

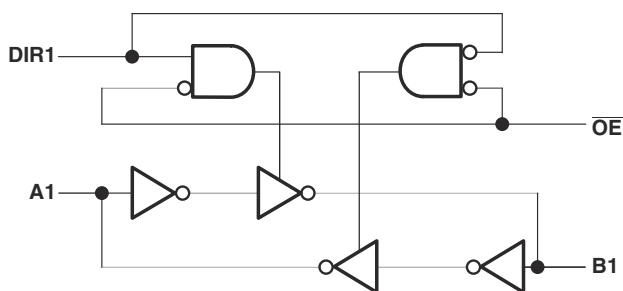
具有可配置电平转换/电压转换和三态输出的 SN74AVC2T245 2 位双电源总线收发器

1 特性

- 每个通道都具有独立方向控制
- 控制输入电平 V_{IH}/V_{IL} 以 V_{CCA} 电压为基准
- 完全可配置的双轨设计，支持各个端口在 1.2V 至 3.6V 的整个电源电压范围内运行
- I/O 可承受 4.6V 的电压
- I_{off} 支持局部省电模式运行
- V_{CC} 隔离特性 - 如果任何一个 V_{CC} 输入接地 (GND)，则两个端口均处于高阻抗状态
- 典型数据速率
 - 500Mbps (1.8V 至 3.3V 电平转换)
 - 320Mbps (<1.8V 至 3.3V 电平转换)
 - 320Mbps (转换至 2.5V 或 1.8V)
 - 280Mbps (转换至 1.5V)
 - 240Mbps (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
 - 5000V 人体放电模型 (A114-A)
 - 200V 机器放电模型 (A115-A)
 - 1500V 充电器件模型 (C101)

2 应用

- 个人电子产品
- 工业
- 企业级
- 电信



A. 本图针对的是单通道

逻辑图 (正逻辑)

3 说明

这款 2 位同相总线收发器使用两个独立的可配置电源轨。A 端口旨在跟踪 V_{CCA} 。 V_{CCA} 电源电压为 1.2V 至 3.6V。 B 端口旨在跟踪 V_{CCB} 。 V_{CCB} 电源电压为 1.2V 至 3.6V。 因此可在 1.2V、1.5V、1.8V、2.5V 和 3.3V 电压节点之间进行通用的低电压双向转换。

SN74AVC2T245 旨在实现两条数据总线间的异步通信。方向控制 (DIR) 输入和输出使能 (\overline{OE}) 的逻辑电平激活 B 端口输出或者 A 端口输出，或者将两个输出端口都置于高阻抗模式。当 B 端口输出被激活时，此器件将数据从 A 总线发送到 B 总线，而当 A 端口输出被激活时，此器件将数据从 B 总线发送到 A 总线。A 端口和 B 端口上的输入电路一直处于激活状态并且必须施加一个逻辑高或低电平，从而防止过大的 I_{CC} 和 I_{CCZ} 。

SN74AVC2T245 的控制引脚 (DIR1、DIR2 和 \overline{OE}) 由 V_{CCA} 供电。

该器件专用于使用 I_{off} 的局部断电应用。 I_{off} 电路可禁用输出，以防在器件断电时电流回流对器件造成损坏。

V_{CC} 隔离特性可确保只要有任何一个 V_{CC} 输入接地 (GND)，则两个端口均处于高阻抗状态。

为了确保上电或下电期间的高阻抗状态， \overline{OE} 必须通过一个上拉电阻器连接至 V_{CC} ；该电阻器的最小阻值由驱动器的电流灌入能力来决定。

器件信息

器件型号	封装 ⁽¹⁾	封装尺寸 (标称值)
SN74AVC2T245	UQFN (10)	1.80mm × 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。



Table of Contents

1 特性	1	7.2 Functional Block Diagram.....	12
2 应用	1	7.3 Feature Description.....	12
3 说明	1	7.4 Device Functional Modes.....	12
4 Pin Configuration and Functions	3	8 Application and Implementation	14
5 Specifications	4	8.1 Application Information.....	14
5.1 Absolute Maximum Ratings.....	4	8.2 Typical Application.....	14
5.2 ESD Ratings.....	4	9 Power Supply Recommendations	16
5.3 Recommended Operating Conditions.....	4	10 Layout	16
5.4 Thermal Information.....	5	10.1 Layout Guidelines.....	16
5.5 Electrical Characteristics.....	6	10.2 Layout Example.....	16
5.6 Switching Characteristics: $V_{CCA} = 1.2\text{ V}$	7	11 Device and Documentation Support	17
5.7 Switching Characteristics: $V_{CCA} = 1.5\text{ V} \pm 0.1\text{ V}$	7	11.1 接收文档更新通知.....	17
5.8 Switching Characteristics: $V_{CCA} = 1.8\text{ V} \pm 0.15\text{ V}$	8	11.2 支持资源.....	17
5.9 Switching Characteristics: $V_{CCA} = 2.5\text{ V} \pm 0.2\text{ V}$	8	11.3 Trademarks.....	17
5.10 Switching Characteristics: $V_{CCA} = 3.3\text{ V} \pm 0.3\text{ V}$	9	11.4 静电放电警告.....	17
5.11 Operating Characteristics.....	9	11.5 术语表.....	17
5.12 Typical Characteristics.....	10	12 Revision History	18
6 Parameter Measurement Information	11	13 Mechanical, Packaging, and Orderable Information	18
7 Detailed Description	12		
7.1 Overview.....	12		

4 Pin Configuration and Functions

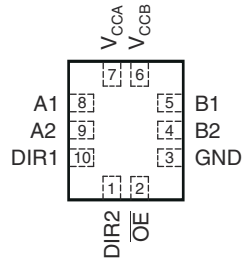


图 4-1. RSW PACKAGE 10-PIN UQFN TOP VIEW

表 4-1. Pin Functions

PIN		DESCRIPTION
NAME	NO. (UQFN)	
V _{CCA}	7	Supply Voltage A
V _{CCB}	6	Supply Voltage B
GND	3	Ground
A1	8	Output or input depending on state of DIR. Output level depends on V _{CCA} .
A2	9	Output or input depending on state of DIR. Output level depends on V _{CCA} .
B1	5	Output or input depending on state of DIR. Output level depends on V _{CCB} .
B2	4	Output or input depending on state of DIR. Output level depends on V _{CCB} .
DIR1,DIR2	10,1	Direction Pin, Connect to GND or to V _{CCA}
\overline{OE}	2	Tri-state output-mode enables. Pull OE high to place all outputs in 3-state mode. Referenced to V _{CCA}

5 Specifications

5.1 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⁾	I/O ports (A port)	- 0.5	4.6	V
		I/O ports (B port)	- 0.5	4.6	
		Control inputs	- 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
		B port	- 0.5	4.6	
V_O	Voltage applied to any output in the high or low state ^{(2) (3)}	A port	- 0.5	$V_{CCA} + 0.5$	V
		B port	- 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_J	Junction Temperature	-40	150	°C	
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, 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.

