

Features

- Maximum rated frequency: 133 MHz
- Low cycle-to-cycle jitter
- Input to output delay, less than 200ps
- External feedback pin allows outputs to be synchronized to the clock input
- 5V tolerant input*
- Operates at 3.3V V_{DD}
- Test mode allows bypass of the PLL for system testing purposes (e.g., IBIS measurements)
- Space-saving Packaging (Pb-free and Green Available):
— 8-pin, 150-mil SOIC (W)

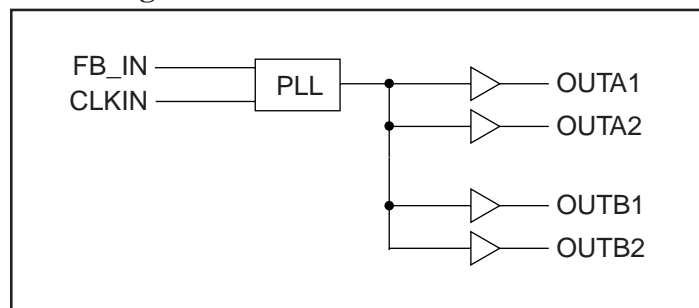
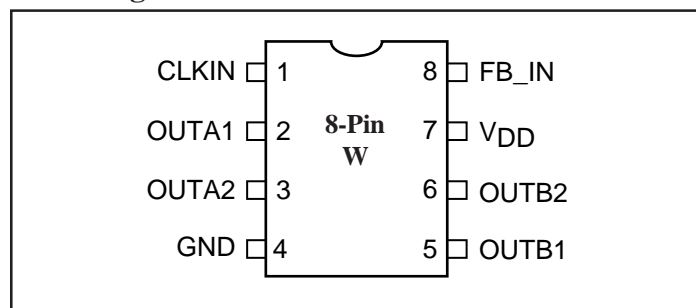
* FB_IN and $CLKIN$ must reference the same voltage thresholds for the PLL to deliver zero delay skewing

Description

The PI6C2404A-1 is a PLL-based, zero-delay buffer, with the ability to distribute four outputs of up to 133 MHz at 3.3V. Two banks of two outputs exist, $OUTA[1-2]$ and $OUTB[1-2]$.

An external feedback pin is used to synchronize the outputs to the input; the relationship between loading of this signal and the other outputs determines the input-output delay.

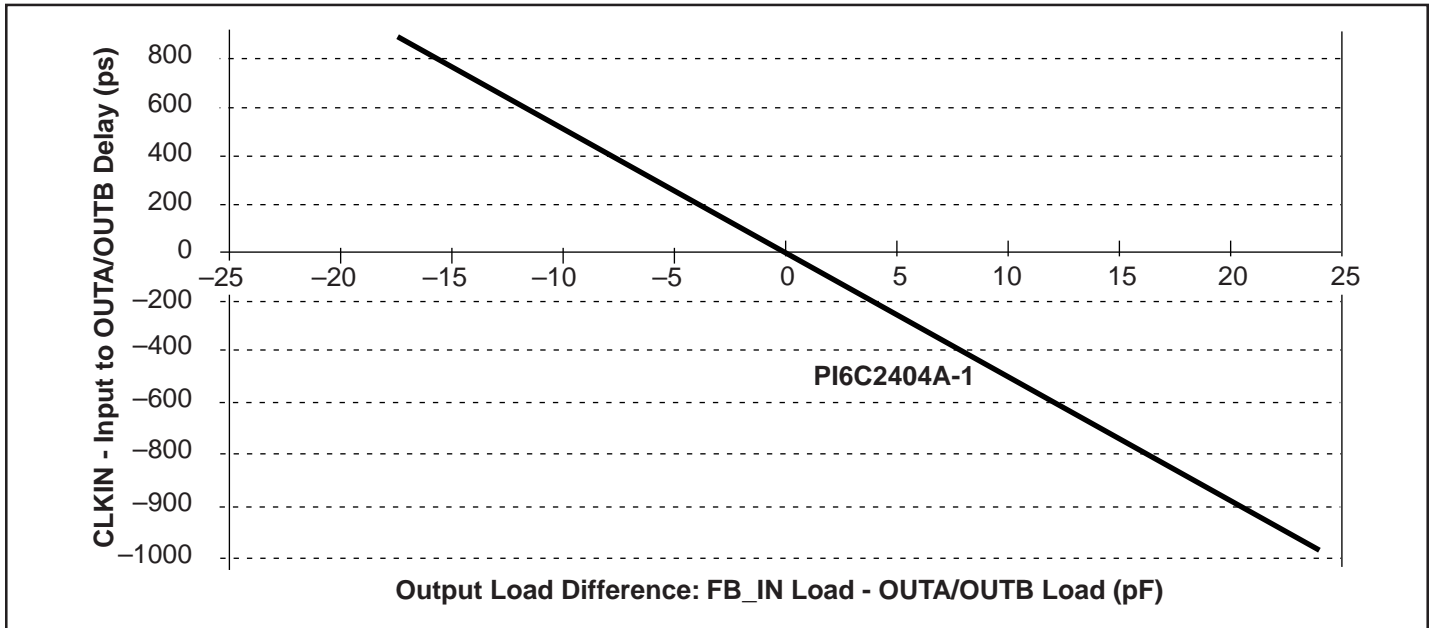
The PI6C2404A-1 is characterized for both commercial and industrial operation.

