

## 1:10 PLL Clock Driver for 2.5V DDR-SDRAM Memory

### Product Features

- Operating Frequency up to 200 MHz and exceeds PC2700 RDIMM specification
- Distributes one differential clock input pair to ten differential clock output pairs.
- Inputs (CLK,  $\overline{\text{CLK}}$ ) and (FBIN,  $\overline{\text{FBIN}}$ ): SSTL\_2
- Input PWRDWN: LVC MOS
- Outputs (Y<sub>x</sub>,  $\overline{\text{Y}}_x$ ), (FBOU<sub>T</sub>,  $\overline{\text{FBOU}}_T$ ): SSTL\_2
- External feedback pins (FBIN,  $\overline{\text{FBIN}}$ ) are used to synchronize the outputs to the clock input.
- Operates at AV<sub>DD</sub> = 2.5V for core circuit and internal PLL, and V<sub>DDQ</sub> = 2.5V for differential output drivers
- Packages (Pb-free and Green available):
  - 48-pin TSSOP

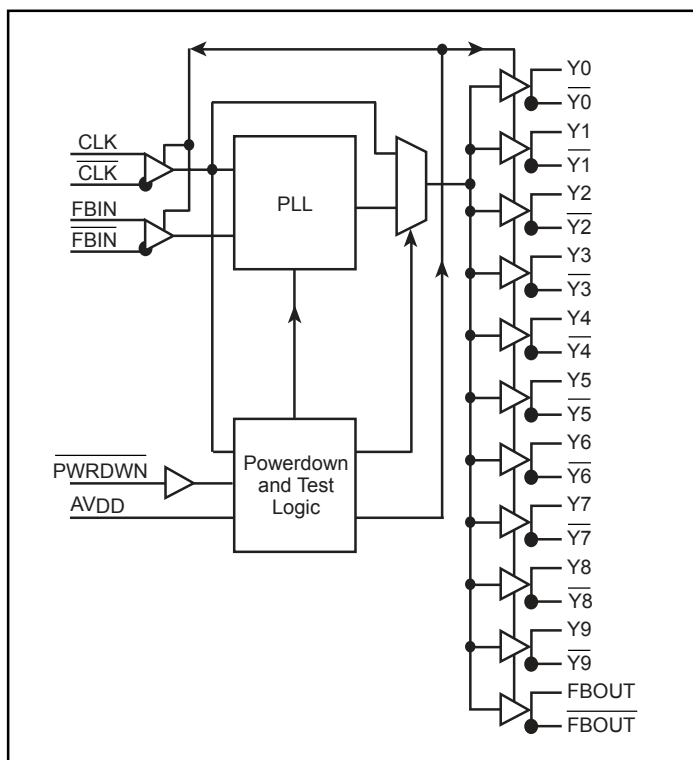
### Product Description

PI6CV857B PLL clock device is developed for registered DDR DIMM applications. This PLL Clock Buffer is designed for 2.5 V<sub>DDQ</sub> and 2.5V AV<sub>DD</sub> operation and differential data input and output levels. The device is a zero delay buffer that distributes a differential clock input pair (CLK,  $\overline{\text{CLK}}$ ) to ten differential pairs of clock outputs (Y[0:9],  $\overline{\text{Y}}[0:9]$ ) and one differential pair feedback clock outputs (FBOU<sub>T</sub>,  $\overline{\text{FBOU}}_T$ ). The clock outputs are controlled by the input clocks (CLK,  $\overline{\text{CLK}}$ ), the feedback clocks (FBIN,  $\overline{\text{FBIN}}$ ), the 2.5V LVC MOS input (PWRDWN) and the Analog Power input (AV<sub>DD</sub>). When input PWRDWN is low while power is applied, the input receivers are disabled, the PLL is turned off and the differential clock outputs are 3-stated. When the AV<sub>DD</sub> is strapped low, the PLL is turned off and bypassed for test purposes.

