

Description

The PI3DBS3224S is a 2:4 bidirectional multiplexer for high-speed differential and single ended signal applications (up to 720Mbps). The PI3DBS3224S offers a high BW of 1.2GHz with channel RON of 13Ω (Typical).

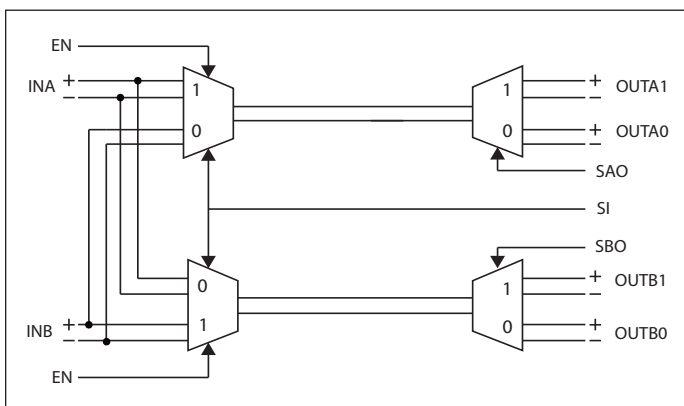
The PI3DBS3224S operates with a 3V to 3.6V power supply. It features ESD protection of up to ±8kV contact discharge and 2kV Human Body Model on its I/O pins.

The PI3DBS3224S provides fail-safe protection by isolating the I/O pins with high impedance when the power supply (V_{CC}) is not present.

Application(s)

- Desktop/Notebooks Computers
- DisplayPort Auxiliary Channel Multiplexing
- DDC
- UART
- LSRX/LSTX for USB4/TBT
- USB 2.0 Multiplexing
- Netbooks/eBooks/Tablets

Block Diagram



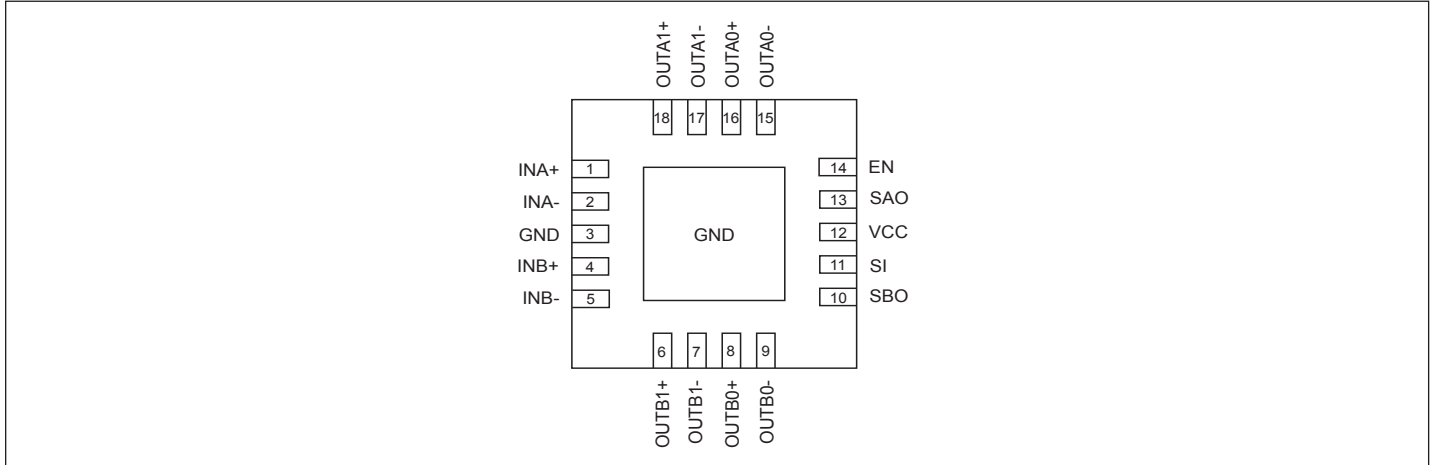
Features

- 2:4 Differential Multiplexer/Demultiplexer
- Bidirectional Operation
- High BW (1.2GHz Typical)
- Low RON and CON:
 - 13Ω RON Typical
 - 9pF CON Typical
- ESD Performance (I/O Pins)
 - ±8kV Contact Discharge (IEC61000-4-2)
 - 2kV Human Body Model per JESD22-A114E (to GND)
- ESD Performance (All Pins)
 - 2kV Human Body Model per JESD22-A114E
- Packaging (Pb-free & Green):
 - 18-Pin, 2mm x 2mm, 0.4mm pitch (X2QFN)
- 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](mailto:contact@diodes.com) or your local Diodes representative. <https://www.diodes.com/quality/product-definitions/>

