

## SN74AVC4T234 4-Bit Dual-Supply Unidirectional Noninverting Voltage Translator

### 1 Features

- Wide operating  $V_{CC}$  range of 0.9 V to 3.6 V
- 3.6-V I/O Tolerant to support mixed-mode signal operation
- Max  $t_{pd}$  of 3.7 ns at 3.3 V
- Balanced propagation delays:  $t_{PLH} = t_{PHL}$
- Low static-power consumption, 5- $\mu$ A Max  $I_{CC}$
- Outputs disabled if either  $V_{CC}$  goes to 0V
- $\pm 3$ -mA Output drive at 1.8 V
- 26- $\Omega$  series resistor on A-side outputs
- $I_{off}$  supports partial power-down-mode operation
- Input hysteresis allows slow input transition and better switching noise immunity at input
- Maximum data rates
  - 380 Mbps (1.8-V to 3.3-V translation)
  - 200 Mbps (<1.8-V to 3.3-V translation)
  - 200 Mbps (translate to 2.5 V or 1.8 V)
  - 150 Mbps (translate to 1.5 V)
  - 100 Mbps (translate to 1.2 V)
- Latch-up performance exceeds 100 mA Per JESD 78, Class II
- ESD protection exceeds JESD 22
  - 2000-V human-body model (A114-A)
  - 500-V charged-device model (C101)

### 2 Applications

- Personal electronics
- Industrial
- Enterprise
- Telecom

### 3 Description

This 4-bit non-inverting bus transceiver uses two separate configurable power-supply rails to enable asynchronous communication between B-port inputs and A-port outputs. The A port is designed to track  $V_{CCA}$  while the B port is designed to track  $V_{CCB}$ . Both  $V_{CCA}$  and  $V_{CCB}$  are configurable from 0.9 V to 3.6 V.

The SN74AVC4T234 solution offers the industry's low-power needs in battery-powered portable applications by ensuring both a very low static and dynamic power consumption across the entire  $V_{CC}$  range of 0.9 V to 3.6 V, resulting in an increased battery life. This product also maintains excellent signal integrity.

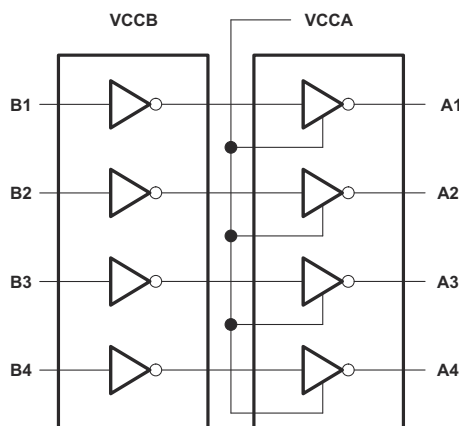
This device is fully specified for partial-power-down applications using  $I_{off}$ . The  $I_{off}$  circuitry disables the outputs, preventing damaging current backflow through the device when it is powered down.

The  $V_{CC}$  isolation feature ensures that if either  $V_{CC}$  input is at GND, then A-side ports are in the high-impedance state.

#### Device Information

PART NUMBER	PACKAGE <sup>(1)</sup>	BODY SIZE (NOM)
SN74AVC4T234ZSU	uCSP (11)	2.00 mm × 1.40 mm
SN74AVC4T234ZWA	NFBGA (11)	2.00 mm × 1.40 mm

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



Logic Diagram (Positive Logic)



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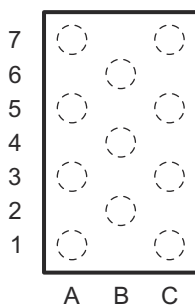
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## 4 Revision History

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

<b>Changes from Revision A (June 2011) to Revision B (July 2020)</b>	<b>Page</b>
• Format to new TI data sheet standard with additional information throughout .....	1
• Removed Feature "Input-Disabled Feature Allows Floating Input Conditions".....	1
• Added Feature "Outputs Disabled if Either $V_{CC}$ goes to 0V".....	1
• Updated the numbering format for tables, figures and cross-references throughout the document.....	1
• Removed <i>Ordering Information</i> table .....	1
• Added ZWA package as orderable .....	1
• Added <i>ESD Ratings</i> table.....	4
• Added <i>Thermal Information</i> table.....	6
• Added <i>Feature Description</i> section. ....	10
• Added <i>Device Functional Modes</i> section.....	10
• Added <i>Application and Implementation</i> section.....	11
• Added <i>Power Supply Recommendations</i> section.....	12
• Added <i>Layout</i> section.....	12
• Added <i>Device and Documentation Support</i> , and <i>Mechanical, Packaging, and Orderable Information</i> sections. ....	13

## 5 Pin Configuration and Functions



**Figure 5-1. ZSU/ZWA Package 11-Pin uCSP Transparent Top View**

### Pin Functions

PIN NAME	NO. ZSU, ZWA	TYPE	DESCRIPTION
B1	C7	I	Channel 1 Data input port
B2	C5	I	Channel 2 Data input port
B3	C3	I	Channel 3 Data input port
B4	C1	I	Channel 4 Data input port
A1	A7	O	Channel 1 Data output port
A2	A5	O	Channel 2 Data output port
A3	A3	O	Channel 3 Data output port
A4	A1	O	Channel 4 Data output port
V <sub>CCA</sub>	B6	—	A-side output port power supply voltage (0.9 V to 3.6 V)
V <sub>CCB</sub>	B4	—	B-side input port power supply voltage (0.9 V to 3.6 V)
GND	B2	—	Ground

## 6 Specifications

### 6.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)<sup>(1)</sup>

			MIN	MAX	UNIT
$V_{CCA}$ $V_{CCB}$	Supply voltage		–0.5	4.6	V
$V_I$	Input voltage <sup>(2)</sup>	Output ports (A port)	–0.5	4.6	V
		Input ports (B port)	–0.5	4.6	
$V_O$	Voltage applied to any output in the high-impedance or power-off state <sup>(2)</sup>	A port	–0.5	4.6	V
$V_O$	Voltage applied to any output in the high or low state <sup>(2) (3)</sup>	A port	–0.5	$V_{CCA} + 0.5$	V
$I_{IK}$	Input clamp current	$V_I < 0$		–50	mA
$I_{OK}$	Output clamp current	$V_O < 0$		–50	mA
$I_O$	Continuous output current			±20	mA
	Continuous current through $V_{CCA}$ , $V_{CCB}$ , or GND			±50	mA
$T_{stg}$	Storage temperature		–65	150	°C

- (1) Stresses beyond those listed under *Absolute Maximum Ratings* may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Conditions*. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
- (2) The input voltage and output negative-voltage ratings may be exceeded if the input and output current ratings are observed.
- (3) The output positive-voltage rating may be exceeded up to 4.6 V maximum if the output current rating is observed.