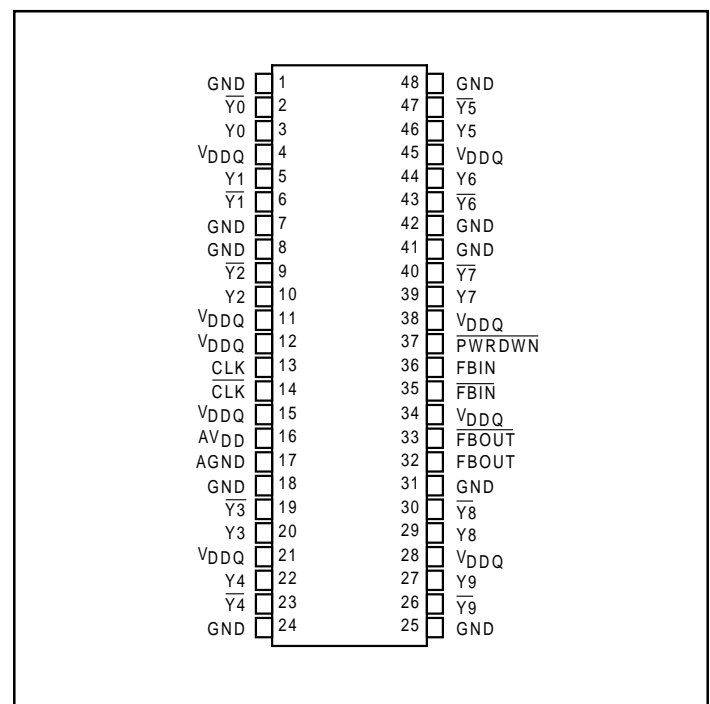
When the input frequency falls below a suggested detection frequency that is below the operating frequency of the PLL, the device will enter a low power mode. An input frequency detection circuit will detect the low frequency condition and perform the same low power features as when the PWRDWN input is low.

The PLL in the PI6CV857B clock driver uses the input clocks (CLK,  $\overline{\text{CLK}}$ ) and the feedback clocks (FBIN,  $\overline{\text{FBIN}}$ ) to provide high-performance, low-skew, low-jitter output differential clocks (Y[0:9],  $\overline{\text{Y}}[0:9]$ ). The PI6CV857B is also able to track Spread Spectrum Clocking for reduced EMI.

### Block Diagram



### Pin Configurations: 48-pin TSSOP (package code A)



**Pinout Table**

Pin Name	Pin No.	I/O Type	Description
$\overline{\text{CLK}}$ CLK	13 14	I	Reference Clock input
Yx	3,5,10,20,22,27,29,39,44,46	O	Clock outputs.
$\overline{\text{Yx}}$	2,6,9,19,23,26,30,40,43,47		Complement Clock outputs.
$\overline{\text{FBOU}}$ FBOU	32 33		Feedback output, and Complement Feedback Output
$\overline{\text{FBIN}}$ FBIN	36 35	I	Feedback Input, and Complement Feedback Input
$\overline{\text{PWRDWN}}$	37		Power down and output disable for all Yx and $\overline{\text{Yx}}$ outputs. When $\overline{\text{PWRDWN}} = 0$ , the part is powered down and the differential clock outputs are disabled to a 3-state. When $\overline{\text{PWRDWN}} = 1$ , all differential clock outputs are enabled and run at the same frequency as CLK.
V <sub>DDQ</sub>	4,11,12,15,21,28,34,38,45	Power	Power Supply for I/O.
AV <sub>DD</sub>	16		Analog /core power supply. AV <sub>DD</sub> can be used to bypass the PLL for testing purposes. When AV <sub>DD</sub> is strapped to ground, PLL is bypassed and CLK is buffered directly to the device outputs.
AGND	17	Ground	Analog/core ground. Provides the ground reference for the analog/core circuitry
GND	1,7,8,18,24,25,31,41,42,48		Ground

**Function Table**

Inputs				Outputs				PLL
AV <sub>DD</sub>	$\overline{\text{PWRDWN}}$	CLK	$\overline{\text{CLK}}$	Y	$\overline{\text{Y}}$	FBOU	$\overline{\text{FBOU}}$	
GND	H	L	H	L	H	L	H	Bypassed/off
GND	H	H	L	H	L	H	L	Bypassed/off
X	L	L	H	Z	Z	Z	Z	off
X	L	H	L	Z	Z	Z	Z	off
2.5V(nom)	H	L	H	L	H	L	H	on
2.5V(nom)	H	H	L	H	L	H	L	on
2.5V(nom)	X	<20 MHz <sup>(1)</sup>		Z	Z	Z	Z	off

**Notes:** For testing and power saving purposes, PI6CV857B will power down if the frequency of the reference inputs CLK,  $\overline{\text{CLK}}$  is well below the operating frequency range. The maximum power down clock frequency is below 20 MHz. For example, PI6CV857B will be powered down when the CLK,  $\overline{\text{CLK}}$  stop running.

