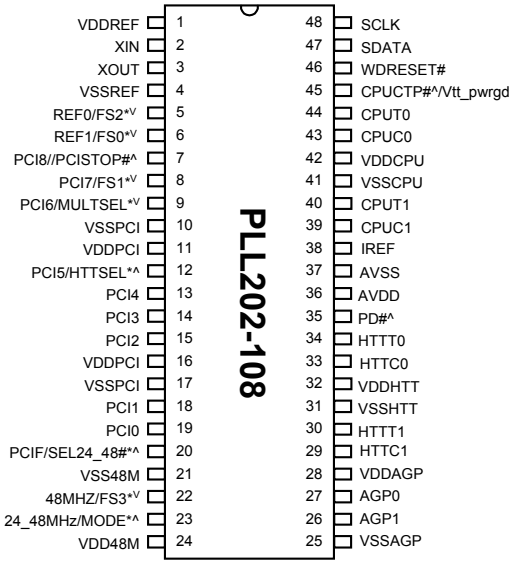
PLL202-108

Programmable Clock Generator for ALI 1681 P4 Chip Sets

FEATURES

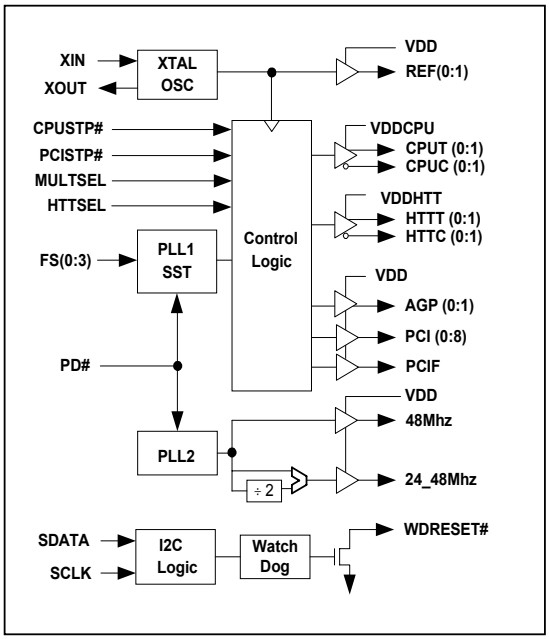
- Supports ALI 1681 Pentium 4 Chipsets.
- Programmable Spread Spectrum Modulation from ±0.1% to ±1.5% with step size as small as ±0.012%.
- Selectable Spread Spectrum either center or down.
- Selectable Spread Spectrum modulation profile.
- AccuSkew™, Programmable Precision skew tuning channel with maximum ±5% precision over the variation of temperature, process and voltage with step size as small as 80ps.
- AccuDrive™ Programmable Output Buffer drive strength with up to +50% or –40%.
- Programmable VCO frequency with one variable
- Programmable Output Divider for CPU, HTT, AGP and PCI.
- 2 differential CPUCLK and HTT CLK, 2 AGP, 9 PCI, 1 USB and 2 REF clock outputs.
- 1 programmable 24MHz or 48MHz for SIO.
- Support 2-wire I2C serial bus interface.
- Built-in programmable watchdog timer
- Available in 300 mil 48 pin SSOP.

PIN CONFIGURATION



Note: ^: Pull Up (120kΩ), V: Pull down (120kΩ), **#**: Active low, *: Bi-directional latched at power-up

BLOCK DIAGRAM



POWER GROUP

- VDDREF (3.3V), VSSREF: REF, XIN, XOUT
- VDDPCI (3.3V), VSSPCI: PCI
- VDDAGP (3.3V), VSSAGP: AGP
- VDD48M (3.3V), VSS48M: 48MHz, 24_48MHz
- VDDCPU (3.3V), VSSCPU: CPUT/C[0:1]
- VDDHTT (3.3V), VSSHTT: HTTT/C[0:1]
- AVDD (3.3V), AVSS: PLL Analog

KEY SPECIFICATIONS

- CPU - CPU Output Skew < 150ps.
- AGP - AGP Output Skew < 150ps
- PCI - PCI Output Skew < 500ps
- CPU (early) to PCI Skew: 1.5 to 2.5 ns (typ 2ns).
- AGP (early) to PCI Skew: 1.5 to 2.5 ns (typ 2ns).
- CPU to HTT Skew < 150ps.
- CPU to AGP Skew < 150ps.
- CPU outputs cycle to cycle jitter < 150ps.
- PCI outputs cycle to cycle jitter < 250ps.
- AGP outputs cycle to cycle jitter < 250ps.
- 48MHz outputs cycle to cycle jitter < 350ps.