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	I/O Type	Description
1	INA+	I/O	I/O Input A
2	INA-	I/O	I/O Input A
3	GND	GND	Ground
4	INB+	I/O	I/O Input B
5	INB-	I/O	I/O Input B
6	OUTB1+	I/O	Output B1
7	OUTB1-	I/O	Output B1
8	OUTB0+	I/O	Output B0
9	OUTB0-	I/O	Output B0
10	SBO	Input	Control Input
11	SI	Input	Control Input
12	VCC	Power	Power Supply
13	SAO	Input	Control Input
14	EN	Input	Control Input
15	OUTA0-	I/O	Output A0
16	OUTA0+	I/O	Output A0
17	OUTA1-	I/O	Output A1
18	OUTA1+	I/O	Output A1

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Function Table

EN	OUTA0	OUTA1	OUTB0	OUTB1
0	Hi-Z	Hi-Z	Hi-Z	Hi-Z
1	-	-	-	-

SI/SAO/SBO	OUTA0	OUTA1	OUTB0	OUTB1
000	INB	-	INA	-
001	INB	-	-	INA
010	-	INB	INA	-
011	-	INB	-	INA
100	INA	-	INB	-
101	INA	-	-	INB
110	-	INA	INB	-
111	-	INA	-	INB

Maximum Ratings

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

Storage Temperature.....	-65°C to +155°C
Supply Voltage to Ground Potential.....	-0.3V to +4.0V
DC Input Voltage	-0.3V to +4.3V
DC Output Current	120mA
Power Dissipation	0.5W

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.

DC Electrical Characteristics over Operating Range

For Single 1:4 or Dual 1:2 configurations. $T_A = -40^{\circ}\text{C}$ to 85°C , Typical values are at $V_{CC} = 3.3\text{V}$, $T_A = 25^{\circ}\text{C}$ (unless otherwise noted)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
V_{IK}	Digital input clamp voltage	$V_{CC} = 3.6\text{V}$, $I_I = -18\text{mA}$	-1.2	-0.9		V
I_{IN}	Digital input leakage current	$V_{CC} = 3.6\text{V}$, $V_{IN} = 0\text{V}$ to 3.6V			± 2	μA
$I_{OZ}^{(3)}$		$V_{CC} = 3.6\text{V}$, $V_O = 0\text{V}$ to 3.6V , $V_I = 0\text{V}$, Switch OFF			± 2	μA
I_{OFF}	Power off leakage current	$V_{CC} = 0\text{V}$, $V_{IN} = V_{CC}$ or GND, $V_{I/O} = 0\text{V}$ to 3.6V			± 8	μA
I_{CC}	Supply current	$V_{CC} = 3.6\text{V}$, $I_{I/O} = 0$, Switch ON or OFF		70	130	μA
C_{IN}	Digital input capacitance	$V_{CC} = 3.3\text{V}$, $V_{IN} = V_{CC}$ or GND		3	5	pF
$C_{I/O(OFF)}$	OFF capacitance	$V_{CC} = 3.3\text{V}$, $V_{I/O} = 3.3\text{V}$ or 0V , $f = 10\text{MHz}$, Switch OFF		6	7	pF
$C_{I/O(ON)}$	ON capacitance	$V_{CC} = 3.3\text{V}$, $V_{I/O} = 3.3\text{V}$ or 0V , $f = 10\text{MHz}$, Switch ON		9	10	pF
r_{on}	ON state resistance	$V_{CC} = 3.6\text{V}$, $V_I = V_{CC}$, $I_O = -30\text{mA}$		13	19	Ω
		$V_{CC} = 3.3\text{V}$, $V_I = 0.5\text{V}$, $I_O = -30\text{mA}$		10		Ω
Δr_{on}	ON state resistance match between channel	$V_{CC} = 3\text{V}$, $V_I = 0\text{V}$ to V_{CC} , $I_O = -30\text{mA}$		2	2.5	Ω
$r_{on(Flat)}$	ON state resistance flatness	$V_{CC} = 3\text{V}$, $V_I = 1.5\text{V}$ and V_{CC} , $I_O = -30\text{mA}$		4	6	Ω

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 $V_{CC} = 3.3\text{V}$ (unless otherwise noted), $T_A = 25^{\circ}\text{C}$.
- For I/O ports, the parameter I_{OZ} includes the input leakage current.

