

具有可配置电压转换和三态输出的 SN74LVC1T45 1 位双电源总线收发器

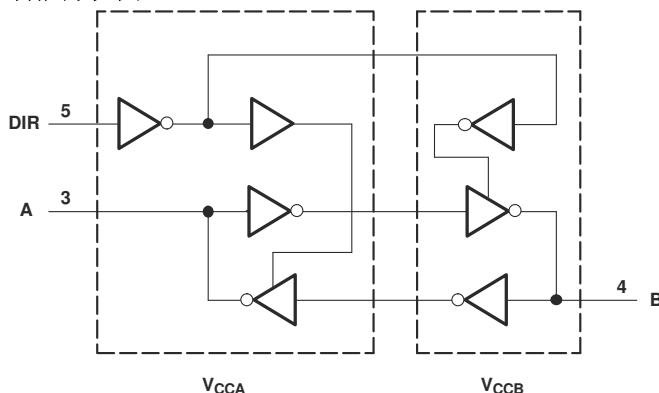
1 特性

- ESD 保护性能超过 JESD 22 规范要求
 - 2000V 人体放电模型 (A114-A)
 - 200V 机器放电模型 (A115-A)
 - 1000V 带电器件模型 (C101)
- 采用德州仪器 (TI) NanoFree™ 封装
- 完全可配置的双轨设计, 支持各个端口在 1.65V 至 5.5V 的整个电源电压范围内运行
- 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
- 以 V_{CCA} 为基准的 DIR 输入电路
- 低功耗, I_{CC} 最大值为 4 μ A
- 电压为 3.3V 时, 输出驱动为 ± 24 mA
- I_{off} 支持局部断电模式运行
- 最大数据速率
 - 420Mbps (3.3V 至 5V 转换)
 - 210Mbps (转换至 3.3V)
 - 140Mbps (转换至 2.5V)
 - 75Mbps (转换至 1.8V)
- 闩锁性能超过 100mA, 符合 JESD 78 II 类规范

2 应用

- 个人电子产品
- 工业
- 企业
- 电信

功能方框图



3 说明

这款 1 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} 可接受从 1.65V 到 5.5V 范围内的任意电源电压。B 端口旨在跟踪 V_{CCB} 。 V_{CCB} 可接受从 1.65 至 5.5V 间的任一电源电压值。这可实现 1.8V, 2.5V, 3.3V 和 5V 电压节点间的通用低压双向转换。

SN74LVC1T45 旨在实现两条数据总线间的异步通信。方向控制 (DIR) 输入的逻辑电平将会激活 B 端口或 A 端口输出。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} 。

SN74LVC1T45 旨在实现通过 V_{CCA} 对 DIR 输入电路供电。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 V_{CC} 中的任何一个是否接地, 然后两个端口都处于高阻抗状态。

NanoFree 封装技术是 IC 封装概念的一项重大突破, 它将硅晶片用作封装。

封装信息

器件型号	封装 ⁽¹⁾	封装尺寸 (标称值)
SN74LVC1T45	DRL (SOT, 6)	1.60mm × 1.20mm
	DBV (SOT-23, 6)	2.90mm × 1.60mm
	DCK (SC70, 6)	2.00mm × 1.25mm
	DPK (USON, 6)	1.60mm × 1.60mm
	YZP (DSBGA, 6)	1.39mm × 0.90mm

(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。



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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 L (February 2017) to Revision M (November 2022)	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 the thermals in the <i>Thermal Information</i> section.....	6
• Updated the <i>Switching Characteristics</i> sections: extended some minimum specifications for lower delays	8
• Updated the <i>I_{off} Supports Partial Power-Down Mode Operation</i> section.....	14
• Added the <i>Balanced High-Drive CMOS Push-Pull Outputs</i> and <i>V_{CC} Isolation</i> sections.....	14
• Updated the <i>Power Supply Recommendations</i> section.....	19
Changes from Revision K (December 2014) to Revision L (February 2017)	Page
• 添加了 DPK (USON) 封装信息.....	1
• 添加了 文档支持 部分、接收文档更新通知 部分和社区资源 部分.....	1
• Added Junction temperature, T_J in <i>Absolute Maximum Ratings</i>	5
Changes from Revision J (December 2013) to Revision K (December 2014)	Page
• 添加了引脚配置和功能 部分、ESD 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
Changes from Revision I (December 2011) to Revision J (December 2013)	Page
• 将文档更新为新的 TI 数据表格式 - 无规格变化.....	1
• 删除了订购信息.....	1
• 添加了 ESD 警告.....	1

5 Pin Configuration and Functions

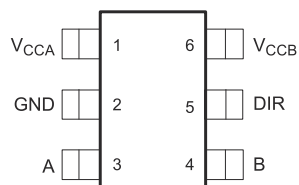


图 5-1. DBV Package, 6-Pin SOT-23 (Top View)

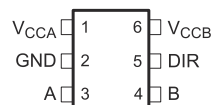


图 5-3. DRL Package, 6-Pin SOT (Top View)

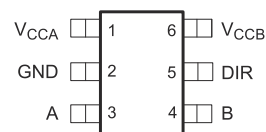


图 5-2. DCK Package, 6-Pin SC70 (Top View)

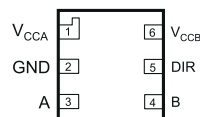


图 5-4. DPK Package, 6-Pin USON (Top View)

表 5-1. Pin Functions

PIN		TYPE ⁽¹⁾	DESCRIPTION
NAME	DBV, DCK, DRL, DPK		
V _{CCA}	1	P	SYSTEM-1 supply voltage (1.65 V to 5.5 V)
GND	2	G	Device GND
A	3	I/O	Output level depends on V _{CC1} voltage.
B	4	I/O	Input threshold value depends on V _{CC2} voltage.
DIR	5	I	GND (low level) determines B-port to A-port direction.
V _{CCB}	6	P	SYSTEM-2 supply voltage (1.65 V to 5.5 V)

(1) P = power, G = ground, I/O = input and output, I = input

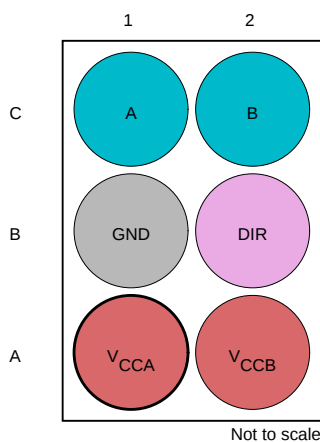


图 5-5. YZP Package, 6-Pin DSBGA (Bottom View)

Legend	
Power	Input
Input or Output	Ground

表 5-2. Pin Functions

PIN		TYPE ⁽¹⁾	DESCRIPTION
NO.	NAME		
A1	V _{CCA}	P	SYSTEM-1 supply voltage (1.65 V to 5.5 V)
A2	V _{CCB}	P	SYSTEM-2 supply voltage (1.65 V to 5.5 V)
B1	GND	G	Device GND
B2	DIR	I	GND (low level) determines B-port to A-port direction.
C1	A	I/O	Output level depends on V _{CC1} voltage.
C2	B	I/O	Input threshold value depends on V _{CC2} voltage.

(1) P = power, G = ground, I/O = input and output, I = input

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	6.5	V
V _I	Input voltage ⁽²⁾		- 0.5	6.5	V
V _O	Voltage range applied to any output in the high-impedance or power-off state ⁽²⁾		- 0.5	6.5	V
V _O	Voltage range applied to any output in the high or low state ^{(2) (3)}	A 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 _{CC} or GND			±100	mA
T _J	Junction temperature			150	°C
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 and output negative-voltage ratings may be exceeded if the input and output clamp-current ratings are observed.
- (3) The value of V_{CC} is provided in the recommended operating conditions table.