### 6.2 ESD Ratings

			VALUE	UNIT
$V_{(ESD)}$	Electrostatic discharge	Human-body model (HBM), per ANSI/ESDA/JEDEC JS-001 <sup>(1)</sup>	±2000	V
		Charged-device model (CDM), per JEDEC specification JESD22-C101 <sup>(2)</sup>	±500	

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

## 6.3 Recommended Operating Conditions

			V <sub>CCI</sub> <sup>(1) (3)</sup>	V <sub>CCO</sub> <sup>(2)</sup>	MIN	MAX	UNIT
V <sub>CCA</sub>	Supply voltage				0.9	3.6	V
V <sub>CCB</sub>	Supply voltage				0.9	3.6	V
V <sub>IH</sub>	High-level input voltage	Data inputs <sup>(4)</sup>	0.9 V to 1.1 V		V <sub>CCI</sub> × 0.8	3.6	V
			1.1 V to 1.4 V		V <sub>CCI</sub> × 0.8	3.6	
			1.4 V to 1.95 V		V <sub>CCI</sub> × 0.65	3.6	
			2.3 V to 2.7 V		V <sub>CCI</sub> × 0.65	3.6	
			3 V to 3.6 V		V <sub>CCI</sub> × 0.65	3.6	
V <sub>IL</sub>	Low-level input voltage	Data inputs <sup>(4)</sup>	0.9 V to 1.1 V		0	V <sub>CCI</sub> × 0.2	V
			1.1 V to 1.4 V		0	V <sub>CCI</sub> × 0.2	
			1.1 V to 1.95 V		0	V <sub>CCI</sub> × 0.35	
			2.3 V to 2.7 V		0	V <sub>CCI</sub> × 0.35	
			3 V to 3.6 V		0	V <sub>CCI</sub> × 0.35	
V <sub>I</sub>	Input voltage				0	3.6	V
V <sub>O</sub>	Output voltage	Active state			0	V <sub>CCO</sub>	V
I <sub>OH</sub>	High-level output current			0.9 V to 1.1 V		–0.1	mA
				1.1 V to 1.3 V		–1	
				1.4 V to 1.6 V		–2	
				1.65 V to 1.95 V		–3	
				2.3 V to 2.7 V		–6	
				3 V to 3.6 V		–12	
I <sub>OL</sub>	Low-level output current			0.9 V to 1.1 V		0.1	mA
				1.1 V to 1.3 V		1	
				1.4 V to 1.6 V		2	
				1.65 V to 1.95 V		3	
				2.3 V to 2.7 V		6	
				3 V to 3.6 V		12	
Δt/Δv	Input transition rise or fall rate			3 V to 3.6 V		10	ns/V
				2.3 V to 2.7 V		20	
				1.65 V to 1.95 V		50	
				1.4 V to 1.6 V		100	
				1.1 V to 1.3 V		100	
T <sub>A</sub>	Operating free-air temperature				–40	85	°C

(1) V<sub>CCI</sub> is the V<sub>CCB</sub> input port.

(2) V<sub>CCO</sub> is the V<sub>CCA</sub> output port.

(3) All unused data inputs of the device must be held at V<sub>CCI</sub> or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, [SCBA004](#).

(4) For V<sub>CCI</sub> values not specified in the data sheet, V<sub>IH</sub> min = V<sub>CCI</sub> × 0.7 V, V<sub>IL</sub> max = V<sub>CCI</sub> × 0.3 V

## 6.4 Thermal Information

THERMAL METRIC <sup>(1)</sup>		SN74AVC4T234	SN74AVC4T234	UNIT
		ZSU (uCSP)	ZWA (NFBGA)	
		11 PINS	11 PINS	
R <sub>θJA</sub>	Junction-to-ambient thermal resistance <sup>(2)</sup>	165.9	181.4	°C/W
R <sub>θJC(top)</sub>	Junction-to-case (top) thermal resistance	123.8	136.7	°C/W
R <sub>θJB</sub>	Junction-to-board thermal resistance	123.2	137.7	°C/W
ψ <sub>JT</sub>	Junction-to-top characterization parameter	4.4	7.5	°C/W
ψ <sub>JB</sub>	Junction-to-board characterization parameter	122.9	137.4	°C/W

- (1) For more information about traditional and new thermal metrics, see the *Semiconductor and IC Package Thermal Metrics* application report, [SPRA953](#).
- (2) The package thermal impedance is calculated in accordance with JESD 51-5.

## 6.5 Electrical Characteristics

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

PARAMETER <sup>(1) (2)</sup>		TEST CONDITIONS	V <sub>CCA</sub>	V <sub>CCB</sub>	T <sub>A</sub>	MIN	TYP	MAX	UNIT
V <sub>OH</sub>		I <sub>OH</sub> = –100 μA	0.9 V	0.9 V to 3.6 V	T <sub>A</sub> = –40°C to 85°C	V <sub>CCA</sub> – 0.1			V
		I <sub>OH</sub> = –1 mA	1.1 V		T <sub>A</sub> = –40°C to 85°C	0.88			
		I <sub>OH</sub> = –2 mA	1.4 V		T <sub>A</sub> = –40°C to 85°C	1.05			
		I <sub>OH</sub> = –3 mA	1.65 V		T <sub>A</sub> = –40°C to 85°C	1.2			
		I <sub>OH</sub> = –6 mA	2.3V		T <sub>A</sub> = –40°C to 85°C	1.75			
		I <sub>OH</sub> = –12 mA	3 V		T <sub>A</sub> = –40°C to 85°C	2.3			
V <sub>OL</sub>		I <sub>OL</sub> = 100 μA	0.9 V	0.9 V to 3.6 V	T <sub>A</sub> = –40°C to 85°C			0.1	V
		I <sub>OL</sub> = 1 mA	1.1 V		T <sub>A</sub> = –40°C to 85°C			0.2	
		I <sub>OL</sub> = 2 mA	1.4 V		T <sub>A</sub> = –40°C to 85°C			0.2	
		I <sub>OL</sub> = 3 mA	1.65 V		T <sub>A</sub> = –40°C to 85°C			0.25	
		I <sub>OL</sub> = 6 mA	2.3V		T <sub>A</sub> = –40°C to 85°C			0.3	
		I <sub>OL</sub> = 12 mA	3 V		T <sub>A</sub> = –40°C to 85°C			0.55	
I <sub>off</sub>	A or B port	V <sub>I</sub> or V <sub>O</sub> = 0 to 3.6 V	0 V	0 V to 3.6 V	T <sub>A</sub> = 25°C		±0.1	±1	μA
					T <sub>A</sub> = –40°C to 85°C			±5	
			0 V to 3.6 V	0 V	T <sub>A</sub> = 25°C		±0.1	±1	
					T <sub>A</sub> = –40°C to 85°C			±5	
I <sub>CCA</sub>		V <sub>CCB</sub> or GND, I <sub>O</sub> = 0	0.8 V to 3.6 V	0.8 V to 3.6 V	T <sub>A</sub> = –40°C to 85°C			8	μA
			0 V	0 V to 3.6 V	T <sub>A</sub> = –40°C to 85°C			8	
			0 V to 3.6 V	0 V	T <sub>A</sub> = –40°C to 85°C			8	
I <sub>CCB</sub>		V <sub>CCB</sub> or GND, I <sub>O</sub> = 0	0.8 V to 3.6 V	0.8 V to 3.6 V	T <sub>A</sub> = –40°C to 85°C			8	μA
			0 V	0 V to 3.6 V	T <sub>A</sub> = –40°C to 85°C			8	
			0 V to 3.6 V	0 V	T <sub>A</sub> = –40°C to 85°C			8	
I <sub>CCA</sub> + I <sub>CCB</sub>		V <sub>CCB</sub> or GND, I <sub>O</sub> = 0	0.8 V to 3.6 V	0.8 V to 3.6 V	T <sub>A</sub> = –40°C to 85°C			16	μA
C <sub>i</sub>	V <sub>CCB</sub>	V <sub>CCB</sub> = 3.3 V or GND	3.3 V	3.3 V	T <sub>A</sub> = 25°C		22		pF
C <sub>io</sub>	A or B port	V <sub>CCA</sub> = 3.3 V or GND	3.3 V	3.3 V	T <sub>A</sub> = 25°C		5		pF
					T <sub>A</sub> = –40°C to 85°C			7	

