

**Clock Generator for Pentium Modules**
**Features**

- Supports Pentium or Pentium II CPU modules
- Spread Spectrum capability reduces EMI
- Low power consumption
- Four CPU Clocks with V<sub>DDQ2</sub> of 3.3V or 2.5V
- Enhanced drive on CPUCLK0
- Seven PCI synchronous clocks (3.3V)
- One IOAPIC Clock @14.31818MHz (Power from pin 46), with V<sub>DDQ1</sub> of 3.3V or 2.5V
- Two 48/24 MHz clocks (3.3V)
- Six/eight SDRAM clocks (3.3V)
- Three Ref. Clocks @14.31818MHz (3.3V)
- Internal crystal loading capacitor
- Ref. 14.31818MHz crystal oscillator input
- Separate 66/60# MHz select pin
- Separate power management MODE control pin
- I<sup>2</sup>C 2-Wire Serial Interface
- 48-pin SSOP Package (V) and TSSOP (A)

**Description**

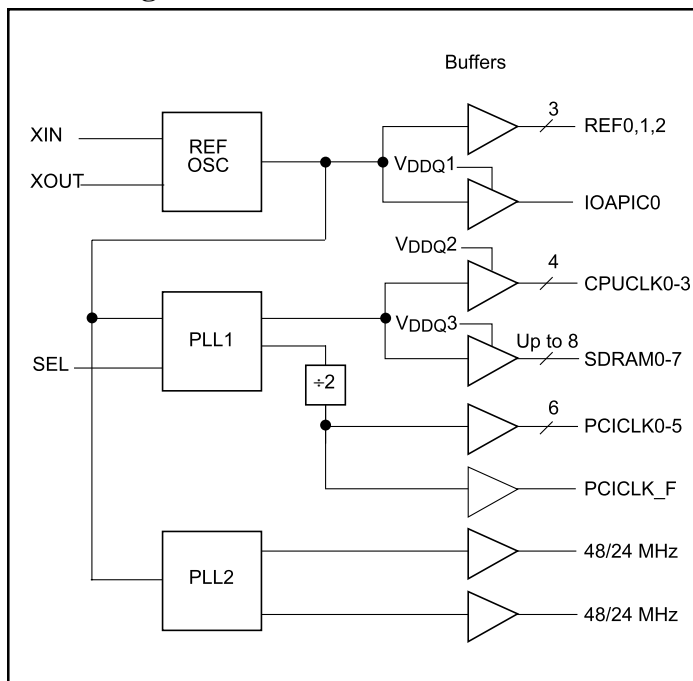
The PI6C671F is a mixed-voltage clock generator designed to provide all timing signals for Intel Pentium/Pentium II module-based motherboards. It provides four CPU, seven PCI, and up to eight SDRAM clocks. Additionally, three reference clocks (same frequency as the crystal) and two selectable 24/48 MHz clocks are available.

Pericom design improvements resulted in a low-power device optimized for 2.5V CPU operation. A special spread-spectrum feature may be enabled to minimize EMI.

The two-wire I<sup>2</sup>C serial interface can be used to reduce circuit noise and power consumption. I<sup>2</sup>C control lets you enable/disable each clock output driver, change CPU frequencies, and select 24 or 48 MHz outputs.

A power-down function (pin 44) puts the whole system in a low-power mode by stopping the crystal oscillator and both PLLs. CPU and PCI clocks may also be stopped by the "CPU\_STOP#" (pin 27), and "PCI\_STOP#" (pin 26) functions.

**Note:** Purchase of I<sup>2</sup>C components from Pericom conveys a license to use them in an I<sup>2</sup>C system as defined by Philips.

**Block Diagram**


All trademarks are of their respective companies.

**Pin Configuration**

REF1	1	48	V <sub>DD</sub>
REF0	2	47	REF2
V <sub>SS</sub>	3	46	V <sub>DDQ1</sub>
XIN	4	45	IOAPIC0
XOUT	5	44	PWR_DWN#
MODE	6	43	V <sub>SS</sub>
V <sub>DDQ3</sub>	7	42	CPUCLK0
PCICLK_F	8	41	CPUCLK1
PCICLK0	9	40	V <sub>DDQ2</sub>
V <sub>SS</sub>	10	39	CPUCLK2
PCICLK1	11	38	CPUCLK3
PCICLK2	12	37	V <sub>SS</sub>
PCICLK3	13	36	SDRAM0
PCICLK4	14	35	SDRAM1
V <sub>DDQ3</sub>	15	34	V <sub>DDQ3</sub>
PCICLK5	16	33	SDRAM2
V <sub>SS</sub>	17	32	SDRAM3
SEL66/60#	18	31	V <sub>SS</sub>
SDATA	19	30	SDRAM4
SDCLK	20	29	SDRAM5
V <sub>DDQ3</sub>	21	28	V <sub>DDQ3</sub>
48/24MHz	22	27	SDRAM6/CPU_STOP#
48/24MHz	23	26	SDRAM7/PCI_STOP#
V <sub>SS</sub>	24	25	V <sub>DD</sub>

