TXB0108 8-Bit Bidirectional Voltage-Level Translator with Auto-Direction Sensing and ±15kV ESD Protection

1 Features

- 1.2V to 3.6V on A Port and 1.65V to 5.5V on B Port ($V_{CCA} \le V_{CCB}$)
- V_{CC} Isolation Feature – If Either V_{CC} Input Is at GND, All Outputs Are in the High-Impedance State
- OE Input Circuit Referenced to V_{CCA}
- Low Power Consumption, 4µA Max I_{CC}
- I_{off} Supports Partial-Power-Down Mode Operation
- Latch-Up Performance Exceeds 100mA Per JESD 78, Class II
- ESD Protection Exceeds JESD 22
  - A Port
    - 2000V Human-Body Model (A114-B)
    - 1000V Charged-Device Model (C101)
  - B Port
    - ±15kV Human-Body Model (A114-B)
    - ±8kV Human-Body Model (A114-B) (YZP Package Only)
    - 1000V Charged-Device Model (C101)

2 Applications

- Handset
- Smartphone
- Tablet
- Desktop PC

3 Description

This 8-bit noninverting translator uses two separate configurable power-supply rails. The A port is designed to track V_{CCA}. V_{CCA} accepts any supply voltage from 1.2V to 3.6V. The B port is designed to track V_{CCB}. V_{CCB} accepts any supply voltage from 1.65V to 5.5V. This allows for universal low-voltage bidirectional translation between any of the 1.2V, 1.5V, 1.8V, 2.5V, 3.3V, and 5V voltage nodes. V_{CCA} should not exceed V_{CCB}.

When the output-enable (OE) input is low, all outputs are placed in the high-impedance state.

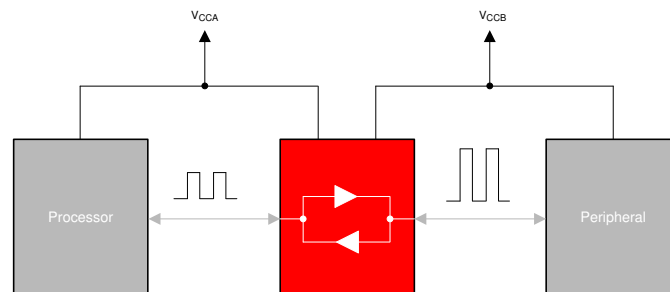The TXB0108 is designed so that the OE input circuit is supplied by V_{CCA}.

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 pulldown resistor; the minimum value of the resistor is determined by the current-sourcing capability of the driver.

Package Information

PART NUMBER	PACKAGE [(1)]	BODY SIZE (NOM)
TXB0108DQS	SON (20)	2.00mm x 4.00mm
TXB0108ZXY	BGA MICROSTAR JUNIOR (20)	2.50mm x 3.00mm
TXB0108PW	TSSOP (20)	6.50mm x 4.40mm
TXB0108RGY	VQFN (20)	4.50mm x 3.50mm
TXB0108YZP	DSGBA (20)	1.90mm x 2.40mm
TXB0108NME	nFBGA (20)	2.50mm x 3.00mm
TXB0108RUK	WQFN (20)	3.00mm x 3.00mm
TXB0108DGS	VSSOP (20)	5.10mm x 3.00mm
TXB0108RKS	VQFN (20)	4.50mm x 2.50mm

(1) For all available packages, see the orderable addendum at the end of the datasheet.

Typical Application Block Diagram for TXB0108

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A. For the RKS/RGY/RUK package, the exposed center thermal pad must be connected to ground.

B. Pullup resistors are not required on both sides for Logic I/O.

C. If pullup or pulldown resistors are needed, the resistor value must be over 50kΩ.

D. 50kΩ is a safe recommended value, if the customer can accept higher V_{OL} or lower V_{OH}, smaller pullup or pulldown resistor is allowed, the draft estimation is $V_{OL} = V_{CCOUT} \times 4.5k/(4.5k + R_{PU})$ and $V_{OH} = V_{CCOUT} \times R_{DW}/(4.5k + R_{DW})$.

E. If pullup resistors are needed, please refer to the TXS0108 or contact TI.

F. For detailed information, please refer A Guide to Voltage Translation With TXB-Type Translators.

YZPR2 PACKAGE[(1)]
(BALL SIDE VIEW)

	1	2	3	4
E	B6	B8	A8	A6
D	GND	B7	A7	OE
C	V_{CCB}	B5	A5	V_{CCA}
B	B4	B3	A3	A4
A	B2	B1	A1	A2

Pin A1- area indicator
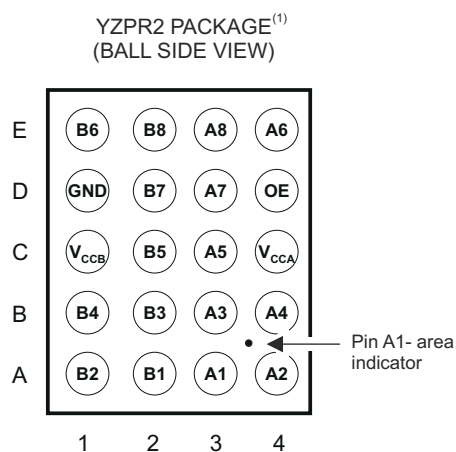
[(1)]See orderable addendum at the end of the data sheet

	1	2	3	4	5
D	○	○	○	○	○
C	○	○	○	○	○
B	○	○	○	○	○
A	○	○	○	○	○
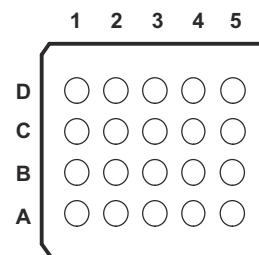
Figure 4-5. NME/GXY/ZXY PACKAGE (BOTTOM VIEW)

Table 4-1. Pin Functions

PIN				I/O[1]	FUNCTION
SIGNAL NAME	PW, RGY NO.	DQS NO.	YZP GRID LOCATOR		
A1	1	1	A3	I/O	Input/output 1. Referenced to V_{CCA}.
V_{CCA}	2	5	C4	S	A-port supply voltage. 1.1 V ≤ V_{CCA} ≤ 3.6 V, V_{CCA} ≤ V_{CCB}.
A2	3	2	A4	I/O	Input/output 2. Referenced to V_{CCA}.
A3	4	3	B3	I/O	Input/output 3. Referenced to V_{CCA}.
A4	5	4	B4	I/O	Input/output 4. Referenced to V_{CCA}.
A5	6	7	C3	I/O	Input/output 5. Referenced to V_{CCA}.
A6	7	8	E4	I/O	Input/output 6. Referenced to V_{CCA}.
A7	8	9	D3	I/O	Input/output 7. Referenced to V_{CCA}.
A8	9	10	E3	I/O	Input/output 8. Referenced to V_{CCA}.
OE	10	6	D4	I	Output enable. Pull OE low to place all outputs in 3-state mode. Referenced to V_{CCA}.
GND	11	15	D1	S	Ground
B8	12	11	E2	I/O	Input/output 8. Referenced to V_{CCB}.
B7	13	12	D2	I/O	Input/output 7. Referenced to V_{CCB}.
B6	14	13	E1	I/O	Input/output 6. Referenced to V_{CCB}.
B5	15	14	C2	I/O	Input/output 5. Referenced to V_{CCB}.
B4	16	17	B1	I/O	Input/output 4. Referenced to V_{CCB}.
B3	17	18	B2	I/O	Input/output 3. Referenced to V_{CCB}.
B2	18	19	A1	I/O	Input/output 2. Referenced to V_{CCB}.
V_{CCB}	19	16	C1	S	B-port supply voltage. 1.65 V ≤ V_{CCB} ≤ 5.5 V.
B1	20	20	A2	I/O	Input/output 1. Referenced to V_{CCB}.
Thermal Pad	—			—	For the RGY/RUK package, the exposed center thermal pad must be connected to ground.

(1) I = input, O = output, I/O = input and output, S = power supply

Table 4-2. Pin Assignments (20-Ball NME/GXY/ZXY Package)

	1	2	3	4	5
D	V_{CCB}	B2	B4	B6	B8
C	B1	B3	B5	B7	GND
B	A1	A3	A5	A7	OE
A	V_{CCA}	A2	A4	A6	A8

5 Specifications

5.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)[1]

			MIN	MAX	UNIT
V_{CCA}	Supply voltage range		−0.5	4.6	V
V_{CCB}	Supply voltage range		−0.5	6.5	V
V_I	Input voltage range[2]		−0.5	6.5	V
V_O	Voltage range applied to any output in the high-impedance or power-off state[2]		−0.5	6.5	V
V_O	Voltage range applied to any output in the high or low state[2] [3]	A inputs	−0.5	V_{CCA} + 0.5	V
		B inputs	−0.5	V_{CCB} + 0.5	
I_{IK}	Input clamp current	V_I < 0		−50	mA
I_{OK}	Output clamp current	V_O < 0		−50	mA
I_O	Continuous output current			±50	mA
	Continuous current through V_{CCA}, V_{CCB}, or GND			±100	mA
T_{stg}	Storage temperature range		−65	150	°C
T_J	Junction temperature			150	°C

(1) Stresses beyond those listed under *Section 5.1* 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 *Section 5.3* is not implied. Exposure to absolute maximum rated conditions for extended periods may affect device reliability.
(2) The input and output negative-voltage ratings may be exceeded if the input and output current ratings are observed.
(3) The value of V_{CCA} and V_{CCB} are provided in the recommended operating conditions table.

5.2 ESD Ratings

			MIN	MAX	UNIT
$V_{(ESD)}$	Electrostatic discharge	Human body model (HBM), per ANSI/ESDA/JEDEC JS-001, all pins [1], A Port		2	kV
		Human body model (HBM), per ANSI/ESDA/JEDEC JS-001, all pins [1], B Port	−15	15	
		Charged device model (CDM), per JEDEC specification JESD22-C101, all pins [2], A Port		1	
		Charged device model (CDM), per JEDEC specification JESD22-C101, all pins ,[2] A Port (YZP Package only)	−8	8	
		Charged device model (CDM), per JEDEC specification JESD22-C101, all pins [2], B Port		1	

(1) JEDEC document JEP155 states that 500V HBM allows safe manufacturing with a standard ESD control process.
(2) JEDEC document JEP157 states that 250V CDM allows safe manufacturing with a standard ESD control process.

5.3 Recommended Operating Conditions

over operating free-air temperature range (unless otherwise noted) [1] [2]

			V_{CCA}	V_{CCB}	MIN	MAX	UNIT
V_{CCA}	Supply voltage				1.2	3.6	V
V_{CCB}					1.65	5.5	
V_{IH}	High-level input voltage	Data inputs	1.2V to 3.6V	1.65V to 5.5V	V_{CCI} x 0.65[3]	V_{CCI}	V
		OE			V_{CCA} x 0.65	5.5	
V_{IL}	Low-level input voltage	Data inputs	1.2V to 5.5V	1.65V to 5.5V	0	V_{CCI} x 0.35[3]	V
		OE	1.2V to 3.6V		0	V_{CCA} x 0.35	
Δt/Δv	Input transition rise or fall rate	A-port inputs	1.2V to 3.6V	1.65V to 5.5V		40	ns/V
		B-port inputs	1.2V to 3.6V	1.65V to 3.6V		40	
				4.5V to 5.5V		30	

over operating free-air temperature range (unless otherwise noted) [1] [2]

		V_{CCA}	V_{CCB}	MIN	MAX	UNIT
T_A	Operating free-air temperature			–40	85	°C

(1) The A and B sides of an unused data I/O pair must be held in the same state, i.e., both at V_{CCI} or both at GND.
(2) V_{CCA} must be less than or equal to V_{CCB} and must not exceed 3.6V.
(3) V_{CCI} is the supply voltage associated with the input port.

5.4 Thermal Information

THERMAL METRIC [1]		TXB0108										UNIT
		PW	RGY	DQS	YZP	GXY	ZXY	NME	RUK	DGS	RKS	
		20 PINS										
$R_{\theta JA}$	Junction-to-ambient thermal resistance	101.8	35.3	108.5	66.2	156.7	156.7	131.4	56.4	111.9	58.8	°C/W
$R_{\theta JC(top)}$	Junction-to-case (top) thermal resistance	35.5	42.1	32.3	0.4	39.9	39.9	56.5	59.1	51.5	63.9	°C/W
$R_{\theta JB}$	Junction-to-board thermal resistance	52.8	11.1	42.4	52.0	85.9	85.9	83.2	30.5	67	31.6	°C/W
ψ_{JT}	Junction-to-top characterization parameter	2.2	0.7	0.7	1.5	1.1	1.1	1.5	2.7	3.7	5.9	°C/W
ψ_{JB}	Junction-to-board characterization parameter	52.2	11.2	42	51.9	85.4	85.4	82.6	30.5	66.2	31.6	°C/W
$R_{\theta JC(bot)}$	Junction-to-case (bottom) thermal resistance	–	3.8	–	–	–	–	–	15.1	-	15.3	°C/W

(1) For more information about traditional and new thermal metrics, see the IC Package Thermal Metrics application note.

5.5 Electrical Characteristics (DGS/RUK/RKS)

over recommended operating free-air temperature range (unless otherwise noted) [1] [2]

PARAMETER		TEST CONDITIONS	V_{CCA}	V_{CCB}	T_A = 25°C			–40°C to 85°C		UNIT
					MIN	TYP	MAX	MIN	MAX	
V_{OHA}		I_{OH} = –20µA	1.2V			1.1				V
			1.4V to 3.6V					V_{CCA} – 0.4		
V_{OLA}		I_{OL} = 20µA	1.2V			0.3				V
			1.4V to 3.6V						0.4	
V_{OHB}		I_{OH} = –20 µA		1.65V to 5.5V				V_{CCB} – 0.4		V
V_{OLB}		I_{OL} = 20µA		1.65V to 5.5V					0.4	V
I_I	OE		1.2V to 3.6V	1.65V to 5.5V			±1		±2	µA
I_{off}	A port		0V	0V to 5.5V			±1		±2	µA
	B port		0V to 3.6V	0V			±1		±2	
I_{OZ}	A or B port	OE = GND	1.2V to 3.6V	1.65V to 5.5V			±1		±2	µA
I_{CCA}		V_I = V_{CCI} or GND, I_O = 0	1.2V	1.65V to 5.5V		0.45				µA
			1.4V to 3.6V						5	
			3.6V	0V					2	
			0V	5.5V					–2	
I_{CCB}		V_I = V_{CCI} or GND, I_O = 0	1.2V	1.65V to 5.5V		3.4				µA
			1.4V to 3.6V						5	
			3.6V	0V					–2	
			0V	5.5V					2	
I_{CCA} + I_{CCB}		V_I = V_{CCI} or GND, I_O = 0	1.2V	1.65V to 5.5V		3.5				µA
			1.4V to 3.6V						10	

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over recommended operating free-air temperature range (unless otherwise noted)[1] [2]

PARAMETER		TEST CONDITIONS	V$_{CCA}$	V$_{CCB}$	T$_A$ = 25°C			−40°C to 85°C		UNIT
					MIN	TYP	MAX	MIN	MAX	
I$_{CCZA}$		V$_I$ = V$_{CCI}$ or GND, I$_O$ = 0, OE = GND	1.2V	1.65V to 5.5V		0.05				μA
			1.4V to 3.6V						5	
I$_{CCZB}$		V$_I$ = V$_{CCI}$ or GND, I$_O$ = 0, OE = GND	1.2V	1.65V to 5.5V		3.3				μA
			1.4V to 3.6V						5	
C$_I$	OE		1.2V to 3.6V	1.65V to 5.5V		5			6.5	pF
C$_{io}$	A port		1.2V to 3.6V	1.65V to 5.5V		5			6.5	pF
	B port					8			13.3	

(1) V$_{CCI}$ is the supply voltage associated with the input port.
(2) V$_{CCO}$ is the supply voltage associated with the output port.

