEW0	01 = –300ps 10 = +300ps 11 = +450ps
2	0	CPU,AGP,PCIF,PCI	Spread Spectrum Enable/Disable Function 0 = Spread spectrum disable 1 = Spread spectrum enable
1	1	REF1	REF1 Output Enable 0 = Disabled, 1 = Enabled
0	1	REF0	REF0 Output Enable 0 = Disabled, 1 = Enabled

Byte 4: Control Register

Bit	@Pup	Name/Pin Affected	Description
7	1	48 MHz	48 MHz Output Enable 0 = Disabled, 1 = Enabled
6	1	24_48 MHz	24_48 MHz Output Enable 0 = Disabled, 1 = Enabled
5	1	PCI5	PCI5 Output Enable 0 = Disabled, 1 = Enabled
4	1	PCI4	PCI4 Output Enable 0 = Disabled, 1 = Enabled
3	1	PCI3	PCI3 Output Enable 0 = Disabled, 1 = Enabled
2	1	PCI2	PCI2 Output Enable 0 = Disabled, 1 = Enabled
1	1	PCI1	PCI1 Output Enable 0 = Disabled, 1 = Enabled
0	1	PCI0	PCI0 Output Enable 0 = Disabled, 1 = Enabled

Byte 5: Control Register

Bit	@Pup	Name/Pin Affected	Description
7	1	AGP2	AGP2 Output Enable 0 = Disabled, 1 = Enabled
6	1	AGP1	AGP1 Output Enable 0 = Disabled, 1 = Enabled
5	1	AGP10	AGP0 Output Enable 0 = Disabled, 1 = Enabled
4	1	25 MHz1	25 MHz1 Output Enable 0 = Disabled, 1 = Enabled
3	1	25 MHz0	25 MHz0 Output Enable 0 = Disabled, 1 = Enabled
2	1	PCIF2	PCIF2 Output Enable 0 = Disabled, 1 = Enabled
1	1	PCIF1	PCIF1 Output Enable 0 = Disabled, 1 = Enabled
0	1	PCIF0	PCIF0 Output Enable 0 = Disabled, 1 = Enabled

Byte 6: Control Register

Bit	@Pup	Name/Pin Affected	Description
7	0	Revision ID Bit 3	Revision ID Bit 3
6	0	Revision ID Bit 2	Revision ID Bit 2
5	0	Revision ID Bit 1	Revision ID Bit 1
4	0	Revision ID Bit 0	Revision ID Bit 0
3	1	Vendor ID Bit 3	Vendor ID Bit 3
2	0	Vendor ID Bit 2	Vendor ID Bit 2
1	0	Vendor ID Bit 1	Vendor ID Bit 1
0	0	Vendor ID Bit 0	Vendor ID Bit 0

Byte 7: Fract Aligner Control Register

Bit	@Pup	Name/Pin Affected	Description
7	1	PCI6	PCI6 Output Enable 0 = Disabled, 1 = Enabled

Byte 7: Fract Aligner Control Register (continued)

Bit	@Pup	Name/Pin Affected	Description
6	0	Test bit	Don't change, Default =0
5	0	Test bit	Don't change, Default =0
4	0	Reserved	Reserved
3	1	Reserved	Reserved
2	0	Reserved	Reserved
1	0	Fract_Align1	AGP and PCI fixed frequency selection bit 1
0	0	Fract_Align0	AGP and PCI fixed frequency. This option does not incorporate spread spectrum. It is enabled through Fixed_AGP_SEL bits (B8b7) **Fract_align1 Fract_align1 AGP PCI** 0 0 66.6 33.3 0 1 75.0 37.5 1 0 75.0 37.5 1 1 85.7 42.8

Byte 8: Control Register

Bit	@Pup	Name/Pin Affected	Description
7	0	AGP	AGP output frequency select mode. Selects the frequency source for AGP outputs. 0 = Set according to Frequency Selection Table 1 = Set according to Fractional Aligner Settings Program Fract Aligner values before setting this bit.
6	1	Reserved	Reserved
5	0	Recovery_Frequency	This bit allows selection of the frequency setting that the clock will be restored to once the system is rebooted. 0 = Use hardware settings, 1 = use last SW table programmed values.
4	0	WD_Alarm	This bit is set to "1" when the watchdog times out. It is reset to "0" when the system clears the WD_TIMER time stamp.
3	0	WD_TIMER3	Watchdog timer time stamp selection: 0000: Off 0001: 10msec 0010: 4 second . . . 1110: 28 seconds 1111: 30 seconds
2	0	WD_TIMER2	
1	0	WD_TIMER1	
0	0	WD_TIMER0	

Byte 9: Control Register

Bit	@Pup	Name/Pin Affected	Description
7	0	CPU_FSEL_N7	If Dial-A-Frequency Enable bit is set, the values programmed in CPU_FSEL_N[8:0] and CPU_FSEL_M[6:0] will be used to determine the CPU output frequency. This setting of the FS_Override bit determines the frequency ratio for CPU and other output clocks. When it is cleared, the same frequency ratio stated in the latched FS[D:A] register will be used. When it is set, the frequency ratio stated in the SEL[3:0] register will be used.
6	0	CPU_FSEL_N6	
5	0	CPU_FSEL_N5	
4	0	CPU_FSEL_N4	
3	0	CPU_FSEL_N3	
2	0	CPU_FSEL_N2	
1	0	CPU_FSEL_N1	
0	0	CPU_FSEL_N0	

Byte 10: Control Register

Bit	@Pup	Name/Pin Affected	Description
7	0	CPU_FSEL_N8	Dial-A-Frequency Enable bit is set, the values programmed in CPU_FSEL_N[8:0] and CPU_FSEL_M[6:0] will be used to determine the CPU output frequency. This setting of the FS_Override bit determines the frequency ratio for CPU and other output clocks. When it is cleared, the same frequency ratio stated in the latched FS[D:A] register will be used. When it is set, the frequency ratio stated in the SEL[3:0] register will be used.
6	0	CPU_FSEL_M6	
5	0	CPU_FSEL_M5	
4	0	CPU_FSEL_M4	
3	0	CPU_FSEL_M3	
2	0	CPU_FSEL_M2	
1	0	CPU_FSEL_M1	
0	0	CPU_FSEL_M0	

