Product Features

- Maximum rated frequency: 140 MHz
- Low cycle-to-cycle jitter
- Input to output delay, less than 150ps
- 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)
- Clock frequency multipliers ½x to 4x dependent on option
- Packages (Pb-free and Green available):
  16-pin, 150-mil SOIC (W)
  16-pin 173-mil TSSOP (L)

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

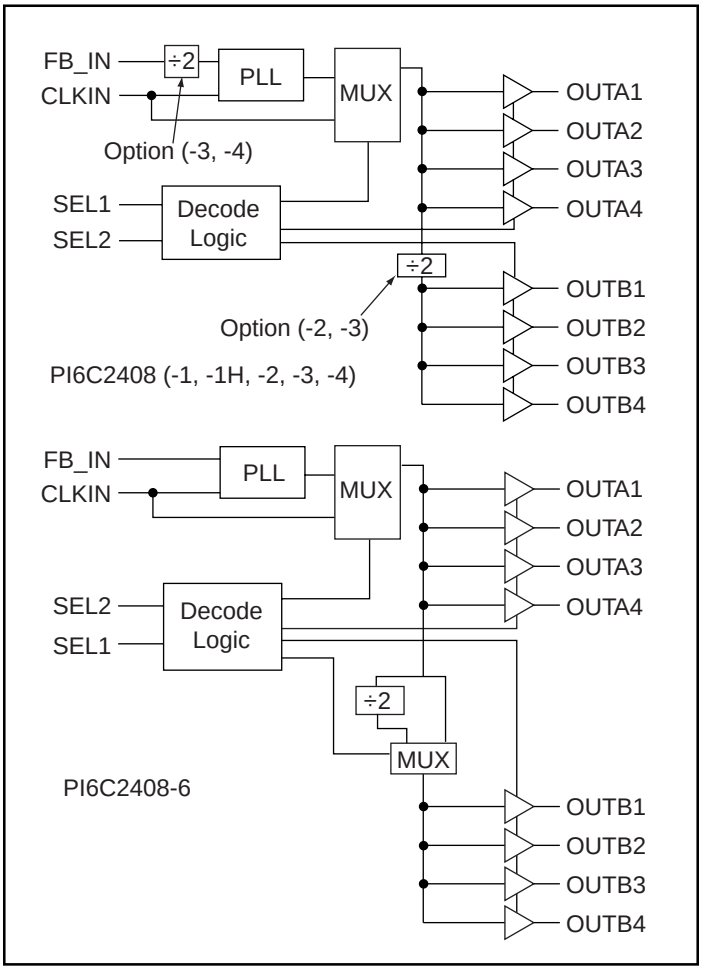
Functional Description

The PI6C2408 is a PLL-based, zero-delay buffer, with the ability to distribute eight outputs of up to 140 MHz at 3.3 V. Two banks of four outputs exist, and, depending on product option ordered, can supply either reference frequency, prescaled half frequency, or multiplied 2x or 4x input clock frequencies. The PI6C2408 family has a power-sparing feature: when input SEL2 is 0, the component will 3-state one or both banks of outputs depending on the state of input SEL1. A PLL bypass test mode also exists. This product line is available in high-drive and industrial environment versions.

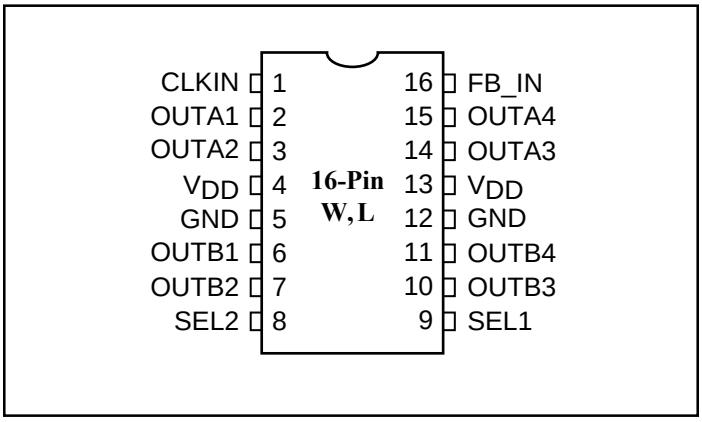
An external feedback pin is used to synchronize the outputs to the input; the relationship between loading of this signal and the other outputs determines the input-output delay.