5.2 ESD Ratings

		VALUE	UNIT	
$V_{(ESD)}$	Electrostatic discharge	Human body model (HBM), per ANSI/ESDA/JEDEC JS-001 ⁽¹⁾	5000	V
		Charged-device model (CDM), per JEDEC specification JESD22-C101 ⁽²⁾	1500	

- (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.

5.3 Recommended Operating Conditions

		V_{CCI}	V_{CCO}	MIN	MAX	UNIT
V_{CCA}	Supply voltage			1.2	3.6	V
V_{CCB}	Supply voltage			1.2	3.6	V
V_{IH}	High-level input voltage	Data inputs ⁽¹⁾	1.2 V to 1.95 V	$V_{CCI} \times 0.65$		V
			1.95 V to 2.7 V	1.6		
			2.7 V to 3.6 V	2		
V_{IL}	Low-level input voltage	Data inputs ⁽¹⁾	1.2 V to 1.95 V	$V_{CCI} \times 0.35$		V
			1.95 V to 2.7 V	0.7		
			2.7 V to 3.6 V	0.8		
V_{IH}	High-level input voltage	DIR (referenced to V_{CCA}) ⁽²⁾	1.2 V to 1.95 V	$V_{CCA} \times 0.65$		V
			1.95 V to 2.7 V	1.6		
			2.7 V to 3.6 V	2		

5.3 Recommended Operating Conditions (续)

(3)			V _{CCI}	V _{CCO}	MIN	MAX	UNIT
V _{IL}	Low-level input voltage	DIR (referenced to V _{CCA}) ⁽²⁾	1.2 V to 1.95 V		V _{CCA} × 0.35		V
			1.95 V to 2.7 V		0.7		
			2.7 V to 3.6 V		0.8		
V _I	Input voltage			0	3.6	V	
V _O	Output voltage	Active state			0	V _{CCO}	V
		3-state			0	3.6	
I _{OH}	High-level output current		1.1 V to 1.2 V		- 3		mA
			1.4 V to 1.6 V		- 6		
			1.65 V to 1.95 V		- 8		
			2.3 V to 2.7 V		- 9		
			3 V to 3.6 V		- 12		
I _{OL}	Low-level output current		1.1 V to 1.2 V		3		mA
			1.4 V to 1.6 V		6		
			1.65 V to 1.95 V		8		
			2.3 V to 2.7 V		9		
			3 V to 3.6 V		12		
Δt/Δv	Input transition rise or fall rate				5	ns/V	
T _A	Operating free-air temperature			- 40	85	°C	

(1) V_{CCI} is the V_{CC} associated with the input port.

(2) V_{CCO} is the V_{CC} associated with the 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.

5.4 Thermal Information

THERMAL METRIC ⁽¹⁾		SN74AVC2T245	UNIT
		RSW (UQFN)	
		10 PINS	
R _{θJA}	Junction-to-ambient thermal resistance	227.4	°C/W
R _{θJC(top)}	Junction-to-case (top) thermal resistance	96.3	°C/W
R _{θJB}	Junction-to-board thermal resistance	139.6	°C/W
ψ _{JT}	Junction-to-top characterization parameter	5.2	°C/W
ψ _{JB}	Junction-to-board characterization parameter	139.2	°C/W
R _{θJC(bot)}	Junction-to-case (bottom) thermal resistance	N/A	°C/W

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

5.5 Electrical Characteristics

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 _{OH}		V _I = V _{IH}	1.2 V to 3.6 V	1.2 V to 3.6 V				V _{CCO} - 0.2		V
			1.2 V	1.2 V	0.95					
			1.4 V	1.4 V			1.05			
			1.65 V	1.65 V			1.2			
			2.3 V	2.3 V			1.75			
			3 V	3 V			2.3			
V _{OL}		V _I = V _{IL}	1.2 V to 3.6 V	1.2 V to 3.6 V				0.2		V
			1.2 V	1.2 V	0.25					
			1.4 V	1.4 V			0.35			
			1.65 V	1.65 V			0.45			
			2.3 V	2.3 V			0.55			
			3 V	3 V			0.7			
I _I	Control inputs	V _I = V _{CCA} or GND	1.2 V to 3.6 V	1.2 V to 3.6 V		±0.025	±0.25		±1	μA
I _{off}	A or B port	V _I or V _O = 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 _{OZ}	A or B port	V _O = V _{CCO} or GND, V _I = V _{CCI} or GND, \overline{OE} = V _{IH}	3.6 V	3.6 V		±0.5	±2.5		±5	μA
I _{CCA}		V _I = V _{CCI} or GND, I _O = 0	1.2 V to 3.6 V	1.2 V to 3.6 V					8	μA
			0 V	0 V to 3.6 V					-2	
			0 V to 3.6 V	0 V					8	
I _{CCB}		V _I = V _{CCI} or GND, I _O = 0	1.2 V to 3.6 V	1.2 V to 3.6 V					8	μA
			0 V	0 V to 3.6 V					8	
			0 V to 3.6 V	0 V					-2	
I _{CCA} + I _{CCB}		V _I = V _{CCI} or GND, I _O = 0	1.2 V to 3.6 V	1.2 V to 3.6 V					16	μA
C _i	Control inputs	V _I = 3.3 V or GND	3.3 V	3.3 V		3.5			4.5	pF
C _{io}	A or B port	V _O = 3.3 V or GND	3.3 V	3.3 V		6			7	pF

(1) V_{CCO} is the V_{CC} associated with the output port.

(2) V_{CCI} is the V_{CC} associated with the input port.

5.6 Switching Characteristics: $V_{CCA} = 1.2\text{ V}$

over recommended operating free-air temperature range, $V_{CCA} = 1.2\text{ V}$ (unless otherwise noted) (see [图 6-1](#))

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CCB} = 1.2\text{ V}$	$V_{CCB} = 1.5\text{ V} \pm 0.1\text{ V}$	$V_{CCB} = 1.8\text{ V} \pm 0.15\text{ V}$	$V_{CCB} = 2.5\text{ V} \pm 0.2\text{ V}$	$V_{CCB} = 3.3\text{ V} \pm 0.3\text{ V}$	UNIT
			TYP	TYP	TYP	TYP	TYP	
t_{PLH}	A	B	2.5	2.1	1.9	1.9	1.9	ns
t_{PHL}			2.5	2.1	1.9	1.9	1.9	
t_{PLH}	B	A	2.5	2.2	2	1.8	1.7	ns
t_{PHL}			2.5	2.2	2	1.8	1.7	
t_{PZH}	\overline{OE}	A	3.8	3.1	2.7	2.6	3	ns
t_{PZL}			3.8	3.1	2.7	2.6	3	
t_{PZH}	\overline{OE}	B	3.7	3.7	3.7	3.7	3.7	ns
t_{PZL}			3.7	3.7	3.7	3.7	3.7	
t_{PHZ}	\overline{OE}	A	4.4	3.6	3.5	3.3	4.1	ns
t_{PLZ}			4.4	3.6	3.5	3.3	4.1	
t_{PHZ}	\overline{OE}	B	4.2	4.2	4.3	4.1	4.2	ns
t_{PLZ}			4.2	4.2	4.3	4.1	4.2	

5.7 Switching Characteristics: $V_{CCA} = 1.5\text{ V} \pm 0.1\text{ V}$

over recommended operating free-air temperature range, $V_{CCA} = 1.5\text{ V} \pm 0.1\text{ V}$ (see [图 6-1](#))