- (1) V<sub>CCI</sub> is the V<sub>CCB</sub> input port.
- (2) V<sub>CCO</sub> is the V<sub>CCA</sub> output port.

## 6.6 Switching Characteristics, $V_{CCB} = 1.1\text{ V}$

over recommended operating free-air temperature range,  $V_{CCB} = 1.1\text{ V}$  (unless otherwise noted) (see [Figure 7-1](#))

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CCA}$	TYP	UNIT
$t_{PLH}$	B	A	$V_{CCA} = 1.1\text{ V}$	5.5	ns
			$V_{CCA} = 1.4\text{ V}$	4.6	
			$V_{CCA} = 1.65\text{ V}$	4.2	
			$V_{CCA} = 2.3\text{ V}$	3.7	
			$V_{CCA} = 3\text{ V}$	3.9	
$t_{PHL}$	B	A	$V_{CCA} = 1.1\text{ V}$	4.7	ns
			$V_{CCA} = 1.4\text{ V}$	3.9	
			$V_{CCA} = 1.65\text{ V}$	3.4	
			$V_{CCA} = 2.3\text{ V}$	3	
			$V_{CCA} = 3\text{ V}$	3.1	

## 6.7 Switching Characteristics, $V_{CCB} = 1.4\text{ V}$

over recommended operating free-air temperature range,  $V_{CCB} = 1.4\text{ V}$  (see [Figure 7-1](#))

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CCA}$	MIN	TYP	MAX	UNIT
$t_{PLH}$	B	A	$V_{CCA} = 1.1\text{ V}$		4.7		ns
			$V_{CCA} = 1.4\text{ V}$	2		5	
			$V_{CCA} = 1.65\text{ V}$	1.5		3.8	
			$V_{CCA} = 2.3\text{ V}$	1.2		3.8	
			$V_{CCA} = 3\text{ V}$	1		3.8	
$t_{PHL}$	B	A	$V_{CCA} = 1.1\text{ V}$		4.2		ns
			$V_{CCA} = 1.4\text{ V}$	2		5	
			$V_{CCA} = 1.65\text{ V}$	1.5		3.9	
			$V_{CCA} = 2.3\text{ V}$	1.2		3	
			$V_{CCA} = 3\text{ V}$	1		3	

## 6.8 Switching Characteristics, $V_{CCB} = 1.65\text{ V}$

over recommended operating free-air temperature range,  $V_{CCB} = 1.65\text{ V}$  (see [Figure 7-1](#))

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CCA}$	MIN	TYP	MAX	UNIT
$t_{PLH}$	B	A	$V_{CCA} = 1.1\text{ V}$		4.3		ns
			$V_{CCA} = 1.4\text{ V}$	2		4.2	
			$V_{CCA} = 1.65\text{ V}$	1.5		4.1	
			$V_{CCA} = 2.3\text{ V}$	1.2		3.8	
			$V_{CCA} = 3\text{ V}$	1		3.7	
$t_{PHL}$	B	A	$V_{CCA} = 1.1\text{ V}$		2.6		ns
			$V_{CCA} = 1.4\text{ V}$	2		4.2	
			$V_{CCA} = 1.65\text{ V}$	1.5		4.1	
			$V_{CCA} = 2.3\text{ V}$	1.2		3.8	
			$V_{CCA} = 3\text{ V}$	1		3.7	

## 6.9 Switching Characteristics, $V_{CCB} = 2.3\text{ V}$

over recommended operating free-air temperature range,  $V_{CCB} = 2.3\text{ V}$  (see [Figure 7-1](#))

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CCA}$	MIN	TYP	MAX	UNIT
$t_{PLH}$	B	A	$V_{CCA} = 1.1\text{ V}$		2.7		ns
			$V_{CCA} = 1.4\text{ V}$	2		3.5	
			$V_{CCA} = 1.65\text{ V}$	1.5		3.1	
			$V_{CCA} = 2.3\text{ V}$	1.2		2.8	
			$V_{CCA} = 3\text{ V}$	0.2		4.1	
$t_{PHL}$	B	A	$V_{CCA} = 1.1\text{ V}$		2.4		ns
			$V_{CCA} = 1.4\text{ V}$	2		3.7	
			$V_{CCA} = 1.65\text{ V}$	1.5		3.7	
			$V_{CCA} = 2.3\text{ V}$	1.2		2.8	
			$V_{CCA} = 3\text{ V}$	0.2		3.5	

## 6.10 Switching Characteristics, $V_{CCB} = 3\text{ V}$

over recommended operating free-air temperature range,  $V_{CCB} = 3\text{ V}$  (see [Figure 7-1](#))

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CCA}$	MIN	TYP	MAX	UNIT
$t_{PLH}$	B	A	$V_{CCA} = 1.1\text{ V}$		3.9		ns
			$V_{CCA} = 1.4\text{ V}$	2		3.8	
			$V_{CCA} = 1.65\text{ V}$	1.5		3.6	
			$V_{CCA} = 2.3\text{ V}$	0.5		3.6	
			$V_{CCA} = 3\text{ V}$	0.2		3.6	
$t_{PHL}$	B	A	$V_{CCA} = 1.1\text{ V}$		3.9		ns
			$V_{CCA} = 1.4\text{ V}$	2		3.7	
			$V_{CCA} = 1.65\text{ V}$	1.5		3.1	
			$V_{CCA} = 2.3\text{ V}$	0.5		3.5	
			$V_{CCA} = 3\text{ V}$	0.2		3	

