

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_x, $\overline{\text{Y}}_x$), (FBOU_T, $\overline{\text{FBOU}}_T$): SSTL_2
- External feedback pins (FBIN, $\overline{\text{FBIN}}$) are used to synchronize the outputs to the clock input.
- Operates at AV_{DD} = 2.5V for core circuit and internal PLL, and V_{DDQ} = 2.5V for differential output drivers
- Packages (Pb-free and Green available):
 - 48-pin TSSOP

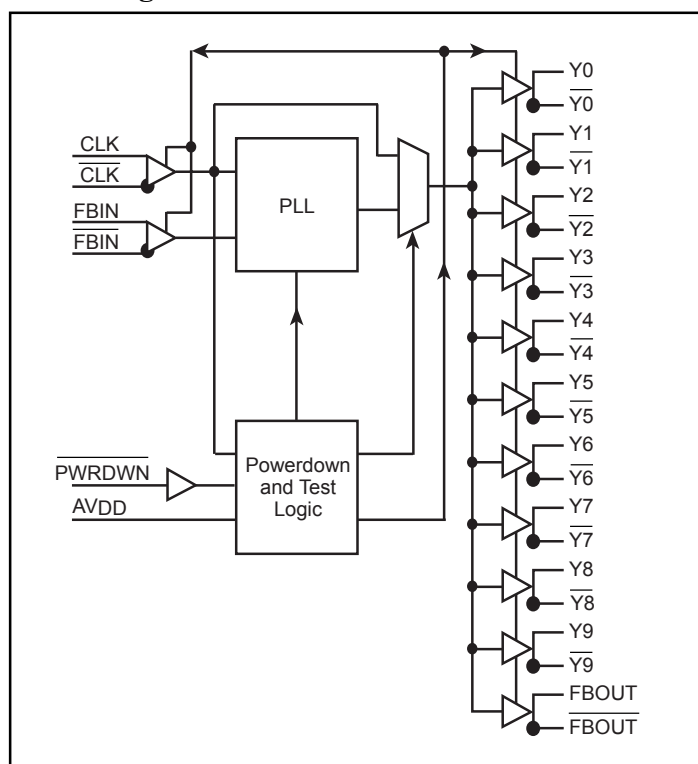
Product Description

PI6CV857B PLL clock device is developed for registered DDR DIMM applications. This PLL Clock Buffer is designed for 2.5 V_{DDQ} and 2.5V AV_{DD} 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_T, $\overline{\text{FBOU}}_T$). 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_{DD}). 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_{DD} is strapped low, the PLL is turned off and bypassed for test purposes.