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CCB} = 1.2\text{ V}$	$V_{CCB} = 1.5\text{ V} \pm 0.1\text{ V}$		$V_{CCB} = 1.8\text{ V} \pm 0.15\text{ V}$		$V_{CCB} = 2.5\text{ V} \pm 0.2\text{ V}$		$V_{CCB} = 3.3\text{ V} \pm 0.3\text{ V}$		UNIT
			TYP	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
t_{PLH}	A	B	2.2	0.3	4.4	0.2	3.9	0.1	3.6	0.1	3.9	ns
t_{PHL}			2.2	0.3	4.4	0.2	3.9	0.1	3.6	0.1	3.9	
t_{PLH}	B	A	2	0.6	5.1	0.4	4.9	0.2	4.6	0.1	4.5	ns
t_{PHL}			2	0.6	5.1	0.4	4.9	0.2	4.6	0.1	4.5	
t_{PZH}	\overline{OE}	A	3.4	1.1	7.1	0.9	6.2	0.7	5.5	0.1	6.4	ns
t_{PZL}			3.4	1.1	7.1	0.9	6.2	0.7	5.5	0.1	6.4	
t_{PZH}	\overline{OE}	B	2.5	1.1	8.2	1.1	8.2	1.1	8.2	1.1	8.2	ns
t_{PZL}			2.5	1.1	8.2	1.1	8.2	1.1	8.2	1.1	8.2	
t_{PHZ}	\overline{OE}	A	4.1	1.2	7.1	0.8	6.7	0.4	5.6	1	7.4	ns
t_{PLZ}			4.1	1.2	7.1	0.8	6.7	0.4	5.6	1	7.4	
t_{PHZ}	\overline{OE}	B	3.3	0.3	7.4	0.2	5.7	0.3	5.6	0.3	5.6	ns
t_{PLZ}			3.3	0.3	7.4	0.2	5.7	0.3	5.6	0.3	5.6	

5.8 Switching Characteristics: $V_{CCA} = 1.8 \text{ V} \pm 0.15 \text{ V}$

over recommended operating free-air temperature range, $V_{CCA} = 1.8 \text{ V} \pm 0.15 \text{ V}$ (see [图 6-1](#))

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CCB} = 1.2 \text{ V}$	$V_{CCB} = 1.5 \text{ V} \pm 0.1 \text{ V}$		$V_{CCB} = 1.8 \text{ V} \pm 0.15 \text{ V}$		$V_{CCB} = 2.5 \text{ V} \pm 0.2 \text{ V}$		$V_{CCB} = 3.3 \text{ V} \pm 0.3 \text{ V}$		UNIT
			TYP	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
t_{PLH}	A	B	2	0.1	4.1	0.1	3.6	0.1	3.1	0.1	3.3	ns
t_{PHL}			2	0.1	4.1	0.1	3.6	0.1	3.1	0.1	3.3	
t_{PLH}	B	A	1.9	0.4	4.3	0.1	4.1	0.1	3.8	0.1	3.7	ns
t_{PHL}			1.9	0.4	4.3	0.1	4.1	0.1	3.8	0.1	3.7	
t_{PZH}	$\overline{\text{OE}}$	A	3.2	0.8	6.7	0.4	5.8	0.4	4.8	0.3	4.6	ns
t_{PZL}			3.2	0.8	6.7	0.4	5.8	0.4	4.8	0.3	4.6	
t_{PZH}	$\overline{\text{OE}}$	B	1.9	0.2	6.7	0.2	6.6	0.2	6.7	0.2	6.7	ns
t_{PZL}			1.9	0.2	6.7	0.2	6.6	0.2	6.7	0.2	6.7	
t_{PHZ}	$\overline{\text{OE}}$	A	3.8	0.7	6.2	0.3	6.5	0.1	5.2	0.8	6.5	ns
t_{PLZ}			3.8	0.7	6.2	0.3	6.5	0.1	5.2	0.8	6.5	
t_{PHZ}	$\overline{\text{OE}}$	B	3.4	0.1	6.8	0.1	6.8	0.1	6.7	0.1	6.7	ns
t_{PLZ}			3.4	0.1	6.8	0.1	6.8	0.1	6.7	0.1	6.7	

5.9 Switching Characteristics: $V_{CCA} = 2.5 \text{ V} \pm 0.2 \text{ V}$

over recommended operating free-air temperature range, $V_{CCA} = 2.5 \text{ V} \pm 0.2 \text{ V}$ (see [图 6-1](#))

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CCB} = 1.2 \text{ V}$	$V_{CCB} = 1.5 \text{ V} \pm 0.1 \text{ V}$		$V_{CCB} = 1.8 \text{ V} \pm 0.15 \text{ V}$		$V_{CCB} = 2.5 \text{ V} \pm 0.2 \text{ V}$		$V_{CCB} = 3.3 \text{ V} \pm 0.3 \text{ V}$		UNIT
			TYP	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
t_{PLH}	A	B	1.9	0.1	3.8	0.1	3.2	0.1	2.7	0.1	2.6	ns
t_{PHL}			1.9	0.1	3.8	0.1	3.2	0.1	2.7	0.1	2.6	
t_{PLH}	B	A	1.8	0.5	3.4	0.2	3.1	0.1	2.8	0.1	2.6	ns
t_{PHL}			1.8	0.5	3.4	0.2	3.1	0.1	2.8	0.1	2.6	
t_{PZH}	$\overline{\text{OE}}$	A	3.1	0.7	6.2	0.5	5.2	0.3	4.1	0.3	3.6	ns
t_{PZL}			3.1	0.7	6.2	0.5	5.2	0.3	4.1	0.3	3.6	
t_{PZH}	$\overline{\text{OE}}$	B	1.4	0.4	4.5	0.4	4.5	0.4	4.5	0.4	4.5	ns
t_{PZL}			1.4	0.4	4.5	0.4	4.5	0.4	4.5	0.4	4.5	
t_{PHZ}	$\overline{\text{OE}}$	A	3.6	0.2	5.2	0.1	5.4	0.1	4.5	0.7	6	ns
t_{PLZ}			3.6	0.2	5.2	0.1	5.4	0.1	4.5	0.7	6	
t_{PHZ}	$\overline{\text{OE}}$	B	2.1	0.1	4.7	0.1	4.6	0.1	4.7	0.1	4.7	ns
t_{PLZ}			2.1	0.1	4.7	0.1	4.6	0.1	4.7	0.1	4.7	

