A product Line of
Diodes Incorporated

PI3WVR628

2:1 MIPI 2-Data Lane Switch

Features

- 3-lane, 2:1 switches that support D-PHY and C-PHY
- Data rate support: up to 3.5Gsps C-PHY, up to 4.5Gb/s D-PHY.
- Bandwidth: 6.0 GHz Typical
- Low Crosstalk: -30 dB@2.25 GHz
- Input Signals 0 to 1.3V
- R_{ON}: 5.0Ω Typical LP & HS MIPI
- ΔR_{ON}: 0.1Ω Typical LP & HS MIPI
- R_{ON_FLAT}: 0.3Ω Typical LP & HS MIPI
- I_{CCZ}: 1μA Maximum
- I_{CC}: 15μA Typical
- Skew of Opposite Transitions of the Same Output: 2ps Typical
- V_{DD} Operating Range: 1.5V to 3.6V
- ESD Tolerance: 2kV HBM
- 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):
  - 24-Pin, X1-LGA2417-24 (1.7mm x 2.4mm) (XB)

Description

Diodes' PI3WVR628 is a two-data-lane MIPI switch. This 6 channel single-pole, double-throw (SPDT) switch is optimized for switching between two high-speed (HS) or low-power (LP) MIPI signal. The PI3WVR628 is designed for the MIPI specification and allows connection to CSI/DSI, C-PHY/D-PHY module.

Applications

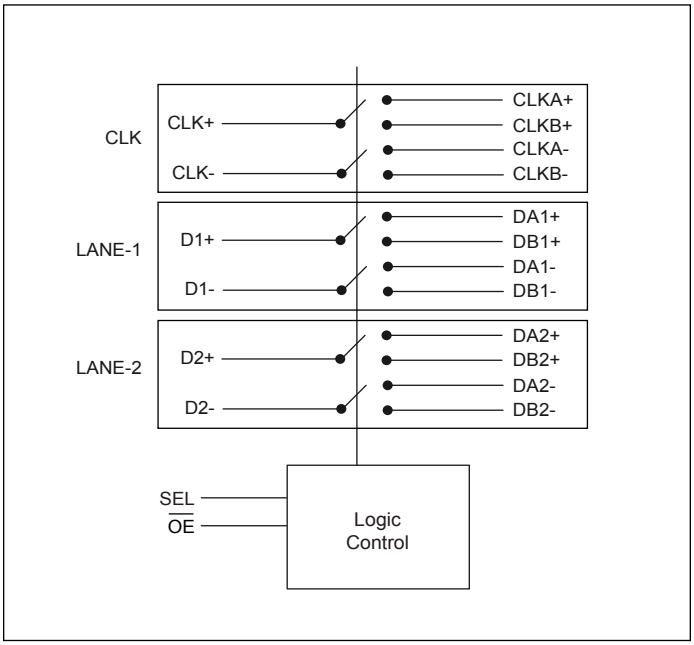
- Cellular Phones, Smart Phone
- Tablets
- Laptops
- Displays

Notes:

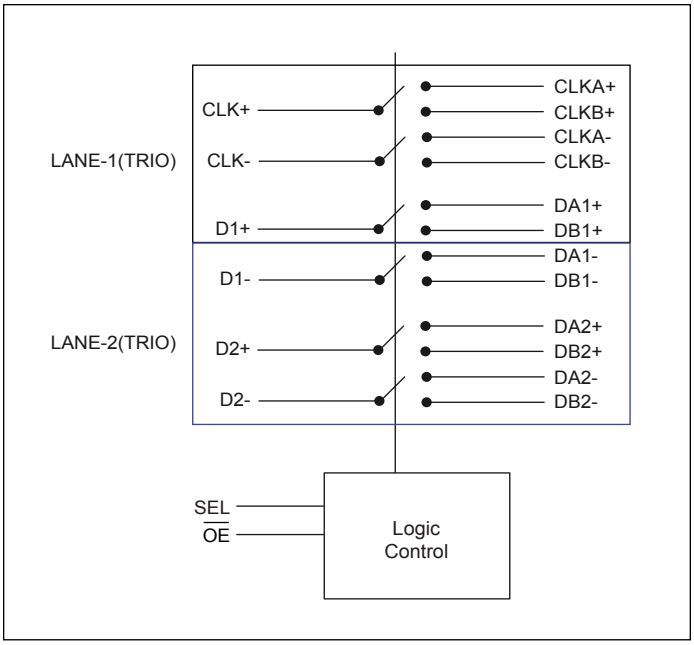
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
2. See https://www.diodes.com/quality/lead-free/ for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
3. Halogen- and Antimony-free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

