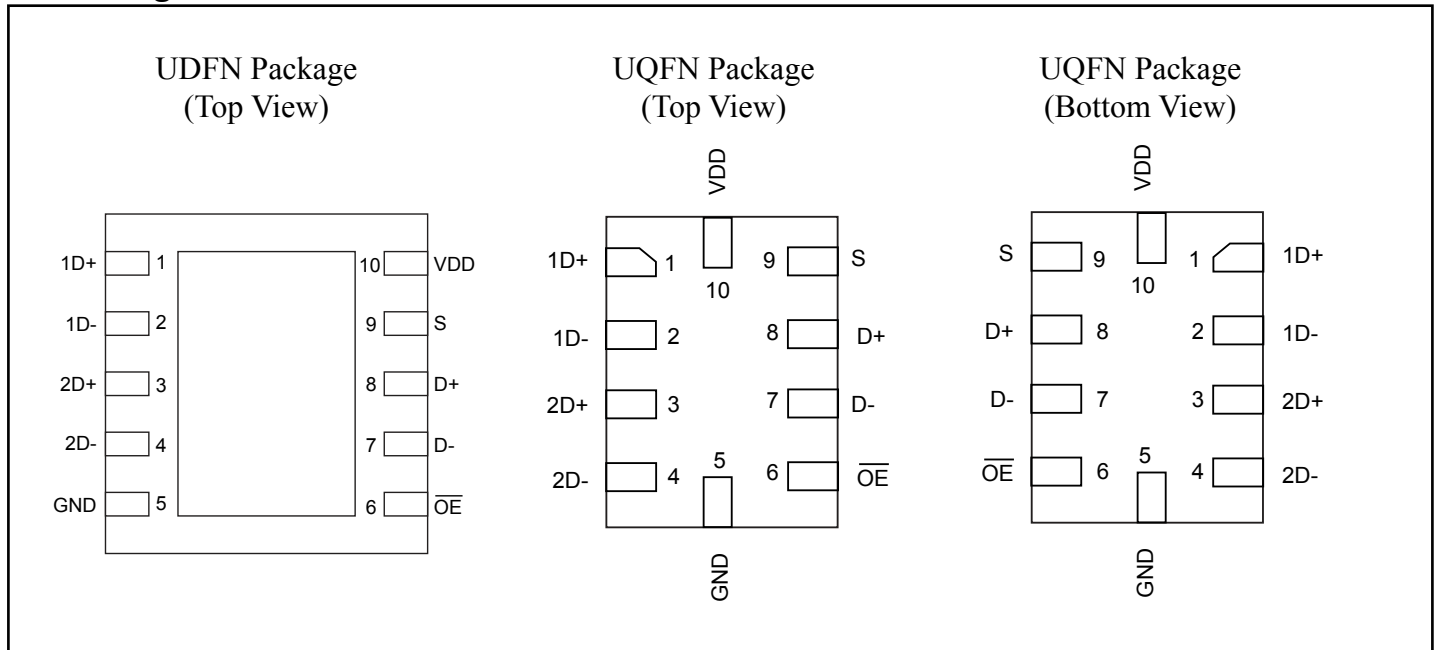


Pin Configuration



Pin Description

Name	Description
\overline{OE}	Active LOW, Output enable
S	Select input
D	COM port
nD	I/O for USB data path (port 1 and port 2)

Absolute Maximum Ratings⁽¹⁾

Over operating free-air temperature range (unless otherwise noted)

V _{DD} Supply Voltage Range	–0.5V to 4.6V
V _{IN} Control Input Voltage Range ^(2, 3)	–0.5V to 5.5V
V _{I/O} Switch I/O Voltage Range ^(2, 3, 4)	–0.5V to 5.5V
I _{IK} Control Input Clamp Current (V _{IN} < 0)	–50mA
I _{I/OK} I/O Port Clamp Current (V _{I/O} < 0)	–50mA
I _{I/O} ON-state Switch Current ⁽⁵⁾	±120mA
Continuous Current through V _{DD} or GND	±100mA
θ _{JA} Package Thermal Impedance	
TLLGA Package	48.7°C/W
TDFN Package	243°C/W
T _{stg} Storage Temperature Range	–65 to 150°C
T _j Junction Temperature	125°C

Notes:

- Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
- All voltages are with respect to ground, unless otherwise specified.
- The input and output voltage ratings may be exceeded if the input and output clamp-current ratings are observed.
- VI and VO are used to denote specific conditions for VI/O.
- II and IO are used to denote specific conditions for II/O.
- The package thermal impedance is calculated in accordance with JESD 51-7.

Recommended Operating Conditions⁽¹⁾

Symbol	Description	Parameter	Min.	Max.	Unit
V _{DD}	Supply voltage		2.3	3.6	V
V _{IH}	High-level control input voltage	V _{DD} = 2.3 V to 2.7 V	1.3	-	
		V _{DD} = 2.7 V to 3.6 V	1.4	-	
V _{IL}	Low-level control input voltage	V _{DD} = 2.3 V to 2.7 V		0.6	
		V _{DD} = 2.7 V to 3.6 V		0.6	
V _{I/O}	Data input/output voltage		0	4.6	°C
T _A	Operating free-air temperature		–40	85	

Note:

- All unused control inputs of the device must be held at V_{DD} or GND to ensure proper device operation.

