A product Line of
Diodes Incorporated

PI3DBS3224

3.3V High Speed 2 : 4 Differential Mux/Demux

Features

- 2:4 Differential Multiplexer/Demultiplexer
- Bidirectional Operation
- Can be used in
  - Single 1:4 Configuration
  - Dual 1:2 Configuration
  - Fan out 1:2 Configuration
- High BW (1.2 GHz Typ)
- Low RON and CON:
  - 13 Ω RON Typ
  - 9 pF CON Typ
- ESD Performance (I/O Pins)
  - ±8-kV Contact Discharge (IEC61000-4-2)
  - 2-kV Human Body Model per JESD22-A114E (to GND)
- ESD Performance (All Pins)
  - 2-kV Human Body Model per JESD22-A114E
- 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/
- Package: 20-pin (TQFN) (3 x 3 mm, 0.4 mm pitch)

Applications

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

Description

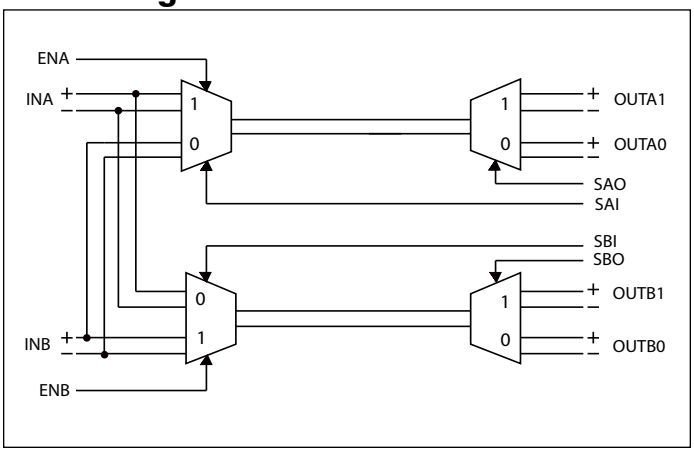
The PI3DBS3224 is a 2:4 bidirectional multiplexer for high-speed differential and single ended signal applications (up to 720 Mbps). The PI3DBS3224 can be used in a 1:4 or dual 1:2 multiplexer/demultiplexer configuration. The PI3DBS3224 offers a high BW of 1.2 GHz with channel RON of 13 Ω (Typ).

The PI3DBS3224 can also be used to fan out a differential or single ended signal pair to two ports simultaneously (fan-out configuration). The BW performance is lower in this configuration.

The PI3DBS3224 operates with a 3 to 3.6V power supply. It features ESD protection of up to ±8-kV contact discharge and 2-kV Human Body Model on its I/O pins.

The PI3DBS3224 provides fail-safe protection by isolating the I/O pins with high impedance when the power supply (V_{CC}) is not present.

