SN74AVC4T234 4 位双电源单向同相电压转换器

1 特性

- 0.9V 至 3.6V 的宽工作 V_{CC} 范围
- 3.6V 耐压 I/O 支持混合模式的信号操作
- 电压为 3.3V 时，t_{pd} 最大值为 3.7ns
- 平衡传播延迟：$t_{PLH} = t_{PHL}$
- 低静态功耗，最大 I_{CC} 为 5μA
- 如果任一 V_{CC} 变为 0V，则会禁用输出
- 电压为 1.8V 时，输出驱动为 ±3mA
- A 侧输出端有 26Ω 串联电阻
- I_{off} 支持局部断电模式运行
- 输入迟滞可在输入端实现缓慢的输入转换和更好的开关噪声抗扰度
- 最大数据速率
  - 380Mbps（1.8V 至 3.3V 转换）
  - 200Mbps（小于 1.8V 至 3.3V 转换）
  - 200Mbps（转换至 2.5V 或 1.8V）
  - 150Mbps（转换至 1.5V）
  - 100Mbps（转换至 1.2V）
- 闩锁性能超过 100mA，符合 JESD 78 II 类规范的要求
- ESD 保护性能超过 JESD 22 规范要求
  - 2000V 人体放电模型 (A114-A)
  - 500V 充电器件模型 (C101)

2 应用

- 个人电子产品
- 工业
- 企业
- 电信

3 说明

这款 4 位同相总线收发器采用两个独立的可配置电源轨来实现 B 端口输入和 A 端口输出之间的异步通信。A 端口旨在跟踪 V_{CCA}，而 B 端口旨在跟踪 V_{CCB}。V_{CCA} 和 V_{CCB} 均可配置为 0.9V 至 3.6V 范围内的值。

SN74AVC4T234 解决方案可确保在整个 0.9V 至 3.6V 的 V_{CC} 范围内实现极低的静态和动态功耗，满足电池供电型便携式应用的低功耗需求，从而延长电池的使用寿命。该产品还可以保持出色的信号完整性。

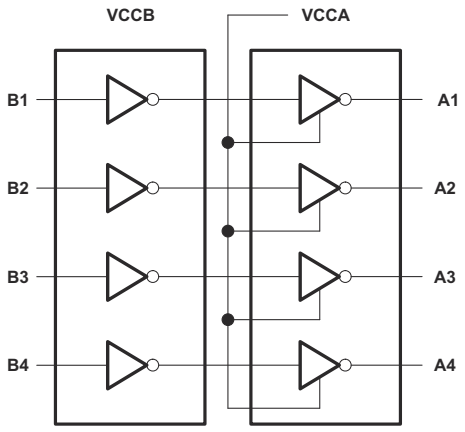
该器件完全符合使用 I_{off} 的部分断电应用的规范要求。I_{off} 电路禁用输出，从而可防止其断电时破坏性电流从该器件回流。

V_{CC} 隔离特性可确保只要有任何一个 V_{CC} 输入接地 (GND)，则 A 侧端口处于高阻抗状态。

器件信息

器件型号	封装(1)	封装尺寸（标称值）
SN74AVC4T234ZSU	uCSP (11)	2.00mm × 1.40mm
SN74AVC4T234ZWA	NFBGA (11)	2.00mm × 1.40mm

(1) 如需了解所有可用封装，请参阅数据表末尾的可订购产品附录。



逻辑图（正逻辑）

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4 Revision History

注：以前版本的页码可能与当前版本的页码不同

Changes from Revision A (June 2011) to Revision B (July 2020)	Page
• 通篇按照新的 TI 数据表标准进行格式调整并增加了信息	1
• 删除了“具有输入禁用特性，允许出现输入悬空的情况”特性	1
• 添加了“如果任一 V_{CC} 变为 0V，则会禁用输出”特性	1
• 更新了整个文档中的表格、图和交叉参考的编号格式	1
• 删除了 *订购信息* 表	1
• 添加了 ZWA 封装作为可订购产品	1
• Added *ESD Ratings* table	4
• Added Thermal Information table	6
• Added Feature Description section.	10
• Added Device Functional Modes section	10
• Added Application and Implementation section	11
• Added Power Supply Recommendations section	12
• Added Layout section	12
• Added Device and Documentation Support, and Mechanical, Packaging, and Orderable Information sections.	13

