

**1:4 Clock Driver for Intel PCIe® 3.0 Chipsets**

**Features**

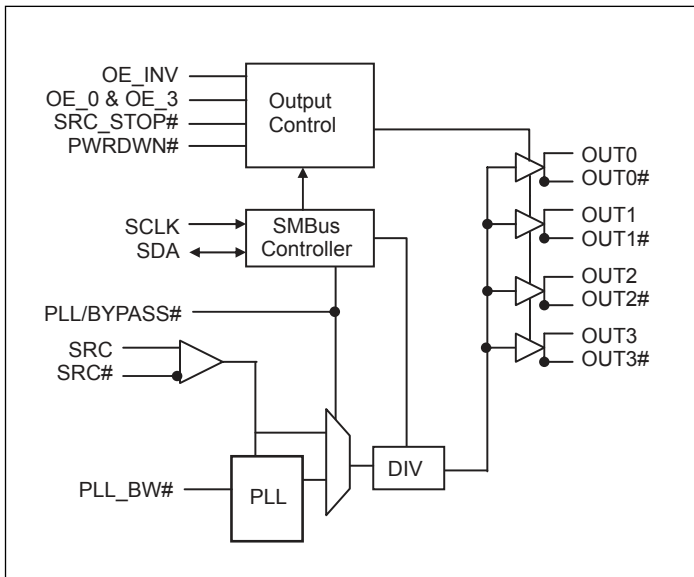
- Phase jitter filter for PCIe 3.0 application
- Four Pairs of Differential Clocks
- Low skew < 50ps
- Low jitter < 50ps cycle-to-cycle
- < 1 ps additive RMS phase jitter
- Output Enable for all outputs
- Outputs tristate control via SMBus
- Programmable PLL Bandwidth
- 100 MHz PLL Mode operation
- 100 - 400 MHz Bypass Mode operation
- 3.3V Operation
- Packaging (Pb-free and Green):
  - 28-Pin SSOP (H28)
  - 28-Pin TSSOP (L28)

**Description**

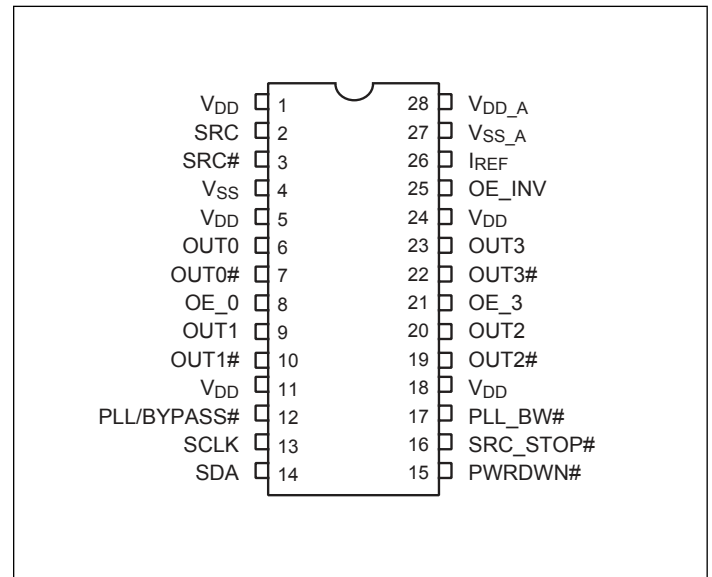
The PI6C20400B is a PCIe 3.0 compliant high-speed, low-noise differential clock buffer designed to be companion to PCIe 3.0 clock generator. It is backward compatible with PCIe 1.0 and 2.0 specification.

The device distributes the differential SRC clock from PCIe 3.0 clock generator to four differential pairs of clock outputs either with or without PLL. The clock outputs are controlled by input selection of SRC\_STOP#, PWRDWN# and SMBus, SCLK and SDA. When input of either SRC\_STOP# or PWRDWN# is low, the output clocks are Tristated. When PWRDWN# is low, the SDA and SCLK inputs must be Tri-stated.