Z = High impedance

X = Don't care

**Absolute Maximum Ratings** (Over operating free-air temperature range)

Symbol	Parameter	Min.	Max.	Units
$V_{DDQ}, AV_{DD}$	I/O supply voltage range and analog/core supply voltage range	- 0.5	3.6	V
$V_I$	Input voltage range	- 0.5	$V_{DDQ} + 0.5$	
$V_O$	Output voltage range	- 0.5		
$I_{IK}$	Input Clamp Current	- 50	50	mA
$I_{OK}$	Output Clamp Current	- 50	50	
$I_O$	Continuous output Current	- 50	50	
$I_{O(PWR)}$	Continuous current through each $V_{DD}$ , $V_{DDQ}$ , or GND	- 100	100	
$T_{stg}$	Storage temperature	- 65	150	°C

**Note:** Stress beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device.

**DC Specifications**

**Recommended Operating Conditions**

Symbol	Parameter	Min.	Nom.	Max.	Units
$AV_{DD}$	Analog/core supply voltage	2.3	2.5	2.7	V
$V_{DDQ}$	Output supply voltage	2.3	2.5	2.7	
$V_{IL}$	Low-level input voltage for $\overline{PWRDWN}$ pin	-0.3		0.7	
$V_{IH}$	High-level input voltage for $\overline{PWRDWN}$ pin	1.7		$V_{DDQ} + 0.3$	
$V_I$	Input Voltage	0		$V_{DDQ}$	
$I_{OH}$	High-level output current	-		12	mA
$I_{OL}$	Low-level output current	-		-12	
$V_{IX}$	Input differential-pair crossing voltage	$(V_{DDQ}/2) - 0.2$		$(V_{DDQ}/2) + 0.2$	V
$V_{IN}$	Input voltage level	-0.3		$V_{DDQ} + 0.3$	
$V_{ID}$	Input differential voltage between CLK and $\overline{CLK}$	0.36		$V_{DDQ} + 0.6$	
$V_{OD}$	Output differential voltage between $Y[n]$ & $\overline{Y[n]}$ and $\overline{FBOUT}$ & $FBOUT$	0.7		$V_{DDQ} + 0.6$	
$T_A$	Operating free air temperature	-40		85	°C

**Timing Requirements** (Over recommended operating free-air temperature)

Symbol	Description	AVDD, VDDQ = 2.5V ±0.2V		Units
		Min.	Max.	
f <sub>CK</sub>	Operating clock frequency <sup>(1,2)</sup>	60	200	MHz
	Application clock frequency <sup>(3)</sup>	95	200	
t <sub>DC</sub>	Input clock duty cycle	40	60	%
t <sub>STAB</sub>	PLL stabilization time after powerup		100	µs

**Notes:**

1. The PLL is able to handle spread spectrum induced skew.
2. Operating clock frequency indicates a range over which the PLL is able to lock, but in which the clock is not required to meet the other timing parameters. (Used for low-speed debug).
3. Application clock frequency indicates a range over which the PLL meets all of the timing parameters.

**Electrical Characteristics** (Over recommended operating free-air temperature)

Parameter		Test Conditions	AVDD, VDDQ	Min.	Typ.	Max.	Units		
V <sub>IK</sub>	All inputs	I <sub>I</sub> = -18mA	2.3V			-1.2	V		
V <sub>OH</sub>	High output voltage	I <sub>OH</sub> = -100µA	2.3 to 2.7V	VDDQ - 0.1					
		I <sub>OH</sub> = -12mA	2.3V	1.7					
V <sub>OL</sub>	Low output voltage	I <sub>OL</sub> = 100µA	2.3 to 2.7V			0.1			
		I <sub>OL</sub> = 12mA	2.3V			0.6			
I <sub>I</sub>	CLK, FBIN	V <sub>I</sub> = V <sub>DDQ</sub> or GND	2.7V			±10		µA	
	PWRDWN	V <sub>I</sub> = V <sub>DDQ</sub> or GND							
I <sub>DDQ</sub>	Dynamic supply current of V <sub>DDQ</sub>	V <sub>DD</sub> = 2.7V				300	mA		
	Static supply current	CLK & $\overline{\text{CLK}}$ <20 MHz or PWRDWN = Low <sup>(4)</sup>				100	µA		
I <sub>ADD</sub>	Dynamic supply current of AV <sub>DD</sub>	V <sub>DD</sub> = 2.7V				12	mA		
	Static supply current	CLK & $\overline{\text{CLK}}$ <20 MHz or PWRDWN = Low <sup>(4)</sup>				100	µA		
C <sub>I</sub>	CLK and $\overline{\text{CLK}}$	V <sub>I</sub> = V <sub>DDQ</sub> or GND	2.5V	2.0		3.5	pF		
	FBIN and $\overline{\text{FBIN}}$								
C <sub>I(Δ)</sub>	CLK and $\overline{\text{CLK}}$	V <sub>I</sub> = V <sub>DDQ</sub> or GND		2.5V	-0.25			0.25	
	FBIN and $\overline{\text{FBIN}}$								
ΔC <sub>I</sub>	Part to Part input Capacitance Variation <sup>(5)</sup>	V <sub>I</sub> = V <sub>DDQ</sub> or GND			2.5V				1