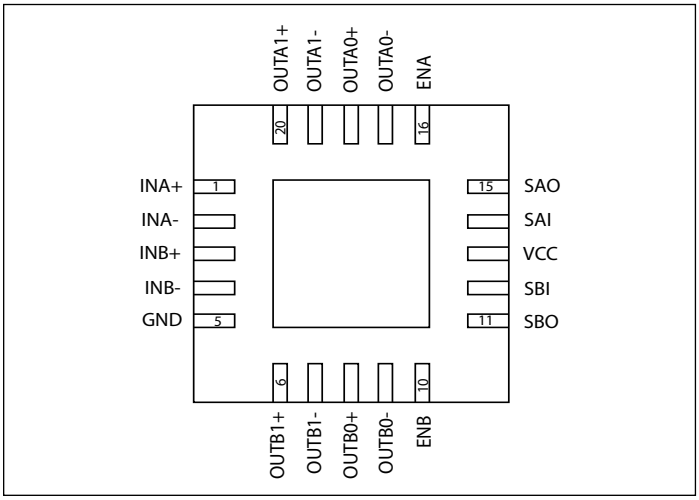
Block Diagram



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 #	Pin Name	I/O Type	Description
14	SAI	Input	Control Input
15	SAO	Input	Control Input
12	SBI	Input	Control Input
11	SBO	Input	Control Input
16	ENA	Input	Enable
1	INA+	I/O	Input A
2	INA-	I/O	Input A
10	ENB	Input	Enable
3	INB+	I/O	Input B
4	INB-	I/O	Input B
9	OUTB0-	I/O	Output B0
8	OUTB0+	I/O	Output B0
7	OUTB1-	I/O	Output B1
6	OUTB1+	I/O	Output B1
5	GND	Ground	Ground
13	VCC	Power	Power Supply
17	OUTA0-	I/O	Output A0
18	OUTA0+	I/O	Output A0
19	OUTA1-	I/O	Output A1
20	OUTA1+	I/O	Output A1

Function Table

ENA, ENB	OUTA0	OUTA1	OUTB0	OUTB1
00	Hi-Z	Hi-Z	Hi-Z	Hi-Z
01	Hi-Z	Hi-Z	-	-
10	-	-	Hi-Z	Hi-Z
11	-	-	-	-

SAI, SAO, SBI, SBO	OUTA0	OUTA1	OUTB0	OUTB1
0000	INB	-	INA	-
0001	INB	-	-	INA
0010	INB	-	INB	-
0011	INB	-	-	INB
0100	-	INB	INA	-
0101	-	INB	-	INA
0110	-	INB	INB	-
0111	-	INB	-	INB
1000	INA	-	INA	-
1001	INA	-	-	INA
1010	INA	-	INB	-
1011	INA	-	-	INB
1100	-	INA	INA	-
1101	-	INA	-	INA
1110	-	INA	INB	-
1111	-	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°C to 85°C, Typical values are at Vcc = 3.3V, T_A= 25°C (unless otherwise noted)

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

Notes:

1. V_{IN} and I_{IN} refer to control inputs. V_I, V_O, I_I and I_O refer to data pins.
2. All typical values are at V_{CC} = 3.3V (unless otherwise noted), T_A = 25 °C.
3. 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°C to 85°C, Typical values are at Vcc = 3.3V ± 10% and T_A = 25°C (unless otherwise noted)

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

Switching Characteristics

For Single 1:4 or Dual 1:2 configurations. Over operating range, T_A = -40°C to 85°C, Vcc = 3.3V ± 10%, GND = 0V (unless otherwise noted)

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

Notes:

1. 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).
2. Output skew between center channel and any other channel.
3. Skew between opposite transitions of the same output ($|t_{PHL} - t_{PLH}|$).

DC Electrical Characteristics over Operating Range

For fan-out 1:2 configurations. T_A = -40°C to 85°C, Typical values are at Vcc = 3.3V, T_A= 25°C (unless otherwise noted)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
V_{IK}	Digital input clamp voltage	V_{CC} = 3.6 V, I_I = -18 mA	-1.2	-0.9		V
I_{IN}	Digital input leakage current	V_{CC} = 3.6 V, V_{IN} =0 to 3.6 V			±2	µA
I_{OZ}[3]		V_{CC} = 3.6 V, V_O = 0 V to 3.6 V, V_I = 0 V, Switch OFF			±2	µA
I_{OFF}	Power off leakage current	V_{CC} = 0 V, V_{IN} = V_{CC} or GND, $V_{I/O}$ = 0 V to 3.6 V			±8	µA
I_{CC}	Supply current	V_{CC} = 3.6 V, $I_{I/O}$ = 0, Switch ON or OFF		70	130	µA
C_{IN}	Digital input capacitance	V_{CC} = 3.3 V, V_{IN} = V_{CC} or GND		3	5	pF
$C_{I/O(OFF)}$	OFF capacitance	V_{CC} = 3.3 V, $V_{I/O}$ = 3.3V or 0, f = 10MHz, Switch OFF		6	7	pF
$C_{I/O(ON)}$	ON capacitance	V_{CC} = 3.3 V, $V_{I/O}$ = 3.3V or 0, f = 10MHz, Switch ON		12	13	pF
r_{on}	ON state resistance	V_{CC} = 3.6 V, V_I = V_{CC}, I_O = -30 mA		13	19	Ω
Δr_{on}	ON state resistance match between channel	V_{CC} = 3 V, V_I = 0 to V_{CC}, I_O = -30 mA		2	2.5	Ω
$r_{on(flat)}$	ON state resistance flatness	V_{CC} = 3 V, V_I = 1.5 V and V_{CC}, I_O = -30 mA		4	6	Ω