The PI6C2408 is characterized for both commercial and industrial operation.

Block Diagram



Pin Configuration PI6C2408



Input Select Decoding for PI6C2408 (-1, -1H,-4)

SEL2	SEL1	OUTA [1-4]	OUTB [1-4]	Output Source	PLL
0	0	3-State	3-State	PLL	OFF
0	1	PLL	3-State	PLL	ON
1	0	CLKIN	CLKIN	CLKIN	OFF
1	1	PLL	PLL	PLL	ON

Input Select Decoding for PI6C2408 (-2,-3)

SEL2	SEL1	OUTA [1-4]	OUTB [1-4]	Output Source	PLL
0	0	3-State	3-State	PLL	OFF
0	1	PLL	3-State	PLL	ON
1	0	CLKIN	CLKIN/2	CLKIN	OFF
1	1	PLL	PLL	PLL	ON

Input Select Decoding for PI6C2408-6

SEL2	SEL1	OUTA [1-4]	OUTB [1-4]	Output Source	PLL
0	0	3-State	3-State	PLL	OFF
0	1	CLKIN	CLKIN/2	CLKIN	OFF
1	0	PLL	PLL	PLL	ON
1	1	PLL	PLL/2	PLL	ON

PI6C2408 Configurations

Device	Feedback From	OUTA [1-4] Frequency	OUTB [1-4] Frequency
PI6C2408-1	OUTA or OUTB	CLKIN	CLKIN
PI6C2408-1H	OUTA or OUTB	CLKIN	CLKIN
PI6C2408-2	OUTA	CLKIN	CLKIN/2
PI6C2408-2	OUTB	2X CLKIN	CLKIN
PI6C2408-3	OUTA	2X CLKIN	CLKIN or $\overline{\text{CLKIN}}$(1)
PI6C2408-3	OUTB	4X CLKIN	2X CLKIN
PI6C2408-4	OUTA or OUTB	2X CLKIN	2XCLKIN
PI6C2408-6	OUTA	CLKIN	CLKIN or CLKIN/2
PI6C2408-6	OUTB	CLKIN or 2X CLKIN	CLKIN

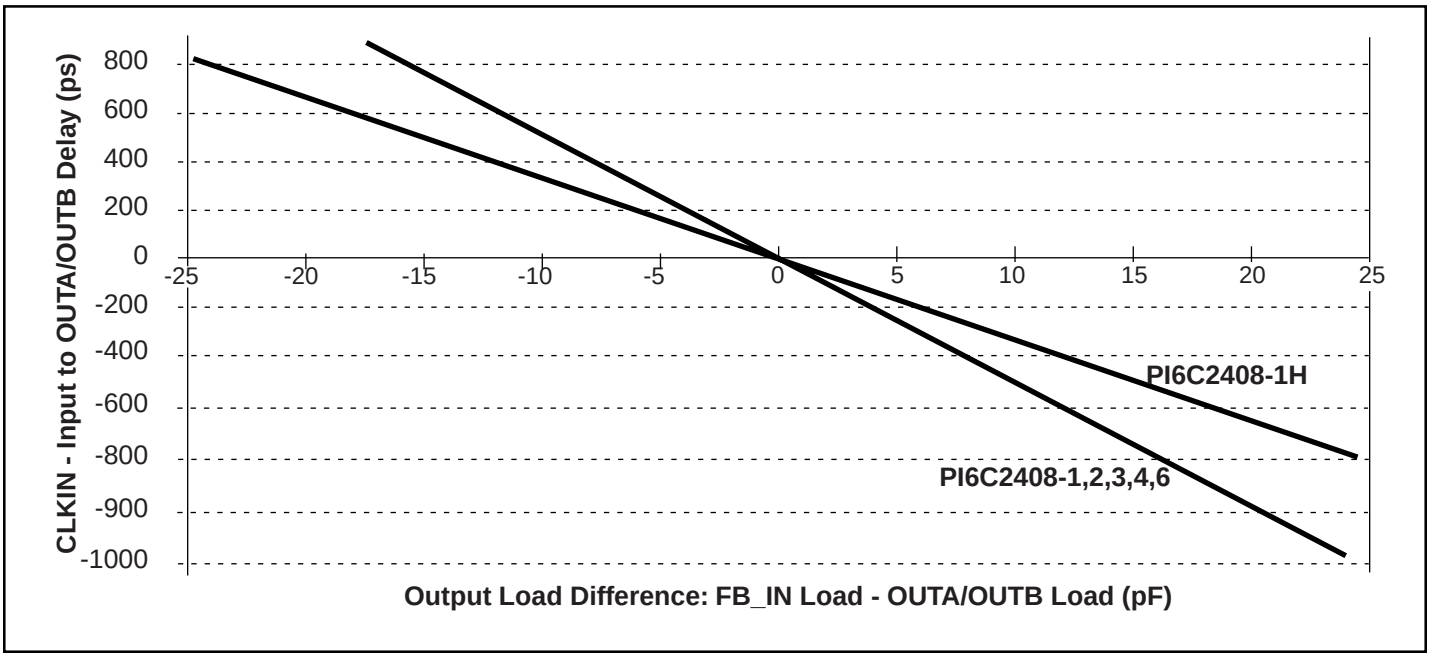
Note:
1. Output phase is indeterminant (0° or 180° from CLKIN)