5 Pin Configuration and Functions

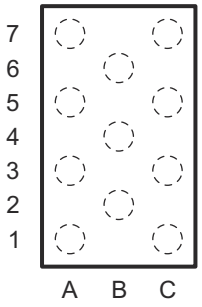


图 5-1. ZSU/ZWA Package 11-Pin uCSP Transparent Top View

Pin Functions

PIN	NO.	TYPE	DESCRIPTION
NAME	ZSU, ZWA		
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_{CCA}	B6	—	A-side output port power supply voltage (0.9 V to 3.6 V)
V_{CCB}	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)(1)

			MIN	MAX	UNIT
V_{CCA} V_{CCB}	Supply voltage		– 0.5	4.6	V
V_I	Input voltage(2)	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(2)	A port	– 0.5	4.6	V
V_O	Voltage applied to any output in the high or low state(2) (3)	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(1)	±2000	V
		Charged-device model (CDM), per JEDEC specification JESD22-C101(2)	±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_{CCI} (1) (3)	V_{CCO} (2)	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(4)	0.9 V to 1.1 V		V_{CCI} × 0.8	3.6	V
			1.1 V to 1.4 V		V_{CCI} × 0.8	3.6	
			1.4 V to 1.95 V		V_{CCI} × 0.65	3.6	
			2.3 V to 2.7 V		V_{CCI} × 0.65	3.6	
			3 V to 3.6 V		V_{CCI} × 0.65	3.6	
V_{IL}	Low-level input voltage	Data inputs(4)	0.9 V to 1.1 V		0	V_{CCI} × 0.2	V
			1.1 V to 1.4 V		0	V_{CCI} × 0.2	
			1.1 V to 1.95 V		0	V_{CCI} × 0.35	
			2.3 V to 2.7 V		0	V_{CCI} × 0.35	
			3 V to 3.6 V		0	V_{CCI} × 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	
				3 V to 3.6 V		12	
$\Delta t/\Delta v$	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*, SCBA004.
(4) For V_{CCI} values not specified in the data sheet, V_{IH} min = V_{CCI} × 0.7 V, V_{IL} max = V_{CCI} × 0.3 V