6.2 ESD Ratings

		VALUE	UNIT
V _(ESD)	Electrostatic discharge	Human-body model (HBM), per ANSI/ESDA/JEDEC JS-001 ⁽¹⁾	V
		Charged-device model (CDM), per JEDEC specification JESD22-C101 ⁽²⁾	
		Machine Model	

- (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

See (1) (2) (3)

			V_{CCI}	V_{CCO}	MIN	MAX	UNIT
V_{CCA}	Supply voltage				1.65	5.5	V
V_{CCB}					1.65	5.5	
V_{IH}	High-level input voltage	Data inputs ⁽⁴⁾	1.65 to 1.95 V		$V_{CCI} \times 0.65$		V
			2.3 to 2.7 V		1.7		
			3 to 3.6 V		2		
			4.5 to 5.5 V		$V_{CCI} \times 0.7$		
V_{IL}	Low-level input voltage	Data inputs ⁽⁴⁾	1.65 to 1.95 V		$V_{CCI} \times 0.35$		V
			2.3 to 2.7 V		0.7		
			3 to 3.6 V		0.8		
			4.5 to 5.5 V		$V_{CCI} \times 0.3$		
V_{IH}	High-level input voltage	DIR (referenced to V_{CCA}) ⁽⁵⁾	1.65 to 1.95 V		$V_{CCA} \times 0.65$		V
			2.3 to 2.7 V		1.7		
			3 to 3.6 V		2		
			4.5 to 5.5 V		$V_{CCA} \times 0.7$		

6.3 Recommended Operating Conditions (continued)

See (1) (2) (3)

			V _{CCI}	V _{CCO}	MIN	MAX	UNIT
V _{IL}	Low-level input voltage	DIR (referenced to V _{CCA}) ⁽⁵⁾	1.65 to 1.95 V		V _{CCA} × 0.35		V
			2.3 to 2.7 V		0.7		
			3 to 3.6 V		0.8		
			4.5 to 5.5 V		V _{CCA} × 0.3		
V _I	Input voltage				0	5.5	V
V _O	Output voltage				0	V _{CCO}	V
I _{OH}	High-level output current		1.65 to 1.95 V		− 4		mA
			2.3 to 2.7 V		− 8		
			3 to 3.6 V		− 24		
			4.5 to 5.5 V		− 32		
I _{OL}	Low-level output current		1.65 to 1.95 V		4		mA
			2.3 to 2.7 V		8		
			3 to 3.6 V		24		
			4.5 to 5.5 V		32		
Δ t/ Δ v	Input transition rise or fall rate	Data inputs	1.65 to 1.95 V		20		ns/V
			2.3 to 2.7 V		20		
			3 to 3.6 V		10		
			4.5 to 5.5 V		5		
		Control inputs	1.65 to 5.5 V		5		
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. See 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.

(5) For V_{CCI} values not specified in the data sheet, V_{IH} min = V_{CCA} × 0.7 V, V_{IL} max = V_{CCA} × 0.3 V.

6.4 Thermal Information

THERMAL METRIC ⁽¹⁾		SN74LVC1T45					UNIT
		DBV (SOT-23)	DCK (SC70)	DPK (USON)	DRL (SOT)	YZP (DSBGA)	
		6 PINS					
R _{θJA}	Junction-to-ambient thermal resistance	215.1	210.9	278.3	223.7	131.0	°C/W
R _{θJC(top)}	Junction-to-case (top) thermal resistance	136.5	139.2	133.4	88.7	1.3	°C/W
R _{θJB}	Junction-to-board thermal resistance	96.6	72	174.1	58.4	22.6	°C/W
ψ _{JT}	Junction-to-top characterization parameter	71.5	54.9	23.4	5.9	5.2	°C/W
ψ _{JB}	Junction-to-board characterization parameter	96.3	71.7	173.5	58.1	22.6	°C/W

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

6.5 Electrical Characteristics

over recommended operating free-air temperature range, $T_A = -40$ to $+85^\circ\text{C}$ (unless otherwise noted)^{(1) (2)}

PARAMETER		TEST CONDITIONS		V _{CCA}	V _{CCB}		MIN	TYP	MAX	UNIT
V _{OH}		I _{OH} = - 100 μ A	V _I = V _{IH}	1.65 to 4.5 V	1.65 to 4.5 V		V _{CCO} - 0.1		V	
		I _{OH} = - 4 mA		1.65 V	1.65 V		1.2			
		I _{OH} = - 8 mA		2.3 V	2.3 V		1.9			
		I _{OH} = - 24 mA		3 V	3 V		2.4			
		I _{OH} = - 32 mA		4.5 V	4.5 V		3.8			
		V _{OL}		I _{OL} = 100 μ A	V _I = V _{IL}	1.65 to 4.5 V	1.65 to 4.5 V			0.1
I _{OL} = 4 mA	1.65 V			1.65 V		0.45				
I _{OL} = 8 mA	2.3 V			2.3 V		0.3				
I _{OL} = 24 mA	3 V			3 V		0.55				
I _{OL} = 32 mA	4.5 V			4.5 V		0.55				
I _I	DIR	V _I = V _{CCA} or GND		1.65 to 5.5 V	1.65 to 5.5 V	T _A = 25 °C	±1		μ A	
				T _A = - 40 to +85°C	±2					
I _{off}	A port	V _I or V _O = 0 to 5.5 V		0 V	0 to 5.5 V	T _A = 25 °C	±1		μ A	
	T _A = - 40 to +85°C					±2				
	B port			0 to 5.5 V	0 V	T _A = 25 °C	±1			
						T _A = - 40 to +85°C		±2		
I _{OZ}	A or B port	V _O = V _{CCO} or GND		1.65 to 5.5 V	1.65 to 5.5 V	T _A = 25 °C	±1		μ A	
						T _A = - 40 to +85°C		±2		
I _{CCA}		V _I = V _{CCI} or GND, I _O = 0		1.65 to 5.5 V	1.65 to 5.5 V		3		μ A	
				5.5 V	0 V		2			
				0 V	5.5 V		- 2			
I _{CCB}		V _I = V _{CCI} or GND, I _O = 0		1.65 to 5.5 V	1.65 to 5.5 V		3		μ A	
				5.5 V	0 V		- 2			
				0 V	5.5 V		2			
I _{CCA} + I _{CCB} (see 表 8-1)		V _I = V _{CCI} or GND, I _O = 0		1.65 to 5.5 V	1.65 to 5.5 V		4		μ A	
Δ I _{CCA}	A port	A port at V _{CCA} - 0.6 V, DIR at V _{CCA} , B port = open		3 to 5.5 V	3 to 5.5 V		50		μ A	
	DIR	DIR at V _{CCA} - 0.6 V, B port = open, A port at V _{CCA} or GND					50			
Δ I _{CCB}		B port at V _{CCB} - 0.6 V, DIR at GND, A port = open		3 to 5.5 V	3 to 5.5 V		50		μ A	
C _i	DIR	V _I = V _{CCA} or GND		3.3 V	3.3 V	T _A = 25 °C	2.5		pF	
C _{io}	A or B port	V _O = V _{CCA/B} or GND		3.3 V	3.3 V	T _A = 25 °C	6		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.

6.6 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 7-1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CCB} = 1.8 \text{ V} \pm 0.15 \text{ V}$		$V_{CCB} = 2.5 \text{ V} \pm 0.2 \text{ V}$		$V_{CCB} = 3.3 \text{ V} \pm 0.3 \text{ V}$		$V_{CCB} = 5 \text{ V} \pm 0.5 \text{ V}$		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
t_{PLH}	A	B	3	17.7	2.2	10.3	1.7	8.3	1.4	7.2	ns
t_{PHL}			2.8	14.3	2.2	8.5	1.8	7.1	1.7	7	
t_{PLH}	B	A	3	17.7	2.3	16	2.1	15.5	1.9	15.1	ns
t_{PHL}			2.8	14.3	2.1	12.9	2	12.6	1.8	12.2	
t_{PHZ}	DIR	A	5.2	19.4	4.8	18.5	4.7	18.4	5.1	17.1	ns
t_{PLZ}			2.3	10.5	2.1	10.5	2.4	10.7	3.1	10.9	
t_{PHZ}	DIR	B	5.2	21.9	4.9	11.5	4.6	10.3	2.8	8.2	ns
t_{PLZ}			4.2	16	3.7	9.2	3.3	8.4	2.4	6.4	
$t_{PZH}^{(1)}$	DIR	A		33.7		25.2		23.9		21.5	ns
$t_{PZL}^{(1)}$				36.2		24.4		22.9		20.4	
$t_{PZH}^{(1)}$	DIR	B		28.2		20.8		19		18.1	ns
$t_{PZL}^{(1)}$				33.7		27		25.5		24.1	

(1) The enable time is a calculated value, derived using the formula shown in the 节 9.2.2.2.1 section.