### Pin Descriptions

Signal Name	Type	Qty	Pin	Description
Xin	I	1	4	Crystal oscillator input or input for externally generated reference signal.
Xout	O	1	5	Crystal oscillator output. Connect to external parallel resonant crystal.
SEL66/60#	I	1	18	Select pin for enabling 66 MHz or 60 MHz. H=66 MHz, L=60 MHz. Has an internal pull-up resistor.
CPUCLK (0-3)	O	4	42,41,39,38	CPU & Host clock outputs. Powered by V <sub>DDQ2</sub> , can be 2.5V or 3.3V.
SDRAM	O	6	29,30,32,33,35,36	SDRAM clocks 60/66 MHz. Powered by V <sub>DDQ3</sub> (3.3V).
SDRAM6/CPU_STOP#	bi-dir	1	27	MODE=1: SDRAM6, MODE=0: CPU_STOP#.
SDRAM7/PCI_STOP#	bi-dir	1	26	MODE=1: SDRAM7, MODE=0: PCI_STOP#.
MODE	I	1	6	Mode Select pin for enabling power management features at pins 26 & 27. Has an internal pull-up resistor.
PCICLK(0-5)	O	6	9,11,12,13,14,16	Low skew PCI clock outputs. TTL compatible. Powered by V <sub>DDQ3</sub> (3.3V).
PCICLK_F	O	1	8	Free running synchronous PCI clock. Stops when in shut down mode.
REF0,REF1,REF2	O	3	2,1,47	14.318 MHz buffered reference clock outputs.
IOAPIC0	O	1	45	IOAPIC0 clock outputs. Powered by V <sub>DDQ1</sub> , can be 2.5V or 3.3V
PWR_DWN#	I	1	44	PWR_DWN#, active LOW.
48/24MHz	O	2	22,23	Selectable 48/24 MHz clock output. Powered by V <sub>DDQ3</sub> (3.3V).
SDATA	I	1	19	Serial data input for I <sup>2</sup> C control.
SDCLK	I	1	20	Clock input for I <sup>2</sup> C control.
V <sub>SS</sub>	Ground	7	3,10,17,24,31,37,43	Ground pins for the device.
V <sub>DD</sub>	Power	2	25,48	Power supply for analog circuits and core logic.
V <sub>DDQ3</sub>	Power	5	7,15,21,28,34	3.3V I/O power supply.
V <sub>DDQ2</sub>	Power	1	40	CPUCLK power supply. Can be either 2.5V or 3.3V.
V <sub>DQ1</sub>	Power	1	46	IOAPIC power supply. Can be either 2.5V or 3.3V.

### Driver Types

Pin	Driver Type	Symbol	Description
2	D	REF0	14.318 MHz clock output.
1,47	C	REF1, REF2	14.318 MHz clock output.
8	E	PCICLK_F	Free running clock during PCICLK stopped.
9,11,12, 13,14,16	E	PCICLK	PCI clock outputs TTL compatible 3.3V.
22,23	C	48/24MHz	48/24 MHz clock output 3.3V selectable.
26,27,29,30, 32,33,35,36	D	SDRAM	SDRAM clocks 60/66 MHz.
38,39,41,42	A	CPUCLK	CPU and host clock outputs: 2.5V or 3.3V
45	B	IOAPIC0, IOAPIC1	IOAPIC clock output: 2.5V or 3.3V.

## Power Management Functions

Any or all clocks can be enabled or shut down via the I<sup>2</sup>C control interface. All clocks stop in the LOW state. CPU, SDRAM, and PCI clocks wait for one rising edge of PCICLK\_F followed by a falling

edge of the clock of interest before settling in the LOW state. To reduce power consumption the PI6C671F clocks may be disabled in accordance with the following table.