**Block Diagram**



**Pin Configuration**



## Pinout Table

Pin#	Pin Name	Type	Description
2, 3	SRC & SRC#	Input	0.7V Differential SRC input from PI6C410 clock synthesizer
8, 21	OE_0 & OE_3	Input	3.3V LVTTL input for enabling outputs, active high. OE_0 for OUT0 / OUT0# OE_3 for OUT3 / OUT3#
25	OE_INV	Input	3.3V LVTTL input for inverting the OE, SRC_STOP# and PWRDWN# pins. When 0 = same stage When 1 = OE_0, OE_3, SRC_STOP#, PWRDWN# inverted.
6, 7, 9, 10, 19, 20, 22, 23	OUT[0:3] & OUT[0:3]#	Output	0.7V Differential outputs
12	PLL/BYPASS#	Input	3.3V LVTTL input for selecting fan-out of PLL operation.
13	SCLK	Input	SMBus compatible SCLOCK input
14	SDA	I/O	SMBus compatible SDATA
26	IREF	Input	External resistor connection to set the differential output current
16	SRC_STOP#	Input	3.3V LVTTL input for SRC stop, active low
17	PLL_BW#	Input	3.3V LVTTL input for selecting the PLL bandwidth
15	PWRDWN#	Input	3.3V LVTTL input for Power Down operation, active low
1, 5, 11, 18, 24	V <sub>DD</sub>	Power	3.3V Power Supply for Outputs
4	VSS	Ground	Ground for Outputs
27	VSS_A	Ground	Ground for PLL
28	VDD_A	Power	3.3V Power Supply for PLL

## Serial Data Interface (SMBus)

This part is a slave only SMBus device that supports indexed block read and indexed block write protocol using a single 7-bit address and read/write bit as shown below.

## Address Assignment

A6	A5	A4	A3	A2	A1	A0	W/R
1	1	0	1	1	1	0	0/1

## Data Protocol

1 bit	7 bits	1	1	8 bits	1	8 bits	1	8 bits	1		8 bits	1	1 bit
Start bit	Slave Addr	R/W	Ack	Register offset	Ack	Byte Count = N	Ack	Data Byte 0	Ack	...	Data Byte N - 1	Ack	Stop bit

### Notes:

1. Register offset for indicating the starting register for indexed block write and indexed block read. Byte Count in write mode cannot be 0.

### Data Byte 0: Control Register

Bit	Descriptions	Type	Power Up Condition	Output(s) Affected	Source Pin
0	Outputs Mode 0 = Divide by 2 1 = Normal	RW	1 = Normal	OUT[0:3], OUT[0:3]#	NA
1	PLL/BYPASS# 0 = Fanout 1 = PLL	RW	1 = PLL	OUT[0:3], OUT[0:3]#	NA
2	PLL Bandwidth 0 = High Bandwidth, 1 = Low Bandwidth	RW	1 = Low	OUT[0:3], OUT[0:3]#	NA
3	Reserved				NA
4	Reserved				NA
5	Reserved				NA
6	SRC_STOP# 0 = Driven when stopped 1 = Tristate	RW	0 = Driven when stopped	OUT[0:3], OUT[0:3]#	NA
7	PWRDWN# 0 = Driven when stopped 1 = Tristate	RW	0 = Driven when stopped	OUT[0:3], OUT[0:3]#	NA

### Data Byte 1: Control Register

Bit	Descriptions	Type	Power Up Condition	Output(s) Affected	Source Pin
0	Reserved				NA
1	OUTPUTS enable	RW	1 = Enabled	OUT0, OUT0#	NA
2	1 = Enabled 0 = Disabled	RW	1 = Enabled	OUT1, OUT1#	NA
3	Reserved				NA
4	Reserved				NA
5	OUTPUTS enable	RW	1 = Enabled	OUT2, OUT2#	NA
6	1 = Enabled 0 = Disabled	RW	1 = Enabled	OUT3, OUT3#	NA
7	Reserved				NA