6.7 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 7-1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CCB} = 1.8 \text{ V} \pm 0.15 \text{ V}$		$V_{CCB} = 2.5 \text{ V} \pm 0.2 \text{ V}$		$V_{CCB} = 3.3 \text{ V} \pm 0.3 \text{ V}$		$V_{CCB} = 5 \text{ V} \pm 0.5 \text{ V}$		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
t_{PLH}	A	B	2.3	16	1.5	8.5	1.3	6.4	1.1	5.1	ns
t_{PHL}			2.1	12.9	1.4	7.5	1.3	5.4	0.9	4.6	
t_{PLH}	B	A	2.2	10.3	1.5	8.5	1.4	8	1	7.5	ns
t_{PHL}			2.2	8.5	1.4	7.5	1.3	7	0.9	6.2	
t_{PHZ}	DIR	A	3	8.1	3.1	8.1	2.8	8.1	3.2	8.1	ns
t_{PLZ}			1.3	5.9	1.3	5.9	1.3	5.9	1	5.8	
t_{PHZ}	DIR	B	5.2	23.7	4.1	11.4	3.9	10.2	2.4	7.1	ns
t_{PLZ}			3.9	18.9	3.2	9.6	2.8	8.4	1.8	5.3	
$t_{PZH}^{(1)}$	DIR	A		29.2		18.1		16.4		12.8	ns
$t_{PZL}^{(1)}$				32.2		18.9		17.2		13.3	
$t_{PZH}^{(1)}$	DIR	B		21.9		14.4		12.3		10.9	ns
$t_{PZL}^{(1)}$				21		15.6		13.5		12.7	

(1) The enable time is a calculated value, derived using the formula shown in the 节 9.2.2.2.1 section.

6.8 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 7-1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CCB} = 1.8 \text{ V} \pm 0.15 \text{ V}$		$V_{CCB} = 2.5 \text{ V} \pm 0.2 \text{ V}$		$V_{CCB} = 3.3 \text{ V} \pm 0.3 \text{ V}$		$V_{CCB} = 5 \text{ V} \pm 0.5 \text{ V}$		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
t_{PLH}	A	B	2.1	15.5	1.4	8	0.7	5.8	0.7	4.4	ns
t_{PHL}			2	12.6	1.3	7	0.8	5	0.7	4	
t_{PLH}	B	A	1.7	8.3	1.3	6.4	0.7	5.8	0.6	5.4	ns
t_{PHL}			1.8	7.1	1.3	5.4	0.8	5	0.7	4.5	
t_{PHZ}	DIR	A	2.9	7.3	3	7.3	2.8	7.3	3.4	7.3	ns
t_{PLZ}			1.8	5.6	1.6	5.6	2.2	5.7	2.2	5.7	
t_{PHZ}	DIR	B	5.4	20.5	3.9	10.1	2.9	8.8	2.4	6.8	ns
t_{PLZ}			3.3	14.5	2.9	7.8	2.4	7.1	1.7	4.9	
$t_{PZH}^{(1)}$	DIR	A		22.8		14.2		12.9		10.3	ns
$t_{PZL}^{(1)}$				27.6		15.5		13.8		11.3	
$t_{PZH}^{(1)}$	DIR	B		21.1		13.6		11.5		10.1	ns
$t_{PZL}^{(1)}$				19.9		14.3		12.3		11.3	

(1) The enable time is a calculated value, derived using the formula shown in the 节 9.2.2.2.1 section.

6.9 Switching Characteristics ($V_{CCA} = 5 \text{ V} \pm 0.5 \text{ V}$)

over recommended operating free-air temperature range, $V_{CCA} = 5 \text{ V} \pm 0.5 \text{ V}$ (see 图 7-1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CCB} = 1.8 \text{ V} \pm 0.15 \text{ V}$		$V_{CCB} = 2.5 \text{ V} \pm 0.2 \text{ V}$		$V_{CCB} = 3.3 \text{ V} \pm 0.3 \text{ V}$		$V_{CCB} = 5 \text{ V} \pm 0.5 \text{ V}$		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
t_{PLH}	A	B	1.9	15.1	1	7.5	0.6	5.4	0.5	3.9	ns
t_{PHL}			1.8	12.2	0.9	6.2	0.7	4.5	0.5	3.5	
t_{PLH}	B	A	1.4	7.2	1	5.1	0.7	4.4	0.5	3.9	ns
t_{PHL}			1.7	7	0.9	4.6	0.7	4	0.5	3.5	
t_{PHZ}	DIR	A	2.1	5.4	2.2	5.4	2.2	5.5	2.2	5.4	ns
t_{PLZ}			0.9	3.8	1	3.8	0.7	3.7	0.7	3.7	
t_{PHZ}	DIR	B	4.8	20.2	2.5	9.8	1	8.5	2.5	6.5	ns
t_{PLZ}			3.2	14.8	2.5	7.4	2.5	7	1.6	4.5	
$t_{PZH}^{(1)}$	DIR	A		22		12.5		11.4		8.4	ns
$t_{PZL}^{(1)}$				27.2		14.4		12.5		10	
$t_{PZH}^{(1)}$	DIR	B		18.9		11.3		9.1		7.6	ns
$t_{PZL}^{(1)}$				17.6		11.6		10		8.6	

(1) The enable time is a calculated value, derived using the formula shown in the 节 9.2.2.2.1 section.

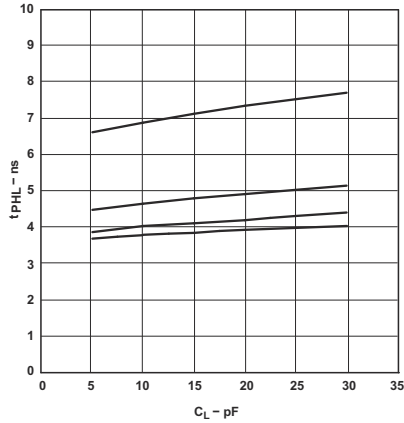
6.10 Operating Characteristics

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

PARAMETER		TEST CONDITIONS	$V_{CCA} =$ $V_{CCB} = 1.8\text{ V}$	$V_{CCA} =$ $V_{CCB} = 2.5\text{ V}$	$V_{CCA} =$ $V_{CCB} = 3.3\text{ V}$	$V_{CCA} =$ $V_{CCB} = 5\text{ V}$	UNIT
			TYP	TYP	TYP	TYP	
C_{pdA} ⁽¹⁾	A-port input, B-port output	$C_L = 0\text{ pF}$, $f = 10\text{ MHz}$, $t_r = t_f = 1\text{ ns}$	3	4	4	4	pF
	B-port input, A-port output		18	19	20	21	
C_{pdB} ⁽¹⁾	A-port input, B-port output	$C_L = 0\text{ pF}$, $f = 10\text{ MHz}$, $t_r = t_f = 1\text{ ns}$	18	19	20	21	pF
	B-port input, A-port output		3	4	4	4	