Block Diagram

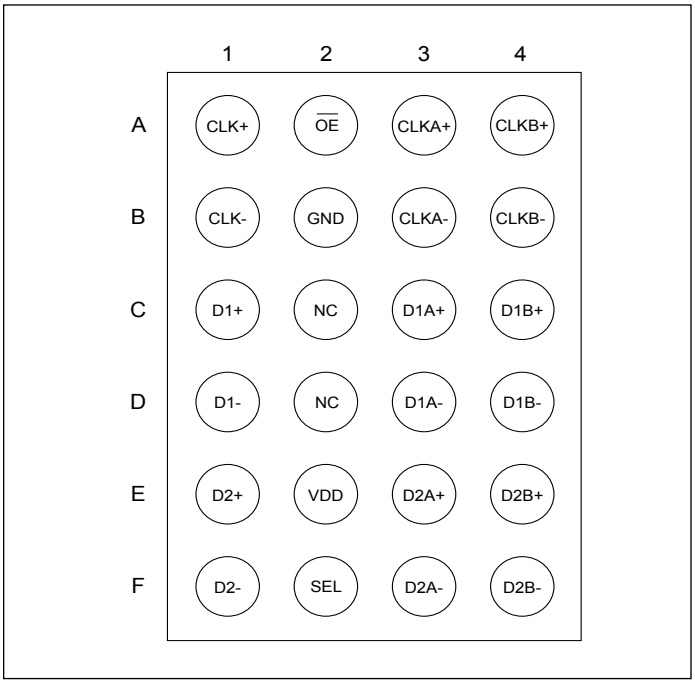
PI3WVR628 D-PHY Application



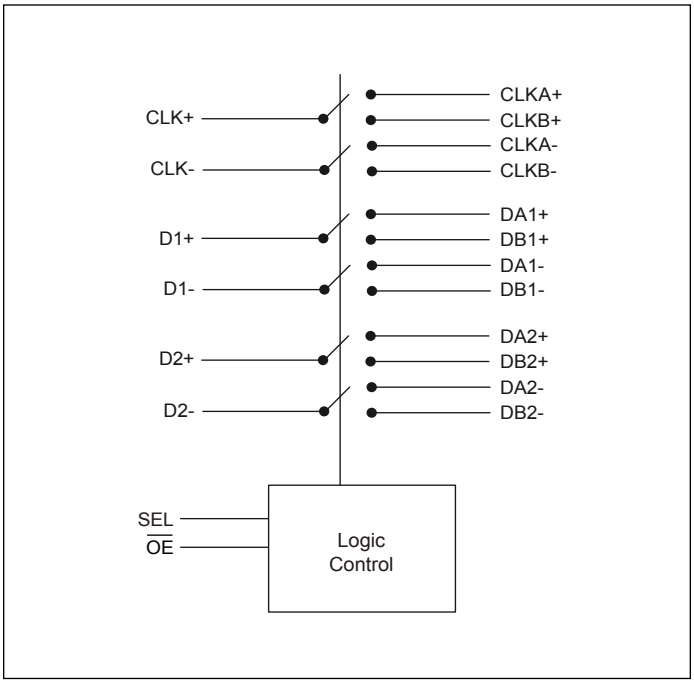
PI3WVR628 C-PHY Application



Pin Configuration(Top View)