**Note:**

4. The maximum power-down clock frequency is below 20 MHz.
5. Guaranteed by design, but not production tested.

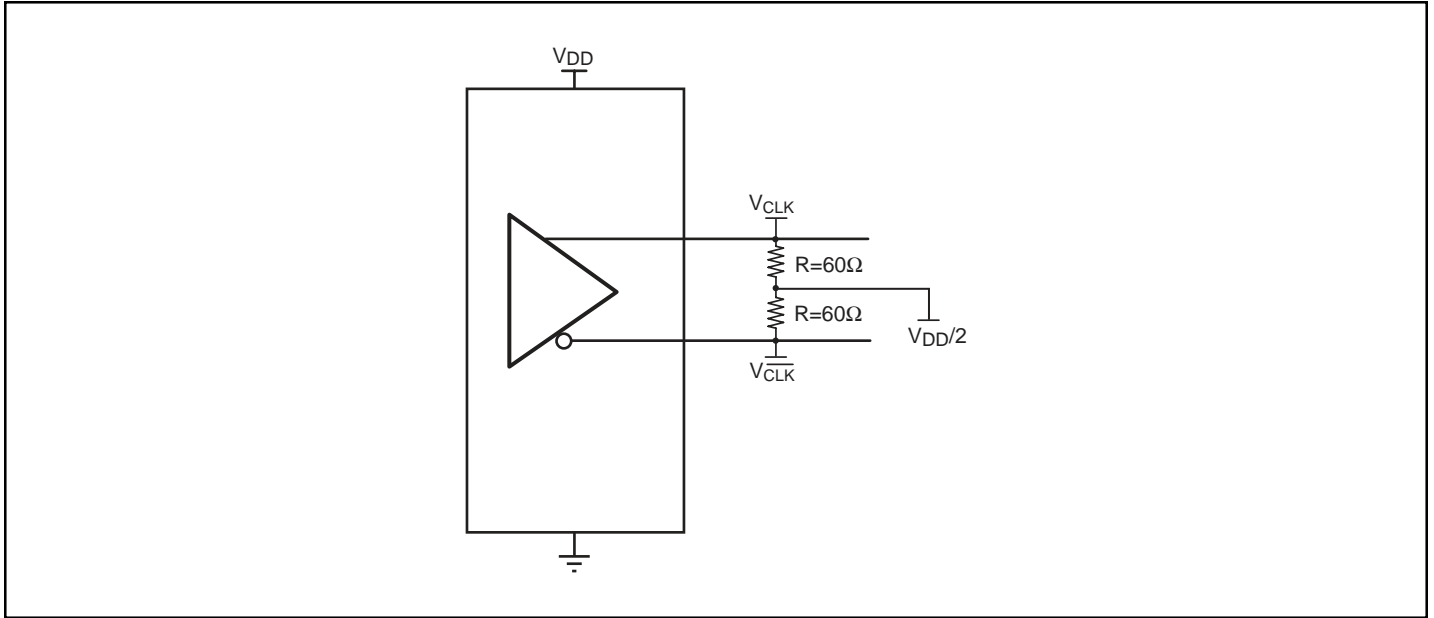
### AC Specifications

Switching characteristics over recommended operating free-air temperature range (unless otherwise noted)( See Figure 1 & 2 )