5.6 Electrical Characteristics (Other Packages)

over recommended operating free-air temperature range (unless otherwise noted)[1] [2]

PARAMETER		TEST CONDITIONS	V$_{CCA}$	V$_{CCB}$	T$_A$ = 25°C			−40°C to 85°C		UNIT
					MIN	TYP	MAX	MIN	MAX	
V$_{OHA}$		I$_{OH}$ = −20µA	1.2V			1.1				V
			1.4V to 3.6V					V$_{CCA}$ − 0.4		
V$_{OLA}$		I$_{OL}$ = 20µA	1.2V			0.3				V
			1.4V to 3.6V						0.4	
V$_{OHB}$		I$_{OH}$ = −20µA		1.65V to 5.5V				V$_{CCB}$ − 0.4		V
V$_{OLB}$		I$_{OL}$ = 20µA		1.65 V to 5.5 V					0.4	V
I$_I$	OE		1.2V to 3.6V	1.65V to 5.5V			±1		±2	µA
I$_{off}$	A port		0V	0V to 5.5V			±1		±2	µA
	B port		0V to 3.6V	0V			±1		±2	
I$_{OZ}$	A or B port	OE = GND	1.2V to 3.6V	1.65V to 5.5V			±1		±2	µA
I$_{CCA}$		V$_I$ = V$_{CCI}$ or GND, I$_O$ = 0	1.2V	1.65V to 5.5V		0.06				µA
			1.4V to 3.6V						5	
			3.6V	0V					2	
			0V	5.5V					−2	
I$_{CCB}$		V$_I$ = V$_{CCI}$ or GND, I$_O$ = 0	1.2V	1.65V to 5.5V		3.4				µA
			1.4V to 3.6V						5	
			3.6V	0V					−2	
			0V	5.5V					2	
I$_{CCA}$ + I$_{CCB}$		V$_I$ = V$_{CCI}$ or GND, I$_O$ = 0	1.2V	1.65V to 5.5V		3.5				µA
			1.4V to 3.6V						10	
I$_{CCZA}$		V$_I$ = V$_{CCI}$ or GND, I$_O$ = 0, OE = GND	1.2V	1.65V to 5.5V		0.05				µA
			1.4V to 3.6V						5	
I$_{CCZB}$		V$_I$ = V$_{CCI}$ or GND, I$_O$ = 0, OE = GND	1.2V	1.65V to 5.5V		3.3				µA
			1.4V to 3.6V						5	
C$_I$	OE		1.2V to 3.6V	1.65V to 5.5V		5			5.5	pF
C$_{io}$	A port		1.2V to 3.6V	1.65V to 5.5V		5			6.5	pF
	B port					8			10	

(1) V$_{CCI}$ is the supply voltage associated with the input port.

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(2) V_{CCO} is the supply voltage associated with the output port.

5.7 Timing Requirements: V_{CCA} = 1.2V

T_A = 25°C, V_{CCA} = 1.2 V

			V_{CCB} = 1.8 V	V_{CCB} = 2.5 V	V_{CCB} = 3.3 V	V_{CCB} = 5 V	UNIT
			TYP	TYP	TYP	TYP	
	Data rate		20	20	20	20	Mbps
t_w	Pulse duration	Data inputs	50	50	50	50	ns

5.8 Timing Requirements: V_{CCA} = 1.5V ± 0.1V

over recommended operating free-air temperature range, V_{CCA} = 1.5V ± 0.1V (unless otherwise noted)

			V_{CCB} = 1.8V ± 0.15V		V_{CCB} = 2.5V ± 0.2V		V_{CCB} = 3.3V ± 0.3V		V_{CCB} = 5V ± 0.5V		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
	Data rate			50		50		50		50	Mbps
t_w	Pulse duration	Data inputs	20		20		20		20		ns

5.9 Timing Requirements: V_{CCA} = 1.8V ± 0.15V

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

			V_{CCB} = 1.8V ± 0.15V		V_{CCB} = 2.5V ± 0.2V		V_{CCB} = 3.3V ± 0.3V		V_{CCB} = 5V ± 0.5V		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
	Data rate			52		60		60		60	Mbps
t_w	Pulse duration	Data inputs	19		17		17		17		ns

5.10 Timing Requirements: V_{CCA} = 2.5V ± 0.2V

over recommended operating free-air temperature range, V_{CCA} = 2.5V ± 0.2V (unless otherwise noted)

			V_{CCB} = 2.5V ± 0.2V		V_{CCB} = 3.3V ± 0.3V		V_{CCB} = 5V ± 0.5V		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	
	Data rate			70		100		100	Mbps
t_w	Pulse duration	Data inputs	14		10		10		ns

5.11 Timing Requirements: V_{CCA} = 3.3V ± 0.3V

over recommended operating free-air temperature range, V_{CCA} = 3.3V ± 0.3V (unless otherwise noted)

			V_{CCB} = 3.3V ± 0.3V		V_{CCB} = 5V ± 0.5V		UNIT
			MIN	MAX	MIN	MAX	
	Data rate			100		100	Mbps
t_w	Pulse duration	Data inputs	10		10		ns

5.12 Switching Characteristics: V_{CCA} = 1.2V (DGS/RUK/RKS)

T_A = 25°C, V_{CCA} = 1.2V

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V_{CCB} = 1.8V	V_{CCB} = 2.5V	V_{CCB} = 3.3V	V_{CCB} = 5V	UNIT
			TYP	TYP	TYP	TYP	
t_{pd}	A	B	9.5	7.9	7.6	8.5	ns
	B	A	9.2	8.8	8.4	8	

$T_A = 25°C$, $V_{CCA} = 1.2V$

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CCB} = 1.8V$ TYP	$V_{CCB} = 2.5V$ TYP	$V_{CCB} = 3.3V$ TYP	$V_{CCB} = 5V$ TYP	UNIT
t_{en}	OE	A	1	1	1	1	µs
		B	1	1	1	1	
t_{dis}	OE	A	392	392	392	392	ns
		B	392	392	392	392	
t_{rA}, t_{fA}	A-port rise and fall times		4.1	4.4	4.1	3.9	ns
t_{rB}, t_{fB}	B-port rise and fall times		5	5	5.1	5.1	ns
$t_{SK(O)}$	Channel-to-channel skew		2.4	1.7	1.9	7	ns
Max data rate			20	20	20	20	Mbps

5.13 Switching Characteristics: V_{CCA} = 1.2V (Other Packages)

$T_A = 25°C$, $V_{CCA} = 1.2V$

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CCB} = 1.8V$ TYP	$V_{CCB} = 2.5V$ TYP	$V_{CCB} = 3.3V$ TYP	$V_{CCB} = 5V$ TYP	UNIT
t_{pd}	A	B	9.5	7.9	7.6	8.5	ns
	B	A	9.2	8.8	8.4	8	
t_{en}	OE	A	1	1	1	1	µs
		B	1	1	1	1	
t_{dis}	OE	A	20	17	17	18	ns
		B	20	16	15	15	
t_{rA}, t_{fA}	A-port rise and fall times		4.1	4.4	4.1	3.9	ns
t_{rB}, t_{fB}	B-port rise and fall times		5	5	5.1	5.1	ns
$t_{SK(O)}$	Channel-to-channel skew		2.4	1.7	1.9	7	ns
Max data rate			20	20	20	20	Mbps

5.14 Switching Characteristics: V_{CCA} = 1.5V ± 0.1V (DGS/RUK/RKS)

over recommended operating free-air temperature range, $V_{CCA} = 1.5V ± 0.1V$ (unless otherwise noted)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CCB} = 1.8V$ ± 0.15V MIN	MAX	$V_{CCB} = 2.5V$ ± 0.2V MIN	MAX	$V_{CCB} = 3.3V$ ± 0.3V MIN	MAX	$V_{CCB} = 5V$ ± 0.5V MIN	MAX	UNIT
t_{pd}	A	B	1.4	12.9	1.2	10.1	1.1	10	0.8	9.9	ns
	B	A	0.9	14.2	0.7	12	0.4	11.7	0.3	13.7	
t_{en}	OE	A		1		1		1		1	µs
		B		1		1		1		1	
t_{dis}	OE	A	278	390	236	305	236	305	236	305	ns
		B	278	390	236	305	236	305	236	305	
t_{rA}, t_{fA}	A-port rise and fall times		0.8	6.5	0.8	6.3	0.8	6.3	0.8	6.3	ns
t_{rB}, t_{fB}	B-port rise and fall times		1	7.3	0.7	4.9	0.7	4.6	0.6	4.6	ns
$t_{SK(O)}$	Channel-to-channel skew			2.6		1.9		1.6		1.3	ns
Max data rate			50		50		50		50		Mbps

Product Folder Links: *TXB0108*

5.15 Switching Characteristics: V_CCA = 1.5V ± 0.1V (Other Packages)

over recommended operating free-air temperature range, V_{CCA} = 1.5V ± 0.1V (unless otherwise noted)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V_CCB = 1.8V ± 0.15V		V_CCB = 2.5V ± 0.2V		V_CCB = 3.3V ± 0.3V		V_CCB = 5V ± 0.5V		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
t_{pd}	A	B	1.4	12.9	1.2	10.1	1.1	10	0.8	9.9	ns
	B	A	0.9	14.2	0.7	12	0.4	11.7	0.3	13.7	
t_{en}	OE	A		1		1		1		1	µs
		B		1		1		1		1	
t_{dis}	OE	A	6.6	33	6.4	25.3	6.1	23.1	5.9	24.6	ns
		B	6.6	35.6	5.8	25.6	5.5	22.1	5.6	20.6	
t_{rA}, t_{fA}	A-port rise and fall times		0.8	6.5	0.8	6.3	0.8	6.3	0.8	6.3	ns
t_{rB}, t_{fB}	B-port rise and fall times		1	7.3	0.7	4.9	0.7	4.6	0.6	4.6	ns
$t_{SK(O)}$	Channel-to-channel skew			2.6		1.9		1.6		1.3	ns
Max data rate			50		50		50		50		Mbps

5.16 Switching Characteristics: V_CCA = 1.8V ± 0.15V (DGS/RUK/RKS)

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V_CCB = 1.8V ± 0.15V		V_CCB = 2.5V ± 0.2V		V_CCB = 3.3V ± 0.3V		V_CCB = 5V ± 0.5V		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
t_{pd}	A	B	1.6	11	1.4	7.7	1.3	6.8	1.2	6.5	ns
	B	A	1.5	12	1.2	8.4	0.8	7.6	0.5	7.1	
t_{en}	OE	A		1		1		1		1	µs
		B		1		1		1		1	
t_{dis}	OE	A	278	389	191	253	190	248	189	248	ns
		B	278	389	191	253	190	248	189	248	
t_{rA}, t_{fA}	A-port rise and fall times		0.7	5.1	0.7	5	1	5	0.7	5	ns
t_{rB}, t_{fB}	B-port rise and fall times		1	7.3	0.7	5	0.7	3.9	0.6	3.8	ns
$t_{SK(O)}$	Channel-to-channel skew			0.8		0.7		0.6		0.6	ns
Max data rate			52		60		60		60		Mbps

5.17 Switching Characteristics: V_CCA = 1.8V ± 0.15V (Other Packages)

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V_CCB = 1.8V ± 0.15V		V_CCB = 2.5V ± 0.2V		V_CCB = 3.3V ± 0.3V		V_CCB = 5V ± 0.5V		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
t_{pd}	A	B	1.6	11	1.4	7.7	1.3	6.8	1.2	6.5	ns
	B	A	1.5	12	1.2	8.4	0.8	7.6	0.5	7.1	
t_{en}	OE	A		1		1		1		1	µs
		B		1		1		1		1	
t_{dis}	OE	A	5.9	26.7	5.6	21.6	5.4	18.9	4.8	18.7	ns
		B	6.1	33.9	5.2	23.7	5	19.9	5	17.6	
t_{rA}, t_{fA}	A-port rise and fall times		0.7	5.1	0.7	5	1	5	0.7	5	ns
t_{rB}, t_{fB}	B-port rise and fall times		1	7.3	0.7	5	0.7	3.9	0.6	3.8	ns
$t_{SK(O)}$	Channel-to-channel skew			0.8		0.7		0.6		0.6	ns

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V_{CCB} = 1.8V ± 0.15V		V_{CCB} = 2.5V ± 0.2V		V_{CCB} = 3.3V ± 0.3V		V_{CCB} = 5V ± 0.5V		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
Max data rate			52		60		60		60		Mbps

5.18 Switching Characteristics: V_{CCA} = 2.5V ± 0.2V (DGS/RUK/RKS)

over recommended operating free-air temperature range, V_{CCA} = 2.5V ± 0.2V (unless otherwise noted)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V_{CCB} = 2.5V ± 0.2V		V_{CCB} = 3.3V ± 0.3V		V_{CCB} = 5V ± 0.5V		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	
t_{pd}	A	B	1.1	6.4	1	5.3	0.9	4.7	ns
	B	A	1	7	0.6	5.6	0.3	4.4	
t_{en}	OE	A		1		1		1	µs
		B		1		1		1	
t_{dis}	OE	A	190	252	137	184	133	169	ns
		B	190	252	137	184	133	169	
t_{rA}, t_{fA}	A-port rise and fall times		0.8	3.6	0.6	3.6	0.5	3.5	ns
t_{rB}, t_{fB}	B-port rise and fall times		0.6	4.9	0.7	3.9	0.6	3.2	ns
$t_{SK(O)}$	Channel-to-channel skew			0.4		0.3		0.3	ns
Max data rate			70		100		100		Mbps

5.19 Switching Characteristics: V_{CCA} = 2.5V ± 0.2V (Other Packages)

over recommended operating free-air temperature range, V_{CCA} = 2.5V ± 0.2V (unless otherwise noted)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V_{CCB} = 2.5V ± 0.2V		V_{CCB} = 3.3V ± 0.3V		V_{CCB} = 5V ± 0.5V		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	
t_{pd}	A	B	1.1	6.4	1	5.3	0.9	4.7	ns
	B	A	1	7	0.6	5.6	0.3	4.4	
t_{en}	OE	A		1		1		1	µs
		B		1		1		1	
t_{dis}	OE	A	5	16.9	4.9	15	4.5	13.8	ns
		B	4.8	21.8	4.5	17.9	4.4	15.2	
t_{rA}, t_{fA}	A-port rise and fall times		0.8	3.6	0.6	3.6	0.5	3.5	ns
t_{rB}, t_{fB}	B-port rise and fall times		0.6	4.9	0.7	3.9	0.6	3.2	ns
$t_{SK(O)}$	Channel-to-channel skew			0.4		0.3		0.3	ns
Max data rate			70		100		100		Mbps

5.20 Switching Characteristics: V_{CCA} = 3.3V ± 0.3V (DGS/RUK/RKS)

over recommended operating free-air temperature range, V_{CCA} = 3.3V ± 0.3V (unless otherwise noted)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V_{CCB} = 3.3V ± 0.3V		V_{CCB} = 5V ± 0.5V		UNIT
			MIN	MAX	MIN	MAX	
t_{pd}	A	B	0.9	4.9	0.8	4	ns
	B	A	0.5	5.4	0.2	4	
t_{en}	OE	A		1		1	µs
		B		1		1	

over recommended operating free-air temperature range, V_{CCA} = 3.3V ± 0.3V (unless otherwise noted)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V_{CCB} = 3.3V ± 0.3V MIN	MAX	V_{CCB} = 5V ± 0.5V MIN	MAX	UNIT
t_{dis}	OE	A	137	183	97.6	127	ns
		B	137	183	97.6	127	
t_{rA}, t_{fA}	A-port rise and fall times		0.5	3	0.5	3	ns
t_{rB}, t_{fB}	B-port rise and fall times		0.7	3.9	0.6	3.2	ns
$t_{SK(O)}$	Channel-to-channel skew			0.4		0.3	ns
Max data rate			100		100		Mbps