PIN DESCRIPTIONS

Name	Number	Type	Description
XIN	2	I	14.318Mhz crystal input to be connected to one end of the crystal
XOUT	3	O	14.318Mhz crystal output
REF[0:1]/FS[0,2]	5,6	B	14.318Mhz Reference clock output. This pin latch FS[0,2] value at power-up. (See Frequency Selection table). It has an internal pull down resistor.
CPUSTP#/Vtt_Pwrgd	45	I	At power-up, this pin is the input of Vtt_PWRGD After the first high to low, this pin acts as CPU_STOP to disable all CPU clock outputs including when Low. When Vtt_PWRGD input is high, FS (0:3), MULTSEL, HTTSEL and MODE inputs are latched and all outputs are enabled. It has 120K ohm internal pull up resistor.
AGP[0:1]	26,27	O	AGP clock output (see Frequency table).
HTT[C/T]_[0:1]	29,30, 33,34	O	Differential pair output for Hyper Transport output clocks
WDRESET	46	O	Watch Dog reset signal will be generated after watchdog timer expires if I2C Enable bit (Byte9.bit7) is set active
PCI[0:4]	13,14,15, 18,19	O	PCI clock output (see Frequency table).
PCI5/HTTSEL	12	B	This pin latches the HTTSEL value at power-up. After power-up, this pin acts as PCI clock output. HTTSEL is used to select the current multiplier for the HTT outputs. If HTTSEL=0, IOH=8XIREF. If HTTSEL=1, IOH=9XIREF. It has an internal pull-up resistor.
PCI6/MULTSEL	9	B	This pin latches the MULTSEL value at power-up. After power-up, this pin acts as PCI clock output. MULTSEL is used to select the current multiplier for the CPU outputs. If MULTSEL=0, IOH=6XIREF. If MULTSEL=1, IOH=7XIREF. It has an internal pull-down resistor.
PCI7/FS1	8	B	Bi-directional pin. At power-up, the FS1 input value is latched. After power-up, this pin acts as PCI7 output. It has an internal pull-down resistor.
PCI8//PCI_STOP#	7	B	When MODE=1 (pin23), this pin acts as PCI_STOP input to stop all PCI clock outputs except PCIF when low. When MODE is low, this pin will acts as PCI clock output. It has 120K ohm internal pull up resistor.
PCIF/SEL24_48#	20	B	This pin latches SEL24_48 value at power up. After power-up, this pin acts as PCIF clock output. SEL24_48=1, select 24Mhz. SEL24_48=0 select 48Mhz. It has 120K ohm internal pull up resistor.
CPU[C/T]_0	39,40	O	Differential pair output for CPU Host.
CPU[C/T]_1	43,44	O	Differential pair output for CPU Chip Sets.
24_48MHz/MODE	23	B	This pin latches the MODE value at power-up. After power-up, this pin acts as 24_48MHz clock output with default 24MHz or selection by I2C. MODE function is to select mobile or desktop mode for pin 7. It has 120K ohm internal pull up resistor.

PIN DESCRIPTIONS (Continue)

Name	Number	Type	Description
48MHz/FS3	22	B	At power-up, the FS3 input value is latched. After power-up, this pin acts as USB output. It has an internal pull-down resistor.
Iref	38	O	This pin establishes the reference current for the CPU and HTT differential pairs, it requires a fixed precision resistor tied to ground in order to establish the appropriate current.
SDATA	47	B	Serial data inputs for serial interface port.
SCLK	48	I	Serial data inputs for serial interface port.
VDDPCI	11,16	P	3.3V Power Supply for PCIF, PCI[0:8] clock
VDDAGP	28	P	3.3V Power Supply for AGP clock.
VDDHTT	32	P	3.3V Power Supply for HTT clock.
VDD48M	24	P	3.3V Power Supply for 48MHz and 24_48MHz clock
AVDD	36	P	3.3V power for internal PLL.
VDDCPU	42	P	3.3v power supply for CPU[T,C]_[0:1] clocks.
VDDREF	1	P	3.3v power supply for REF[0:2] clocks
VSS	4,10,17,21,25,31,37,41,	P	Ground.

HOST SWING SELECT FUNCTIONS

MULTISEL0	Board Target Trace/Term Z	Reference R (Rr) I_{ref} = VDD/(3*Rr)	Output Current	V_{oh} @ Z
0	50Ω	Rr = 221Ω; 1% Iref = 5.0mA	I_{oh} = 6*IREF	1.0V @ 50Ω
1	50Ω	Rr = 475Ω; 1% Iref = 2.32 mA	I_{oh} = 7*IREF	0.7V @ 50Ω

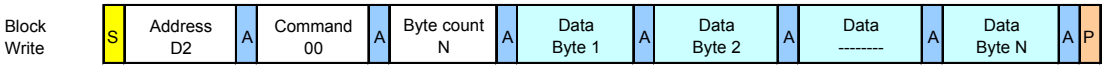
FREQUENCY (MHz) SELECTION TABLE

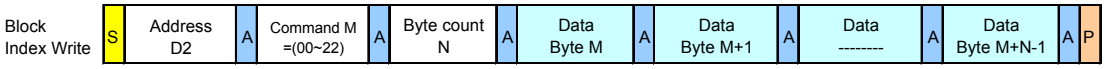
FS4	FS3	FS2	FS1	FS0	CPU	AGP	HTT	PCI	SST Amplitude	VCO	α (CPU)	N
0	0	0	0	0	100.00	66.67	33.33	33.33	-0.5% down	400	0.45	14,286
0	0	0	0	1	133.33	66.67	33.33	33.33	-0.5% down	400	0.60	14,286
0	0	0	1	0	200.00	66.67	33.33	33.33	-0.5% down	400	0.90	14,286
0	0	0	1	1	166.67	66.67	33.33	33.33	-0.5% down	333	0.90	11,905
0	0	1	0	0	66.67	66.67	33.33	33.33	±0.3% center	400	0.30	14,286
0	0	1	0	1	90.00	60.00	30.00	30.00	±0.3% center	360	0.45	12,857
0	0	1	1	0	105.00	70.00	35.00	35.00	±0.3% center	420	0.45	15,000
0	0	1	1	1	165.00	55.00	27.50	27.50	±0.3% center	330	0.90	11,786
0	1	0	0	0	101.00	67.33	33.67	33.67	±0.3% center	404	0.45	14,429
0	1	0	0	1	134.67	67.33	33.67	33.67	±0.3% center	404	0.60	14,429
0	1	0	1	0	202.00	67.33	33.67	33.67	±0.3% center	404	0.90	14,429
0	1	0	1	1	168.33	67.33	33.67	33.67	±0.3% center	337	0.90	12,024
0	1	1	0	0	103.00	68.67	34.33	34.33	±0.3% center	412	0.45	14,714
0	1	1	0	1	137.33	68.67	34.33	34.33	±0.3% center	412	0.60	14,714
0	1	1	1	0	206.00	68.67	34.33	34.33	±0.3% center	412	0.90	14,714
0	1	1	1	1	171.67	68.67	34.33	34.33	±0.3% center	343	0.90	12,262
1	0	0	0	0	105.00	70.00	35.00	35.00	±0.3% center	420	0.45	15,000
1	0	0	0	1	140.00	70.00	35.00	35.00	±0.3% center	420	0.60	15,000
1	0	0	1	0	210.00	70.00	35.00	35.00	±0.3% center	420	0.90	15,000
1	0	0	1	1	175.00	70.00	35.00	35.00	±0.3% center	350	0.90	12,500
1	0	1	0	0	107.00	71.33	35.67	35.67	±0.3% center	428	0.45	15,286
1	0	1	0	1	142.67	71.33	35.67	35.67	±0.3% center	428	0.60	15,286
1	0	1	1	0	214.00	71.33	35.67	35.67	±0.3% center	428	0.90	15,286
1	0	1	1	1	178.35	71.34	35.67	35.67	±0.3% center	357	0.90	12,739
1	1	0	0	0	110.00	73.33	36.67	36.67	±0.3% center	440	0.45	15,714
1	1	0	0	1	146.67	73.33	36.67	36.67	±0.3% center	440	0.60	15,714
1	1	0	1	0	220.00	73.33	36.67	36.67	±0.3% center	440	0.90	15,714
1	1	0	1	1	183.35	73.34	36.67	36.67	±0.3% center	367	0.90	13,096
1	1	1	0	0	113.00	75.33	37.67	37.67	±0.3% center	452	0.45	16,143
1	1	1	0	1	150.67	75.33	37.67	37.67	±0.3% center	452	0.60	16,143
1	1	1	1	0	226.00	75.33	37.67	37.67	±0.3% center	452	0.90	16,143
1	1	1	1	1	188.35	75.34	37.67	37.67	±0.3% center	377	0.90	13,454