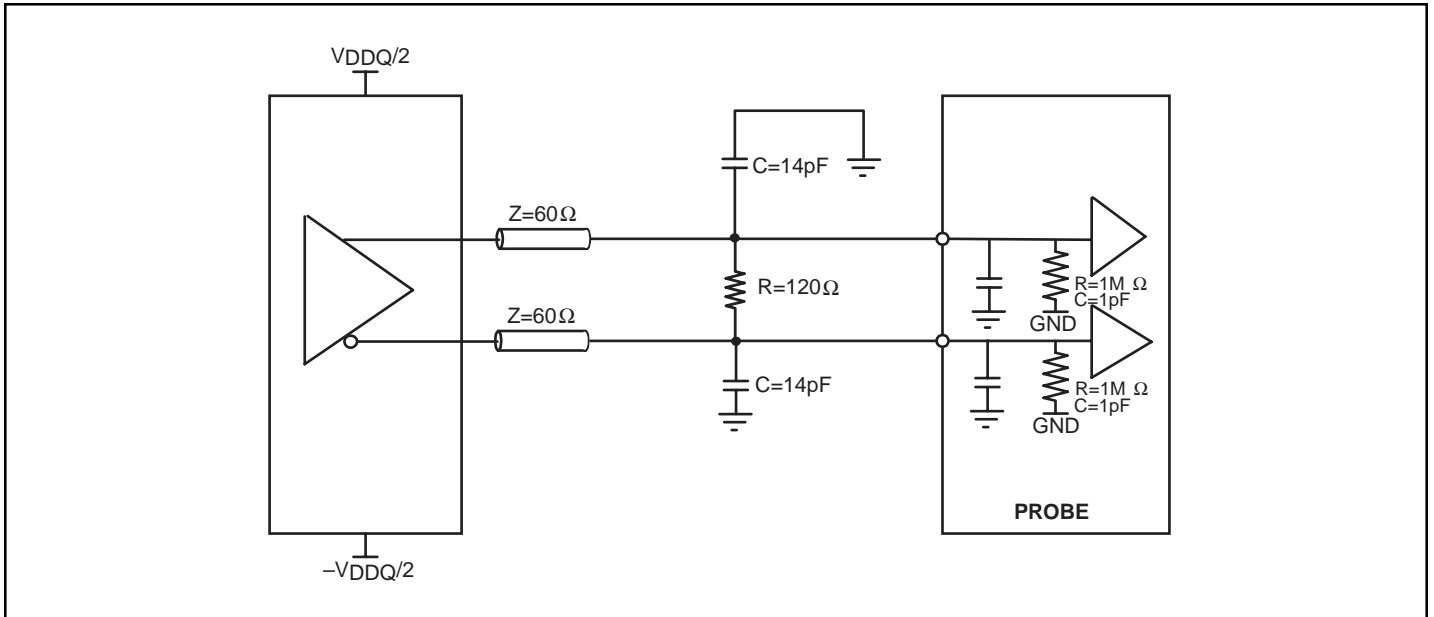
Parameter	Description	Diagram	AV <sub>CC</sub> , V <sub>DDQ</sub> = 2.5V ±0.2V			Units
			Min.	Nom.	Max	
tjit(cc)	Cycle-to-cycle jitter	see Figure 3	-50		50	ps
t(θ)	Static phase offset <sup>(1)</sup>	see Figure 4	-50	0	50	
tsk(o)	Output clock skew	see Figure 5			75	
tjit(per)	Period jitter	see Figure 6	-75		75	
tjit(hper)	Half-period jitter	see Figure 7	-100		100	
tsl(i)	Input clock slew rate <sup>(2)</sup>	see Figure 8	1.0		4.0	V/ns
tsl(o)	Output clock slew rate <sup>(2)</sup>	see Figure 8	1.0		2.0	
V <sub>OX</sub>	Output Differential Cross-Voltage		(V <sub>DDQ</sub> /2) -0.1		(V <sub>DDQ</sub> /2) +0.1	V
The PLL is capable of meeting all the above parameters while supporting SSC synthesizers with the following parameters <sup>(3)</sup> .						
	SSC modulation frequency		30.00		50.00	kHz
	SSC clock input frequency deviation		0.00		-0.50	%
	PLL loop bandwidth		2			MHz
	Phase angle				-0.031	degrees

**Notes:**

1. Static Phase offset does not include Jitter.
2. All AC parameters are measured using test load shown in Figure2.
3. The SSC requirements meet the Intel PC100 SDRAM Registered DIMM specification.