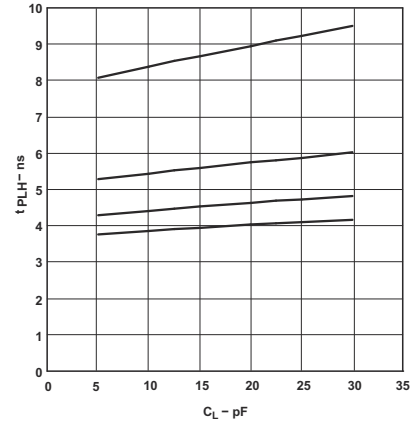
(1) Power dissipation capacitance per transceiver

6.11 Typical Characteristics



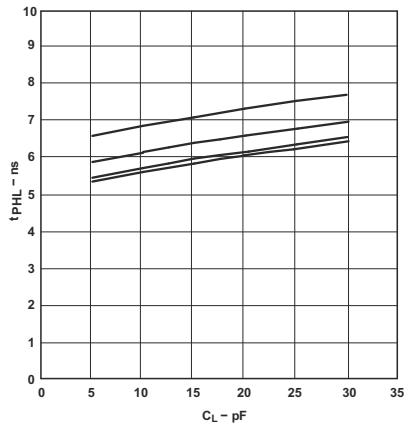
$T_A = 25^\circ\text{C}$, $V_{CCA} = 1.8\text{ V}$

图 6-1. Typical Propagation Delay (A to B) vs Load Capacitance



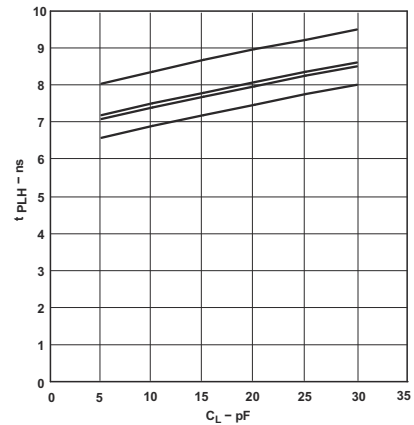
$T_A = 25^\circ\text{C}$, $V_{CCA} = 1.8\text{ V}$

图 6-2. Typical Propagation Delay (B to A) vs Load Capacitance



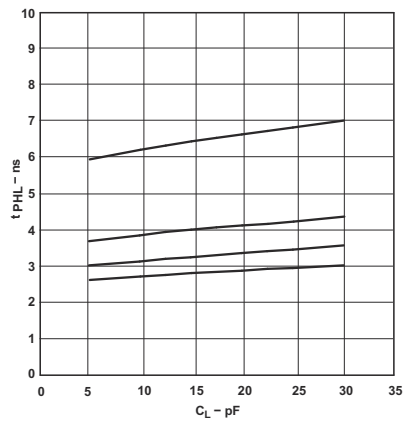
$T_A = 25^\circ\text{C}$, $V_{CCA} = 2.5\text{ V}$

图 6-3. Typical Propagation Delay (A to B) vs Load Capacitance



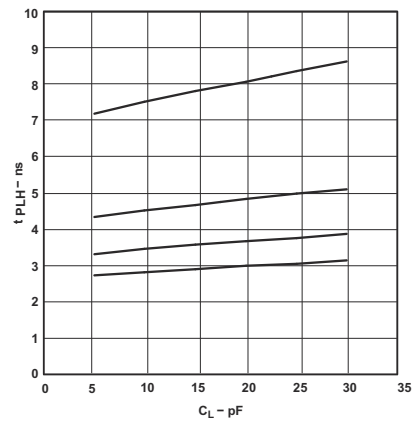
$T_A = 25^\circ\text{C}$, $V_{CCA} = 2.5\text{ V}$

图 6-4. Typical Propagation Delay (B to A) vs Load Capacitance



$T_A = 25^\circ\text{C}$, $V_{CCA} = 3.3\text{ V}$

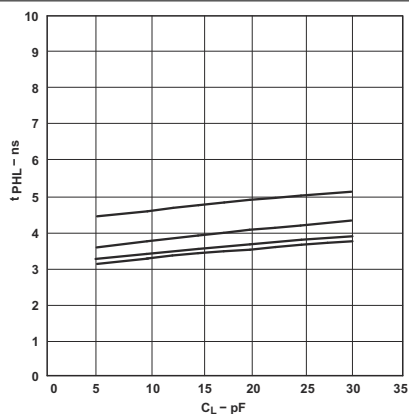
图 6-5. Typical Propagation Delay (A to B) vs Load Capacitance



$T_A = 25^\circ\text{C}$, $V_{CCA} = 3.3\text{ V}$

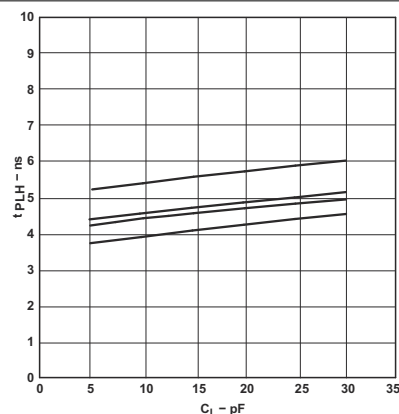
图 6-6. Typical Propagation Delay (B to A) vs Load Capacitance

6.11 Typical Characteristics (continued)



$T_A = 25^\circ\text{C}$, $V_{CCA} = 5\text{ V}$

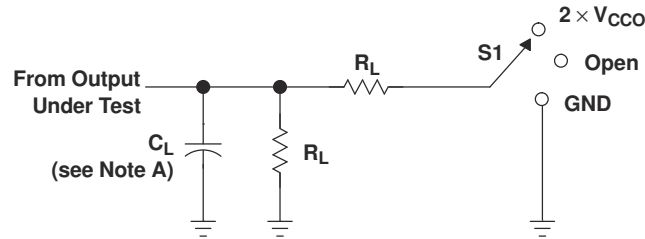
图 6-7. Typical Propagation Delay (A to B) vs Load Capacitance



$T_A = 25^\circ\text{C}$, $V_{CCA} = 5\text{ V}$

图 6-8. Typical Propagation Delay (B to A) vs Load Capacitance

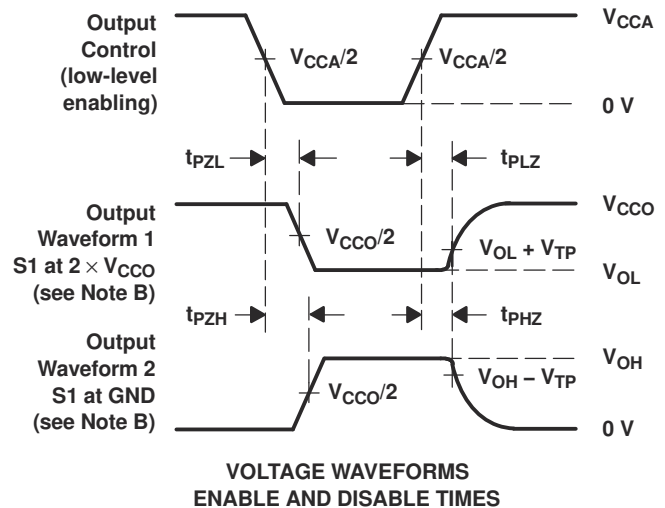
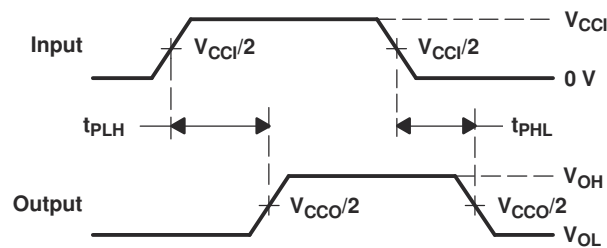
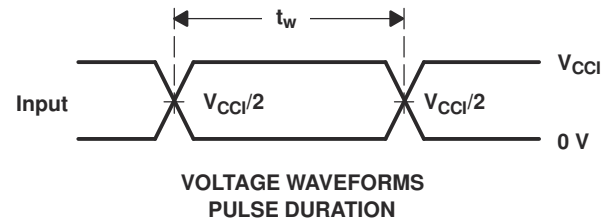
7 Parameter Measurement Information