Block Diagram



Truth Table

SEL	$\overline{OE}$	Function
LOW	LOW	CLK+ = CLKA+, CLK- = CLKA-, Dn(+/-) = DAn(+/-)
HIGH	LOW	CLK+ = CLKB+, CLK- = CLKB-, Dn(+/-) = DBn(+/-)
X	HIGH	Clock and Data Ports High Impedance

Pin Description

Pin#	Pin Name	Signal Type	Description
E2	V_{DD}	Power	1.5V to 3.3V power supply
B2	GND	Ground	Ground
A2	$\overline{OE}$	I	Output enable. if OE is low, IC is enabled. if OE is high, IC is power down and all I/Os are Hi-Z
F2	SEL	I	Switch logic control
C2, D2	NC	-	Not Connect
F4	D2B-	I/O	Negative differential signal 2 for port B
E4	D2B+	I/O	Positive differential signal 2 for port B
F3	D2A-	I/O	Negative differential signal 2 for port A
E3	D2A+	I/O	Positive differential signal 2 for port A
F1	D2-	I/O	Negative differential signal 2 for COM port
E1	D2+	I/O	Positive differential signal 2 for COM port
D4	D1B-	I/O	Negative differential signal 1 for port B
C4	D1B+	I/O	Positive differential signal 1 for port B
D3	D1A-	I/O	Negative differential signal 1 for port A
C3	D1A+	I/O	Positive differential signal 1 for port A
D1	D1-	I/O	Negative differential signal 1 for COM port
C1	D1+	I/O	Positive differential signal 1 for COM port
B4	CLKB-	I/O	Clock negative differential signal for port B
A4	CLKB+	I/O	Clock positive differential signal for port B
B3	CLKA-	I/O	Clock negative differential signal for port A
A3	CLKA+	I/O	Clock positive differential signal for port A
B1	CLK-	I/O	Clock negative differential signal for COM port
A1	CLK+	I/O	Clock positive differential signal for COM port

Absolute Maximum Ratings

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

V_{CC}, Supply Voltage, ... -0.5V to 4.6V
V_{CNTRL}, DC Input Voltage ($\overline{OE}$, SEL)(1) ..... -0.5V to V_{CC}
V_{SW}, DC Switch I/O Voltage(1,2) ..... -0.3V to 2.5V
I_{IK}, DC Input Diodes Current ..... -50mA
I_{OUT}, DC Output Current 25mA
T_{STG}, Storage Temperature ..... -65°C to +150°C
Tj, Junction Temperature ..... 125°C
ESD:
Human Body Model, JEDEC: JESD22-A114, All Pins 2.0kV
Charged Device Model, JEDEC: JESD22-C101 ..... 1.0kV

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.

Note:

1. The input and output negative ratings may be exceeded if the input and output diode current ratings are observed.
2. V_{SW} refers to analog data switch paths.

Recommended Operating Conditions

The Recommended operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications.

Symbol	Description	Test Conditions	Min.	Max.	Units
V_{CC}	Supply Voltage		1.5	3.6	V
V_{CNTRL}	Control Input Voltage (SEL, $\overline{OE}$)(1)		0	V_{CC}	V
V_{SW}	Switch I/O Voltage (CLK-, D-, CLKA-, CLKB-, DA-, DB-)	HS Mode	0	0.5	V
		LP Mode	0	1.3	V
T_A	Operating Temperature		-40	+85	°C

Note:

1. The control inputs must be held HIGH or LOW; they must not float.

DC and Transient Characteristics

All typical values are at T_A = 25°C unless otherwise specified.