6.4 Thermal Information

THERMAL METRIC(1)		SN74AVC4T234 ZSU (uCSP) 11 PINS	SN74AVC4T234 ZWA (NFBGA) 11 PINS	UNIT
$R_{\theta JA}$	Junction-to-ambient thermal resistance(2)	165.9	181.4	°C/W
$R_{\theta JC(top)}$	Junction-to-case (top) thermal resistance	123.8	136.7	°C/W
$R_{\theta JB}$	Junction-to-board thermal resistance	123.2	137.7	°C/W
ψ_{JT}	Junction-to-top characterization parameter	4.4	7.5	°C/W
ψ_{JB}	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(1) (2)		TEST CONDITIONS		V_{CCA}	V_{CCB}	T_A	MIN	TYP	MAX	UNIT
V_{OH}		I_{OH} = – 100 μA	$V_I = V_{IH}$	0.9 V	0.9 V to 3.6 V	T_A = – 40°C to 85°C	V_{CCA} – 0.1			V
		I_{OH} = – 1 mA		1.1 V		T_A = – 40°C to 85°C	0.88			
		I_{OH} = – 2 mA		1.4 V		T_A = – 40°C to 85°C	1.05			
		I_{OH} = – 3 mA		1.65 V		T_A = – 40°C to 85°C	1.2			
		I_{OH} = – 6 mA		2.3V		T_A = – 40°C to 85°C	1.75			
		I_{OH} = – 12 mA		3 V		T_A = – 40°C to 85°C	2.3			
V_{OL}		I_{OL} = 100 μA	$V_I = V_{IL}$	0.9 V	0.9 V to 3.6 V	T_A = – 40°C to 85°C			0.1	V
		I_{OL} = 1 mA		1.1 V		T_A = – 40°C to 85°C			0.2	
		I_{OL} = 2 mA		1.4 V		T_A = – 40°C to 85°C			0.2	
		I_{OL} = 3 mA		1.65 V		T_A = – 40°C to 85°C			0.25	
		I_{OL} = 6 mA		2.3V		T_A = – 40°C to 85°C			0.3	
		I_{OL} = 12 mA		3 V		T_A = – 40°C to 85°C			0.55	
I_{off}	A or B port	V_I or V_O = 0 to 3.6 V		0 V	0 V to 3.6 V	T_A = 25°C		±0.1	±1	μA
						T_A = – 40°C to 85°C			±5	
				0 V to 3.6 V	0 V	T_A = 25°C		±0.1	±1	
						T_A = – 40°C to 85°C			±5	
I_{CCA}		V_{CCB} or GND, I_O = 0		0.8 V to 3.6 V	0.8 V to 3.6 V	T_A = – 40°C to 85°C			8	μA
				0 V	0 V to 3.6 V	T_A = – 40°C to 85°C			8	
				0 V to 3.6 V	0 V	T_A = – 40°C to 85°C			8	
I_{CCB}		V_{CCB} or GND, I_O = 0		0.8 V to 3.6 V	0.8 V to 3.6 V	T_A = – 40°C to 85°C			8	μA
				0 V	0 V to 3.6 V	T_A = – 40°C to 85°C			8	
				0 V to 3.6 V	0 V	T_A = – 40°C to 85°C			8	
$I_{CCA} + I_{CCB}$		V_{CCB} or GND, I_O = 0		0.8 V to 3.6 V	0.8 V to 3.6 V	T_A = – 40°C to 85°C			16	μA
C_i	V_{CCB}	V_{CCB} = 3.3 V or GND		3.3 V	3.3 V	T_A = 25°C		22		pF
C_{io}	A or B port	V_{CCA} = 3.3 V or GND		3.3 V	3.3 V	T_A = 25°C		5		pF
						T_A = – 40°C to 85°C			7	

(1) V_{CCI} is the V_{CCB} input port.
(2) V_{CCO} is the V_{CCA} output port.

6.6 Switching Characteristics, V_{CCB} = 1.1 V

over recommended operating free-air temperature range, V_{CCB} = 1.1 V (unless otherwise noted) (see 图 7-1)

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

6.7 Switching Characteristics, V_{CCB} = 1.4 V

over recommended operating free-air temperature range, V_{CCB} = 1.4 V (see 图 7-1)

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

6.8 Switching Characteristics, V_{CCB} = 1.65 V

over recommended operating free-air temperature range, V_{CCB} = 1.65 V (see 图 7-1)

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

6.9 Switching Characteristics, V_{CCB} = 2.3 V

over recommended operating free-air temperature range, V_{CCB} = 2.3 V (see 图 7-1)

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

6.10 Switching Characteristics, V_{CCB} = 3 V

over recommended operating free-air temperature range, V_{CCB} = 3 V (see 图 7-1)