CPU_STOP#	PCI_STOP#	PWR_DWN#	CPUCLK, SDRAM	PCICLK	Other Clocks	Crystal & VCOs
X	X	0	LOW	LOW	LOW	Off
0	0	1	LOW	LOW	Running	Running
0	1	1	LOW	33/30 MHz	Running	Running
1	0	1	66/60 MHz	LOW	Running	Running
1	1	1	66/60 MHz	33/30 MHz	Running	Running

## 2-Wire I<sup>2</sup>C Control

The I<sup>2</sup>C interface permits individual enable/disable of each clock output and test mode enable.

The PI6C671F is a slave receiver device. It can not be read back. Sub addressing is not supported. All preceding bytes must be sent in order to change one of the control bytes.

Every bite put on the SDATA line must be 8-bits long (MSB first), followed by an acknowledge bit generated by the receiving device.

During normal data transfers SDATA changes only when SDCLK is LOW. Exceptions: A HIGH to LOW transition on SDATA while SDCLK is HIGH indicates a “start” condition. A LOW to HIGH transition on SDATA while SDCLK is HIGH is a “stop” condition and indicates the end of a data transfer cycle.

Each data transfer is initiated with a start condition and ended with

a stop condition. The first byte after a start condition is always a 7-bit address byte followed by a read/write bit. (HIGH = read from addressed device, LOW = write to addressed device). If the device’s own address is detected, PI6C671F generates an acknowledge by pulling SDATA line LOW during ninth clock pulse, then accepts the following data bytes until another start or stop condition is detected.

Following acknowledgement of the address byte (D2), two more bytes must be sent:

1. “Command Code” byte, and
2. “Byte Count” byte.

Although the data bits on these two bytes are “don’t care,” they must be sent and acknowledged.

The I<sup>2</sup>C interface is disabled when the PWR\_DWN# pin is LOW. Preset control register contents are retained.

## I<sup>2</sup>C Serial Configuration

### Byte 0: Functional and Frequency Select

Clock Register (1 = enable, 0 = disable)

Bit	Pin No.	@ Powerup	Description
7		0	(Reserved)
6		0	(Reserved, don't change)
5		0	(Reserved, don't change)
4		0	(Reserved, don't change)
3	23	1	48/24 MHz (Freq Select) 1 = 48 MHz, 0 = 24 MHz
2	22	1	48/24 MHz (Freq Select) 1 = 48 MHz, 0 = 24 MHz
1		0	<b>Bit1 Bit0</b> 1 1 : Tri-State 1 0 : Spread Spectrum 0 1 : Test Mode 0 0 : Normal Operation
0		0	

**Byte 1: CPU 24/48 MHz Active/Inactive Register**  
(1 = enable, 0 = disable)

Bit	Pin No.	@ Powerup	Description
7	23	1	48/24 MHz (Active/Inactive)
6	22	1	48/24 MHz (Active/Inactive)
5		X	(Reserved)
4	N/A	X	CPUCLK4 (Active/Inactive)
3	38	1	CPUCLK3 (Active/Inactive)
2	39	1	CPUCLK2 (Active/Inactive)
1	41	1	CPUCLK1 (Active/Inactive)
0	42	1	CPUCLK0 (Active/Inactive)

**Byte 4: SDRAM Active/Inactive Register**  
(1 = enable, 0 = disable)

Bit	Pin No.	Description
7	N/A	SDRAM15 (Active/Inactive)
6	N/A	SDRAM14 (Active/Inactive)
5	N/A	SDRAM13 (Active/Inactive)
4	N/A	SDRAM12 (Active/Inactive)
3	N/A	SDRAM11 (Active/Inactive)
2	N/A	SDRAM10 (Active/Inactive)
1	N/A	SDRAM9 (Active/Inactive)
0	N/A	SDRAM8 (Active/Inactive)

**Byte 2: PCI Active/Inactive Register**  
(1 = enable, 0 = disable)

Bit	Pin No.	@ Powerup	Description
7		X	(Reserved)
6	8	1	PCICLK_F (Active/Inactive)
5	16	1	PCICLK5 (Active/Inactive)
4	14	1	PCICLK4 (Active/Inactive)
3	13	1	PCICLK3 (Active/Inactive)
2	12	1	PCICLK2 (Active/Inactive)
1	11	1	PCICLK1 (Active/Inactive)
0	9	1	PCICLK0 (Active/Inactive)

**Byte 5: Peripheral Active/Inactive Register**  
(1 = enable, 0 = disable)

Bit	Pin No.	@ Powerup	Description
7		X	(Reserved)
6		X	(Reserved)
5		1	(Reserved)
4	45	1	IOAPIC (Active/Inactive)
3		X	(Reserved)
2	47	1	REF2 (Active/Inactive)
1	1	1	REF1 (Active/Inactive)
0	2	1	REF0 (Active/Inactive)