Symbol	Description	Test Conditions	V_{CC} (V)	T_A = -40°C to +85°C			Units
				Min.	Typ.	Max.	
V_{IK}	Clamp Diode Voltage ($\overline{OE}$, SEL)	I_{IN} = -18mA	1.5	-1.2		-0.6	V
V_{IH}	Input Voltage High	SEL, $\overline{OE}$	1.5 to 3.3	1.0			V
V_{IL}	Input Voltage Low	SEL, $\overline{OE}$	1.5 to 3.3			0.5	V
I_{IN}	Control Input Leakage ($\overline{OE}$, SEL)	V_{CNTRL} = 0 to V_{CC}	3.3	-0.5		0.5	µA
$I_{NO(OFF)}$ $I_{NC(OFF)}$	Off Leakage Current of Port CLKA-, DA-, CLKB- and DB-	V_{SW} = 0.0 ≤ DATA ≤ 1.3V	3.3	-0.5		0.5	µA
$I_{A(ON)}$	On Leakage Current of Common Ports (CLK-, D-)	V_{SW} = 0.0 ≤ DATA ≤ 1.3V	3.3	-0.5		0.5	µA

DC and Transient Characteristics Cont.

Symbol	Description	Test Conditions	V_{CC} (V)	T_A = -40°C to +85°C			Units
				Min.	Typ.	Max.	
I_{OFF}	Power-Off Leakage Current (All I/O Ports)	V_{SW} = 0.0 or 1.3V	0	-0.5		0.5	µA
I_{OZ}	Off-State Leakage	V_{SW} = 0.0 ≤ DATA ≤ 1.3V, $\overline{OE}$ = High	3.3	-0.5		0.5	µA
$R_{ON\_MIPI\_HS}$	Switch On Resistance for HS MIPI	I_{ON} = -8mA, $\overline{OE}$ = 0V, SEL = V_{CC} or 0V, CLKA, CLKB, DB- or DA- = 0.2V	1.5		5		Ω
			2.5				
			3.3				
$R_{ON\_MIPI\_LP}$	Switch On Resistance for LP MIPI	I_{ON} = -8mA, $\overline{OE}$ = 0V, SEL = V_{CC} or 0V, CLKA, CLKB, DB- or DA- = 1.2V	1.5		5		Ω
			2.5				
			3.3				
$\Delta R_{ON\_MIPI\_HS}$	On Resistance Matching Between HS MIPI Channels(1)	I_{ON} = -8mA, $\overline{OE}$ = 0V, SEL = V_{CC} or 0V, CLKA, CLKB, DB- or DA- = 0.2V	1.5		0.1		Ω
			2.5				
			3.3				
$\Delta R_{ON\_MIPI\_LP}$	On Resistance Matching Between LP MIPI Channels(1)	I_{ON} = -8mA, $\overline{OE}$ = 0V, SEL = V_{CC} or 0V, CLKA, CLKB, DB- or DA- = 1.2V	1.5		0.1		Ω
			2.5				
			3.3				
$R_{ON\_FLAT\_MIPI\_HS}$	On Resistance Flatness for HS MIPI	I_{ON} = -8mA, $\overline{OE}$ = 0V, SEL = V_{CC} or 0V, CLKA, CLKB, DB- or DA- = 0 to 0.5V	1.5		0.3		Ω
			2.5				
			3.3				
$R_{ON\_FLAT\_MIPI\_LP}$	On Resistance Flatness for LP MIPI	I_{ON} = -8mA, $\overline{OE}$ = 0V, SEL = V_{CC} or 0V, CLKA, CLKB, DB- or DA- = 0 to 1.3V	1.5		0.3		Ω
			2.5				
			3.3				
I_{CC}	Quiescent Supply Current	V_{SEL} = 0 or V_{CC}, I_{OUT} = 0, $\overline{OE}$ = 0V	3.6		11	20	µA
I_{CCZ}	Quiescent Supply Current (High Impedance)	V_{SEL} = 0 or V_{CC}, I_{OUT} = 0, $\overline{OE}$ = 0V	3.6			1	µA
I_{CCT}	Increase in I_{CC} Current Per Control Voltage and V_{CC}	V_{SEL} = 0 or V_{CC}, $\overline{OE}$ = 1.5V	3.6		1		µA

AC Electrical Characteristics

All typical values are for V_{CC} = 3.3V and T_A = 25°C unless otherwise specified.