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

6.11 Operating Characteristics

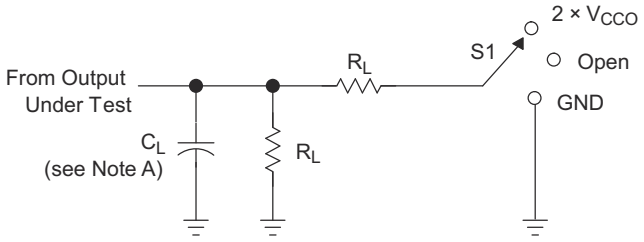
T_A = 25°C

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

(1) Power dissipation capacitance per transceiver

7 Parameter Measurement Information

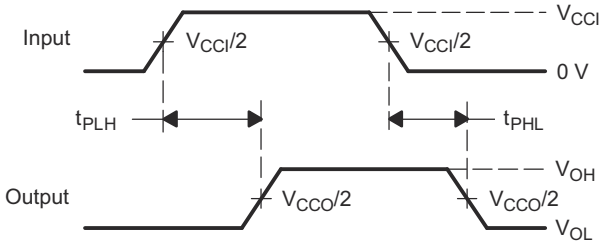
7.1 Load Circuit and Voltage Waveforms



TEST	S1
t_{pd}	Open

LOAD CIRCUIT

V_{CCO}	C_L	R_L	V_{TP}
1.2 V	30 pF	0.5 kΩ	0.1 V
1.5 V ± 0.1 V	30 pF	0.5 kΩ	0.1 V
1.8 V ± 0.15 V	30 pF	0.5 kΩ	0.15 V
2.5 V ± 0.2 V	30 pF	0.5 kΩ	0.15 V
3.3 V ± 0.3 V	30 pF	0.5 kΩ	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 ≤ 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 V_{CCB}.
F. V_{CCO} is V_{CCA}.

图 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

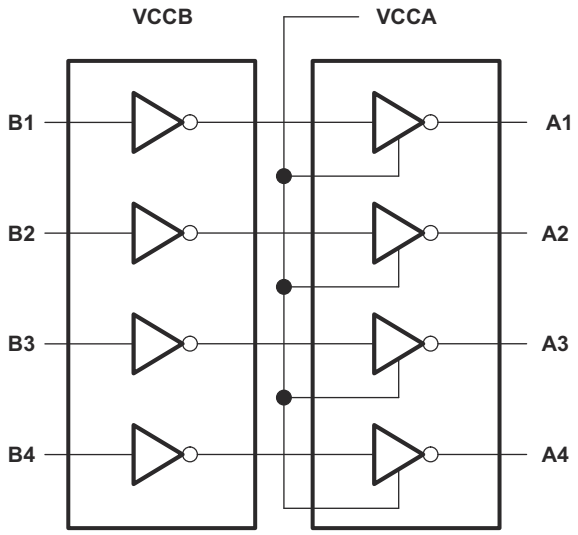


图 8-1. Logic Diagram (Positive Logic)

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

表 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

以下应用部分的信息不属于 TI 组件规范，TI 不担保其准确性和完整性。客户应负责确定 TI 组件是否适用于其应用。客户应验证并测试其设计，以确保系统功能。

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

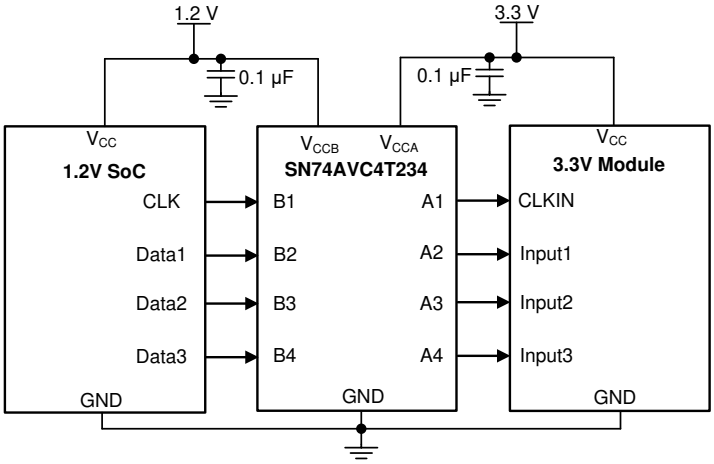


图 9-1. Typical Application Diagram

9.2.1 Design Requirements

For the design example shown in *Typical Application,* use the parameters listed in 表 9-1.

