

PI6C5912016

16 Output LVPECL Fanout Buffer

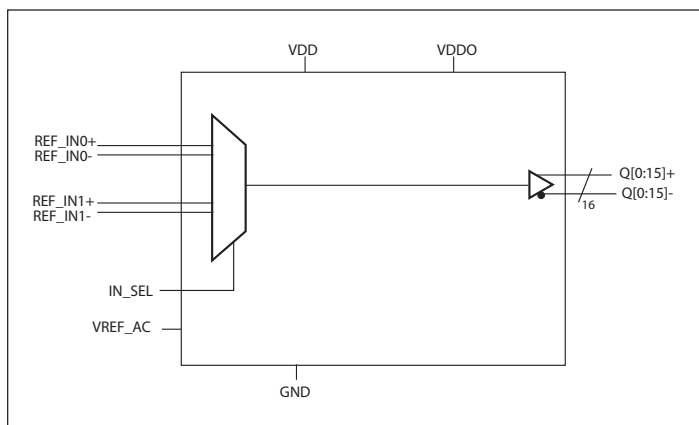
Description

The DIODES™ PI6C5912016 is a high performance LVPECL fanout buffer device which supports up to 2GHz frequency. This device is ideal for systems that need to distribute low jitter LVPECL clock signals to multiple destinations.

Application(s)

- Networking systems including switches and routers
- High frequency backplane based computing and telecom platforms

Block Diagram



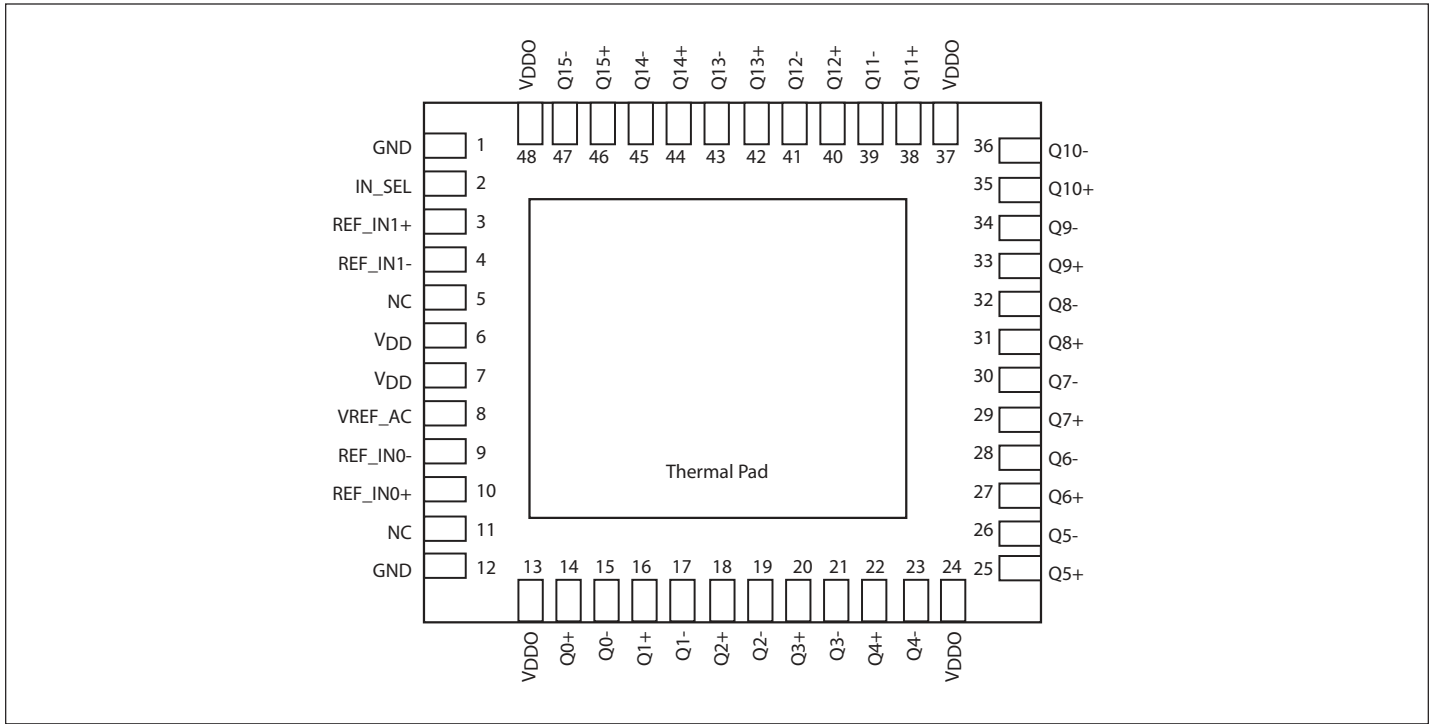
Features

- 16 differential LVPECL outputs
- 2 selectable reference inputs support either single-ended or differential
- Up to 2GHz output frequency
- Ultra low additive phase jitter: < 0.01 ps (typ) (differential 156.25MHz, 12KHz to 20MHz integration range)
- Low skew between outputs
- Low delay from input to output (Tpd typ. < 1.7ns)
- Separate Input output supply voltage for level shifting
- 2.5V / 3.3V power supply
- Industrial temperature support
- 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-Q100/101/104/200, PPAP capable, and manufactured in IATF 16949 certified facilities), please [contact us](https://www.diodes.com/quality/product-definitions/) or your local Diodes representative.
- Packaging (Pb-free & Green):
 - 48-pin, TQFN

