3.3V CPU Frequency Generator

Features

- 3.3V version of PI6C9155U-01/02/03
- Generates most essential clock signals for CPU boards
- Generates five simultaneous clock signals for most peripheral controllers
- Replaces six crystal oscillators, for cost savings and board space savings
- On-chip loop filters — no external loop filter circuit
- Smooth jitter-free transition between two CPU frequencies for power savings
- Single low cost (14.318 MHz) crystal as reference input frequency
- Low power 0.8 micron CMOS technology
- ESD protection exceeds 2000V
- Packages available:
  - 20-pin 300 mil wide plastic DIP (P20)
  - 20-pin 300 mil wide plastic SOIC (S20)

Clock Table (MHz)

Clock	PI6C9156U-01	PI6C9156U-02
KBCLK	12	12
BUSCLK	16	32
FDCLK	24	24
COMMCLK	1.84	1.84
14.318 (2)	14.318	14.318
CPUCLK	4, 8, 16, 20, 25, 33.3, 40, or 50	
2XCPUCLK	8, 16, 32, 40, 50, or 66.6	

General Description

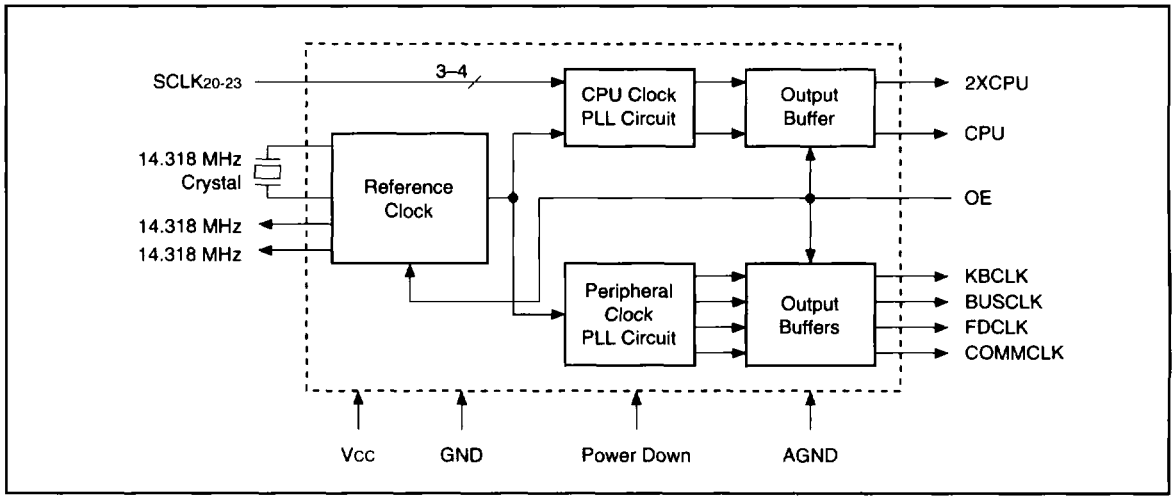
The PI6C9156 clock generator provides a low cost solution for generating most of the necessary clock frequencies for motherboards with 3V power supply, for tremendous cost and board savings.

The two main clock outputs CPU and 2XCPU can be set by the user to one of several popular processor clock frequencies. It also offers four simultaneous clocks for popular peripherals, plus two reference clock outputs which are identical to the reference input crystal frequency.

The device has other advanced features which include on-chip filter circuits, for simplifying the board design, and hard power-down capacity for power savings. Enhanced versions with customized frequencies and features are also available. Contact the factory for the enhanced versions.

The CPU and 2XCPU clocks offer an additional feature of reducing the operating clock speeds for saving power of the entire computer while the computer is at idle. This feature cannot be accomplished by metal-can oscillators. A smooth, jitter-free frequency transition is provided for the CPU and 2XCPU clocks during the transition of slow down and speed up. The frequency transition rates meet the specifications of all x86 microprocessors to within 0.1% frequency change per clock period.