Notes:

1. V_{IN} and I_{IN} refer to control inputs. V_I, V_O, I_I and I_O refer to data pins.
2. All typical values are at V_{CC} = 3.3V (unless otherwise noted), T_A = 25 °C.
3. For I/O ports, the parameter I_{OZ} includes the input leakage current.

Dynamic Characteristics

For fan-out 1:2 configurations. T_A = -40°C to 85°C, Typical values are at Vcc = 3.3V ± 10% and T_A= 25°C (unless otherwise noted)

Symbol	Parameter	Test Condition	Typ.	Unit
BW	Bandwidth	R_L = 50 Ω, Switch ON	500	MHz
O_{ISO}	OFF Isolation	R_L = 50 Ω, f = 250 MHz	-30	dB
X_{TALK}	Crosstalk	R_L = 50 Ω, f = 250 MHz	-35	dB

Switching Characteristics

For fan-out 1:2 configuration. Over operating range, T_A = -40°C to 85°C, Vcc = 3.3V ± 10%, GND = 0V (unless otherwise noted)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
t_{pd}(1)		R_L = 50 Ω, C_L = 2 pF		140		ps
t_{ON}	SAI/SAO/SBI/SBO to OUTAx/OUTBx	R = 50 Ω, C_L = 2 pF		40	100	ns
t_{OFF}	SAI/SAO/SBI/SBO to OUTAx/OUTBx	R_{LL} = 50 Ω, C_L = 2 pF		20	30	ns
$t_{sk(o)}$(2)		R_L = 50 Ω, C_L = 2 pF		60		ps
$t_{sk(p)}$(3)		R_L = 50 Ω, C_L = 2 pF		60		ps

Notes:

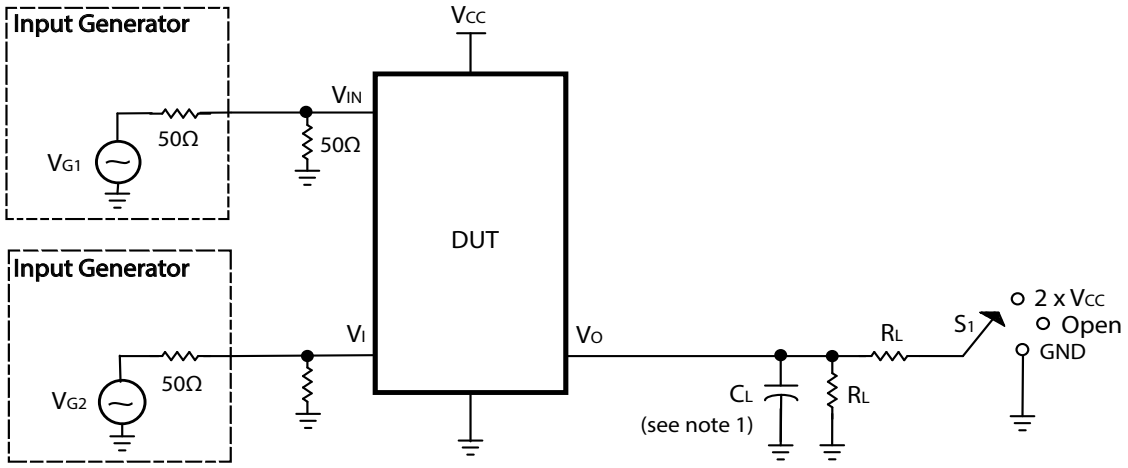
1. The propagation delay is the calculated RC time constant of the typical ON-State resistance of the switch and the specified load capacitance when driven by an ideal voltage source (zero output impedance).
2. Output skew between center channel and any other channel.
3. Skew between opposite transitions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