Pin Description

Pin	Signal	Description
1	CLKIN	Input clock reference frequency (weak pull-down)
2, 3, 14, 15	OUTA[1-4]	Clock output, Bank A (weak pull-down)
4, 13	V_{DD}	3.3V supply
5, 12	GND	Ground
6, 7, 10 ,11	OUTB[1-4]	Clock output, Bank B (weak pull-down)
8	SEL2	Select input, bit 2 (weak pull-up)
9	SEL1	Select input, bit 1 (weak pull-up)
16	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	–65ºC to +150ºC
Maximum Soldering Temperature (10 seconds)	260ºC
Junction Temperature	150ºC
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	ºC
	Industrial Operating Temperature	–40	85	
C_L	Load Capacitance, below 100 MHz	—	30	pF
	Load Capacitance, from 100 MHz to 140MHz	—	15	
C_{IN}	Input Capacitance	—	7	

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		50.0	µA
I_{IH}	Input HIGH Current	V_{IN} = V_{DD}		100.0	
V_{OL}	Output LOW Voltage	I_{OL} = 8mA (–1, –2, –3,–4, –6); I_{OL} = 12mA (–1H)		0.4	V
V_{OH}	Output HIGH Voltage	I_{OH} = –8mA (–1, –2, –3,–4, –6); I_{OH} = –12mA (–1H)	2.4		
I_{DD} (PD mode)	Pwr Dwn Supply Current	SEL1 = 0 (–1, –2, –3, –4, –1H); SEL2 = 0 (–6)		25.0	µA
I_{DD}	Supply Current	Unloaded outputs 100 MHz, Select inputs at V_{DD} or GND		54.0	mA
				70.0 (–1H)	
		Unloaded outputs 66 MHz, CLKIN, except (–1H)		39.0	
		Unloaded outputs 33MHz, CLKIN, except (–1H)		20.0	

