

A Inter Chip-USB Voltage Level Translator

Check for Samples: [TXS0202](#)

FEATURES

- **No Direction Control Signal Required**
- **V_{CCA} , V_{CCB} Supply Voltage: 1.65 V to 3.6 V**
- **Meets All Requirements of the IC-USB Standard**
- **Small Packages: WCSP**
- **Latch-Up Performance Exceeds 100 mA Per JESD 78, Class II**
- **I_{off} Supports Partial-Power-Down Mode Operation**
- **ESD Performance**
 - **A port (Host-Side)**
 - **2000-V Human-Body Model**
 - **100-V Machine Model**
 - **500-V Charged-Device Model**
 - **B port (Peripheral-Side)**
 - **>4kV HBM**

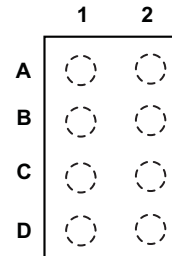


Table 1. YZP TERMINAL ASSIGNMENTS (Top Through View)

	1	2
A	D+(B)	D–(B)
B	GND	V_{CCB}
C	V_{CCA}	OE
D	D+(A)	D–(A)

DESCRIPTION

The TXS0202 is a 2-bit voltage level translator optimized for use in Interchip USB (IC-USB) applications. V_{CCA} and V_{CCB} can each operate over the full range of 1.65 V to 3.6 V. The device has been designed to maintain cross-over skew to be less than 1 ns. The device has integrated pull-ups and pull-down resistors to aid in the protocol communication between a host and a peripheral. The translator is a buffered auto-direction sensing type translator. When the output-enable (OE) input is low, all outputs are placed in the high-impedance state.

This device is fully specified for partial-power-down applications using I_{off} . The I_{off} circuitry disables the outputs, preventing damaging current backflow through the device when it is powered down. To ensure the high-impedance state during power up or power down, OE should be tied to GND through a pull-down resistor; the minimum value of the resistor is determined by the current-sourcing capability of the driver.

ORDERING INFORMATION⁽¹⁾

T_A	PACKAGE ⁽²⁾		ORDERABLE PART NUMBER	TOP-SIDE MARKING
–40°C to 85°C	WCSP – YZP	Tape and reel	TXS0202YZPR	__ _ 7PS _ ⁽³⁾

(1) For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI website at www.ti.com.

(2) Package drawings, thermal data, and symbolization are available at www.ti.com/packaging.

(3) YZP: The actual top-side marking has three preceding characters to denote year, month, and sequence code, and one following character to designate the wafer fab/assembly site.

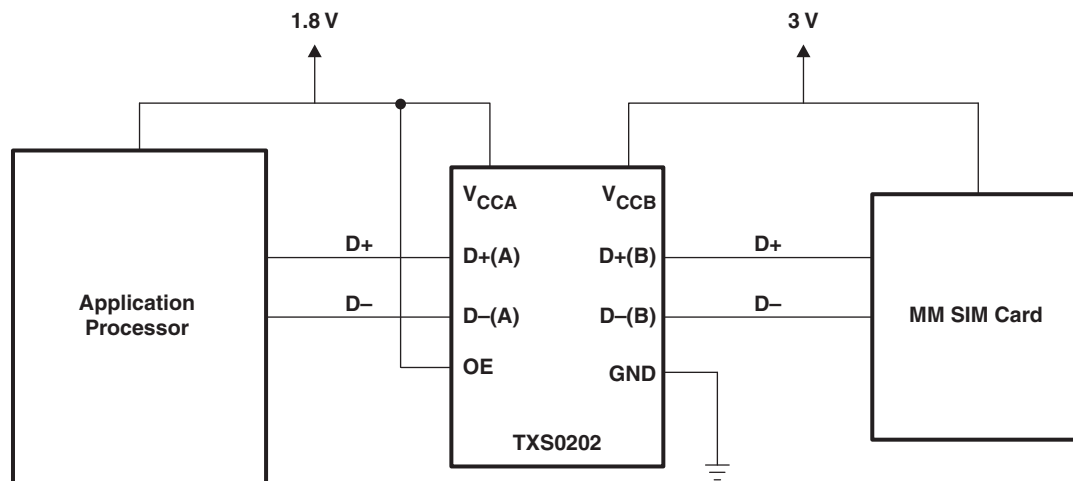


Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.