Electrical Characteristics

Over operating free-air temperature range (unless otherwise noted)

Parameter		Testing Conditions	Min.	Typ.	Max.	Unit	
V _{IK}		V _{DD} = 3.6V, 2.7V, I _I = −18 mA			−1.2	V	
I _{IN}	Control Inputs	V _{DD} = 3.6V, 2.7V, 0V, V _{IN} = 0V to 3.6V			±1	μA	
I _{OZ} ⁽³⁾		V _{DD} = 3.6V, 2.7V, V _{IN} = V _{DD} or GND, V _O = 0V to 3.6V, V _I = 0V, Switch OFF			±1		
I _(OFF)		V _{DD} = 0V	V _{I/O} = 0V to 3.6V		±2		
			V _{I/O} = 0 to 2.7V		±1		
I _{CC}		V _{DD} = 3.6V, 2.7V, V _{IN} = V _{DD} or GND, I _{I/O} = 0 V, Switch ON or OFF			25		50
I _{CC} (low power mode)		V _{DD} = 3.6V, 2.7V, V _{IN} = V _{DD} or GND, Switch disabled, (\overline{OE} in high state)					4
DI _{CC} ⁽⁴⁾	Control Inputs		V _{DD} = 2.7V, S sweeps from 1.4V to 3.3V, OE/ = 0V			15	
			V _{DD} = 2.7V, OE/ sweeps from 1.4V to 3.3V, S = 0V			0.75	
C _{IN}	Control Inputs	V _{DD} = 3.3V, 2.5V, V _{IN} = 3.3V or 0V			1	2	pF
C _{io(OFF)}		V _{DD} = 3.3V, 2.5V, V _{IN} = 3.3V or 0V, Switch OFF			2	3	
C _{io(ON)}		V _{DD} = 3.3V, 2.5V, V _{IN} = 3.3V or 0V, Switch ON			4	6	
r _{ON} ⁽⁵⁾		V _{DD} = 3V, 2.3V	V _I = 0V, I _O = 30 mA			4	Ω
			V _I = 2.4V, I _O = −15 mA			6	
Dr _{ON} ⁽⁶⁾		V _{DD} = 3V, 2.3V	V _I = 0V, I _O = 30 mA		0.2		
			V _I = 1.7V, I _O = −15 mA		0.2		
r _{ON(flat)}		V _{DD} = 3V, 2.3V	V _I = 0V, I _O = 30 mA		1		
			V _I = 1.7V, I _O = −15 mA		1		
V _{pass}		V _{DD} = 2.5 - 3.3V	V _{IN} > 3.8V, I _O = 10uA	2.8	3.8	4.2	V

Notes:

- V_{IN} and I_{IN} refer to control inputs. V_I , V_O , I_I , and I_O refer to data pins.
- All typical values are at $V_{DD} = 3.3\text{ V}$ (unless otherwise noted), $T_A = 25^\circ C$.
- For I/O ports, the parameter I_{OZ} includes the input leakage current.
- This is the increase in supply current for each input that is at the specified TTL voltage level, rather than V_{DD} or GND.
- Measured by the voltage drop between the input and output terminals at the indicated current through the switch. ON-state resistance is determined by the lower of the voltages of the two terminals.
- Dr_{ON} is delta R_{ON} between channels

Dynamic Electrical Characteristics

Over operating range, $T_A = -40^\circ C\text{ to }85^\circ C$, $V_{DD} = 3.3\text{ V} \pm 10\%$, $GND = 0V$

Symbol	Parameter	Test Conditions	Typ. ⁽¹⁾	Unit
X_{TALK}	Crosstalk	$R_L = 50\Omega, f = 250\text{ MHz}$	-40	dB
O_{IRR}	OFF isolation	$R_L = 50\Omega, f = 250\text{ MHz}$	-41	
BW	Bandwidth (-3 dB)	$R_L = 50\Omega$	1.6	GHz

Note:

- For Max or Min conditions, use the appropriate value specified under Electrical Characteristics for the applicable device type.

Switching Characteristics

Over operating range, $T_A = -40^{\circ}\text{C}$ to 85°C , $V_{DD} = 3.3\text{ V} \pm 10\%$, $\text{GND} = 0\text{V}$

Symbol	Parameter	Min.	Typ. ⁽¹⁾	Max.	Unit
t_{pd}	Propagation Delay ^(2,3)		0.25		ns
t_{ON}	Line enable time	S to D, nD		125	
		$\overline{\text{OE}}$ to D, nD		100	
t_{OFF}	Line disable time	S to D, nD		12	
		$\overline{\text{OE}}$ to D, nD		12	
$t_{SK(O)}$	Output skew between center port to any other port ⁽²⁾		0.1	0.2	
$t_{SK(P)}$	Skew between opposite transitions of the same output ($t_{PHL} - t_{PLH}$) ⁽²⁾		0.1	0.2	
t_{VPASS}	OVP response time		53		ns

Notes:

- For Max or Min conditions, use the appropriate value specified under Electrical Characteristics for the applicable device type.
- Specified by design
- The switch contributes no propagational delay other than the RC delay of the on resistance of the switch and the load capacitance. The time constant for the switch alone is of the order of 0.25 ns for 10-pF load. Since this time constant is much smaller than the rise/fall times of typical driving signals, it adds very little propagational delay to the system. Propagational delay of the bus switch, when used in a system, is determined by the driving circuit on the driving side of the switch and its interactions with the load on the driven side.