## 6.11 Operating Characteristics

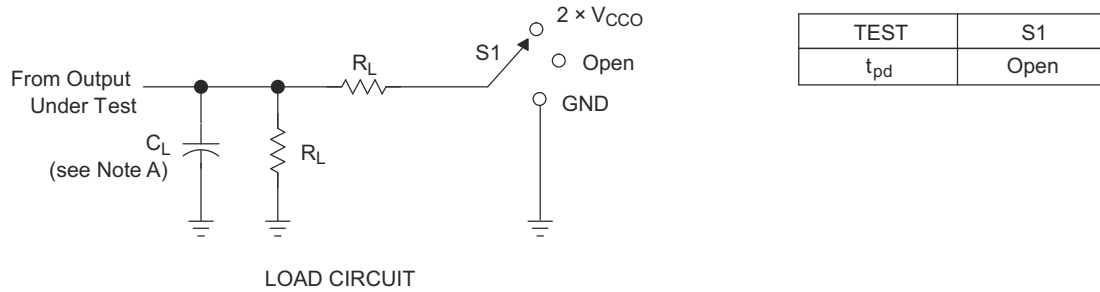
$T_A = 25^\circ\text{C}$

PARAMETER			TEST CONDITIONS	$V_{CCA}, V_{CCB}$	TYP	UNIT
$C_{pdA}$ <sup>(1)</sup>	B to A	Outputs enabled	$C_L = 0$ , $f = 10\text{ MHz}$ , $t_r = t_f = 1\text{ ns}$	$V_{CCA} = V_{CCB} = 1.1\text{ V}$	18.5	pF
				$V_{CCA} = V_{CCB} = 1.4\text{ V}$		
				$V_{CCA} = V_{CCB} = 1.65\text{ V}$		
				$V_{CCA} = V_{CCB} = 2.3\text{ V}$		
				$V_{CCA} = V_{CCB} = 3\text{ V}$		

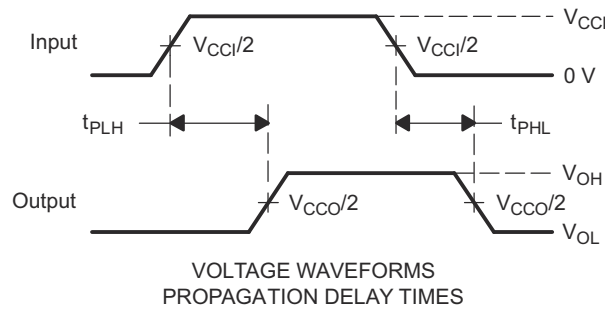
(1) Power dissipation capacitance per transceiver

## 7 Parameter Measurement Information

### 7.1 Load Circuit and Voltage Waveforms



$V_{CCO}$	$C_L$	$R_L$	$V_{TP}$
1.2 V	30 pF	0.5 k $\Omega$	0.1 V
1.5 V $\pm$ 0.1 V	30 pF	0.5 k $\Omega$	0.1 V
1.8 V $\pm$ 0.15 V	30 pF	0.5 k $\Omega$	0.15 V
2.5 V $\pm$ 0.2 V	30 pF	0.5 k $\Omega$	0.15 V
3.3 V $\pm$ 0.3 V	30 pF	0.5 k $\Omega$	0.3 V



- NOTES:
- A.  $C_L$  includes probe and jig capacitance.
  - B. All input pulses are supplied by generators having the following characteristics:  $PRR \leq 10$  MHz,  $Z_O = 50 \Omega$ ,  $dv/dt \geq 1$  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  $V_{CCB}$ .
  - F.  $V_{CCO}$  is  $V_{CCA}$ .

**Figure 7-1. Load and Circuit and Voltage Waveforms**

## 8 Detailed Description

### 8.1 Overview

The SN74AVC4T234 is a 4-bit, dual-supply noninverting voltage level translation device. The B input port pins are referenced to the  $V_{CCB}$  supply, and the A output port pins are referenced to the  $V_{CCA}$ . The B port is able to accept I/O voltages ranging from 0.9 V to 3.6 V.

### 8.2 Functional Block Diagram

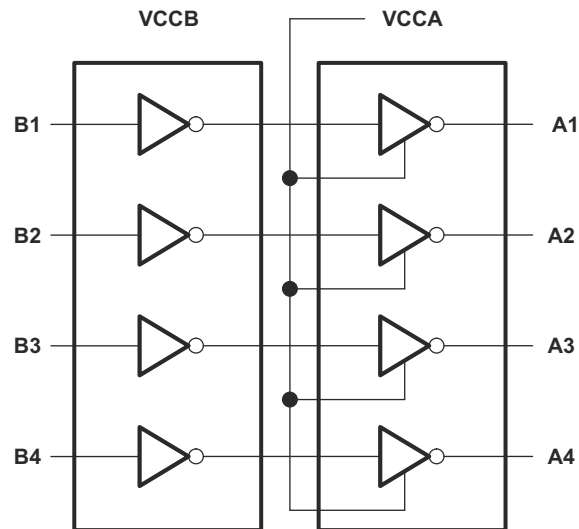


Figure 8-1. Logic Diagram (Positive Logic)

### 8.3 Feature Description

#### 8.3.1 Fully Configurable Dual-Rail Design Allows Each Port to Operate Over the Full 0.9-V to 3.6-V Power-Supply Range

Both  $V_{CCA}$  and  $V_{CCB}$  can be supplied at any voltage between 0.9 V and 3.6 V; thus, making the device suitable for translating between any of the low voltage nodes (0.9, 1.05 V, 1.2 V, 1.8 V, 2.5 V, and 3.3 V).

#### 8.3.2 Supports High Speed Translation

The SN74AVC4T234 device can support high data rate applications. The translated signal data rate can be up to 380 Mbps when the signal is translated from 1.8 V to 3.3 V.

#### 8.3.3 $I_{off}$ Supports Partial-Power-Down Mode Operation

$I_{off}$  will prevent backflow current by disabling I/O output circuits when device is in partial-power-down mode.

### 8.4 Device Functional Modes

Table 8-1. Function Table

INPUTS	OUTPUTS
Bx	Ax
L	L
H (referenced to $V_{CCB}$ )	H (referenced to $V_{CCA}$ )

## 9 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. Customers should validate and test their design implementation to confirm system functionality.

### 9.1 Application Information

The SN74AVC4T234 device can be used in level-translation applications for interfacing devices or systems operating at different interface voltages with one another. The SN74AVC4T234 device is ideal for use in applications where a push-pull driver is connected to the data I/Os. The max data rate can be up to 380 Mbps when device translates a signal from 1.8 V to 3.3 V.

### 9.2 Typical Application

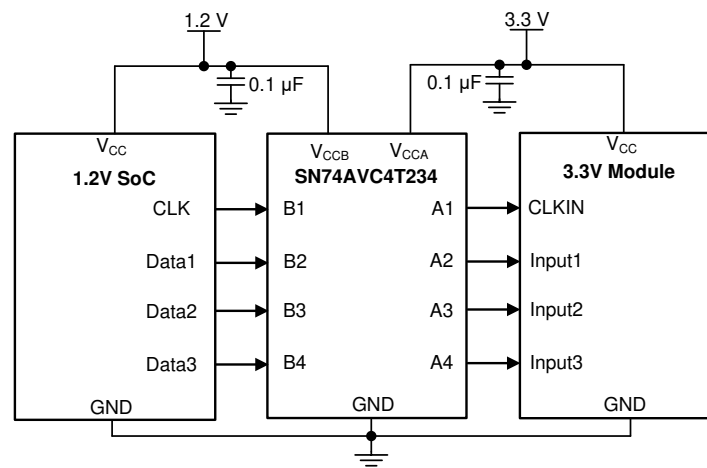


Figure 9-1. Typical Application Diagram

#### 9.2.1 Design Requirements

For the design example shown in [Typical Application](#), use the parameters listed in [Table 9-1](#).