Block Diagram

Pin Configuration

Pin Description

| Pin | Signal | Description |
|------|-----------|--|
| 1 | CLKIN | Input clock reference frequency (weak pull-down) |
| 2, 3 | OUTA[1-2] | Clock output, Bank A |
| 7 | V_{DD} | 3.3V supply |
| 4 | GND | Ground |
| 5, 6 | OUTB[1-2] | Clock output, Bank B |
| 8 | FB_IN | PLL feedback input |

Zero-Delay and Skew Control

CLKIN Input to Output Bank Delay vs. Difference in Loading between FB_IN pin and OUTA/OUTB pins



The relationship between loading of the FB_IN signal and other outputs determines the input-output delay. Zero delay is achieved when all outputs, including feedback, are loaded equally.

Maximum Ratings

| | |
|---|--------------------------------|
| Supply Voltage to Ground Potential | -0.5V to +7.0V |
| DC Input Voltage (Except CLKIN) | -0.5V to V _{DD} +0.5V |
| DC Input Voltage CLKIN | -0.5 to 7V |
| Storage Temperature | -65°C to +150°C |
| Maximum Soldering Temperature (10 seconds) | 260°C |
| Junction Temperature | 150°C |
| Static Discharge Voltage (per MIL-STD-883, Method 3015) | >2000V |

Operating Conditions (V_{CC}=3.3V±0.3V)

| Parameter | Description | Min. | Max. | Units |
|-----------------|---|------|------|-------|
| V _{DD} | Supply Voltage | 3.0 | 3.6 | V |
| T _A | Commerical Operating Temperature | 0 | 70 | °C |
| | Industrial Operating Temperature | -40 | 85 | |
| C _L | Load Capacitance, below 100 MHz | — | 30 | pF |
| | Load Capacitance, from 100 MHz to 133 MHz | — | 15 | |
| C _{IN} | Input Capacitance | — | 7.3 | |

DC Electrical Characteristics for Industrial Temperature Devices

| Parameter | Description | Test Conditions | Min. | Max. | Units |
|-----------------|---------------------|---|------|------|-------|
| V _{IL} | Input LOW Voltage | | | 0.8 | V |
| V _{IH} | Input HIGH Voltage | | 2.0 | | |
| I _{IL} | Input LOW Current | V _{IN} = 0V | | 50 | μA |
| I _{IH} | Input HIGH Current | V _{IN} = V _{DD} | | 112 | |
| V _{OL} | Output LOW Voltage | I _{OL} = 8mA | | 0.4 | V |
| V _{OH} | Output HIGH Voltage | I _{OH} = -8mA | 2.4 | | |
| I _{DD} | Supply Current | Unloaded outputs 100 MHz, Select inputs at V _{DD} or GND | | 54 | mA |
| | | Unloaded outputs 66 MHz, CLKIN | | 39 | |
| | | Unloaded outputs 33MHz, CLKIN | | 22 | |