Application Information

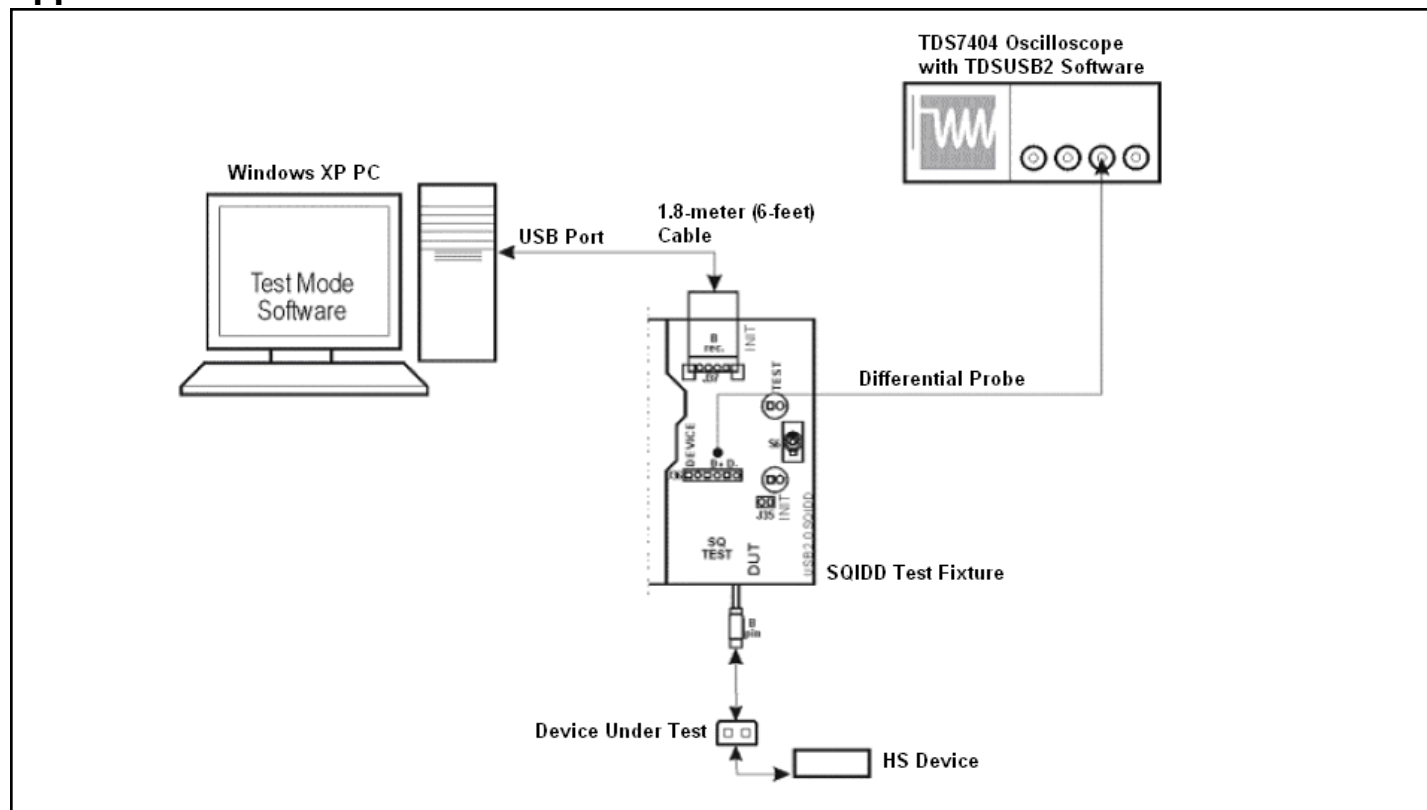
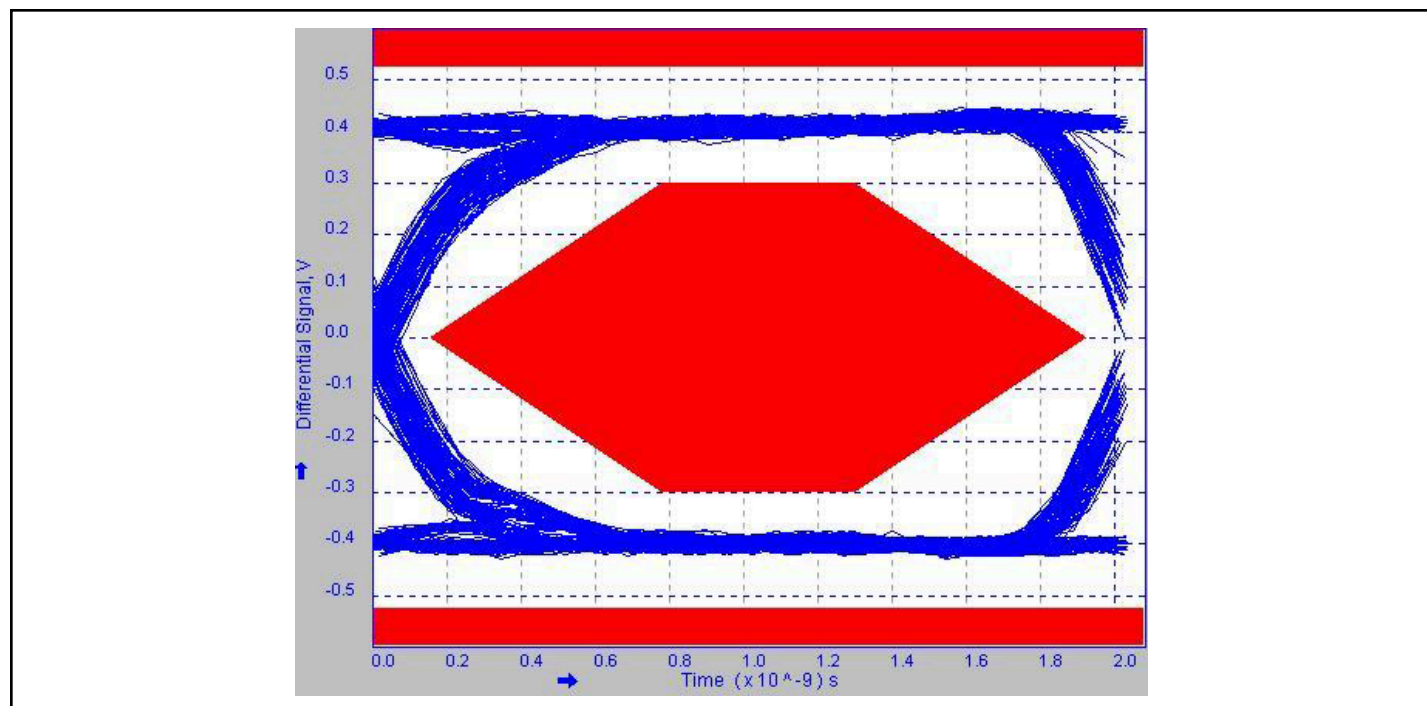