Table 9-1. Design Parameters

DESIGN PARAMETER	EXAMPLE VALUE
Input voltage range	0.9 V to 3.6 V
Output voltage range	0.9 V to 3.6 V

#### 9.2.2 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 SN74AVC4T234 device to determine the input voltage range. For a valid logic high, the value must exceed the  $V_{IH}$  of the input port. For a valid logic low, the value must be less than the  $V_{IL}$  of the input port.
- Output voltage range
  - Use the supply voltage of the device that the SN74AVC4T234 device is driving to determine the output voltage range.

### 9.2.3 Application Curves

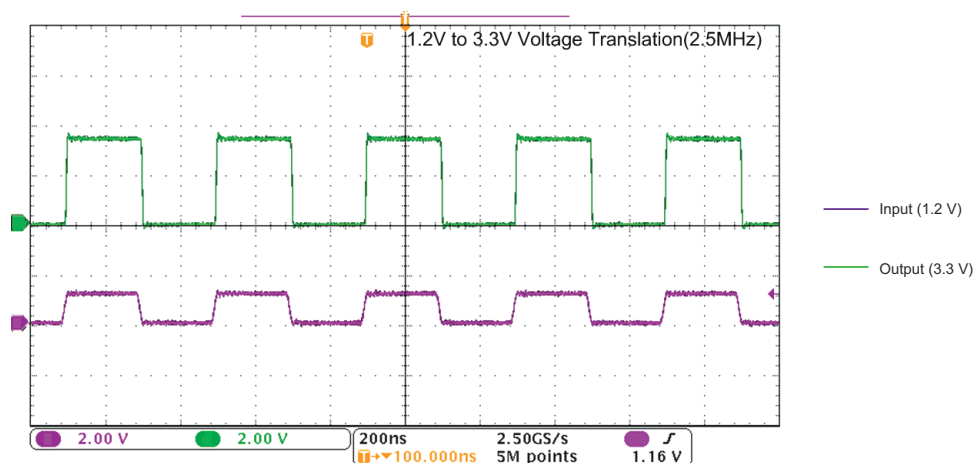


Figure 9-2. Translation Up (1.2 V to 3.3 V) at 2.5 MHz

## 10 Power Supply Recommendations

The SN74AVC4T234 device uses two separate configurable power-supply rails,  $V_{CCA}$  and  $V_{CCB}$ .  $V_{CCA}$  accepts any supply voltage from 0.9 V to 3.6 V and  $V_{CCB}$  accepts any supply voltage from 0.9 V to 3.6 V. The A port and B port are designed to track  $V_{CCA}$  and  $V_{CCB}$  respectively allowing for low-voltage bidirectional translation between any of the 0.9-V, 1.05-V, 1.2-V, 1.5-V, 1.8-V, 2.5-V and 3.3-V voltage nodes.

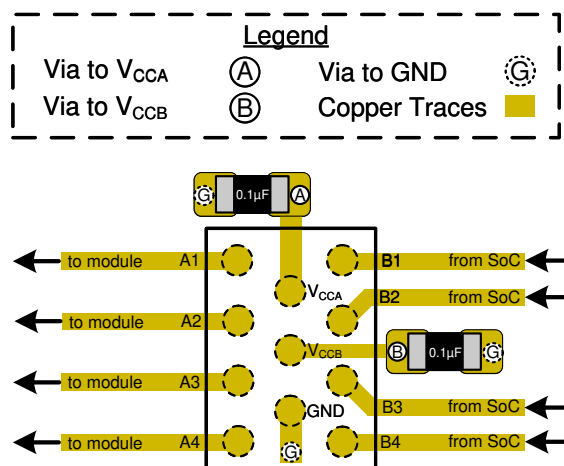
## 11 Layout

### 11.1 Layout Guidelines

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

- Bypass capacitors should be used on power supplies.
- Short trace lengths should be used to avoid excessive loading.
- Place pads on the signal paths for loading capacitors or pullup resistors to help adjust rise and fall times of signals, depending on the system requirements.

### 11.2 Layout Example



## 12 Device and Documentation Support

### 12.1 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.

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### 12.2 Trademarks

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### 12.3 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.

### 12.4 Glossary

[TI Glossary](#) This glossary lists and explains terms, acronyms, and definitions.

## 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 Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead finish/ Ball material (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
SN74AVC4T234ZSUR	OBSOLETE	uCSP	ZSU	11		RoHS & Green	SN98.5/AG1/CU0.5	Level-2-260C-1 YEAR	-40 to 85	ZTD	
SN74AVC4T234ZWAR	ACTIVE	NFBGA	ZWA	11	2500	RoHS & Green	SN98.5/AG1/CU0.5	Level-2-260C-1 YEAR	-40 to 85	1G2	<a href="#">Samples</a>

(1) The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

**OBSOLETE:** TI has discontinued the production of the device.

(2) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

**RoHS Exempt:** TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

**Green:** TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

(3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

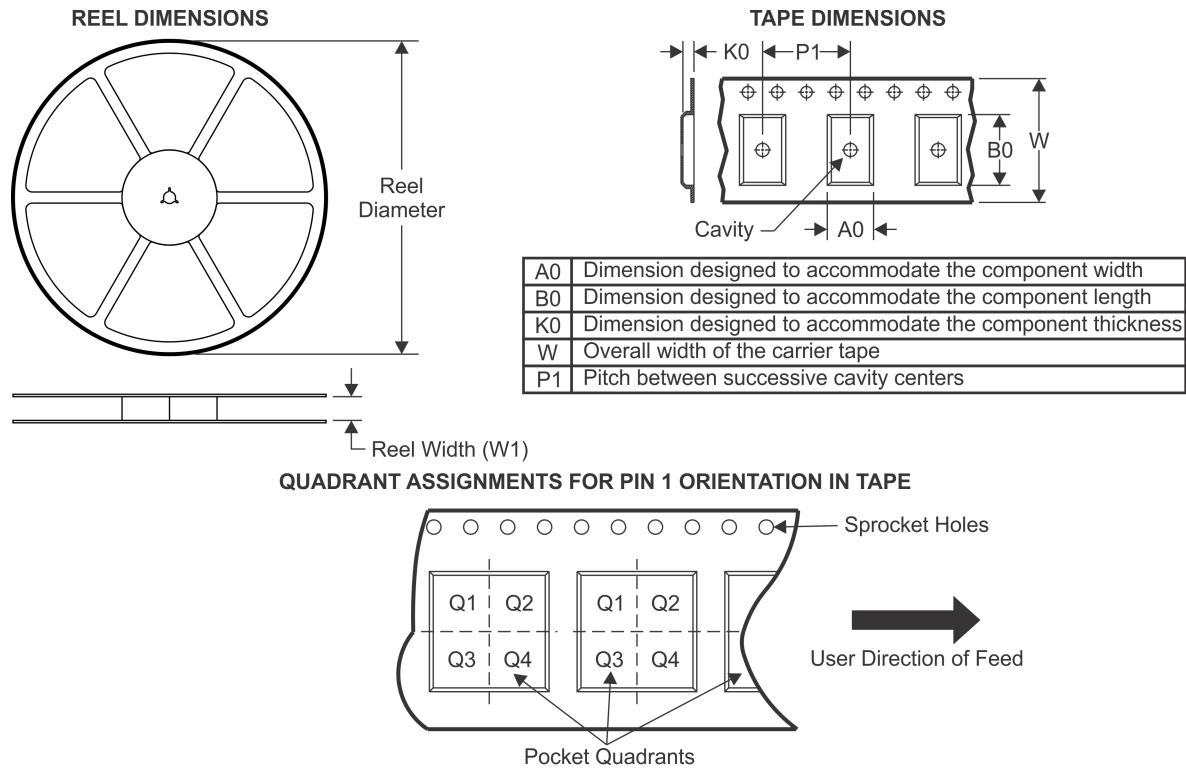
(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead finish/Ball material - Orderable Devices 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.