表 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

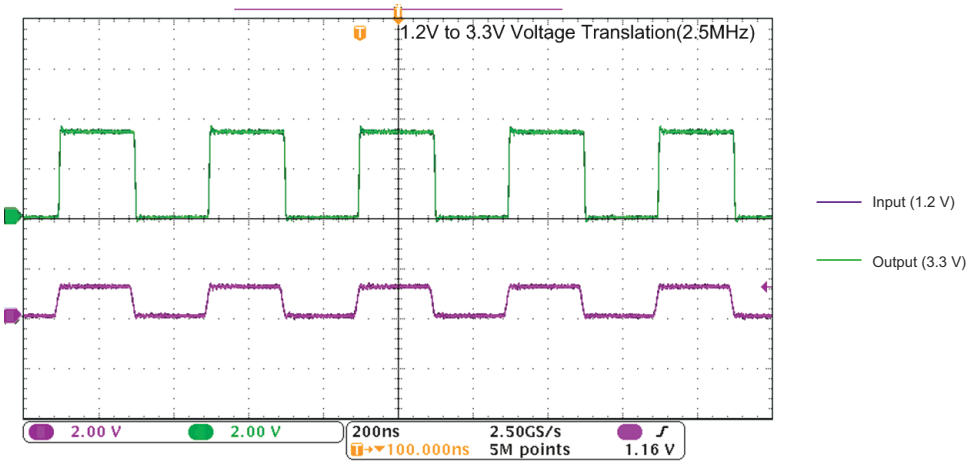


图 9-2. Translation Up (1.2 V to 3.3 V) at 2.5 MHz

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.

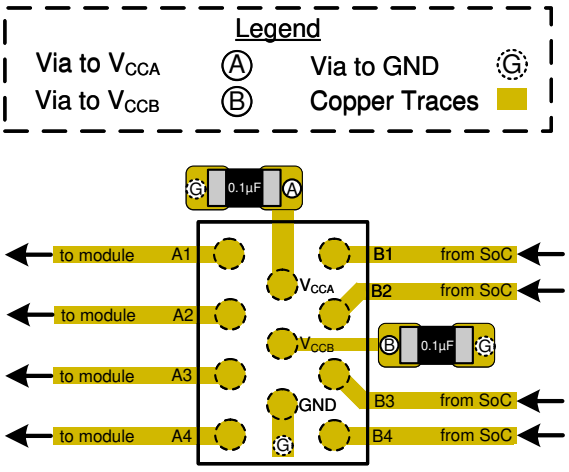
11 Layout

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.

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.

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
SN74AVC4T234ZWAR	ACTIVE	NFBGA	ZWA	11	2500	RoHS & Green	SN98.5/AG1/CU0.5	Level-2-260C-1 YEAR	-40 to 85	1G2	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) **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.

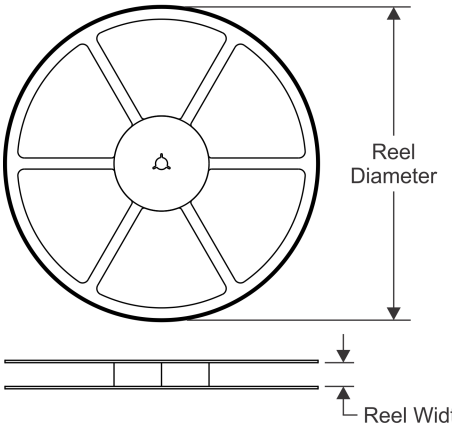
(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(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.

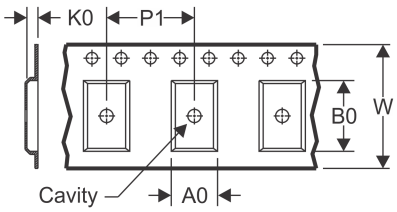
(6) Lead finish/Ball material - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