Dynamic Characteristics

For Single 1:4 or Dual 1:2 configurations. $T_A = -40^{\circ}\text{C}$ to 85°C , Typical values are at $V_{CC} = 3.3\text{V} \pm 10\%$ and $T_A = 25^{\circ}\text{C}$ (unless otherwise noted)

Symbol	Parameter	Test Condition	Typ.	Unit
BW	Bandwidth	$R_L = 50\Omega$, Switch ON	1.2	GHz
O_{ISO}	OFF Isolation	$R_L = 50\Omega$, $f = 250\text{MHz}$	-30	dB
X_{TALK}	Crosstalk	$R_L = 50\Omega$, $f = 250\text{MHz}$	-35	dB

Switching Characteristics

For Single 1:4 or Dual 1:2 configurations. Over operating range, $T_A = -40^{\circ}\text{C}$ to 85°C , $V_{CC} = 3.3\text{V} \pm 10\%$, $GND = 0\text{V}$ (unless otherwise noted)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
$t_{pd}^{(1)}$		$R_L = 50\Omega$, $C_L = 2\text{pF}$		50		ps
t_{ON}	SI/SAO/SBO to OUTAx/OUTBx	$R_L = 50\Omega$, $C_L = 2\text{pF}$		40	100	ns
t_{OFF}	SI/SAO/SBO to OUTAx/OUTBx	$R_L = 50\Omega$, $C_L = 2\text{pF}$		20	30	ns
$t_{sk(o)}^{(2)}$		$R_L = 50\Omega$, $C_L = 2\text{pF}$		40		ps
$t_{sk(p)}^{(3)}$		$R_L = 50\Omega$, $C_L = 2\text{pF}$		40		ps

Notes:

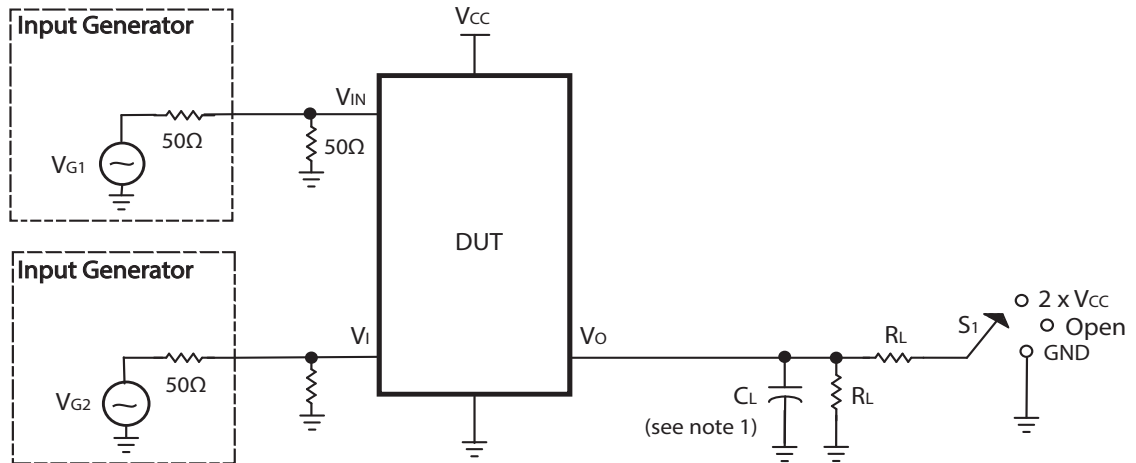
- The propagation delay is the calculated RC time constant of the typical ON-State resistance of the switch and the specified load capacitance when driven by an ideal voltage source (zero output impedance).
- Output skew between center channel and any other channel.
- Skew between opposite transitions of the same output ($|t_{PHL} - t_{PLH}|$).