AC Elecrical Characteristics for Industrial Temperature Devices

Parameters	Name	Test Conditions	Min.	Typ.	Max.	Units
F_O	Output Frequency	30pF load	10.0		100	MHz
		15pF load			140	
t_{DC}	Duty Cycle(1) (–1, –2, –3, –4, –6)	Measured at $V_{DD}/2$, F_{OUT} <66.67MHz 30pF load	40.0	50	60.0	%
		Measured at $V_{DD}/2$, F_{OUT} <140 MHz 15pF load				
		Measured at $V_{DD}/2$, F_{OUT} <45 MHz 30pF load	45.0		55.0	
	Duty Cycle(1) (–1H)	Measured at $V_{DD}/2$, F_{OUT} <66.67MHz 30pF load	45.0			
		Measured at $V_{DD}/2$, F_{OUT} <140 MHz 15pF load	40.0		60.0	
		Measured at $V_{DD}/2$, F_{OUT} <45MHz 30pF load	45.0		55.0	
t_R	Rise Time(1) (–1, –2, –3, –4,)	Measured between 0.8V and 2.0V, 30pF load			2.2	ns
		Measured between 0.8V and 2.0V, 15pF load			1.50	
	Rise Time(1) (–1H)	Measured between 0.8V and 2.0V, 30pF load			1.50	
t_F	Fall Time(1) (–1, –2, –3, –4,)	Measured between 0.8V and 2.0V, 30pF load			2.50	
		Measured between 0.8V and 2.0V, 15pF load			1.50	
	Fall Time(1) (–1H)	Measured between 0.8V and 2.0V, 30pF load			1.25	
$t_{SK(O)}$	Output to Output Skew within same Bank (–1,–2,–3,–4,–6)(1)	All outputs equally loaded			200	ps
	OUTA to OUTB Skew(1) (–1,–1H,–4)					
	OUTA to OUTB Skew(1) (–2,–3,–6)				400	
t_0	Delay, CLKIN Rising Edge to FB_IN Rising Edge(1)	Measured at $V_{DD}/2$		0	±150	
$t_{SK(D)}$	Device-to-Device Skew(1)	Measured at $V_{DD}/2$ on FB_IN pins of devices		0	500	
t_{SLEW}	Output Slew Rate(1)	Measured between 0.8V & 2.0V on –1H device using Test Crt #2	1			V/ns
t_{JIT}	Cycle-to-Cycle Jitter(1) (–1,–1H,–4)	Measured at 66.67 MHz, loaded 30pF load			200	ps
		Measured at 140 MHz, loaded 15pF load			100	
	Cycle-to-Cycle Jitter(1) (–2,–3,–6)	Measured at 66.67 MHz, loaded 30pF load			400	
t_{LOCK}	PLL Lock Time(1)	Stable power supply, valid clocks presented on CLKIN and FB_IN pins			1.0	ms

Notes:
1. See Switching Waveforms on page 7.

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}	—	100	
V_{OL}	Output LOW Voltage	I_{OL} = 8mA (–1, –2, –3,–4, –6); I_{OL} = 12mA (–1H)	—	0.4	V
V_{OH}	Output HIGH Voltage	I_{OH} = –8mA (–1, –2, –3,–4, –6); I_{OH} = –12mA (–1H)	2.4	—	
I_{DD} (PD mode)	Power Down Supply Current	SEL1 = 0 (-1,-2,-3,-4,-1H); SEL2 = 0 (-6)	—	12	µA
I_{DD}	Supply Current	Unloaded outputs, 66.67 MHz, Select inputs at V_{DD} or GND	—	39	mA
I_{DD}	Supply Current	Unloaded outputs 100 MHz Select Inputs @ V_{DD} or GND	—	54	

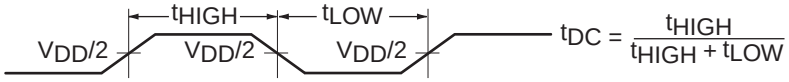
AC Electrial Characteristics for Commercial Temperature Device

Parameters	Name	Test Conditions	Min.	Typ.	Max.	Units
F_O	Output Frequency	30pF load	10		100	MHz
		15pF load			140	
t_{DC}	Duty Cycle(1) (–1H)	Measured at V_{DD}/2, for high drive output	45	50	55	%
	Duty Cycle (–1, –2, –3, –4, –6)	Measured at V_{DD}/2, for normal drive output	40	50	60	
t_R	Rise Time(1) @30pF	Measured between 0.8V and 2.0V			2.2	ns
	Rise Time(1) @15pF				1.5	
	Rise Time(1) @30pF (–1H)				1.5	
t_F	Fall Time(1) @30pF				2.2	
	Fall Time(1) @15pF				1.5	
	Fall Time(1) @30pF (–1H)				1.25	
$t_{SK(O)}$	Output to Output Skew(1) within same bank (–1,–1H,–2,–3,–4,–6)	All outputs equally loaded, V_{DD}/2			200	ps
	OUTA to OUTB Skew(1) (–1,–1H,–4)	All outputs equally loaded, V_{DD}/2			200	
	OUTA to OUTB Skew(1) (–2,–3,–6)	All outputs equally loaded, V_{DD}/2			400	
t_0	Input to Output Delay, CLKIN Rising Edge to FB_IN Rising Edge(1)	Measured at V_{DD}/2		0	±150	
$t_{SK(D)}$	Device to Device Skew(1)	Measured at V_{DD}/2 on FB_IN pins of devices		0	500	
t_{SLEW}	Output Slew Rate(1)	Measured between 0.8V and 2.0V on –1H device using Test Circuit #2	1			V/ns
t_{JIT}	Cycle-to-Cycle Jitter (1)(–1,–1H,–4)	Measured at 66.67 MHz, loaded 30pF outputs			200	ps
		Measured at 140 MHz, loaded 15pF outputs			100	
	Cycle-to-Cycle Jitter(1) (–2,–3,–6)	Measured at 66.7 MHz, loaded 30pF outputs			400	
t_{LOCK}	PLL Lock Time(1)	Stable power supply, valid clocks presented on CLKIN and FB_IN pins			1.0	ms