5.21 Switching Characteristics: V_{CCA} = 3.3V ± 0.3V (Other Packages)

over recommended operating free-air temperature range, V_{CCA} = 3.3V ± 0.3V (unless otherwise noted)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V_{CCB} = 3.3V ± 0.3V MIN	MAX	V_{CCB} = 5V ± 0.5V MIN	MAX	UNIT
t_{pd}	A	B	0.9	4.9	0.8	4	ns
	B	A	0.5	5.4	0.2	4	
t_{en}	OE	A		1		1	µs
		B		1		1	
t_{dis}	OE	A	4.5	13.9	4.1	12.4	ns
		B	4.1	17.3	4	14.4	
t_{rA}, t_{fA}	A-port rise and fall times		0.5	3	0.5	3	ns
t_{rB}, t_{fB}	B-port rise and fall times		0.7	3.9	0.6	3.2	ns
$t_{SK(O)}$	Channel-to-channel skew			0.4		0.3	ns
Max data rate			100		100		Mbps

5.22 Operating Characteristics

T_A = 25°C

PARAMETER		TEST CONDITIONS	V_{CCA} 1.2V	1.2V	1.5V	1.8V	2.5V	2.5V	3.3V	UNIT
			V_{CCB} 5V	1.8V	1.8V	1.8V	2.5V	5V	3.3V to 5V	
			TYP	TYP	TYP	TYP	TYP	TYP	TYP	
C_{pdA}	A-port input, B-port output	C_L = 0, f = 10MHz, t_r = t_f = 1ns, OE = V_{CCA} (outputs enabled)	9	8	7	7	7	7	8	pF
	B-port input, A-port output		12	11	11	11	11	11	11	
C_{pdB}	A-port input, B-port output		35	26	27	27	27	27	28	
	B-port input, A-port output		26	19	18	18	18	20	21	
C_{pdA}	A-port input, B-port output	C_L = 0, f = 10MHz, t_r = t_f = 1ns, OE = GND (outputs disabled)	0.01	0.01	0.01	0.01	0.01	0.01	0.01	pF
	B-port input, A-port output		0.01	0.01	0.01	0.01	0.01	0.01	0.01	
C_{pdB}	A-port input, B-port output		0.01	0.01	0.01	0.01	0.01	0.01	0.03	
	B-port input, A-port output		0.01	0.01	0.01	0.01	0.01	0.01	0.03	

5.23 Typical Characteristics
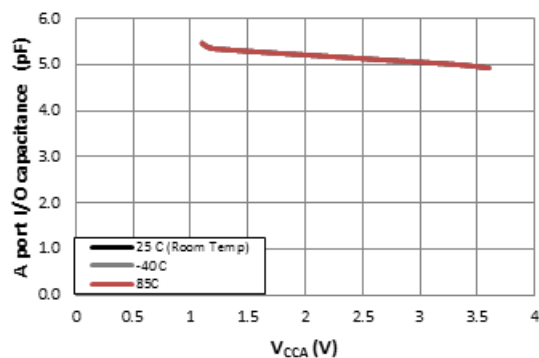
$V_{CCB} = 3.3V$

Figure 5-1. Input Capacitance for OE Pin (C_I) vs Power Supply (V_{CCA})
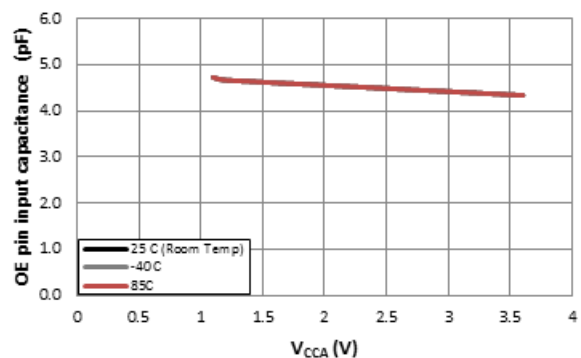
$V_{CCB} = 3.3V$

Figure 5-2. Capacitance for A Port I/O Pins (C_{IO}) vs Power Supply (V_{CCA})
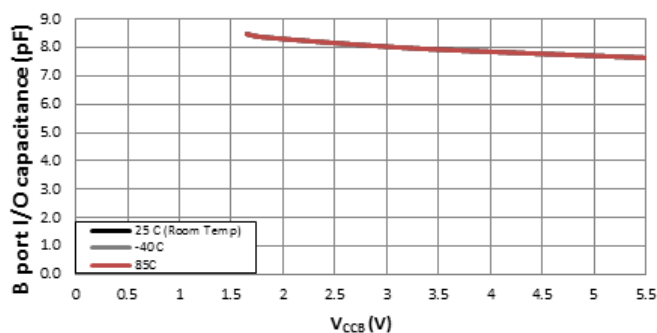
$V_{CCA} = 1.8V$

Figure 5-3. Capacitance fpr B Port I/O Pins (C_{IO}) vs Power Supply (V_{CCB})

Product Folder Links: *TXB0108*

6 Parameter Measurement Information

LOAD CIRCUIT FOR MAX DATA RATE, PULSE DURATION PROPAGATION DELAY OUTPUT RISE AND FALL TIME MEASUREMENT

LOAD CIRCUIT FOR ENABLE/DISABLE TIME MEASUREMENT

TEST	S1
t_{PZL}/t_{PLZ}	$2 \times V_{CCO}$
t_{PHZ}/t_{PZH}	Open

VOLTAGE WAVEFORMS PROPAGATION DELAY TIMES

VOLTAGE WAVEFORMS PULSE DURATION
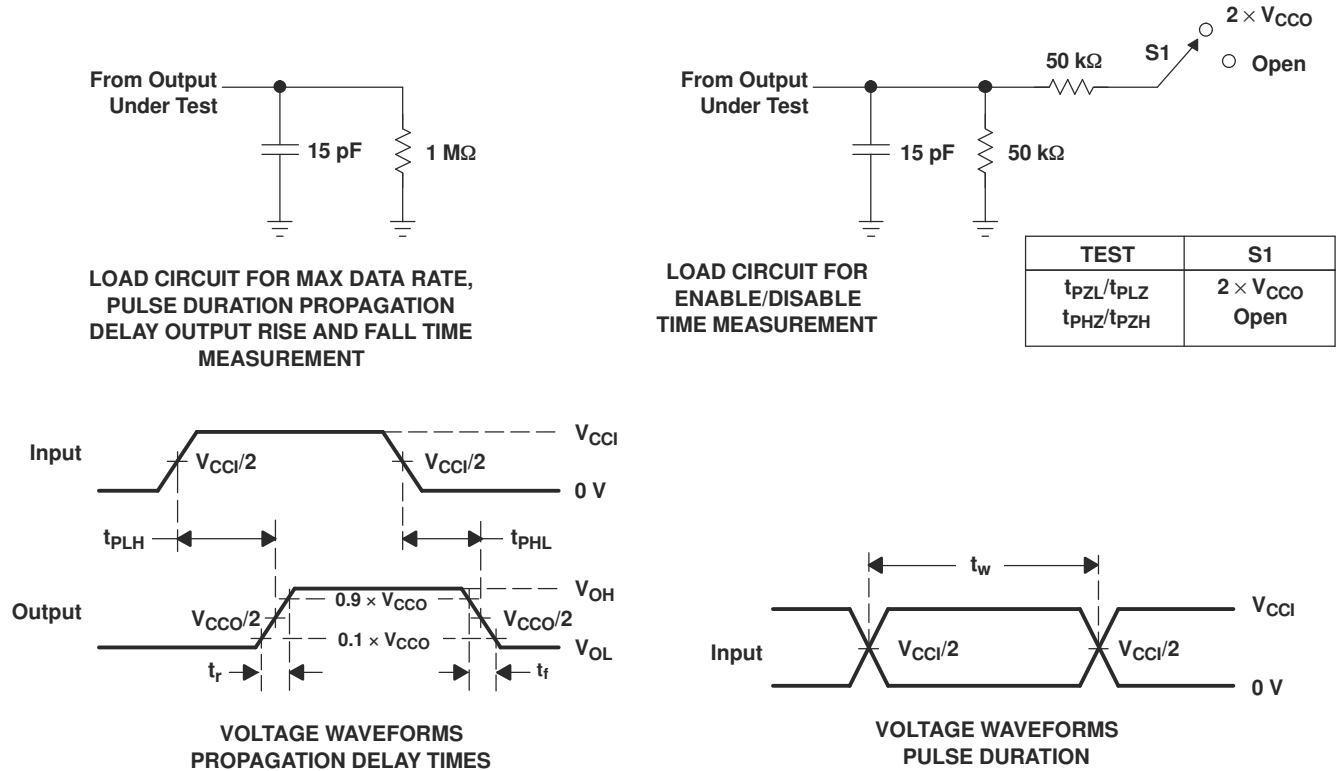
A. C_L includes probe and jig capacitance.
B. All input pulses are supplied by generators having the following characteristics: PRR ≤ 10 MHz, Z_O = 50 Ω, dv/dt ≥ 1 V/ns.
C. The outputs are measured one at a time, with one transition per measurement.
D. t_{PLH} and t_{PHL} are the same as t_{pd}.
E. V_{CCI} is the V_{CC} associated with the input port.
F. V_{CCO} is the V_{CC} associated with the output port.
G. All parameters and waveforms are not applicable to all devices.

Figure 6-1. Load Circuits and Voltage Waveforms

7 Detailed Description

7.1 Overview

The TXB0108 device is an 8-bit, directionless voltage-level translator specifically designed for translating logic voltage levels. The A port is able to accept I/O voltages ranging from 1.2V to 3.6V, while the B port can accept I/O voltages from 1.65V to 5.5V. The device is a buffered architecture with edge-rate accelerators (one-shots) to improve the overall data rate. This device can only translate push-pull CMOS logic outputs. If for open-drain signal translation, please refer to TI TXS products.

7.2 Functional Block Diagram

Product Folder Links: *TXB0108*
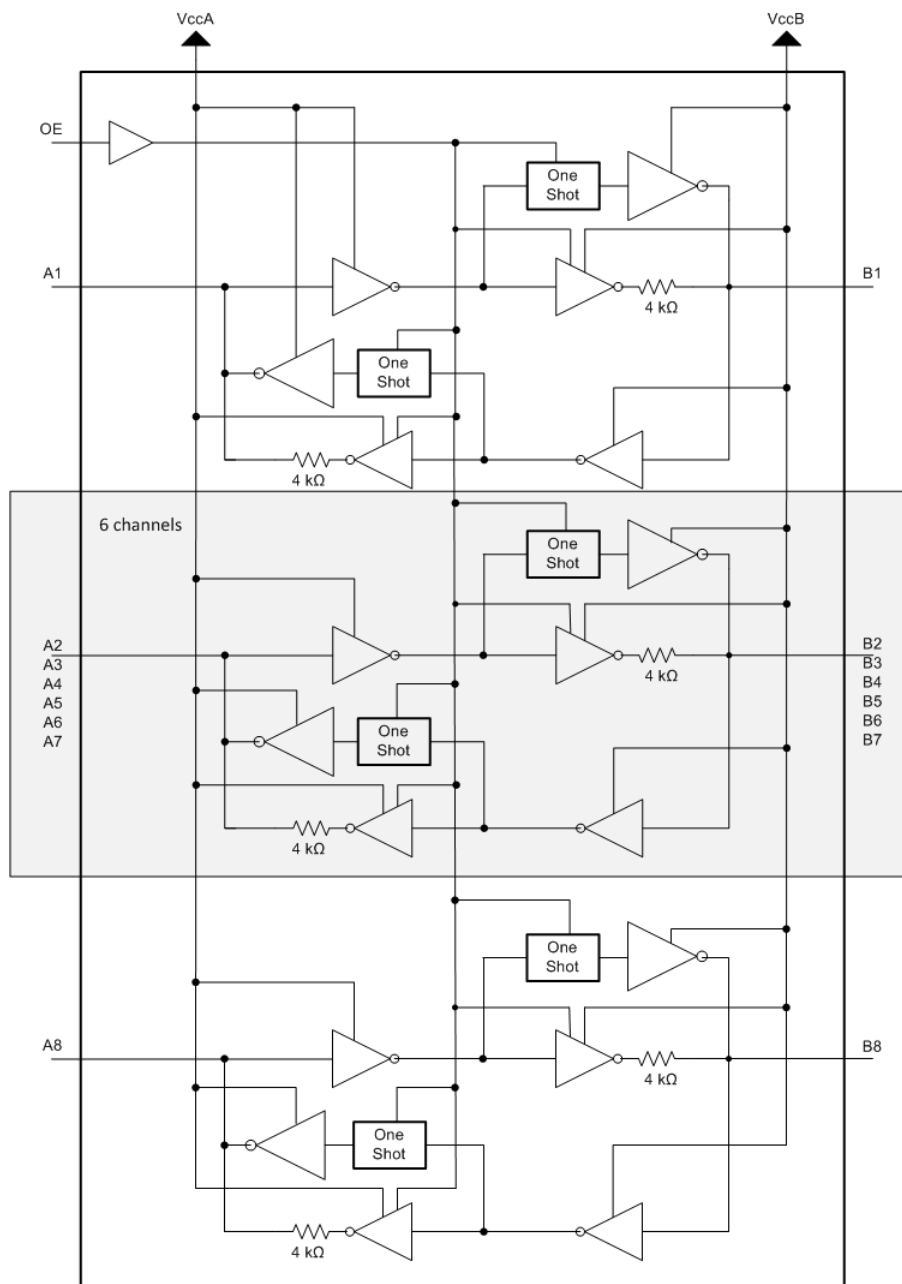
7.3 Feature Description

7.3.1 Architecture

The TXB0108 architecture (see Figure 7-1) does not require a direction-control signal to control the direction of data flow from A to B or from B to A. In a dc state, the output drivers of the TXB0108 can maintain a high or low, but are designed to be weak so that they can be overdriven by an external driver when data on the bus starts flowing the opposite direction. The output one-shots detect rising or falling edges on the A or B ports. During a rising edge, the one-shot turns on the PMOS transistors (T1, T3) for a short duration, which speeds up the low-to-high transition. Similarly, during a falling edge, the one-shot turns on the NMOS transistors (T2, T4) for a short duration, which speeds up the high-to-low transition. The typical output impedance during output transition is 70Ω at VCCO = 1.2V to 1.8V, 50Ω at VCCO = 1.8V to 3.3V and 40Ω at VCCO = 3.3V to 5V.
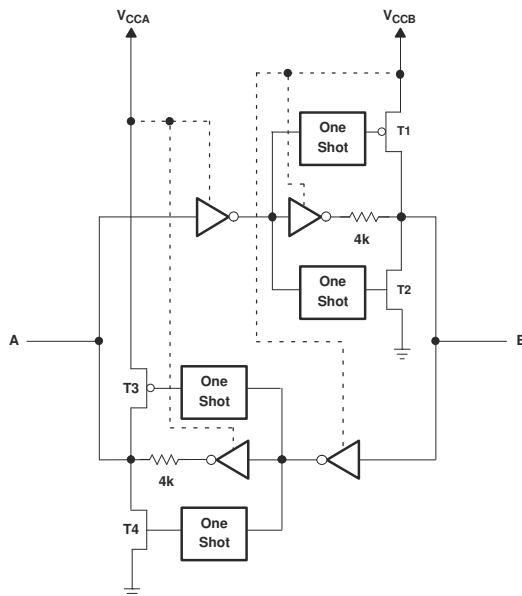
Figure 7-1. Architecture of TXB0108 I/O Cell

7.3.2 Input Driver Requirements

Typical I_{IN} vs V_{IN} characteristics of the TXB0108 are shown in Figure 7-2. For proper operation, the device driving the data I/Os of the TXB0108 must have drive strength of at least ±2mA.