5.10 Switching Characteristics: $V_{CCA} = 3.3\text{ V} \pm 0.3\text{ V}$

over recommended operating free-air temperature range, $V_{CCA} = 3.3\text{ V} \pm 0.3\text{ V}$ (see 图 6-1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CCB} = 1.2\text{ V}$	$V_{CCB} = 1.5\text{ V} \pm 0.1\text{ V}$		$V_{CCB} = 1.8\text{ V} \pm 0.15\text{ V}$		$V_{CCB} = 2.5\text{ V} \pm 0.2\text{ V}$		$V_{CCB} = 3.3\text{ V} \pm 0.3\text{ V}$		UNIT
			TYP	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
t_{PLH}	A	B	1.8	0.1	3.6	0.1	3	0.1	2.6	0.1	2.4	ns
t_{PHL}			1.8	0.1	3.6	0.1	3	0.1	2.6	0.1	2.4	
t_{PLH}	B	A	1.9	0.5	3.4	0.2	2.9	0.1	2.5	0.1	2.3	ns
t_{PHL}			1.9	0.5	3.4	0.2	2.9	0.1	2.5	0.1	2.3	
t_{PZH}	\overline{OE}	A	3.1	0.9	5.9	0.5	5	0.3	3.8	0.3	3.3	ns
t_{PZL}			3.1	0.9	5.9	0.5	5	0.3	3.8	0.3	3.3	
t_{PZH}	\overline{OE}	B	1.2	0.4	3.6	0.4	3.6	0.4	3.6	0.4	3.6	ns
t_{PZL}			1.2	0.4	3.6	0.4	3.6	0.4	3.6	0.4	3.6	
t_{PHZ}	\overline{OE}	A	3.4	0.1	4.6	0.1	4.7	0.3	4.8	0.7	4.5	ns
t_{PLZ}			3.4	0.1	4.6	0.1	4.7	0.3	4.8	0.7	4.5	
t_{PHZ}	\overline{OE}	B	2.9	0.1	5.4	0.1	5.3	0.1	5.3	0.1	5.3	ns
t_{PLZ}			2.9	0.1	5.4	0.1	5.3	0.1	5.3	0.1	5.3	

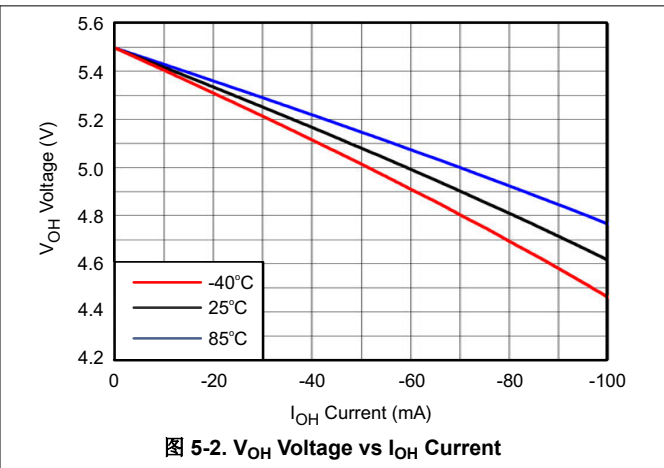
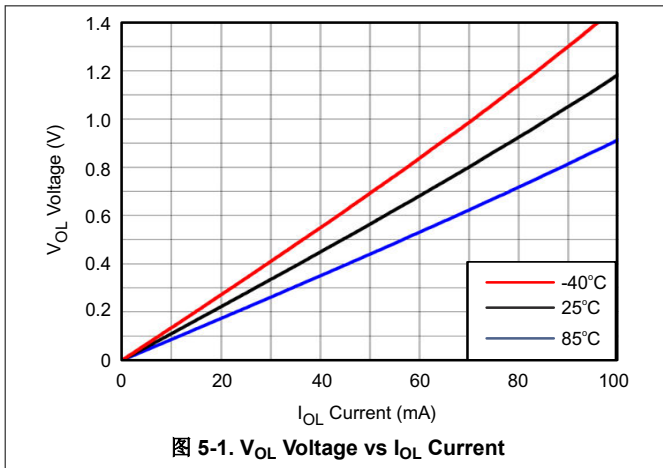
5.11 Operating Characteristics

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

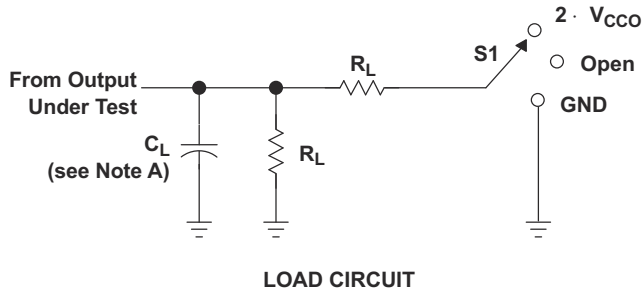
PARAMETER			TEST CONDITIONS	$V_{CCA} = V_{CCB} = 1.2\text{ V}$	$V_{CCA} = V_{CCB} = 1.5\text{ V}$	$V_{CCA} = V_{CCB} = 1.8\text{ V}$	$V_{CCA} = V_{CCB} = 2.5\text{ V}$	$V_{CCA} = V_{CCB} = 3.3\text{ V}$	UNIT
				TYP	TYP	TYP	TYP	TYP	
C_{pdA} ⁽¹⁾	A to B	Outputs enabled	$C_L = 0,$ $f = 10\text{ MHz},$ $t_r = t_f = 1\text{ ns}$	3	3	3	3	4	pF
		Outputs disabled		1	1	1	2	2	
	B to A	Outputs enabled		12	13	13	15	15	
		Outputs disabled		1	2	2	2	2	
C_{pdB} ⁽¹⁾	A to B	Outputs enabled	$C_L = 0,$ $f = 10\text{ MHz},$ $t_r = t_f = 1\text{ ns}$	12	13	13	14	16	pF
		Outputs disabled		1	2	2	2	2	
	B to A	Outputs enabled		3	3	3	4	4	
		Outputs disabled		1	1	1	2	2	

(1) Power dissipation capacitance per transceiver. Refer to the TI application report, CMOS Power Consumption and Cpd Calculation, [SCAA035](#)

5.12 Typical Characteristics

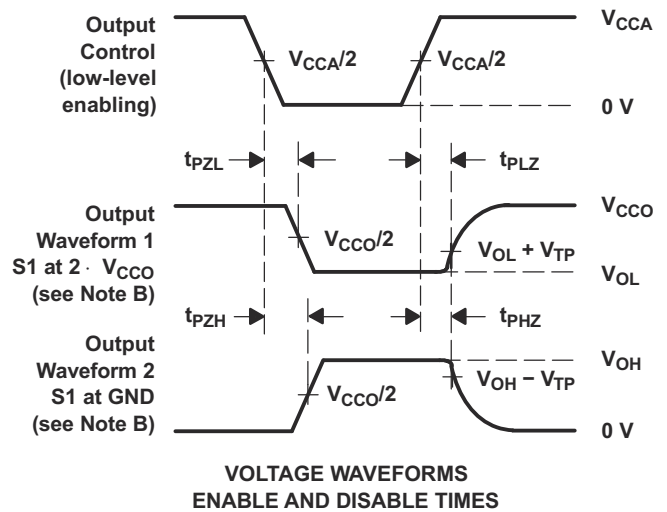
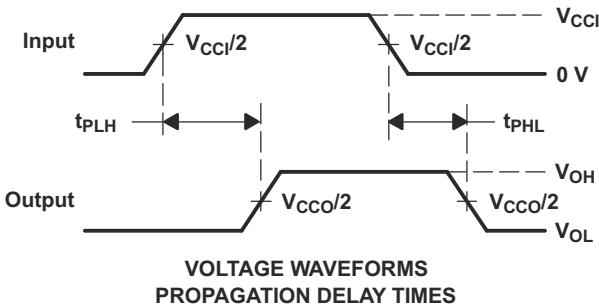
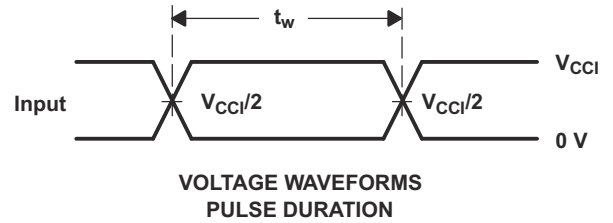