Symbol	Description	Test Conditions	V_{CC} (V)	T_A = -40°C to +85°C			Units
				Min.	Typ.	Max.	
t_{INIT}	Initialization Time V_{CC} to Output[1]	R_L = 50Ω, C_L = 0pF, V_{SW} = 0.6V	1.5 to 3.6		60		µs
t_{EN}	Enable Time $\overline{OE}$ to Output	R_L = 50Ω, C_L = 0pF, V_{SW} = 0.6V	1.5 to 3.6		60	150	µs
t_{DIS}	Disable Time $\overline{OE}$ to Output	R_L = 50Ω, C_L = 0pF, V_{SW} = 0.6V	1.5 to 3.6		35	250	ns
t_{ON}	Turn-On Time SEL to Output	R_L = 50Ω, C_L = 0pF, V_{SW} = 0.6V	1.5 to 3.6		350	1100	ns
t_{OFF}	Turn-Off Time SEL to Output	R_L = 50Ω, C_L = 0pF, V_{SW} = 0.6V	1.5 to 3.6		125	800	ns
t_{BBM}	Break-Before-Make Time	R_L = 50Ω, C_L = 0pF, V_{SW} = 0.6V	1.5 to 3.6			450	ns
t_{PD}	Propagation Delay[1]	C_L = 0pF, R_L = 50Ω	1.5 to 3.6			0.25	ns
O_{IRR}	Differential Off Isolation for MIPI[1]	R_L = 50Ω, f = 1250MHz, $\overline{OE}$ = HIGH, V_{SW} = 0.5V	1.5 to 3.6		-26		dB
X_{TALK}	Differential Crosstalk for MIPI[1]	R_L = 50Ω, f = 1250MHz, SEL = HIGH, V_{SW} = 0.5V	1.5 to 3.6			-35	dB
		R_L = 50Ω, f = 2250MHz, SEL = LOW, V_{SW} = 0.5V				-30	
I_{LOSS}	Differential Insertion Loss[1]	R_L = 50Ω, C_L = 0pF, f = 2250MHz, V_{SW} = 0.5V	1.5 to 3.6		-1.1		dB
		R_L = 50Ω, C_L = 0pF, f = 1250MHz, V_{SW} = 0.5V	1.5 to 3.6		-0.8		
BW	Differential -3db Bandwidth[1]	R_L = 50Ω, C_L = 0pF, V_{SW} = 0.5V	1.5 to 3.6	5	6		GHz

Note:

1. Guaranteed by characterization.

High-Speed-Related AC Electrical Characteristics

Symbol	Description	Test Conditions	V_{CC} (V)	T_A = -40°C to +85°C			Units
				Min.	Typ.	Max.	
$t_{SK(P)}$	D-PHY HS Mode Skew of Opposite Transitions of the Same Output(1)	R_L = 50Ω, C_L = 0pF, V_{SW} = 0.3V	1.5 to 3.6		4		ps
	C-PHY HS Mode Skew of 3 channels in same lane	R_L = 50Ω, C_L = 0pF, V_{SW} = 0.5V	1.5 to 3.6		4		
	D-PHY HS Mode Skew of all group A or group B channels(1)	R_L = 50Ω, C_L = 0pF, V_{SW} = 0.3V	1.5 to 3.6		8		

Note:
1. Guaranteed by characterization.

Capacitance

Symbol	Description	Test Conditions	T_A = -40°C to +85°C			Units
			Min.	Typ.	Max.	
C_{IN}	Control Pin Input Capacitance(1)	V_{CC} = 0V, f = 1MHz		2.1		pF
C_{ON}	On Capacitance(1)	V_{CC} = 3.3V, $\overline{OE}$ = 0V, f = 1250MHz (In HS common value)		1.3		pF
C_{OFF}	Off Capacitance(1)	V_{CC} or $\overline{OE}$ = 3.3V, f = 1250MHz (Both sides in HS common value)		0.8		pF

Note:
1. Guaranteed by characterization.

