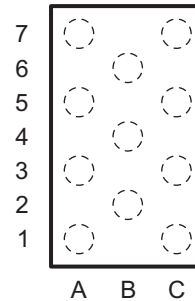


## 4-BIT DUAL-SUPPLY NON-INVERTING BUS TRANSLATOR

Check for Samples: [SN74AVC4T234](#)

### 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  $I_{CC}$
- Input-Disable Feature Allows Floating Input Conditions
- $\pm$ 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)

**ZSU PACKAGE  
(TOP VIEW)**


### DESCRIPTION

This 4-bit noninverting 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.



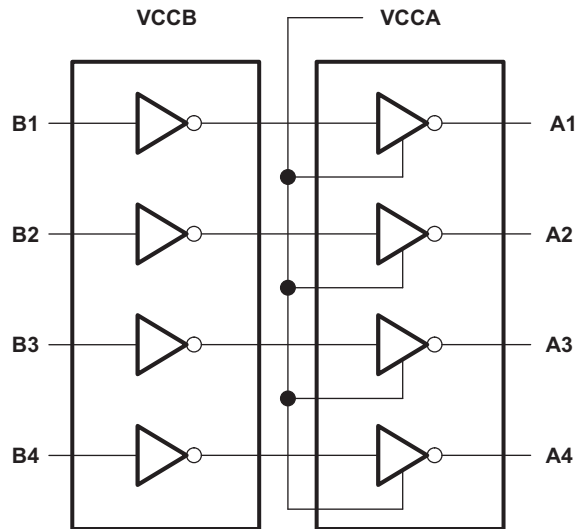
Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

**ORDERING INFORMATION<sup>(1)</sup>**

T <sub>A</sub>	PACKAGE <sup>(2)</sup>		ORDERABLE PART NUMBER	TOP-SIDE MARKING
-40°C to 85°C	MicroStarCSP -- ZSU	Tape and reel	SN74AVC4T234ZSUR	ZTD _ _ <sup>(3)</sup>

- (1) For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI web site at [www.ti.com](http://www.ti.com).
- (2) Package drawings, thermal data, and symbolization are available at [www.ti.com/packaging](http://www.ti.com/packaging).
- (3) ZSU: The actual top-side marking has two additional characters that designate the year and month date code.

**LOGIC DIAGRAM (POSITIVE LOGIC)**



**TERMINAL FUNCTIONS**

TERMINAL		TYPE	DESCRIPTION
NAME	ZSU Package		
B1	C7	I	Data input port
B2	C5	I	Data input port
B3	C3	I	Data input port
B4	C1	I	Data input port
A1	A7	O	Data output port
A2	A5	O	Data output port
A3	A3	O	Data output port
A4	A1	O	Data output port
V <sub>CCA</sub>	B6	PWR	A-side output port power supply voltage (0.9 V to 3.6 V)
V <sub>CCB</sub>	B4	PWR	B-side input port power supply voltage (0.9 V to 3.6 V)
GND	B2	PWR	Ground

**ABSOLUTE MAXIMUM RATINGS<sup>(1)</sup>**

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

		MIN	MAX	UNIT	
$V_{CCA}$ $V_{CCB}$	Supply voltage range	-0.5	4.6	V	
$V_I$	Input voltage range <sup>(2)</sup>	Output ports (A port)	-0.5	4.6	V
		Input ports (B port)	-0.5	4.6	
$V_O$	Voltage range 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 range 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
$\theta_{JA}$	Package thermal impedance <sup>(4)</sup>			180.4	°C/W
$T_{stg}$	Storage temperature range	-65	150		°C

- (1) Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
- (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.
- (4) The package thermal impedance is calculated in accordance with JESD 51-7.