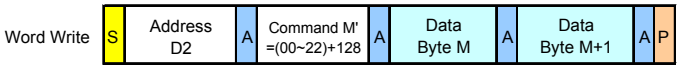
I2C BUS CONFIGURATION SETTING

Address Assignment	A6	A5	A4	A3	A2	A1	A0	R/W
	1	1	0	1	0	0	1	_
Slave Receiver/Transmitter	Provides both slave write and readback functionality							
Data Transfer Rate	Standard mode at 100kbits/s							
Data Protocol	This serial interface is designed to allow multiple protocols to write and read from the controller. It includes Block Read/Write, Block Index Read/Write, Byte Read/Write and Word Read/Write. In general, the bytes must be accessed in sequential order from lowest to highest byte. Each byte transferred must be followed by 1 acknowledge bit. A byte transferred without acknowledged bit will terminate the transfer. The write or read block both begins with the master sending a slave address and a write condition (0xD2) or a read condition (0xD3).							

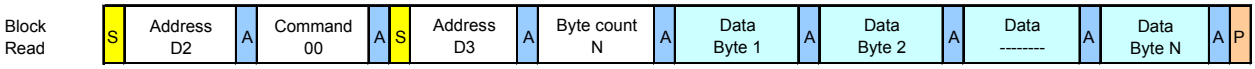
WRITE MODE

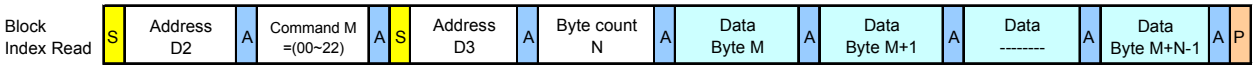


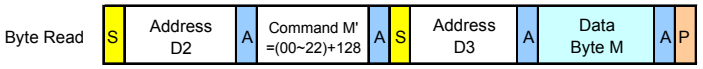


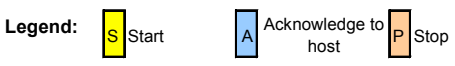


READ MODE









I2C CONTROL REGISTERS

1. BYTE 0: Functional and Frequency Select Clock Register (1=Enable, 0=Disable)

Bit	Pin#	Default	Description
Bit 7	22	Power-up Latched FS3:FS0 value	FS3
Bit 6	5		FS2
Bit 5	8		FS1
Bit 4	6		FS0
Bit 3	-	0	Frequency selection bit 1=Via I2C, 0=Via External jumper
Bit 2	-	0	FS4
Bit 1	-	1	0=normal, 1= Spread Spectrum Enable
Bit 0	-	0	(Reserved)

2. BYTE 1: Control Register (1=Enable, 0=Disable)

Bit	Pin#	Default	Description
Bit 7	26	1	AGP1 (1=Active 0=Inactive)
Bit 6	27	1	AGP0 (1=Active 0=Inactive)
Bit 5	23	1	24_48MHz (1=Active, 0=Inactive)
Bit 4	22	1	48MHz (1=Active, 0=Inactive)
Bit 3	22	X	Inverted Power-up latched FS3 value (Read only)
Bit 2	5	X	Inverted Power-up latched FS2 value (Read only)
Bit 1	8	X	Inverted Power-up latched FS1 value (Read only)
Bit 0	6	X	Inverted Power-up latched FS0 value (Read only)

3. BYTE 2: Control Register (1=Enable, 0=Disable)

Bit	Pin#	Default	Description
Bit 7	43,44	1	CPU_STOP# setting for CPU[C/T]_0 (0=Free Running, 1=Stopped)
Bit 6	39,40	1	CPU_STOP# setting for CPU[C/T]_1 (0=Free Running, 1=Stopped)
Bit 5	27	1	CPU_STOP# setting for AGP0 (0=Free Running, 1=Stopped)
Bit 4	26	1	CPU_STOP# setting for AGP1 (0=Free Running, 1=Stopped)
Bit 3	33,34	1	CPU_STOP# setting for HTT[C/T]_0 (0=Free Running, 1=Stopped)
Bit 2	29,30	1	CPU_STOP# setting for HTT[C/T]_1 (0=Free Running, 1=Stopped)
Bit 1	43,44	1	CPU[C/T]_0 (1=Active 0=Inactive)
Bit 0	39,40	1	CPU[C/T]_1 (1=Active 0=Inactive)