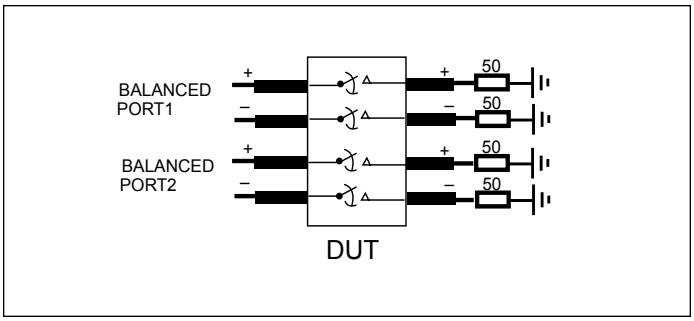


Fig 1. Crosstalk Setup

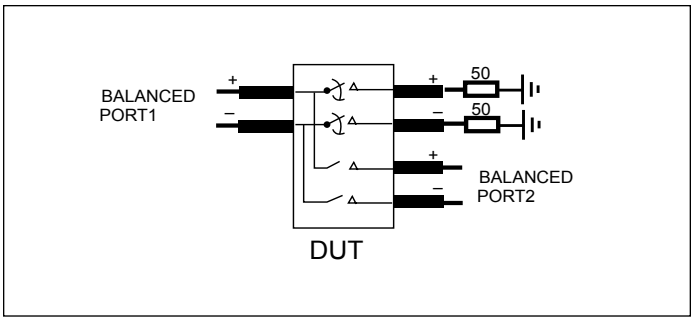


Fig 2. Off-Isolation Setup

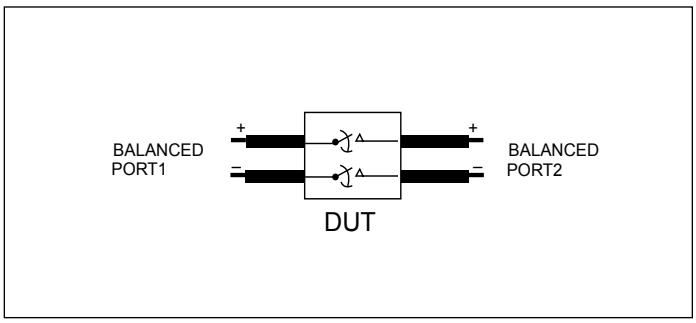
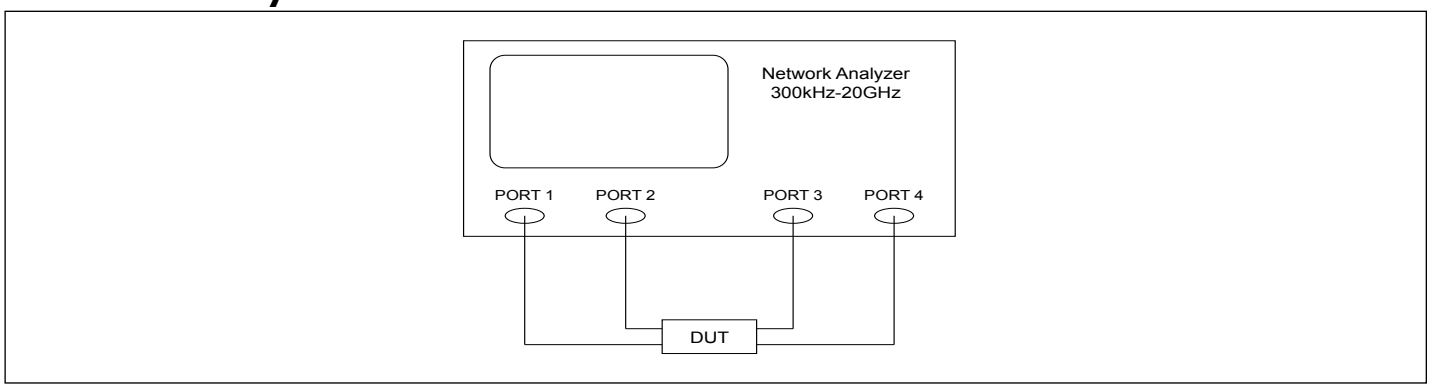
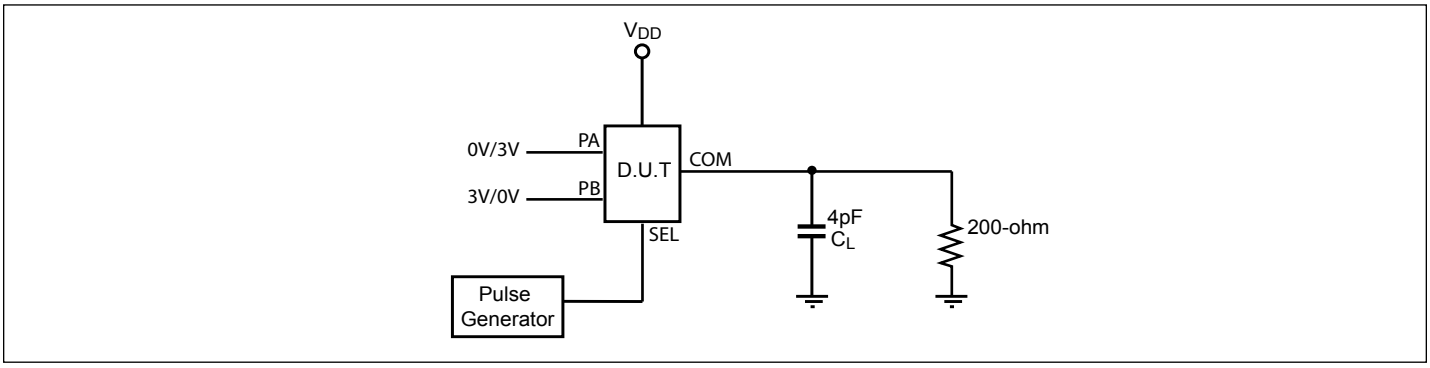