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 #	Pin Name	Type	Description
1, 12	GND	Power	Power supply ground
2	IN_SEL	Input Pulldown	Input clock select. See Table 1 for function. LVCMOS/LVTTL interface levels.
3, 4	REF_IN1+ REF_IN1-	Input	Reference input 1. Accepts Differential or Single Ended inputs
5, 11	NC	-	No Connect
6, 7	VDD	Power	Core power supply
8	VREF_AC	Output	Bias voltage output.
9, 10	REF_IN0+ REF_IN0-	Input	Reference input 0. Accepts Differential or Single Ended inputs
13, 24, 37, 48	VDDO	Power	Output power supply
14, 15	Q0+ Q0-	Output	LVPECL output pair 0.
16, 17	Q1+ Q1-	Output	LVPECL output pair 1.
18, 19	Q2+ Q2-	Output	LVPECL output pair 2.

Pin #	Pin Name	Type	Description
20, 21	Q3+	Output	LVPECL output pair 3.
	Q3-		
22, 23	Q4+	Output	LVPECL output pair 4.
	Q4-		
25, 26	Q5+	Output	LVPECL output pair 5.
	Q5-		
27, 28	Q6+	Output	LVPECL output pair 6.
	Q6-		
29, 30	Q7+	Output	LVPECL output pair 7.
	Q7-		
31, 32	Q8+	Output	LVPECL output pair 8.
	Q8-		
33, 34	Q9+	Output	LVPECL output pair 9.
	Q9-		
35, 36	Q10+	Output	LVPECL output pair 10.
	Q10-		
38, 39	Q11+	Output	LVPECL output pair 11.
	Q11-		
40, 41	Q12+	Output	LVPECL output pair 12.
	Q12-		
42, 43	Q13+	Output	LVPECL output pair 13.
	Q13-		
44, 45	Q14+	Output	LVPECL output pair 14.
	Q14-		
46, 47	Q15+	Output	LVPECL output pair 15.
	Q15-		
Thermal pad	-	-	Thermal pad. Connect to ground.

Function Table

Table 1: Input select function

IN_SEL	Function
0	REF_IN0 is the selected reference input
1	REF_IN1 is the selected reference input
Open	No inputs selected. Outputs Hi-Z

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Units
C_{IN}	Input Capacitance			2		pF
$R_{PULLDOWN}$	Input Pulldown Resistor			200		k Ω
R_{PULLUP}	Input Pullup Resistor			200		k Ω

Maximum Ratings

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

Storage Temperature.....	-55 to +150°C
Supply Voltage to Ground Potential (V_{DD}, V_{DDO})...	-0.5 to +4.6V
Inputs (Referenced to GND)	-0.5 to $V_{DD}+0.5V$
Clock Output (Referenced to GND).....	-0.5 to $V_{DD}+0.5V$
Latch up	200mA
ESD Protection (Input)	2000 V min (HBM)
ESD Protection (Input)	1000 V min (CDM)

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.

Power Supply Characteristics and Operating Conditions

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Units
V_{DD}	Core Supply Voltage		3.135	3.3	3.465	V
			2.375	2.5	2.625	V
V_{DDO}	Output Supply Voltage		3.135	3.3	3.465	V
			2.375	2.5	2.625	V
I_{EE}	Supply Internal Current			127	146	mA
I_{DD}	Core Power Supply Current			91	105	
T_A	Ambient Operating Temperature		-40		85	°C

DC Electrical Specifications - Differential Inputs

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Units
I_{IH}	Input High current	Input = V_{DD}			20	uA
I_{IL}	Input Low current	Input = GND	-20			uA
V_{IH}	Input high voltage				$V_{DD}+0.3$	V
V_{IL}	Input low voltage		-0.3			V
V_{ID}	Input Differential Amplitude PK-PK		0.1			V
V_{CM}	Common mode input voltage		GND + 0.5		$V_{DD}-0.85$	V
ISO_{MUX}	MUX isolation			-89		dBc

DC Electrical Specifications - LVCMOS Inputs

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Units
I_{IH}	Input High current	Input = V_{DD}			50	μA
I_{IL}	Input Low current	Input = GND	-50			μA
V_{IH}	Input high voltage	$V_{DD}=3.3V$	2.0		$V_{DD}+0.3$	V
V_{IL}	Input low voltage	$V_{DD}=3.3V$	-0.3		0.8	V
V_{IH}	Input high voltage	$V_{DD}=2.5V$	1.7		$V_{DD}+0.3$	V
V_{IL}	Input low voltage	$V_{DD}=2.5V$	-0.3		0.7	V

DC Electrical Specifications - LVPECL Outputs

Parameter	Description	Conditions	Min.	Typ.	Max.	Units
V_{OH}	Output High voltage		$V_{DDO}-1.4$		$V_{DDO}-0.9$	V
V_{OL}	Output Low voltage	$V_{DD}=2.5V$	$V_{DDO}-1.9$		$V_{DDO}-1.25$	V
		$V_{DD}=3.3V$	$V_{DDO}-2.2$		$V_{DDO}-1.25$	V

AC Electrical Specifications - Differential Inputs

Parameter	Description	Conditions	Min.	Typ.	Max.	Units
F_{IN}	Clock input frequency				2000	MHz
V_{INPP}	Differential Input peak to peak voltage	$1.5GHz \leq F_{IN} \leq 2 GHz$	0.2		1.5	V
		$F_{IN} \leq 1.5 GHz$	0.1		1.5	V
ER	Input Edge Rate		1.5			V/ns