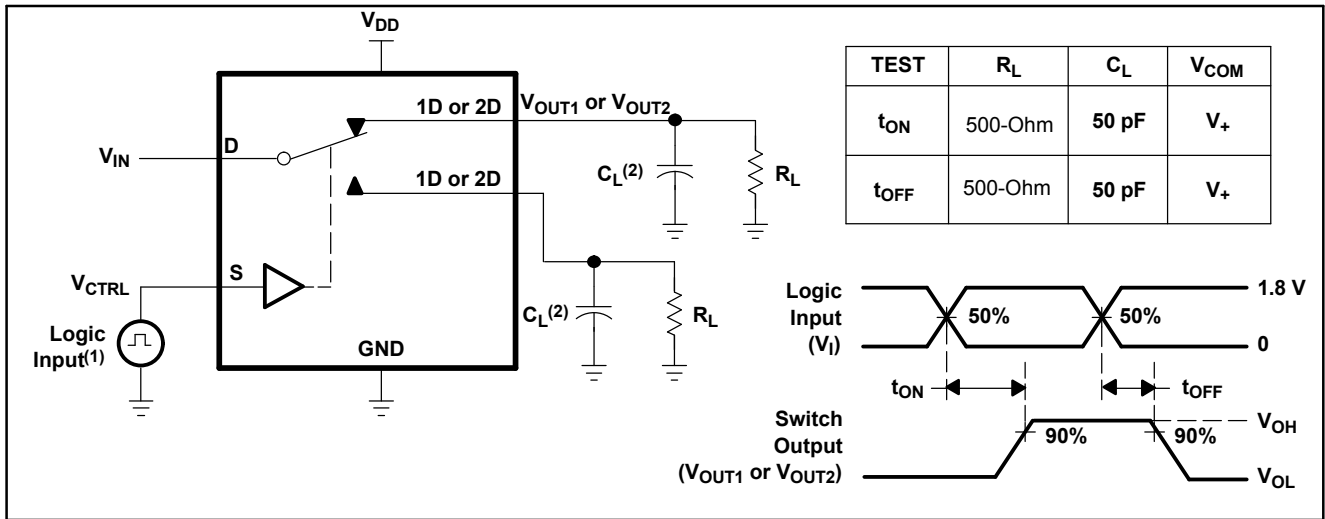
Figure 1: HS Eye Test Setup

Test Result



Test Result: High-speed, Up-stream, Near-end Eye of PI3USB221E

Parameter Measurement Information



- (1) All input pulses are supplied by generators having the following characteristics: PRR \leq 10 MHz, $Z_O = 50\text{-}\Omega$, $t_r < 5\text{ ns}$, $t_f < 5\text{ ns}$.
 (2) C_L includes probe and jig capacitance.

Figure 2. Turn-On (t_{ON}) and Turn-Off Time (t_{OFF})

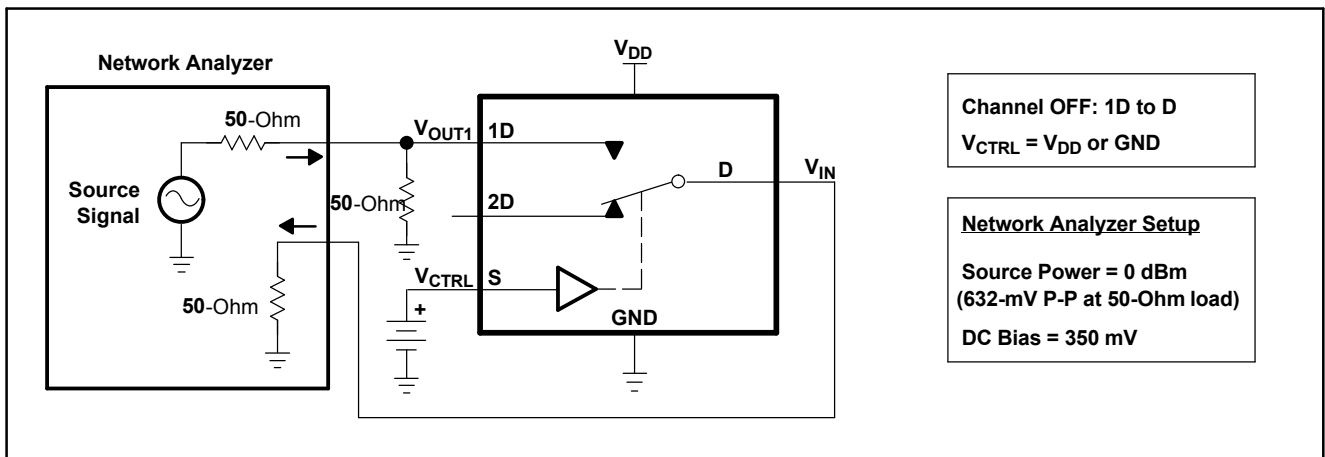


Figure 3. OFF Isolation (O_{ISO})