6 Parameter Measurement Information



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

V_{CCO}	C_L	R_L	V_{TP}
1.2 V	15 pF	2 k Ω	0.1 V
1.5 V \pm 0.1 V	15 pF	2 k Ω	0.1 V
1.8 V \pm 0.15 V	15 pF	2 k Ω	0.15 V
2.5 V \pm 0.2 V	15 pF	2 k Ω	0.15 V
3.3 V \pm 0.3 V	15 pF	2 k Ω	0.3 V



- NOTES:
- C_L includes probe and jig capacitance.
 - Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high, except when disabled by the output control.
 - All input pulses are supplied by generators having the following characteristics: PRR = 10 MHz, $Z_O = 50 \Omega$, $dv/dt \geq 1 \text{ V/ns}$.
 - The outputs are measured one at a time, with one transition per measurement.
 - t_{PLH} and t_{PHL} are the same as t_{pd} .
 - V_{CCI} is the V_{CC} associated with the input port.
 - V_{CCO} is the V_{CC} associated with the output port.

图 6-1. Load and Circuit and Voltage Waveforms

7 Detailed Description

7.1 Overview

The SN74AVC2T245 is a dual-bit, dual-supply noninverting bidirectional voltage level translator. Pins A and control pins (DIR and \overline{OE}) are supported by V_{CCA} and pins B are supported by V_{CCB} . The A port can accept I/O voltages ranging from 1.2 V to 3.6 V, while the B port can accept I/O voltages from 1.2 V to 3.6 V. A high on DIR allows data transmission from A to B and a low on DIR allows data transmission from B to A when \overline{OE} is set to low. When \overline{OE} is set to high, both A and B are in the high-impedance state.

This device is fully specified for partial-power-down applications using off output current (I_{off}).

The V_{CC} isolation feature ensures that if either V_{CC} input is at GND, both ports are put in a high-impedance state.

7.2 Functional Block Diagram

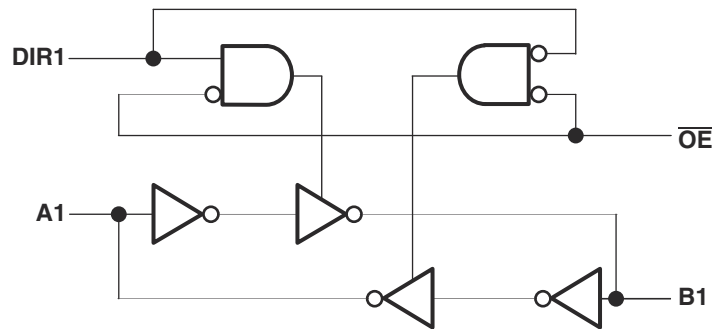


图 7-1. Logic Diagram (Positive Logic)

7.3 Feature Description

7.3.1 Fully Configurable Dual-Rail Design Allows Each Port to Operate Over the Full 1.2 V to 3.6 V Power-Supply Range

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

7.3.2 Partial-Power-Down Mode Operation

This device is fully specified for partial-power-down applications using off output current (I_{off}). The I_{off} circuitry will prevent backflow current by disabling I/O output circuits when device is in partial power-down mode.

7.3.3 V_{CC} Isolation

The V_{CC} isolation feature ensures that if either V_{CCA} or V_{CCB} are at GND, both ports will be in a high-impedance state (I_{OZ}). This prevents false logic levels from being presented to either bus.

7.4 Device Functional Modes

The SN74AVC2T245 is a voltage level translator that can operate from 1.2 V to 3.6 V (V_{CCA}) and 1.2 V to 3.6 V (V_{CCB}). The signal translation requires direction control and output enable control. The table below enlists the operation of the part for the respective states of the control inputs.

表 7-1. Function Table (Each Transceiver)

CONTROL INPUTS ⁽¹⁾		OUTPUT CIRCUITS		OPERATION
\overline{OE}	DIR1	A PORT	B PORT	
L	L	Enabled	Hi-Z	B data to A data
L	H	Hi-Z	Enabled	A data to B data

表 7-1. Function Table (Each Transceiver) (续)

CONTROL INPUTS ⁽¹⁾		OUTPUT CIRCUITS		OPERATION
OE	DIR1	A PORT	B PORT	
H	X	Hi-Z	Hi-Z	Isolation

(1) Input circuits of the data I/Os are always active.

8 Application and Implementation

备注

以下应用部分中的信息不属于 TI 器件规格的范围，TI 不担保其准确性和完整性。TI 的客户应负责确定器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。

8.1 Application Information

The SN74AVC2T245 is used to shift IO voltage levels from one voltage domain to another. Bus A and bus B have independent power supplies, and a direction pin is used to control the direction of data flow. Unused data ports must not be floating; tie the unused port input and output to ground directly.

8.1.1 Enable Times

Calculate the enable times for the SN74AVC16T45 using the following formulas:

$$t_{PZH} \text{ (DIR to A)} = t_{PLZ} \text{ (DIR to B)} + t_{PLH} \text{ (B to A)} \quad (1)$$

$$t_{PZL} \text{ (DIR to A)} = t_{PHZ} \text{ (DIR to B)} + t_{PHL} \text{ (B to A)} \quad (2)$$

$$t_{PZH} \text{ (DIR to B)} = t_{PLZ} \text{ (DIR to A)} + t_{PLH} \text{ (A to B)} \quad (3)$$

$$t_{PZL} \text{ (DIR to B)} = t_{PHZ} \text{ (DIR to A)} + t_{PHL} \text{ (A to B)} \quad (4)$$

In a bidirectional application, these enable times provide the maximum delay from the time the DIR bit is switched until an output is expected. For example, if the SN74AVC2T245 initially is transmitting from A to B, then the DIR bit is switched; the B port of the device must be disabled before presenting it with an input. After the B port has been disabled, an input signal applied to it appears on the corresponding A port after the specified propagation delay.