TAPE AND REEL INFORMATION

REEL DIMENSIONS

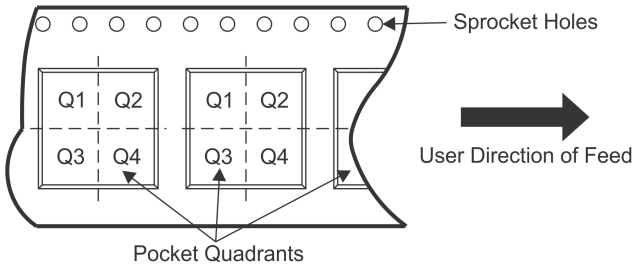


TAPE DIMENSIONS



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

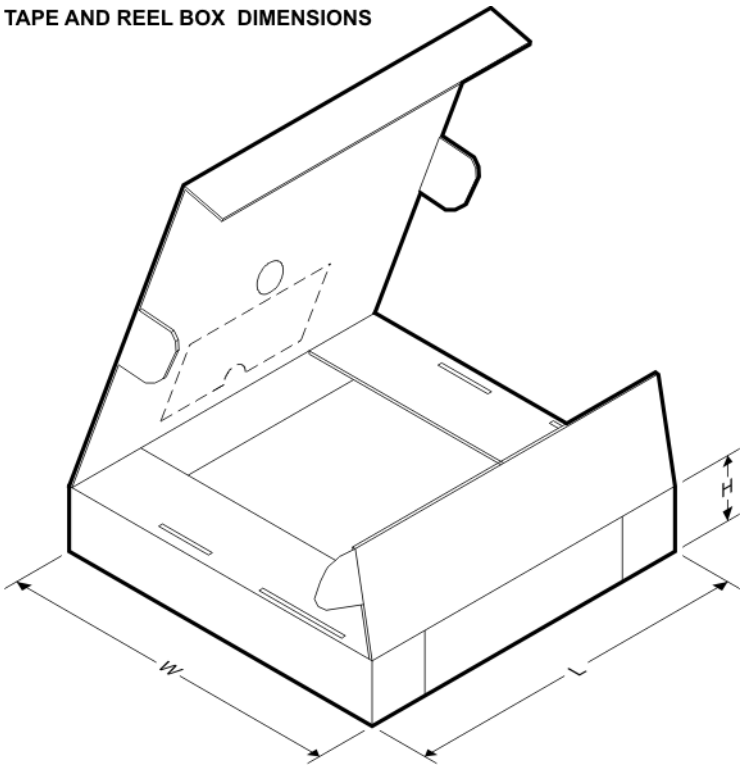
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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
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