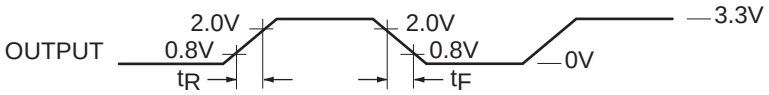
Notes:
1. See Switching Waveforms on page 7.

Switching Waveforms

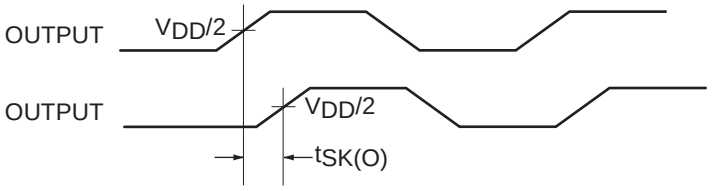
Duty Cycle Timing



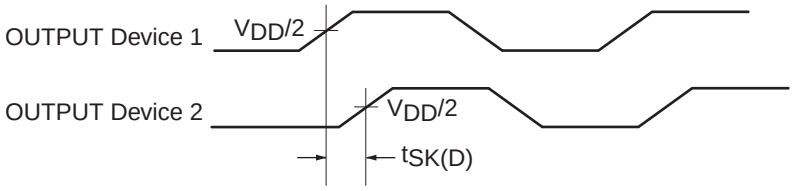
All Outputs Rise/Fall Time



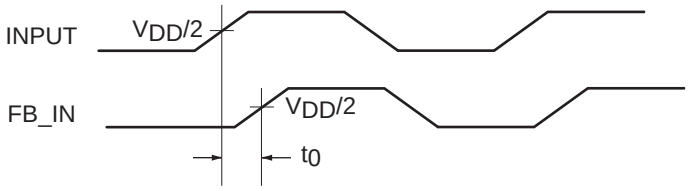