8.2 Typical Application

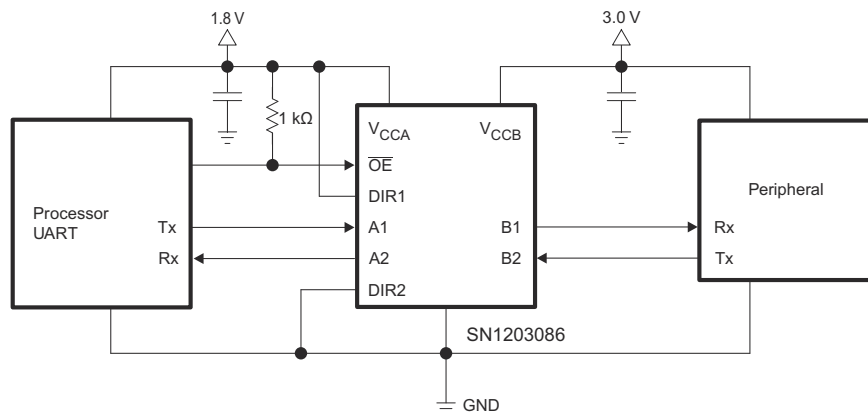


图 8-1. Typical Application of the SN74AVC2T245

8.2.1 Design Requirements

This device uses drivers which are enabled depending on the state of the DIR pin. The designer must know the intended flow of data and take care not to violate any of the high or low logic levels. Unused data inputs must not be floating, as this can cause excessive internal leakage on the input CMOS structure. Tie any unused input and output ports directly to ground.

For this design example, use the parameters listed in [表 8-1](#).

表 8-1. Design Parameters

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

8.2.2 Detailed Design Procedure

To begin the design process, determine the following:

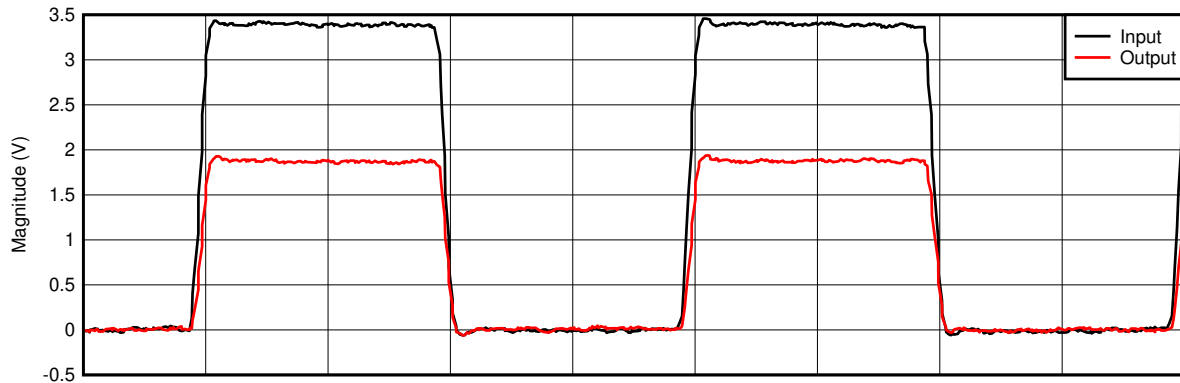
8.2.2.1 Input Voltage Ranges

Use the supply voltage of the device that is driving the SN74AVC2T245 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.

8.2.2.2 Output Voltage Range

Use the supply voltage of the device that the SN74AVC2T245 device is driving to determine the output voltage range.

8.2.3 Application Curves



D001

图 8-2. 3.3 V to 1.8 V Level-Shifting With 1-MHz Square Wave

9 Power Supply Recommendations

The SN74AVC2T245 device uses two separate configurable power-supply rails, V_{CCA} and V_{CCB} . V_{CCA} accepts any supply voltage from 1.2 V to 3.6 V and V_{CCB} accepts any supply voltage from 1.2 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 1.2 V, 1.5 V, 1.8 V, 2.5 V, 3.3 V and 5 V voltage nodes.

10 Layout

10.1 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.
- Placing 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.

10.2 Layout Example

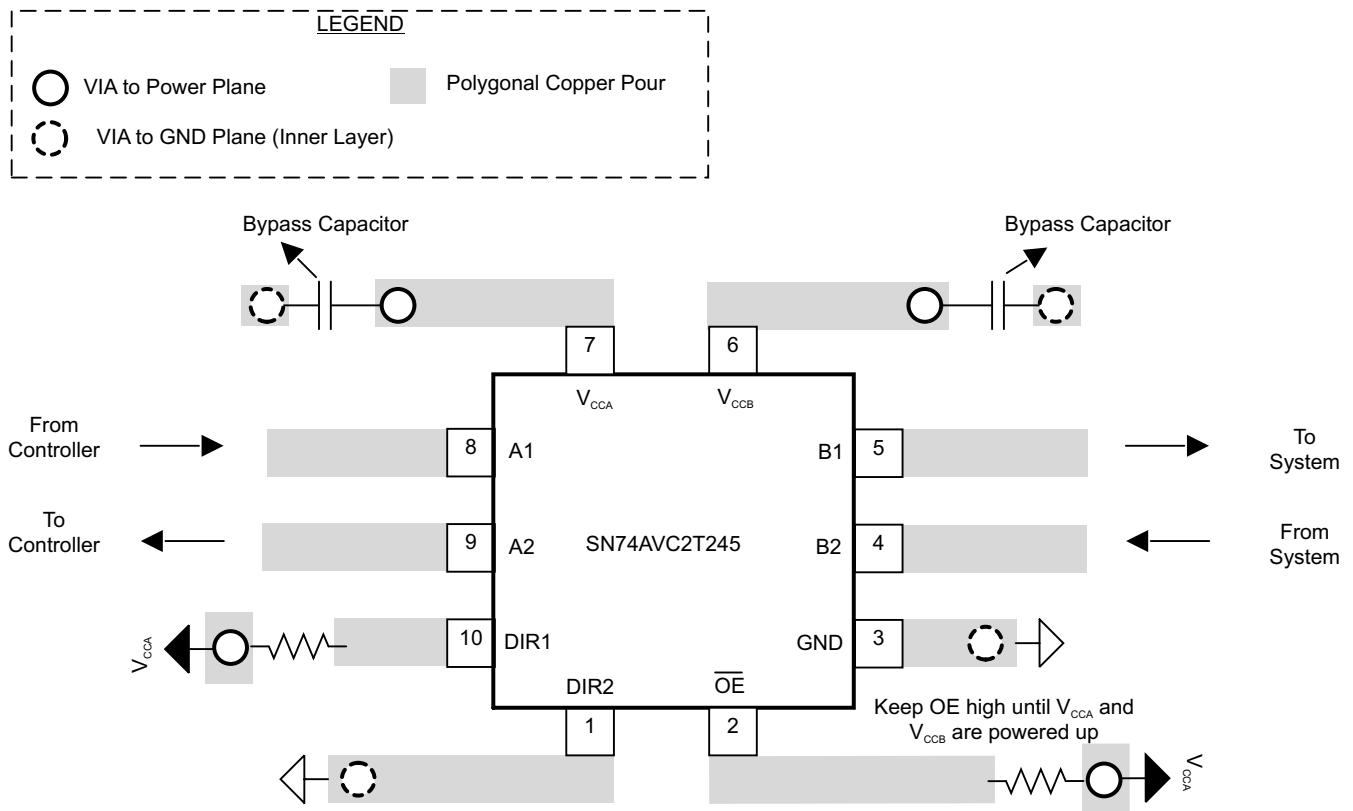


图 10-1. Recommended Layout Example

11 Device and Documentation Support

11.1 接收文档更新通知

要接收文档更新通知，请导航至 [ti.com](https://www.ti.com) 上的器件产品文件夹。点击 [通知](#) 进行注册，即可每周接收产品信息更改摘要。有关更改的详细信息，请查看任何已修订文档中包含的修订历史记录。

11.2 支持资源

[TI E2E™ 中文支持论坛](#) 是工程师的重要参考资料，可直接从专家处获得快速、经过验证的解答和设计帮助。搜索现有解答或提出自己的问题，获得所需的快速设计帮助。

链接的内容由各个贡献者“按原样”提供。这些内容并不构成 TI 技术规范，并且不一定反映 TI 的观点；请参阅 TI 的 [使用条款](#)。

11.3 Trademarks

TI E2E™ is a trademark of Texas Instruments.