DC Electrical Characteristics over Operating Range

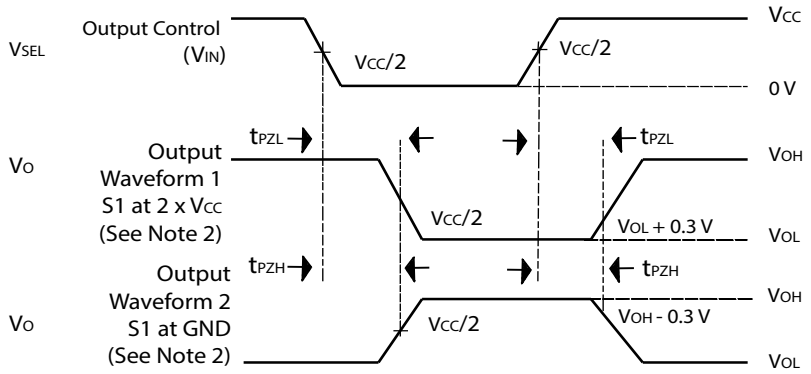
T_A = -40°C to 85°C, Typical values are at Vcc = 3.3V, T_A= 25°C

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	ENx, SAx, SBx Pins	0.75V_{CC}		V_{CC}	V
V_{IL}	Low level input control voltage	ENx, SAx, SBx 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}	3.3 V ± 0.3 V	2 x V_{CC}	50Ω	GND	2 pF	0.3 V
t_{PHZ}/t_{PZH}	3.3 V ± 0.3 V	GND	50Ω	V_{CC}	2pF	0.3 V