Output-Output Skew



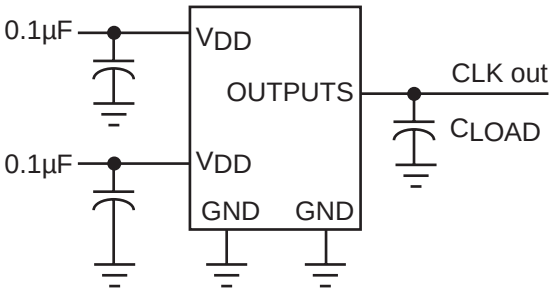
Device-Device Skew



Input-Output Propagation Delay

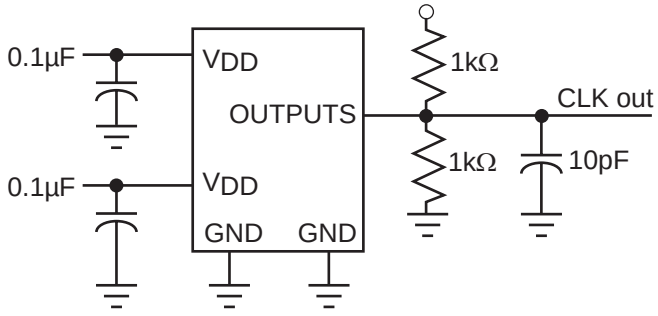


Test Circuit 1



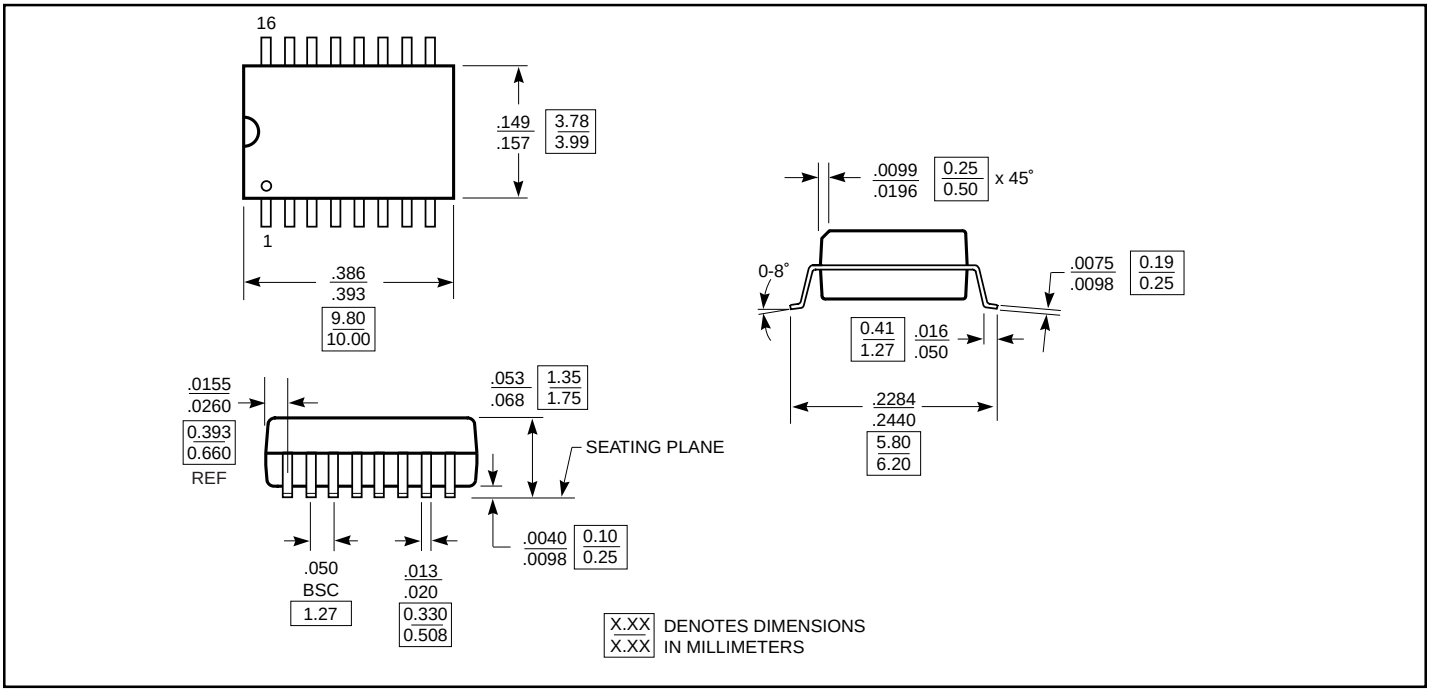
Test Circuit for all parameters except t_{SLEW}