**PI6C20400B**

**Data Byte 2: Control Register**

Bit	Descriptions	Type	Power Up Condition	Output(s) Affected	Source Pin
0	Reserved				NA
1	Allow control of OUTPUTS with assertion of SRC_STOP# 0 = Free running 1 = Stopped with SRC_Stop#	RW	0 = Free running	OUT0, OUT0#	NA
2		RW	0 = Free running	OUT1, OUT1#	NA
3	Reserved				NA
4	Reserved				NA
5	Allow control of OUTPUTS with assertion of SRC_STOP# 0 = Free running 1 = Stopped with SRC_Stop#	RW	0 = Free running	OUT2, OUT2#	NA
6		RW	0 = Free running	OUT3, OUT3#	NA
7	Reserved				NA

**Data Byte 3: Control Register**

Bit	Descriptions	Type	Power Up Condition	Output(s) Affected	Source Pin
0	Reserved	RW			
1		RW			
2		RW			
3		RW			
4		RW			
5		RW			
6		RW			
7		RW			

**Data Byte 3: Control Register**

Bit	Descriptions	Type	Power Up Condition	Output(s) Affected	Pin
0	Pericom ID	R	0	NA	NA
1		R	0	NA	NA
2		R	0	NA	NA
3		R	0	NA	NA
4		R	0	NA	NA
5		R	1	NA	NA
6		R	0	NA	NA
7		R	0	NA	NA

**Functionality**

PWRDWN#	OUT	OUT#	SRC_Stop#	OUT	OUT#
1	Normal	Normal	1	Normal	Normal
0	$I_{REF} \times 2$ or Float	Low	0	$I_{REF} \times 6$ or Float	Low