4. BYTE 3: PCI Clock Register (1=Enable, 0=Disable)

Bit	Pin#	Default	Description
Bit 7	20	0	PCI_STOP# setting for PCIF (0=Free Running, 1=Stopped)
Bit 6	19	1	PCI_STOP# setting for PCI0 (0=Free Running, 1=Stopped)
Bit 5	18	1	PCI_STOP# setting for PCI1 (0=Free Running, 1=Stopped)
Bit 4	15	1	PCI_STOP# setting for PCI2 (0=Free Running, 1=Stopped)
Bit 3	14	1	PCI_STOP# setting for PCI3 (0=Free Running, 1=Stopped)
Bit 2	13	1	PCI_STOP# setting for PCI4 (0=Free Running, 1=Stopped)
Bit 1	12	1	PCI_STOP# setting for PCI5 (0=Free Running, 1=Stopped)
Bit 0	9	1	PCI_STOP# setting for PCI6 (0=Free Running, 1=Stopped)

5. BYTE 4: Vendor ID and Revision ID Register

Bit	Pin#	Default	Description
Bit 7	20	1	PCIF (1=Active 0=Inactive)
Bit 6	19	1	PCI0 (1=Active 0=Inactive)
Bit 5	18	1	PCI1 (1=Active 0=Inactive)
Bit 4	15	1	PCI2 (1=Active 0=Inactive)
Bit 3	14	1	PCI3 (1=Active 0=Inactive)
Bit 2	13	1	PCI4 (1=Active 0=Inactive)
Bit 1	12	1	PCI5 (1=Active 0=Inactive)
Bit 0	9	1	PCI6 (1=Active 0=Inactive)

6. BYTE 5: Output Control Register

Bit	Pin#	Default	Description
Bit 7	8	1	PCI7 (1=Active 0=Inactive)
Bit 6	7	1	PCI8 (1=Active 0=Inactive)
Bit 5	33,34	1	HTT[C/T]0 (1=Active, 0=Inactive)
Bit 4	29,30	1	HTT[C/T]1 (1=Active, 0=Inactive)
Bit 3	-	1	(Reserved)
Bit 2	-	1	(Reserved)
Bit 1	6	1	REF1 (1=Active, 0=Inactive)
Bit 0	5	1	REF0 (1=Active, 0=Inactive)

7. BYTE 6: Control Register (1=Enable, 0=Disable)

Bit	Pin#	Default	Description
Bit 7	-	0	Vendor ID Bit 3 (read only)
Bit 6	-	0	Vendor ID Bit 2 (read only)
Bit 5	-	1	Vendor ID Bit 1 (read only)
Bit 4	-	1	Vendor ID Bit 0 (read only)
Bit 3	-	0	Revision ID Bit 3 (read only)
Bit 2	-	0	Revision ID Bit 2 (read only)
Bit 1	-	0	Revision ID Bit 1 (read only)
Bit 0	-	0	Revision ID Bit 0 (read only)

8. BYTE 7: Linear Programming Register (1=Enable, 0=Disable)

Bit	Pin#	Default	Description
Bit 7	-	0	Linear programming sign bit (0 is “+”, 1 is “–”)
Bit 6	-	0	Linear programming magnitude bit 6 (MSB)
Bit 5	-	0	Linear programming magnitude bit 5
Bit 4	-	0	Linear programming magnitude bit 4
Bit 3	-	0	Linear programming magnitude bit 3
Bit 2	-	0	Linear programming magnitude bit 2
Bit 1	-	0	Linear programming magnitude bit 1
Bit 0	-	0	Linear programming magnitude bit 0 (LSB)

9. BYTE 8: WATCHDOG Fall Back Register (1=Enable, 0=Disable)

Bit	Pin#	Default	Description
Bit 7	-	0	Watchdog Timer Unit Bit[7:6]: 00 = 250 ms, 01 = 500ms, 10 = 1s, 11 = 4s
Bit 6	-	0	
Bit 5	-	0	Initialization setting for Linear Programming Byte after Watch dog reset. 0= Byte 7 initialized to 0 after WD-Reset generated. 1= Byte 7 unchanged after WD-Reset generated.
Bit 4	-	0	WDT Fall-back Frequency selection for FS4
Bit 3	-	0	WDT Fall-back Frequency selection for FS3
Bit 2	-	0	WDT Fall-back Frequency selection for FS2
Bit 1	-	0	WDT Fall-back Frequency selection for FS1
Bit 0	-	0	WDT Fall-back Frequency selection for FS0

10. BYTE 9: WATCHDOG TIMER Register (1=Enable, 0=Disable)

Bit	Name	Default	Description
Bit 7	WDT ENB	0	Watchdog Timer Enable Bit. 1=Enable, 0=Disable
Bit 6	-	0	0=Watch Dog falls back to hardware jumper setting frequency 1=Watch Dog falls back to fall back frequency setting in Byte 8.
Bit 5	WDT<5>	0	Watchdog Time Interval Bit 5 (MSB)
Bit 4	WDT<4>	0	Watchdog Time Interval Bit 4
Bit 3	WDT<3>	0	Watchdog Time Interval Bit 3
Bit 2	WDT<2>	0	Watchdog Time Interval Bit 2
Bit 1	WDT<1>	0	Watchdog Time Interval Bit 1
Bit 0	WDT<0>	0	Watchdog Time Interval Bit 0 (LSB)