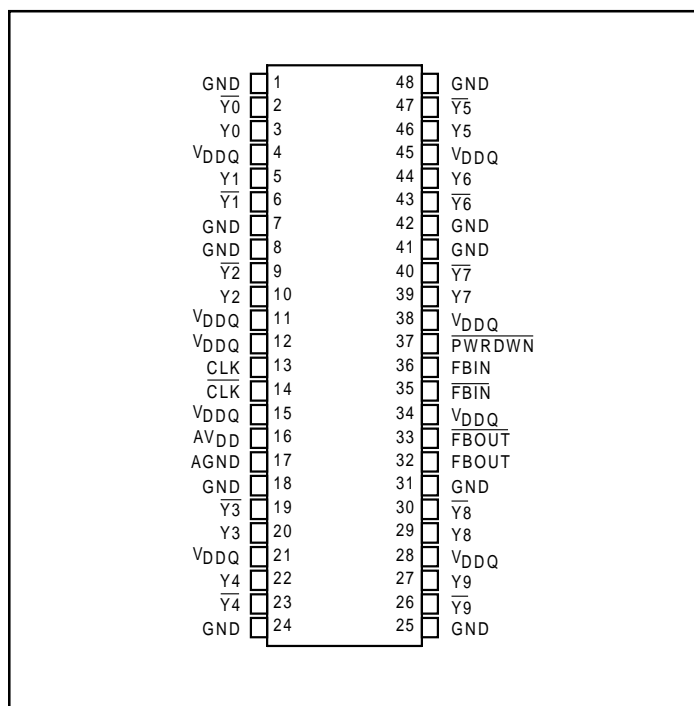
When the input frequency falls below a suggested detection frequency that is below the operating frequency of the PLL, the device will enter a low power mode. An input frequency detection circuit will detect the low frequency condition and perform the same low power features as when the PWRDWN input 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 |
|--|-----------------------------|----------|--|
| CLK CLK | 13 14 | I | Reference Clock input |
| Y _x | 3,5,10,20,22,27,29,39,44,46 | O | Clock outputs. |
| \overline{Y}_x | 2,6,9,19,23,26,30,40,43,47 | | Complement Clock outputs. |
| FBOU _T FBOU _T | 32 33 | | Feedback output, and Complement Feedback Output |
| FBIN FBIN | 36 35 | I | Feedback Input, and Complement Feedback Input |
| \overline{PWRDWN} | 37 | | Power down and output disable for all Y _x and \overline{Y}_x outputs. When $\overline{PWRDWN} = 0$, the part is powered down and the differential clock outputs are disabled to a 3-state. When $\overline{PWRDWN} = 1$, all differential clock outputs are enabled and run at the same frequency as CLK. |
| V _{DDQ} | 4,11,12,15,21,28,34,38,45 | Power | Power Supply for I/O. |
| AV _{DD} | 16 | | Analog /core power supply. AV _{DD} can be used to bypass the PLL for testing purposes. When AV _{DD} 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 _{DD} | \overline{PWRDWN} | CLK | \overline{CLK} | Y | \overline{Y} | FBOU _T | \overline{FBOU}_T | |
| 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 ⁽¹⁾ | | 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{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{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 _{CK} | Operating clock frequency ^(1,2) | 60 | 200 | MHz |
| | Application clock frequency ⁽³⁾ | 95 | 200 | |
| t _{DC} | Input clock duty cycle | 40 | 60 | % |
| t _{STAB} | 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 _{IK} | All inputs | I _I = -18mA | 2.3V | | | -1.2 | V |
| V _{OH} | High output voltage | I _{OH} = -100µA | 2.3 to 2.7V | VDDQ - 0.1 | | | |