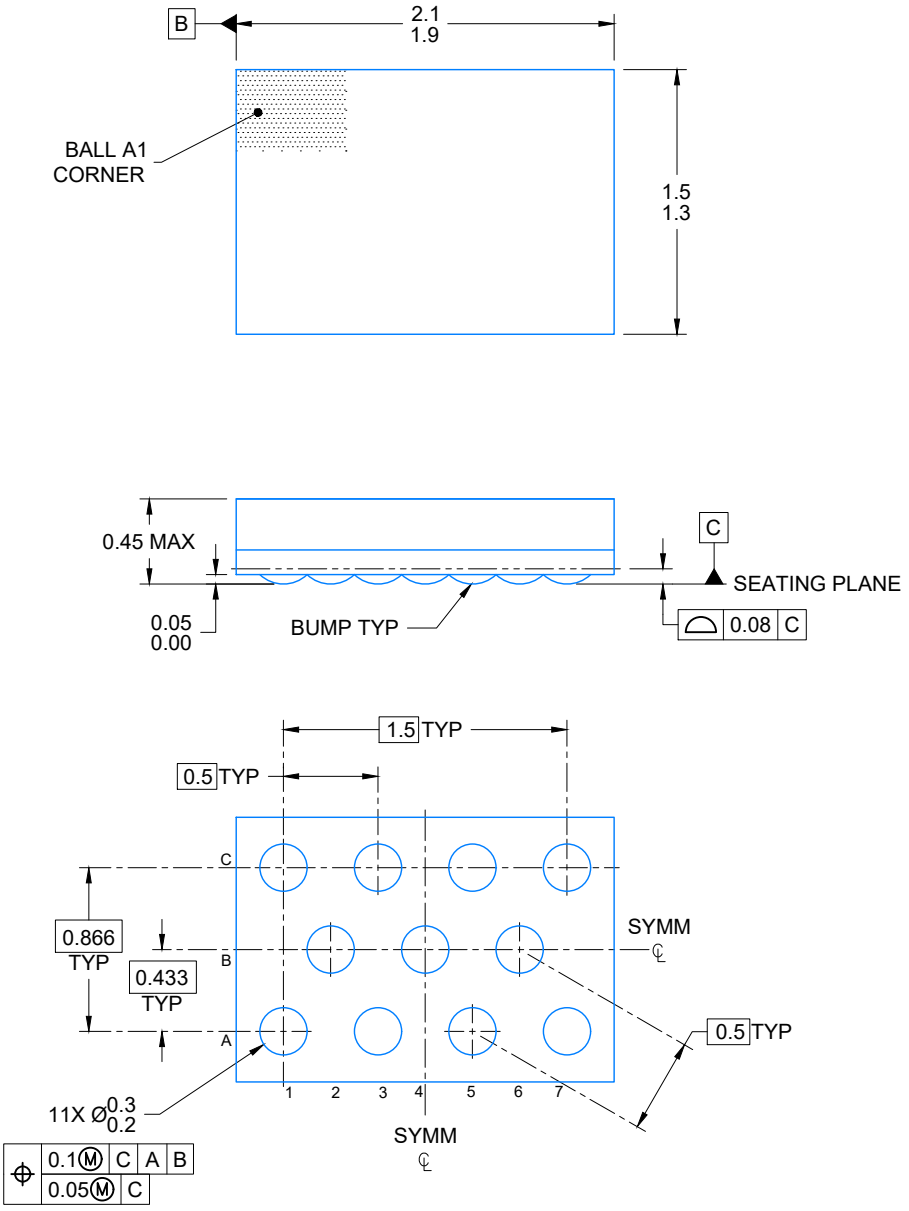
Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74AVC4T234ZWAR	NFBGA	ZWA	11	2500	338.1	338.1	20.6

PACKAGE OUTLINE

ZWA0011A

NFBGA - 0.45 mm max height

MICRO CHIP SCALE PACKAGE



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NOTES:

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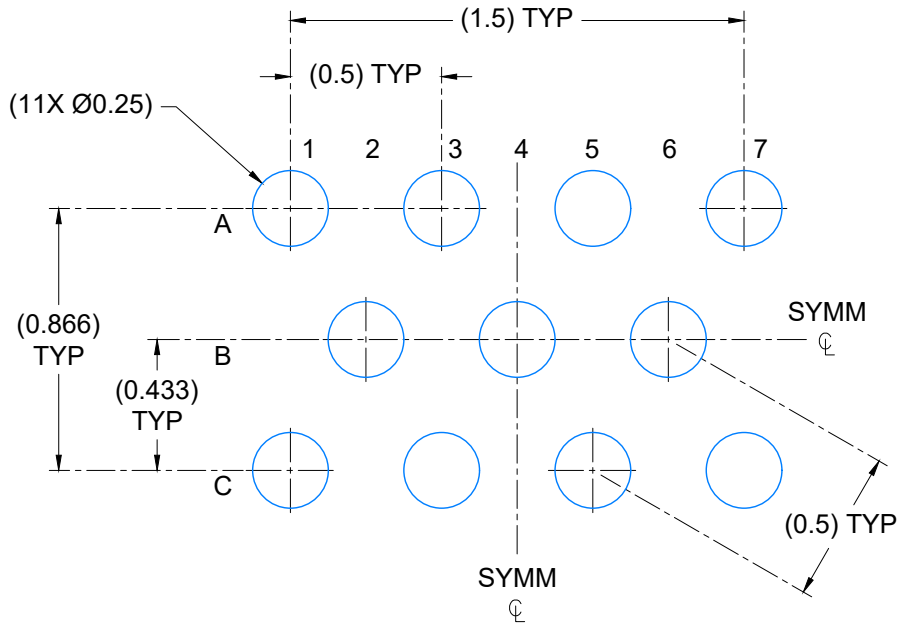
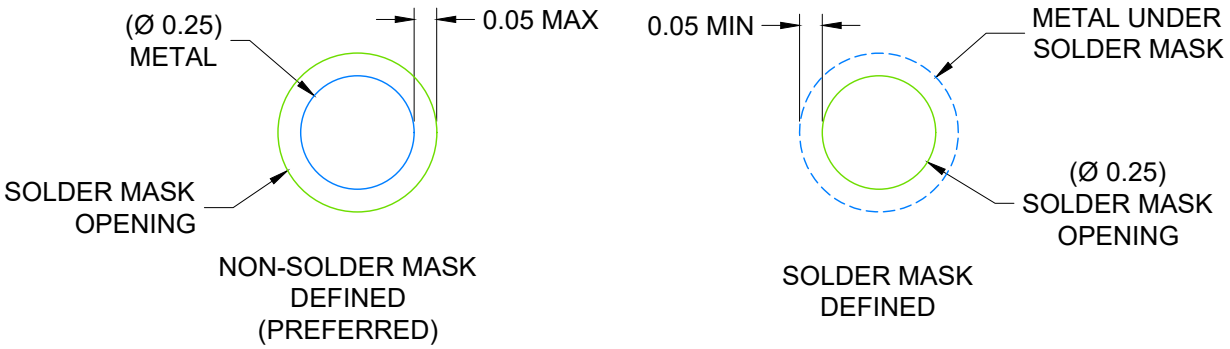
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.