These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

TYPICAL APPLICATION BLOCK DIAGRAM



PIN FUNCTIONS

PIN		DESCRIPTION
WSCP (YFP) BALL NO.	NAME	
A1	D+(B)	USB data signal connected to peripheral
A2	D-(B)	USB data signal connected to peripheral
B1	GND	Ground
B2	V _{CCB}	B-side supply voltage (1.65 V to 3.6 V)
C1	V _{CCA}	A-side supply voltage (1.65 V to 3.6 V)
C2	OE	Output enable input control
D1	D+(A)	USB data signal connected to host
D2	D-(A)	USB data signal connected to host

FUNCTIONAL TABLE

CONTROL INPUT	OUTPUT CIRCUIT	OPERATION
OE	B PORT	
L	Hi-Z	Isolation
H	Enabled	Bi-directional communications between host and peripheral

ABSOLUTE MAXIMUM RATINGS⁽¹⁾

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

			MIN	MAX	UNIT
V_{CCA} V_{CCB}	Supply voltage rang		–0.5	4.6	V
V_I	Input voltage range	A port, B port, control inputs	–0.5	$V_{CCx} + 0.5$	V
V_O	Voltage range applied to any output in the high-impedance or power-off state	A port, B port	–0.5	$V_{CCx} + 0.5$	V
I_{IK}	Input clamp current	$V_I < 0$		–50	mA
I_{OK}	Output clamp current	$V_O < 0$		–50	mA
I_{CC} I_{GND}	Continuous current through V_{CCA} , V_{CCB} , or GND			±100	mA
T_{stg}	Storage temperature range		–65	150	°C

- (1) 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.

THERMAL INFORMATION

THERMAL METRIC ⁽¹⁾		TXS0202	UNITS
		YZP	
		8 PINS	
θ_{JA}	Junction-to-ambient thermal resistance	102	°C/W

- (1) For more information about traditional and new thermal metrics, see the *IC Package Thermal Metrics* application report, [SPRA953](#).

RECOMMENDED OPERATING CONDITIONS

			MIN	MAX	UNIT
V_{CCA} , V_{CCB}	Supply voltage		1.65	3.6	V
V_{IH}	High-level input voltage	A port I/Os	$V_{CCA} - 0.2$	V_{CCA}	V
		B port I/Os	$V_{CCB} - 0.2$	V_{CCB}	
		OE	$V_{CCA} \times 0.65$	3.6	
V_{IL}	Low-level input voltage	A port I/Os	0	0.15	V
		B port I/Os	0	0.15	
		OE	0	$V_{CCA} \times 0.35$	
$\Delta t/\Delta v$	Input transition rise or fall rate			10	ns/V
T_A	Operating free-air temperature		–40	85	°C