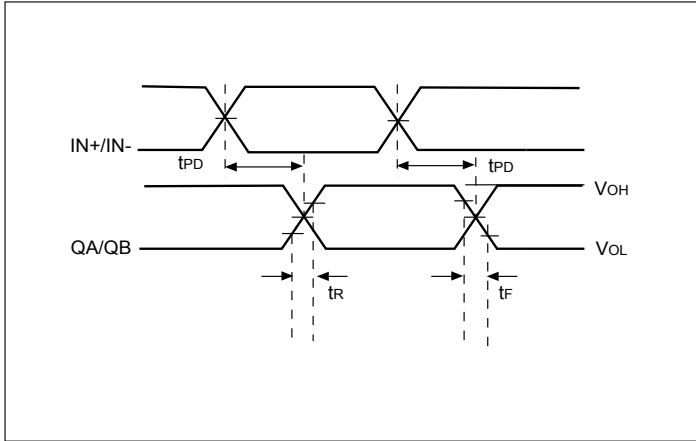
AC Electrical Specifications - LVCMOS Inputs

Parameter	Description	Conditions	Min.	Typ.	Max.	Units
F_{IN}	Clock input frequency	REF_IN0+, REF_IN1+			200	MHz
V_{INPP}	LVCMOS Input peak to peak voltage		0.8		VDD	V
ER	Input Edge Rate		1.5			V/ns

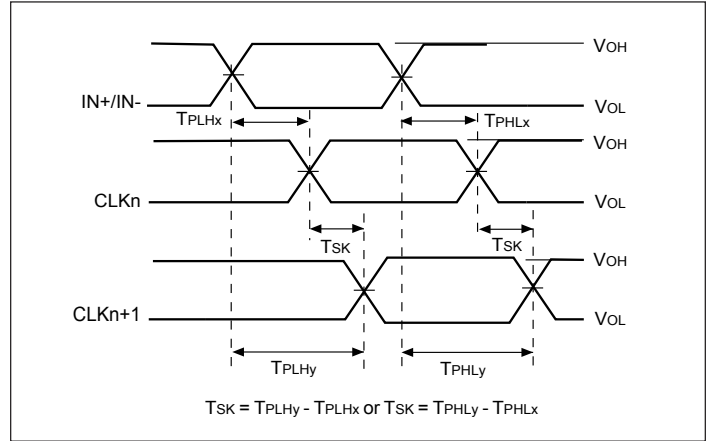
AC Electrical Specifications - LVPECL Outputs

Parameter	Description	Conditions	Min.	Typ.	Max.	Units
F_{OUT}	Clock output frequency	LVPECL			2000	MHz
T_r	Output rise time	From 20% to 80%		150		ps
T_f	Output fall time	From 80% to 20%		150		ps
T_{ODC}	Output duty cycle		48		52	%
V_{PP}	Output swing Single-ended	@1GHz to \leq 2GHz	250		850	mV
		@ \leq 1GHz	500		950	mV
T_j	Buffer additive jitter RMS	156.25MHz, 12kHz to 20MHz		0.04	0.08	ps
		156.25MHz, 10kHz to 1MHz		0.03	0.08	ps
T_{SK}	Output Skew			13	30	ps
T_{PD}	Propagation Delay			620	700	ps
T_{OD}	Valid to HiZ				100	ns
T_{OE}	HiZ to valid				100	ns
$T_{P2P Skew}$	Part to Part Skew ¹		-50		50	ps
V_{REF_AC}	Input bias voltage	$I_{AC} = 2mA$	$V_{DD}-1.6$		$V_{DD}-1.1$	V

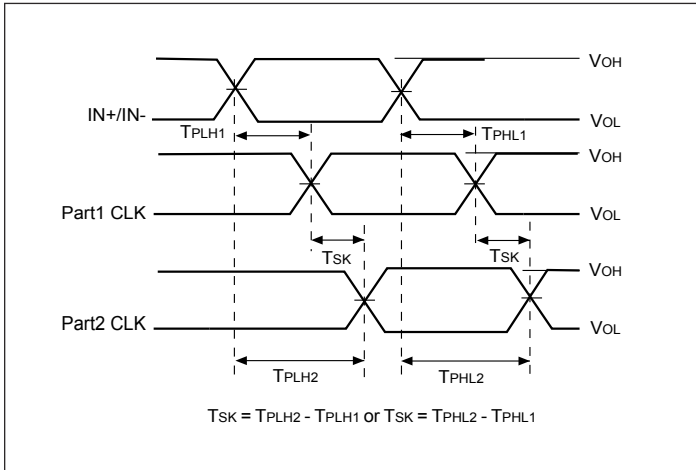
Propagation Delay (T_{PD})