11. BYTE 10: Programming Mode Counter Register (1=Enable, 0=Disable)

Bit	Name	Default	Description
Bit 7	AccuSkew Enable	0	AccuSkew Setting for ± 5% process independent accuracy. 1=enable, 0=disable.
Bit 6	-	0	Initialization setting for Skew Control and Buffer drive strength registers after Watch dog reset. 0= Byte 12~17 initialized to 0 after WD-Reset generated. 1= Byte 12~17 unchanged after WD-Reset generated.
Bit 5	WDT Status	0	Watch Dog Timer Status info (read only)
Bit 4			
Bit 3	SST Profile	0	0= linear, 1= non-linear
Bit 2	Accu-SST Enable	0	Accu-SST programming Enable: 1= via I2C Byte11, 0= via ROM setting
Bit 1	Skew Enable	0	Enable Skew programming (byte12~14). 1=enable, 0=disable
Bit 0	VCO-N Enable	0	Enable VCO-N Counter programming (byte21~22) 1= programming through setting I2C byte 21~22 0= programming through Frequency ROM setting

12. BYTE 11: Spread Spectrum Modulation Amplitude Programming Register:

Bit	NAME	Default	Description
Bit 7	-	1	Spread Spectrum mode selection. 1=Center Spread, 0= Down Spread
Bit 6	SST6	1	1. Center Spread: SST<6:0> = Modulation rate * N /7 2. Down Spread: SST<6:0> = Modulation rate * N /14
Bit 5	SST5	1	
Bit 4	SST4	1	
Bit 3	SST3	1	
Bit 2	SST2	1	
Bit 1	SST1	1	
Bit 0	SST0	1	

TABLE 1: Output Signals SKEW Programming Summary:

Bit<2:0>	Skew Setting I (±80ps/step)		Skew Setting II (±160ps/step)	
111	+320ps	Setting applies to the following outputs: 1. CPU0 2. CPU1	+640ps	Setting applies to the following outputs: 1. HTT 2. AGP 3. All PCI
110	+240ps		+480ps	
101	+160ps		+320ps	
100	+80ps		+160ps	
011	**Default**		**Default**	
010	-80ps		-160ps	
001	-160ps		-320ps	
000	-240ps		-480ps	

13. Byte 12: SKEW Control Register

Bit	Name		Default	Description
Bit 7	-		0	Reserved.
Bit 6	-		0	Reserved.
Bit 5	Skew CPU0	Bit <2>	0	These three bits will adjust timing of CPU_Host signals (CPUT_0/CPUC_0) either positive or negative delay up to +320ps or –240ps with ±80ps per step and ± 5% accuracy.
Bit 4		Bit <1>	1	
Bit 3		Bit <0>	1	
Bit 2	Skew CPU1	Bit <2>	0	These three bits will adjust timing of CPU_chip_sets signals (CPUT_1/CPUC_1) either positive or negative delay up to +320ps or –240ps with ±80ps per step and ± 5% accuracy.
Bit 1		Bit <1>	1	
Bit 0		Bit <0>	1	

14. Byte 13: SKEW Control Register

Bit	Name		Default	Description
Bit 7	CPU-PCI Skew		1	Skew setting between CPU and PCI clocks Bit[7:6]: 00 = 0.5 ns, 01 = 1.3 ns, 10 = 2 ns (default) 11 = 2.5ns
Bit 6			0	
Bit 5	Skew HTT0	Bit <2>	0	These three bits will adjust timing of HTTT_0/HTTC_0 signal either positive or negative delay up to +640ps or –480ps with ±160ps per step and ± 5% accuracy.
Bit 4		Bit <1>	1	
Bit 3		Bit <0>	1	
Bit 2	Skew HTT1	Bit <2>	0	These three bits will adjust timing of HTTT_1/HTTC_1 clock signals either positive or negative delay up to +640ps or –480ps with ±160ps per step and ± 5% accuracy.
Bit 1		Bit <1>	1	
Bit 0		Bit <0>	1	

15. Byte 14: SKEW Control Register

Bit	Name		Default	Description
Bit 7	-		0	Reserved.
Bit 6	-		0	Reserved.
Bit 5	Skew AGP	Bit <2>	0	These three bits will adjust timing of AGP0 and AGP1 clock signals either positive or negative delay up to +640ps or –480ps with ±160ps per step and ± 5% accuracy.
Bit 4		Bit <1>	1	
Bit 3		Bit <0>	1	
Bit 2	Skew PCI	Bit <2>	0	These three bits will adjust timing of all PCI clock signals either positive or negative delay up to +640ps or –480ps with ±160ps per step and ± 5% accuracy.
Bit 1		Bit <1>	1	
Bit 0		Bit <0>	1	

TABLE 2: Output Drive Strength Programming Summary:

Bit<2:0>	Setting I		Setting II	
111	+40%	Setting applies to the following outputs 1. AGP[0:1] 2. 48M, 24_48MHz	+50%	Setting applies to the following outputs 1. PCIF,PCI[5:8] 2. PCI[0:4] 3. REF[0:1]
110	+30%		+38%	
101	+20%		+25%	
100	+10%		+13%	
011	**Default**		**Default**	
010	-10%		-13%	
001	-20%		-25%	
000	-30%		-38%	

16. Byte 15: Buffer Drive Strength Control Register

Bit	Name		Default	Description
Bit 7	-		0	Reserved.
Bit 6	-		0	Reserved.
Bit 5	-		0	Reserved.
Bit 4	-		0	Reserved.
Bit 3	-		0	Reserved.
Bit 2	AGP Strength	Bit <2>	0	These three bits will program drive strength for all AGP clocks output clock (see Table 2).
Bit 1		Bit <1>	1	
Bit 0		Bit <0>	1	

