A product Line of
Diodes Incorporated

PI6CB33801

Very-Low-Power 8-Output PCIe Clock Buffer with On-Chip Termination

Features

- 3.3V Supply Voltage
- HCSL Input: 100MHz, also supports 50MHz, 125MHz, or 133.33MHz via SMBus
- Eight Differential Low-Power HCSL Outputs with On-Chip Termination
- Default Z_{OUT} = 100Ω
- Spread Spectrum Tolerant
- Individual Output Enable
- Programmable Slew Rate and Output Amplitude for Each Output
- Differential Outputs Blocked until PLL is locked
- Strapping pins or SMBus for Configuration
- Differential output-to-output skew <50ps
- Very low jitter outputs
  - Differential cycle-to-cycle jitter <50ps
  - PCIe Gen1/Gen2/Gen3/Gen4/Gen5 CC compliant
  - PCIe Gen 2 and 3 SRiS and SRnS compliant
- Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)
- Halogen and Antimony Free. "Green" Device (Note 3)
- For automotive applications requiring specific change control (i.e. parts qualified to AEC-Q100/101/200, PPAP capable, and manufactured in IATF 16949 certified facilities), please contact us or your local Diodes representative.

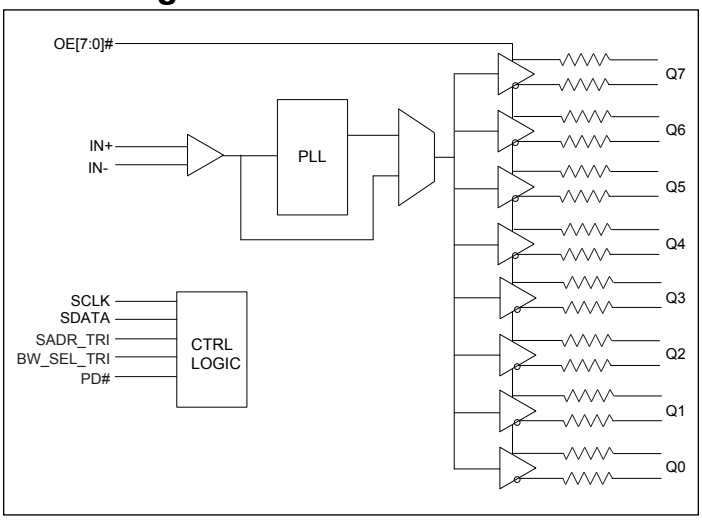
  https://www.diodes.com/quality/product-definitions/
- Packaging (Pb-free & Green):
  - 48-lead 6mm × 6mm TQFN

Description

The PI6CB33801 is an eight-output very-low-power PCIe Gen1/Gen2/Gen3/Gen4/Gen5 clock buffer. It takes a reference input to fanout eight 100MHz low-power differential HCSL outputs with on-chip terminations. The on-chip termination can save 32 external resistors and make layout easier. Individual OE pin for each output provides easier power management.

It uses Diodes proprietary PLL design to achieve very-low jitter that meets PCIe Gen1/Gen2/Gen3/Gen4/Gen5 requirements. Other than PCIe 100MHz support, this device also supports Ethernet application with 50MHz, 125MHz, and 133.33MHz via SMBus. It provides various options such as different slew rate and amplitude through SMBUS, so users can configure the device easily to get the optimized performance for their individual boards.

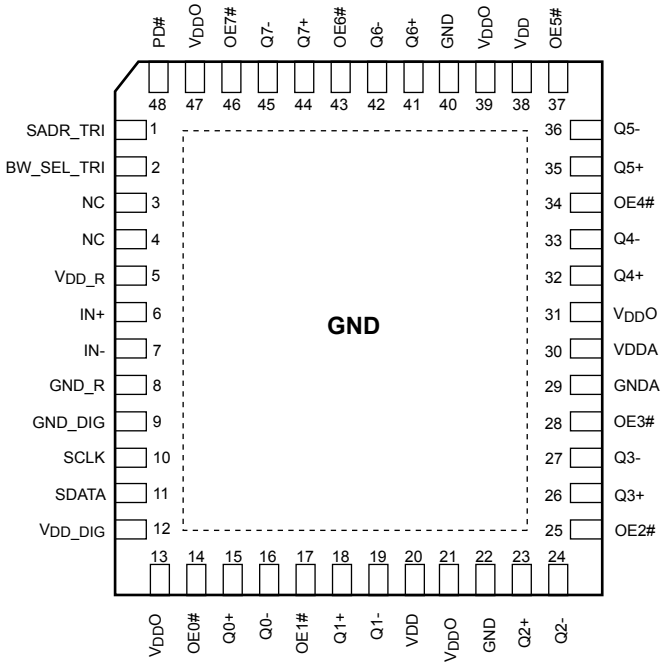
Block Diagram



Notes:

1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
2. See https://www.diodes.com/quality/lead-free/ for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.

Pin Configuration



Pin Description

Pin Number	Pin Name	Type		Description
1	SADR_TRI	Input	Tri-level	Latch to select SMBus Address. This pin has an internal pull-down.
2	BW_SEL_TRI	Input	Tri-level	Latch to select low-loop bandwidth, bypass PLL, and high-loop bandwidth. This pin has both internal pull-up and pull-down.
3	NC	—	—	Internal connected for feedback loop. Do not connect this pin.
4	NC	—	—	Internal connected for feedback loop. Do not connect this pin.
5	V_{DD}_R	Power	—	Power supply for input differential buffers
6	IN+	Input	—	Differential true clock input
7	IN-	Input	—	Differential complementary clock input
8	GND_R	Power	—	Ground for input differential buffers
9	GND_DIG	Power	—	Ground for digital circuitry
10	SCLK	Input	CMOS	SMBUS clock input, 3.3V tolerant
11	SDATA	Input/ Output	CMOS	SMBUS data line, 3.3V tolerant
12	V_{DD}_DIG	Power	—	Power supply for digital circuitry, nominal 3.3V
13, 21, 31, 39, 47	V_{DDO}	Power	—	Power supply for differential outputs
14	OE0#	Input	CMOS	Active low input for enabling Q0 pair. This pin has an internal pull-down. 1 =disable outputs, 0 = enable outputs
15	Q0+	Output	HCSL	Differential true clock output

Pin Description Cont.