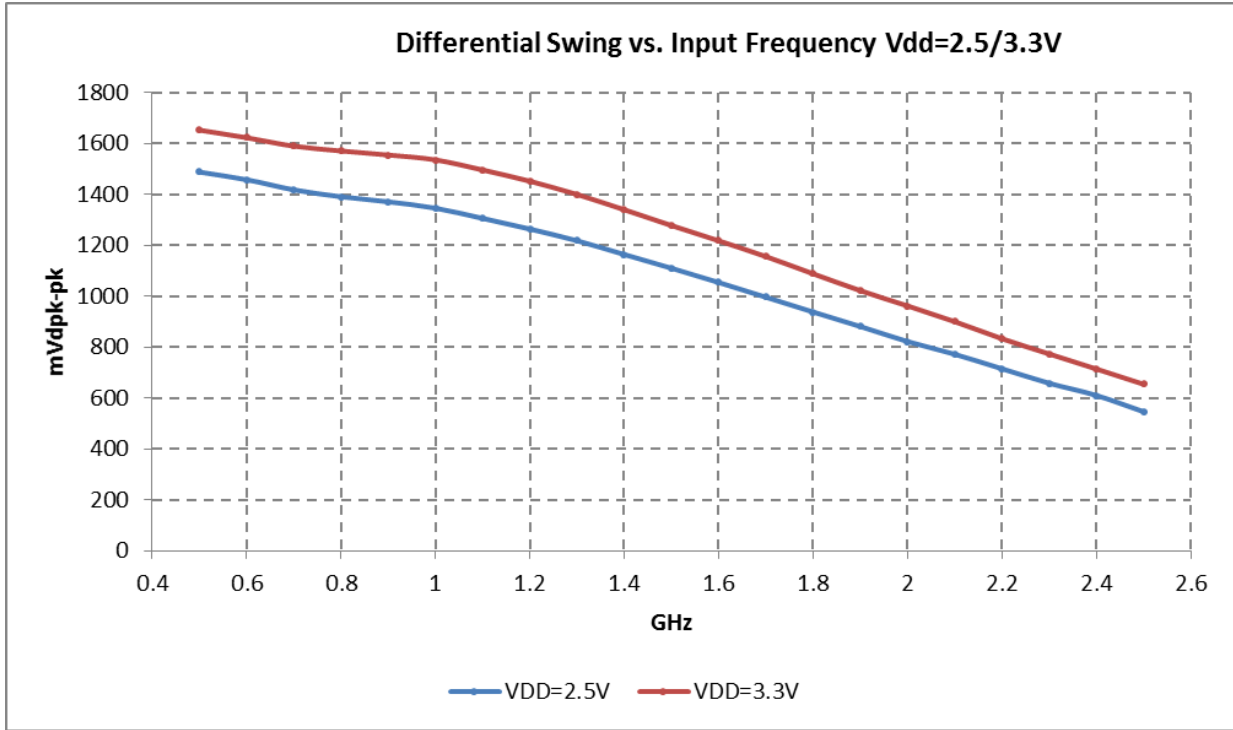
Output Skew (T_{SK})