LOAD CIRCUIT

V_{CCO}	C_L	R_L	V_{TP}
$1.8\text{ V} \pm 0.15\text{ V}$	15 pF	2 k Ω	0.15 V
$2.5\text{ V} \pm 0.2\text{ V}$	15 pF	2 k Ω	0.15 V
$3.3\text{ V} \pm 0.3\text{ V}$	15 pF	2 k Ω	0.3 V
$5\text{ V} \pm 0.5\text{ V}$	15 pF	2 k Ω	0.3 V

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



- NOTES:
- A. C_L includes probe and jig capacitance.
 - B. 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.
 - C. All input pulses are supplied by generators having the following characteristics: PRR ≤ 10 MHz, $Z_O = 50\ \Omega$, $dv/dt \geq 1$ V/ns.
 - D. The outputs are measured one at a time, with one transition per measurement.
 - E. t_{PLZ} and t_{PHZ} are the same as t_{dis} .
 - F. t_{PZL} and t_{PZH} are the same as t_{en} .
 - G. t_{PLH} and t_{PHL} are the same as t_{pd} .
 - H. V_{CCI} is the V_{CC} associated with the input port.
 - I. V_{CCO} is the V_{CC} associated with the output port.
 - J. All parameters and waveforms are not applicable to all devices.

图 7-1. Load Circuit and Voltage Waveforms

8 Detailed Description

8.1 Overview

The SN74LVC1T45 is a single-bit, dual-supply, noninverting voltage level transceiver. Pin A and the direction control pin (DIR) are supported by V_{CCA} and pin B is supported by V_{CCB} . The A port is able to accept I/O voltages ranging from 1.65 V to 5.5 V, while the B port can accept I/O voltages from 1.65 V to 5.5 V. The high on the DIR allows data transmissions from A to B and a low on the DIR allows data transmissions from B to A.

8.2 Functional Block Diagram

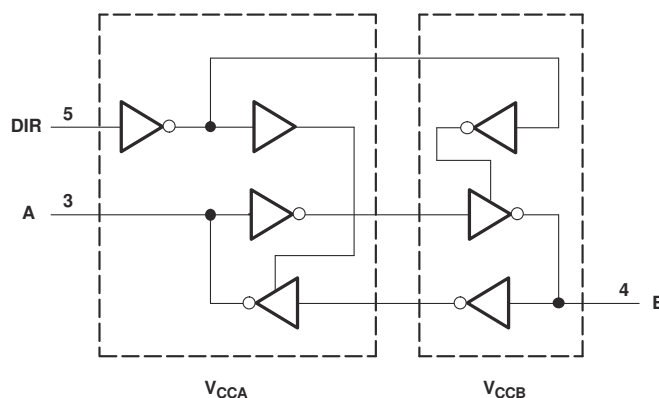


图 8-1. Logic Diagram (Positive Logic)

8.3 Feature Description

8.3.1 Fully Configurable Dual-Rail Design Allows Each Port to Operate Over the Full 1.65-V to 5.5-V Power-Supply Range

Both V_{CCA} and V_{CCB} can be supplied at any voltage between 1.65 V and 5.5 V, making the device suitable for translating between any of the voltage nodes (1.8-V, 2.5-V, 3.3-V, and 5-V).

8.3.2 Support High Speed Translation

The SN74LVC1T45 device supports high data rate applications. The translated signal data rate can be up to 420 Mbps when the signal is translated from 3.3 V to 5 V.

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

The inputs and outputs for this device enter a high-impedance state when the device is powered down, inhibiting current backflow into the device. The maximum leakage into or out of any input or output pin on the device is specified by I_{off} in the [Electrical Characteristics](#).

8.3.4 Balanced High-Drive CMOS Push-Pull Outputs

A balanced output allows the device to sink and source similar currents. The high drive capability of this device creates fast edges into light loads so impedance matching and load conditions should be considered to prevent ringing. Additionally, the outputs of this device are capable of driving larger currents than the device can sustain without being damaged. Two outputs can be connected together for a stronger output drive strength. The electrical and thermal limits defined in the [Absolute Maximum Ratings](#) must be followed at all times.

8.3.5 V_{CC} Isolation

The I/O's of both ports will enter a high-impedance state when either of the supplies are at GND, while the other supply is still connected to the device. The maximum leakage into or out of any input or output pin on the device is specified by I_{off} in the [Electrical Characteristics](#).

8.4 Device Functional Modes

表 8-1. Function Table⁽¹⁾

INPUT DIR	OPERATION
L	B data to A bus
H	A data to B bus

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

9 Applications 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。

9.1 Application Information

The SN74LVC1T45 device can be used in level-translation applications for interfacing devices or systems operating at different interface voltages with one another. The maximum data rate can be up to 420 Mbps when device translates signals from 3.3 V to 5 V.

9.2 Typical Application

9.2.1 Unidirectional Logic Level-Shifting Application

图 9-1 shows an example of the SN74LVC1T45 being used in a unidirectional logic level-shifting application.

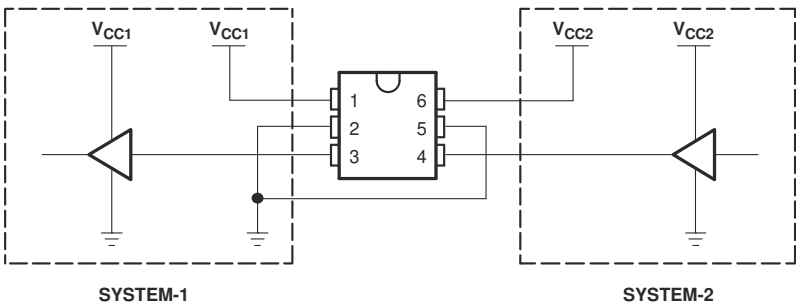


图 9-1. Unidirectional Logic Level-Shifting Application

9.2.1.1 Design Requirements

For this design example, use the parameters listed in 表 9-1.

表 9-1. Design Parameters

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

9.2.1.2 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 SN74LVC1T45 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 SN74LVC1T45 device is driving to determine the output voltage range.

9.2.1.3 Application Curve

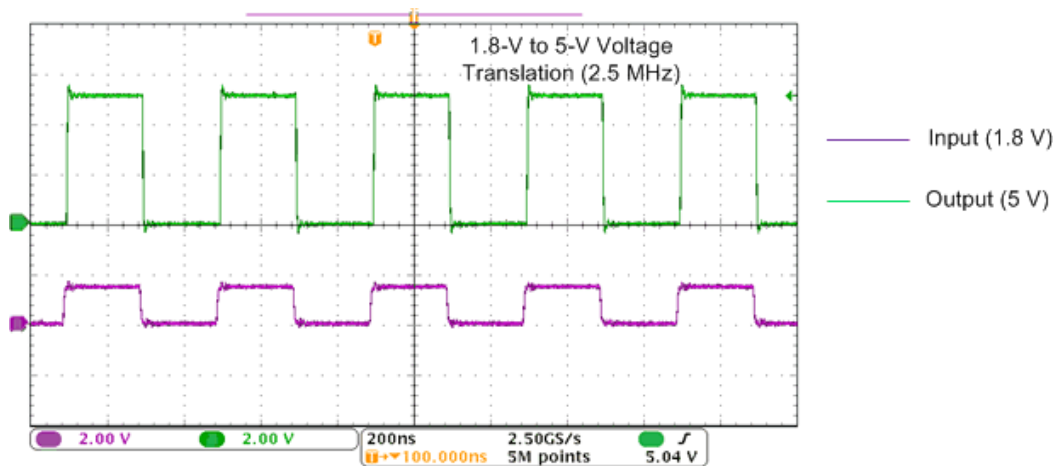


图 9-2. Translation Up (1.8 V to 5 V) at 2.5 MHz

9.2.2 Bidirectional Logic Level-Shifting Application

图 9-3 shows the SN74LVC1T45 being used in a bidirectional logic level-shifting application. Because the SN74LVC1T45 does not have an output-enable (OE) pin, the system designer should take precautions to avoid bus contention between SYSTEM-1 and SYSTEM-2 when changing directions.