Test Circuit 2

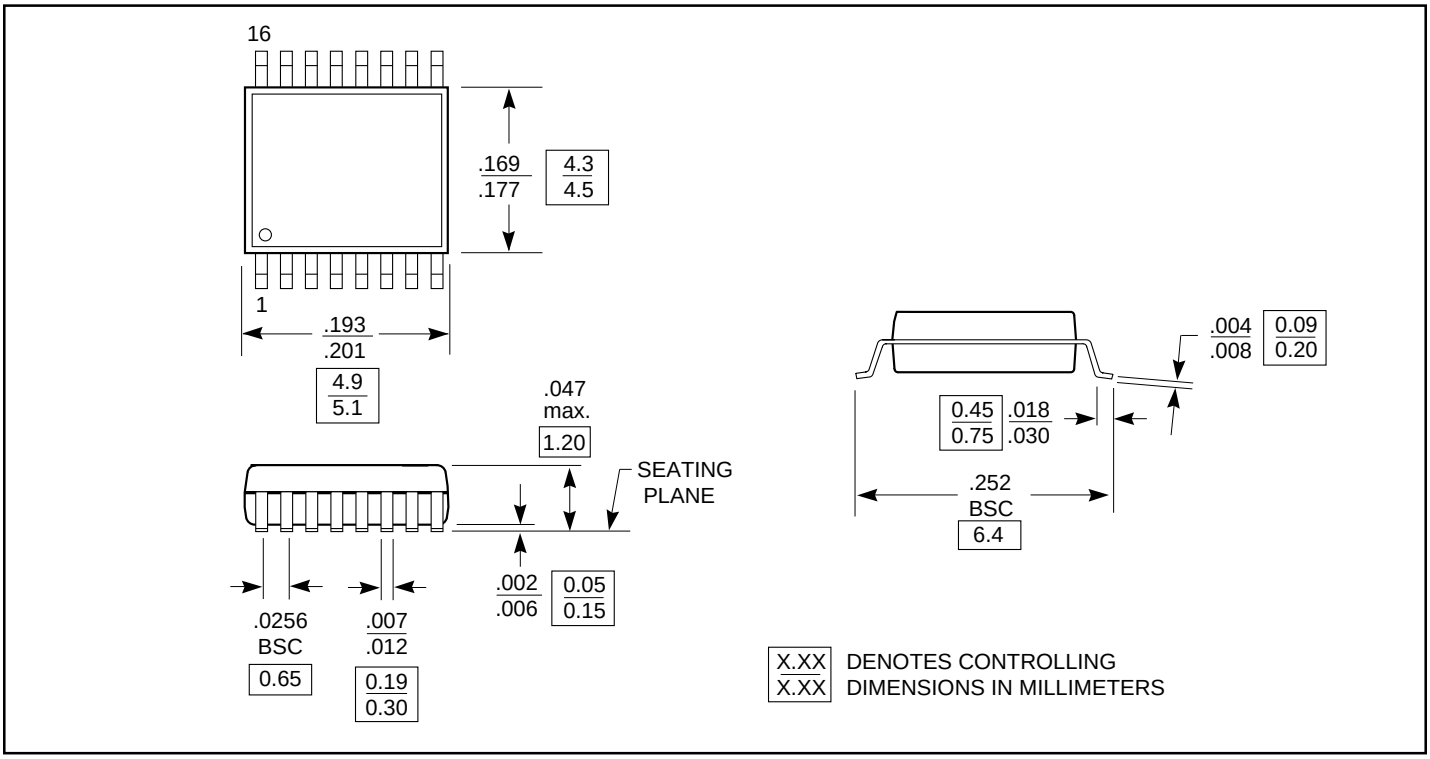


Test Circuit for t_{SLEW} ,Output slew rate on –1H device

16-Pin SOIC (W) Package



16-Pin TSSOP (L) Package



Note: Controlling dimensions in millimeters. Ref: JEDEC MS - 012 AC

Ordering Information (Commercial Temperature Device)

Ordering Code	Package Code	Package Type	Operating Range
PI6C2408-1W	W16	16-pin 150-mil SOIC	Comercial
PI6C2408-1HW			
PI6C2408-2W			
PI6C2408-3W			
PI6C2408-4W			
PI6C2408-6W			
PI6C2408-1WE		Pb-free and Greem 16-pin 150-mil SOIC	
PI6C2408-1HWE			
PI6C2408-1L	L16	16-pin 173-mil TSSOP	
PI6C2408-1HL			
PI6C2408-3L			
PI6C2408-4L			

Ordering Information (Industrial Temperature Device)

Ordering Code	Package Code	Package Type	Operating Range
PI6C2408-1WI	W16	16-pin 150-mil SOIC	Industrial
PI6C2408-1HWI			
PI6C2408-2WI			
PI6C2408-4WI			
PI6C2408-6WI			
PI6C2408-1LI	L16	16-pin 173-mil TSSOP	
PI6C2408-6LI			
PI6C2408-1LE		Pb-free and Green, 16-pin 173-mil TSSOP	
PI6C2408-1HLE			

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