DC Electrical Characteristics over Operating Range

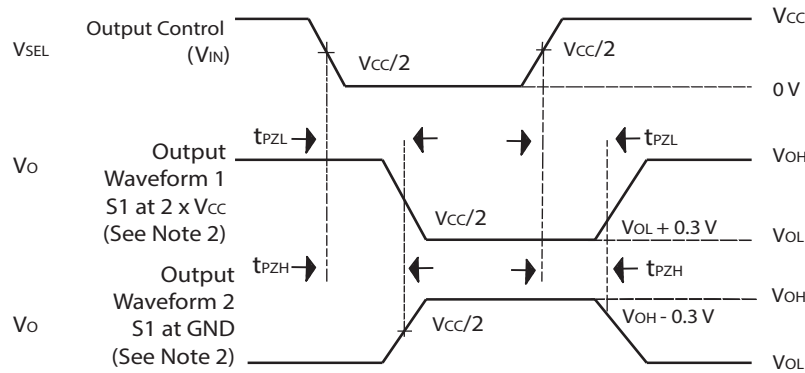
$T_A = -40^{\circ}\text{C}$ to 85°C , Typical values are at $V_{CC} = 3.3\text{V}$, $T_A = 25^{\circ}\text{C}$

Symbol	Parameter	Test Condition	Min	Typ	Max	Unit
V_{IO}	Analog I/O voltage		0		V_{CC}	V
V_{IH}	High level input control voltage	EN, SI, SAO, SBO Pins	$0.75V_{CC}$		V_{CC}	V
V_{IL}	Low level input control voltage	EN, SI, SAO, SBO Pins	0		0.6	V
V_{CC}	Supply voltage		3.0		3.6	V

Test Circuit For Electrical Characteristics



TEST	V _{CC}	S1	R _L	V _{in}	C _L	V _Δ
t _{PLZ} /t _{PZL}	3.3V ± 0.3V	2 x V _{CC}	50Ω	GND	2pF	0.3V
t _{PHZ} /t _{PZH}	3.3V ± 0.3V	GND	50Ω	V _{CC}	2pF	0.3V