**Power Down (PWRDWN# assertion)**

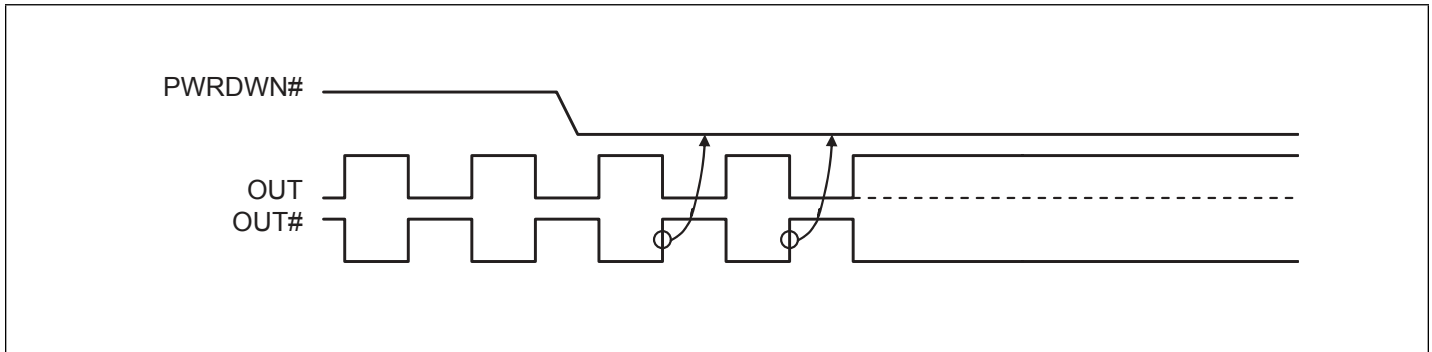


Figure 1. Power down sequence

**Power Down (PWRDWN# De-assertion)**

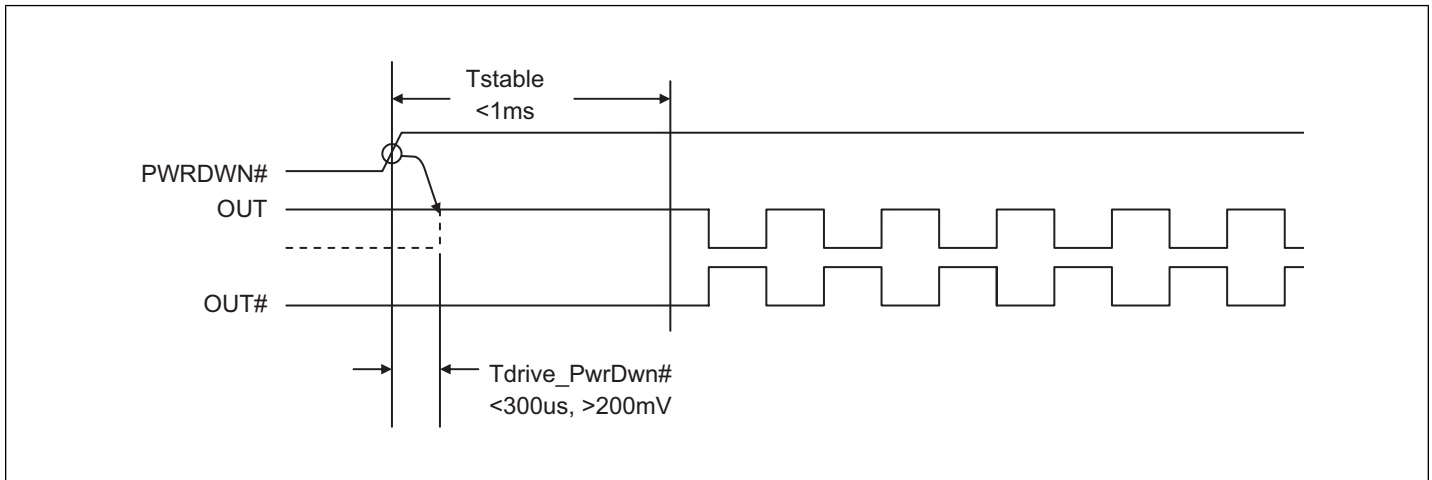
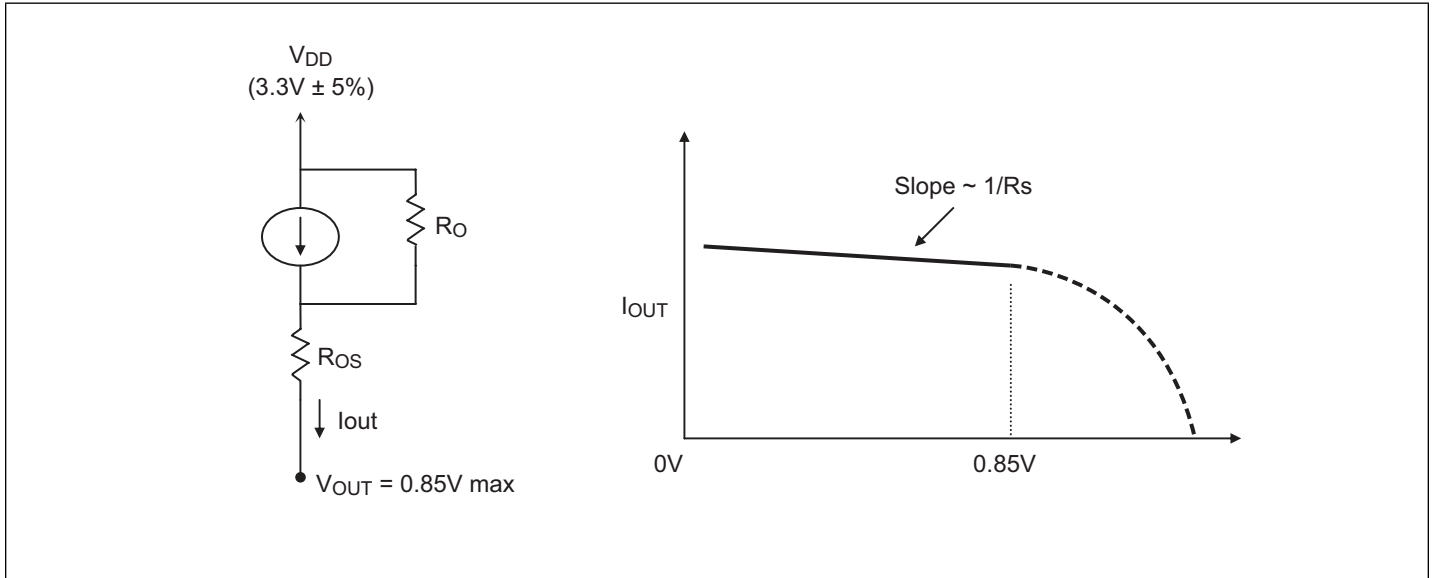