Part to Part Skew



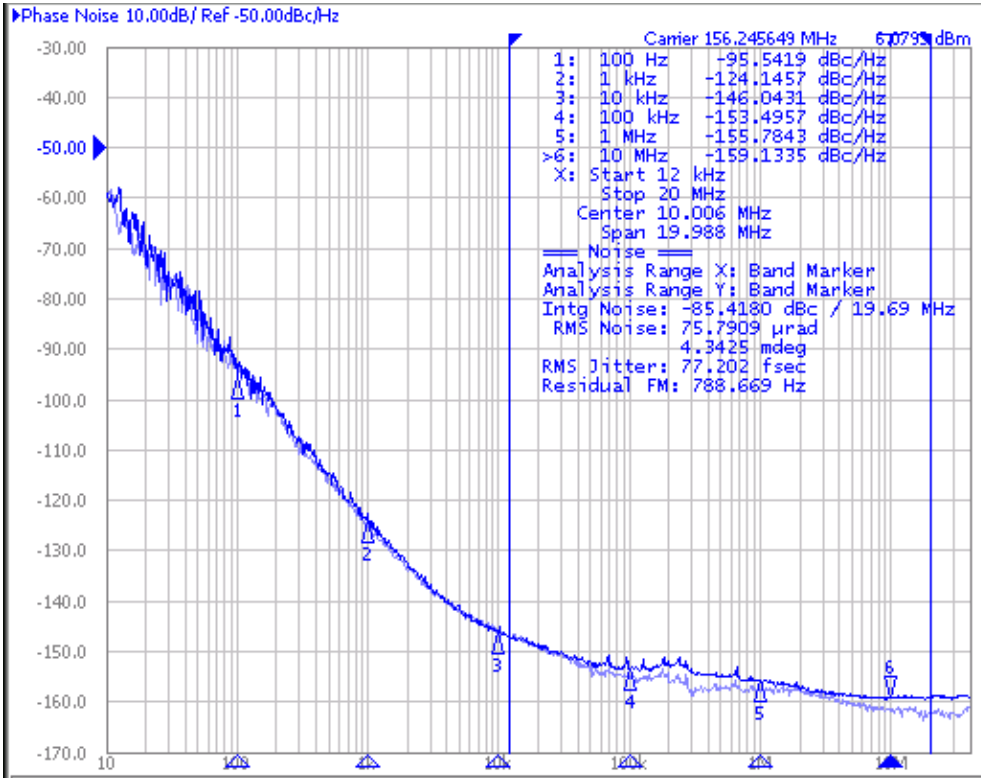
LVPECL Output Swing vs. Frequency



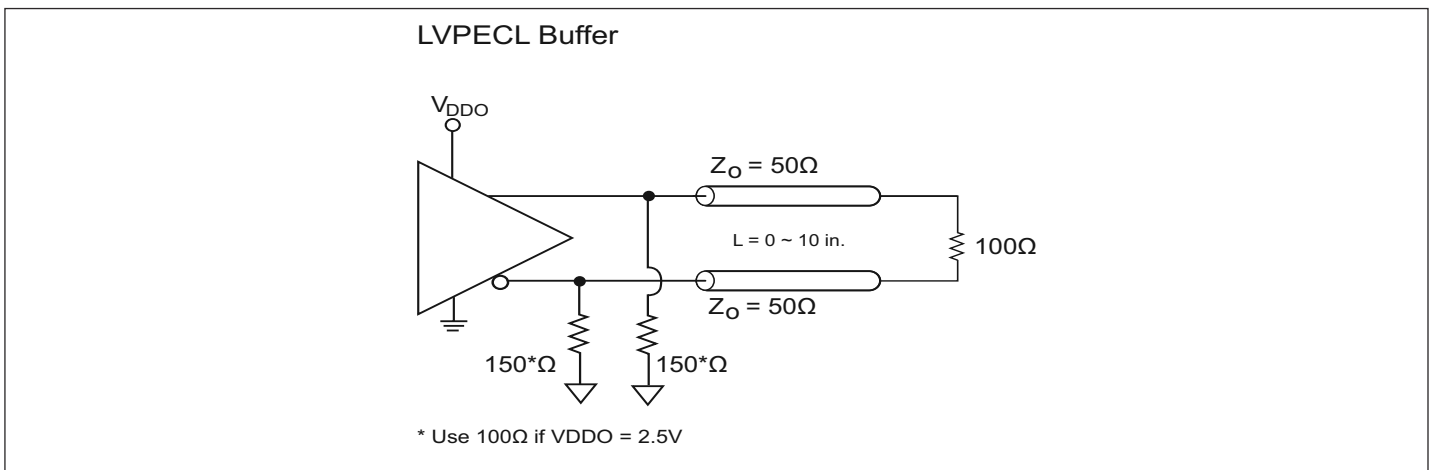
Phase Noise and Additive Jitter

Output phase noise (Dark Blue) vs Input phase noise (light blue)

$$\text{Additive jitter} = \sqrt{(\text{Output jitter}^2 - \text{Input jitter}^2)}$$