**Figure 1. IBIS Model Output Load**



**Figure 2. Output Load Test Circuit**

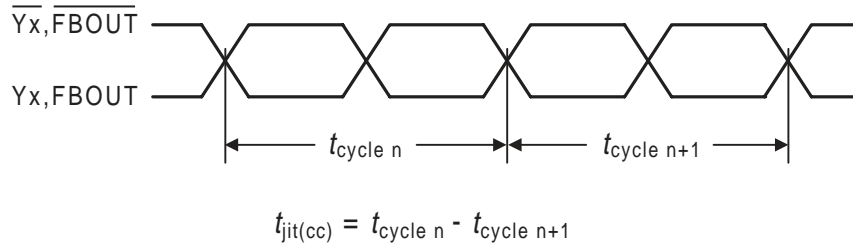


Figure 3. Cycle-to-Cycle Jitter

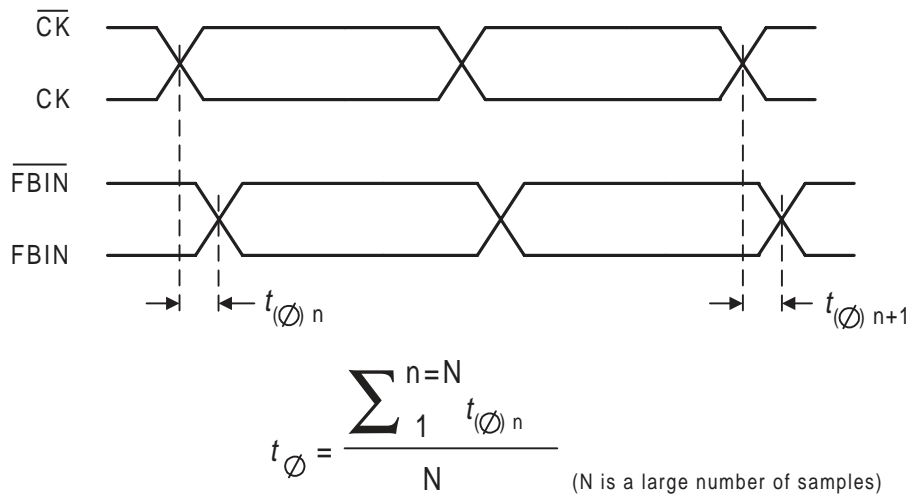


Figure 4. Static Phase Offset

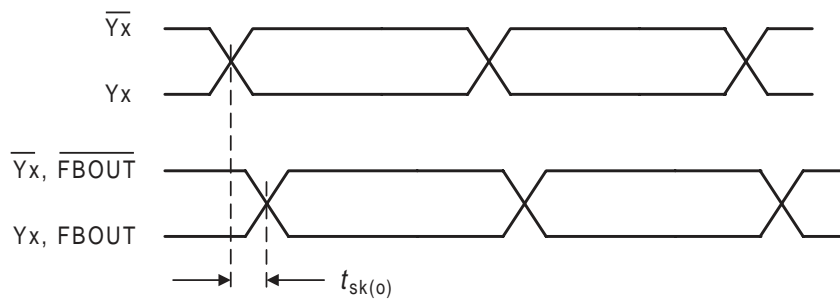
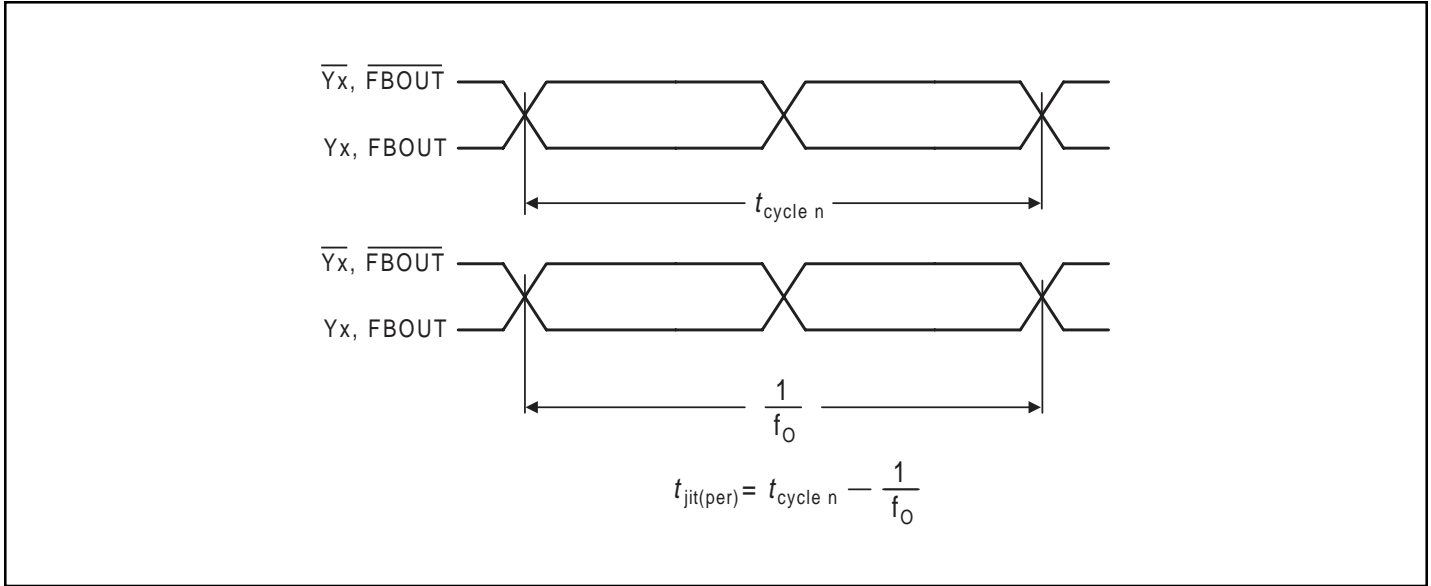