Pin Number	Pin Name	Type		Description
16	Q0-	Output	HCSL	Differential complementary clock output
17	OE1#	Input	CMOS	Active low input for enabling Q1 pair. This pin has an internal pull-down. 1 =disable outputs, 0 = enable outputs
18	Q1+	Output	HCSL	Differential true clock output
19	Q1-	Output	HCSL	Differential complementary clock output
20, 38	V_{DD}	Power	—	Power supply, nominal 3.3V
22, 40	GND	Power	—	Ground
23	Q2+	Output	HCSL	Differential true clock output
24	Q2-	Output	HCSL	Differential complementary clock output
25	OE2#	Input	CMOS	Active low input for enabling Q2 pair. This pin has an internal pull-down. 1 =disable outputs, 0 = enable outputs
26	Q3+	Output	HCSL	Differential true clock output
27	Q3-	Output	HCSL	Differential complementary clock output
28	OE3#	Input	CMOS	Active low input for enabling Q3 pair. This pin has an internal pull-down. 1 =disable outputs, 0 = enable outputs
29	GNDA	Power	—	Ground for analog circuitry
30	V_{DDA}	Power	—	Power supply for analog circuitry
32	Q4+	Output	HCSL	Differential true clock output
33	Q4-	Output	HCSL	Differential complementary clock output
34	OE4#	Input	CMOS	Active low input for enabling Q4 pair. This pin has an internal pull-down. 1 =disable outputs, 0 = enable outputs
35	Q5+	Output	HCSL	Differential true clock output
36	Q5-	Output	HCSL	Differential complementary clock output
37	OE5#	Input	CMOS	Active low input for enabling Q5 pair. This pin has an internal pull-down. 1 =disable outputs, 0 = enable outputs
41	Q6+	Output	HCSL	Differential true clock output
42	Q6-	Output	HCSL	Differential complementary clock output
43	OE6#	Input	CMOS	Active low input for enabling Q6 pair. This pin has an internal pull-down. 1 =disable outputs, 0 = enable outputs
44	Q7+	Output	HCSL	Differential true clock output
45	Q7-	Output	HCSL	Differential complementary clock output
46	OE7#	Input	CMOS	Active low input for enabling Q7 pair. This pin has an internal pull-down. 1 =disable outputs, 0 = enable outputs
48	PD#	Input	CMOS	Input notifies device to sample latched inputs and start up on first high assertion. Low enters Power Down Mode; subsequent high assertions exit Power Down Mode. This pin has internal pull-up resistor.
49	EPAD	Power	—	Connect to ground

SMBus Address Selection Table

	SADR	Address	+Read/Write Bit
State of SADR on First Application of PD#	0	1101011	X
	M	1101100	X
	1	1101101	X

Power Management Table

PD#	IN	SMBus OE bit	OEn#	Qn+	Qn-	PLL Status
0	X	X	X	Low(2)	Low(2)	Off
1	Running	0	X	Low(2)	Low(2)	On(1)
1	Running	1	0	Running	Running	On(1)
1	Running	1	1	Low(2)	Low(2)	On(1)

Note:
1. If PLL Bypass mode is selected, the PLL will be off and outputs will be running.
2. The output state is set by B11[1:0] (Low/Low default).

PLL Operating Mode Select Table

BW_SEL_TRI	Operating Mode	Byte1 [7:6] Readback	Byte1 [4:3] Control
0	PLL with Low Bandwidth	00	00
M	PLL Bypass	01	01
1	PLL with High Bandwidth	11	11

Frequency Select Table

Freq. Select Byte 3 [4:3]	IN (MHz)	Qn (MHz)
00 (default)	100	100
01	50	50
10	125	125
11	133.33	133.33

Maximum Ratings

(Above which useful life may be impaired. For user guidelines, not tested.)

Storage Temperature..... –65°C to +150°C
Supply Voltage to Ground Potential, V_{DDxx} .....–0.5V to +4.6V
Input Voltage ..... –0.5V to V_{DD}+0.5V, not exceed 4.6V
SMBus, Input High Voltage 3.6V
ESD Protection (HBM) 2000V
Junction Temperature .....125°C max

Note:

Stresses greater than those listed under MAXIMUM RATINGS may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

Operating Conditions

Temperature = T_A; Supply voltages per normal operation conditions; See test circuits for the load conditions

Symbol	Parameters	Conditions	Min.	Typ.	Max.	Units
V_{DD}, V_{DDA}, V_{DD}_R, V_{DD}_DIG	Power Supply Voltage	—	3.135	3.3	3.465	V
V_{DDO}	Output Power Supply Voltage	—	0.95	1.05-3.3	3.465	V
I_{DDA}	Analog Power Supply Current	V_{DDA}, PLL mode, All outputs active @ 100MHz	—	21	25	mA
I_{DD}	Power Supply Current	V_{DD} + V_{DD_DIG} + V_{DD_R}, All outputs active @ 100MHz	—	34	40	mA
I_{DDO}	Power Supply Current for Outputs(2)	V_{DDO}, PLL mode, All outputs active @ 100MHz	—	31	36	mA
I_{DDA_PD}	Analog Power Supply Power Down(1) Current	V_{DDA}, PLL mode, All outputs LOW/LOW	—	0.5	1	mA
I_{DD_PD}	Power Supply Power Down(1) Current	V_{DD} + V_{DD_DIG} + V_{DD_R}, All outputs LOW/LOW	—	1.0	2	mA
I_{DDO_PD}	Power Supply Current Power Down(1) for Outputs	V_{DDO}, All outputs LOW/LOW	—	0.04	0.1	mA
T_A	Ambient Temperature	Industrial grade	–40	—	85	°C

Note:
1. Input clock is not running.
2. Outputs drive 5 inch trace.