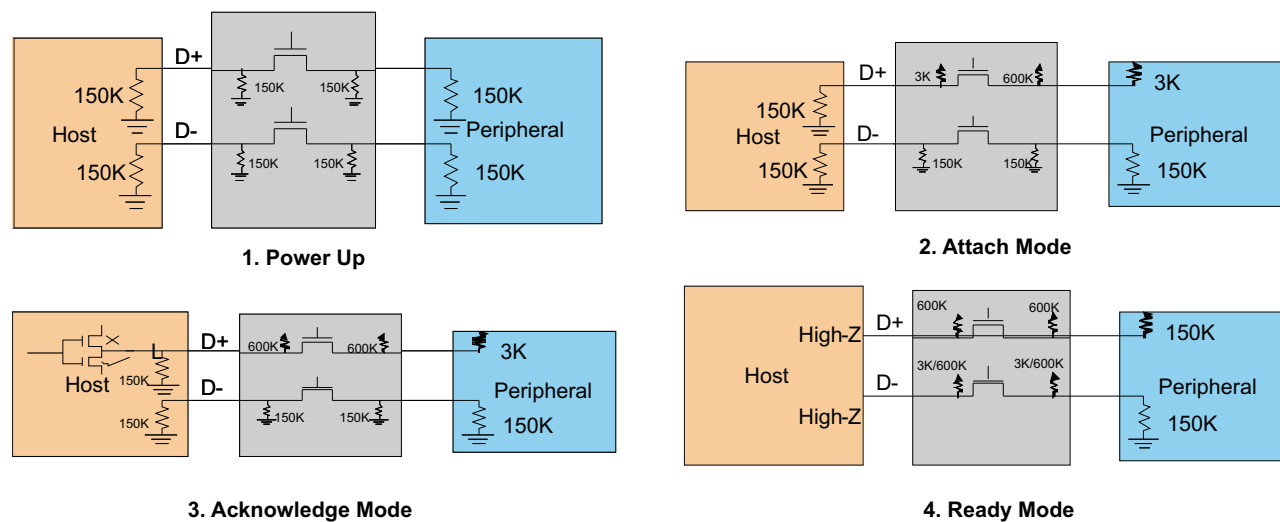


Figure 1. Block Diagram Showing Different Modes in the TXS0202

ELECTRICAL CHARACTERISTICS

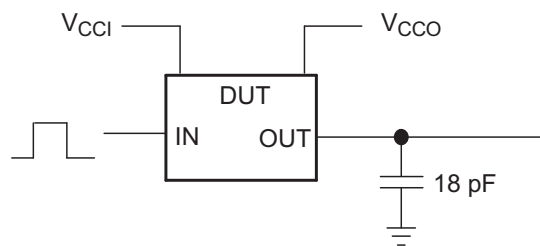
PARAMETER	TEST CONDITIONS	V _{CCA}	V _{CCBx}	T _A = 25°C	T _A = –40°C to 85°C		UNIT
				TYP	MIN	MAX	
V _{OH(D–)} (D– A or B port)	I _{OH} = –20 μA, V _{Ix} ≥ V _{CCx} – 0.2 V	1.65 V	1.65 V		V _{CCO} × 0.67		V
		2.3 V	2.3 V		V _{CCO} × 0.67		
		3.3 V	3.3 V		V _{CCO} × 0.67		
V _{OL(D–)} (D– A or B port)	I _{OL} = 220 μA, V _{Ix} ≤ 0.15 V	1.65 V	1.65 V		0.45		V
	I _{OL} = 180 μA, V _{Ix} ≤ 0.15 V	2.3 V	2.3 V		0.55		
	I _{OL} = 220 μA, V _{Ix} ≤ 0.15 V	3.3 V	3.3 V		0.7		
V _{OH(D+)} (D+ A or B port)	I _{OH} = –20 μA, V _{Ix} ≥ V _{CCx} – 0.2 V	1.65 V	1.65 V		V _{CCO} × 0.67		V
		2.3 V	2.3 V		V _{CCO} × 0.67		
		3.3 V	3.3 V		V _{CCO} × 0.67		
V _{OL(D+)} (D– A or B port)	I _{OL} = 220 μA, V _{Ix} ≤ 0.15 V	1.65 V	1.65 V		0.45		V
	I _{OL} = 300 μA, V _{Ix} ≤ 0.15 V	2.3 V	2.3 V		0.55		
	I _{OL} = 620 μA, V _{Ix} ≤ 0.15 V	3.3 V	3.3 V		0.7		
I _I	OE	1.65 V to 3.6 V	1.65 V to 3.6 V	±2	±2		μA
	D–/D+ A or B port, OE = OPEN			±2	±2		
	I _{BOFF} , D+, D– B port	1.65 V to 3.6 V	0 V		±2		
	I _{AOFF} , D+, D– A port	0 V	1.65 V to 3.6 V		±2		
I _{CCA}	V _I = V _O = Open, OE = High	1.65 V to 3.6 V	1.65 V to 3.6 V	2.2	12		μA
		3.6 V	0 V	2.3	12		
		0 V	3.6 V	0.026	–1		
I _{CCB}	V _I = V _O = Open, OE = High	1.65 V to 3.6 V	1.65 V to 3.6 V	2.7	24		μA
		3.6 V	0 V	0.031	–12		
		0 V	3.6 V	2.7	24		
C _i	OE	3.6 V	3.6 V	2.5	3.5		pF
C _{io}	A port	3.6 V	3.6 V	7	7.5		pF
	B port			9.5	10		

