

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)

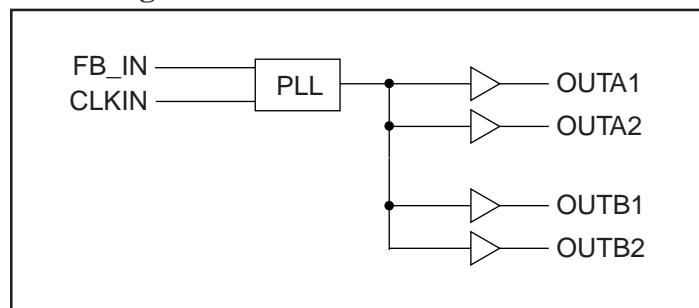
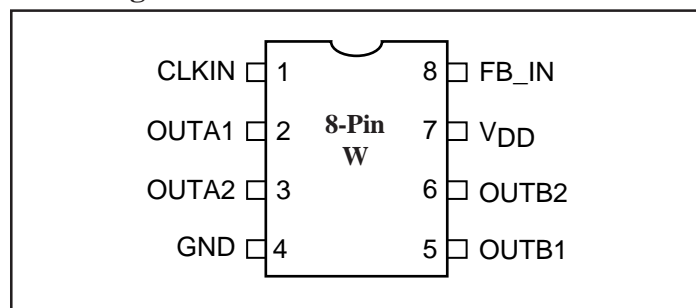
* FB_IN and $CLKIN$ must reference the same voltage thresholds for the PLL to deliver zero delay skewing

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.

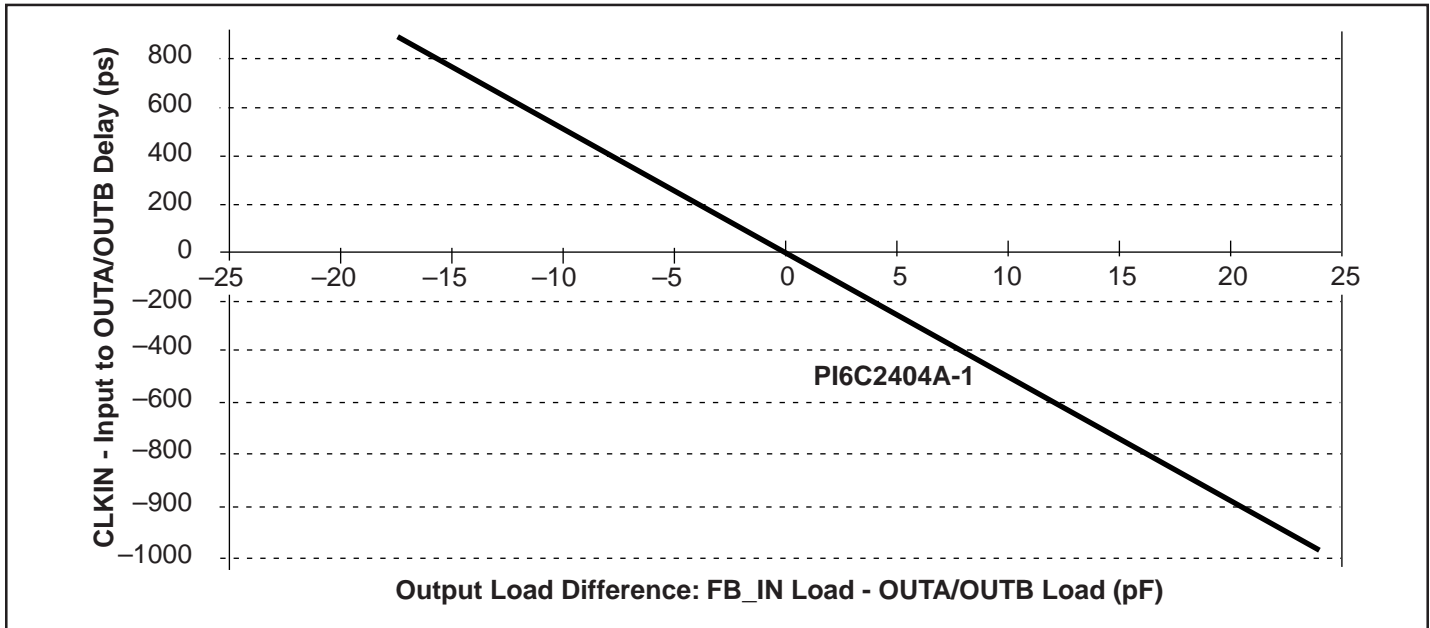
The PI6C2404A-1 is characterized for both commercial and industrial operation.