Input Electrical Characteristics

Symbol	Parameters	Conditions	Min.	Typ.	Max.	Units
R_{pu}	Internal Pull-up Resistance	—	—	120	—	KΩ
R_{dn}	Internal Pull-down Resistance	—	—	120	—	KΩ
L_{PIN}	Pin Inductance	—	—	—	7	nH

SMBus Electrical Characteristics

Temperature = T_A; Supply voltages per normal operation conditions; See test circuits for the load conditions

Symbol	Parameters	Conditions	Min.	Typ.	Max.	Units
V_{DDSMB}	Nominal Bus Voltage	—	2.7	—	3.6	V
V_{IHSMB}	SMBus Input High Voltage	SMBus, V_{DDSMB} = 3.3V	2.1	—	3.6	V
		SMBus, V_{DDSMB} < 3.3V	0.65 V_{DDSMB}	—	—	
V_{ILSMB}	SMBus Input Low Voltage	SMBus, V_{DDSMB} = 3.3V	—	—	0.8	V
		SMBus, V_{DDSMB} < 3.3V	—	—	0.8	
$I_{SMBSINK}$	SMBus Sink Current	SMBus, at V_{OLSMB}	4	—	—	mA
V_{OLSMB}	SMBus Output Low Voltage	SMBus, at $I_{SMBSINK}$	—	—	0.4	V
f_{MAXSMB}	SMBus Operating Frequency	Maximum frequency	—	—	500	kHz
t_{RMSB}	SMBus Rise Time	(Max V_{IL} - 0.15) to (Min V_{IH} + 0.15)	—	—	1000	ns
t_{FMSB}	SMBus Fall Time	(Min V_{IH} + 0.15) to (Max V_{IL} - 0.15)	—	—	300	ns

LVCMOS DC Electrical Characteristics

Temperature = T_A; Supply voltages per normal operation conditions; See test circuits for the load conditions

Symbol	Parameters	Conditions	Min.	Typ.	Max.	Units
V_{IH}	Input High Voltage	Single-ended inputs, except SMBus	0.75 V_{DD}	—	V_{DD} +0.3	V
V_{IM}	Input Mid Voltage	SADR_TRI, BW_SEL_TRI	0.4V_{DD}	0.5V_{DD}	0.6V_{DD}	V
V_{IL}	Input Low Voltage	Single-ended inputs, except SMBus	-0.3	—	0.25 V_{DD}	V
I_{IH}	Input High Current	Single-ended inputs, V_{IN} = V_{DD}	—	—	5	µA
I_{IL}	Input Low Current	Single-ended inputs, V_{IN} = 0V	-5	—	—	µA
I_{IH}	Input High Current	Single-ended inputs with pull-up/pull-down resistor, V_{IN} = V_{DD}	—	—	50	µA
I_{IL}	Input Low Current	Single-ended inputs with pull-up/pull-down resistor, V_{IN} = 0V	-50	—	—	µA
C_{IN}	Input Capacitance	—	1.5	—	5	pF

LVCMOS AC Electrical Characteristics

Temperature = T_A; Supply voltages per normal operation conditions; See test circuits for the load conditions

Symbol	Parameters	Conditions	Min.	Typ.	Max.	Units
t_{OELAT}	Output Enable Latency	Q start after OE# assertion Q stop after OE# deassertion	1	—	3	clocks
t_{PDLAT}	PD# Deassertion	Differential outputs enable after PD# deassertion	—	20	300	µs

HCSL Input Characteristics(1)

Temperature = T_A; Supply voltages per normal operation conditions; See test circuits for the load conditions

Symbol	Parameters	Conditions	Min.	Typ.	Max.	Units
V_{IHDIF}	Diff. Input High Voltage(3)	IN+, IN-, single-end measurement	600	800	1150	mV
V_{ILDIF}	Diff. Input Low Voltage(3)	IN+, IN-, single-end measurement	-300	0	300	mV
V_{COM}	Diff. Input Common Mode Voltage		150		900	mV
V_{SWING}	Diff. Input Swing Voltage	Peak to peak value (V_{IHDIF} - V_{ILDIF})	300		2900	mV
f_{INBP}	Input Frequency	PLL Bypass mode	1		200	MHz
f_{IN100}	Input Frequency	100MHz PLL	99.9	100	100.1	MHz
f_{IN133}	Input Frequency	133MHz PLL	133.2	133.33	133.46	MHz
f_{IN125}	Input Frequency	125MHz PLL	124.87	125	125.12	MHz
f_{IN50}	Input Frequency	50MHz PLL	49.95	50	50.05	MHz
$f_{MODI-PCIe}$	Input SS Modulation Freq. PCIe	Allowable frequency for PCIe applications (Triangular Modulation)	30		33	kHz
$f_{MODIN-non-PCIe}$	Input SS Modulation Freq. non-PCIe	Allowable frequency for non-PCIe applications (Triangular Modulation)	0		46	kHz
t_{STAB}	Clock stabilization	From V_{DD} Power-Up and after input clock stabilization or de-assertion of PD# to 1st clock		0.75	1.0	ms
t_{RF}	Diff. Input Slew Rate(2)	Measured differentially	0.4			V/ns
I_{IN}	Diff. Input Leakage Current	V_{IN} = V_{DD}, V_{IN} = GND	-5	0.01	5	uA
t_{DC}	Diff. Input Duty Cycle	Measured differentially	45		55	%
tj_{c-c}	Diff. Input Cycle to cycle jitter	Measured differentially			125	ps

Note:

1. Guaranteed by design and characterization, not 100% tested in production
2. Slew rate measured through +/-75mV window centered around differential zero
3. The device can be driven by a single-ended clock by driving the true clock and biasing the complement clock input to the Vbias, where Vbias is (V_{IH}-V_{IL})/2

HCSL Output Characteristics

Temperature = T_A; Supply voltages per normal operation conditions; See test circuits for the load conditions

Symbol	Parameters	Condition	Min.	Typ.	Max.	Units
V_{OH}	Output Voltage High(1)	Statistical measurement on single-ended signal using oscilloscope math function	660	784	850	mV
V_{OL}	Output Voltage Low(1)		-150	—	150	mV
V_{OMAX}	Output Voltage Maximum(1)	Measurement on single ended signal using absolute value	—	816	1150	mV
V_{OMIN}	Output Voltage Minimum(1)		-300	-42	—	mV
V_{OC}	Output Cross Voltage(1,2,4)	—	250	430	550	mV
DV_{OC}	V_{OC} Magnitude Change(1,2,5)	—	—	12	140	mV

Note:

1. At default SMBUS amplitude settings.
2. Guaranteed by design and characterization—not 100% tested in production.
3. Measured from differential waveform.
4. This one is defined as voltage where Q+ = Q- measured on a component test board and only applied to the differential rising edge.
5. The total variation of all Vcross measurements in any particular system. This is a subset of Vcross_min/max allowed.

HCSL Output AC Characteristics

Temperature = T_A; Supply voltages per normal operation conditions; See test circuits for the load conditions

Symbol	Parameters	Condition	Min.	Typ.	Max.	Units
f_{OUT}	Output Frequency	—	50	100	133.33	MHz
BW	PLL Bandwidth(1,8)	-3dB point in High-Bandwidth Mode	1.3	3.2	3.6	MHz
		-3dB point in Low-Bandwidth Mode	0.7	1.7	1.9	MHz
tj_{peak}	PLL Jitter Peaking(1)	Peak pass band gain	—	0.8	2	dB
t_{RF}	Slew Rate(1,2,3)	Scope averaging on fast setting	2.5	3.2	4.0	V/ns
		Scope averaging on slow setting	2.2	3.0	3.7	V/ns
Dt_{RF}	Slew Rate Matching(1,2,4)	Scope averaging on	—	7	15	%
t_{SKEW}	Output Skew(1,2)	Averaging on, V_T = 50%	—	35	50	ps
t_{PDELAY}	Propagation Delay	PLL Bypass Mode, V_T = 50%	2000	2500	3000	ps
		PLL Mode, V_T = 50%	-200	90	200	ps
t_{DC}	Duty Cycle(1,2)	Measured differentially, PLL Mode	45	50	55	%
t_{DCD}	Duty Cycle Distortion(1,7)	Measured differentially, PLL Bypass Mode at 100MHz	-3.5	0	3.5	%
t_{DCD}	Duty Cycle Distortion(1,7)	Measured differentially, SE input, PLL Bypass Mode at 100MHz	-10	0	10	%
tj_{c-c}	Cycle-to-Cycle Jitter(1,2)	PLL mode	—	14	50	ps
		Additive jitter, Bypass Mode	—	0.1	1	ps

HCSL Output AC Characteristics (Jitter)

Symbol	Parameters	Condition	Min.	Typ.	Max.	Spec Limit	Units
$tj_{PHASEPLL}$	Integrated Phase Jitter PLL Mode (RMS)(1,5)	PCIe Gen 1(6)	—	25	35	86	ps(p-p)
		PCIe Gen 2 Low Band, 10kHz < f < 1.5MHz	—	0.6	0.8	3	ps
		PCIe Gen 2 High Band, 1.5MHz < f < Nyquist (50MHz)	—	0.7	1.2	3.1	ps
		PCIe Gen 3 (PLL BW of 2-4 or 2-5MHz, CDR =10MHz)	—	0.25	0.4	1	ps
		PCIe Gen 4 (PLL BW of 2-4 or 2-5MHz, CDR =10MHz)	—	0.25	0.4	0.5	ps
		PCIe Gen 5(11) (PLL BW of 500k to 1.8MHz. CDR =20MHz)	—	0.07	0.12	0.15	ps
		125MHz, 1.5MHz to 20MHz, -20dB/decade Rollover < 1.5MHz, -40dB/decade rolloff > 10MHz	—	0.15	0.3	—	ps
		133.33MHz	—	0.15	0.3	—	ps
tj_{PHASEA}	Additive Integrated Phase Jitter (RMS)(1,5,10)	PCIe Gen 1	—	0.01	0.05	—	ps(p-p)
		PCIe Gen 2 Low Band, 10kHz < f < 1.5MHz	—	0.01	0.05	—	ps
		PCIe Gen 2 High Band, 1.5MHz < f < Nyquist (50MHz)	—	0.01	0.05	—	ps
		PCIe Gen 3 (PLL BW of 2-4 or 2-5MHz, CDR =10MHz)	—	0.01	0.05	—	ps
		PCIe Gen 4 (PLL BW of 2-4 or 2-5MHz, CDR =10MHz)	—	0.01	0.05	—	ps
		PCIe Gen 5(11) (PLL BW of 500k to 1.8MHz. CDR =20MHz)	—	0.01	0.05	—	ps
		125MHz, 1.5MHz to 20MHz, -20dB/decade Rollover < 1.5MHz, -40dB/decade rolloff > 10MHz	—	0.01	0.05	—	ps
		133.33MHz	—	0.01	0.05	—	ps
		156.25MHz 12k to 20MHz	—	0.01	0.05	—	ps

Note:

1. Guaranteed by design and characterization—not 100% tested in production.
2. Measured from differential waveform.
3. Slew rate is measured through the Vswing voltage range centered around differential 0V, within ±150mV window.
4. Slew rate matching is measured through ±75mV window centered around differential zero.
5. See http://www.pcisig.com for complete specs.
6. Sample size of at least 100k cycles. This can be extrapolated to 108ps pk-pk @ 1M cycles for a BER of 10^{-12}.
7. Duty cycle distortion is the difference in duty cycle between the output and input clock when the device is operated in the PLL bypass mode.
8. The Min and Max values of each BW setting track each other, low BW max will never occur with high BW min.
9. Applies to all differential outputs.
10. For additive jitter RMS value is calculated by the following equation = SQRT [(total jitter)*2 - (input jitter)*2].
11. PCIe Gen 5 v0.9 specification.