17. Byte 16: Buffer Drive Strength Control Register

Bit	Name		Default	Description
Bit 7	-		0	Reserved.
Bit 6	-		0	Reserved.
Bit 5	USB Strength	Bit <2>	0	These three bits will program drive strength for 48MHz and 24_48MHz output clocks (see Table 2).
Bit 4		Bit <1>	1	
Bit 3		Bit <0>	1	
Bit 2	PCIF, PCI[5:8] Strength	Bit <2>	0	These three bits will program drive strength for PCIF and PCI[5:8] output clocks (see Table 2).
Bit 1		Bit <1>	1	
Bit 0		Bit <0>	1	

18. Byte 17: Buffer Drive Strength Control Register

Bit	Name		Default	Description
Bit 7	-		0	Reserved.
Bit 6	-		0	Reserved.
Bit 5	PCI[0:4] Strength	Bit <2>	0	These three bits will program drive strength for PCI[0:4] output clocks (see Table 2).
Bit 4		Bit <1>	1	
Bit 3		Bit <0>	1	
Bit 2	REF Strength	Bit <2>	0	These three bits will program drive strength for REF[0:1] output clocks (see Table 2).
Bit 1		Bit <1>	1	
Bit 0		Bit <0>	1	

TABLE 3: VCO Divider Programming Summary:

Bit<3:0>	High Speed Divider		Mid Speed Divider		Low Speed Divider	
1111	Default ROM Selection	1. CPU0 2. CPU1	Default ROM Selection	1. AGP[0:1]	Default ROM Selection	1. PCIF,PCI 2. HTT
1110	N/A		N/A		N/A	
1101						
1100			/15		/30	
1011	/14		/14		N/A	
1010	/16		/16		/32	
1001	/12		/12		/24	
1000	/10		/10		/20	
0111	N/A		N/A		N/A	
0110	/4		/4		/8	
0101	/3		/3		/6	
0100	/2		/7.5		/15	
0011	/7		/7		/14	
0010	/8		/8		/16	
0001	/6		/6		/12	
0000	/5		/5		/10	

19. Byte 18: VCO Divider Control Register

Bit	Name		Default	Description
Bit 7	CPU-Host Divider -	Bit <3>	1	These four bits will program VCO divider for CPUT_0 and CPUC_0 clocks (see Table 3).
Bit 6		Bit <2>	1	
Bit 5		Bit <1>	1	
Bit 4		Bit <0>	1	
Bit 3	CPU-CS Divider	Bit <3>	1	These four bits will program VCO divider for CPUC_1 and CPUT_1 clocks (see Table 3).
Bit 2		Bit <2>	1	
Bit 1		Bit <1>	1	
Bit 0		Bit <0>	1	

20. Byte 19: VCO Divider Control Register

Bit	Name		Default	Description
Bit 7	PCI Divider	Bit <3>	1	These four bits will program VCO divider for all PCI clocks (see Table 3).
Bit 6		Bit <2>	1	
Bit 5		Bit <1>	1	
Bit 4		Bit <0>	1	
Bit 3	AGP Divider	Bit <3>	1	These four bits will program VCO divider for all AGP clocks (see Table 3).
Bit 2		Bit <2>	1	
Bit 1		Bit <1>	1	
Bit 0		Bit <0>	1	

21. Byte 20: VCO Divider Control Register

Bit	Name		Default	Description
Bit 7	-		1	(Reserved)
Bit 6	-		1	
Bit 5	-		1	
Bit 4	-		1	
Bit 3	HTT Divider	Bit <3>	1	These four bits will program VCO divider all AGP clocks (see Table 3).
Bit 2		Bit <2>	1	
Bit 1		Bit <1>	1	
Bit 0		Bit <0>	1	

22. BYTE 21: VCO N Counter Register:

Bit	Name	Default	Description
Bit 7	N<15>	1	VCO(MHz)= N<15:0> * 14.318/ 512
Bit 6	N<14>	1	
Bit 5	N<13>	1	
Bit 4	N<12>	1	
Bit 3	N<11>	1	
Bit 2	N<10>	1	
Bit 1	N<9>	1	
Bit 0	N<8>	1	

22. BYTE 22: VCO N Counter Register

Bit	Name	Default	Description
Bit 7	N<7>	1	VCO(MHz)= N<15:0> * 14.318/ 512
Bit 6	N<6>	1	
Bit 5	N<5>	1	
Bit 4	N<4>	1	
Bit 3	N<3>	1	
Bit 2	N<2>	1	
Bit 1	N<1>	1	
Bit 0	N<0>	1	

PROGRAMMING OF CPU FREQUENCY

To simplify traditional loop counter setting, the PLL202-108 device incorporates SMART-BYTE ™ and AccuVCO technology with one single variable programming via I2C. Detail of PLL202-108's tri-mode frequency programming method is described below:

1. **ROM-table Frequency Programming:**

   The pre-defined 32 frequencies found in Frequency table can be accessed through external jumpers or 5 bits I2C setting.

2. **Micro-step Linear Frequency Programming:**

   CPU Frequency can be programmed via I2C in fine and linear positive or negative stepping around selected CPU frequency in Frequency table. The highest step is either +127 or -127. Other bus frequencies will be changed proportionally with the rate that CPU frequency changes.

$$F_{CPU} = F_{CPU.ROM\text{-}Table} \pm \alpha * M$$

Where:
1. M is a magnitude factor defined in I2C Byte 7.bit (0:6)
2. ± (sign bit) of M is defined in I2C Byte7.bit 7
3. α is defined in Frequency table or = 1.79/(VCO_Divider).