SWITCHING CHARACTERISTICS

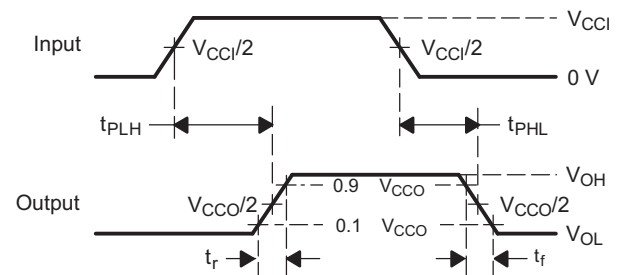
over recommended operating free-air temperature range, $V_{CCA} = 1.8 \text{ V} \pm 0.15 \text{ V}$ (unless otherwise noted)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CCB} = 1.8 \text{ V} \pm 0.15 \text{ V}$	$V_{CCB} = 3.3 \text{ V} \pm 0.3 \text{ V}$	UNIT
			TYP	TYP	
t_{pd}	A	B	5	5	ns
	B	A	5	5	
t_{rA}	A port rise times		2	2	ns
t_{fA}	A port fall times		2	2	ns
t_{rB}	B port rise times		2	2	ns
t_{fB}	B port fall times		2	2	ns
$t_{sk(o)}$	Channel-to-channel		0.5	0.5	ns
Max data rate			15	15	Mbps

PARAMETER MEASUREMENT INFORMATION



DATA RATE, SKEW, PROPAGATION DELAY,
OUTPUT RISE AND FALL TIME MEASUREMENT



VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES

- A. C_L includes probe and jig capacitance.
- B. The outputs are measured one at a time, with one transition per measurement.
- C. t_{PLH} and t_{PHL} are the same as t_{pd} .

PACKAGING INFORMATION

Orderable part number	Status (1)	Material type (2)	Package Pins	Package qty Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
TXS0202YZPR	Active	Production	DSBGA (YZP) 8	3000 LARGE T&R	Yes	SNAGCU	Level-1-260C-UNLIM	-40 to 85	7P
TXS0202YZPR.B	Active	Production	DSBGA (YZP) 8	3000 LARGE T&R	Yes	SNAGCU	Level-1-260C-UNLIM	-40 to 85	7P

⁽¹⁾ **Status:** For more details on status, see our [product life cycle](#).

⁽²⁾ **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

⁽³⁾ **RoHS values:** Yes, No, RoHS Exempt. See the [TI RoHS Statement](#) for additional information and value definition.

⁽⁴⁾ **Lead finish/Ball material:** Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

⁽⁵⁾ **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

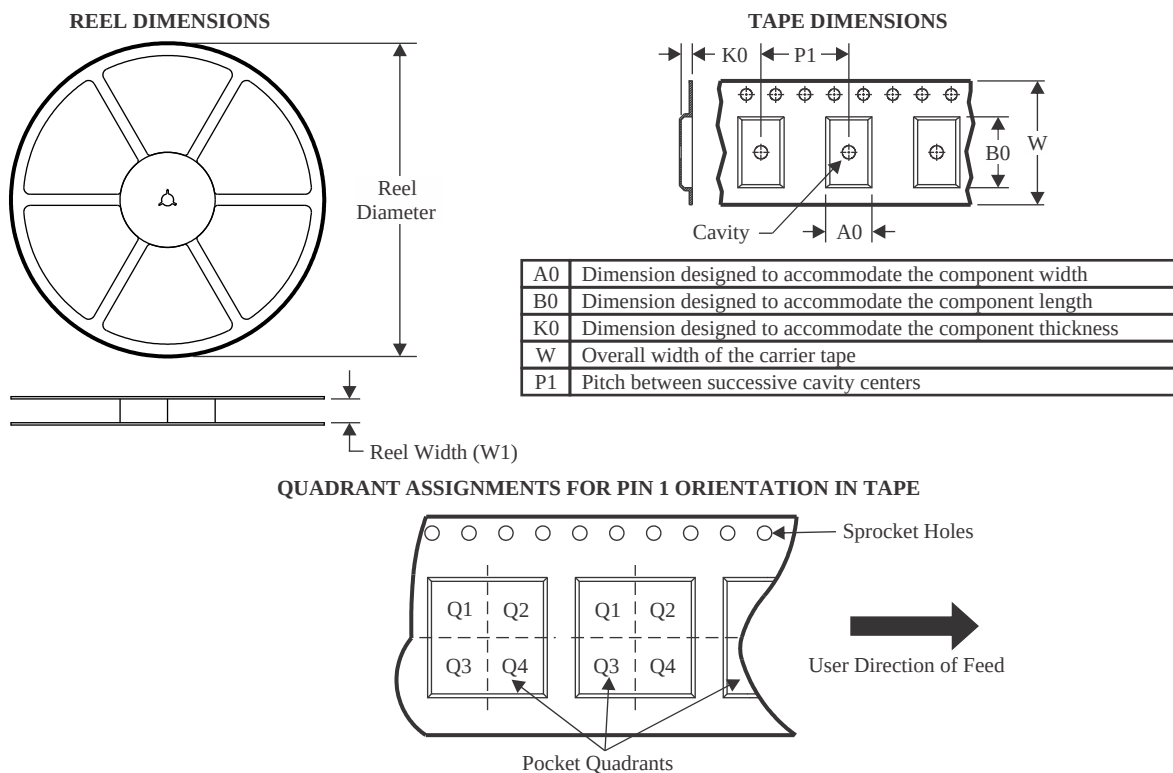
⁽⁶⁾ **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