SMBus Serial Data Interface

PI6CB33801 is a slave-only device that supports block read and block write protocol using a single 7-bit address and read/write bit as shown below.

Read and write block transfers can be stopped after any complete byte transfer.

Address Assignment

A6	A5	A4	A3	A2	A1	A0	R/W
1	1	0	1	See SBMus Address Selection table			1/0

Note: SMBus address is latched on SADR pin

How to Write

1 bit	7 bits	1 bit	1 bit	8 bits	1 bit	8 bits	1 bit	8 bits	1 bit		8 bits	1 bit	1 bit
Start bit	Add.	W(0)	Ack	Beginning Byte location = N	Ack	Data Byte count = X	Ack	Beginning Data Byte (N)	Ack	.....	Data Byte (N+X-1)	Ack	Stop bit

How to Read

1 bit	7 bits	1 bit	1 bit	8 bits	1 bit	1 bit	7 bits	1 bit	1 bit	8 bits	1 bit	8 bits	1 bit
Start bit	Address	W(0)	Ack	Beginning Byte location = N	Ack	Repeat Start bit	Address	R(1)	Ack	Data Byte count = X	Ack	Beginning Data Byte (N)	Ack

	8 bits	1 bit	1 bit
.....	Data Byte (N+X-1)	NAck	Stop bit

Byte 0: Output Enable Register

Bit	Control Function	Description	Type	Power-up Condition	0	1
7	Q7_OE	Q7 output enable	RW	1	See B11[1:0]	Pin Control
6	Q6_OE	Q6 output enable	RW	1	See B11[1:0]	Pin Control
5	Q5_OE	Q5 output enable	RW	1	See B11[1:0]	Pin Control
4	Q4_OE	Q4 output enable	RW	1	See B11[1:0]	Pin Control
3	Q3_OE	Q3 output enable	RW	1	See B11[1:0]	Pin Control
2	Q2_OE	Q2 output enable	RW	1	See B11[1:0]	Pin Control
1	Q1_OE	Q1 output enable	RW	1	See B11[1:0]	Pin Control
0	Q0_OE	Q0 output enable	RW	1	See B11[1:0]	Pin Control

Note:
1. A low on these bits overrides the OE# pins and force the differential outputs to the state indicated by B11[1:0] (Low/Low default).

Byte 1: PLL Operating Mode and Output Amplitude Control Register

Bit	Control Function	Description	Type	Power-up Condition	0	1
7	PLLMODERB1	PLL Mode Readback Bit1	R	Latch	See PLL Operating Mode Table	
6	PLLMODERB0	PLL Mode Readback Bit0	R	Latch		
5	PLLMODE_SWCTR	Enable SW control of PLL Mode	RW	0	Values in B1[7:6] set PLL Mode	Values in B1[4:3] set PLL Mode
4	PLLMODE1	PLL Mode control Bit1	RW(1)	0	See PLL Operating Mode Table	
3	PLLMODE0	PLL Mode control Bit0	RW(1)	0		
2	Reserved	—	—	1	—	—
1	Amplitude1	Control output amplitude	RW	1	'00' = 0.6V, '01' = 0.68V, '10' = 0.75V, '11' = 0.85V	
0	Amplitude0		RW	0		

Note:
1. B1[5] must be set to a 1 for these bits to have any effect on the part.

Byte 2: Differential Output Slew Rate Control Register

Bit	Control Function	Description	Type	Power-up Condition	0	1
7	SLEWRATECTR_Q7	Control slew rate of Q7	RW	1	Slow setting	Fast setting
6	SLEWRATECTR_Q6	Control slew rate of Q6	RW	1	Slow setting	Fast setting
5	SLEWRATECTR_Q5	Control slew rate of Q5	RW	1	Slow setting	Fast setting
4	SLEWRATECTR_Q4	Control slew rate of Q4	RW	1	Slow setting	Fast setting
3	SLEWRATECTR_Q3	Control slew rate of Q3	RW	1	Slow setting	Fast setting
2	SLEWRATECTR_Q2	Control slew rate of Q2	RW	1	Slow setting	Fast setting
1	SLEWRATECTR_Q1	Control slew rate of Q1	RW	1	Slow setting	Fast setting
0	SLEWRATECTR_Q0	Control slew rate of Q0	RW	1	Slow setting	Fast setting

Byte 3: Frequency Select Control Register

Bit	Control Function	Description	Type	Power-up Condition	0	1
7	Reserved	—	—	1	—	—
6	Reserved	—	—	1	—	—
5	FREQ_SEL_EN	Enable SW selection of frequency	RW	0	SW Freq. selection disabled	SW Freq. selection enabled
4	FSEL1	Freq. Select Bit 1	RW(1)	0	See Frequency Select Table	
3	FSEL0	Freq. Select Bit 0	RW(1)	0		
2	Reserved	—	—	1	—	—
1	Reserved	—	—	1	—	—
0	SLEWRATESEL FB	Adjust slew rate of feedback signal	RW	1	Slow setting	Fast setting

Note:
1. B3[5] must be set to a 1 for these bits to have any effect on the part.