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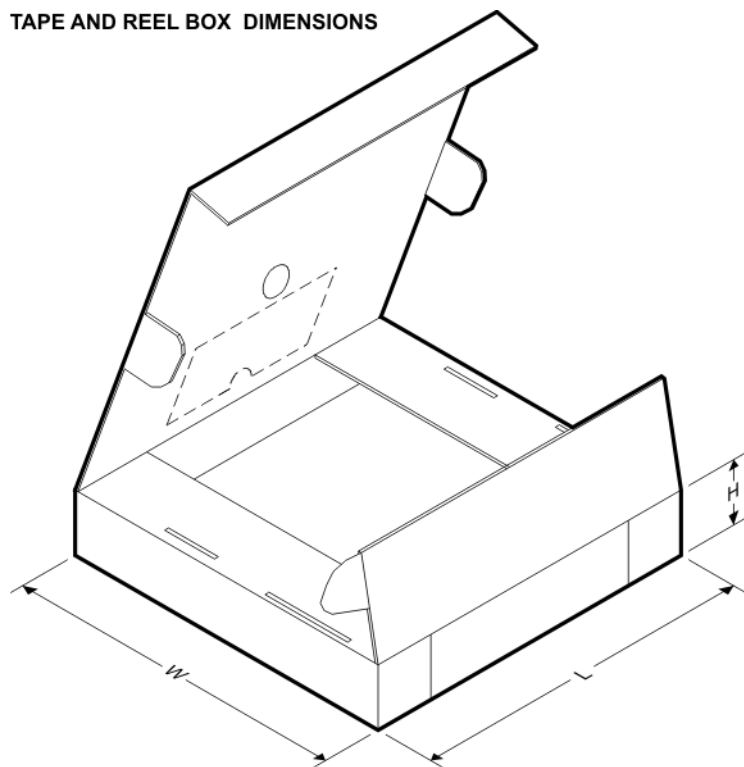
## TAPE AND REEL INFORMATION



\*All dimensions are nominal

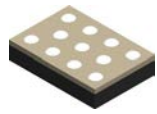
Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN74AVC4T234ZSUR	uCSP	ZSU	11	0	330.0	8.4	1.6	2.2	0.55	4.0	8.0	Q2
SN74AVC4T234ZWAR	NFBGA	ZWA	11	2500	330.0	8.4	1.6	2.2	0.55	4.0	8.0	Q2

## TAPE AND REEL BOX DIMENSIONS



\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74AVC4T234ZSUR	uCSP	ZSU	11	0	338.1	338.1	20.6
SN74AVC4T234ZWAR	NFBGA	ZWA	11	2500	338.1	338.1	20.6