Important Information and Disclaimer:The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

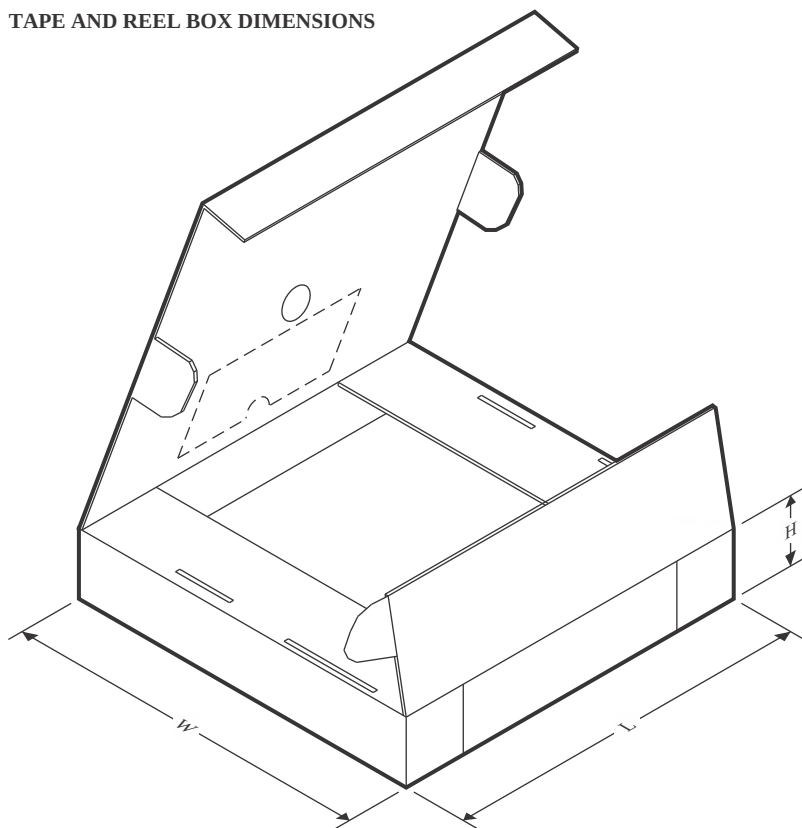
TAPE AND REEL INFORMATION



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
TXS0202YZPR	DSBGA	YZP	8	3000	180.0	8.4	1.02	2.02	0.63	4.0	8.0	Q1

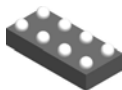
TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TXS0202YZPR	DSBGA	YZP	8	3000	182.0	182.0	20.0