Byte 4: Reserved

Bit	Control Function	Description	Type	Power-up Condition	0	1
7:0	Reserved	—	—	1	—	—

Byte 5: Revision and Vendor ID Register

Bit	Control Function	Description	Type	Power-up Condition	0	1
7	RID3	Revision ID	R	0	rev = 0000	
6	RID2		R	0		
5	RID1		R	0		
4	RID0		R	0		
3	PVID3	Vendor ID	R	0	Diodes = 0011	
2	PVID2		R	0		
1	PVID1		R	1		
0	PVID0		R	1		

Byte 6: Device Type/Device ID Register

Bit	Control Function	Description	Type	Power-up Condition	0	1
7	DTYPE1	Device type	R	0	'00' = CG, '01' = ZDB,	
6	DTYPE0		R	1	'10' = Reserve, '11' = ZDB	
5	DID5	Device ID	R	0	001000 binary, 08Hex	
4	DID4		R	0		
3	DID3		R	1		
2	DID2		R	0		
1	DID1		R	0		
0	DID0		R	0		

Byte 7: Reserved

Bit	Control Function	Description	Type	Power-up Condition	0	1
7:0	Reserved	—	R	0x08	—	—

Byte 8 and 9: Reserved

Bit	Control Function	Description	Type	Power-up Condition	0	1
7:0	Reserved	—	—	B8 = 0x36 B9 = 0x00	—	—

Byte 10: PD Restore

Bit	Control Function	Description	Type	Power-up Condition	0	1
7	Reserved	—	RW	1	—	—
6	PD Restore	PD Restore to default configuration	RW	1	Clear PD Config	Keep PD Config
5:0	Reserved	—	R	0	—	—

Byte 11: Stop Control

Bit	Control Function	Description	Type	Power-up Condition	0	1
7	FB_imp[1]	Feedback Zout	RW	1	00=Reserved	10=100 DIF Zout
6	FB_imp[0]		RW	0	01=85 DIF Zout	11 = Reserved
5:2	Reserved	—	—	0	—	—
1	STP1	True/ Compliment DIF Output Disable Sate	RW	0	00= Low/Low	10= High/ Low
0	STP0		RW	0	01= HiZ/HiZ	11= Low/High

Byte 12: Impedance Control

Bit	Control Function	Description	Type	Power-up Condition	0	1
7	Q3_Zout1	Q3 Zout	RW	10	00 = Reserved 01 = 85Ω 10 = 100Ω 11 = Reserved	
6	Q3_Zout0	Q3 Zout	RW			
5	Q2_Zout1	Q2 Zout	RW			
4	Q2_Zout0	Q2 Zout	RW			
3	Q1_Zout1	Q1 Zout	RW			
2	Q1_Zout0	Q1 Zout	RW			
1	Q0_Zout1	Q0 Zout	RW			
0	Q0_Zout0	Q0 Zout	RW			

Byte 13: Impedance Control

Bit	Control Function	Description	Type	Power-up Condition	0	1
7	Q7_Zout1	Q7 Zout	RW	10	00 = Reserved 01 = 85Ω 10 = 100Ω 11 = Reserved	
6	Q7_Zout0	Q7 Zout	RW			
5	Q6_Zout1	Q6 Zout	RW			
4	Q6_Zout0	Q6 Zout	RW			
3	Q5_Zout1	Q5 Zout	RW			
2	Q5_Zout0	Q5 Zout	RW			
1	Q4_Zout1	Q4 Zout	RW			
0	Q4_Zout0	Q4 Zout	RW			

Byte 14: OE Termination Control

Bit	Control Function	Description	Type	Power-up Condition	0	1
7	OE3_term1	OE3 Pull-up or down	RW	0	00=None	10= Pull-up
6	OE3_term0	OE3 Pull-up or down	RW	1	01=Pull-down	11=Pull-up and Down
5	OE2_term1	OE2 Pull-up or down	RW	0	00=None	10= Pull-up
4	OE2_term0	OE2 Pull-up or down	RW	1	01=Pull-down	11=Pull-up and Down
3	OE1_term1	OE1 Pull-up or down	RW	0	00=None	10= Pull-up
2	OE1_term0	OE1 Pull-up or down	RW	1	01=Pull-down	11=Pull-up and Down
1	OE0_term1	OE0 Pull-up or down	RW	0	00=None	10= Pull-up
0	OE0_term0	OE0 Pull-up or down	RW	1	01=Pull-down	11=Pull-up and Down

Byte 15: OE Termination Control

Bit	Control Function	Description	Type	Power-up Condition	0	1
7	OE7_term1	OE7 Pull-up or down	RW	0	00=None	10= Pull-up
6	OE7_term0	OE7 Pull-up or down	RW	1	01=Pull-down	11=Pull-up and Down
5	OE6_term1	OE6 Pull-up or down	RW	0	00=None	10= Pull-up
4	OE6_term0	OE6 Pull-up or down	RW	1	01=Pull-down	11=Pull-up and Down
3	OE5_term1	OE5 Pull-up or down	RW	0	00=None	10= Pull-up
2	OE5_term0	OE5 Pull-up or down	RW	1	01=Pull-down	11=Pull-up and Down
1	OE4_term1	OE4 Pull-up or down	RW	0	00=None	10= Pull-up
0	OE4_term0	OE4 Pull-up or down	RW	1	01=Pull-down	11=Pull-up and Down

Byte 16: Power Good Termination Control

Bit	Control Function	Description	Type	Power-up Condition	0	1
7:2	Reserved	—	—	0x00	—	—
1	PWRGD_PD1	Clock Power Good and Power Down Pull-up or Pull-down	RW	1	00=None	10= Pull-up
0	PWRGD_PD0		RW	0	01=Pull-down	11=Pull-up and Down

Byte 17: Reserved

Bit	Control Function	Description	Type	Power-up Condition	0	1
7:0	Reserved	—	—	0	—	—