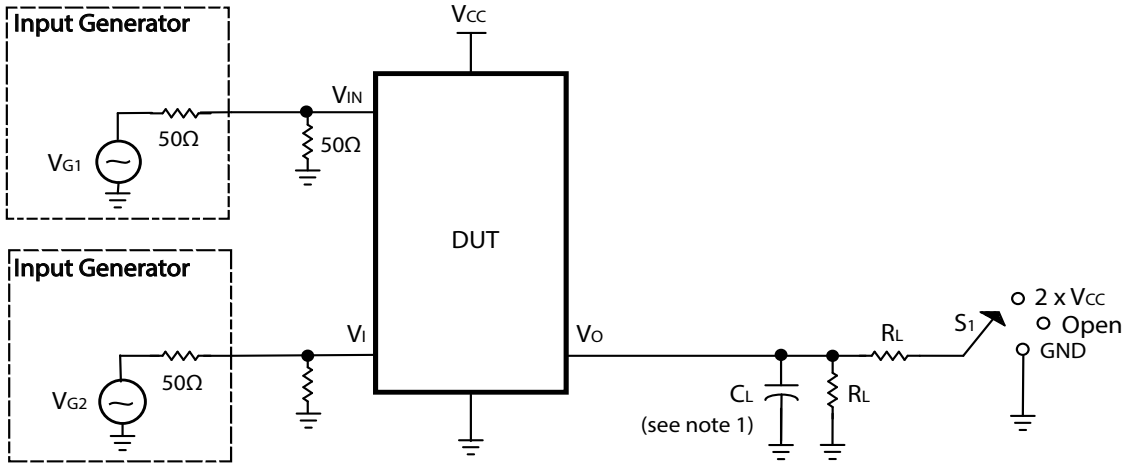


VOLTAGE WAVEFORMS
ENABLE AND DISABLE TIME

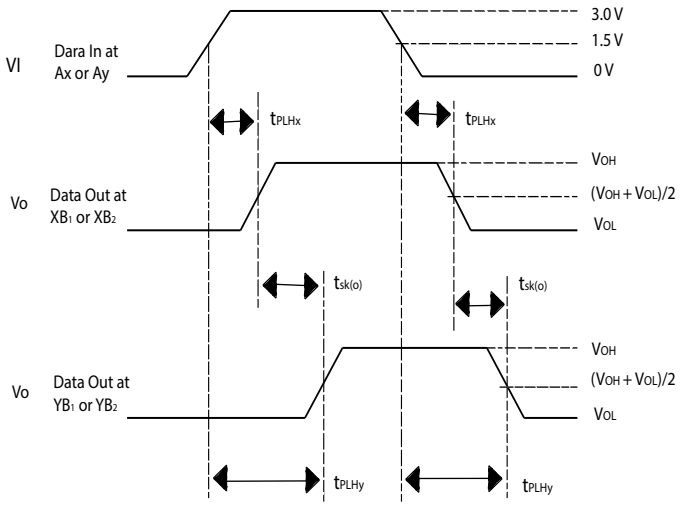
Notes:

1. C_L includes probe and jig capacitance.
2. 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.
3. All input pulses are supplied by generators having the following characteristics: PRR ≤ 10 MH_Z, ZO = 50 Ω, t_r ≤ 2.5 ns. t_f ≤ 2.5 ns.
4. The outputs are measured one at a time, with one transition per measurement.
5. t_{PLZ} and t_{PHZ} are the same as t_{OFF}.
6. t_{PZL} and t_{PZH} are the same as t_{ON}.

Test Circuit For Electrical Characteristics

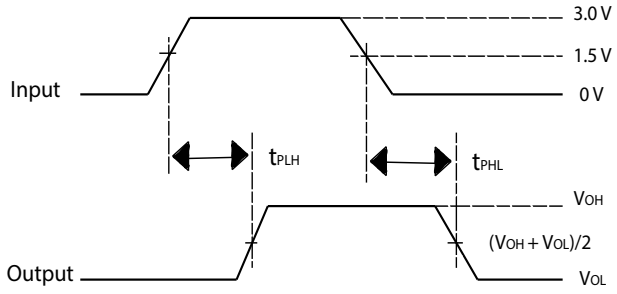


TEST	V_{CC}	S1	R_L	V_{in}	C_L
$t_{sk(o)}$	3.3 V ± 0.3 V	Open	50Ω	V_{CC} or GND	2 pF
$t_{sk(p)}$	3.3 V ± 0.3 V	Open	50Ω	V_{CC} or GND	2pF



$t_{sk(o)} = t_{PLHy} - t_{PLHx}$ or $t_{PHLy} - t_{PHLx}$

VOLTAGE WAVEFORMS
OUTPUT SKEW ($t_{SK(O)}$)