PI3USB221E

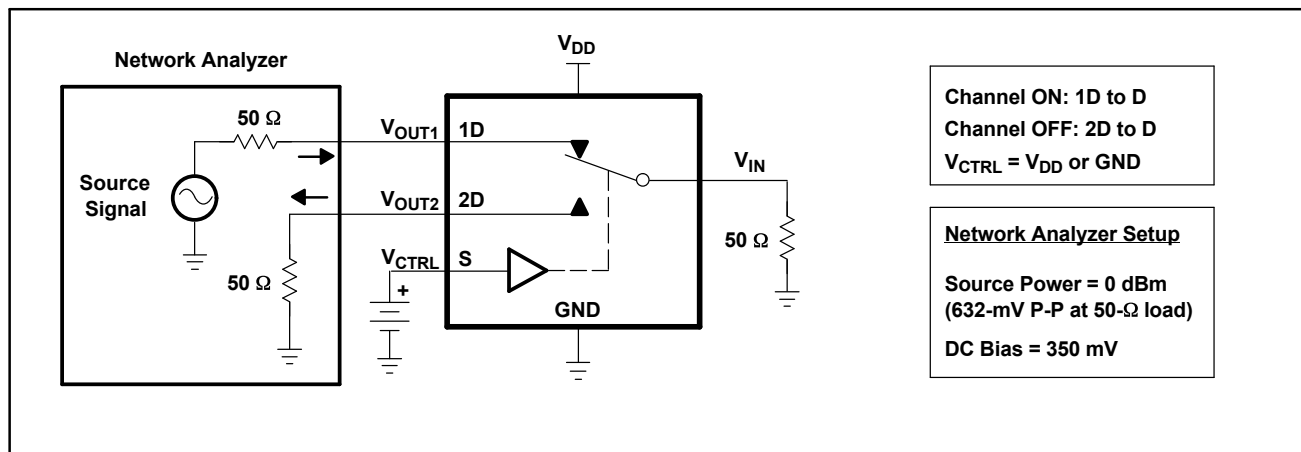


Figure 4. Crosstalk (X_{TALK})

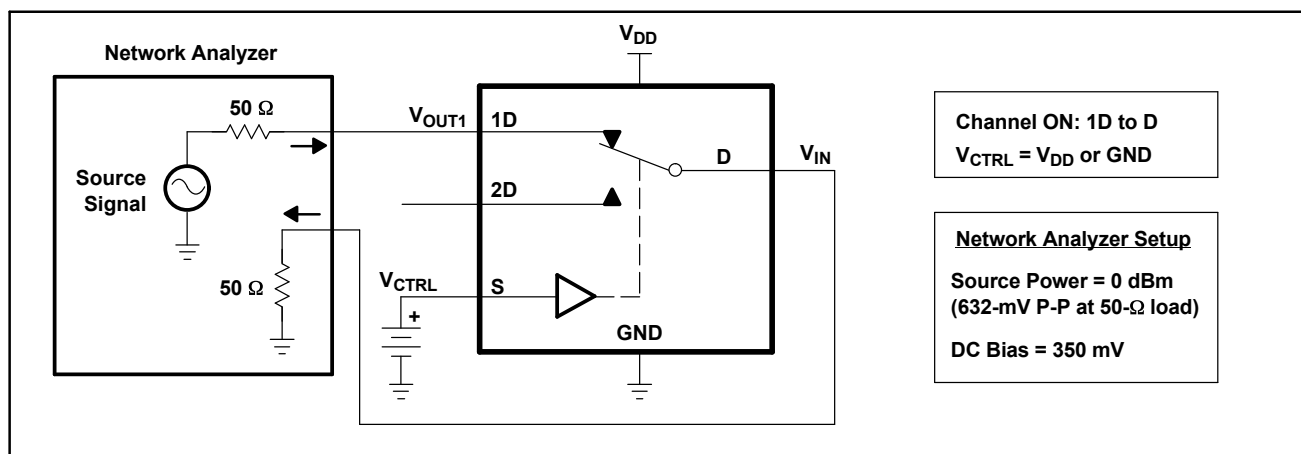


Figure 5. Bandwidth (BW)