Figure 2. Power down de-assert sequence

**Current-mode output buffer characteristics of OUT[0:3], OUT[0:3]#**



**Differential Clock Buffer characteristics**

Symbol	Minimum	Maximum
$R_O$	3000Ω	N/A
$R_{OS}$	unspecified	unspecified
$V_{OUT}$	N/A	850mV

**Current Accuracy**

Symbol	Conditions	Configuration	Load	Min.	Max.
$I_{OUT}$	$V_{DD} = 3.30 \pm 5\%$	$R_{REF} = 475\Omega$ 1% $I_{REF} = 2.32mA$	Nominal test load for given configuration	-12% $I_{NOMINAL}$	+12% $I_{NOMINAL}$

Note:

- 1.  $I_{NOMINAL}$  refers to the expected current based on the configuration of the device.

**Differential Clock Output Current**

Board Target Trace/Term Z	Reference R, Iref = $V_{DD}/(3xRr)$	Output Current	$V_{OH} @ Z$
100Ω (100Ω differential ≈ 15% coupling ratio)	$R_{REF} = 475\Omega$ 1%, $I_{REF} = 2.32mA$	$I_{OH} = 6 \times I_{REF}$	0.7V @ 50

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

Symbol	Parameters	Min.	Max.	Units
$V_{DD\_A}$	3.3V Core Supply Voltage	-0.5	4.6	V
$V_{DD}$	3.3V I/O Supply Voltage	-0.5	4.6	
$V_{IH}$	Input High Voltage		4.6	
$V_{IL}$	Input Low Voltage	-0.5		
$T_s$	Storage Temperature	-65	150	°C
$V_{ESD}$	ESD Protection	2000		V

**Note:**

1. Stress beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device.

**DC Electrical Characteristics** ( $V_{DD} = 3.3 \pm 5\%$ ,  $V_{DD\_A} = 3.3 \pm 5\%$ )

Symbol	Parameters	Condition	Min.	Max.	Units
$V_{DD\_A}$	3.3V Core Supply Voltage		3.135	3.465	V
$V_{DD}$	3.3V I/O Supply Voltage		3.135	3.465	
$V_{IH}$	3.3V Input High Voltage	$V_{DD}$	2.0	$V_{DD} + 0.3$	
$V_{IL}$	3.3V Input Low Voltage		$V_{SS} - 0.3$	0.8	
$I_{IL}$	Input Leakage Current	$0 < V_{IN} < V_{DD}$	-5	+5	μA
$V_{OH}$	3.3V Output High Voltage	$I_{OH} = -1\text{mA}$	2.4		V
$V_{OL}$	3.3V Output Low Voltage	$I_{OL} = 1\text{mA}$		0.4	
$I_{OH}$	Output High Current	$I_{OH} = 6 \times I_{REF}$ $I_{REF} = 2.32\text{mA}$	12.2		mA
				15.6	
$C_{IN}$	Input Pin Capacitance		3	5	pF
$C_{OUT}$	Output Pin Capacitance			6	
$L_{PIN}$	Pin Inductance			7	nH
$I_{DD(BYPASS)}$	Power Supply Current (PLL Bypass)	$V_{DD} = 3.465\text{V}$ , $F_{CPU} = 100\text{MHz}$		90	mA
$I_{DD}$	Power Supply Current	$V_{DD} = 3.465\text{V}$	Bypass mode	100	
		$F_{CPU} = 100\text{MHz}$	PLL mode	130	
$I_{SS}$	Power Down Current	Driven outputs		40	
$I_{SS}$	Power Down Current	Tristate outputs		12	
$T_A$	Ambient Temperature		-40	85	°C