A. V_T is the input threshold voltage of the TXB0108 (typically $V_{CCI}/2$).
B. V_D is the supply voltage of the external driver.
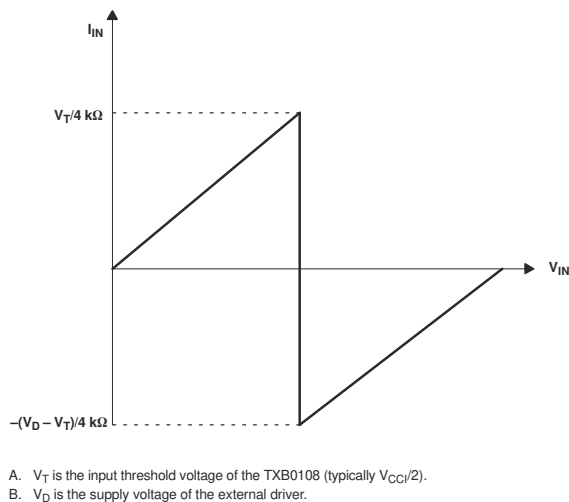
Figure 7-2. Typical I_{IN} vs V_{IN} Curve

7.3.3 Output Load Considerations

TI recommends careful PCB layout practices with short PCB trace lengths to avoid excessive capacitive loading and to ensure that proper O.S. triggering takes place. PCB signal trace-lengths should be kept short enough such that the round-trip delay of any reflection is less than the one-shot duration. This improves signal integrity by ensuring that any reflection sees a low impedance at the driver. The O.S. circuits have been designed to stay on for approximately 10ns. The maximum capacitance of the lumped load that can be driven also depends directly on the one-shot duration. With very heavy capacitive loads, the one-shot can time-out before the signal is driven fully to the positive rail. The O.S. duration has been set to best optimize trade-offs between dynamic ICC, load driving capability, and maximum bit-rate considerations. Both PCB trace length and connectors add to the capacitance that the TXB0108 output sees, so it is recommended that this lumped-load capacitance be considered to avoid O.S. re-triggering, bus contention, output signal oscillations, or other adverse system-level affects.

7.3.4 Enable and Disable

The TXB0108 has an OE input that is used to disable the device by setting OE = low, which places all I/Os in the high-impedance (Hi-Z) state. The disable time (tdis) indicates the delay between when OE goes low and when the outputs actually get disabled (Hi-Z). The enable time (ten) indicates the amount of time the user must allow for the one-shot circuitry to become operational after the OE is high.

7.3.5 Pullup or Pulldown Resistors on I/O Lines

The TXB0108 is designed to drive capacitive loads of up to 70pF. The output drivers of the TXB0108 have low dc drive strength. If pullup or pulldown resistors are connected externally to the data I/Os, their values must be kept higher than 50kΩ to ensure that they do not contend with the output drivers of the TXB0108. For the same reason, the TXB0108 should not be used in applications such as I2C or 1-Wire where an open-drain driver is connected on the bidirectional data I/O. For these applications, use a device from the TI TXS01xx series of level translators.

7.4 Device Functional Modes

The TXB0108 device has two functional modes, enabled and disabled. To disable the device, set the OE input low, which places all I/Os in a high impedance state. Setting the OE input high will enable the device.

8 Application and Implementation

Note

Information in the following applications sections is not part of the TI component specification, and TI does not warrant its accuracy or completeness. TI's customers are responsible for determining suitability of components for their purposes, as well as validating and testing their design implementation to confirm system functionality.

8.1 Application Information

The TXB0108 can be used in level-translation applications for interfacing devices or systems operating at different interface voltages with one another. It can only translate push-pull CMOS logic outputs. If for open-drain signal translation, please refer to TI TXS010X products. Any external pulldown or pullup resistors are recommended to be larger than 50kΩ.

8.2 Typical Application
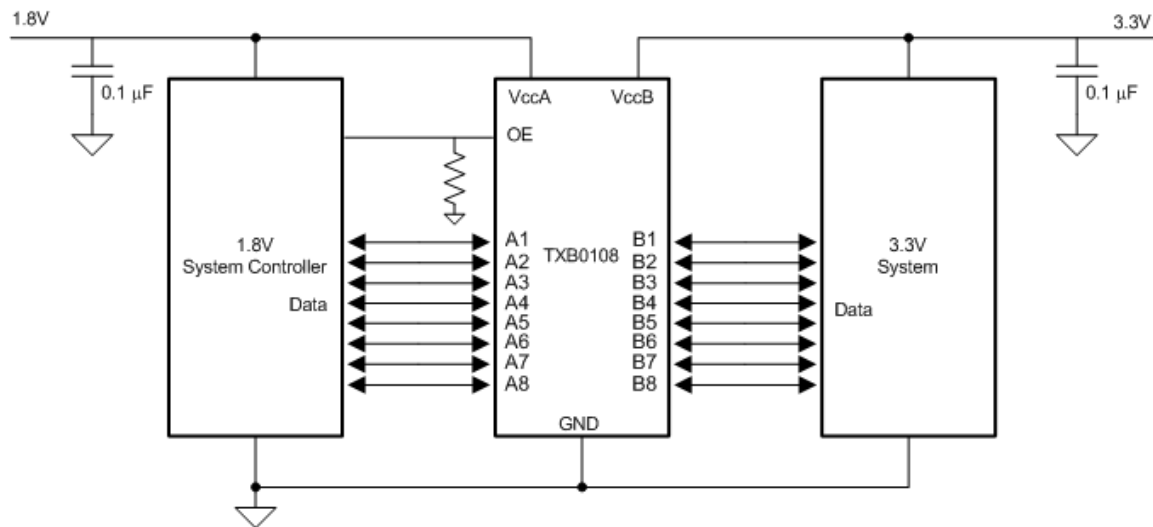
Figure 8-1. Typical Operating Circuit

8.2.1 Design Requirements

For this design example, use the parameters listed in Table 8-1. Make sure the VCCA ≤VCCB.

Table 8-1. Design Parameters

DESIGN PARAMETER	EXAMPLE VALUE
Input voltage range	1.2V to 3.6V
Output voltage range	1.65V to 5.5V

8.2.2 Detailed Design Procedure

To begin the design process, determine the following:

- Input voltage range
  - Use the supply voltage of the device that is driving the TXB0108 device to determine the input voltage range. For a valid logic high the value must exceed the VIH of the input port. For a valid logic low, the value must be less than the VIL of the input port.
- Output voltage range
  - Use the supply voltage of the device that the TXB0108 device is driving to determine the output voltage range.

– Do not recommend having the external pullup or pulldown resistors. If mandatory, it is recommended the value should be larger than 50kΩ.

An external pulldown or pullup resistor decreases the output V_{OH} and V_{OL}. Use the below equations to draft estimate the V_{OH} and V_{OL} as a result of an external pulldown and pullup resistor.

$V_{OH} = V_{CCx} \times R_{PD} / (R_{PD} + 4.5\text{k}\Omega)$

$V_{OL} = V_{CCx} \times 4.5\text{k}\Omega / (R_{PU} + 4.5\text{k}\Omega)$

Where:

- V_{CCx} is the output port supply voltage on either VCCA or VCCB.
- R_{PD} is the value of the external pull down resistor.
- R_{PU} is the value of the external pull up resistor.
- 4.5kΩ is the counting the variation of the serial resistor 4kΩ in the I/O line. Refer to the Effects of external pullup and pulldown resistors on TXB application note.

8.2.3 Application Curves
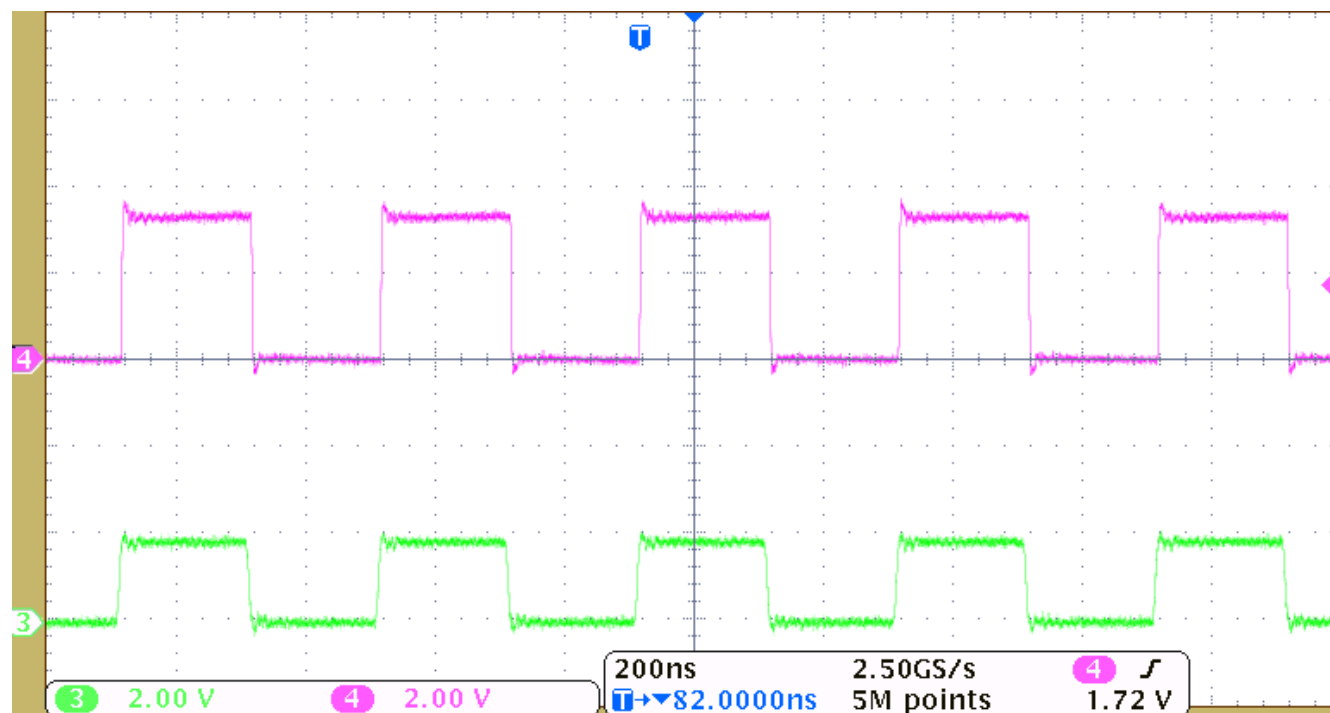
Figure 8-2. Level-Translation of a 2.5MHz Signal

Product Folder Links: *TXB0108*

9 Power Supply Recommendations

During operation, ensure that $V_{CCA} \leq V_{CCB}$ at all times. During power-up sequencing, $V_{CCA} \geq V_{CCB}$ does not damage the device, so any power supply can be ramped up first. The TXB0108-Q1 has circuitry that disables all output ports when either VCC is switched off ($V_{CCA/B}$ = 0V).

The output-enable (OE) input circuit is designed so that it is supplied by V_{CCA} and when the (OE) input is low, all outputs are placed in the high-impedance state. To ensure the high-impedance state of the outputs during power-up or power-down, the OE input pin must be tied to GND through a pulldown resistor and must not be enabled until V_{CCA} and V_{CCB} are fully ramped and stable. The minimum value of the pulldown resistor to ground is determined by the current-sourcing capability of the driver.

10 Layout

10.1 Layout Guidelines

To ensure reliability of the device, the following common printed-circuit board layout guidelines is recommended.

- Bypass capacitors should be used on power supplies and should be placed as close as possible to the V_{CCA}, V_{CCB} pin and GND pin.
- Short trace lengths should be used to avoid excessive loading.
- PCB signal trace-lengths must be kept short enough so that the round-trip delay of any reflection is less than the one-shot duration, approximately 10ns, ensuring that any reflection encounters low impedance at the source driver.

10.2 Layout Example
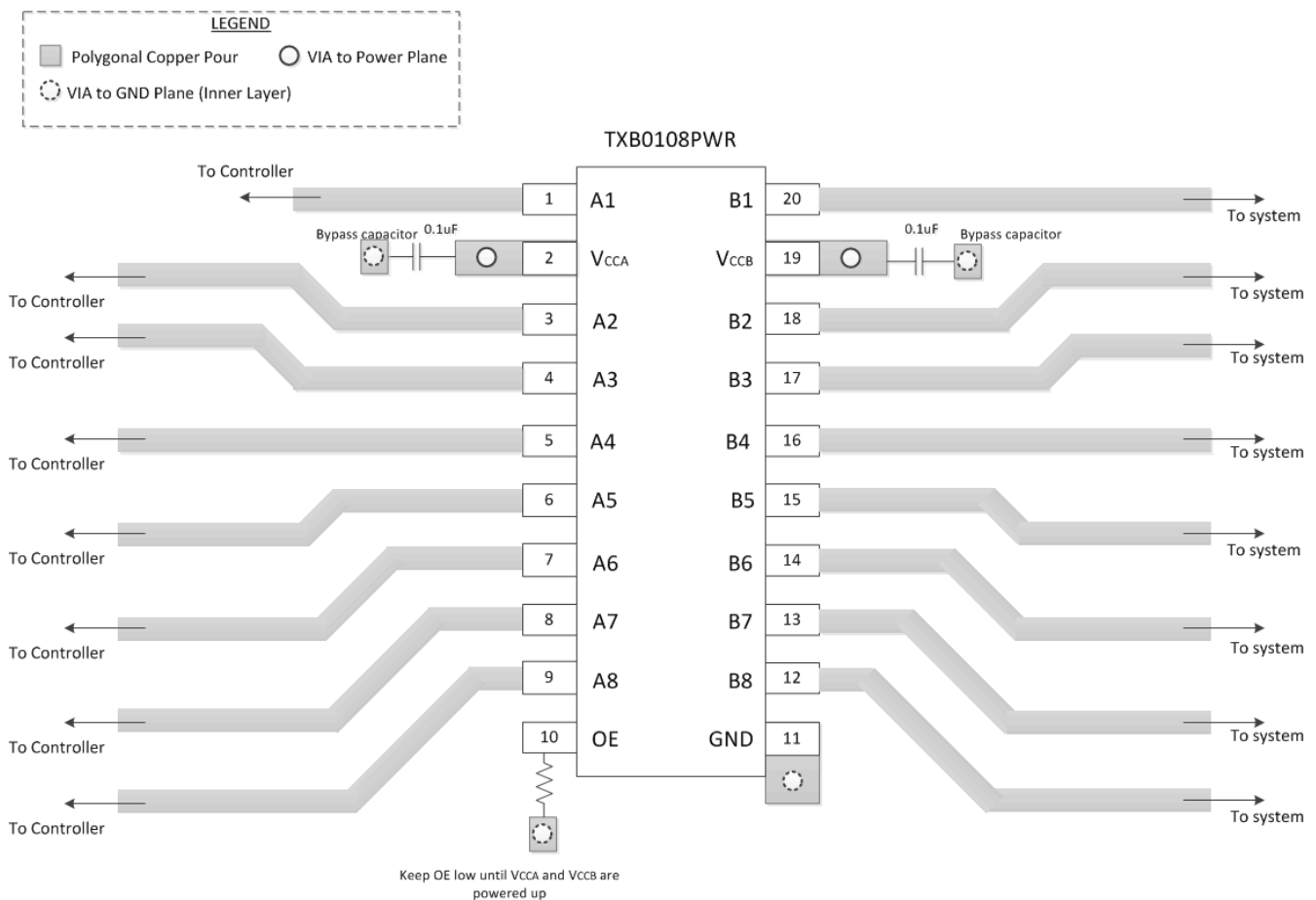
11 Device and Documentation Support

11.1 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on ti.com. Click on *Notifications* to register and receive a weekly digest of any product information that has changed. For change details, review the revision history included in any revised document.

11.2 Support Resources

TI E2E™ support forums are an engineer's go-to source for fast, verified answers and design help — straight from the experts. Search existing answers or ask your own question to get the quick design help you need.

Linked content is provided "AS IS" by the respective contributors. They do not constitute TI specifications and do not necessarily reflect TI's views; see TI's Terms of Use.

11.3 Trademarks

TI E2E™ is a trademark of Texas Instruments.
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11.4 Electrostatic Discharge Caution

This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

11.5 Glossary

TI Glossary   This glossary lists and explains terms, acronyms, and definitions.

12 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

13 Mechanical, Packaging, and Orderable Information

The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.