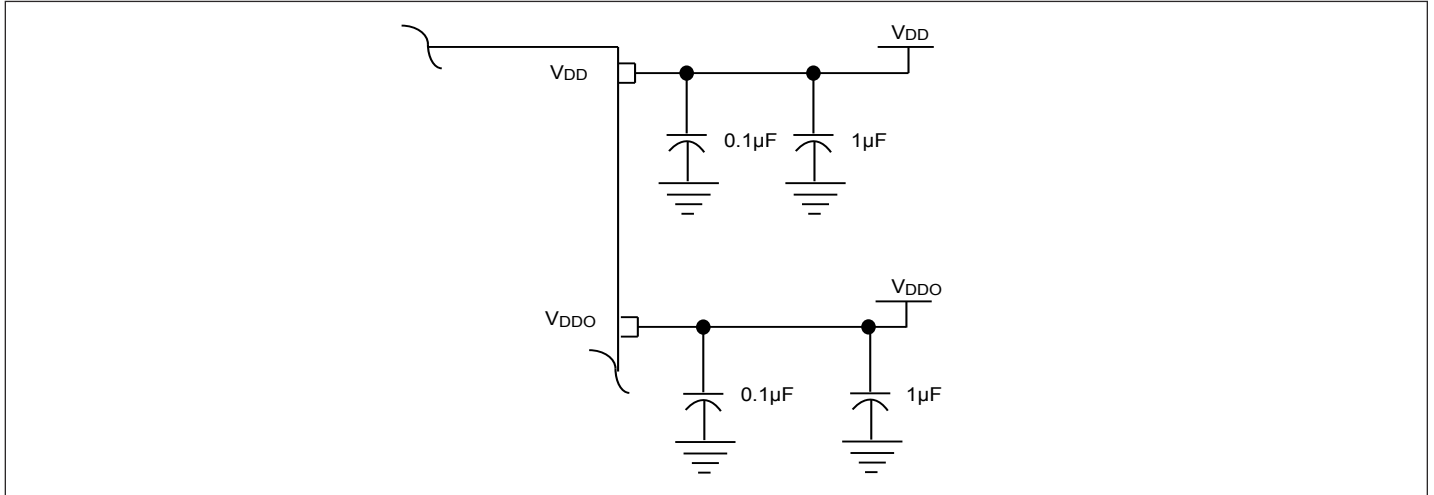


Configuration Test Load Board Termination for LVPECL Outputs

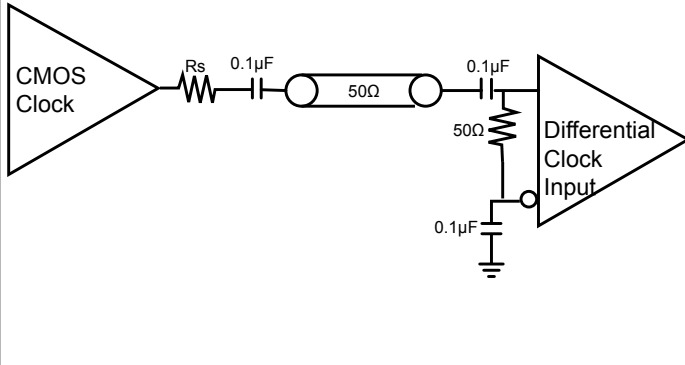


Power Supply Filtering Techniques

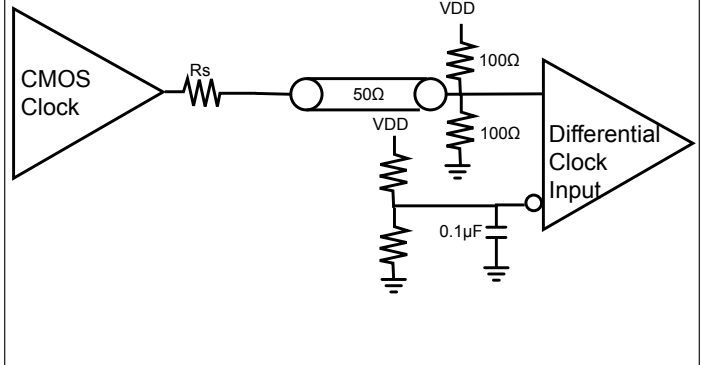
As in any high speed analog circuitry, the power supply pins are vulnerable to random noise. To achieve optimum jitter performance, power supply isolation is required. All power pins should be individually connected to the power supply plane through vias, and 0.1 μ F and 1 μ F bypass capacitors should be used for each pin.