**RECOMMENDED OPERATING CONDITIONS**(1) (2) (3)

		$V_{CCI}$	$V_{CCO}$	MIN	MAX	UNIT
$V_{CCA}$	Supply voltage			0.9	3.6	V
$V_{CCB}$	Supply voltage			0.9	3.6	V
$V_{IH}$	High-level input voltage	Data inputs <sup>(4)</sup>	0.9 V to 1.1 V	$V_{CCI} \times 0.8$	3.6	V
			1.1 V to 1.4 V	$V_{CCI} \times 0.8$	3.6	
			1.4 V to 1.95 V	$V_{CCI} \times 0.65$	3.6	
			2.3 V to 2.7 V	$V_{CCI} \times 0.65$	3.6	
			3 V to 3.6 V	$V_{CCI} \times 0.65$	3.6	
$V_{IL}$	Low-level input voltage	Data inputs <sup>(4)</sup>	0.9 V to 1.1 V	0	$V_{CCI} \times 0.2$	V
			1.1 V to 1.4 V	0	$V_{CCI} \times 0.2$	
			1.1 V to 1.95 V	0	$V_{CCI} \times 0.35$	
			2.3 V to 2.7 V	0	$V_{CCI} \times 0.35$	
			3 V to 3.6 V	0	$V_{CCI} \times 0.35$	
$V_I$	Input voltage			0	3.6	V
$V_O$	Output voltage	Active state		0	$V_{CCO}$	V
$I_{OH}$	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	
$I_{OL}$	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	
$\Delta t/\Delta v$	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	
$T_A$	Operating free-air temperature			-40	85	°C

(1)  $V_{CCI}$  is the  $V_{CCB}$  input port.

(2)  $V_{CCO}$  is the  $V_{CCA}$  output port.

(3) All unused data inputs of the device must be held at  $V_{CCI}$  or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.

(4) For  $V_{CCI}$  values not specified in the data sheet,  $V_{IH}$  min =  $V_{CCI} \times 0.7$  V,  $V_{IL}$  max =  $V_{CCI} \times 0.3$  V

**ELECTRICAL CHARACTERISTICS<sup>(1) (2)</sup>**

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

PARAMETER	TEST CONDITIONS		V <sub>CCA</sub>	V <sub>CCB</sub>	T <sub>A</sub> = 25°C			–40°C to 85°C		UNIT
					MIN	TYP	MAX	MIN	MAX	
V <sub>OH</sub>		V <sub>I</sub> = V <sub>IH</sub>	0.9 V	0.9 V to 3.6 V				V <sub>CCA</sub> – 0.1		V
			1.1 V					0.88		
			1.4 V					1.05		
			1.65 V					1.2		
			2.3V					1.75		
			3 V					2.3		
V <sub>OL</sub>		V <sub>I</sub> = V <sub>IL</sub>	0.9 V	0.9 V to 3.6 V					0.1	V
			1.1 V					0.2		
			1.4 V					0.2		
			1.65 V					0.25		
			2.3V					0.3		
			3 V					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		±0.1	±1		±5	µA
			0 V to 3.6 V	0 V		±0.1	±1		±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					8	µA
			0 V	0 V to 3.6 V					8	
			0 V to 3.6 V	0 V					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					8	µA
			0 V	0 V to 3.6 V					8	
			0 V to 3.6 V	0 V					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					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		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		5			7	pF

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

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

## SWITCHING CHARACTERISTICS

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

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

## SWITCHING CHARACTERISTICS

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CCA} = 1.1\text{ V}$	$V_{CCA} = 1.4\text{ V}$		$V_{CCA} = 1.65\text{ V}$		$V_{CCA} = 2.3\text{ V}$		$V_{CCA} = 3\text{ V}$		UNIT
			TYP	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
$t_{PLH}$	B	A	4.7	2.0	5	1.5	3.8	1.2	3.8	1.0	3.8	ns
$t_{PHL}$			4.2	2.0	5	1.5	3.9	1.2	3	1.0	3.0	

## SWITCHING CHARACTERISTICS

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CCA} = 1.1\text{ V}$	$V_{CCA} = 1.4\text{ V}$		$V_{CCA} = 1.65\text{ V}$		$V_{CCA} = 2.3\text{ V}$		$V_{CCA} = 3\text{ V}$		UNIT
			TYP	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
$t_{PLH}$	B	A	4.3	2.0	4.2	1.5	4.1	1.2	3.8	1.0	3.7	ns
$t_{PHL}$			2.6	2.0	4.2	1.5	4.1	1.2	3.8	1.0	3.7	