| | | I _{OH} = -12mA | 2.3V | 1.7 | | | |
| V _{OL} | Low output voltage | I _{OL} = 100µA | 2.3 to 2.7V | | | 0.1 | |
| | | I _{OL} = 12mA | 2.3V | | | 0.6 | |
| I _I | CLK, FBIN | V _I = V _{DDQ} or GND | 2.7V | | | ±10 | µA |
| | PWRDWN | V _I = V _{DDQ} or GND | | | | | |
| I _{DDQ} | Dynamic supply current of V _{DDQ} | V _{DD} = 2.7V | | | | 300 | mA |
| | Static supply current | CLK & $\overline{\text{CLK}}$ <20 MHz or PWRDWN = Low ⁽⁴⁾ | | | | 100 | µA |
| I _{ADD} | Dynamic supply current of AV _{DD} | V _{DD} = 2.7V | | | | 12 | mA |
| | Static supply current | CLK & $\overline{\text{CLK}}$ <20 MHz or PWRDWN = Low ⁽⁴⁾ | | | 100 | µA | |
| C _I | CLK and $\overline{\text{CLK}}$ | V _I = V _{DDQ} or GND | 2.5V | 2.0 | | 3.5 | pF |
| | FBIN and $\overline{\text{FBIN}}$ | | | | | | |
| C _{I(Δ)} | CLK and $\overline{\text{CLK}}$ | V _I = V _{DDQ} or GND | 2.5V | -0.25 | | 0.25 | |
| | FBIN and $\overline{\text{FBIN}}$ | | | | | | |
| ΔC _I | Part to Part input Capacitance Variation ⁽⁵⁾ | V _I = V _{DDQ} 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 _{CC} , V _{DDQ} = 2.5V ±0.2V | | | Units |
|---|---------------------------------------|--------------|--|------|-------------------------------|---------|
| | | | Min. | Nom. | Max | |
| t _{jit(cc)} | Cycle-to-cycle jitter | see Figure 3 | -50 | | 50 | ps |
| t(θ) | Static phase offset ⁽¹⁾ | see Figure 4 | -50 | 0 | 50 | |
| tsk(o) | Output clock skew | see Figure 5 | | | 75 | |
| t _{jit(per)} | Period jitter | see Figure 6 | -75 | | 75 | |
| t _{jit(hper)} | Half-period jitter | see Figure 7 | -100 | | 100 | |
| tsl(i) | Input clock slew rate ⁽²⁾ | see Figure 8 | 1.0 | | 4.0 | V/ns |
| tsl(o) | Output clock slew rate ⁽²⁾ | see Figure 8 | 1.0 | | 2.0 | |
| V _{OX} | Output Differential Cross-Voltage | | (V _{DDQ} /2) -0.1 | | (V _{DDQ} /2) +0.1 | V |
| The PLL is capable of meeting all the above parameters while supporting SSC synthesizers with the following parameters ⁽³⁾ . | | | | | | |
| | 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.