Byte 11: Control Register

Bit	@Pup	Name/Pin Affected	Description
7	0	Dial_A_Frequency Enable	Dial-A-Frequency output frequencies enabled 0 = Disabled, 1 = Enabled
6	0	WD Timer Reload & Reset	To enable this function the register bit must first be set to “0” before toggling to “1” 0 = Do not reload, 1 =Reset timer but continue to count.
5	1	Test bit	Don’t change, Default =1
4	0	Test bit	Don’t change, Default =0
3	0	Test bit	Don’t change, Default =0
2	0	Test bit	Don’t change, Default =0
1	HW	24-48 M_SEL	“0” = 48 MHz, “1” = 24 MHz, default = “0”, level can be change during BIOS boot up only. System will hang if this configuration is changed after system boots.
0	1	Test bit	Don’t change, Default =1

Crystal Recommendations

The CY28326 requires a **Parallel Resonance Crystal.** Substituting a series resonance crystal will cause the CY28326 to operate at the wrong frequency and violate the ppm specification. For most applications there is a 300-ppm frequency shift between series and parallel crystals due to incorrect loading.

Table 7. Crystal Recommendations

Frequency (Fund)	Cut	Loading	Load Cap	Drive (max.)	Shunt Cap (max.)	Motional (max.)	Tolerance (max.)	Stability (max.)	Aging (max.)
14.31818 MHz	AT	Parallel	20 pF	0.1 mW	5 pF	0.016 pF	50 ppm	50 ppm	5 ppm

Crystal Loading

Crystal loading plays a critical role in achieving low ppm performance. To realize low ppm performance, the total capacitance the crystal will see must be considered to calculate the appropriate capacitive loading (CL).The following diagram shows a typical crystal configuration using the two trim capacitors. An important clarification for the following discussion is that the trim capacitors are in series with the crystal not parallel. It's a common misconception that load capacitors are in parallel with the crystal and should be approximately equal to the load capacitance of the crystal. This is not true.

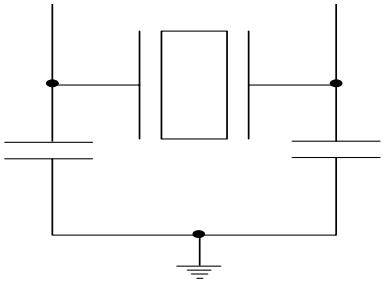


Figure 1. Crystal Capacitive Clarification

Calculating Load Capacitors

In addition to the standard external trim capacitors, trace capacitance and pin capacitance must also be considered to correctly calculate crystal loading. As mentioned previously, the capacitance on each side of the crystal is in series with the crystal. This means the total capacitance on each side of the crystal must be twice the specified crystal load capacitance (CL). While the capacitance on each side of the crystal is in series with the crystal, trim capacitors (Ce1,Ce2) should be calculated to provide equal capacitive loading on both sides.

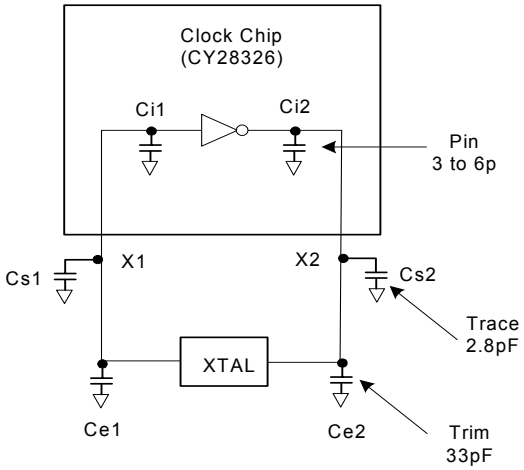


Figure 2. Crystal Loading Example

As mentioned previously, the capacitance on each side of the crystal is in series with the crystal. This mean the total capacitance on each side of the crystal must be 2 times the specified load capacitance (CL). While the capacitance on each side of the crystal is in series with the crystal, trim capacitors(Ce1,Ce2) should be calculated to provide equal capacitative loading on both sides.

Use the following formulas to calculate the trim capacitor values fro Ce1 and Ce2.

Load Capacitance (each side)

$$Ce = 2 * CL - (Cs + Ci)$$

Total Capacitance (as seen by the crystal)

$$CLe = \frac{1}{\left(\frac{1}{Ce1 + Cs1 + Ci1} + \frac{1}{Ce2 + Cs2 + Ci2}\right)}$$

CL ..... Crystal load capacitance

CLe ..... Actual loading seen by crystal using standard value trim capacitors

Ce ..... External trim capacitors

Cs..... CStray capacitance (trace,etc)

Ci ..... Internal capacitance (lead frame, bond wires etc)

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. 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 as not to cause glitches while transitioning to the low 'stopped' state.

PD# – Assertion

When PD# is sampled low by two consecutive rising edges of CPUC clock then all clock outputs (except CPU) clocks must be held low on their next high to low transition. CPU clocks must be driven high with a value of 2x Iref and CPUC undriven.

Due to the state of internal logic, stopping and holding the REF clock outputs in the LOW state may require more than one clock cycle to complete

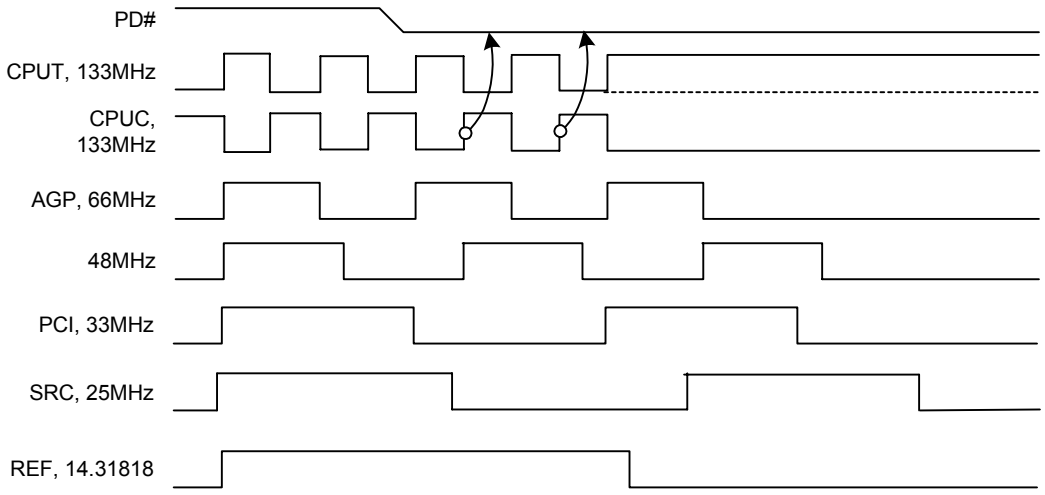


Figure 3. Power-down Assertion Timing Waveforms

PD# De-assertion

The power-up latency between PD# rising to a valid logic '1' level and the starting of all clocks is less than 3.0 ms.