$t_{sk(p)} = t_{PHL} - t_{PLH}$

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

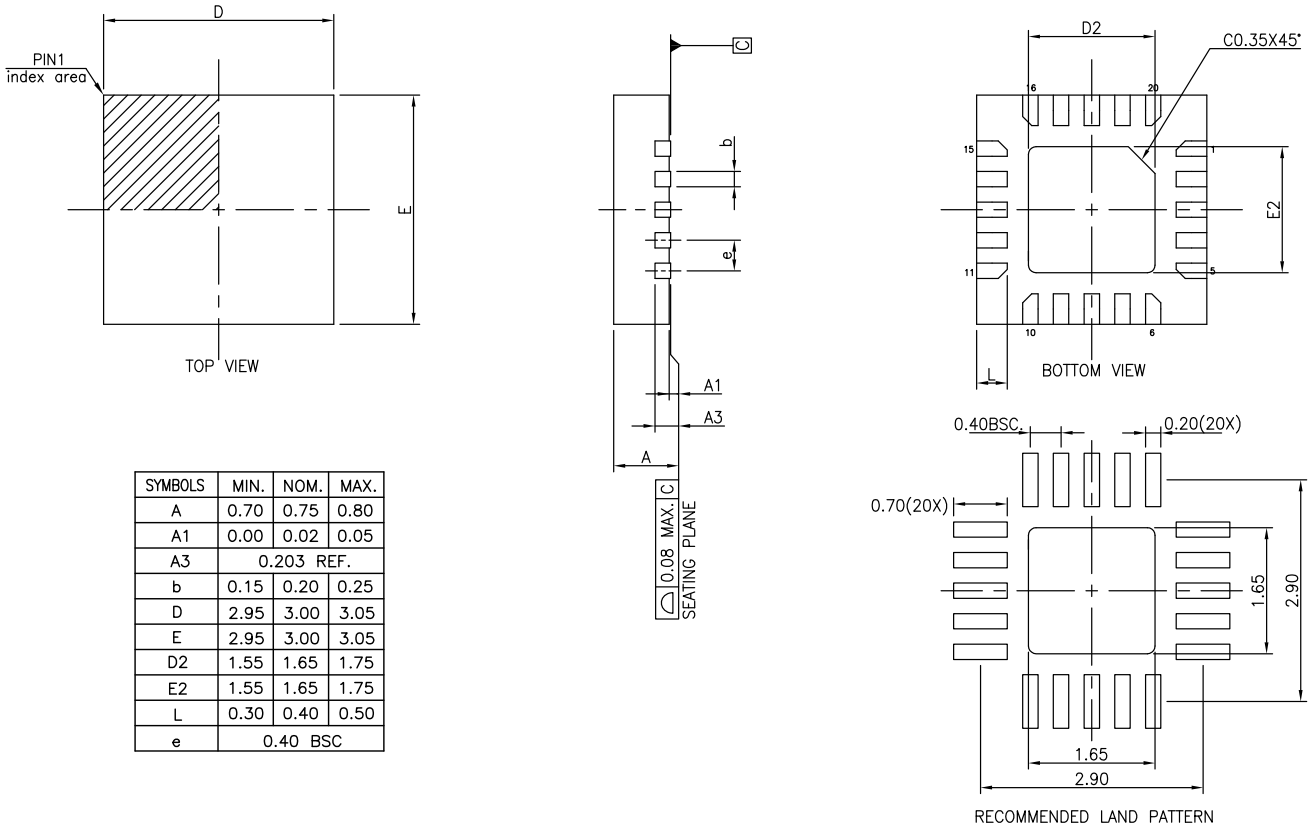
Notes:

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, t_r ≤ 2.5 ns. t_f ≤ 2.5 ns.
3. The outputs are measured one at a time, with one transition per measurement.

Part Marking

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

Packaging Mechanical: 20-TQFN (ZNA)



SYMBOLS	MIN.	NOM.	MAX.
A	0.70	0.75	0.80
A1	0.00	0.02	0.05
A3		0.203 REF.	
b	0.15	0.20	0.25
D	2.95	3.00	3.05
E	2.95	3.00	3.05
D2	1.55	1.65	1.75
E2	1.55	1.65	1.75
L	0.30	0.40	0.50
e		0.40 BSC	

Notes:
1. All dimensions are in mm. Angles in degrees.
2. Refer JEDEC MO-220.
3. Recommended land pattern is for reference only.

PERICOM Enabling Serial Connectivity

DATE: 09/19/13

DESCRIPTION: 20-contact, Thin Fine Pitch Quad Flat No lead Package (TQFN)

PACKAGE CODE: ZNA

DOCUMENT CONTROL #: PD-2169 **REVISION: --**

13-0240

For latest package info.
please check: http://www.diodes.com/design/support/packaging/pericom-packaging/packaging-mechanicals-and-thermal-characteristics/

Ordering Information

Ordering Code	Packaging Code	Package Description
PI3DBS3224ZNAEX	ZNA	20-contact, Thin Fine Pitch Quad Flat No Lead Package (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.
4. E = Pb-free and Green
5. X suffix = Tape/Reel

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