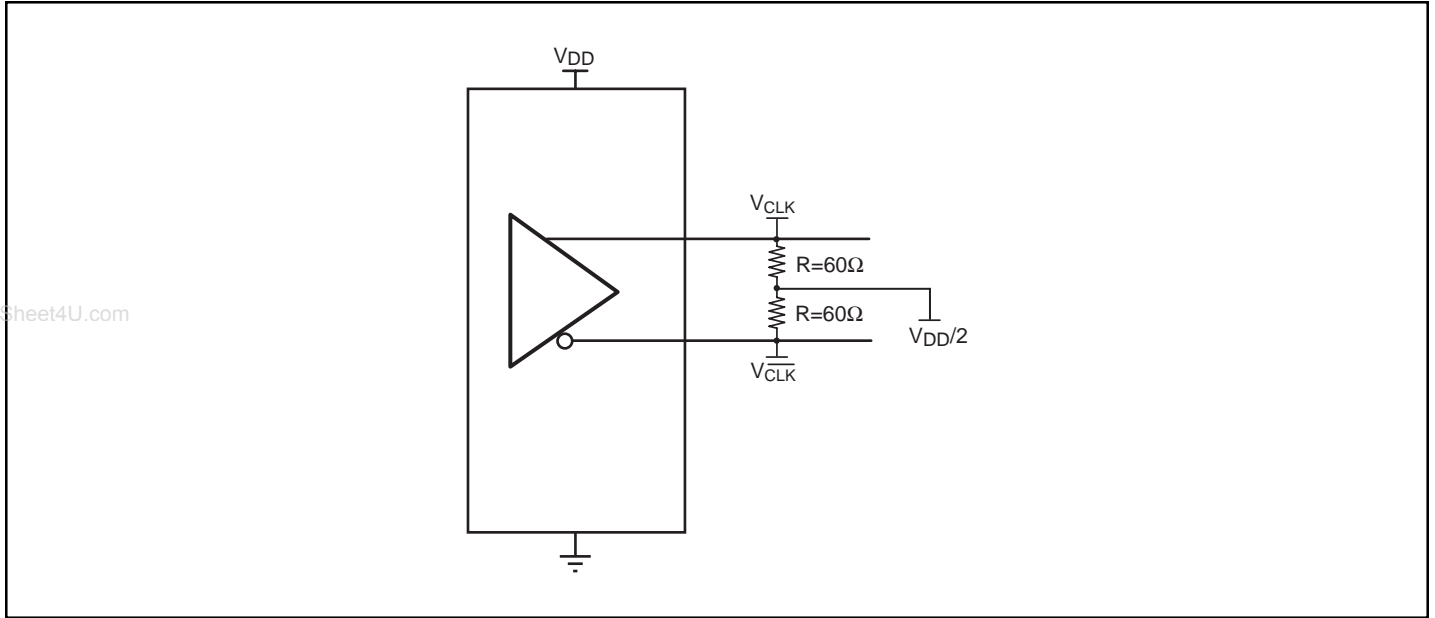


Figure 1. IBIS Model Output Load

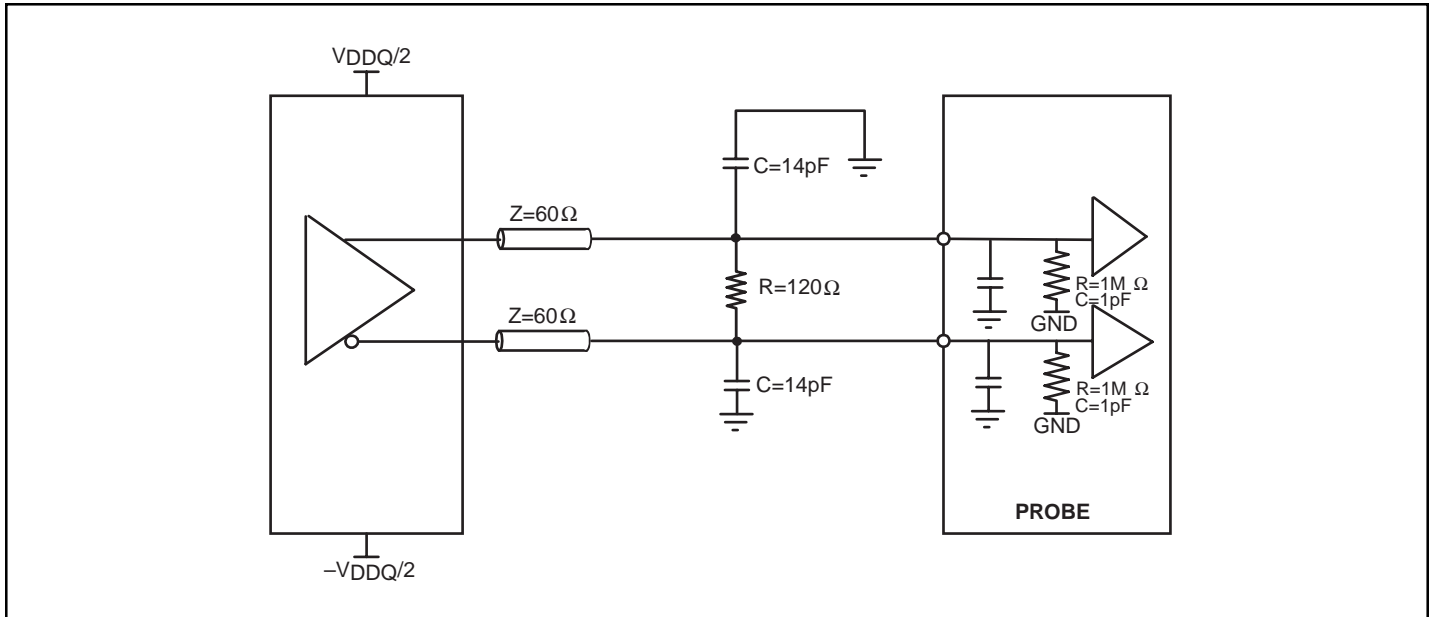