**Byte3: SDRAM Active/Inactive Register**  
(1 = enable, 0 = disable)

Bit	Pin No.	@ Powerup	Description
7	26	1	SDRAM7 (Active/Inactive)
6	27	1	SDRAM6 (Active/Inactive)
5	29	1	SDRAM5 (Active/Inactive)
4	30	1	SDRAM4 (Active/Inactive)
3	32	1	SDRAM3 (Active/Inactive)
2	33	1	SDRAM2 (Active/Inactive)
1	35	1	SDRAM1 (Active/Inactive)
0	36	1	SDRAM0 (Active/Inactive)

**Byte 6: Optional Register**  
for Possible Future Requirements

Bit	Pin Number	Description
7	X	(Reserved)
6	X	(Reserved)
5	X	(Reserved)
4	X	(Reserved)
3	X	(Reserved)
2	X	(Reserved)
1	X	(Reserved)
0	X	(Reserved)

**Byte 7: Frequency Control**

Bit	@ Power up	Description
7	X	(Reserved)
6	X	(Reserved)
5	X	(Reserved)
4	X	(Reserved)
3	X	(Reserved)
2	1	FSEL2
1	1	FSEL1
0	1	FSEL0

FSEL2	FSEL1	FSEL0	Frequency
0	0	0	(Reserved)
0	0	1	(Reserved)
0	1	0	(Reserved)
0	1	1	33 MHz
1	0	0	50 MHz
1	0	1	55 MHz
1	1	0	60 MHz
1	1	1	From SEL66/60# pin

**DC Specifications**

**Absolute Maximum DC Power Supply**

Symbol	Supply Voltage	Min.	Max.	Units
V <sub>DDQ3</sub>	3.3V Core & I/O	-0.5	4.6	V
V <sub>DD</sub>	3.3V Core	-0.5	4.6	
V <sub>DDQ2</sub>	2.5/3.3V I/O	-0.5	4.6	
V <sub>DDQ1</sub>	2.5/3.3V I/O	-0.5	4.6	

**DC Operating Requirements**

(V<sub>DD</sub>, V<sub>DDQ3</sub>=3.3V ±5%, V<sub>DDQ2</sub>=2.5V ±5%, T<sub>A</sub>=0 to 70°C)

Symbol	Parameter	Condition	Min.	Typ.	Max.	Units
V <sub>OH2</sub>	2.5V Output High Voltage	I <sub>OH</sub> = -1mA	2.1			V
V <sub>OH3</sub>	3.3V Output High Voltage	I <sub>OH</sub> = -1mA	2.4			
V <sub>OL2</sub>	2.5V Output Low Voltage	I <sub>OL</sub> = 1mA			0.4	
V <sub>OL3</sub>	3.3V Output Low Voltage	I <sub>OL</sub> = 1mA			0.4	
I <sub>DD</sub>	Dynamic Supply Current	66 MHz Unloaded Outputs		55	70	mA
I <sub>PD</sub>	Power Down Supply Current	PWR_DWN# = 0 MODE = Float (high)		14	20	μA