Fig 3. Differential Insertion Loss

Test Circuit for Dynamic Electrical Characteristics



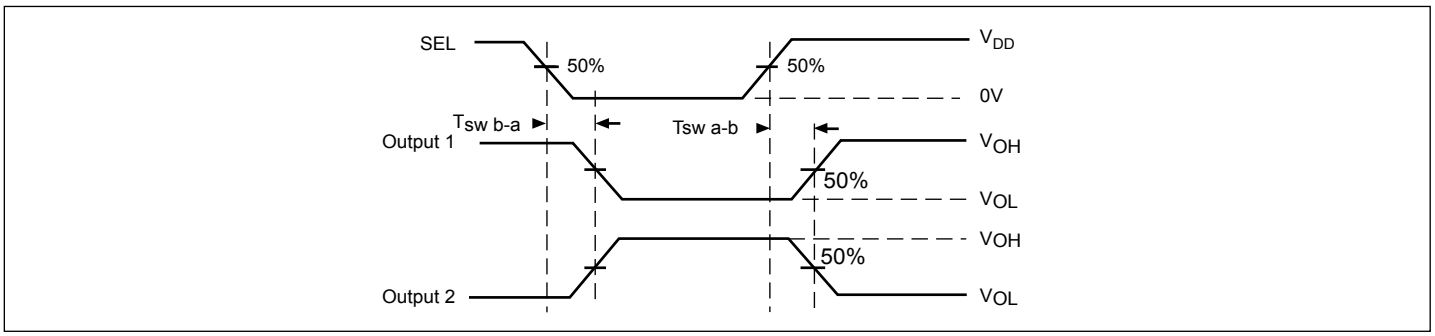
Test Circuit for Electrical Characteristics(1-4)



Notes:

1. C_L = Load capacitance: includes jig and probe capacitance.
2. R_T = Termination resistance: should be equal to Z_{OUT} of the Pulse Generator
3. All input impulses are supplied by generators having the following characteristics: PRR ≤ MHz, $Z_O = 50\Omega$, $t_R \leq 2.5$ns, $t_F \leq 2.5$ns.
4. The outputs are measured one at a time with one transition per measurement.