所有商标均为其各自所有者的财产。

11.4 静电放电警告



静电放电 (ESD) 会损坏这个集成电路。德州仪器 (TI) 建议通过适当的预防措施处理所有集成电路。如果不遵守正确的处理和安装程序，可能会损坏集成电路。

ESD 的损坏小至导致微小的性能降级，大至整个器件故障。精密的集成电路可能更容易受到损坏，这是因为非常细微的参数更改都可能会导致器件与其发布的规格不相符。

11.5 术语表

[TI 术语表](#) 本术语表列出并解释了术语、首字母缩略词和定义。

12 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 D (February 2016) to Revision E (September 2024)	Page
• 更新了整个文档中的表格、图和交叉参考的编号格式.....	1
• Updated Thermal Information.....	5
<hr/>	
Changes from Revision C (July 2015) to Revision D (February 2016)	Page
• 更改了 引脚配置和功能	1
<hr/>	
Changes from Revision B (June 2015) to Revision C (July 2015)	Page
• The <i>Ordering Information</i> table (formally on page 1) contained a Top-Side Marking of TQ_. The table has been replaced with the Package Option Addendum in Mechanical, Packaging, and Orderable Information . VC_ was added to the device marking	18
<hr/>	
Changes from Revision A (May 2012) to Revision B (June 2015)	Page
• 添加了 引脚配置和功能 部分、 <i>ESD</i> 等级表、特性说明部分、器件功能模式、应用和实施部分、电源相关建议部分、布局部分、器件和文档支持部分以及机械、封装和可订购信息部分.....	1
• 删除了“订购信息”表。.....	1

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
SN74AVC2T245RSWR	ACTIVE	UQFN	RSW	10	3000	RoHS & Green	NIPDAU NIPDAUAG	Level-1-260C-UNLIM	-40 to 85	(TQ7, TQO, TQR, TQV) (TQH, TQJ, TQY) (VCH, VCO) (VCJ, VCR)	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.

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

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

TAPE AND REEL INFORMATION

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE

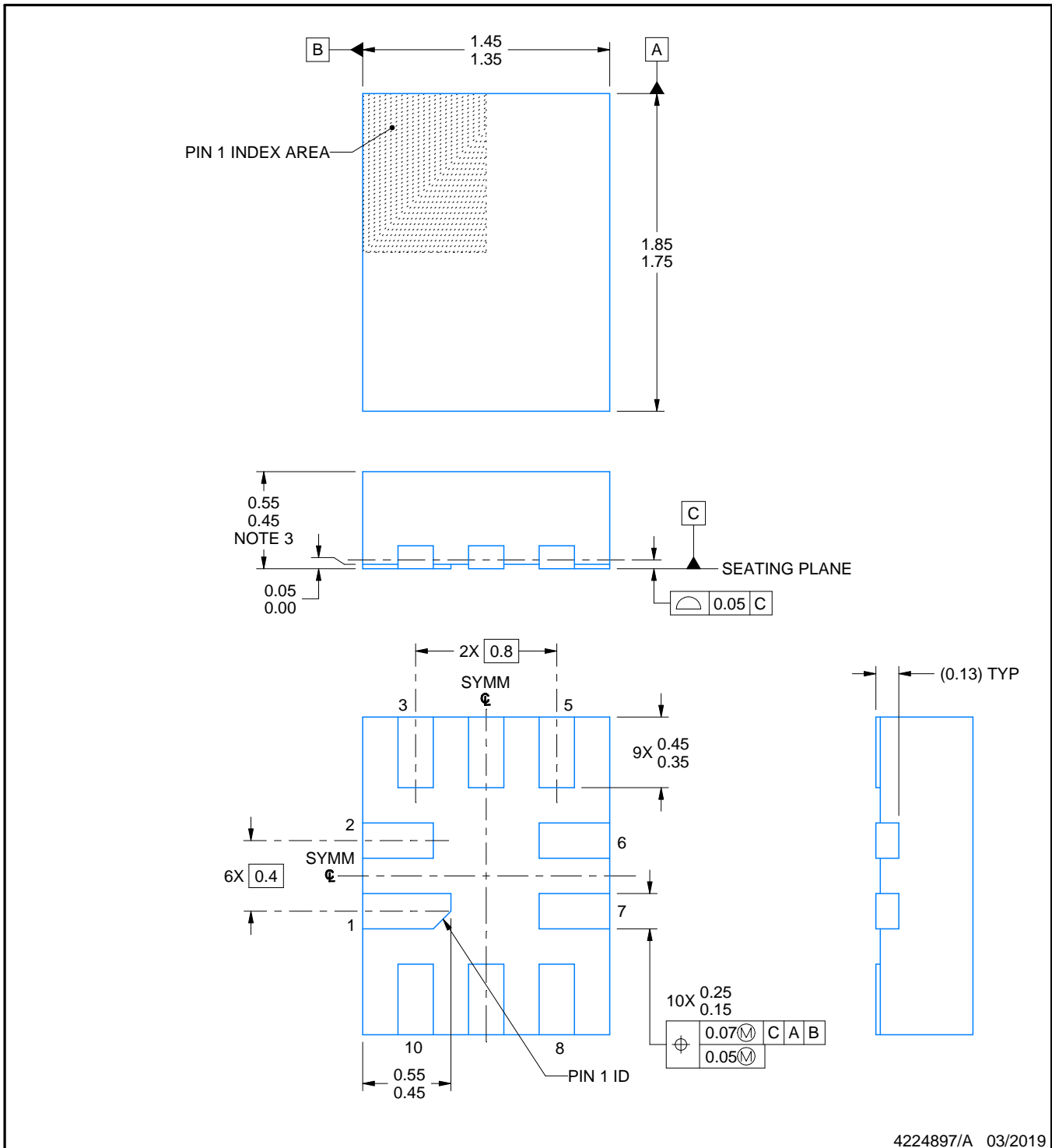
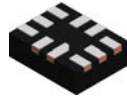

*All dimensions are nominal

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
SN74AVC2T245RSWR	UQFN	RSW	10	3000	180.0	9.5	1.6	2.0	0.8	4.0	8.0	Q1
SN74AVC2T245RSWR	UQFN	RSW	10	3000	180.0	9.5	1.6	2.0	4.0	4.0	8.0	Q1

TAPE AND REEL BOX DIMENSIONS


*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74AVC2T245RSWR	UQFN	RSW	10	3000	189.0	185.0	36.0
SN74AVC2T245RSWR	UQFN	RSW	10	3000	184.0	184.0	19.0