**AC Switching Characteristics** ( $V_{DD} = 3.3 \pm 5\%$ ,  $V_{DD,A} = 3.3 \pm 5\%$ )

Symbol	Parameters	Condition	Min.	Typ.	Max.	Units
$F_{IN}$	PLL Mode		95		105	MHz
	Bypass Mode		100		400	MHz
$T_{rise} / T_{fall}^2$	Rise and Fall Time (measured between 0.175V to 0.525V)		175		700	ps
$DT_{rise} / DT_{fall}^2$	Rise and Fall Time Variation				125	ps
$T_{pd}$	PLL Mode				$\pm 250$	ps
	Non-PLL Mode		2.5		6.5	ns
$T_{jitter}^{3,4}$	Cycle – Cycle Jitter				50	ps
$V_{HIGH}^2$	Voltage High including overshoot		660		1150	mV
$V_{LOW}^2$	Voltage Low including undershoot		-300			mV
$V_{cross}^2$	Absolute crossing point voltages		250		550	mV
$DV_{cross}^2$	Total Variation of Vcross over all edges				140	mV
$T_{DC}^3$	Duty Cycle		45		55	%
$t_{jphPCIEG1}$	Phase Jitter, PLL Mode	PCIe Gen1		30	86	ps (p-p)
$t_{jphPCIEG2}$		PCIE_2_0_8MHz_1_5M_H3_STEP, Low Freq.	0.7	3	ps (rms)	
		PCIE_2_0_8MHz_1_5M_H3_STEP, High Freq.	2	3.1		
$t_{jphPCIEG3}$		PCIE_3_0_2MHz_5M_H3_FIRST, Low Freq.	2	3		
		PCIE_3_0_2MHz_5M_H3_FIRST, High Freq.	0.47	1		
$t_{jphPCIEG1}$		Additive Phase Jitter, Bypass Mode	PCIe Gen1		0	0.001
$t_{jphPCIEG2}$	PCIE_2_0_8MHz_1_5M_H3_FIRST, Low Freq.			0	0.001	ps (rms)
	PCIE_2_0_8MHz_1_5M_H3_FIRST, High Freq.			0	0.001	
$t_{jphPCIEG3}$	PCIE_3_0_2MHz_5M_H3_FIRST, Low Freq.			0	0.001	
	PCIE_3_0_2MHz_5M_H3_FIRST, High Freq.			0	0.001	