AC Electrical Characteristics for Industrial Temperature Devices

| Parameters | Name | Test Conditions | Min. | Typ. | Max. | Units |
|--------------------|--|---|------|------|------|-------|
| F _O | Output Frequency | 30pF load | 10 | | 100 | MHz |
| | | 15pF load | | | 133 | |
| t _{DC} | Duty Cycle ⁽¹⁾ | Measured at V _{DD} /2, F _{OUT} < 66.67MHz 30pF load | 40 | 50 | 60 | % |
| | | Measured at V _{DD} /2, F _{OUT} < 50MHz 15pF load | 45 | | 55 | |
| t _R | Rise Time ⁽¹⁾ | Measured between 0.8V and 2.0V, 30pF load | | | 2.2 | ns |
| | | Measured between 0.8V and 2.0V, 15pF load | | | 1.5 | |
| t _F | Fall Time ⁽¹⁾ | Measured between 0.8V and 2.0V, 30pF load | | | 2.2 | ns |
| | | Measured between 0.8V and 2.0V, 15pF load | | | 1.5 | |
| t _{SK(O)} | Output to Output Skew within same bank ⁽¹⁾ | All outputs equally loaded | | | 200 | ps |
| | OUTA to OUTB Skew ⁽¹⁾ | | | | | |
| t ₀ | Delay, CLKIN Rising Edge to FB_IN Rising Edge ⁽¹⁾ | Measured at V _{DD} /2 | | | 275 | ps |
| t _{SK(D)} | Device-to-Device Skew ⁽¹⁾ | Measured at V _{DD} /2 on FB_IN pins of devices | | 0 | 500 | ps |
| t _{JT} | Cycle-to-Cycle Jitter ⁽¹⁾ | Measured at 66.67 MHz, loaded 30pF load | | | 200 | ps |
| | | Measured at 133 MHz, loaded 15pF load | | | 150 | |
| t _{LOCK} | PLL Lock Time ⁽¹⁾ | Stable power supply, valid clocks presented on CLKIN and FB_IN pins | | | 1.0 | ms |

Notes:

1. CLKIN and FB_IN inputs have a threshold voltage of V_{DD}/2.

DC Electrical Characteristics for Commercial Temperature Devices

| Parameter | Description | Test Conditions | Min. | Max. | Units |
|-----------------|---------------------|--|------|------|-------|
| V _{IL} | Input LOW Voltage | | — | 0.8 | V |
| V _{IH} | Input HIGH Voltage | | 2.0 | — | |
| I _{IL} | Input LOW Current | V _{IN} = 0V | — | 50 | μA |
| I _{IH} | Input HIGH Current | V _{IN} = V _{DD} | — | 112 | |
| V _{OL} | Output LOW Voltage | I _{OL} = 8mA | — | 0.4 | V |
| V _{OH} | Output HIGH Voltage | I _{OH} = -8mA | 2.4 | — | |
| I _{DD} | Supply Current | Unloaded outputs 100 MHz Select Inputs @ V _{DD} or GND | — | 54 | |
| I _{DD} | Supply Current | Unloaded outputs, 66.67 MHz, Select inputs at V _{DD} or GND | — | 39 | mA |

AC Electrical Characteristics for Commercial Temperature Device

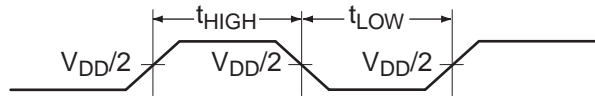
| Parameters | Name | Test Conditions | Min. | Typ. | Max. | Units |
|--------------------|--|--|------|------|------|-------|
| F _O | Output Frequency | 30pF load | 10 | | 100 | MHz |
| | | 15pF load, | | | 133 | |
| t _{DC} | Duty Cycle ⁽²⁾ | Measured at V _{DD} /2, F _O < 66.67MHz, 30pF load | 40 | 50 | 60 | % |
| | | Measured at V _{DD} /2, F _O < 50MHz, 15pF load | 45 | 50 | 55 | |
| t _R | Rise Time ⁽¹⁾ @ 30pF | Measured between 0.8V and 2.0V | | | 2.2 | ns |
| | Rise Time ⁽¹⁾ @ 15pF | | | | 1.5 | |
| t _F | Fall Time ⁽¹⁾ @ 30pF | | | | 2.2 | |
| | Fall Time ⁽¹⁾ @ 15pF | | | | 1.5 | |
| t _{SK(O)} | Output to Output Skew ⁽¹⁾ within same bank | All outputs equally loaded, V _{DD} /2 | | | 200 | |
| | OUTA to OUTB Skew ⁽¹⁾ | All outputs equally loaded, V _{DD} /2 | | | 200 | |
| t ₀ | Input to Output Delay, CLKIN Rising Edge to FB_IN Rising Edge ⁽¹⁾ | Measured at V _{DD} /2 | | | 275 | ps |
| t _{SK(D)} | Device to Device Skew ⁽¹⁾ | Measured at V _{DD} /2 on FB_IN pins of devices | | 0 | 500 | |
| t _{JIT} | Cycle-to-Cycle Jitter ⁽¹⁾ | Measured at 66.67 MHz, loaded 30pF outputs | | | 200 | |
| | | Measured at 133 MHz, loaded 15pF outputs | | | 150 | |
| t _{LOCK} | PLL Lock Time ⁽¹⁾ | Stable power supply, valid clocks presented on CLKIN and FB_IN pins | | | 1.0 | ms |