**Note:** Typical values are at room temperature

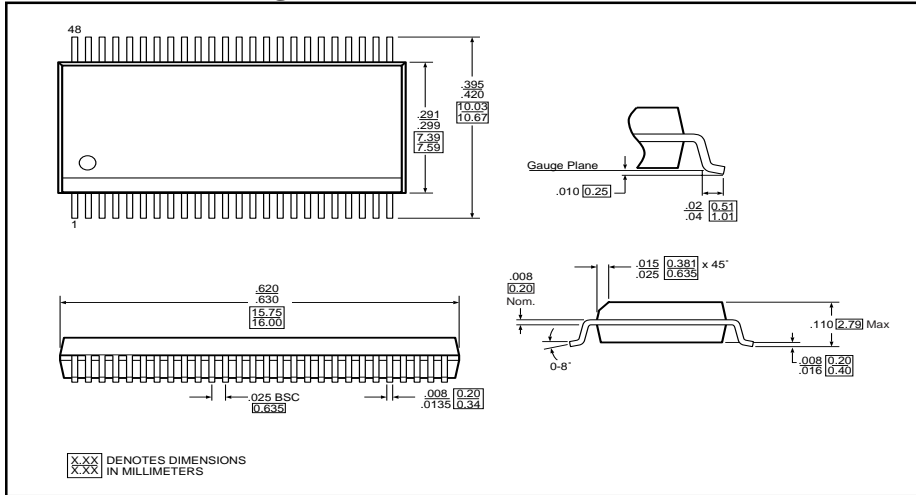
**Driver Specifications**

Symbol	Parameter	Condition	Minimum	Typical	Maximum	Units
<b>Type A: CPUCLK1-3 2.5V Buffer</b>						
Iohmin	Pull-up Current	Vout = 1.0V	-49			mA
Iolmin	Pull-down Current	Vout = 1.2V	48			
<b>Type A: CPUCLK1-3 3.3V Buffer</b>						
Iohmin	Pull-up Current	Vout = 1.0V	-69			mA
Iolmin	Pull-down Current	Vout = 1.6V	63			
<b>Type B: IOAPIC 2.5V Buffer</b>						
Iohmin	Pull-up Current	Vout = 1.4V	-36			mA
Iolmin	Pull-down Current	Vout = 1.0V	36			
<b>Type B: IOAPIC 3.3V Buffer</b>						
Iohmin	Pull-up Current	Vout = 1.0V	-58			mA
Iolmin	Pull-down Current	Vout = 1.9V	57			
<b>Type C: REF1, REF2, 48/24 MHz (3.3V) Buffer</b>						
Iohmin	Pull-up Current	Vout = 1.0V	-29			mA
Iolmin	Pull-down Current	Vout = 1.95V	29			
<b>Type D: REF0, SDRAM (3.3V) Buffer</b>						
Iohmin	Pull-up Current	Vout = 2.0V	-54			mA
Iolmin	Pull-down Current	Vout = 1.0V	54			
<b>Type E: PCI Clock Buffer</b>						
Iohmin	Pull-up Current	Vout = 1.0V	-33			mA
Iolmin	Pull-down Current	Vout = 1.95V	30			
<b>Type F: CPUCLK0 2.5V Buffer</b>						
Iohmin	Pull-up Current	Vout = 1.0V	-62			mA
Iohmax		Vout = 2.5V			-19	
Iohmin	Pull-down Current	Vout = 1.2V	60			
		Vout = 0.3V			41	

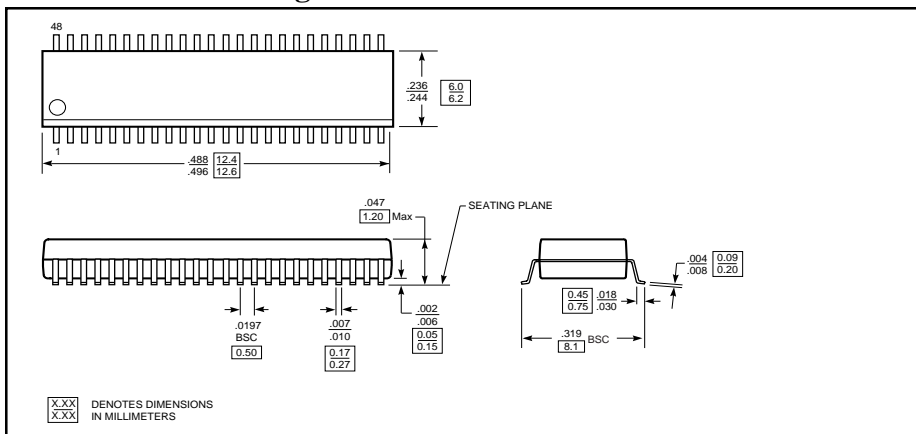
### AC Timing

Symbol	Parameter	Min.	Max.	Units
t <sub>RF</sub>	Host CLK rise/fall time, 0.4V - 2.0V	0.4	1.6	ns
t <sub>JITTER</sub>	Host CLK Jitter		250	ps
Duty Cycle	Measured the rising edge CLKs at 1.25V for the 2.5V clocks and at 1.5V for the 3.3V clocks	45	55	%
t <sub>HSKW</sub>	Host Bus CLK skew		250	ps
t <sub>HSKSD</sub>	Host to SDRAM		500	
t <sub>PKPS</sub>	PCI CLK period stability		500	
t <sub>PSKW</sub>	PCI Bus CLK skew		500	
t <sub>HPOFFSET</sub>	Host to PCI Clock Offset	1	4	ns
t <sub>STB</sub>	CLK Stabilization at power-up		3	ms

### 48-Pin SSOP Package Data



### 48-Pin TSSOP Package Data



### Ordering Information

P/N	Description
PI6C671FV	48-pin SSOP Package
PI6C671FA	48-pin TSSOP Package