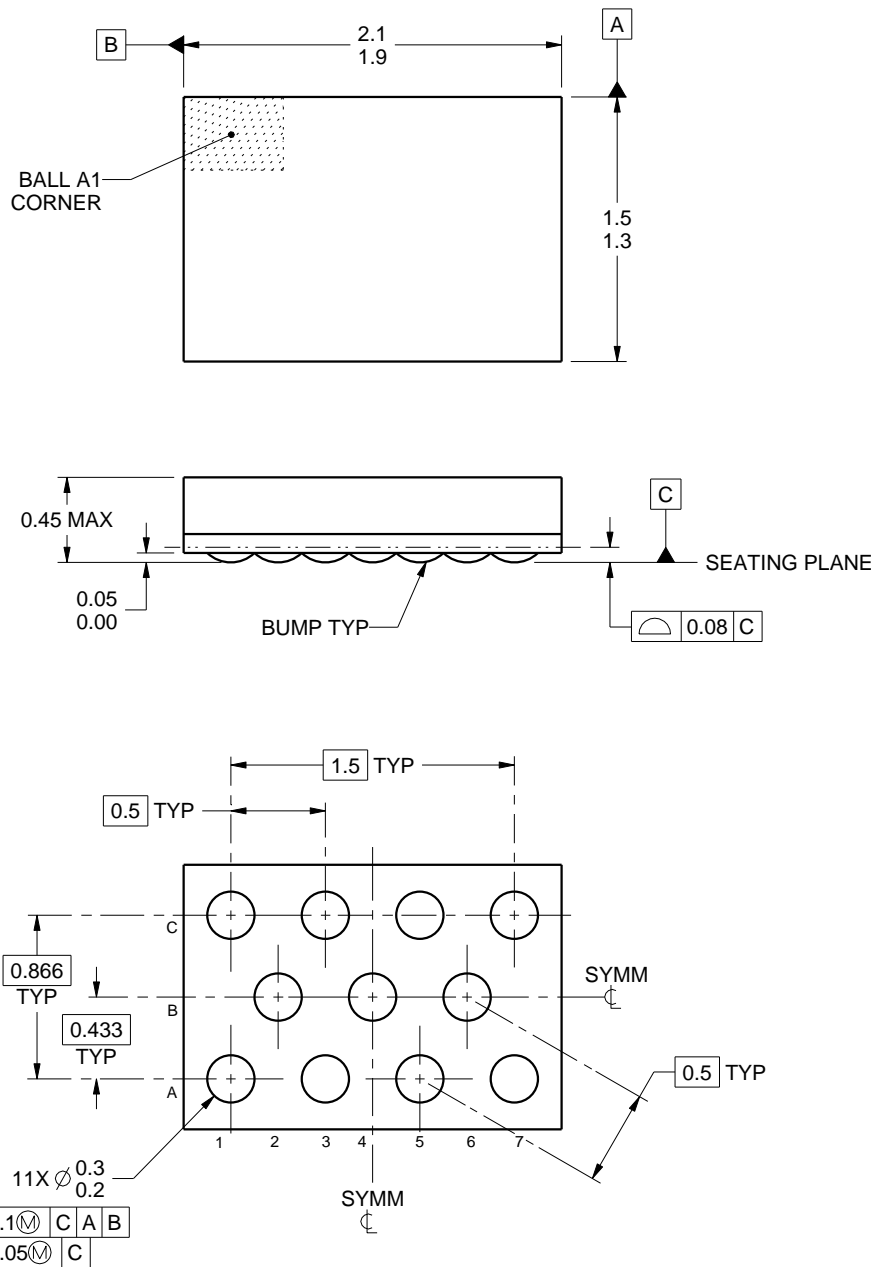


# PACKAGE OUTLINE

**ZSU0011A**

**MicroStar CSP™ - 0.45 mm max height**

MICRO CHIP SCALE PACKAGE



4220297/B 07/2016

## NOTES:

MicroStar CSP is a trademark of Texas Instruments

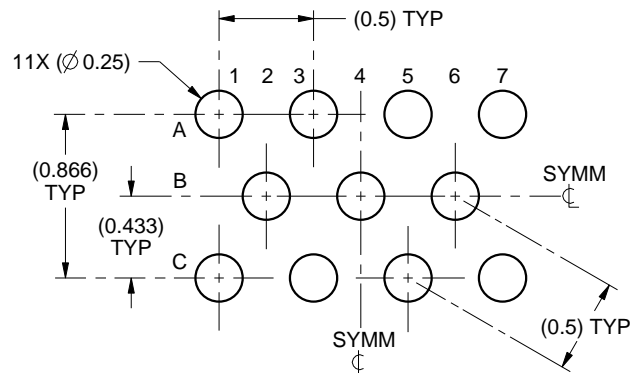
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.

# EXAMPLE BOARD LAYOUT

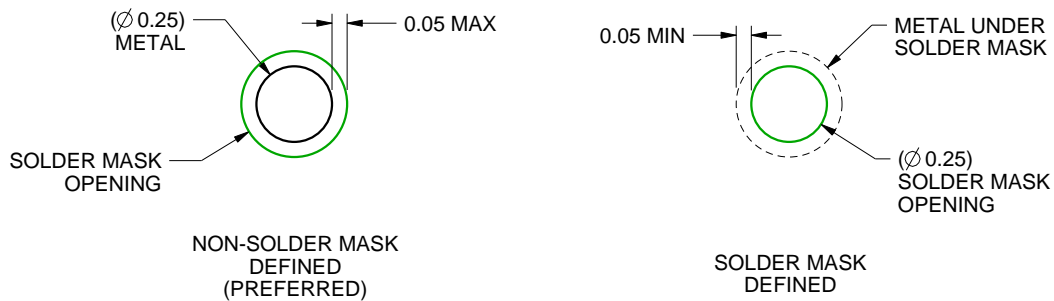
ZSU0011A

MicroStar CSP™ - 0.45 mm max height

MICRO CHIP SCALE PACKAGE



LAND PATTERN EXAMPLE  
SCALE:25X



SOLDER MASK DETAILS  
NOT TO SCALE

4220297/B 07/2016

NOTES: (continued)

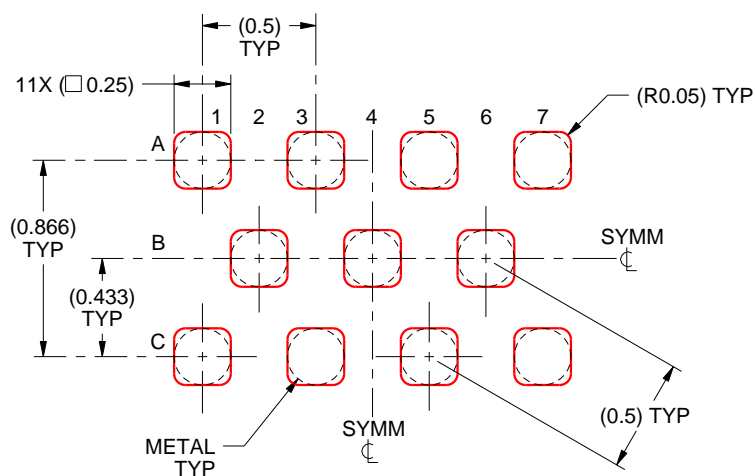
- Final dimensions may vary due to manufacturing tolerance considerations and also routing constraints. See Texas Instruments Literature No. SLUA271 ([www.ti.com/lit/slua271](http://www.ti.com/lit/slua271)).

# EXAMPLE STENCIL DESIGN

ZSU0011A

MicroStar CSP™ - 0.45 mm max height

MICRO CHIP SCALE PACKAGE

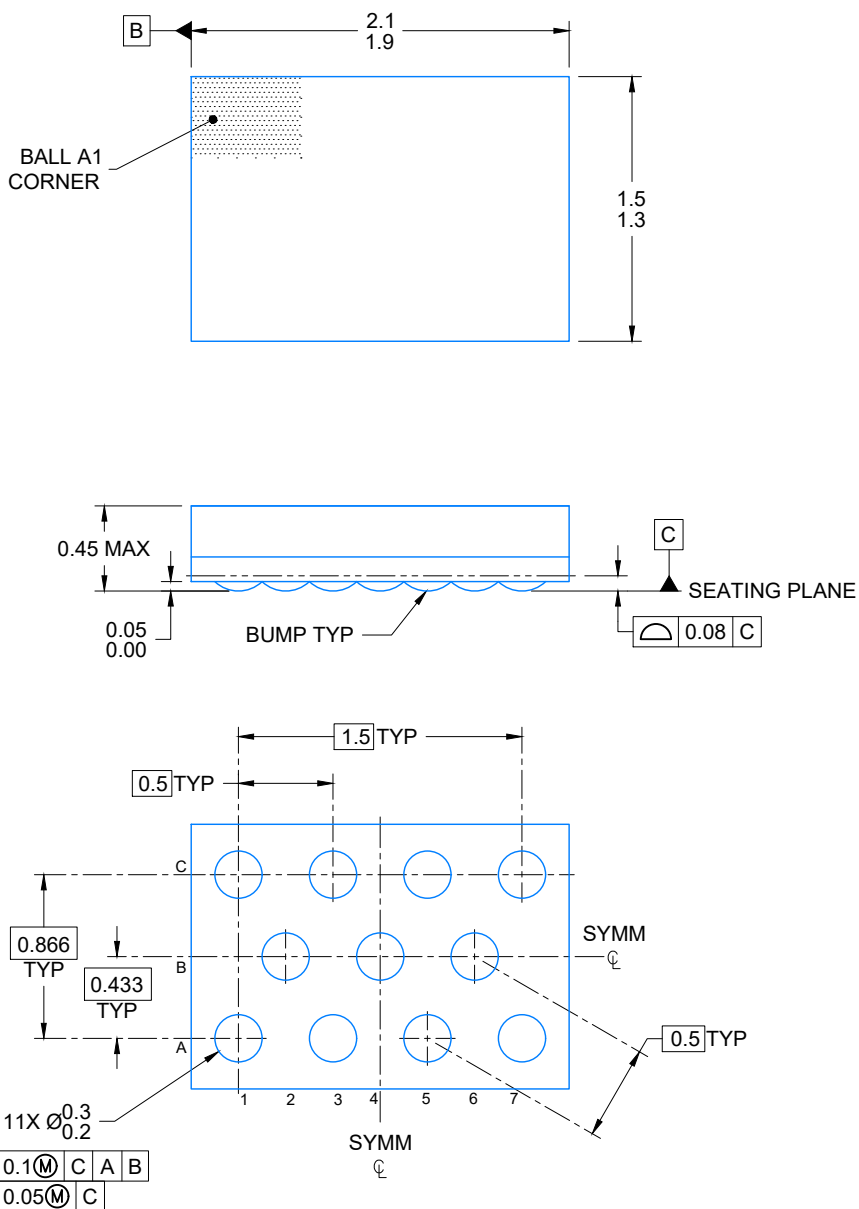


SOLDER PASTE EXAMPLE  
BASED ON 0.1 mm THICK STENCIL  
SCALE:30X

4220297/B 07/2016

NOTES: (continued)