4224897/A 03/2019

NOTES:

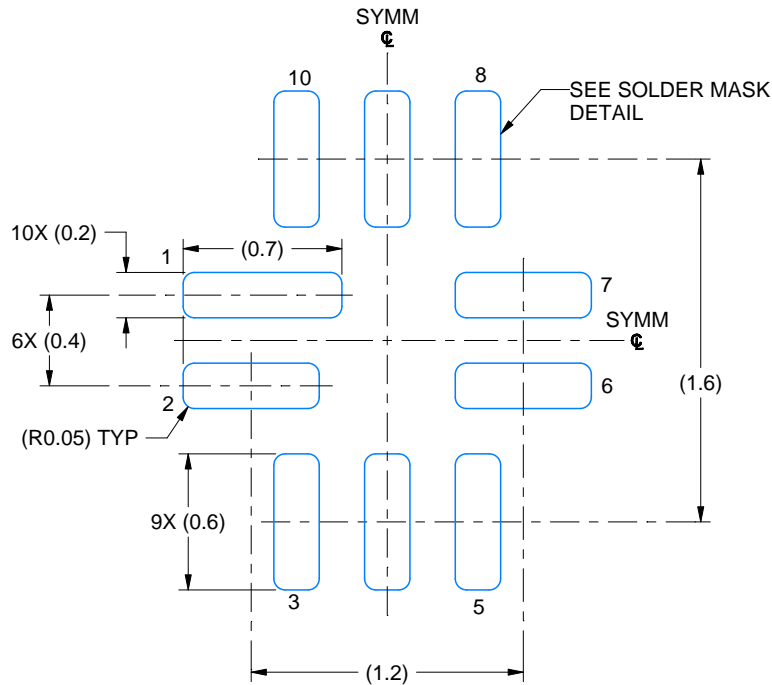
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This package complies to JEDEC MO-288 variation UDEE, except minimum package height.

EXAMPLE BOARD LAYOUT

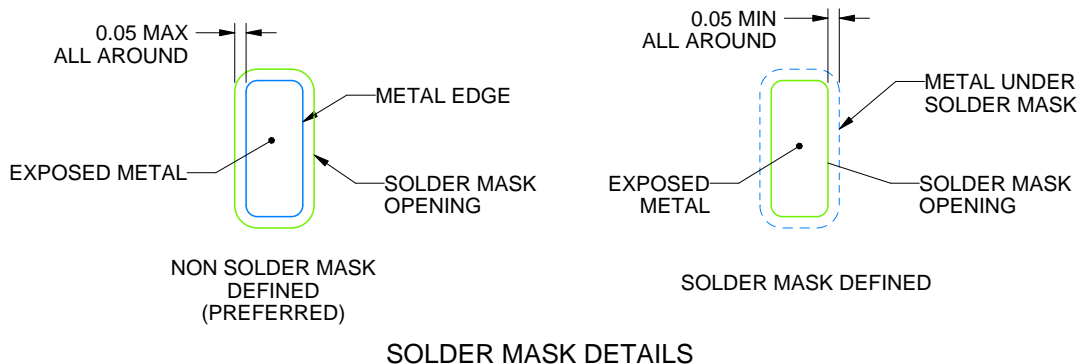
RSW0010A

UQFN - 0.55 mm max height

PLASTIC QUAD FLATPACK - NO LEAD



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 30X



4224897/A 03/2019

NOTES: (continued)

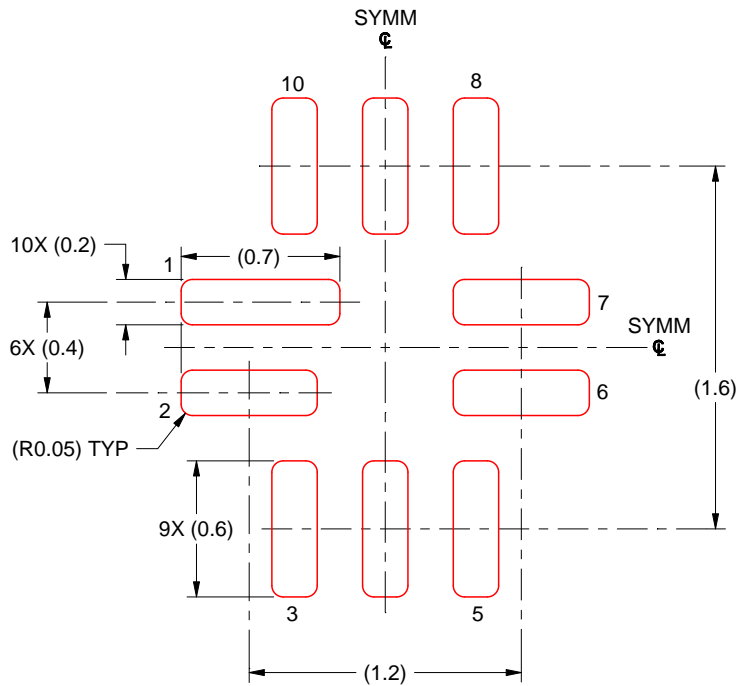
4. This package is designed to be soldered to a thermal pad on the board. For more information, see Texas Instruments literature number SLUA271 (www.ti.com/lit/sluea271).
5. Vias are optional depending on application, refer to device data sheet. If any vias are implemented, refer to their locations shown on this view. It is recommended that vias under paste be filled, plugged or tented.

EXAMPLE STENCIL DESIGN

RSW0010A

UQFN - 0.55 mm max height

PLASTIC QUAD FLATPACK - NO LEAD



SOLDER PASTE EXAMPLE
BASED ON 0.125 MM THICK STENCIL
SCALE: 30X

4224897/A 03/2019

NOTES: (continued)

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

重要声明和免责声明

TI“按原样”提供技术和可靠性数据（包括数据表）、设计资源（包括参考设计）、应用或其他设计建议、网络工具、安全信息和其他资源，不保证没有瑕疵且不做任何明示或暗示的担保，包括但不限于对适销性、某特定用途方面的适用性或不侵犯任何第三方知识产权的暗示担保。

这些资源可供使用 TI 产品进行设计的熟练开发人员使用。您将自行承担以下全部责任：(1) 针对您的应用选择合适的 TI 产品，(2) 设计、验证并测试您的应用，(3) 确保您的应用满足相应标准以及任何其他功能安全、信息安全、监管或其他要求。

这些资源如有变更，恕不另行通知。TI 授权您仅可将这些资源用于研发本资源所述的 TI 产品的应用。严禁对这些资源进行其他复制或展示。您无权使用任何其他 TI 知识产权或任何第三方知识产权。您应全额赔偿因在这些资源的使用中对 TI 及其代表造成的任何索赔、损害、成本、损失和债务，TI 对此概不负责。

TI 提供的产品受 [TI 的销售条款](#) 或 [ti.com](#) 上其他适用条款/TI 产品随附的其他适用条款的约束。TI 提供这些资源并不会扩展或以其他方式更改 TI 针对 TI 产品发布的适用的担保或担保免责声明。

TI 反对并拒绝您可能提出的任何其他或不同的条款。

邮寄地址：Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2024，德州仪器 (TI) 公司