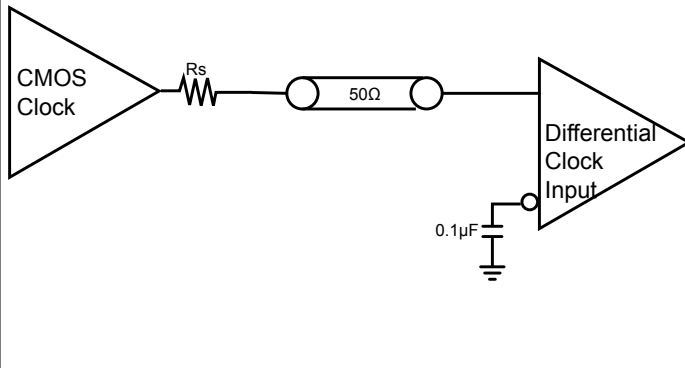
Single Ended Input, AC couple



Single Ended Input, DC couple

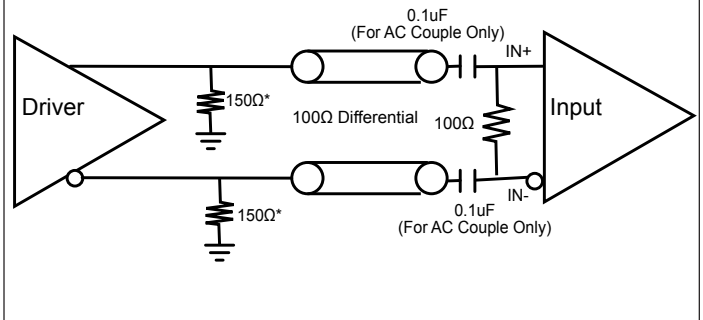


Single Ended Input, DC couple

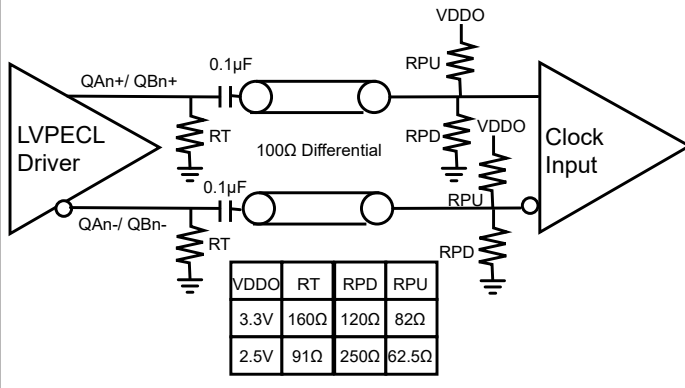


LVPECL/ LVDS AC and DC input

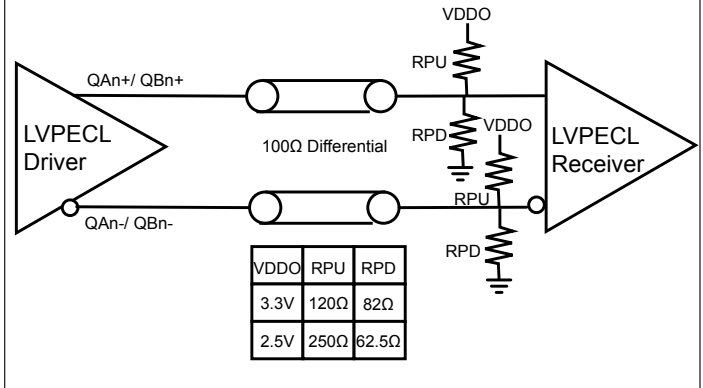
*Remove for LVDS

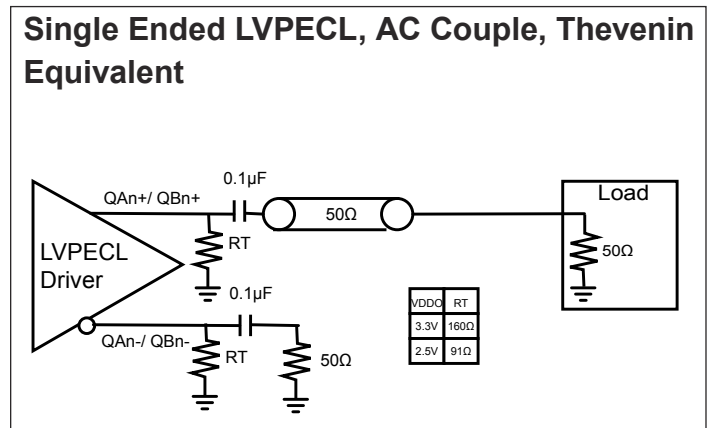
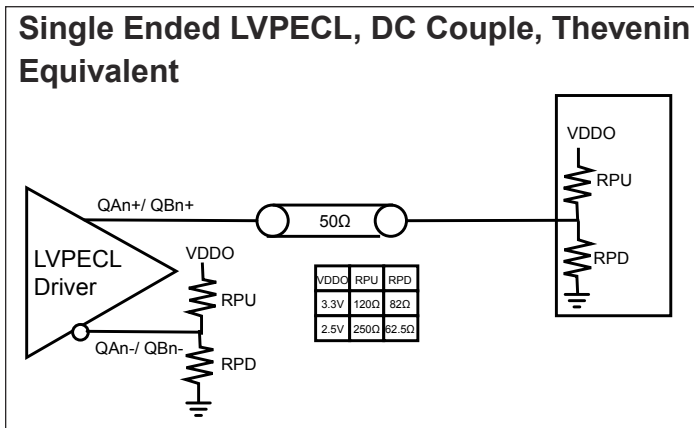
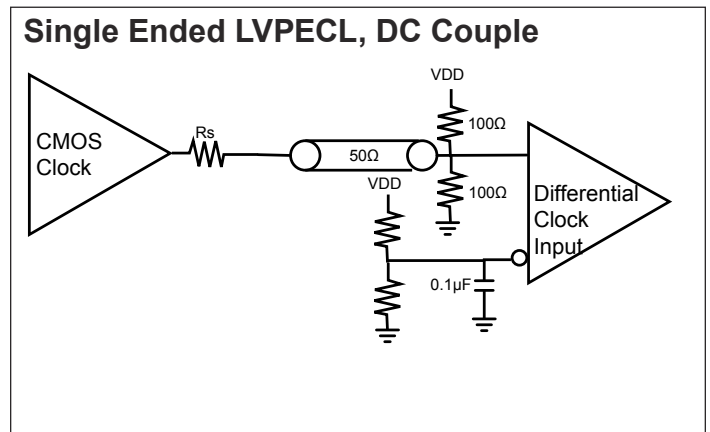
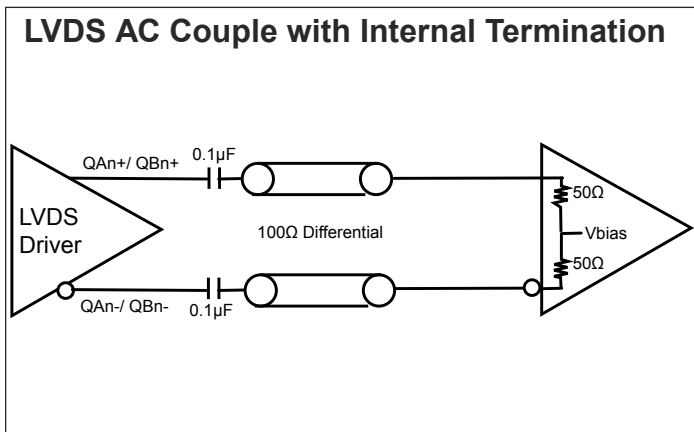
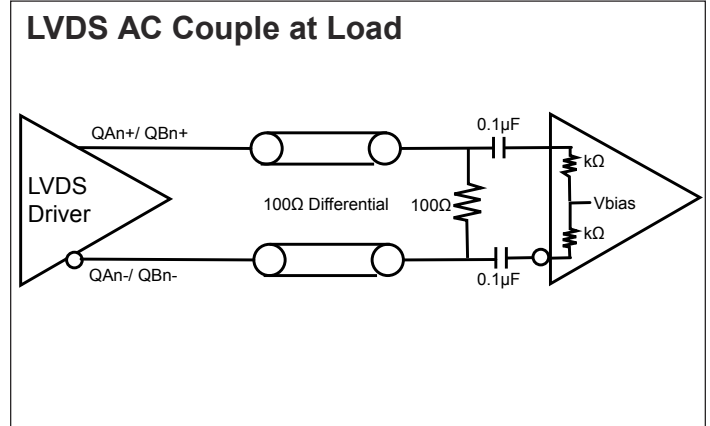
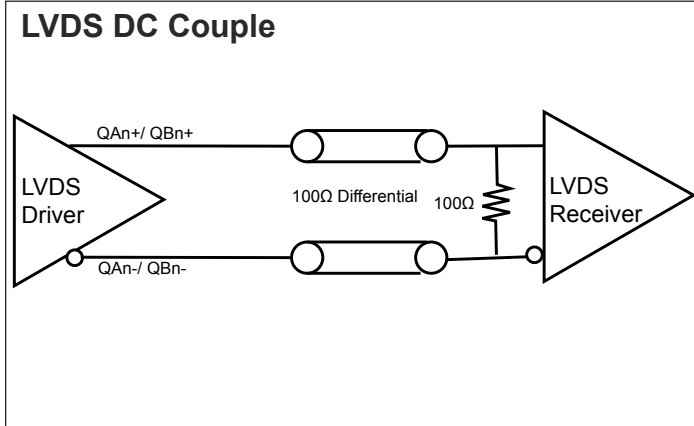