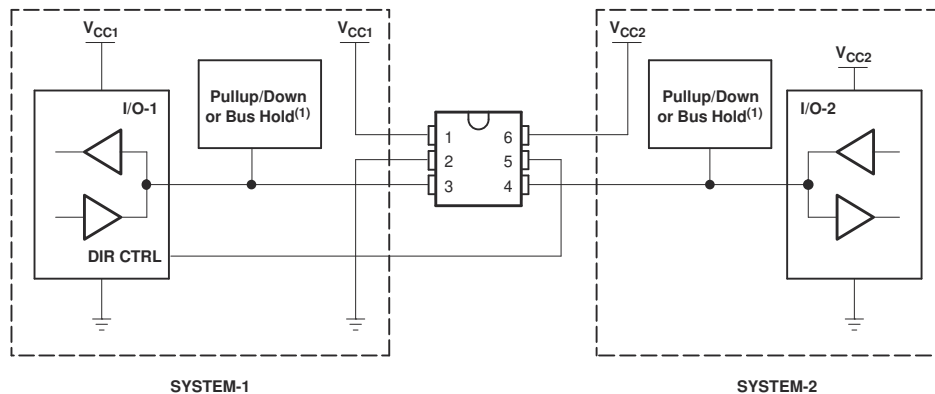


图 9-3. Bidirectional Logic Level-Shifting Application

9.2.2.1 Design Requirements

See 节 9.2.1.1.

9.2.2.2 Detailed Design Procedure

表 9-2 shows data transmission from SYSTEM-1 to SYSTEM-2 and then from SYSTEM-2 to SYSTEM-1.

表 9-2. SYSTEM-1 and SYSTEM-2 Data Transmission

STATE	DIR CTRL	I/O-1	I/O-2	DESCRIPTION
1	H	Out	In	SYSTEM-1 data to SYSTEM-2
2	H	Hi-Z	Hi-Z	SYSTEM-2 is getting ready to send data to SYSTEM-1. I/O-1 and I/O-2 are disabled. The bus-line state depends on pullup or pulldown. ⁽¹⁾
3	L	Hi-Z	Hi-Z	DIR bit is flipped. I/O-1 and I/O-2 still are disabled. The bus-line state depends on pullup or pulldown. ⁽¹⁾
4	L	In	Out	SYSTEM-2 data to SYSTEM-1

(1) SYSTEM-1 and SYSTEM-2 must use the same conditions, that is, both pullup or both pulldown.

9.2.2.2.1 Enable Times

Calculate the enable times for the SN74LVC1T45 using the following formulas:

- $t_{PZH} \text{ (DIR to A)} = t_{PLZ} \text{ (DIR to B)} + t_{PLH} \text{ (B to A)}$
- $t_{PZL} \text{ (DIR to A)} = t_{PHZ} \text{ (DIR to B)} + t_{PHL} \text{ (B to A)}$
- $t_{PZH} \text{ (DIR to B)} = t_{PLZ} \text{ (DIR to A)} + t_{PLH} \text{ (A to B)}$
- $t_{PZL} \text{ (DIR to B)} = t_{PHZ} \text{ (DIR to A)} + t_{PHL} \text{ (A to B)}$

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 SN74LVC1T45 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.

9.2.2.3 Application Curve

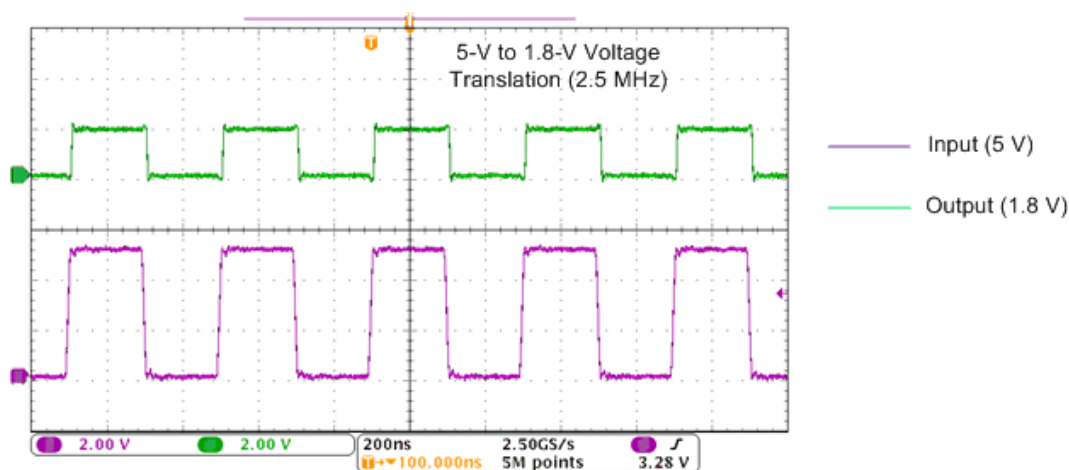


图 9-4. Translation Down (5V to 1.8 V) at 2.5 MHz

10 Power Supply Recommendations

The SN74LVC1T45 device uses two separate configurable power-supply rails, V_{CCA} and V_{CCB} . V_{CCA} accepts any supply voltage from 1.65 V to 5.5 V and V_{CCB} accepts any supply voltage from 1.65 V to 5.5 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 1.8-V, 2.5-V, 3.3-V and 5-V voltage nodes. The recommendation is to first power-up the input supply rail to help avoid internal floating while the output supply rail ramps up. However, both power-supply rails can be ramped up simultaneously.

11 Layout

11.1 Layout Guidelines

To ensure reliability of the device, the following common printed-circuit board layout guidelines are 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 depends on the system requirements

11.2 Layout Example

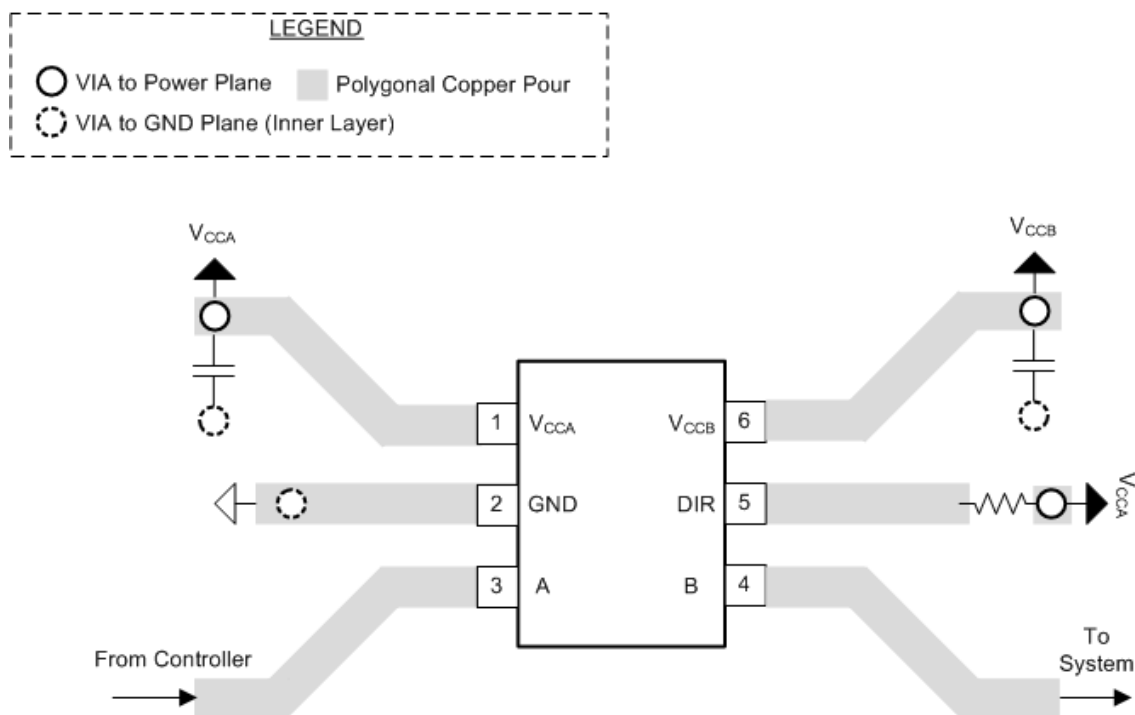


图 11-1. Layout Example

12 Device and Documentation Support

12.1 Documentation Support

12.1.1 Related Documentation

For related documentation see the following:

- Texas Instruments, [Implications of Slow or Floating CMOS Inputs](#)

12.2 接收文档更新通知

要接收文档更新通知，请导航至 ti.com 上的器件产品文件夹。点击 [订阅更新](#) 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。

12.3 支持资源

[TI E2E™ 支持论坛](#) 是工程师的重要参考资料，可直接从专家获得快速、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可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》。

12.4 Trademarks

NanoFree™ is a trademark of Texas Instruments.