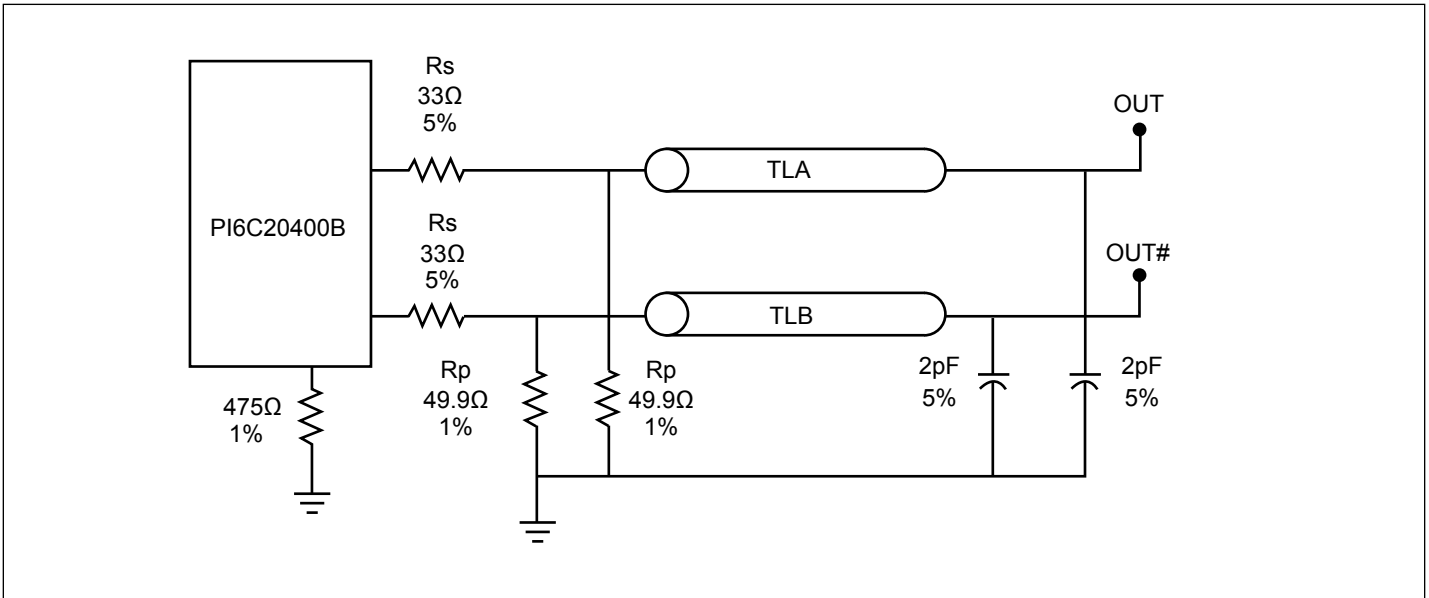
**Notes:**

1. Test configuration is  $R_s = 33.2\Omega$ ,  $R_p = 49.9\Omega$ , and 2pF.
2. Measurement taken from Single Ended waveform.
3. Measurement taken from Differential waveform.
4. Measurement taken using M1 data capture analysis tool.
5. Additive jitter is calculated from input and output RMS phase jitter by using PCIe 2.0 filter. ( $T_{jadd} = \sqrt{(\text{output jitter})^2 - (\text{input jitter})^2}$ )