3. **VCO Frequency Programming:**

   Internal VCO frequency is defined as the function of N times a fixed constant of 0.028.

$$F_{VCO} = N * 0.028$$

Where:
1. F_{VCO} is limited in the range between 200(Mhz) to 1200(Mhz).
2. N (counter) is defined in I2C byte 21,22

Programmable VCO divider via I2C in Table 3 or pre-defined VCO divider in Frequency table will then determine the output CPU Frequency. Other bus frequencies will be changed proportionally with the rate that CPU frequency changes. The formula is as follow:

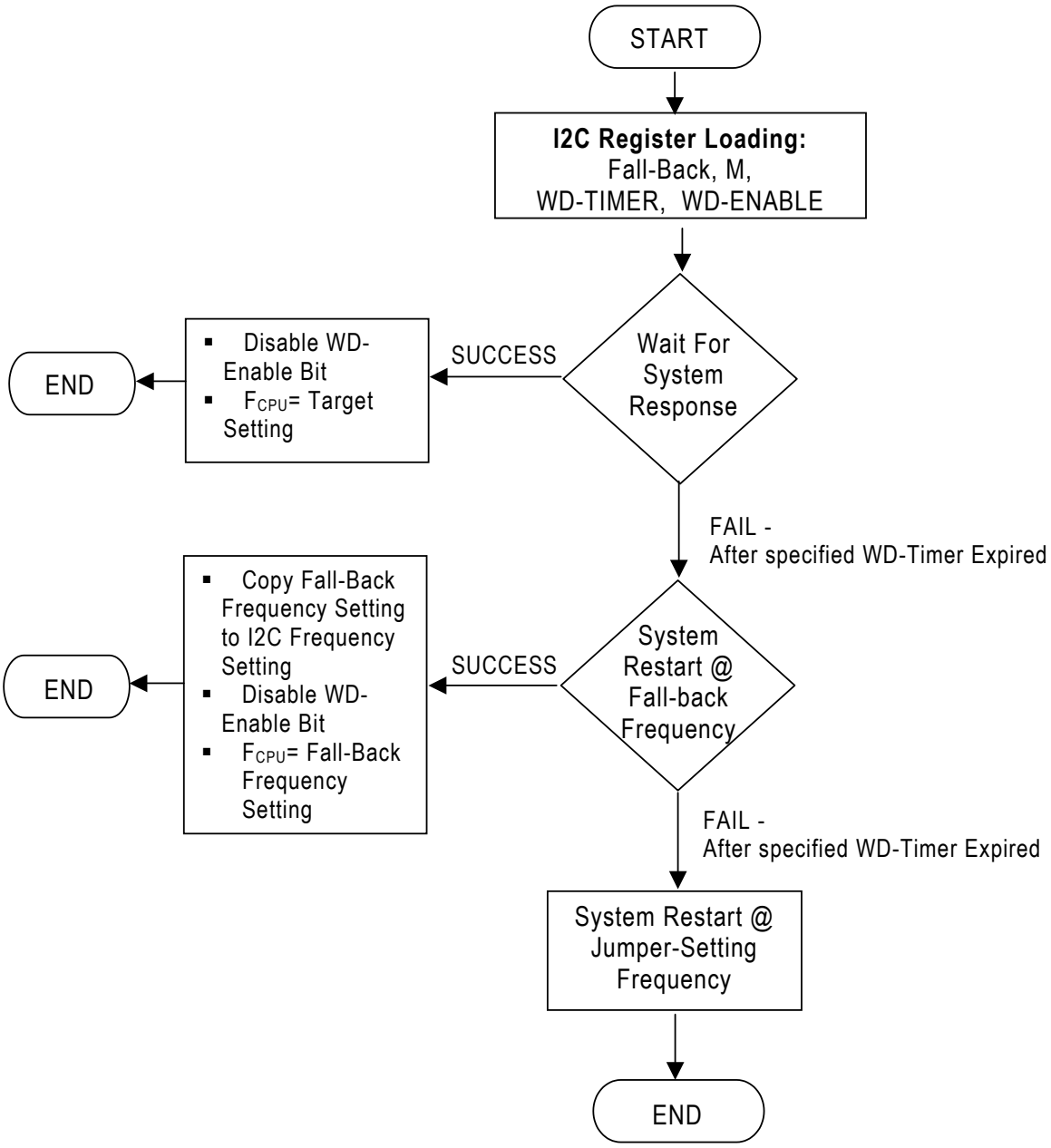
$$F_{CPU} = F_{VCO} \div VCO\_divider$$

Where:
1. VCO_divider is either predefined by frequency table or through I2C Byte 18-20

BUILT-IN WATCHDOG TIMER (WDT)

Watchdog timer is used to perform safe recovery if frequency switching causes system to enter into "Hang-up" state within a reasonable period of time (or Watchdog time interval). While disabled, the watchdog time interval can be programmed between 250ms and 256 seconds by setting the timer unit and timer interval. Once Enabled, WDT has to be disabled within a period that is shorter than the programmed watchdog interval; otherwise WDT will generate a 500ms low watchdog reset pulse to provoke a system reset. After system restarts, the PLL202-108 will start from predefined Fall-back Frequency if system for any reason fails again at Fall-back Frequency, the internal hardware will then generate a watchdog reset to restart the system from the value of external hardware jumper setting to ensure a safe recovery.

WDT OPERATIONAL FLOW CHART



ELECTRICAL SPECIFICATIONS

1. Absolute Maximum Ratings

PARAMETERS	SYMBOL	MIN.	MAX.	UNITS
Supply Voltage	V_{DD}	V_{SS}-0.5	7	V
Input Voltage, dc	V_I	V_{SS}-0.5	V_{DD}+0.5	V
Output Voltage, dc	V_O	V_{SS}-0.5	V_{DD}+0.5	V
Storage Temperature	T_S	-65	150	°C
Ambient Operating Temperature	T_A	0	70	°C
Junction Temperature	T_J		115	°C
ESD Voltage			2	KV

Exposure of the device under conditions beyond the limits specified by Maximum Ratings for extended periods may cause permanent damage to the device and affect product reliability. These conditions represent a stress rating only, and functional operations of the device at these or any other conditions above the operational limits noted in this specification is not implied.