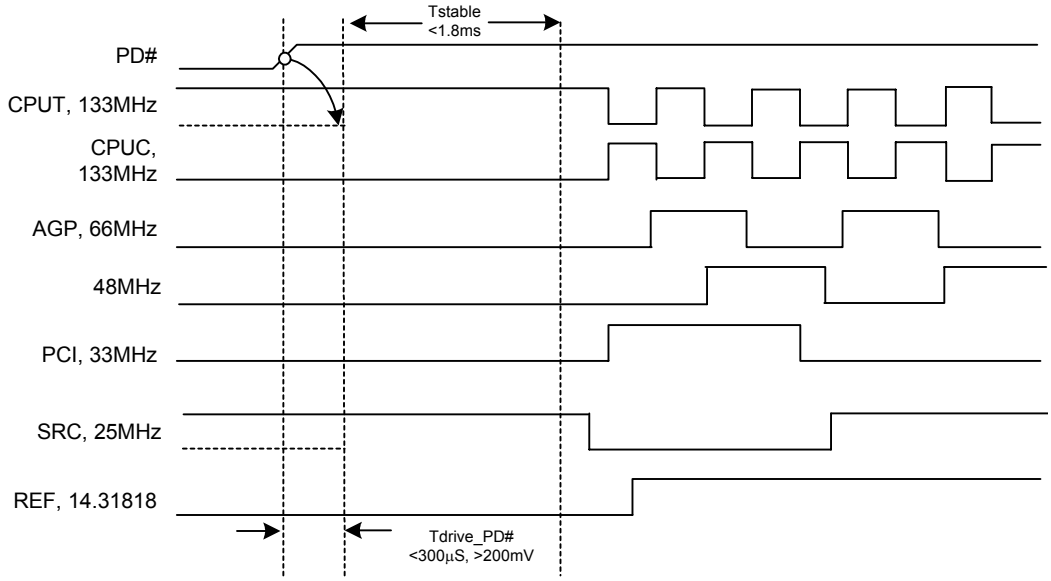


Figure 4. Power-down De-assertion Timing Waveforms

CPU_STP# Assertion

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. When the CPU_STP# pin is asserted, all CPU outputs that are set with the SMBus configuration to be stoppable via assertion of CPU_STP# will be stopped after being sampled by three rising edges of the internal CPUT clock. The final states of the stopped CPU signals are CPUT = HIGH and CPUC = LOW. There is no change to the output drive current values during the stopped state. The CPUT is driven HIGH with a current value equal to (Mult 0 'select') x (Iref), and the CPUC signal will not be driven. Due to the external pull-down circuitry, CPUC will be LOW during this stopped state.

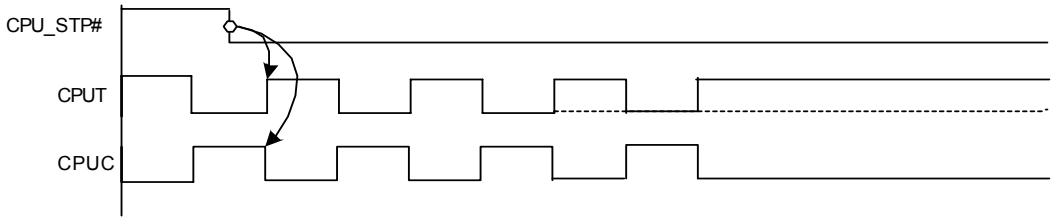


Figure 5. CPU_STP# Assertion Waveform

CPU_STP# De-assertion

The de-assertion of the CPU_STP# signal will cause all CPU outputs that were stopped to resume normal operation in a synchronous manner. Synchronous manner meaning that no short or stretched clock pulses will be produce when the clock resumes. The maximum latency from the deassertion to active outputs is no more than three CPU clock cycles.

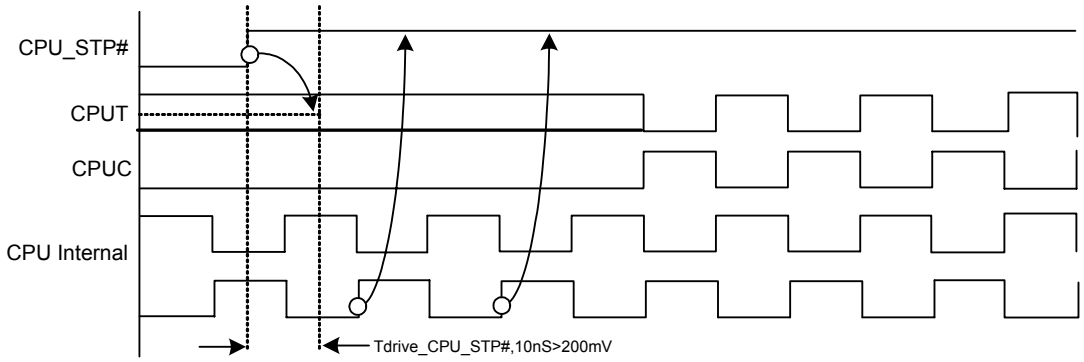


Figure 6. CPU_STP# De-assertion Waveform

PCI_STP# Assertion[2]

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_{SU}). (See *Figure 7*.)