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)
TXB0108DGSR	Active	Production	VSSOP (DGS) | 20	5000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	YE08
TXB0108DGSR.A	Active	Production	VSSOP (DGS) | 20	5000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	YE08
TXB0108DQSR	Active	Production	USON (DQS) | 20	3000 | LARGE T&R	Yes	NIPDAUAG	Level-1-260C-UNLIM	-40 to 85	5MR 5MH
TXB0108DQSR.A	Active	Production	USON (DQS) | 20	3000 | LARGE T&R	Yes	NIPDAUAG	Level-1-260C-UNLIM	-40 to 85	5MR 5MH
TXB0108DQSR.B	Active	Production	USON (DQS) | 20	3000 | LARGE T&R	Yes	NIPDAUAG	Level-1-260C-UNLIM	-40 to 85	5MR 5MH
TXB0108NMER	Active	Production	NFBGA (NME) | 20	2500 | LARGE T&R	Yes	SNAGCU	Level-2-260C-1 YEAR	-40 to 85	29WW
TXB0108NMER.B	Active	Production	NFBGA (NME) | 20	2500 | LARGE T&R	Yes	SNAGCU	Level-2-260C-1 YEAR	-40 to 85	29WW
TXB0108PWR	Active	Production	TSSOP (PW) | 20	2000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	YE08
TXB0108PWR.A	Active	Production	TSSOP (PW) | 20	2000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	YE08
TXB0108PWR.B	Active	Production	TSSOP (PW) | 20	2000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	YE08
TXB0108PWRG4	Active	Production	TSSOP (PW) | 20	2000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	YE08
TXB0108RGYR	Active	Production	VQFN (RGY) | 20	3000 | LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 85	YE08
TXB0108RGYR.A	Active	Production	VQFN (RGY) | 20	3000 | LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 85	YE08
TXB0108RGYR.B	Active	Production	VQFN (RGY) | 20	3000 | LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 85	YE08
TXB0108RGYRG4	Active	Production	VQFN (RGY) | 20	3000 | LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 85	YE08
TXB0108RGYRG4.A	Active	Production	VQFN (RGY) | 20	3000 | LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 85	YE08
TXB0108RGYRG4.B	Active	Production	VQFN (RGY) | 20	3000 | LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 85	YE08
TXB0108RUKR	Active	Production	WQFN (RUK) | 20	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	YE08
TXB0108YZPR	Active	Production	DSBGA (YZP) | 20	3000 | LARGE T&R	Yes	SNAGCU	Level-1-260C-UNLIM	-40 to 85	5M
TXB0108YZPR.B	Active	Production	DSBGA (YZP) | 20	3000 | LARGE T&R	Yes	SNAGCU	Level-1-260C-UNLIM	-40 to 85	5M
TXB0108YZPR2	Active	Production	DSBGA (YZP) | 20	3000 | LARGE T&R	Yes	SNAGCU	Level-1-260C-UNLIM	-40 to 85	EK
TXB0108YZPR2.B	Active	Production	DSBGA (YZP) | 20	3000 | LARGE T&R	Yes	SNAGCU	Level-1-260C-UNLIM	-40 to 85	EK
TXB0108ZXYR	Obsolete	Production	BGA MICROSTAR JUNIOR (ZXY) | 20	-	-	Call TI	Call TI	-40 to 85	

(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.

OTHER QUALIFIED VERSIONS OF TXB0108 :

- Automotive : TXB0108-Q1

NOTE: Qualified Version Definitions:

- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects

PACKAGE MATERIALS INFORMATION

TAPE AND REEL INFORMATION

REEL DIMENSIONS

TAPE DIMENSIONS

A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE

User Direction of Feed

Pocket Quadrants

*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
TXB0108DGSR	VSSOP	DGS	20	5000	330.0	16.4	5.4	5.4	1.45	8.0	16.0	Q1
TXB0108DQSR	USON	DQS	20	3000	177.8	12.4	2.21	4.22	0.81	4.0	12.0	Q1
TXB0108NMER	NFBGA	NME	20	2500	330.0	12.4	2.85	3.4	1.34	4.0	12.0	Q2
TXB0108PWR	TSSOP	PW	20	2000	330.0	16.4	6.95	7.0	1.4	8.0	16.0	Q1
TXB0108RGYR	VQFN	RGY	20	3000	330.0	12.4	3.71	4.71	1.1	8.0	12.0	Q1
TXB0108RGYRG4	VQFN	RGY	20	3000	330.0	12.4	3.71	4.71	1.1	8.0	12.0	Q1
TXB0108RUKR	WQFN	RUK	20	3000	330.0	12.4	3.3	3.3	1.1	8.0	12.0	Q2
TXB0108YZPR	DSBGA	YZP	20	3000	180.0	8.4	1.99	2.49	0.56	4.0	8.0	Q1
TXB0108YZPR2	DSBGA	YZP	20	3000	180.0	8.4	1.99	2.49	0.56	4.0	8.0	Q2

TAPE AND REEL BOX DIMENSIONS

*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TXB0108DGSR	VSSOP	DGS	20	5000	353.0	353.0	32.0
TXB0108DQSR	USON	DQS	20	3000	202.0	201.0	28.0
TXB0108NMER	NFBGA	NME	20	2500	336.6	336.6	31.8
TXB0108PWR	TSSOP	PW	20	2000	353.0	353.0	32.0
TXB0108RGYR	VQFN	RGY	20	3000	353.0	353.0	32.0
TXB0108RGYRG4	VQFN	RGY	20	3000	353.0	353.0	32.0
TXB0108RUKR	WQFN	RUK	20	3000	367.0	367.0	35.0
TXB0108YZPR	DSBGA	YZP	20	3000	182.0	182.0	20.0
TXB0108YZPR2	DSBGA	YZP	20	3000	182.0	182.0	20.0

RGY 20

VQFN - 1 mm max height

3.5 x 4.5, 0.5 mm pitch
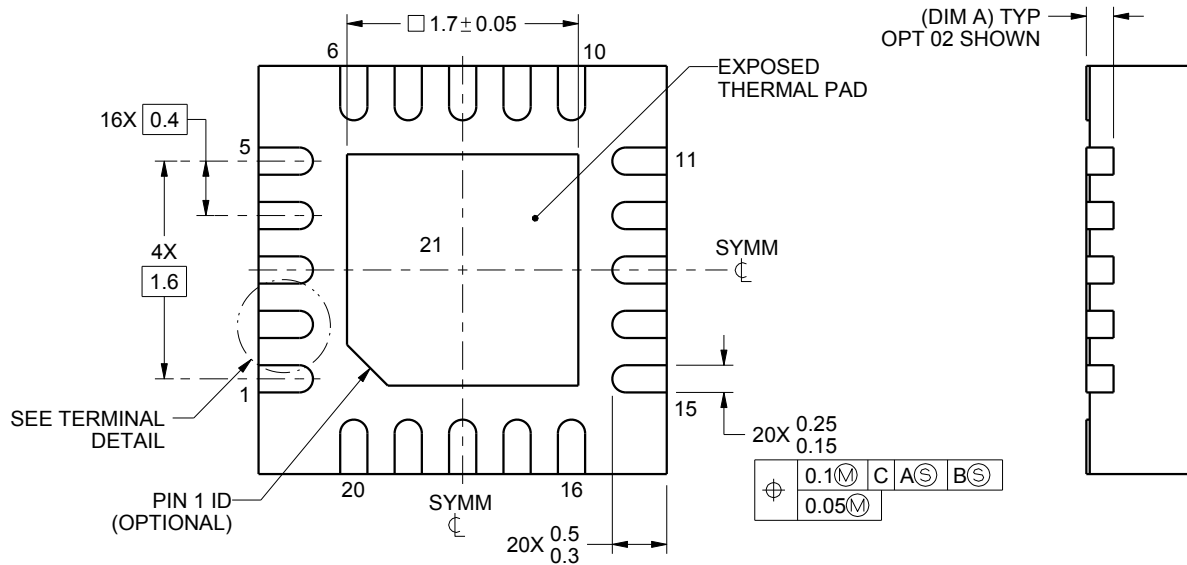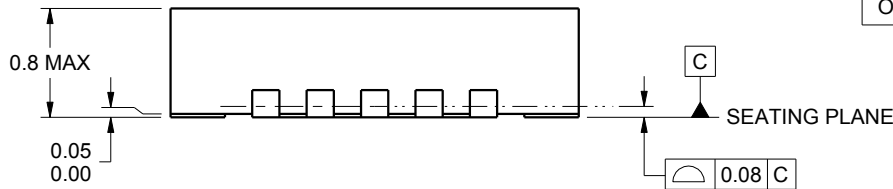
This image is a representation of the package family, actual package may vary.
Refer to the product data sheet for package details.

4225264/A

A ← 3.65 / 3.35 → B

PIN 1 INDEX AREA

4.65 / 4.35

1.0 / 0.8

0.05 / 0.00

C

SEATING PLANE

0.08 C

2.05± 0.1

2X 1.5

10   11

9

14X 0.5

2X 3.5

SYMM

21

3.05± 0.1

2

PIN 1 ID   1   20

SYMM

EXPOSED THERMAL PAD

12

19

20X 0.30 / 0.18

20X 0.5 / 0.3

0.1 Ⓜ C A B
0.05 Ⓜ

(0.2) TYP
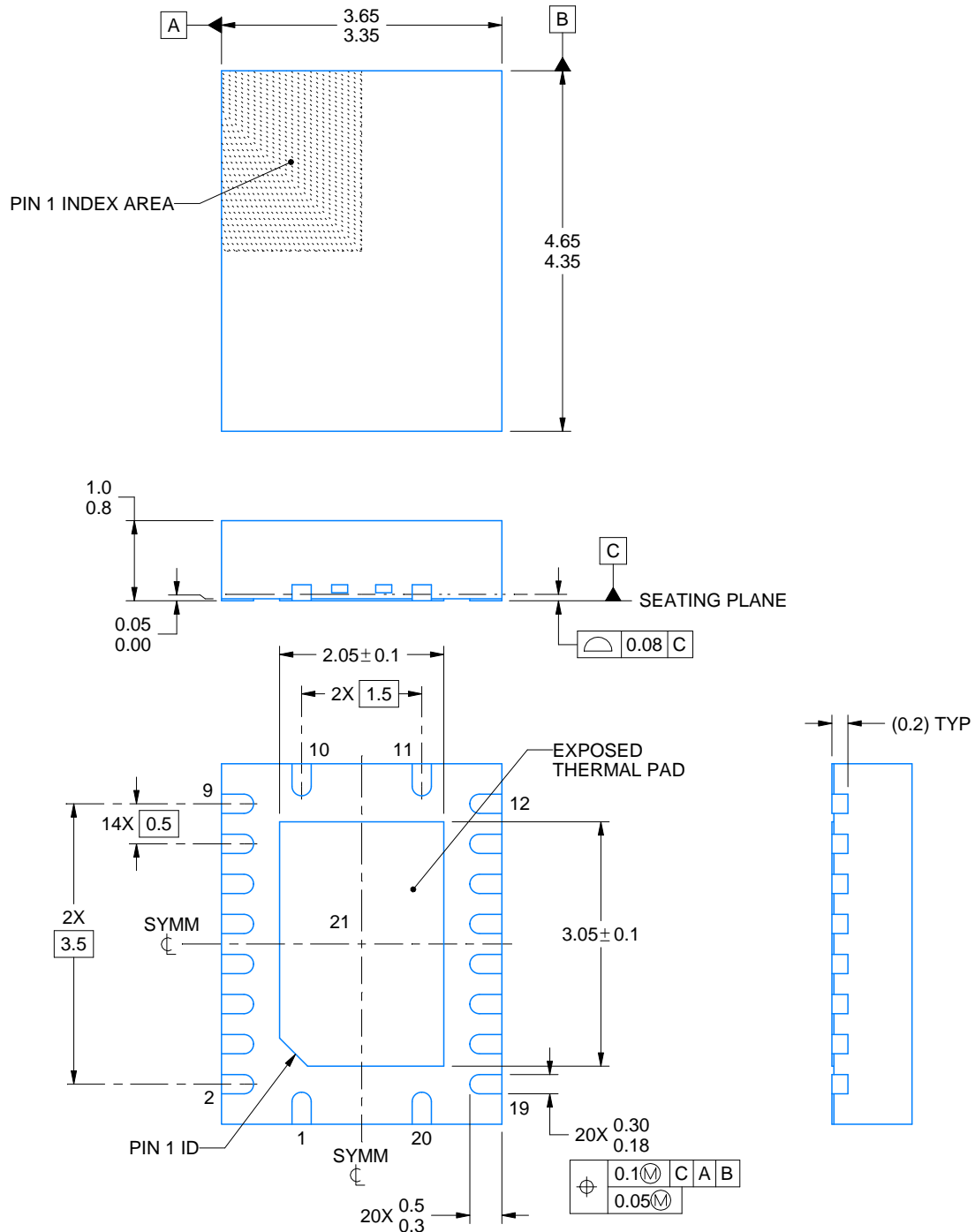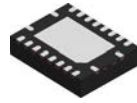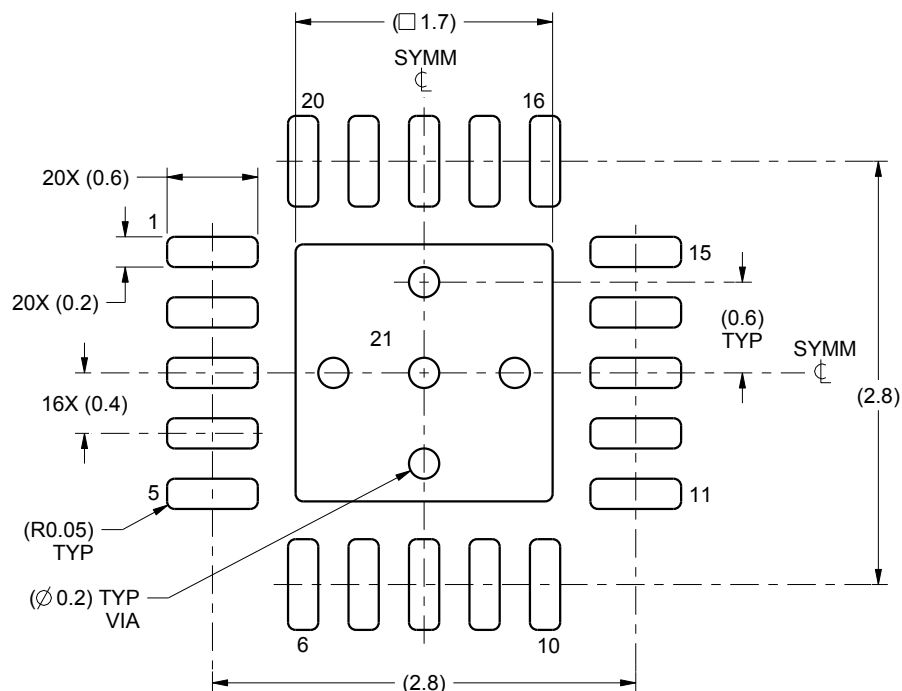
4225320/A   09/2019

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.
3. The package thermal pad must be soldered to the printed circuit board for thermal and mechanical performance.