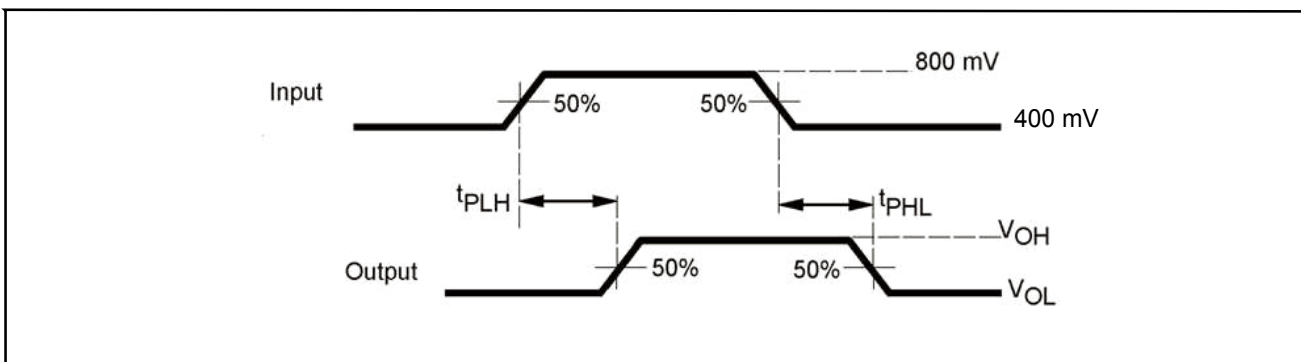


Figure 6. Propagation Delay

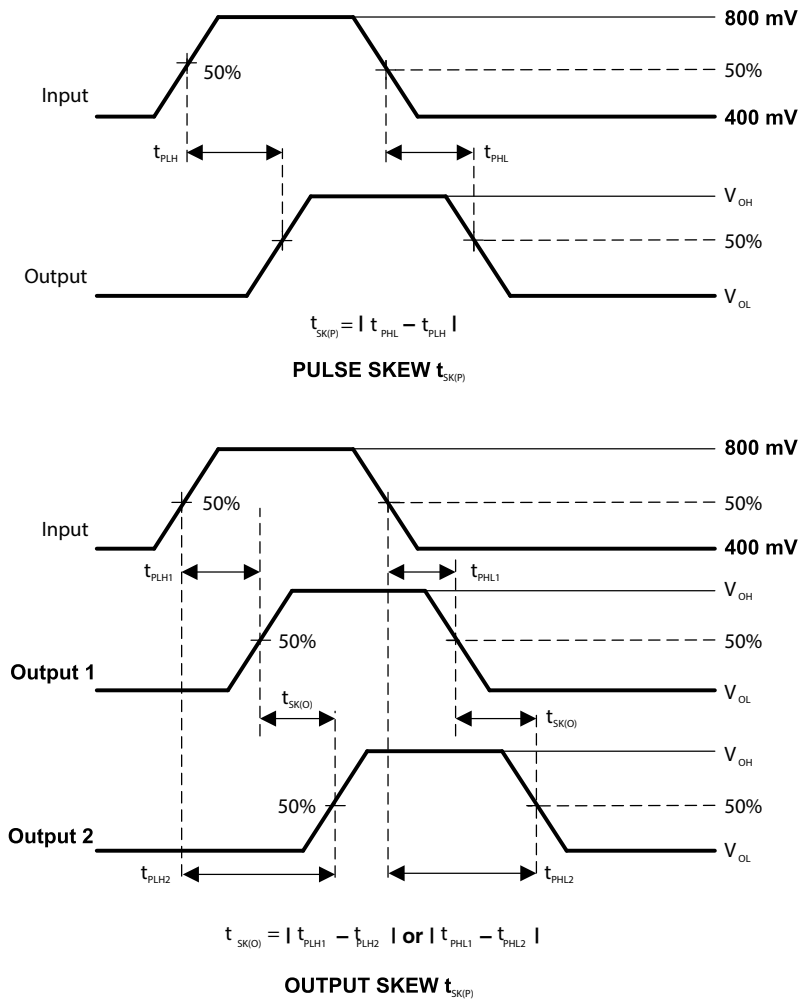


Figure 7. Skew Test

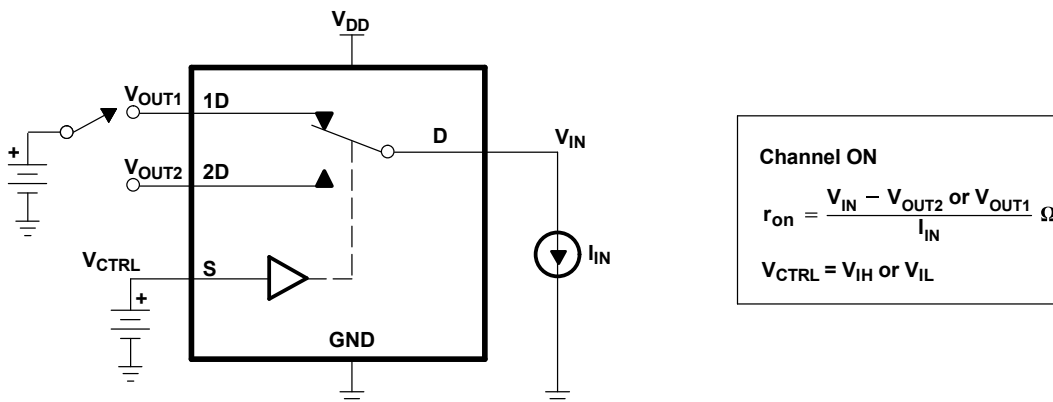


Figure 8. ON-State Resistance (r_{on})