Block Diagram



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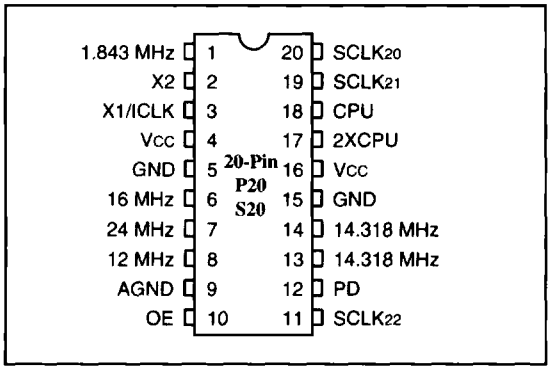
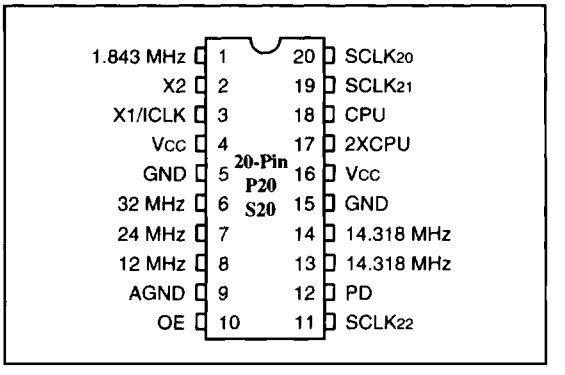
Product Pin Configuration, PI6C9156U-01



Product Pin Configuration, PI6C9156U-02



PI6C9156U-01, PI6C9156U-02 Product Pin Description

Pin Name	Pin Number	Pin Type	Description
1.843 MHz	1	Output	1.84 MHz Clock Output
X2	2	Output	Crystal connection. Leave as NC for clock input
X1/ICLK	3	Input	Crystal connection/Input Clock
VCC	4	—	Digital power supply (+3.3V)
GND	5	—	Digital Ground
16 MHz/32 MHz	6	Output	16 MHz (PI6C9156U-01) or 32 MHz (PI6C9156U-02) Clock Output
24 MHz	7	Output	24 MHz Floppy disk/Combination I/O Clock Output
12 MHz	8	Output	12 MHz Keyboard Clock Output
AGND	9	—	Analog Ground (Original version)
OE	10	Input	Output Enable. Tri-states all outputs when low.
SCLK22	11	Input	CPU Clock frequency Select #2
PD	12	Input	Hard Power-Down. Shuts off entire chip when low
14.318 MHz	13	Output	14.318 MHz Reference Clock Output
14.318 MHz	14	Output	14.318 MHz Reference Clock Output
GND	15	—	Digital Ground
VCC	16	—	Digital power supply (+3.3ZV)
2XCPU	17	Output	2X CPU Clock Output
CPU	18	Output	1X CPU Clock Output
SCLK21	19	Input	CPU Clock frequency Select #1
SCLK20	20	Input	CPU Clock frequency Select #0

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PI6C9156U-01 Decoding and Clock Tables (14.318 MHz Input. All frequencies in MHz)

CPU and 2XCPU Clocks

SCLK22 (Pin 11)	SCLK21 (Pin 19)	SCLK20 (Pin 20)	2XCPU (Pin 17) Pin 10 = 1	CPU (Pin 18) Pin 10 = 1
0	0	0	8	4
0	0	1	16	8
0	1	0	32	16
0	1	1	40	20
1	0	0	50	25
1	0	1	66.66	33.33

Peripheral Clocks

COMMCLK (Pin 1)	BUSCLK (Pin 6)	FDCLK (Pin 7)	KBCLK (Pin 8)
1.843	16	24	12

Reference Clocks

REFCLK1 (Pin 13)	REFCLK2 (Pin 14)
14.318	14.318

PI6C9156U-02 Decoding and Clock Tables (14.318 MHz Input. All frequencies in MHz)

CPU and 2XCPU Clocks

SCLK22 (Pin 11)	SCLK21 (Pin 19)	SCLK20 (Pin 20)	2XCPU (Pin 17) Pin 10 = 1	CPU (Pin 18) Pin 10 = 1
0	0	0	8	4
0	0	1	16	8
0	1	0	32	16
0	1	1	40	20
1	0	0	50	25
1	0	1	66.66	33.33