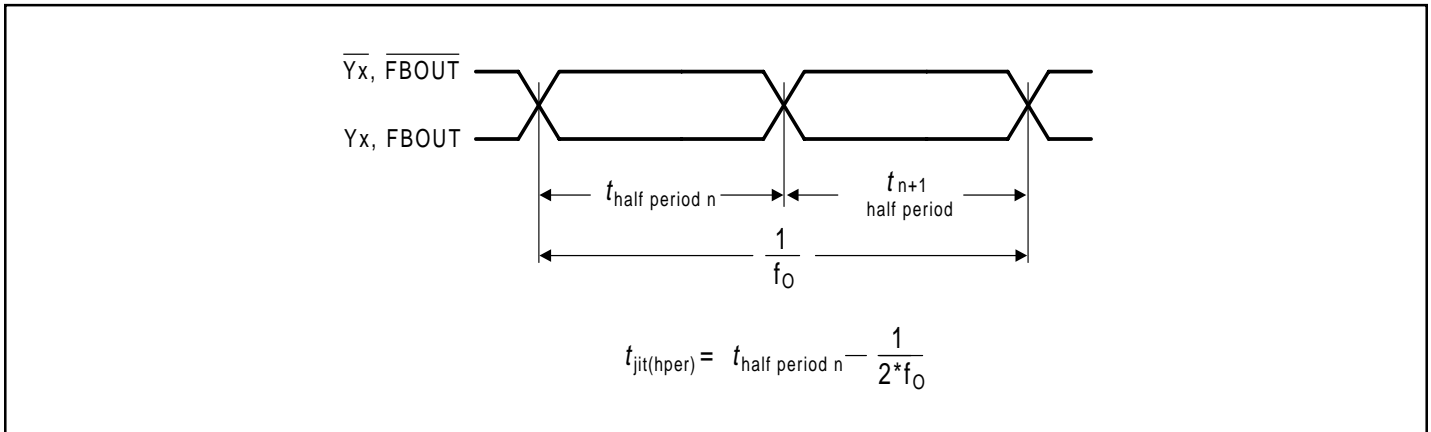
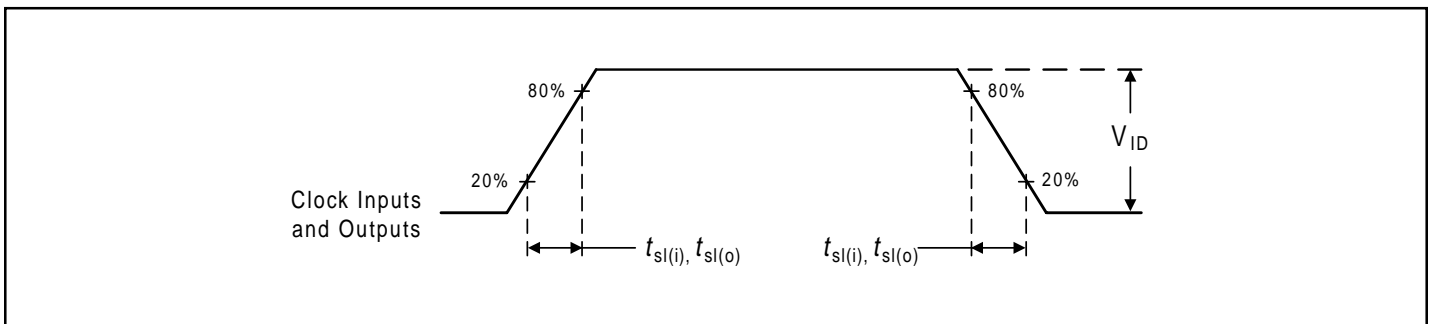
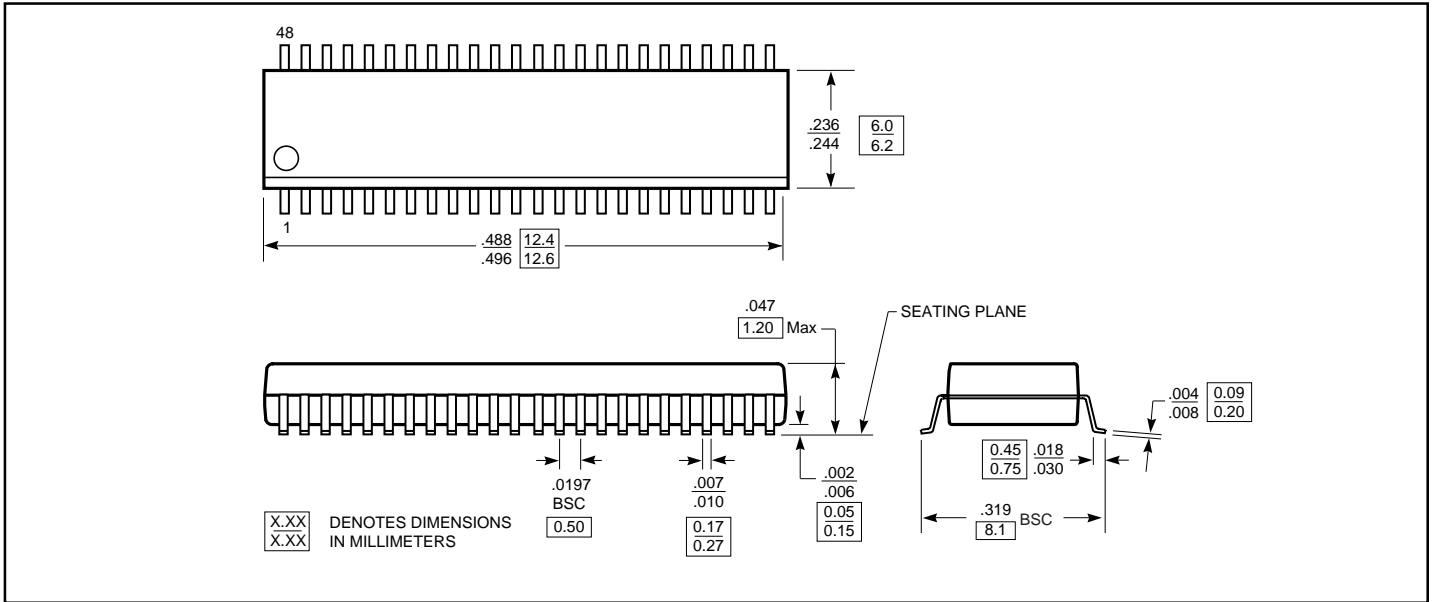


Figure 5. Output Skew


**Figure 6. Period Jitter**

**Figure 7. Half-Period Jitter**

**Figure 8. Input and Output Slew Rates**



**Packaging Mechanical: 48-Pin TSSOP**



**Ordering Information**

Ordering Code	Packaging Code	Package Type
PI6CV857BA	A	48-pin, 240-mil wide TSSOP
PI6CV857BAE	A	Pb-free and Green 48-pin, 240-mil wide TSSOP

**Notes:**

1. Thermal characteristics can be found on the company web site at <http://www.pericom.com/packaging/>