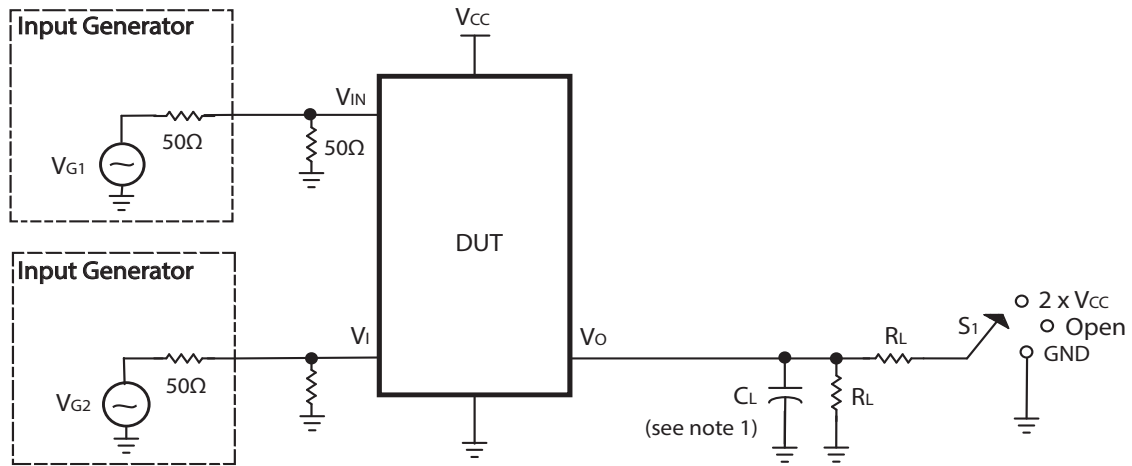


VOLTAGE WAVEFORMS
ENABLE AND DISABLE TIME

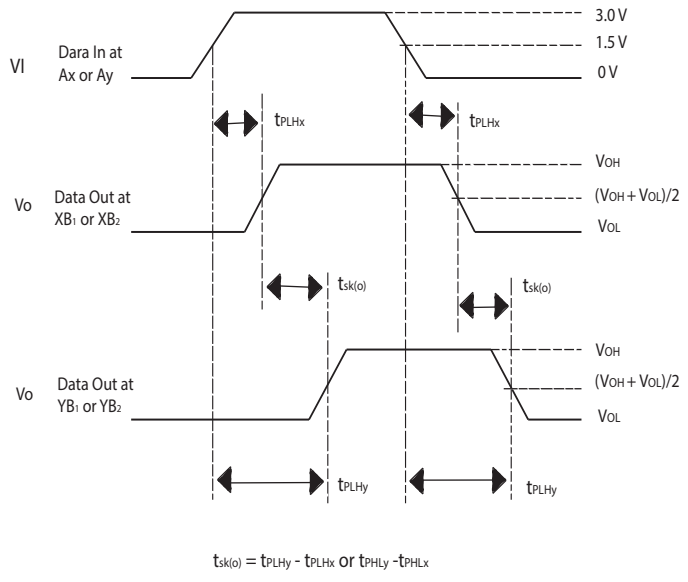
Notes:

- C_L includes probe and jig capacitance.
- Waveform 1 is for an output with internal conditions such that the output is low, except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high, except when disabled by the output control.
- All input pulses are supplied by generators having the following characteristics: PRR ≤ 10 MHz, Z_O = 50 Ω, t_r ≤ 2.5 ns, t_f ≤ 2.5 ns.
- The outputs are measured one at a time, with one transition per measurement.
- t_{PLZ} and t_{PHZ} are the same as t_{OFF}.
- t_{PZL} and t_{PZH} are the same as t_{ON}.

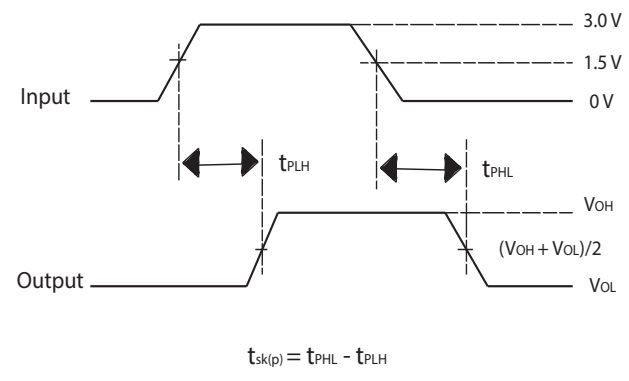
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TEST	V _{CC}	S1	R _L	V _{in}	C _L
t _{sk(o)}	3.3V ± 0.3V	Open	50Ω	V _{CC} or GND	2pF
t _{sk(p)}	3.3V ± 0.3V	Open	50Ω	V _{CC} or GND	2pF



VOLTAGE WAVEFORMS
OUTPUT SKEW (t_{sk(o)})



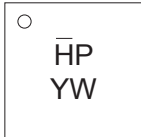
VOLTAGE WAVEFORMS
PULSE SKEW [t_{sk(p)}]

Notes:

1. C_L includes probe and jig capacitance.
2. All input pulses are supplied by generators having the following characteristics: PRR ≤ 10 MHz, ZO = 50 Ω, tr ≤ 2.5 ns, tf ≤ 2.5 ns.
3. The outputs are measured one at a time, with one transition per measurement.

PI3DBS3224S

Part Marking



Y: Date Code (Year)

W: Date Code (Workweek)

Line above "H" denotes Lead-free & Green

Packaging Mechanical

18-X2QFN (XUB)

SYMBOLS	MIN.	NOM.	MAX.
A	0.30	0.35	0.40
A1	0.00	0.02	0.05
A3	0.127 REF.		
b	0.15	0.20	0.25
D	1.95	2.00	2.05
E	1.95	2.00	2.05
e	0.40 BSC		
L	0.15	0.25	0.35
D2	0.95	1.00	1.05
E2	0.95	1.00	1.05

NOTE :
 1. ALL DIMENSIONS ARE IN mm. ANGLES IN DEGREES.
 2. REFER JEDEC MO-288
 3. RECOMMENDED LAND PATTERN IS FOR REFERENCE ONLY.
 MESH STENCIL DESIGN IS RECOMMENDED.

DATE: 10/13/16

DESCRIPTION: 18-Pin, X2QFN 2X2mm

PACKAGE CODE: XUB (XUB18)

DOCUMENT CONTROL #: PD-2203

REVISION: A

16-0224

For latest package info.

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

Ordering Information

Orderable Part Number	Package Code	Package Description
PI3DBS3224SXUBEX	XUB	18-Pin, 2x2mm (X2QFN)

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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