Byte 18: Enable Pin Control

Bit	Control Function	Description	Type	Power-up Condition	0	1
7	OE7_Enable	Sets Enable High or Low	RW	0	Enable = Low	Enable = High
6	OE6_Enable	Sets Enable High or Low	RW	0	Enable = Low	Enable = High
5	OE5_Enable	Sets Enable High or Low	RW	0	Enable = Low	Enable = High
4	OE4_Enable	Sets Enable High or Low	RW	0	Enable = Low	Enable = High
3	OE3_Enable	Sets Enable High or Low	RW	0	Enable = Low	Enable = High
2	OE2_Enable	Sets Enable High or Low	RW	0	Enable = Low	Enable = High
1	OE1_Enable	Sets Enable High or Low	RW	0	Enable = Low	Enable = High
0	OE0_Enable	Sets Enable High or Low	RW	0	Enable = Low	Enable = High

Byte 19: Power Down Pin Control

Bit	Control Function	Description	Type	Power-up Condition	0	1
7:1	Reserved	—	—	0	—	—
0	PWRGD_PD	PWRGD_PD Active via Pull-up or Pull-down	RW	0	Power Down = Low	Power Down = High

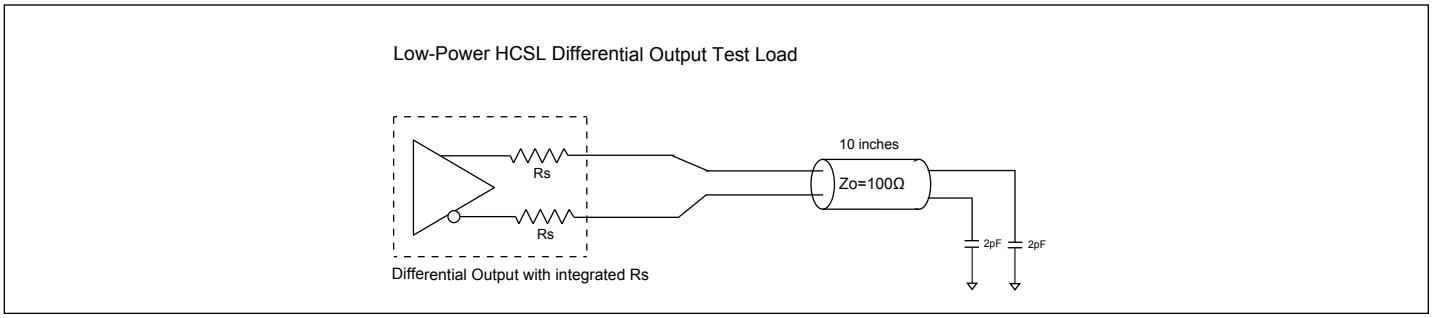


Figure 1. Low-Power HCSL Test Circuit

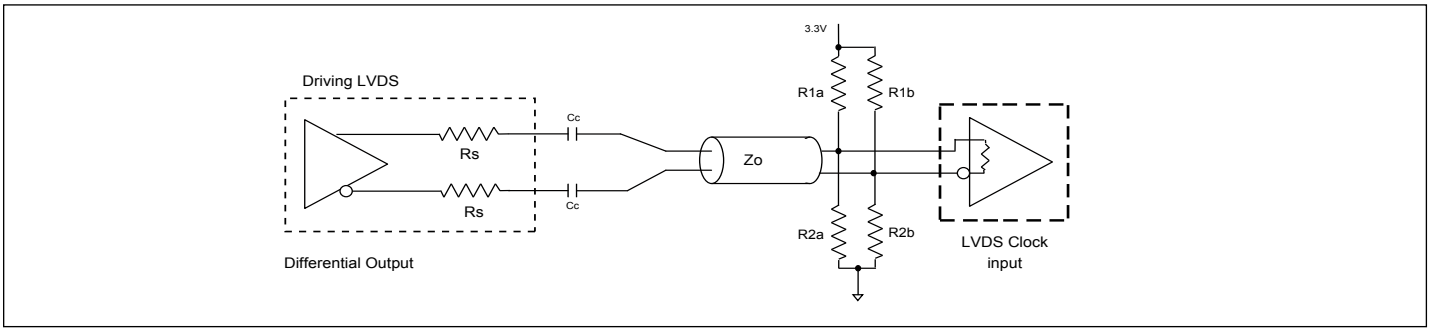


Figure 2. Differential Output Driving LVDS

Alternate Differential Output Terminations

Component	Receiver with Termination	Receiver without Termination	Unit
R_{1a}, R_{1b}	10,000	140	Ω
R_{2a}, R_{2b}	5600	75	Ω
C_C	0.1	0.1	µF
V_{CM}	1.2	1.2	V