PI3USB221E

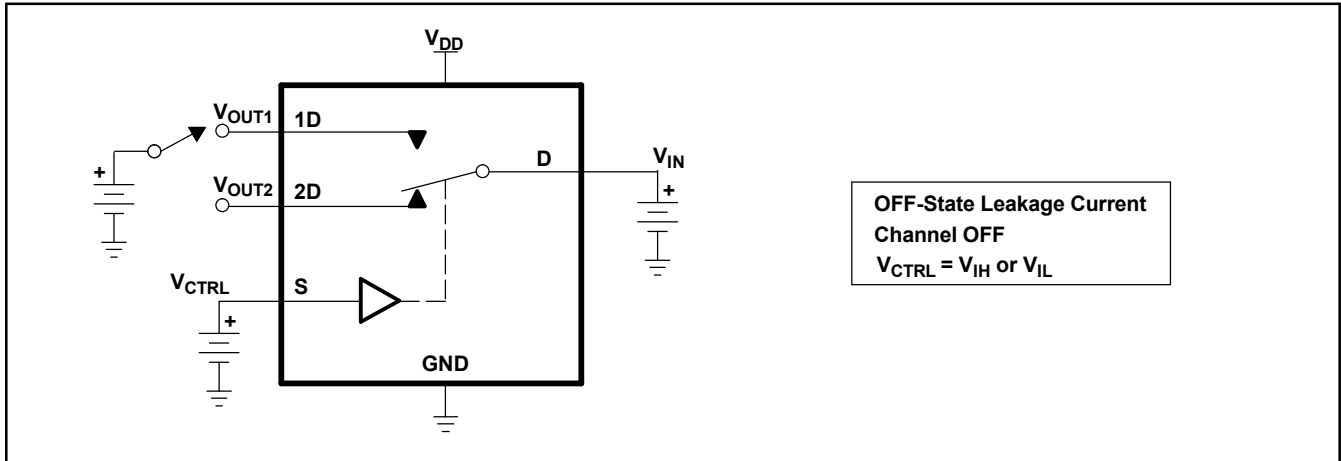


Figure 9. OFF-State Leakage Current

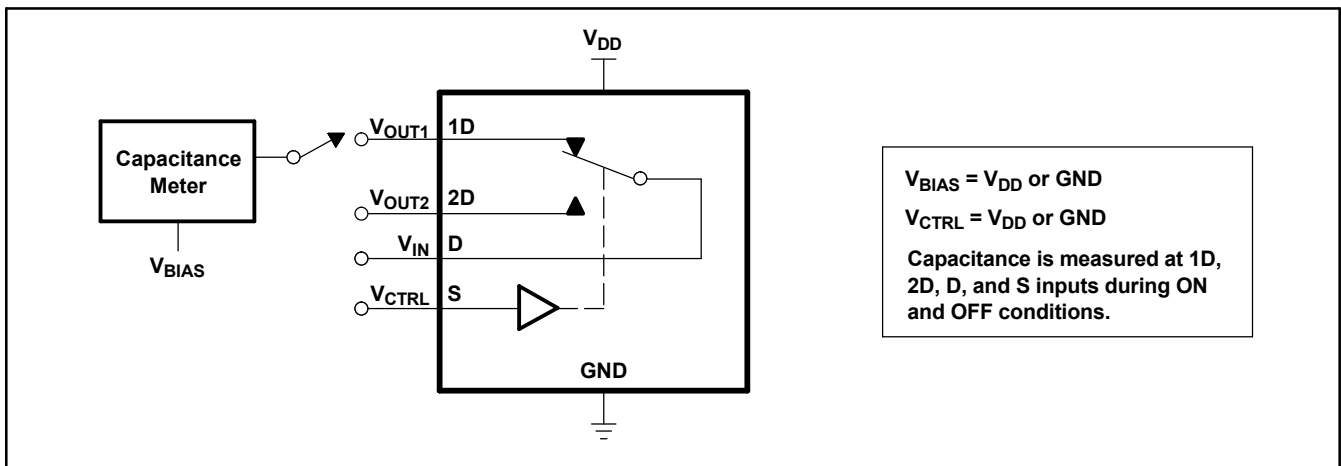
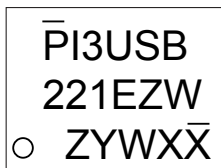


Figure 10. Capacitance

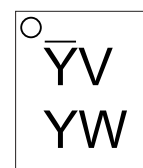
Part Marking

ZW Package



Z : Die Rev
Y : Year
W : Workweek
1st X: Assembly Code
2nd X: Fab Code

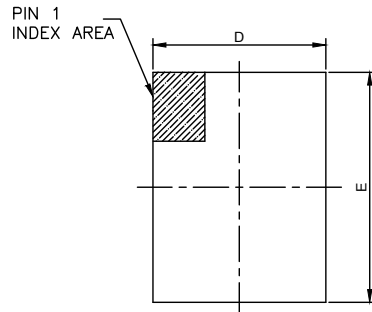
ZUA Package



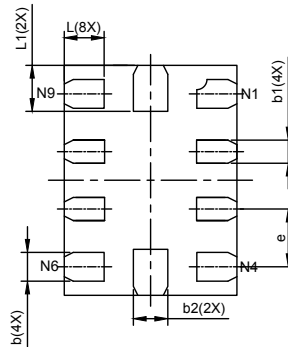
Y : Shorten Year Code
W : Shorten Workweek Code

PI3USB221E

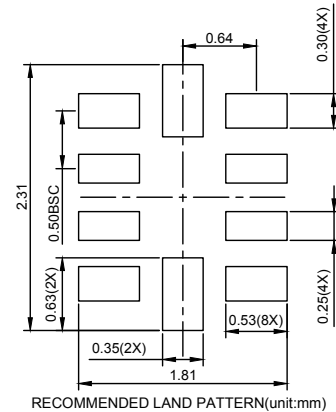
Packaging Mechanical: 10-UQFN (ZUA)