Switching Waveforms

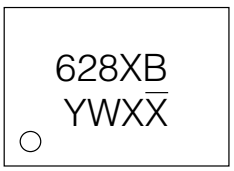


Voltage Waveforms for Select Timing

Test Condition

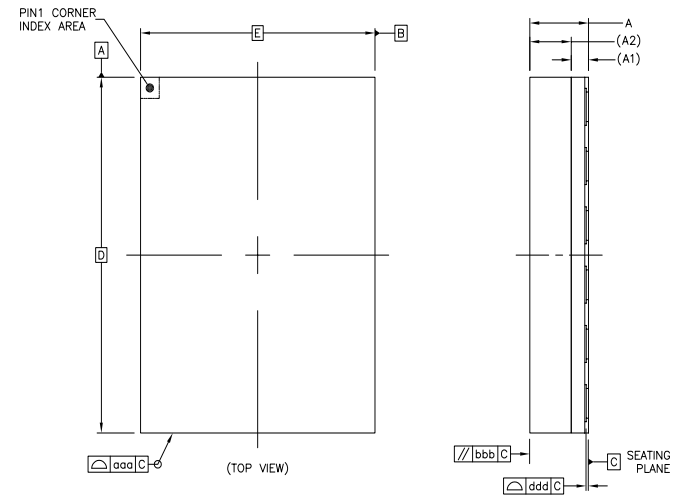
Output 1 Test Condition	Output 2 Test Condition
PA = Low	PA = High
PB = High	PB = Low

Part Marking

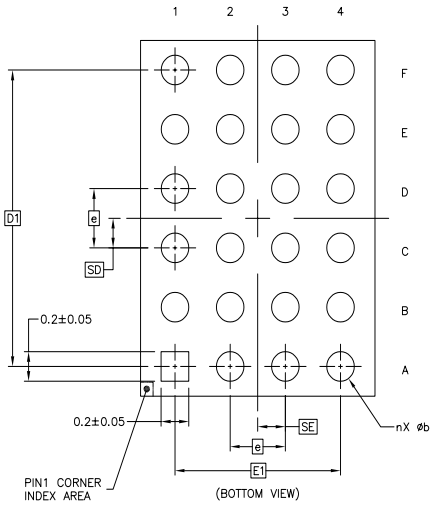


Y: Shortened Date Code (Year)
W: Shortened Date Code (Workweek)
1st X: Assembly Code
2nd X: Fab Code

Packaging Mechanical: 24-X1-LGA2417-24 (XB)



	SYMBOL	COMMON DIMENSIONS		
		MIN.	NOR.	MAX.
TOTAL THICKNESS	A	---	---	0.5
SUBSTRATE THICKNESS	A1		0.125	REF
MOLD THICKNESS	A2		0.3	REF
BODY SIZE	D		2.4	BSC
	E		1.7	BSC
LEAD OPENING	b		0.2	
LEAD PITCH	e		0.4	BSC
LEAD COUNT	n		23	
EDGE LEAD CENTER TO CENTER	D1		2	BSC
	E1		1.2	BSC
BODY CENTER TO CONTACT LEAD	SD		0.2	BSC
	SE		0.2	BSC
PRE-SOLDER		---	---	---
PACKAGE EDGE TOLERANCE	aaa		0.05	
MOLD FLATNESS	bbb		0.1	
COPLANARITY	ddd		0.08	



NOTE :
1. ALL DIMENSIONS ARE IN mm. ANGLES IN DEGREES.

DATE: 09/17/19

DESCRIPTION: 24-Contact, X1-LGA2417-24

PACKAGE CODE: XB (XB24)

DOCUMENT CONTROL #: PD-2246 REVISION: --

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
PI3WVR628XBEX	XB	24-contact, X1-LGA2417-24

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

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1. are intended to implant into the body, or

2. support or sustain life and whose failure to perform when properly used in accordance with instructions for use provided in the labeling can be reasonably expected to result in significant injury to the user.

B. A critical component is any component in a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or to affect its safety or effectiveness.

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