Figure 2. Output Load Test Circuit

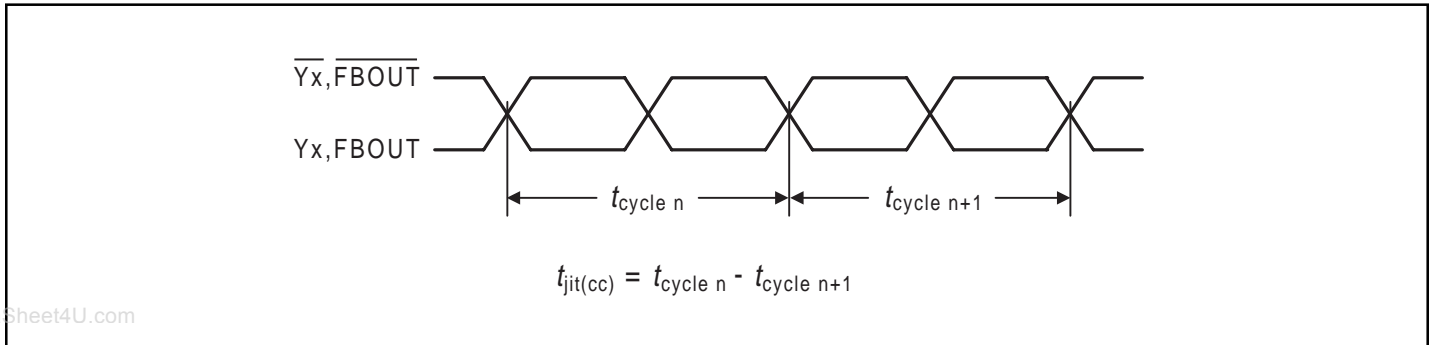


Figure 3. Cycle-to-Cycle Jitter

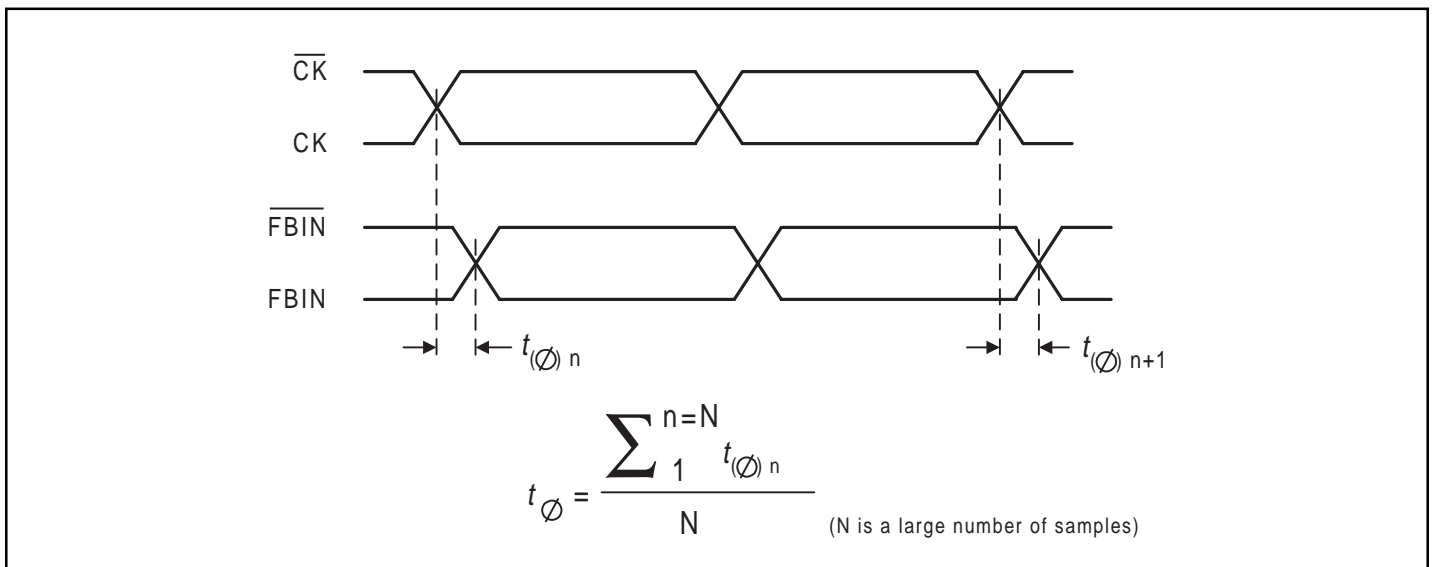