LAND PATTERN EXAMPLE
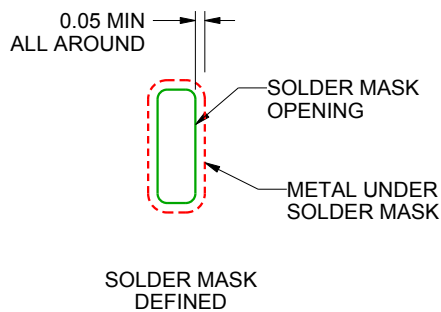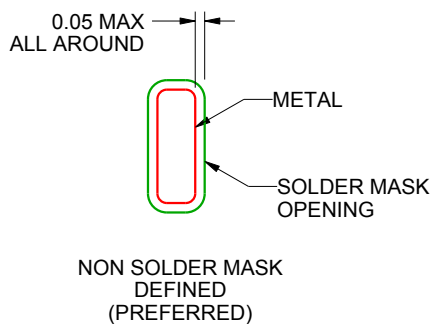EXPOSED METAL SHOWN
SCALE:18X
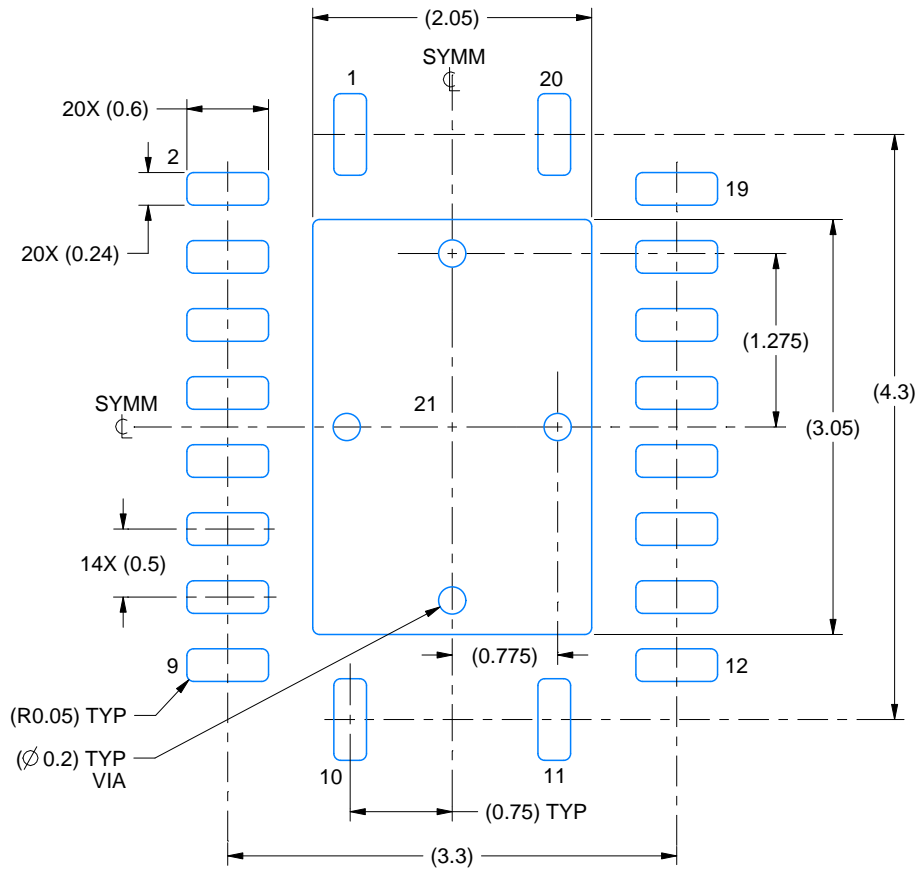
NON SOLDER MASK
DEFINED
(PREFERRED)

SOLDER MASK
DEFINED
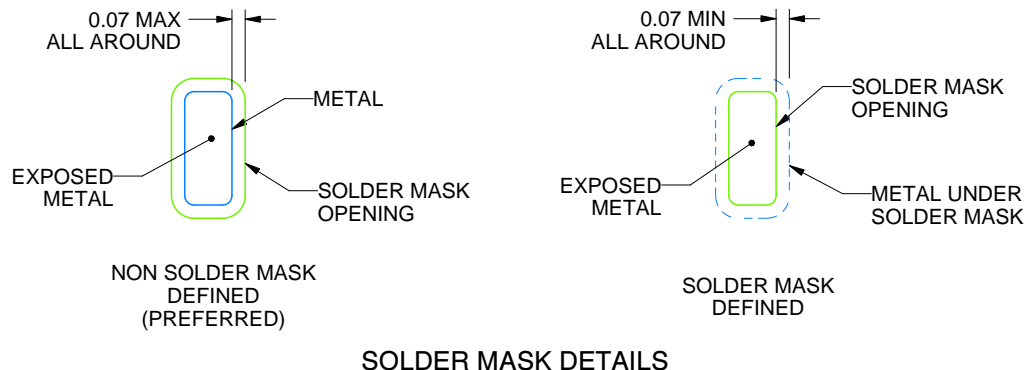
SOLDER MASK DETAILS

4225320/A   09/2019

NOTES: (continued)

4. This package is designed to be soldered to a thermal pad on the board. For more information, see Texas Instruments literature number SLUA271 (www.ti.com/lit/slua271).
5. Vias are optional depending on application, refer to device data sheet. If any vias are implemented, refer to their locations shown on this view. It is recommended that vias under paste be filled, plugged or tented.

SYMM

4X (0.92)

1

20

(R0.05) TYP

20X (0.6)

2

20X (0.24)

19

21

SYMM

4X
(1.33)

(4.3)

(0.77)

14X (0.5)

9

METAL
TYP

(0.56)

12

10

11

(0.75)
TYP

(3.3)
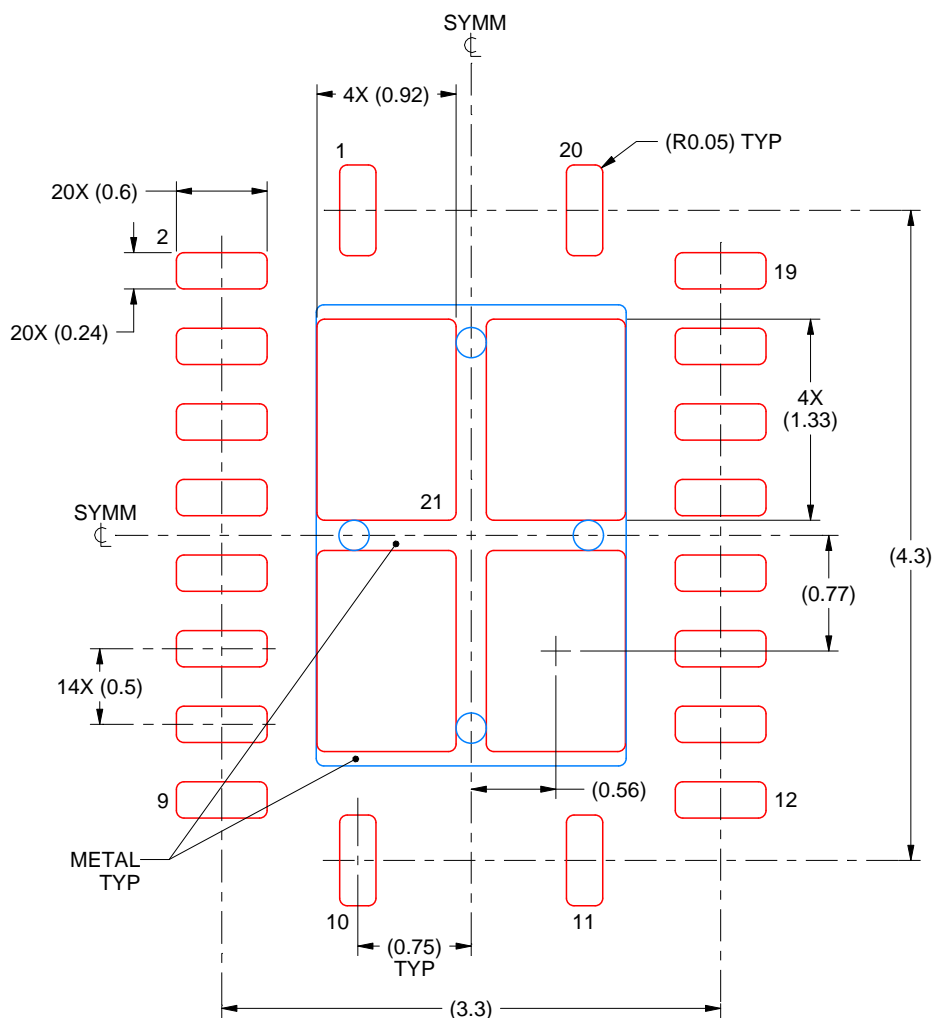
SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL

EXPOSED PAD 21
78% PRINTED SOLDER COVERAGE BY AREA UNDER PACKAGE
SCALE:20X

4225320/A   09/2019

NOTES: (continued)

6. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate
design recommendations.

RUK 20

3 x 3, 0.4 mm pitch

This image is a representation of the package family, actual package may vary.
Refer to the product data sheet for package details.

4229651/A

A | 3.1 / 2.9 | B

PIN 1 INDEX AREA

3.1 / 2.9

0.5 / 0.3

0.25 / 0.15

DETAIL
OPTIONAL TERMINAL
TYPICAL
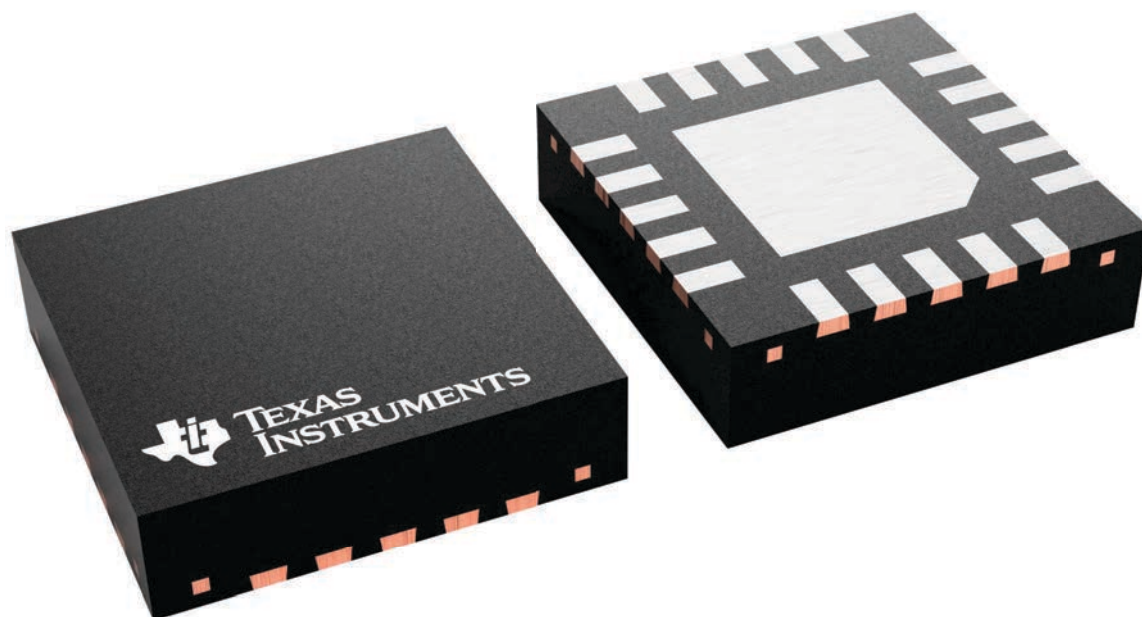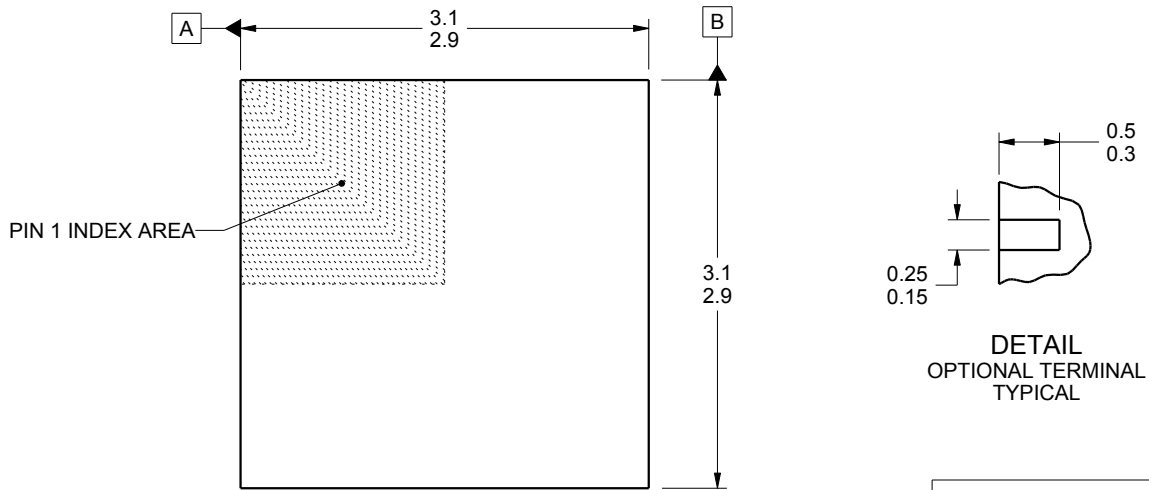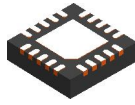
DIMENSION A	
OPTION 01	(0.1)
OPTION 02	(0.2)

0.8 MAX

0.05 / 0.00
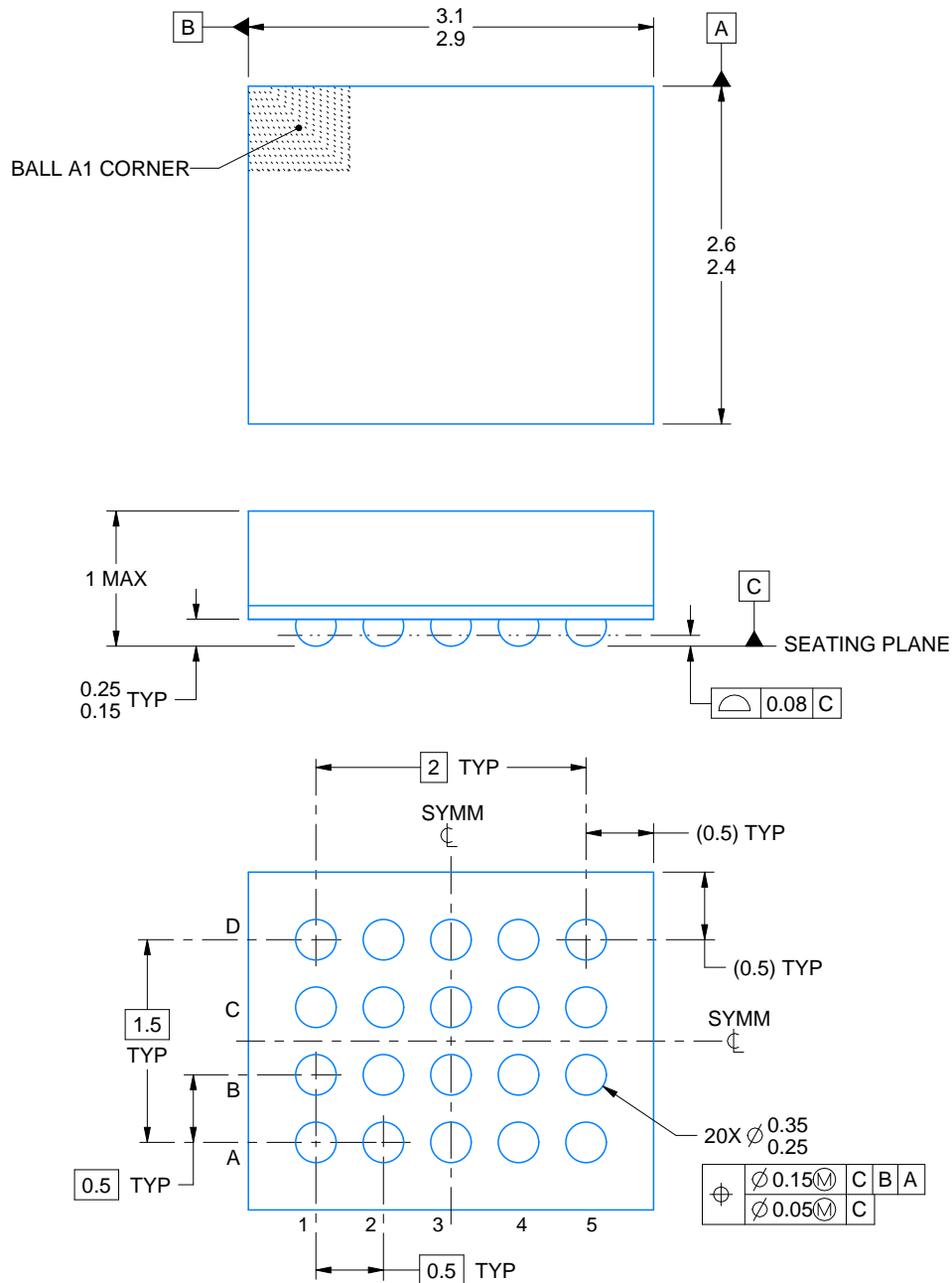
C

SEATING PLANE

☐ 0.08 C

☐ 1.7 ± 0.05

6   10

16X 0.4

5

4X 1.6

1

EXPOSED
THERMAL PAD

11

21

SYMM ₵

15

20X 0.25 / 0.15

⊕ 0.1 Ⓜ C AⓈ BⓈ
0.05 Ⓜ

(DIM A) TYP
OPT 02 SHOWN

SEE TERMINAL
DETAIL

PIN 1 ID
(OPTIONAL)