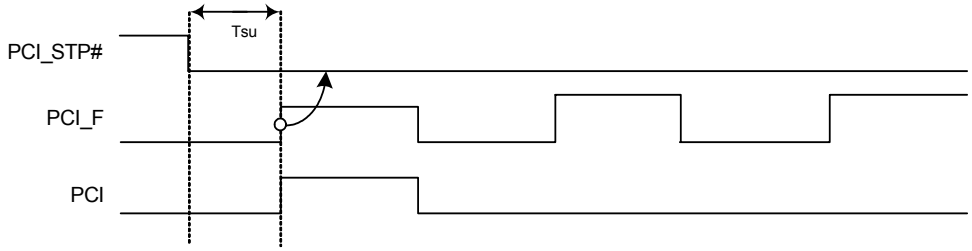


Figure 7. PCI_STP# Assertion Waveform

PCI_STP# Deassertion

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

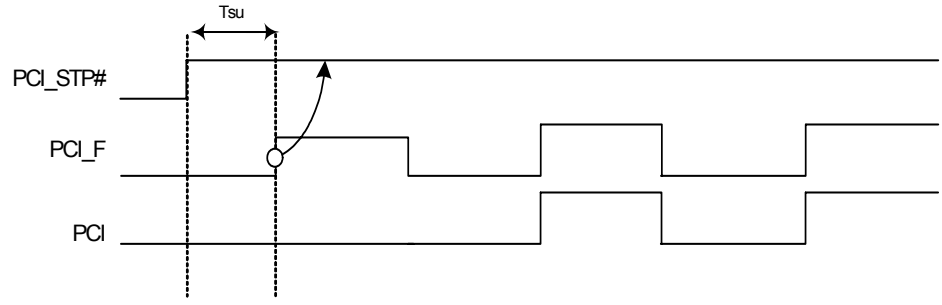


Figure 8. PCI_STP# Deassertion Waveform

Note:
2. The PCI STOP function is controlled by PCI_STP# pin number 19.