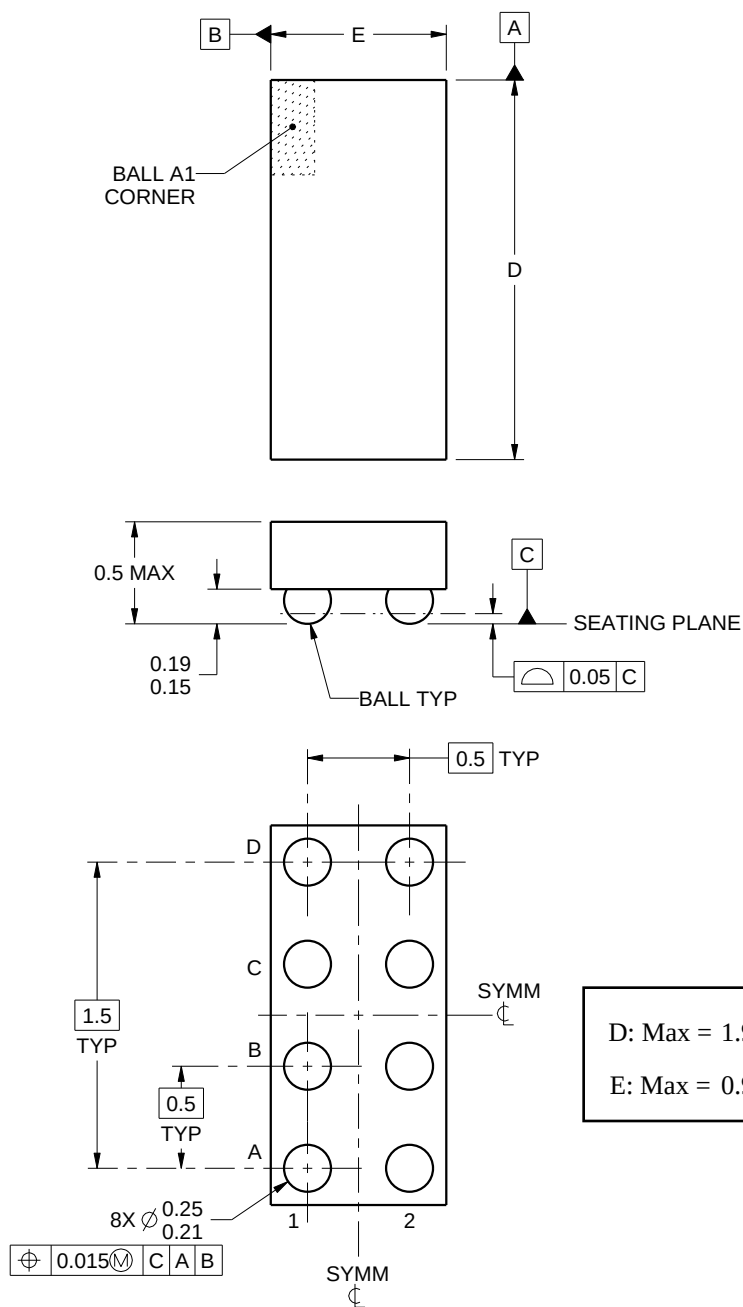
YZP0008



PACKAGE OUTLINE

DSBGA - 0.5 mm max height

DIE SIZE BALL GRID ARRAY



D: Max = 1.918 mm, Min = 1.858 mm
E: Max = 0.918 mm, Min = 0.858 mm

4223082/A 07/2016

NOTES:

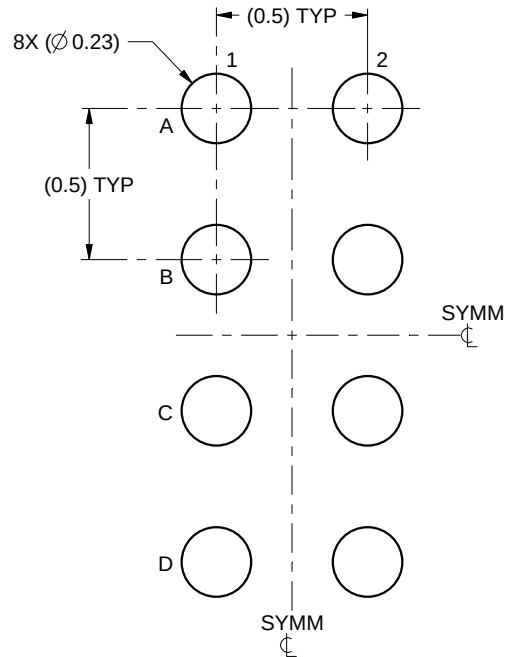
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.