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

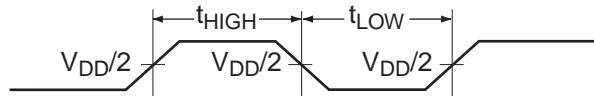
Notes:

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

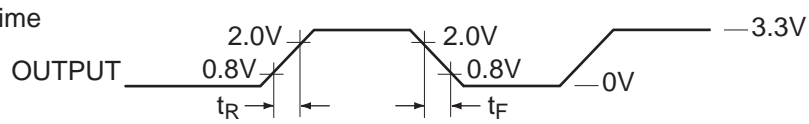
2. $t_{DC} = \frac{t_{HIGH}}{t_{HIGH} + t_{LOW}}$

Switching Waveforms

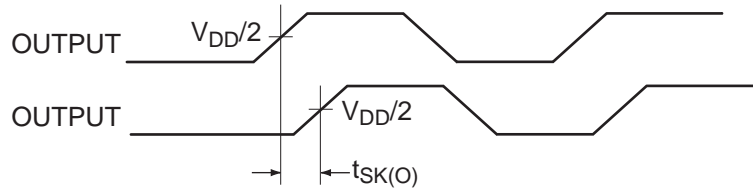
Duty Cycle Timing



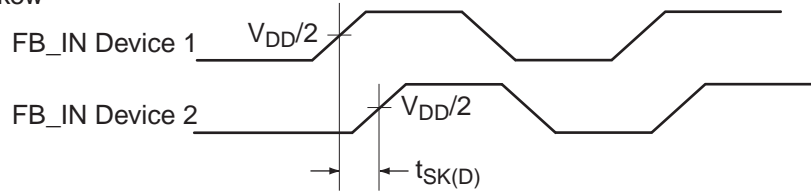
All Outputs Rise/Fall Time



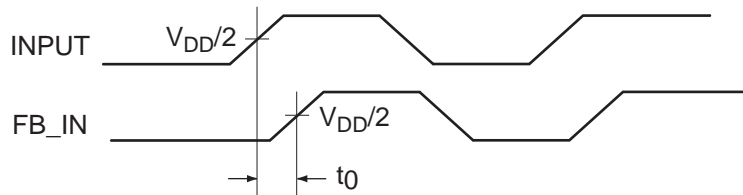
Output-Output Skew



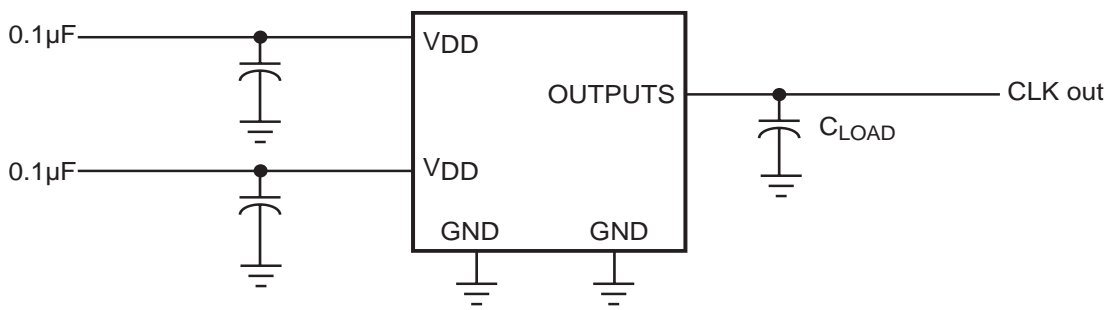
Device-Device Skew



Input-Output Propagation Delay

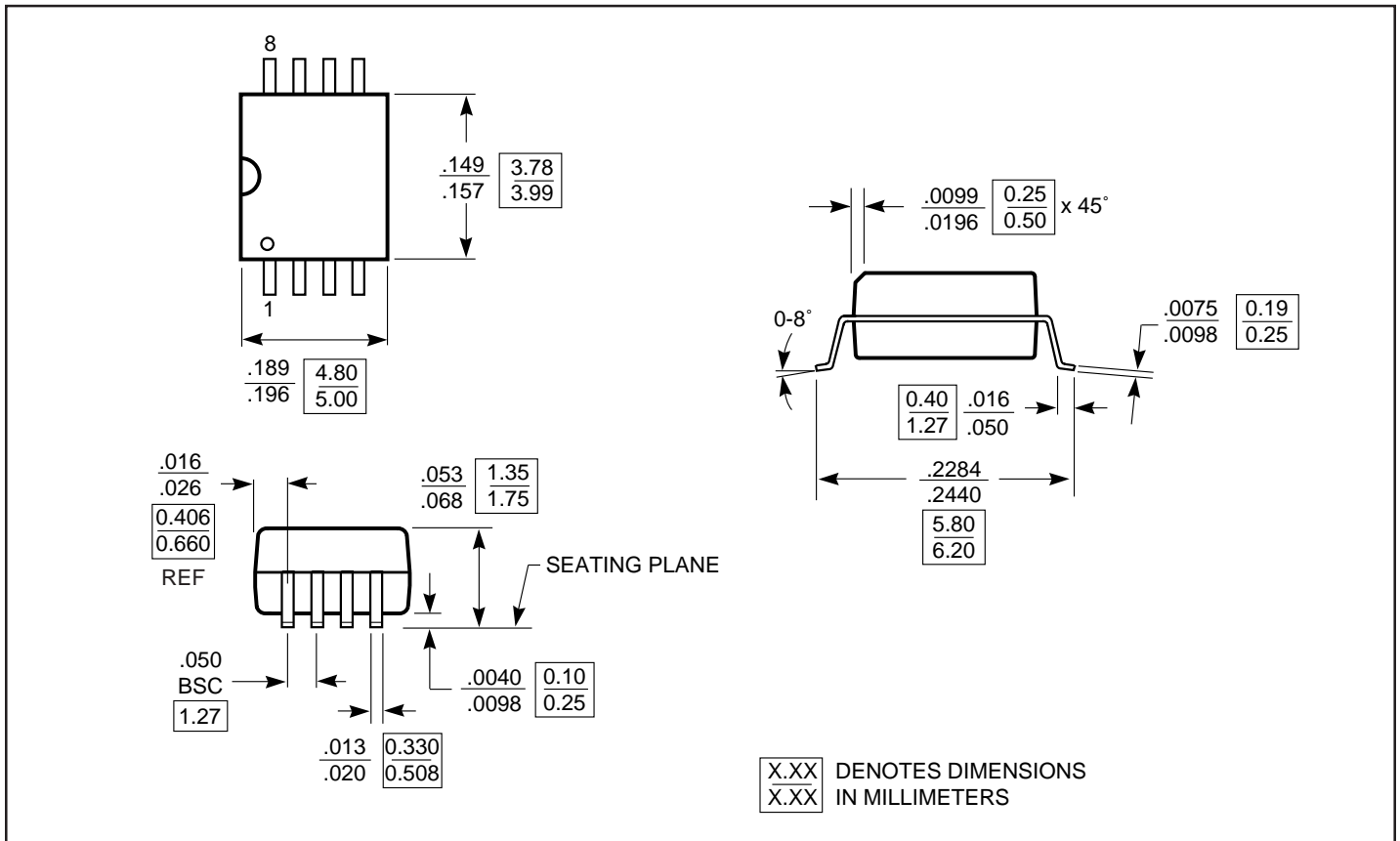


Test Circuit



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