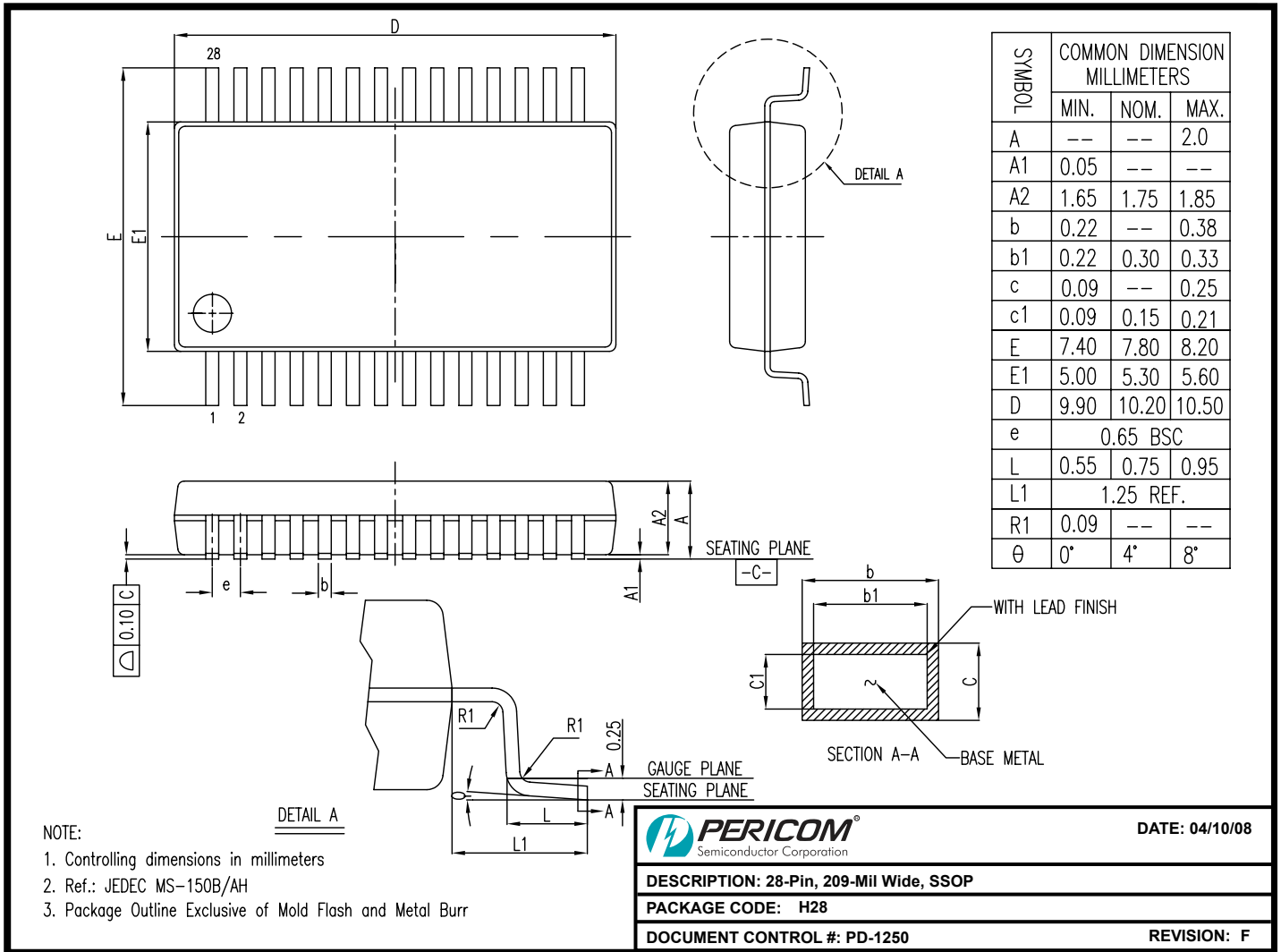
**PI6C20400B**

**Configuration Test Load Board Termination**



**PI6C20400B**

**Packaging Mechanical: 28-Pin SSOP (H)**



08-0143

**PI6C20400B**

**Packaging Mechanical: 28-Pin TSSOP (L)**

SYMBOLS	MIN.	NOM.	MAX.
A	–	–	1.20
A1	0.05	–	0.15
A2	0.80	1.00	1.05
b	0.19	–	0.30
c	0.09	–	0.20
D	9.60	9.70	9.80
E1	4.30	4.40	4.50
E	6.20	6.40	6.60
e	0.65 BSC		
L1	1.00 REF		
L	0.45	0.60	0.75
S	0.20	–	–
$\theta$	0°	–	8°

**NOTES:**  
 1. ALL DIMENSIONS IN MILLIMETERS. ANGLES IN DEGREES.  
 2. JEDEC MO-153F  
 3. DIMENSIONS DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS.

		DATE: 03/31/16
DESCRIPTION: 28-Pin, 173mil Wide TSSOP		
PACKAGE CODE: L (L28)		
DOCUMENT CONTROL #: PD-1313	REVISION: F	

16-0076

Note: For latest package info, please check: <http://www.pericom.com/support/packaging/packaging-mechanicals-and-thermal-characteristics/>

**Ordering Information<sup>(1-3)</sup>**

Ordering Code	Package Code	Package Description
PI6C20400BHE	H	28-pin, 209-mil wide (SSOP)
PI6C20400BHEX	H	28-pin, 209-mil wide (SSOP), Tape & Reel
PI6C20400BLE	L	28-pin, 173-mil wide (TSSOP)
PI6C20400BLEX	L	28-pin, 173-mil wide (TSSOP), Tape & Reel

**Notes:**

1. Thermal characteristics can be found on the company web site at [www.pericom.com/packaging/](http://www.pericom.com/packaging/)
2. E = Pb-free and Green
3. Adding an X suffix = Tape/Reel

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