LAND PATTERN EXAMPLE
SCALE: 40X



SOLDER MASK DETAILS
NOT TO SCALE

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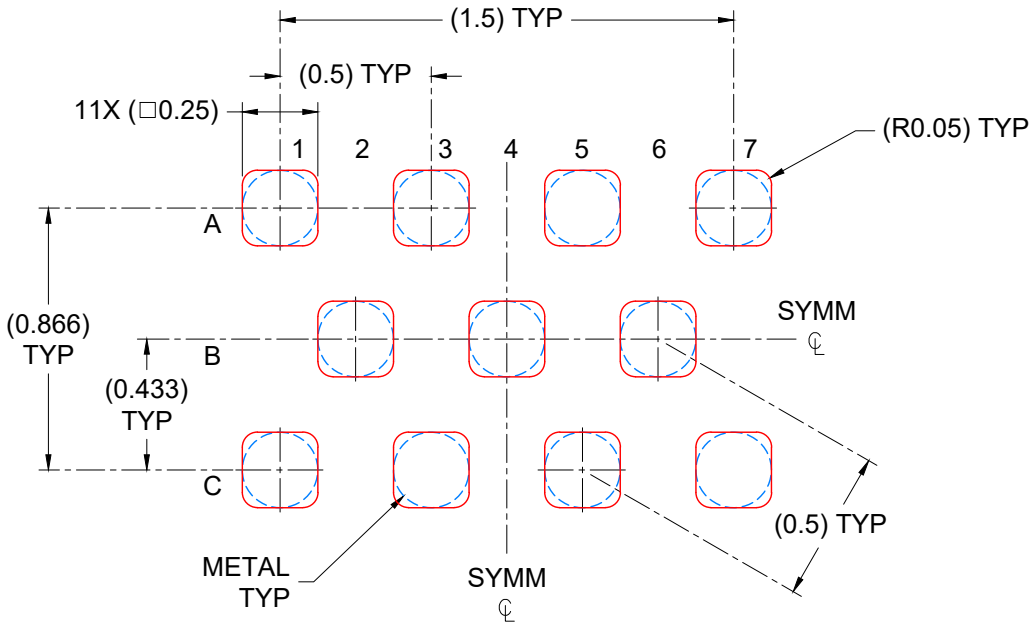
NOTES: (continued)

3. 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).

EXAMPLE STENCIL DESIGN

NFBGA - 0.45 mm max height

MICRO CHIP SCALE PACKAGE



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

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NOTES: (continued)

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

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