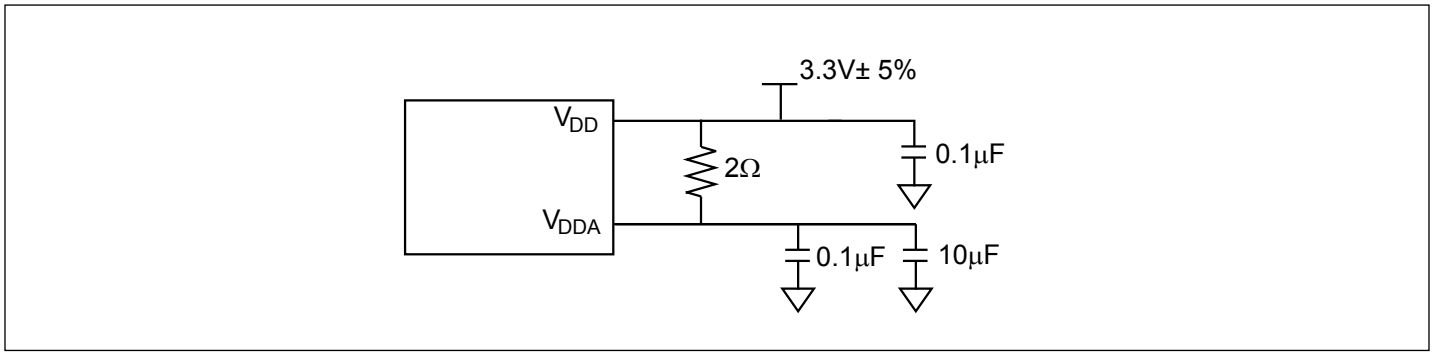


Figure 3. Power Supply Filter

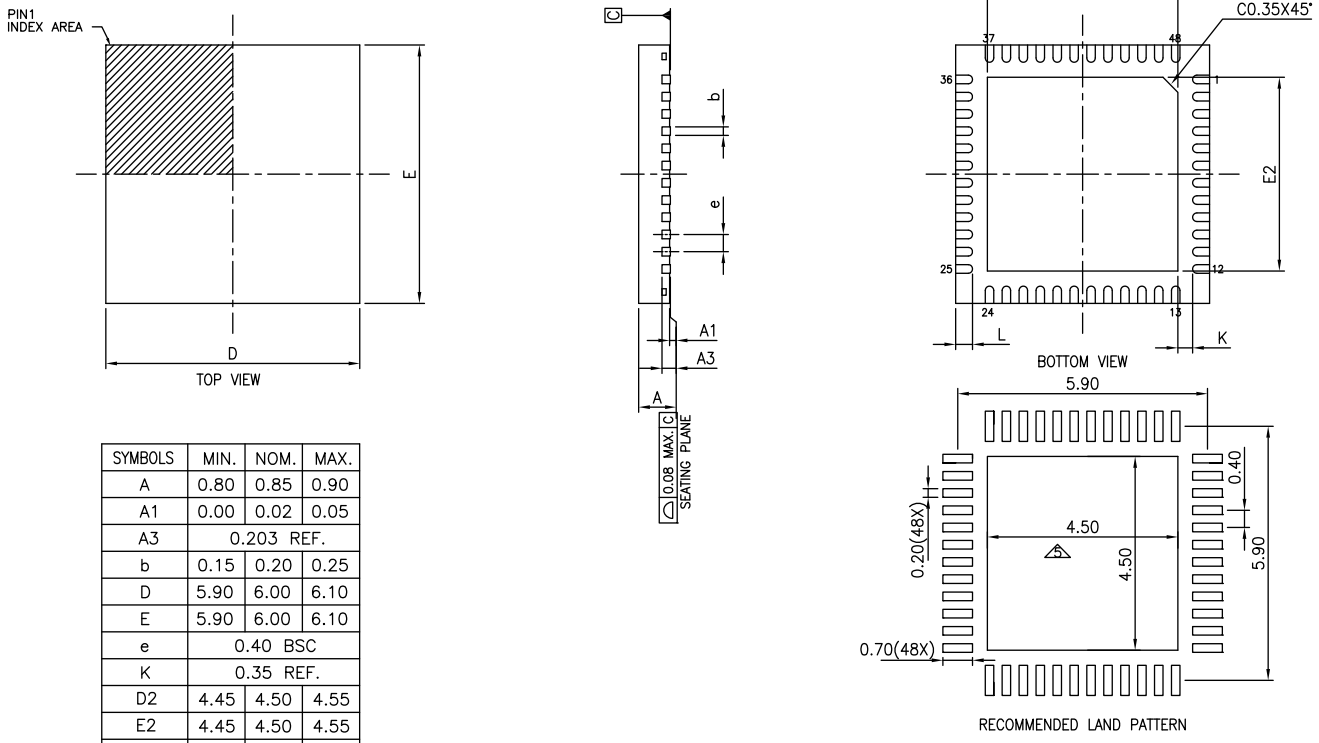
Thermal Characteristics

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
θ_{JA}	Thermal Resistance Junction to Ambient	Still air			38.15	°C/W
θ_{JC}	Thermal Resistance Junction to Case				24.66	°C/W

Part Marking

Z: Die Rev
YY: Year
WW: Workweek
1st X: Assembly Code
2nd X: Fab Code

Packaging Mechanical: 48-Pin TQFN (ZL)



SYMBOLS	MIN.	NOM.	MAX.
A	0.80	0.85	0.90
A1	0.00	0.02	0.05
A3		0.203 REF.	
b	0.15	0.20	0.25
D	5.90	6.00	6.10
E	5.90	6.00	6.10
e		0.40 BSC	
K		0.35 REF.	
D2	4.45	4.50	4.55
E2	4.45	4.50	4.55
L	0.35	0.40	0.45

NOTE :
1. ALL DIMENSIONS ARE IN mm. ANGLES IN DEGREES.
2. COPLANARITY APPLIES TO THE EXPOSED THERMAL PAD AS WELL AS THE TERMINALS.
3. REFER JEDEC MO-220
4. RECOMMENDED LAND PATTERN IS FOR REFERENCE ONLY.
5. THERMAL PAD SOLDERING AREA (MESH STENCIL DESIGN IS RECOMMENDED).

PERICOM Enabling Serial Connectivity — DATE: 10/26/15

DESCRIPTION: 48-Contact, Very Thin Quad Flat No-Lead (TQFN)

PACKAGE CODE: ZL (ZL48)

DOCUMENT CONTROL #: PD-2201 — REVISION: A

15-0244

For latest package information:

See http://www.diodes.com/design/support/packaging/pericom-packaging/packaging-mechanicals-and-thermal-characteristics/.

Ordering Information

Ordering Code	Package Code	Package Description	Pin 1 Location
PI6CB33801ZLIEX	ZL	48-Contact, Very Thin Quad Flat No-Lead (TQFN)	Top Right Corner
PI6CB33801ZLIEX-13R	ZL	48-Contact, Very Thin Quad Flat No-Lead (TQFN)	Top Left Corner

Notes:

1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
2. See https://www.diodes.com/quality/lead-free/ for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.
4. E = Pb-free and Green
5. X suffix = Tape/Reel
6. For packaging details, go to our website at: https://www.diodes.com/assets/MediaList-Attachments/Diodes-Package-Information.pdf

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