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

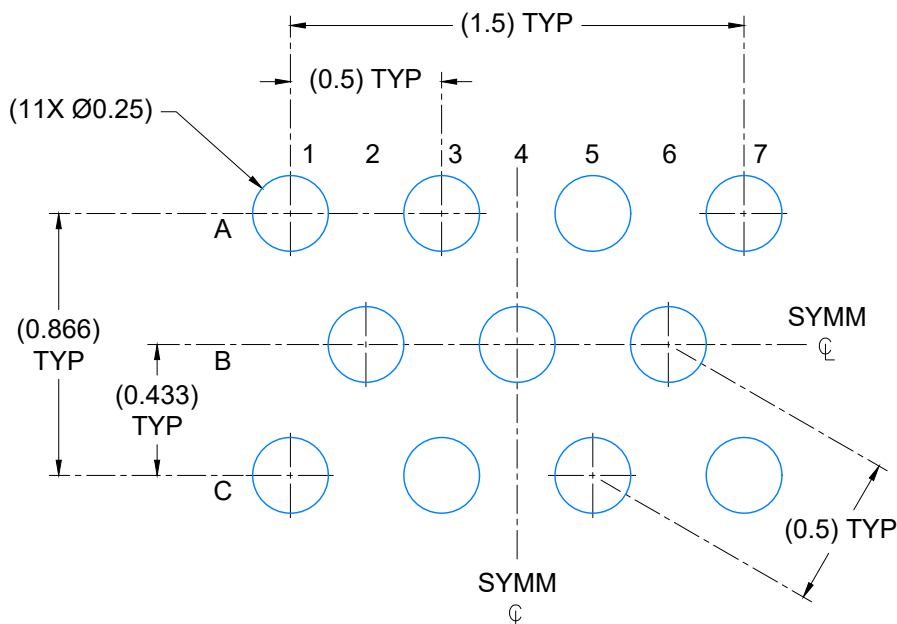


4224717/A 12/2018

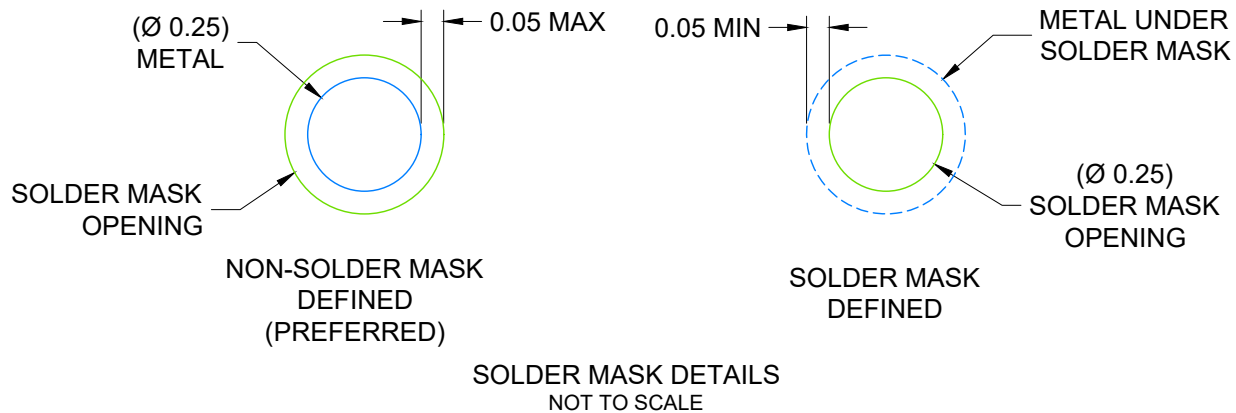
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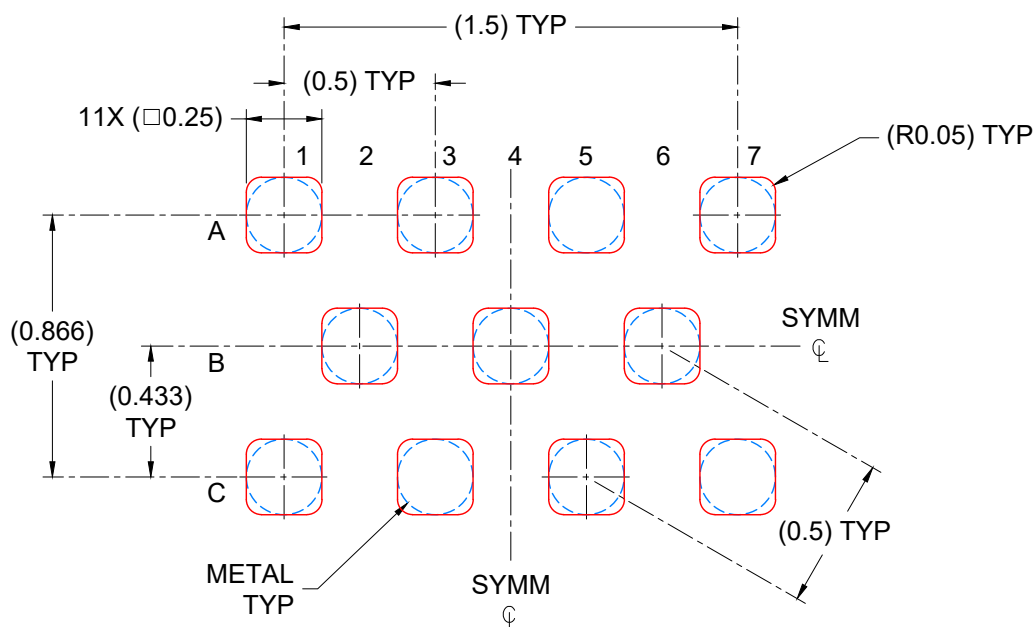
LAND PATTERN EXAMPLE  
SCALE: 40X



4224717/A 12/2018

NOTES: (continued)

- Final dimensions may vary due to manufacturing tolerance considerations and also routing constraints. Refer to Texas Instruments Literature number SNVA009 ([www.ti.com/lit/snva009](http://www.ti.com/lit/snva009)).



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

4224717/A 12/2018

NOTES: (continued)

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

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