EXAMPLE BOARD LAYOUT

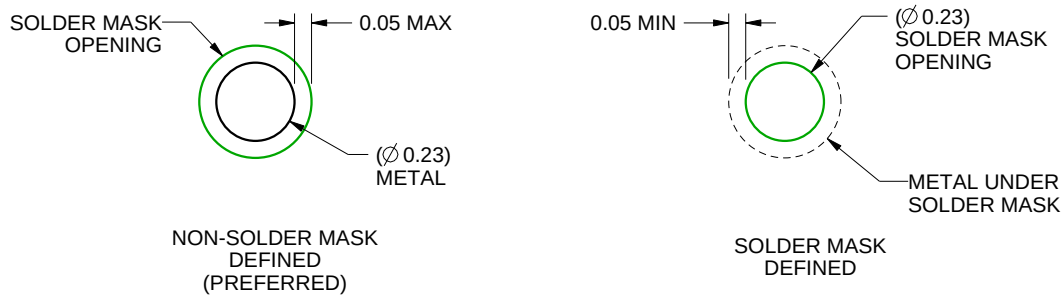
YZP0008

DSBGA - 0.5 mm max height

DIE SIZE BALL GRID ARRAY



LAND PATTERN EXAMPLE
SCALE:40X

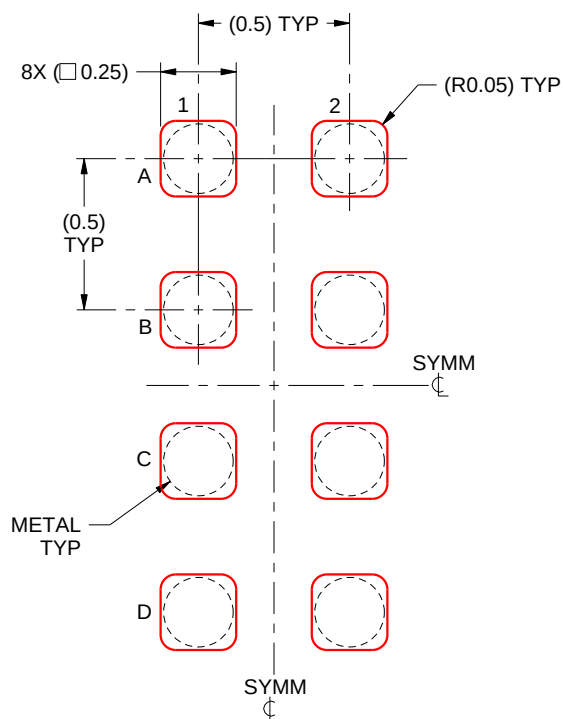


SOLDER MASK DETAILS
NOT TO SCALE

4223082/A 07/2016

NOTES: (continued)

- Final dimensions may vary due to manufacturing tolerance considerations and also routing constraints. For more information, see Texas Instruments literature number SNVA009 (www.ti.com/lit/snva009).



SOLDER PASTE EXAMPLE
 BASED ON 0.1 mm THICK STENCIL
 SCALE:40X

4223082/A 07/2016

NOTES: (continued)

4. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release.

IMPORTANT NOTICE AND DISCLAIMER

TI PROVIDES TECHNICAL AND RELIABILITY DATA (INCLUDING DATASHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES "AS IS" AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS AND IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for skilled developers designing with TI products. You are solely responsible for (1) selecting the appropriate TI products for your application, (2) designing, validating and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, regulatory or other requirements.

These resources are subject to change without notice. TI grants you permission to use these resources only for development of an application that uses the TI products described in the resource. Other reproduction and display of these resources is prohibited. No license is granted to any other TI intellectual property right or to any third party intellectual property right. TI disclaims responsibility for, and you fully indemnify TI and its representatives against any claims, damages, costs, losses, and liabilities arising out of your use of these resources.

TI's products are provided subject to [TI's Terms of Sale](#), [TI's General Quality Guidelines](#), or other applicable terms available either on [ti.com](#) or provided in conjunction with such TI products. TI's provision of these resources does not expand or otherwise alter TI's applicable warranties or warranty disclaimers for TI products. Unless TI explicitly designates a product as custom or customer-specified, TI products are standard, catalog, general purpose devices.

TI objects to and rejects any additional or different terms you may propose.

Copyright © 2025, Texas Instruments Incorporated

Last updated 10/2025