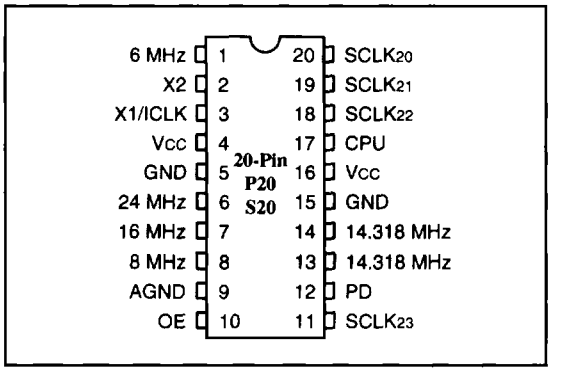
Peripheral Clocks

COMMCLK (Pin 1)	BUSCLK (Pin 6)	FDCLK (Pin 7)	KBCLK (Pin 8)
1.843	32	24	12

Reference Clocks

REFCLK1 (Pin 13)	REFCLK2 (Pin 14)
14.318	14.318

Product Pin Configuration, PI6C9156U-03



PI6C9156U-03 Product Pin Description

Pin Name	Pin Number	Pin Type	Description
6 MHz	1	Output	6 MHz Clock Output
X2	2	Output	Crystal connection. Leave as NC for clock input
X1/ICLK	3	Input	Crystal connection/Input Clock
Vcc	4	—	Digital power supply (+3.3V)
GND	5	—	Digital Ground
24 MHz	6	Output	24 MHz Floppy disk/Combination I/O Clock Output
16 MHz	7	Output	16 MHz Bus Clock
8 MHz	8	Output	8 MHz Keyboard Clock Output
AGND	9	—	Analog Ground (Original version)
OE	10	Input	Output Enable. Tri-states all outputs when low.
SCLK23	11	Input	CPU Clock frequency Select #3
$\overline{PD}$	12	Input	Hard Power-Down. Shuts off entire chip when low (9156U-03)
14.318 MHz	13	Output	14.318 MHz Reference Clock Output
14.318 MHz	14	Output	14.318 MHz Reference Clock Output
GND	15	—	Digital Ground
Vcc	16	—	Digital power supply (+3.3V)
CPU	17	Output	CPU Clock Output
SCLK22	18	Input	CPU Clock frequency Select #2
SCLK21	19	Input	CPU Clock frequency Select #1
SCLK20	20	Input	CPU Clock frequency Select #0

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PI6C9156U-03 Decoding and Clock Tables (14.318 MHz Input. All frequencies in MHz)

CPU Clock

SCLK23 (Pin 11)	SCLK22 (Pin 18)	SCLK21 (Pin 19)	SCLK20 (Pin 20)	CPU (Pin 17) Pin 10 = 1
0	0	0	0	16
0	0	0	1	40
0	0	1	0	50
0	1	0	0	66.66
0	1	1	0	8
0	1	1	1	4
1	0	0	0	8
1	0	0	1	20
1	0	1	0	25
1	1	0	0	33.3
1	1	1	0	4
1	1	1	1	2

To guarantee smooth, glitch-free frequency transitions, the state of SCLK23 (pin 11) must remain unchanged (smooth transitions are guaranteed in either the top or bottom half of the frequency decode table).

Peripheral Clocks

COMMCLK (Pin 1)	BUSCLK (Pin 7)	FDCLK (Pin 6)	KBCLK (Pin 8)
6	16	24	8

Reference Clocks

REFCLK1 (Pin 13)	REFCLK2 (Pin 14)
14.318	14.318

Maximum Ratings

(Above which the useful life may be impaired. For user guidelines, not tested.)