20   SYMM ₵   16
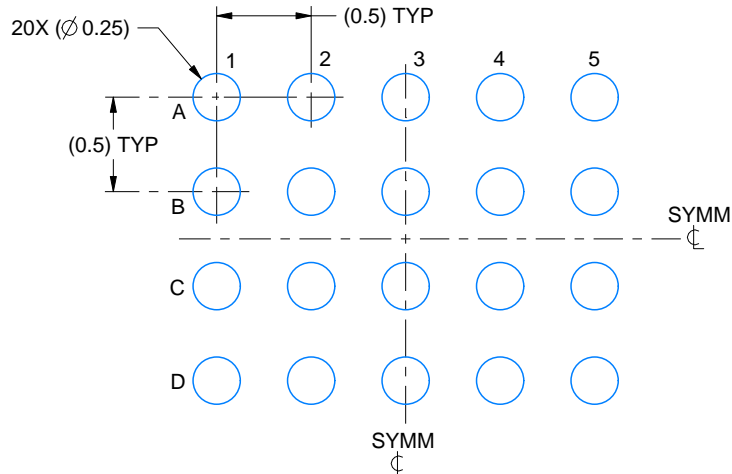
20X 0.5 / 0.3

4222676/A   02/2016

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.
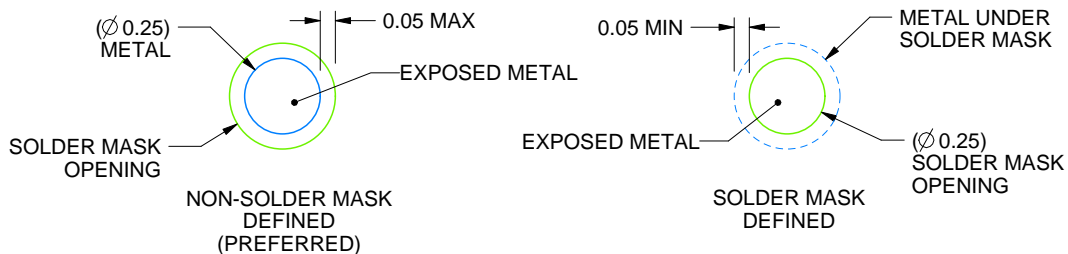3. The package thermal pad must be soldered to the printed circuit board for thermal and mechanical performance.

(□ 1.7)
SYMM
℄

20X (0.6)
1
20X (0.2)
16X (0.4)
5
(R0.05) TYP
(∅ 0.2) TYP VIA

20

16

15
(0.6) TYP
SYMM ℄
21
(2.8)
11

6
10

(2.8)

LAND PATTERN EXAMPLE
SCALE:20X

0.05 MAX ALL AROUND

METAL

SOLDER MASK OPENING

NON SOLDER MASK DEFINED (PREFERRED)

0.05 MIN ALL AROUND

SOLDER MASK OPENING

METAL UNDER SOLDER MASK

SOLDER MASK DEFINED

SOLDER MASK DETAILS

4222676/A   02/2016

NOTES: (continued)

4. This package is designed to be soldered to a thermal pad on the board. For more information, see Texas Instruments literature number SLUA271 (www.ti.com/lit/slua271).
5. Vias are optional depending on application, refer to device data sheet. If any vias are implemented, refer to their locations shown on this view. It is recommended that vias under paste be filled, plugged or tented.

SYMM

(0.47) TYP

(R0.05) TYP

20X (0.6)

20X (0.2)

16X (0.4)

METAL
TYP

SYMM

(2.8)

4X (□0.75)

(2.8)
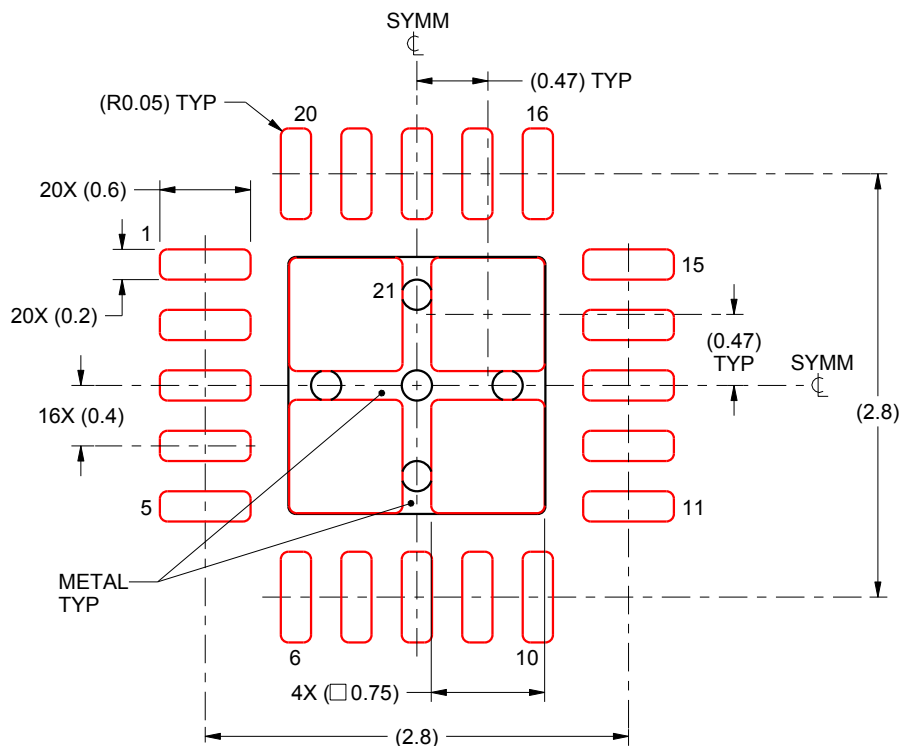
SOLDER PASTE EXAMPLE
BASED ON 0.1 mm THICK STENCIL

EXPOSED PAD 21:
78% PRINTED SOLDER COVERAGE BY AREA UNDER PACKAGE
SCALE:20X

4222676/A 02/2016

NOTES: (continued)

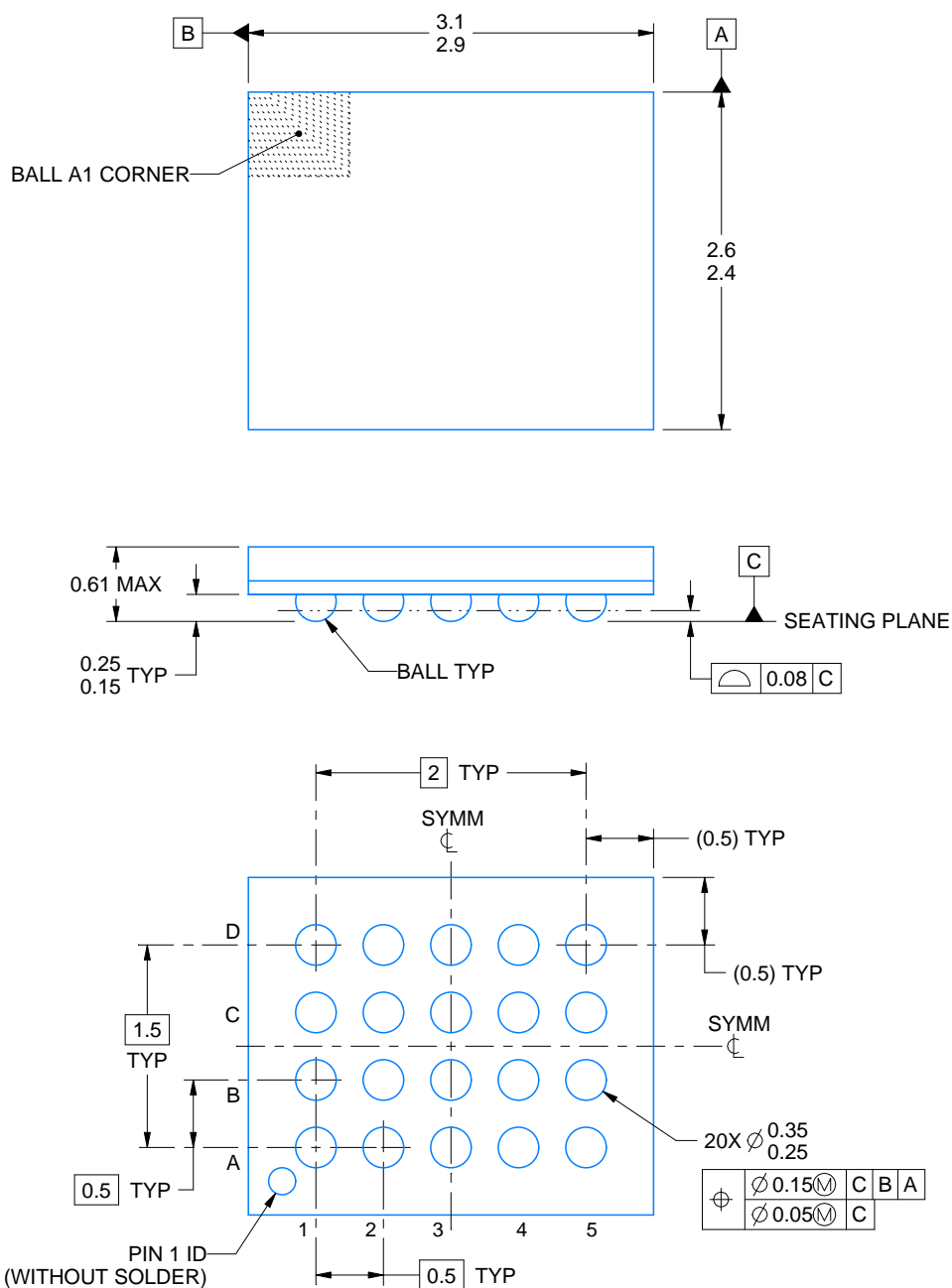6. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.

3.1
2.9

BALL A1 CORNER

2.6
2.4

B | A

1 MAX

0.25
0.15 TYP

C

SEATING PLANE

0.08 | C

2 TYP

SYMM ₵

(0.5) TYP

(0.5) TYP

SYMM ₵

D
C
B
A

1.5 TYP

0.5 TYP

1 2 3 4 5

0.5 TYP

20X ⌀ 0.35
0.25

⊕ | ⌀ 0.15 Ⓜ | C | B | A
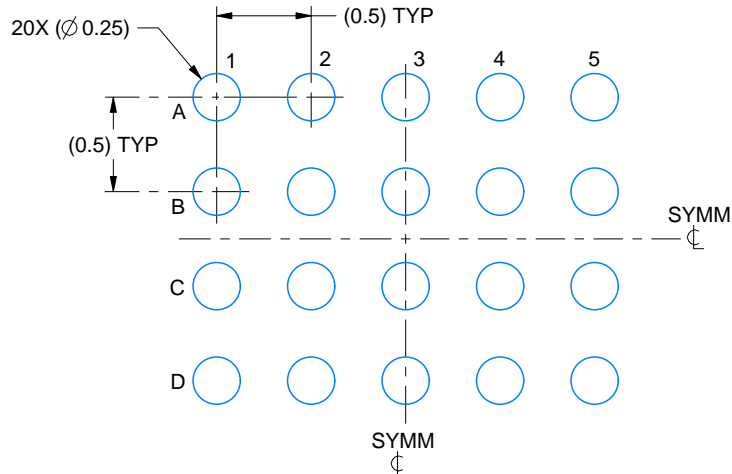| ⌀ 0.05 Ⓜ | C
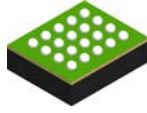
4224888/C   05/2023

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.

20X (∅ 0.25)

(0.5) TYP

(0.5) TYP

1 2 3 4 5

A B C D

SYMM ℄

SYMM ℄

LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:25X

(∅ 0.25) METAL

0.05 MAX

EXPOSED METAL

SOLDER MASK OPENING

NON-SOLDER MASK DEFINED (PREFERRED)

0.05 MIN

METAL UNDER SOLDER MASK

EXPOSED METAL

(∅ 0.25) SOLDER MASK OPENING

SOLDER MASK DEFINED

SOLDER MASK DETAILS
NOT TO SCALE

4224888/C   05/2023

NOTES: (continued)

3. Final dimensions may vary due to manufacturing tolerance considerations and also routing constraints.
   For information, see Texas Instruments literature number SPRAA99 (www.ti.com/lit/spraa99).

(0.5) TYP

20X (□ 0.25)

1   2   3   4   5

A

(0.5) TYP

B

SYMM ℄

C

(R0.05) TYP

D

SYMM ℄
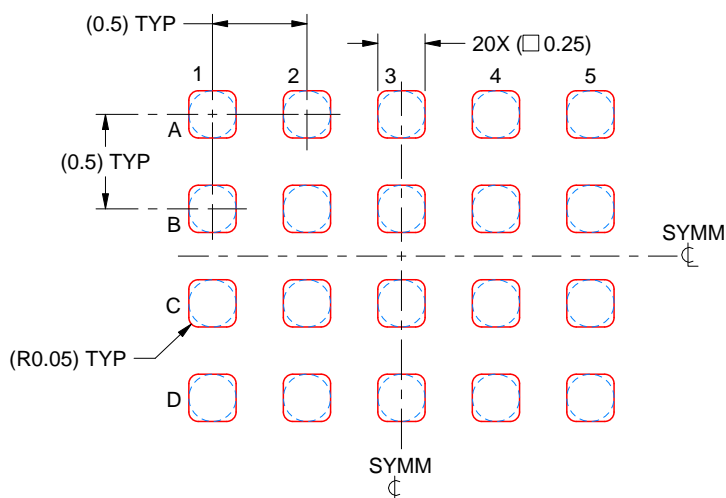
SOLDER PASTE EXAMPLE
BASED ON 0.1 mm THICK STENCIL
SCALE: 25X

4224888/C   05/2023

NOTES: (continued)

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

B | 3.1 / 2.9 | A

BALL A1 CORNER

2.6 / 2.4

0.61 MAX

C

SEATING PLANE

0.25 / 0.15 TYP

BALL TYP

$\bigtriangleup$ | 0.08 | C

2 TYP

SYMM ℄

(0.5) TYP

(0.5) TYP

D

C

SYMM ℄

1.5 TYP

B

A

20X $\varnothing$ 0.35 / 0.25

1 2 3 4 5

0.5 TYP

| $\oplus$ | $\varnothing$ 0.15 Ⓜ | C | B | A |
| | $\varnothing$ 0.05 Ⓜ | C | | |

0.5 TYP

PIN 1 ID
(WITHOUT SOLDER)

4222996/A   12/2016

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.

20X (⌀ 0.25)

(0.5) TYP

(0.5) TYP

SYMM ℄

SYMM ℄

LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:25X

(⌀ 0.25) METAL

0.05 MAX

EXPOSED METAL

SOLDER MASK OPENING

NON-SOLDER MASK DEFINED (PREFERRED)

0.05 MIN

METAL UNDER SOLDER MASK

EXPOSED METAL

(⌀ 0.25) SOLDER MASK OPENING

SOLDER MASK DEFINED

SOLDER MASK DETAILS
NOT TO SCALE

4222996/A   12/2016

NOTES: (continued)

3. Final dimensions may vary due to manufacturing tolerance considerations and also routing constraints.
   For information, see Texas Instruments literature number SPRAA99 (www.ti.com/lit/spraa99).

SOLDER PASTE EXAMPLE
BASED ON 0.1 mm THICK STENCIL
SCALE: 25X

4222996/A   12/2016

NOTES: (continued)

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

PACKAGE OUTLINE

PW0020A

TSSOP - 1.2 mm max height

6.6 / 6.2 TYP

A

PIN 1 INDEX AREA

1

20

18X 0.65

6.6 / 6.4 NOTE 3

2X 5.85

10

11

B

4.5 / 4.3 NOTE 4

20X 0.30 / 0.19

⊕ 0.1 Ⓜ C A B

C — SEATING PLANE

⌒ 0.1 C

1.2 MAX

SEE DETAIL A

(0.15) TYP

0.25 GAGE PLANE

0.15 / 0.05

0.75 / 0.50

0° -8°

DETAIL A
TYPICAL

4220206/A   02/2017

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.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm per side.
5. Reference JEDEC registration MO-153.