## SWITCHING CHARACTERISTICS

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CCA} = 1.1\text{ V}$	$V_{CCA} = 1.4\text{ V}$		$V_{CCA} = 1.65\text{ V}$		$V_{CCA} = 2.3\text{ V}$		$V_{CCA} = 3\text{ V}$		UNIT
			TYP	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
$t_{PLH}$	B	A	2.7	2.0	3.5	1.5	3.1	1.2	2.8	0.2	4.1	ns
$t_{PHL}$			2.4	2.0	3.7	1.5	3.7	1.2	2.8	0.2	3.5	

## SWITCHING CHARACTERISTICS

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CCA} = 1.1\text{ V}$	$V_{CCA} = 1.4\text{ V}$		$V_{CCA} = 1.65\text{ V}$		$V_{CCA} = 2.3\text{ V}$		$V_{CCA} = 3\text{ V}$		UNIT
			TYP	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
$t_{PLH}$	B	A	3.9	2.0	3.8	1.5	3.6	0.5	3.6	0.2	3.6	ns
$t_{PHL}$			3.9	2.0	3.7	1.5	3.1	0.5	3.5	0.2	3.0	

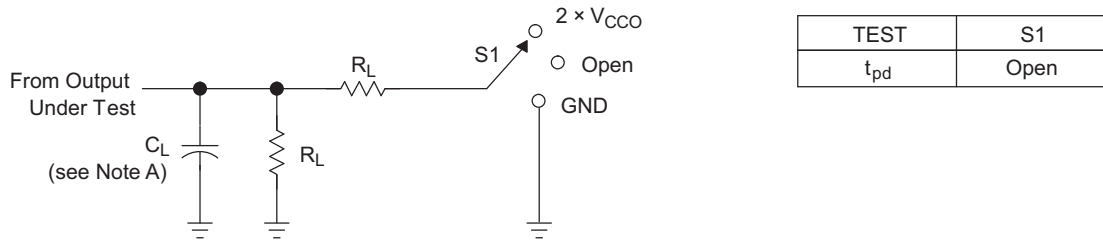
## OPERATING CHARACTERISTICS

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

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

(1) Power dissipation capacitance per transceiver

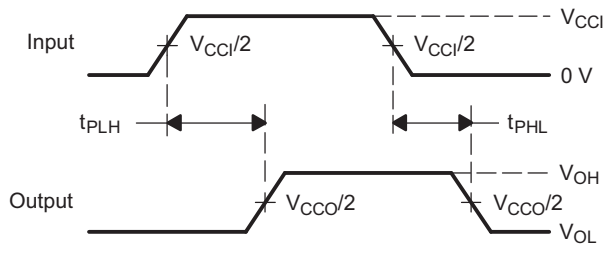
**PARAMETER MEASUREMENT INFORMATION**



TEST	S1
$t_{pd}$	Open

LOAD CIRCUIT

$V_{CCO}$	$C_L$	$R_L$	$V_{TP}$
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



VOLTAGE WAVEFORMS  
PROPAGATION DELAY TIMES

- 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 1. Load and Circuit and Voltage Waveforms**



**PACKAGING INFORMATION**

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
SN74AVC4T234ZSUR	ACTIVE	uCSP	ZSU	11	2500	Green (RoHS & no Sb/Br)	NIAU	Level-2-260C-1 YEAR	-40 to 85	ZTD	Samples

(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) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

**TBD:** The Pb-Free/Green conversion plan has not been defined.

**Pb-Free (RoHS):** TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

**Pb-Free (RoHS Exempt):** This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

(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.