LVPECL, AC Couple, Thevenin Equivalent



LVPECL, DC Couple, Thevenin Equivalent





Thermal Information

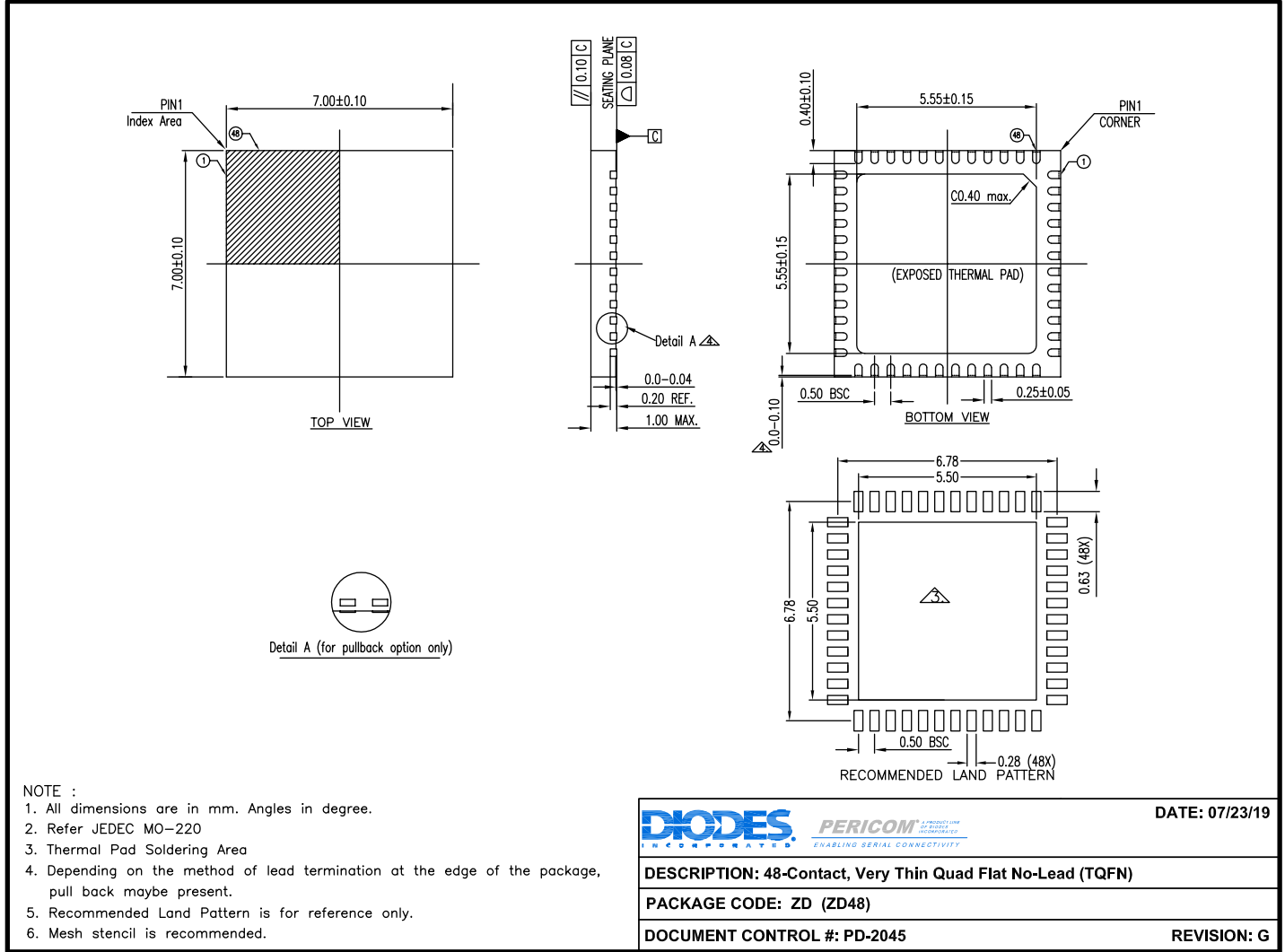
Symbol	Description	Condition	
Θ_{JA}	Junction-to-ambient thermal resistance	Still air	23.65 °C/W
Θ_{JC}	Junction-to-case thermal resistance		9.10 °C/W

Part Marking

Top mark not available at this time. To obtain advance information regarding the top mark, please contact your local sales representative.

Packaging Mechanical

48-TQFN (ZD)



19-1087

For latest package info.

please check: <http://www.diodes.com/design/support/packaging/pericom-packaging/packaging-mechanicals-and-thermal-characteristics/>

Ordering Information

Ordering Code	Package Code	Package Description	Operating Temperature	Pin 1 Location
PI6C5912016ZDIEX	ZD	48-Contact, Very Thin Quad Flat No-Lead (TQFN)	-40°C to 85°C	Top Left
PI6C5912016ZDIEX-13R	ZD	48-Contact, Very Thin Quad Flat No-Lead (TQFN)	-40°C to 85°C	Top Right

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. I = Industrial
5. E = Pb-free and Green
6. X suffix = Tape/Reel
7. The taping orientation and tape details can be found at <https://www.diodes.com/assets/MediaList-Attachments/Diodes-Package-Information.pdf>

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