TEXAS INSTRUMENTS
www.ti.com

20X (1.5)

SYMM

(R0.05) TYP

1

20X (0.45)

20

18X (0.65)

SYMM

10

11

(5.8)

LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 10X

SOLDER MASK
OPENING

METAL

EXPOSED METAL

0.05 MAX
ALL AROUND

NON-SOLDER MASK
DEFINED
(PREFERRED)

METAL UNDER
SOLDER MASK

SOLDER MASK
OPENING

EXPOSED METAL

0.05 MIN
ALL AROUND

SOLDER MASK
DEFINED

SOLDER MASK DETAILS

4220206/A   02/2017

NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

20X (1.5)

SYMM

(R0.05) TYP

1

20

20X (0.45)

18X (0.65)

SYMM

10

11

(5.8)

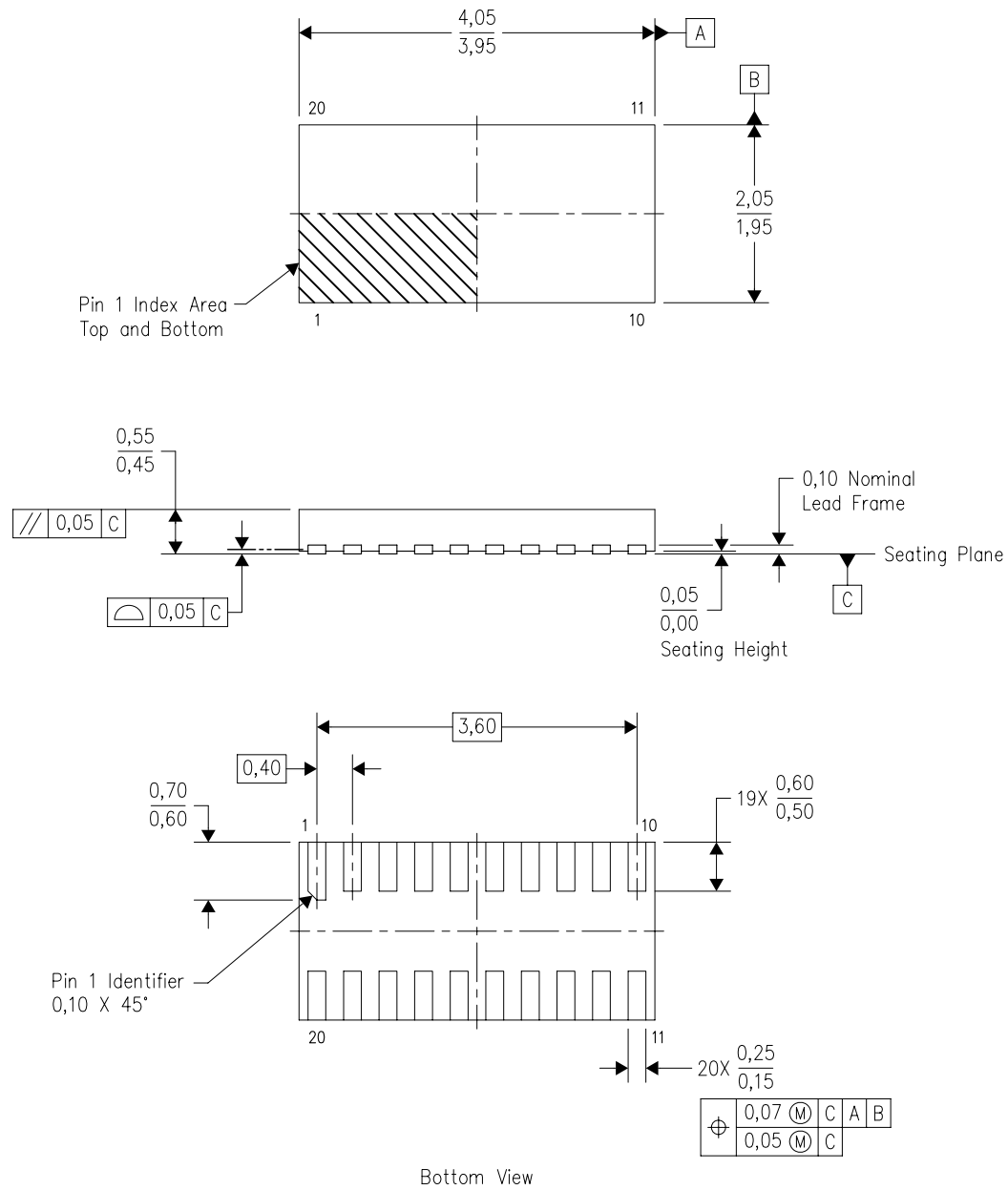SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE: 10X

4220206/A   02/2017

NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

4226367/A   10/2020

PowerPAD is a trademark of Texas Instruments.

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.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. No JEDEC registration as of September 2020.
5. Features may differ or may not be present.

20X (1.45)

SYMM

1

20

20X (0.3)

(R0.05) TYP

18X (0.5)

SYMM

10

11

(4.4)

LAND PATTERN EXAMPLE
SCALE: 16X

SOLDER MASK OPENING

METAL

METAL UNDER SOLDER MASK

SOLDER MASK OPENING

0.05 MAX ALL AROUND

EXPOSED METAL

NON-SOLDER MASK DEFINED (PREFERRED)

0.05 MIN ALL AROUND

SOLDER MASK DEFINED

EXPOSED METAL

SOLDER MASK DETAILS

4226367/A 10/2020

NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.
8. This package is designed to be soldered to a thermal pad on the board. For more information, see Texas Instruments literature numbers SLMA002 (www.ti.com/lit/slma002) and SLMA004 (www.ti.com/lit/slma004).
9. Size of metal pad may vary due to creepage requirement.
10. Vias are optional depending on application, refer to device data sheet. It is recommended that vias under paste be filled, plugged or tented.

20X (1.45)

20X (0.3)

SYMM

1

20

(R0.05) TYP

(18X 0.5)

SYMM

10

11

(4.4)

SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE: 16X

4226367/A   10/2020

NOTES: (continued)

11. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
12. Board assembly site may have different recommendations for stencil design.

DQS (R−PUSON−N20)   PLASTIC SMALL OUTLINE NO−LEAD

Pin 1 Index Area
Top and Bottom

Seating Plane

0,10 Nominal
Lead Frame

Seating Height

Pin 1 Identifier
0,10 X 45°

Bottom View

4210558/B 03/11

NOTES: A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M−1994.
        B. This drawing is subject to change without notice.
        C. SON (Small Outline No−Lead) package configuration.

DQS (R−PUSON−N20)   PLASTIC SMALL OUTLINE NO−LEAD

Example Board Layout

Example Stencil Design
0.125mm Stencil Thickness
(Note D)

18x0,40

18x0,40

2,80

0,80

0,85   2,75

1,10

1,05

20x0,20

Non Solder Mask
Defined Pad

0,10

Solder Mask Opening
(Note F)

1,00

Pad Geometry
(Note C)

0,20

0,05
All around

4211489/B   03/11
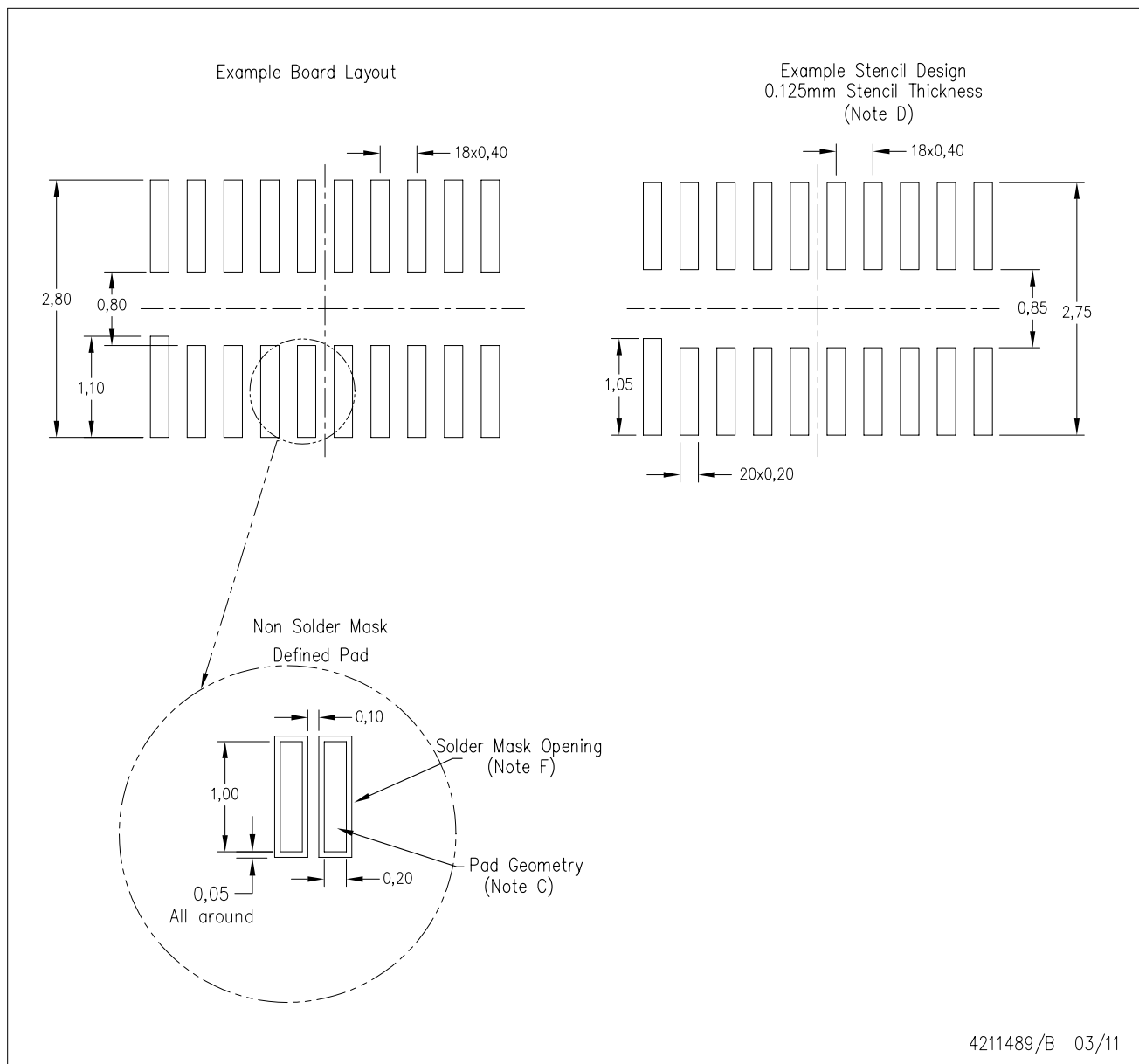
NOTES: A.   All linear dimensions are in millimeters.
         B.   This drawing is subject to change without notice.
         C.   Publication IPC−7351 is recommended for alternate designs.
         D.   Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should
              contact their board assembly site for stencil design recommendations. Refer to IPC 7525 for stencil design considerations.
         E.   Customers should contact their board fabrication site for minimum solder mask web tolerances between signal pads.

YZP (R−XBGA−N20)   DIE−SIZE BALL GRID ARRAY
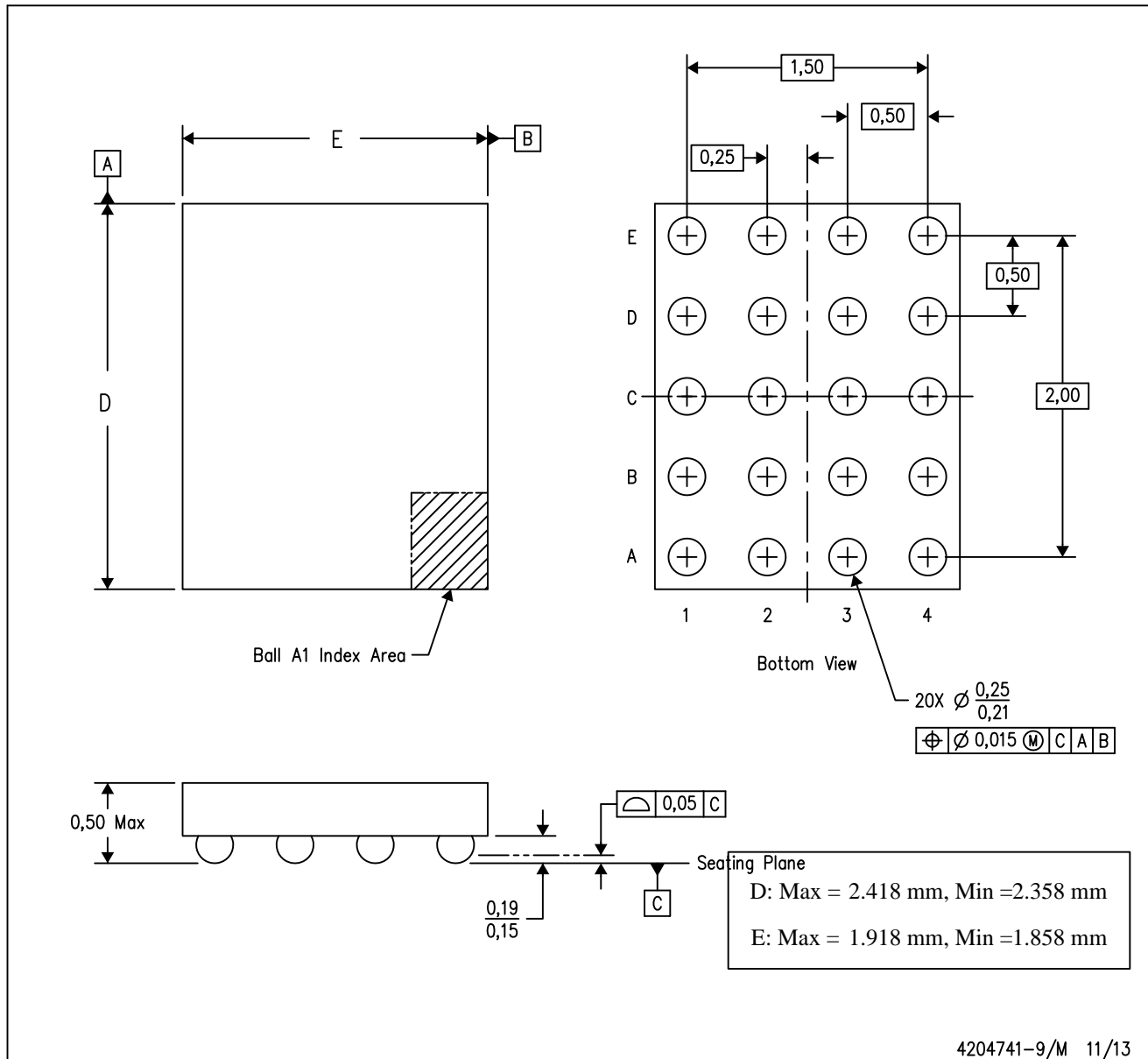
1,50

0,50

0,25

E
D
C
B
A

1   2   3   4

Bottom View

0,50

2,00

20X ⌀ 0,25 / 0,21

⌖ ⌀ 0,015 Ⓜ C A B

E

A

B

D

Ball A1 Index Area

0,50 Max

0,05 C

0,19 / 0,15

Seating Plane

C

D: Max = 2.418 mm, Min =2.358 mm

E: Max = 1.918 mm, Min =1.858 mm

4204741−9/M   11/13

NOTES: A.   All linear dimensions are in millimeters.   Dimensioning and tolerancing per ASME Y14.5M−1994.
         B.   This drawing is subject to change without notice.
         C.   NanoFree™ package configuration.

NanoFree is a trademark of Texas Instruments.

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