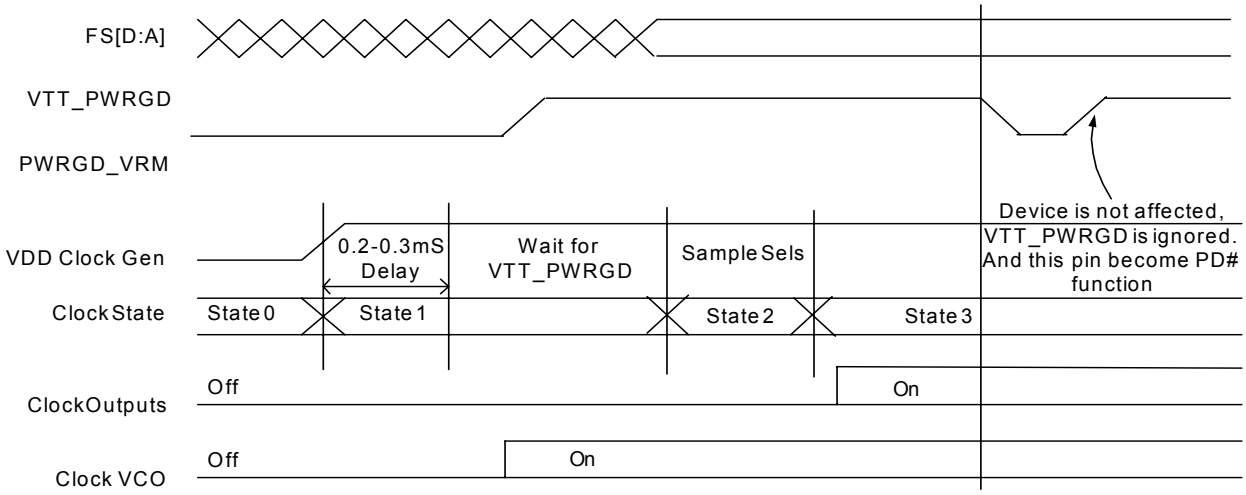


Figure 9. VTT_PWRGD Timing Diagram

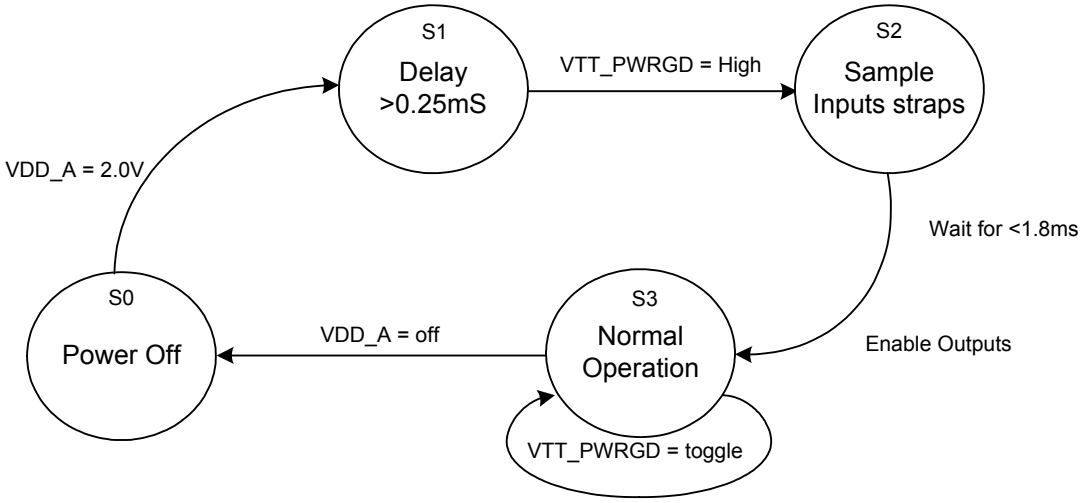


Figure 10. Clock Generator Power-up/Run State Diagram

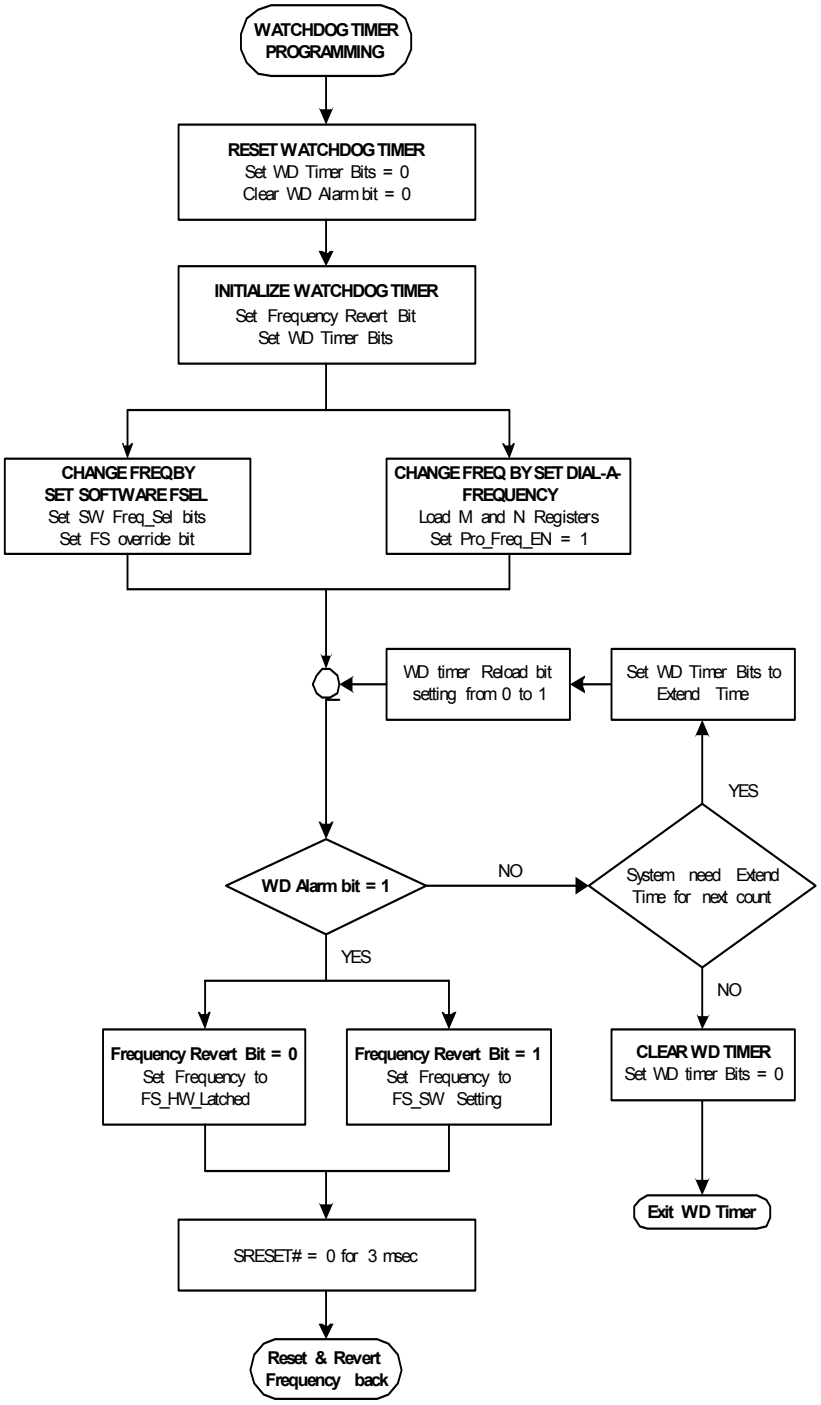


Figure 11. Watch Dog timer flowchart for BIOS programming

Situation 1 : Power on & Ratio initial by HW strapping

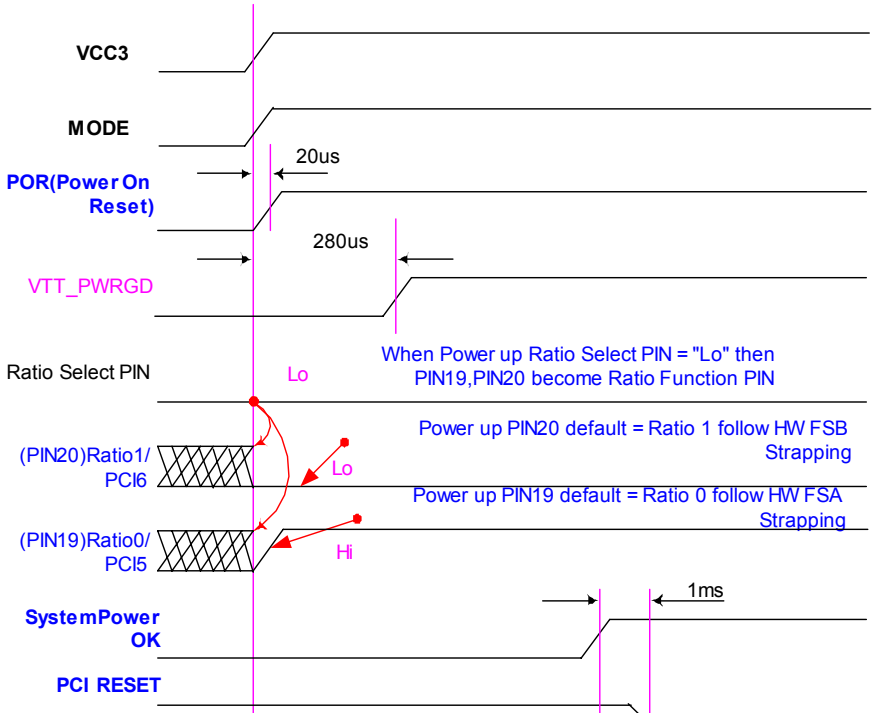


Figure 12. Situation 1: Power on & Ratio initial by HW strapping

Power sequence for Ratio PIN

Situation 2 : BIOS programming SW FSEL table and System reset by Watchdog timer reset function (NO Frequecny recovery).