Notes:

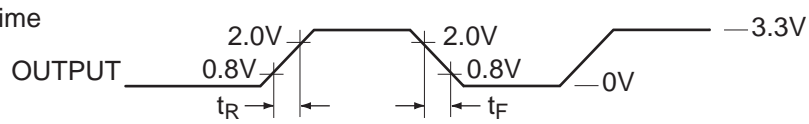
- CLKIN and FB_IN inputs have a threshold voltage of V_{DD}/2.
- $t_{DC} = \frac{t_{HIGH}}{t_{HIGH} + t_{LOW}}$

Switching Waveforms

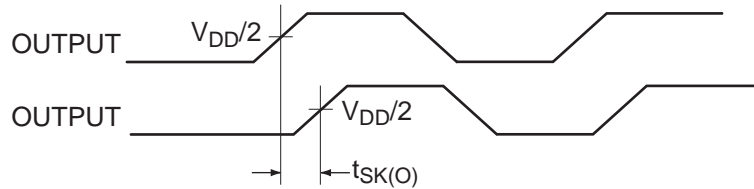
Duty Cycle Timing



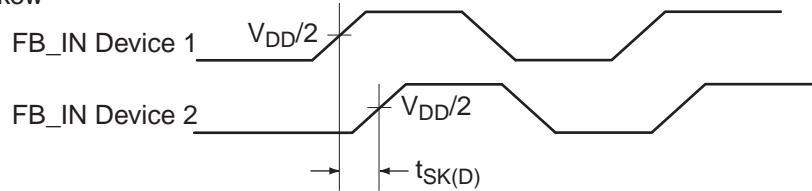
All Outputs Rise/Fall Time



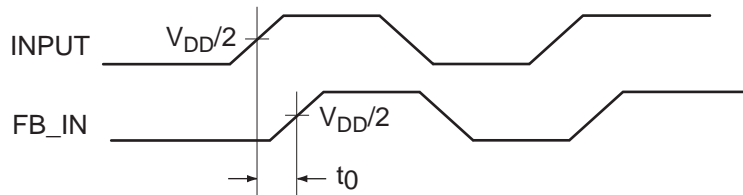
Output-Output Skew



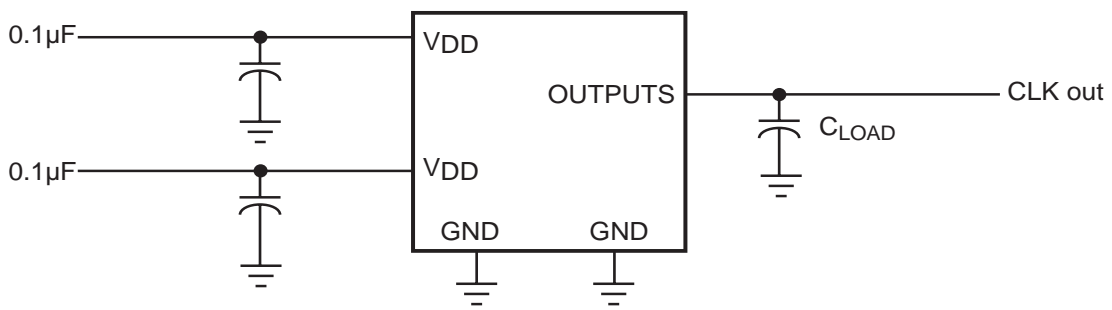
Device-Device Skew



Input-Output Propagation Delay

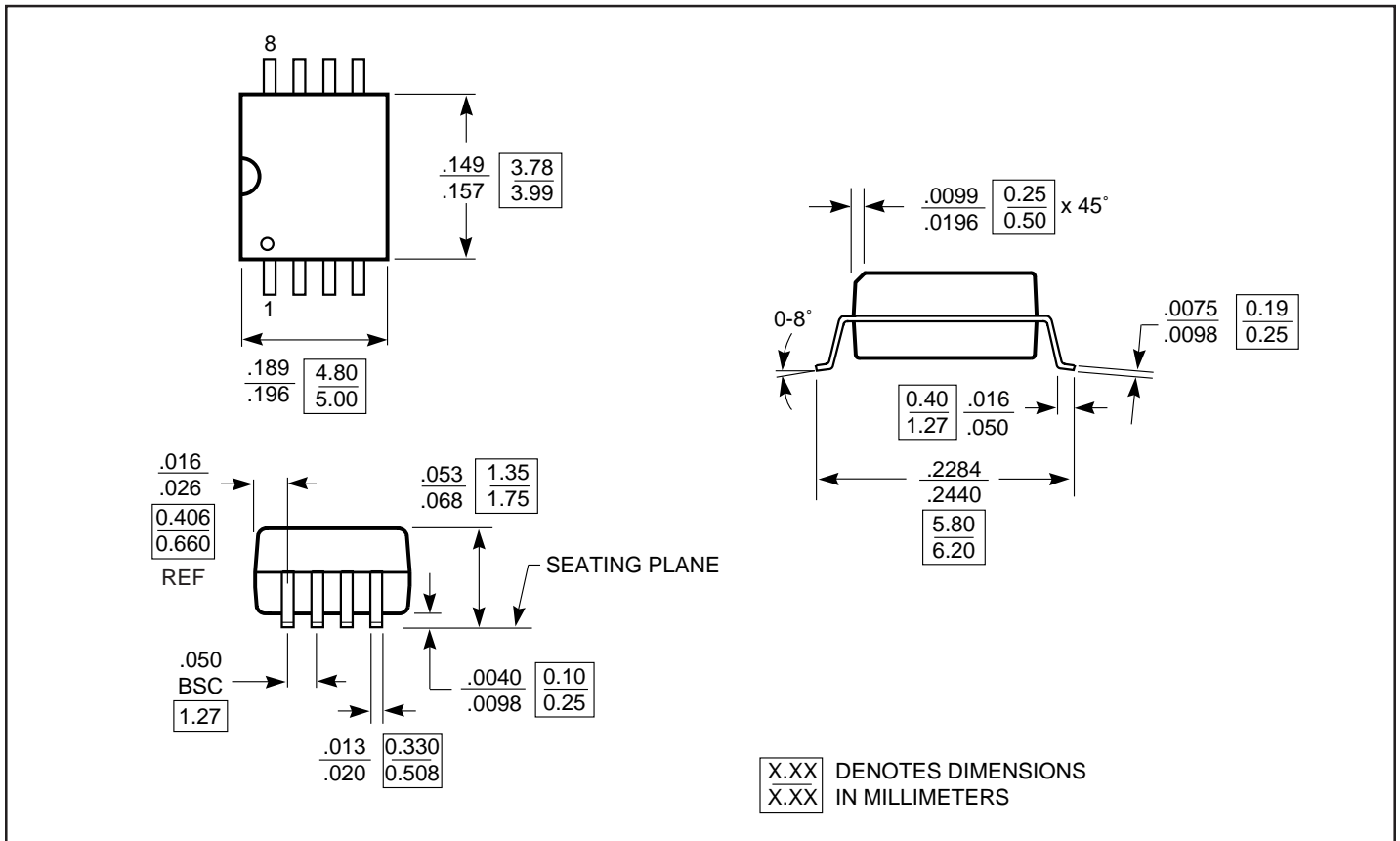


Test Circuit



Test Circuit for all parameters

Packaging Mechanical: 8-Pin SOIC (W)



Ordering Information

| Ordering Code | Package Code | Package Description | Operating Range |
|----------------|--------------|---|-----------------|
| PI6C2404A-1W | W | 8-pin 150-mil SOIC | Commercial |
| PI6C2404A-1WE | W | Pb-free and Green 8-pin 150-mil SOIC | Commercial |
| PI6C2404A-1WI | W | 8-pin 150-mil SOIC | Industrial |
| PI6C2404A-1WIE | W | Pb-free and Green 8-pin 150-mil SOIC | Industrial |