Figure 4. Static Phase Offset

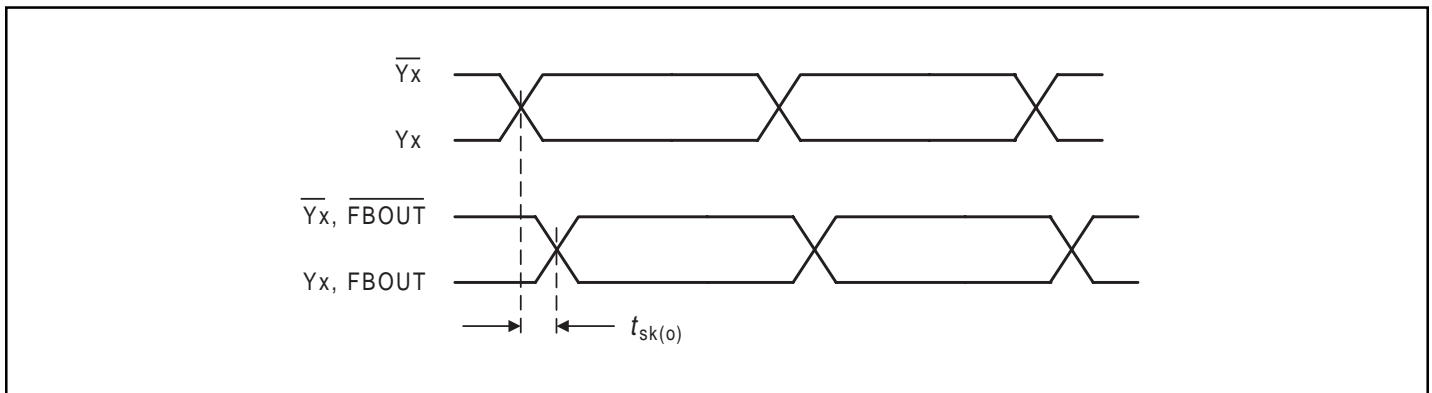
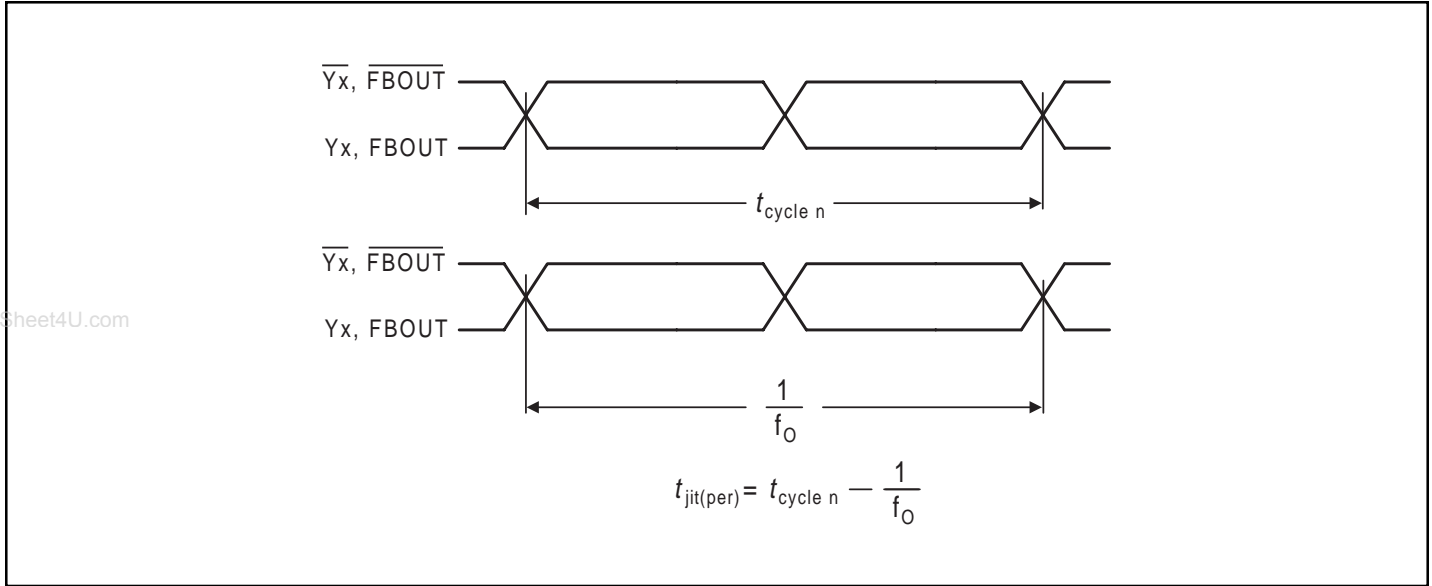