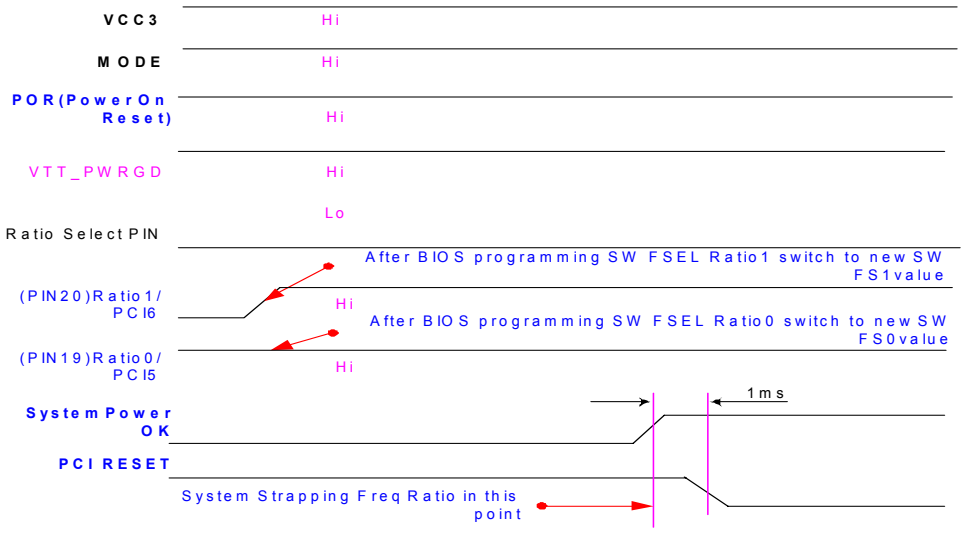


Figure 13. BIOS programming SW FSEL table and System reset by Watch timer reset function (NO Frequency recovery).

Situation 3 : Power on & Ratio PIN switch to PCI clock

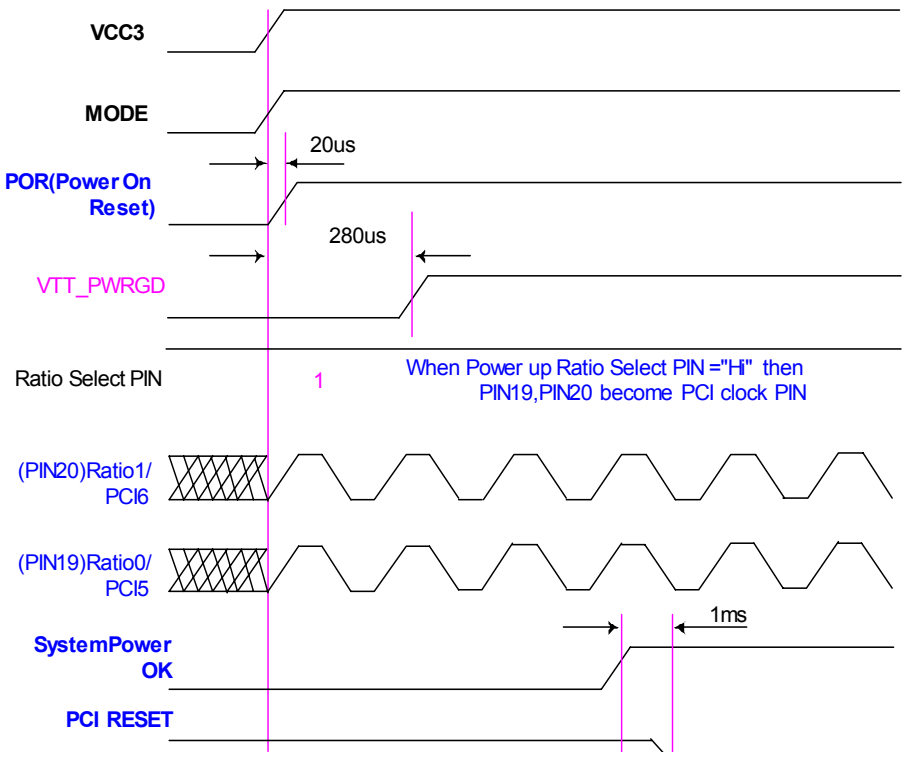


Figure 14. Power on & Ratio PIN switch to PCI clock

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
$Ø_{JC}$	Dissipation, Junction to Case	Mil-Spec 883E Method 1012.1	36.92		°C/W
$Ø_{JA}$	Dissipation, Junction to Ambient	JEDEC (JESD 51)	83.52		°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	Condition	Min.	Max.	Unit
V_{DD}, V_{DDA}	3.3 Operating Voltage	3.3V ± 5%	3.135	3.465	V
V_{ILI2C}	Input Low Voltage	SDATA, SCLK	–	1.0	V
V_{IHI2C}	Input High Voltage	SDATA, SCLK	2.2	–	V
V_{IL}	Input Low Voltage		V_{SS}–0.5	0.8	V

DC Electrical Specifications

Parameter	Description	Condition	Min.	Max.	Unit
V_{IH}	Input High Voltage		2.0	V_{DD}+0. 5	V
I_{IL}	Input Leakage Current	except Pull-ups or Pull downs $0 < V_{IN} < V_{DD}$	–5	5	µA
V_{OL}	Output Low Voltage	I_{OL} = 1 mA	–	0.4	V
V_{OH}	Output High Voltage	I_{OH} = –1 mA	2.4	–	V
I_{OZ}	High-Impedance Output Current		–10	10	µA
C_{IN}	Input Pin Capacitance		2	5	pF
C_{OUT}	Output Pin Capacitance		3	6	pF
L_{IN}	Pin Inductance		–	7	nH
V_{XIH}	Xin High Voltage		$0.7V_{DD}$	V_{DD}	V
V_{XIL}	Xin Low Voltage		0	$0.3V_{DD}$	V
I_{DD}	Dynamic Supply Current	At 200 MHz and all outputs loaded per *Table 8* and *Figure 15*	–	350	mA