TI E2E™ is a trademark of Texas Instruments.

所有商标均为其各自所有者的财产。

12.5 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.

12.6 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。

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
SN74LVC1T45DBVR	ACTIVE	SOT-23	DBV	6	3000	RoHS & Green	NIPDAU SN	Level-1-260C-UNLIM	-40 to 85	(2PUH, CT15, CT1F, CT1R)	Samples
SN74LVC1T45DBVRE4	ACTIVE	SOT-23	DBV	6	3000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	(2PUH, CT15, CT1F, CT1R)	Samples
SN74LVC1T45DBVRG4	ACTIVE	SOT-23	DBV	6	3000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	(2PUH, CT15, CT1F, CT1R)	Samples
SN74LVC1T45DBVT	ACTIVE	SOT-23	DBV	6	250	RoHS & Green	NIPDAU SN	Level-1-260C-UNLIM	-40 to 85	(CT15, CT1F, CT1R)	Samples
SN74LVC1T45DBVTG4	ACTIVE	SOT-23	DBV	6	250	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	(CT15, CT1F, CT1R)	Samples
SN74LVC1T45DCKR	ACTIVE	SC70	DCK	6	3000	RoHS & Green	NIPDAU SN	Level-1-260C-UNLIM	-40 to 85	(TA5, TAF, TAR)	Samples
SN74LVC1T45DCKRE4	ACTIVE	SC70	DCK	6	3000	RoHS & Green	SN	Level-1-260C-UNLIM	-40 to 85	(TA5, TAF, TAR)	Samples
SN74LVC1T45DCKRG4	ACTIVE	SC70	DCK	6	3000	RoHS & Green	SN	Level-1-260C-UNLIM	-40 to 85	(TA5, TAF, TAR)	Samples
SN74LVC1T45DCKT	ACTIVE	SC70	DCK	6	250	RoHS & Green	SN	Level-1-260C-UNLIM	-40 to 85	(TA5, TAF, TAR)	Samples
SN74LVC1T45DCKTE4	ACTIVE	SC70	DCK	6	250	RoHS & Green	SN	Level-1-260C-UNLIM	-40 to 85	(TA5, TAF, TAR)	Samples
SN74LVC1T45DCKTG4	ACTIVE	SC70	DCK	6	250	RoHS & Green	SN	Level-1-260C-UNLIM	-40 to 85	(TA5, TAF, TAR)	Samples
SN74LVC1T45DPKR	ACTIVE	USON	DPK	6	5000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	TA7	Samples
SN74LVC1T45DRLR	ACTIVE	SOT-5X3	DRL	6	4000	RoHS & Green	NIPDAU NIPDAUAG	Level-1-260C-UNLIM	-40 to 85	(1JX, TA7, TAR)	Samples
SN74LVC1T45DRLRG4	ACTIVE	SOT-5X3	DRL	6	4000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	(1JX, TA7, TAR)	Samples
SN74LVC1T45YZPR	ACTIVE	DSBGA	YZP	6	3000	RoHS & Green	SNAGCU	Level-1-260C-UNLIM	-40 to 85	(TA2, TA7, TAN)	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 ≤ 1000 ppm threshold. Antimony trioxide based flame retardants must also meet the ≤ 1000 ppm 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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In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

OTHER QUALIFIED VERSIONS OF SN74LVC1T45 :

- Automotive : [SN74LVC1T45-Q1](#)
- Enhanced Product : [SN74LVC1T45-EP](#)

NOTE: Qualified Version Definitions:

- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects
- Enhanced Product - Supports Defense, Aerospace and Medical Applications

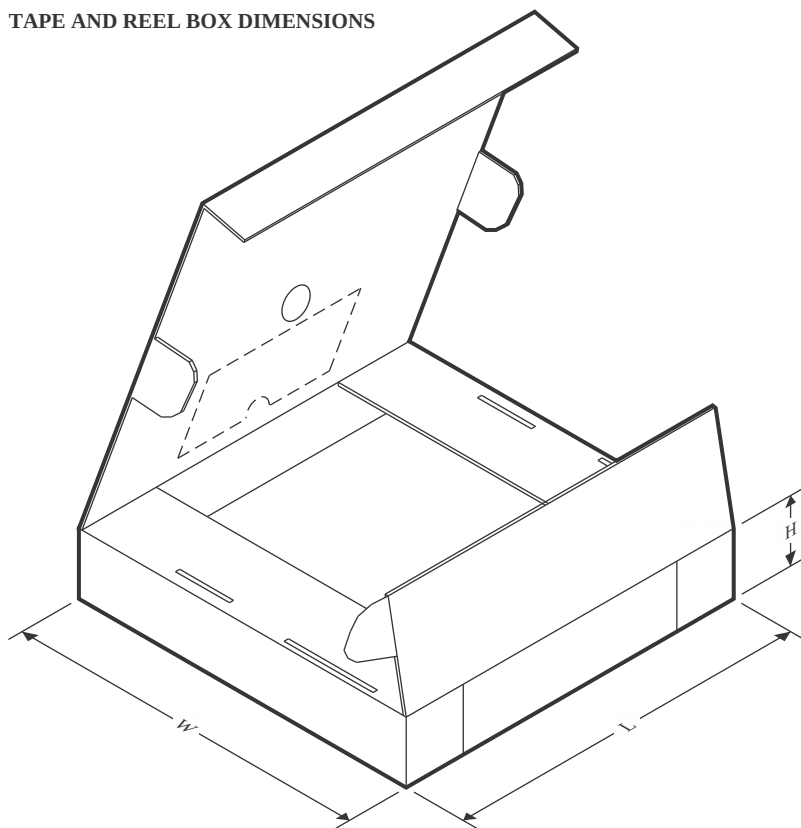
TAPE AND REEL INFORMATION



*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
SN74LVC1T45DBVR	SOT-23	DBV	6	3000	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
SN74LVC1T45DBVR	SOT-23	DBV	6	3000	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
SN74LVC1T45DBVT	SOT-23	DBV	6	250	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
SN74LVC1T45DBVT	SOT-23	DBV	6	250	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
SN74LVC1T45DCKR	SC70	DCK	6	3000	178.0	9.0	2.4	2.5	1.2	4.0	8.0	Q3
SN74LVC1T45DPKR	USON	DPK	6	5000	180.0	9.5	1.75	1.75	0.7	4.0	8.0	Q2
SN74LVC1T45DRLR	SOT-5X3	DRL	6	4000	180.0	8.4	2.0	1.8	0.75	4.0	8.0	Q3
SN74LVC1T45YZPR	DSBGA	YZP	6	3000	178.0	9.2	1.02	1.52	0.63	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)
SN74LVC1T45DBVR	SOT-23	DBV	6	3000	210.0	185.0	35.0
SN74LVC1T45DBVR	SOT-23	DBV	6	3000	210.0	185.0	35.0
SN74LVC1T45DBVT	SOT-23	DBV	6	250	210.0	185.0	35.0
SN74LVC1T45DBVT	SOT-23	DBV	6	250	210.0	185.0	35.0
SN74LVC1T45DCKR	SC70	DCK	6	3000	180.0	180.0	18.0
SN74LVC1T45DPKR	USON	DPK	6	5000	184.0	184.0	19.0
SN74LVC1T45DRLR	SOT-5X3	DRL	6	4000	210.0	185.0	35.0
SN74LVC1T45YZPR	DSBGA	YZP	6	3000	220.0	220.0	35.0