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## TAPE AND REEL INFORMATION



### QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



\*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	2500	330.0	8.4	1.6	2.2	0.55	4.0	8.0	Q2

**TAPE AND REEL BOX DIMENSIONS**

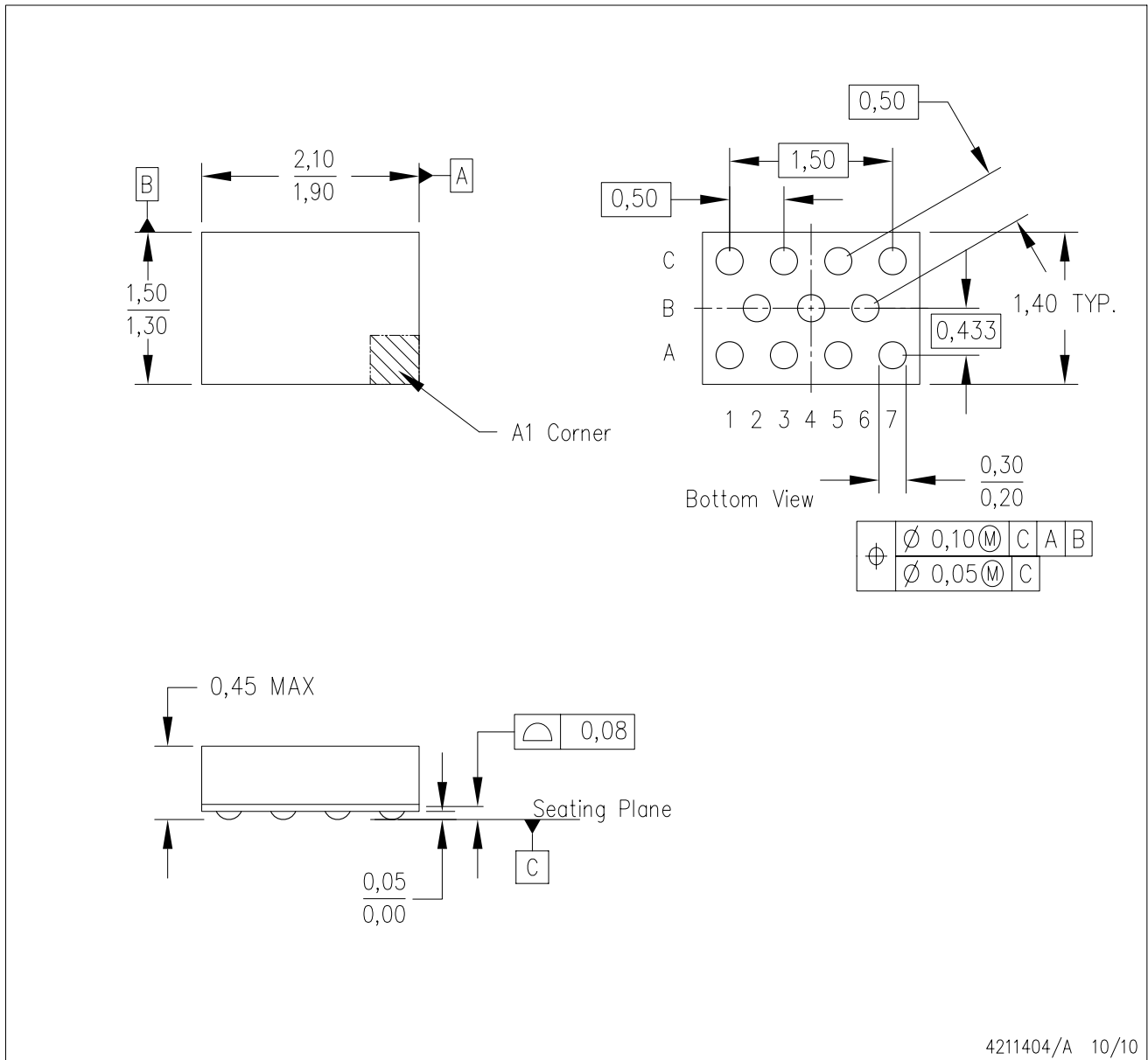


\*All dimensions are nominal

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

ZSU (R-uCSP-N11)

MicrostarCSP™



4211404/A 10/10

- 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. MicrostarCSP™ configuration.
  - D. This is a Pb-free solder ball design.

MicrostarCSP is a trademark of Texas Instruments

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