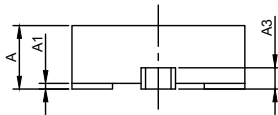
TOP VIEW



BOTTOM VIEW



RECOMMENDED LAND PATTERN(unit:mm)



SIDE VIEW

PKG. DIMENSIONS(MM)			
SYMBOL	Min	NOM	Max
A	0.50	0.60	0.65
A1	0.00	0.02	0.05
A3	0.15 REF		
D	1.45	1.50	1.55
E	1.95	2.00	2.05
b	0.20	0.25	0.30
b1	0.15	0.20	0.25
b2	0.25	0.30	0.35
e	0.50 BSC		
L	0.25	0.35	0.45
L1	0.30	0.40	0.50

Notes:

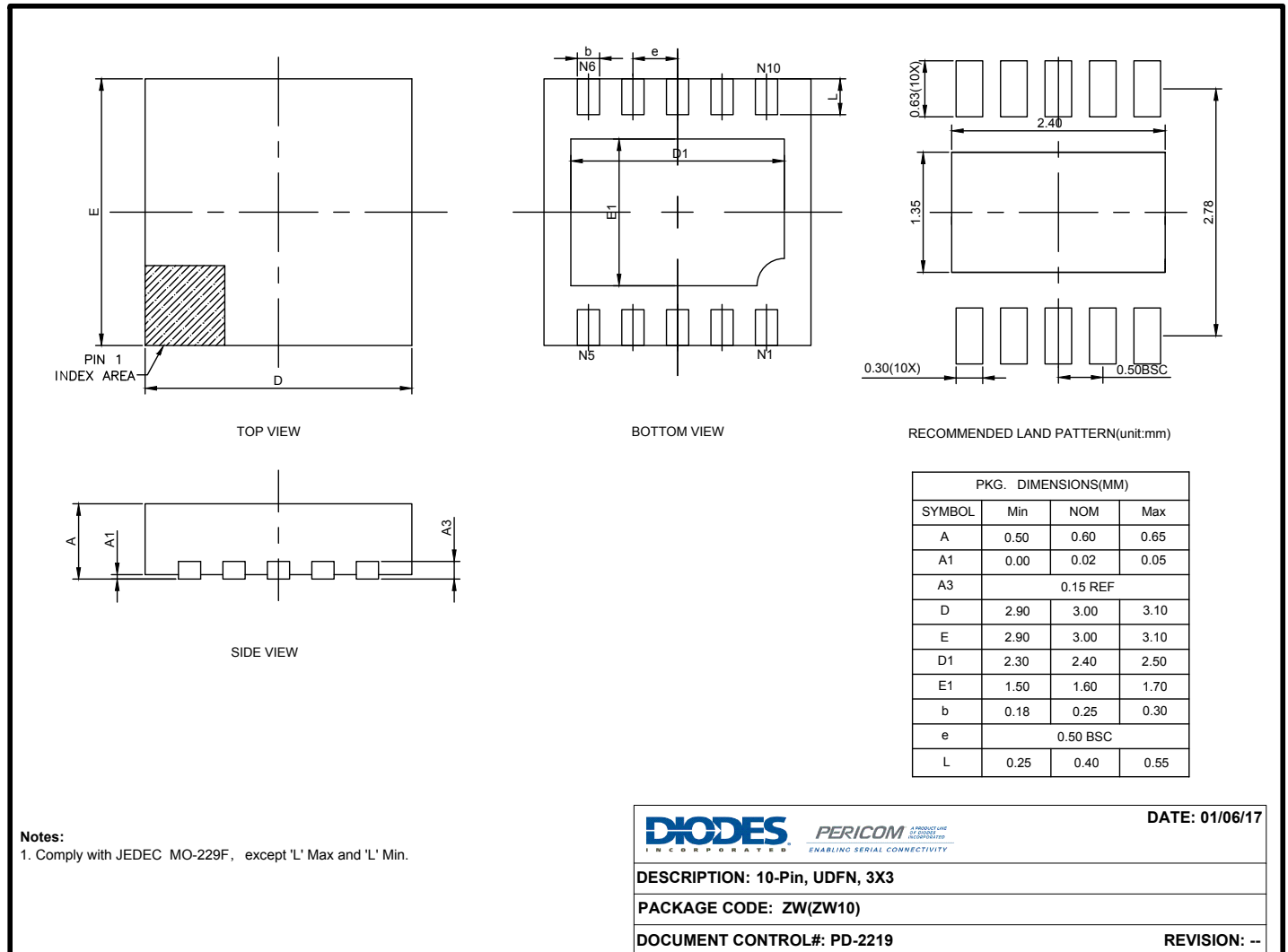
1. Ref: JEDEC MO-288B.

DESCRIPTION: 10-Pin, UQFN, 1.5X2.0

PACKAGE CODE: ZUA(ZUA10)

DOCUMENT CONTROL#: PD-2220

REVISION: --

PI3USB221E
Packaging Mechanical: 10-UDFN (ZW)


17-0001

For latest package info.

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

Ordering Number	Package Code	Package Description	Pin 1 Orientation
PI3USB221EZUAEX	ZUA	10-Pin, 1.5x2.0 (UQFN)	Top Left Corner
PI3USB221EZWEX	ZW	10-Pin, 3x3 (UDFN)	Top Left Corner
PI3USB221EZWEX-13R	ZW	10-Pin, 3x3 (UDFN)	Top Right 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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