2. DC/AC Electrical Specifications

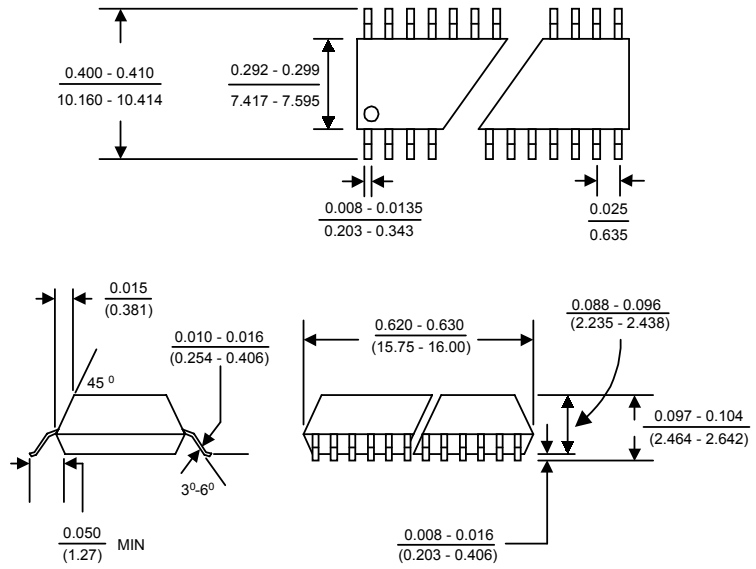
PARAMETERS	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS
Input High Voltage	V_{IH}	All Inputs except XIN	2		V_{DD}+0.3	V
Input Low Voltage	V_{IL}	All inputs except XIN	V_{SS}-0.3		0.8	V
Input High Current	I_{IH}	$V_{IN} = V_{DD}$			5	uA
Input Low Current	I_{IL1}	V_{IN}=0 with no pull-up resistor	-5			uA
Input Low Current	I_{IL2}	V_{IN}=0 with pull-up resistor	-200			
Supply Current	I_{DD}	C_L=0 pF@66MHz, 3.3V±5%			180	mA
	I_{DDL}	C_L=0 pF@133MHz, 3.3V±5%				
	I_{DD}	C_L=0 pF@66MHz, 2.5V±5%			72	
	I_{DDL}	C_L=0 pF@133MHz, 2.5V±5%			100	
Transition Time	T_{trans}	To 1st crossing of target Freq.			3	ms
Input frequency	F_I	V_{DD} = 3.3V	12	14.318	16	MHz
Input Capacitance	C_{IN}	Logic Inputs			5	pF
	C_{INX}	XIN & XOUT pins	27	28	45	pF

2. DC/AC Electrical Specifications (continued)

Unless otherwise stated, all power supplies = 3.3V±5%, and ambient temperature range T_A= 0°C to 70°C

PARAMETERS	SYMBOL	OUTPUTS	CONDITIONS	MIN.	TYP.	MAX.	UNITS
Output Rise time	T_{OR}	CPU	Measured @ 0.4V ~ 2.0V, C_L=10-20pf, 2.5V±5%			1.6	ns
		REF, 48MHz, 24MHz	Measured @ 0.4V ~ 2.4V, C_L=10-20pf			4	
		PCIF, PCI, AGP, APIC	Measured @ 0.4V ~ 2.4V, C_L=10-30pf			2	
Output Fall time	T_{OF}	CPU	Measured @ 2.0 ~ 0.4V, C_L=10-20pf, 2.5V±5%			1.6	ns
		REF, 48MHz, 24MHz	Measured @ 2.4V ~ 0.4V, C_L=10-20pf			4	
		PCIF, PCI, AGP, APIC	Measured @ 2.4V ~ 0.4V, C_L=10-30pf			2	
Duty Cycle	D_T	CPU,APIC,REF, 48MHz,24MHz	Measured @ 1.5V C_L=20pf	45	50	55	%
		PCI, AGP	Measured @ 1.5V, C_L=20~30pf	40		55	
Clock Skew	T_{SKEW}	CPU	Rising edge @ 1.25V, C_L=20pf			175	ps
		PCI	Rising edge @ 1.5V, C_L=30pf			500	
		AGP	Rising edge @ 1.5V, C_L=30pf			500	
Jitter(Cycle to Cycle)	$J_{cyc-cyc}$	CPU	Measured @ 1.25V			250	ps
		REF	Measured @ 1.5V			500	
		PCI, AGP	Measured @ 1.5V			250	
Frequency Stabilization Time	T_{FST}	CPU,PCIF,PCI, APIC,AGP,REF, 48MHz,24MHz	Assumes full supply voltage reached within 1ms from power-up. Short cycle exist prior to frequency stabilization.			3	ms
AC output impedance	Z_0	CPU	V_{DD}=3.3V(2.5V)±5%		20		ohm
		PCI,AGP	V_{DD}=3.3V±5%		30		
		REF,48MHz,24MHz	V_{DD}=3.3V±5%		40		

PACKAGE INFORMATION



48PIN SSOP

ORDERING INFORMATION

For part ordering, please contact our Sales Department:

47745 Fremont Blvd., Fremont, CA 94538, USA

Tel: (510) 492-0990 Fax: (510) 492-0991

PART NUMBER

The order number for this device is a combination of the following:
Device number, Package type and Operating temperature range

PLL202-108 X C

PART NUMBER

TEMPERATURATURE
C=COMMERCIAL
M=MILITARY
I=INDUSTRAL

PACKAGE TYPE
X=SSOP