AC Electrical Specifications

Parameter	Description	Condition	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 1µs duration	–	500	ps
L_{ACC}	Long Term Accuracy	Over 150 ms		300	ppm
CPU at 0.7V					
T_{DC}	CPUT and CPUC Duty Cycle	Measured at crossing point V_{OX}	38	62	%
T_{PERIOD}	100 MHz CPUT and CPUC Period	Measured at crossing point V_{OX}	9.9970	10.003	ns
T_{PERIOD}	133 MHz CPUT and CPUC Period	Measured at crossing point V_{OX}	7.4978	7.5023	ns
T_{PERIOD}	166 MHz CPUT and CPUC Period	Measured at crossing point V_{OX}	5.9982	6.0018	ns
T_{PERIOD}	200 MHz CPUT and CPUC Period	Measured at crossing point V_{OX}	4.9985	5.0015	ns
T_{SKEW}	Any CPUT/C to CPUT/C Clock Skew	Measured at crossing point V_{OX}	–	±110	ps
T_{CCJ}	CPUT/C Cycle to Cycle Jitter	Measured at crossing point V_{OX}	–	250	ps
T_R / T_F	CPUT and CPUC Rise and Fall Times	Measured from Vol = 0.175 to Voh = 0.525V	175	1300	ps
ΔT_R	Rise Time Variation		–	550	ps
ΔT_F	Fall Time Variation		–	550	ps
V_{HIGH}	Voltage High	Math averages *Figure 15*	660	850	mv
V_{LOW}	Voltage Low	Math averages *Figure 15*	–150	–	mv
V_{OX}	Crossing Point Voltage at 0.7V Swing		200	550	mv
V_{OVS}	Maximum Overshoot Voltage		–	V_{HIGH} + 0.3	V
V_{UDS}	Minimum Undershoot Voltage		–0.3	–	V
V_{RB}	Ring Back Voltage	See *Figure 15*. Measure SE	–	0.2	V
AGP					

AC Electrical Specifications (continued)

Parameter	Description	Condition	Min.	Max.	Unit
T_{DC}	AGP Duty Cycle	Measurement at 1.5V	44	56	%
T_{PERIOD}	Spread Disabled AGP Period	Measurement at 1.5V	14.9955	15.0045	ns
T_{PERIOD}	Spread Enabled AGP Period	Measurement at 1.5V	14.9955	15.0799	ns
T_{HIGH}	AGP High Time	Measurement at 2.0V	4.5000	8.0	ns
T_{LOW}	AGP Low Time	Measurement at 0.8V	4.5000	8.0	ns
T_R / T_F	AGP Rise and Fall Times	Measured between 0.8V and 2.0V	0.5	2.0	ns
T_{SKEW}	Any AGP to Any AGP Clock Skew	Measurement at 1.5V	–	±550	ps
T_{CCJ}	AGP Cycle to Cycle Jitter	Measurement at 1.5V	–	500	ps
PCI/PCIF					
T_{DC}	PCI Duty Cycle	Measurement at 1.5V	45	55	%
T_{PERIOD}	Spread Disabled PCIF/PCI Period	Measurement at 1.5V	29.9910	30.0009	ns
T_{PERIOD}	Spread Enabled PCIF/PCI Period	Measurement at 1.5V	29.9910	30.1598	ns
T_{HIGH}	PCIF and PCI High Time	Measurement at 2.0V	11.0	15.0	ns
T_{LOW}	PCIF and PCI Low Time	Measurement at 0.8V	11.0	15.0	ns
T_R / T_F	PCIF and PCI Rise and Fall Times	Measured between 0.8V and 2.0V	0.5	2.0	ns
T_{SKEW}	Any PCI clock to Any PCI Clock Skew	Measurement at 1.5V	–	±700	ps
T_{CCJ}	PCIF and PCI Cycle to Cycle Jitter	Measurement at 1.5V	–	550	ps
48M					
T_{DC}	Duty Cycle	Measurement at 1.5V	45	55	%
T_{PERIOD}	Period	Measurement at 1.5V	20.8271	20.8396	ns
T_{HIGH}	48 MHz High Time	Measurement at 2.0V	8.000	10.386	ns
T_{LOW}	48 MHz Low Time	Measurement at 0.8V	8.000	10.386	ns
T_R / T_F	Rise and Fall Times	Measured between 0.8V and 2.0V	0.5	1.6	ns
T_{CCJ}	Cycle to Cycle Jitter	Measurement at 1.5V	–	800	ps
T_{SKEW}	Any 48 MHz to 48 MHz clock skew	Measurement @1.5V	–	±100	ps
25M					
T_{DC}	Duty Cycle	Measurement at 1.5V	45	55	%
T_{PERIOD}	Period	Measurement at 1.5V	39.998	40.002	ns
T_{HIGH}	25 MHz High Time	Measurement at 1.5V	17.9999	20.000	ns
T_{LOW}	25 MHz Low Time	Measurement at 1.5V	17.9999	20.000	ns
T_R / T_F	Rise and Fall Times	Measured between 0.8V and 2.0V	0.4	2.0	ns
T_{CCJ}	Cycle to Cycle Jitter	Measurement at 1.5V	–	350	ps
T_{SKEW}	Any 25 MHz to 25 MHz Clock Skew	Measurement @1.5V	–	±100	ps
L_{ACC}	25MHz Long Term Accuracy	Measurement @1.5V	–	50	ppm
REF					
T_{DC}	REF Duty Cycle	Measurement at 1.5V	45	55	%
T_{PERIOD}	REF Period	Measurement at 1.5V	69.827	69.855	ns
T_R / T_F	REF Rise and Fall Times	Measured between 0.8V and 2.0V	0.45	1.8	ns
T_{CCJ}	REF Cycle to Cycle Jitter	Measurement at 1.5V	–	1600	ps
T_{SKEW}	Any REF to REF clock skew	Measurement @1.5V	–	500	ps

AC Electrical Specifications (continued)

Parameter	Description	Condition	Min.	Max.	Unit
ENABLE/DISABLE and SET-UP					
T_{STABLE}	Clock Stabilization from Power-up		–	1.8	ms
T_{SS}	Stopclock Set-up Time		10.0	–	ns
T_{SH}	Stopclock Hold Time		0	–	ns
Special Skew & Jitter Specification Requirement					
CPU to CPU pin to pin Skew	CPU group skew	Measured at crossing point V_{OX}	-100	100	ps
AGP to PCI pin to pin Skew	AGP group to PCI group skew **AGP must leading PCI**	Measurement at 1.5V	1	3	ns