Storage Temperature	–65°C to +150°C
Ambient Temperature with Power Applied	0°C to +70°C
Supply Voltage to Ground Potential (Inputs & Vcc Only)	–0.5V to +7.0V
Supply Voltage to Ground Potential (Outputs & D/O Only)	–0.5V to +7.0V
DC Input Voltage	–0.5V to +7.0V
DC Output Current	120 mA
Power Dissipation	0.5W

Note:
Stresses greater than those listed under MAXIMUM RATINGS may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

DC Electrical Characteristics at 3V (Operating Range, V_{CC} = +3.0V to 3.6V, Temperature 0°C to +70°C)

Parameters	Description	Test Conditions		Min.	Typ.	Max.	Units
V_{OH}	Output HIGH Voltage	V_{CC} = Min., V_{IN} = V_{IH} or V_{IL}	I_{OH} = –4 mA	2.4			V
V_{OL}	Output LOW Voltage	V_{CC} = Min., V_{IN} = V_{IH} or V_{IL}	I_{OL} = 8 mA			0.4	V
V_{IH}	Input HIGH Voltage	Guaranteed Logic HIGH Level		2.0			V
V_{IL}	Input LOW Voltage	Guaranteed Logic LOW Level				0.8	V
I_{DD}	Supply Current	No Load, Runing at Highest Possible Frequencies			40		mA
Fd	Output Freq. Change [1]	With Respect to Typical Frequency			0.002	0.01	%
I_{SC}	Short Circuit Current	Each Output Clock		25	40		mA
R_{PU}	Pull-up Resistor Value	Pins 10 and 12			680		kΩ
C_i	Input Capacitance	Except X1, X2				10	pF
C_L	Load Capacitance	Pins X1, X2			20		pF

Notes:
1. Over Supply and Temperature.

AC Electrical Characteristics at 3V (Operating Range, V_{CC} = +3.0V to 3.6V, Temperature 0°C to +70°C)

Parameters	Description	Test Conditions	Min.	Typ.	Max.	Units
t_{ICr}	Input Clock Rise Time				20	ns
t_{ICf}	Input Clock Fall Time				20	ns
tr	Output Rise Time, 0.8 to 2.0V	25 pF Load for CPU and 2XCPU			2	ns
		25 pF Load for Peripherals			3	ns
tf	Output Fall Time, 2.0 to 0.8V	25 pF Load for CPU and 2XCPU			2	ns
		25 pF Load for Peripherals			3	ns
dt	Duty Cycle, CPU and 2XCPU	25 pF Load	40/60		60/40	%
dt	Duty Cycle, Other Clocks	25 pF Load	40/60		60/40	%
Tjis	Jitter, 1 Sigma	As Compared with Clock Period		0.8	2.5	%
Tjab	Jitter, Absolute	As Compared with Clock Period		2	5	%
fi	Input Frequency			14.318		MHz
Tsk	Clock Skew between CPU & 2XCPU outputs			1	1.5	ns
tft	Frequency Transition Time				20	ms

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ACTUAL OUTPUT FREQUENCIES
(14.318 MHz Input. All frequencies in MHz)

PI6C9156U-01 and PI6C9156U-02

CPU and 2XCPU Clocks

SCLK22 (Pin 11)	SCLK21 (Pin 19)	SCLK20 (Pin 20)	2XCPU (Pin 17) Pin 10 = 1	CPU (Pin 18) Pin 10 = 1
0	0	0	8.18	4.1
0	0	1	16.36	8.2
0	1	0	32.22	16.11
0	1	1	40.09	20.05
1	0	0	50.11	25.06
1	0	1	66.82	33.41

Peripheral Clocks

COMMCLK (Pin 1)	BUSCLK (Pin 6)	FDCLK (Pin 7)	KBCLK (Pin 8)
1.846	32.00 or 16.00	24.00	12.00

PI6C9156U-03

CPU Clock

SCLK23 (Pin 11)	SCLK22 (Pin 18)	SCLK21 (Pin 19)	SCLK20 (Pin 20)	CPU (Pin 17) Pin 10 = 1
0	0	0	0	16.36
0	0	0	1	40.09
0	0	1	0	50.11
0	1	0	0	66.82
0	1	1	0	8.18
0	1	1	1	4.09
1	0	0	0	8.18
1	0	0	1	20.05
1	0	1	0	25.06
1	1	0	0	33.41
1	1	1	0	4.09
1	1	1	1	2.1

Peripheral Clocks

COMMCLK (Pin 1)	BUSCLK (Pin 6)	FDCLK (Pin 7)	KBCLK (Pin 8)
6.00	24.00	16.00	8.00

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