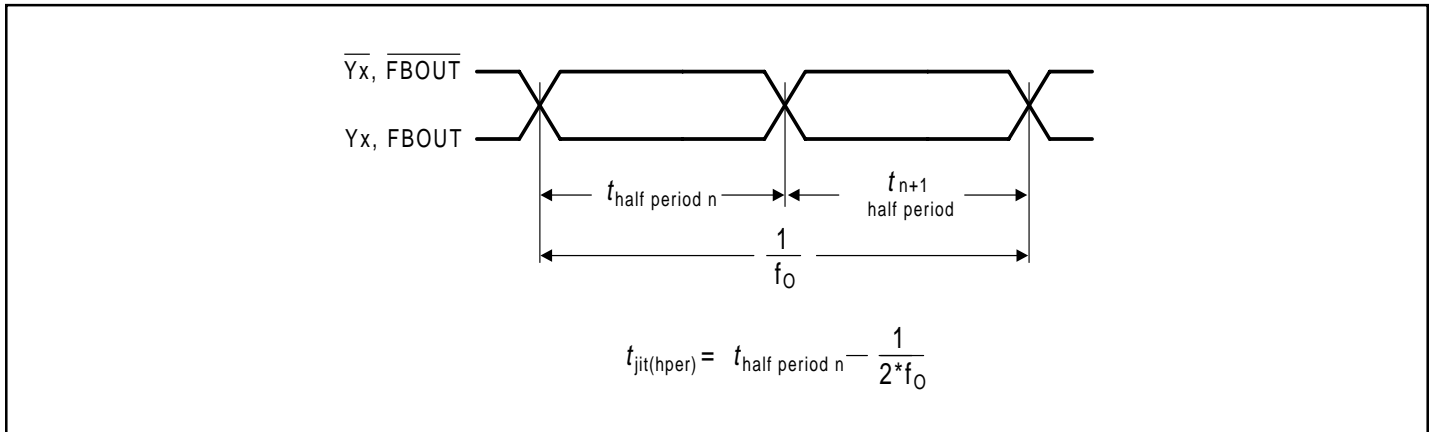
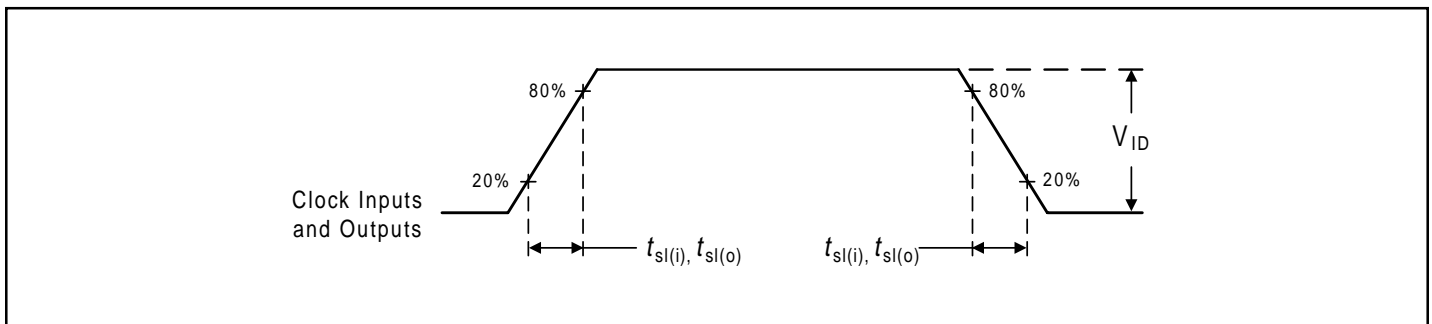
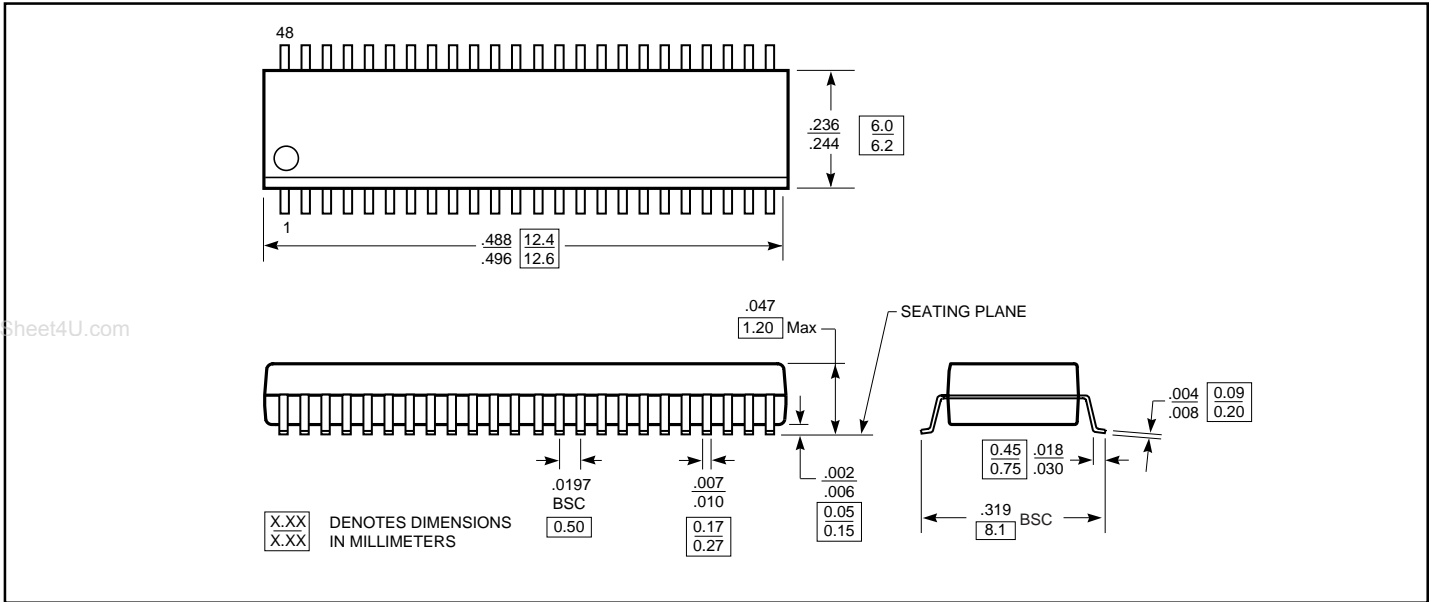


Figure 5. Output Skew


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:

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