Table 8. Maximum Lumped Capacitive Output Loads

Clock	Max Load	Unit
PCI Clocks	30	pF
AGP Clocks	30	pF
48M Clock	30	pF
25M Clock	30	pF
REF Clock	30	pF

Test and Measurement Set-up

For Differential CPU and SRC Output Signals

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

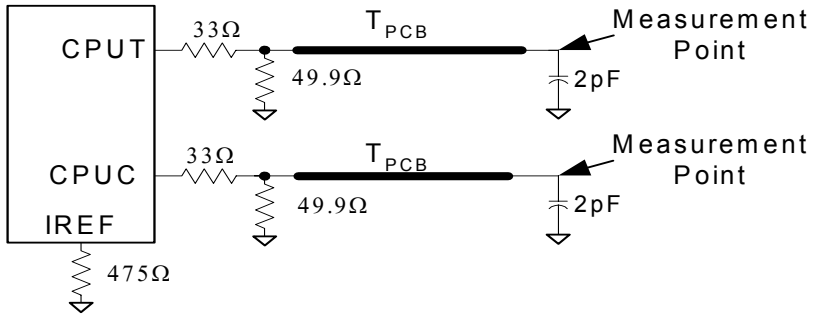


Figure 15. 0.7V Load Configuration

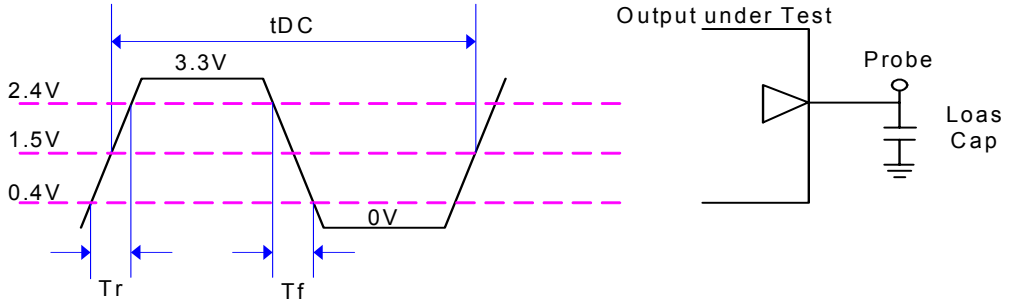


Figure 16. Lumped Load For Single-ended Output Signals (for AC Parameters Measurement)

Table 9. CPU Clock Current Select Function

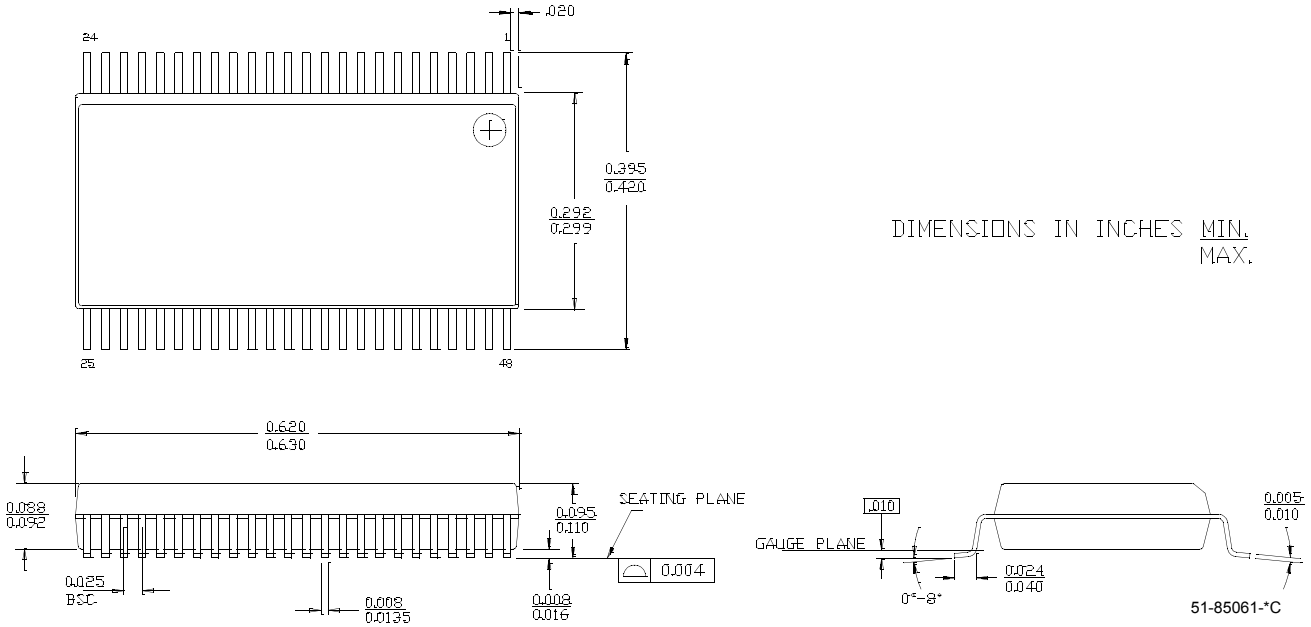
Board Target Trace/Term Z	Reference R, I_{REF} – V_{DD} ($3*R_{REF}$)	Output Current	V_{OH} @ Z
50 Ohms	R_{REF} = 475 1%, I_{REF} = 2.32mA	$I_{OH} = 6*I_{REF}$	0.7V @ 50

Ordering Information

Part Number	Package Type	Product Flow
CY28326OC	48-pin SSOP	Commercial, 0° to 70°C
CY28326OCT	48-pin SSOP – Tape and Reel	Commercial, 0° to 70°C
Lead Free (Planned)		
CY28326OXC	48-pin SSOP	Commercial, 0° to 70°C
CY28326OXCT	48-pin SSOP – Tape and Reel	Commercial, 0° to 70°C

Package Drawing and Dimensions

48-lead Shrunk Small Outline Package O48



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REV.	**ECN NO.**	**Issue Date**	**Orig. of Change**	**Description of Change**
**	224103	See ECN	RGL	New Data Sheet
*A	237729	See ECN	RGL	Updated the AC Electrical Specs based on the characterization result