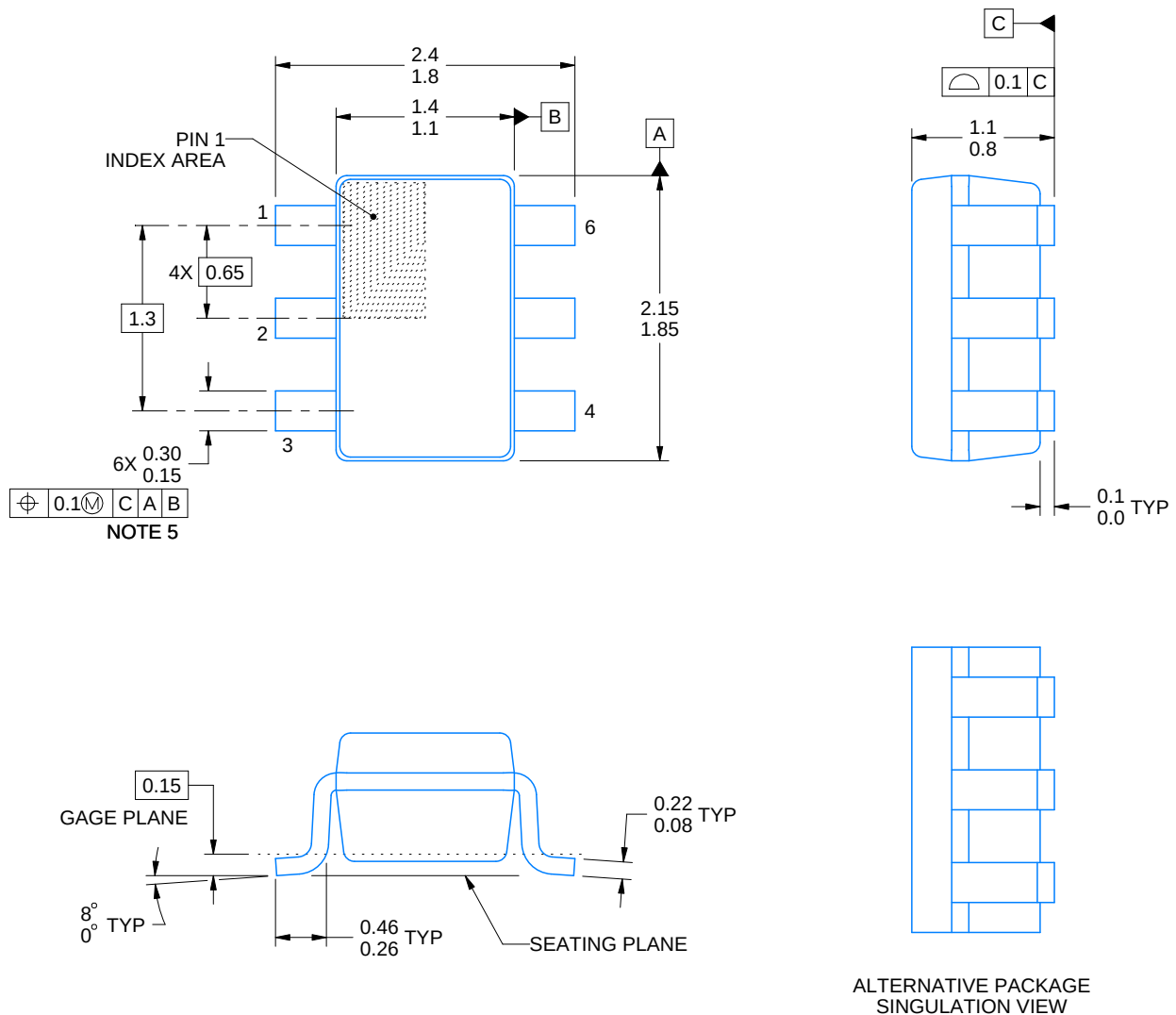
DCK0006A



PACKAGE OUTLINE

SOT - 1.1 max height

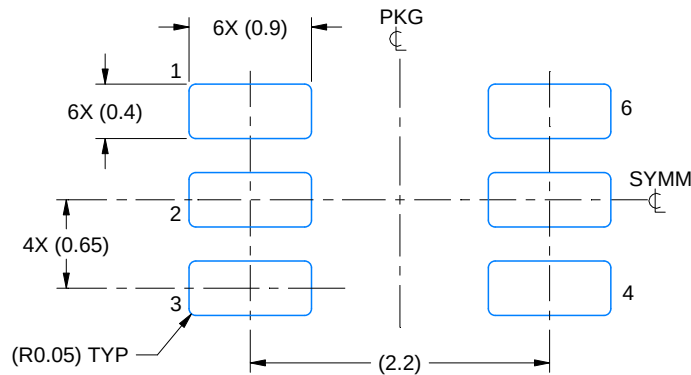
SMALL OUTLINE TRANSISTOR



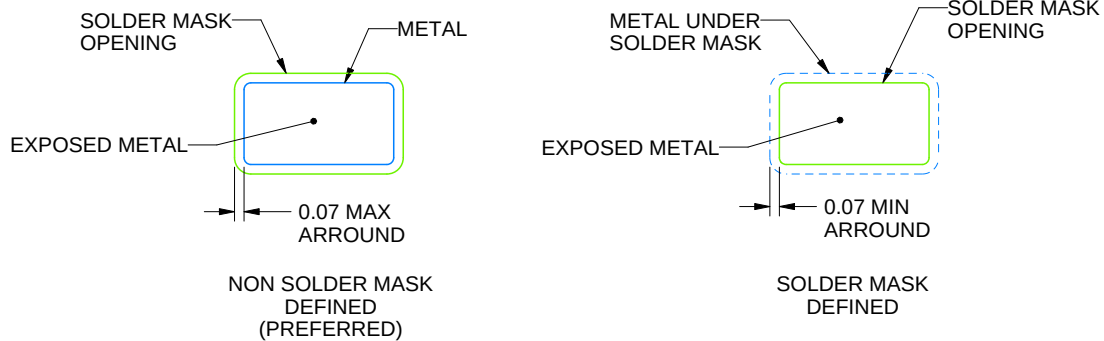
4214835/B 04/2024

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. Body dimensions do not include mold flash or protrusion. Mold flash and protrusion shall not exceed 0.15 per side.
4. Falls within JEDEC MO-203 variation AB.



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:18X

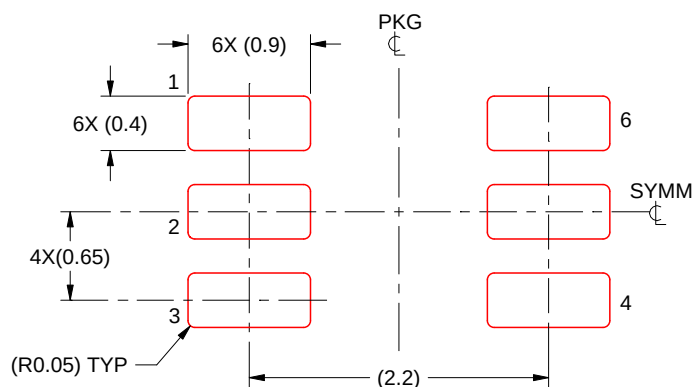


SOLDER MASK DETAILS

4214835/B 04/2024

NOTES: (continued)

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



SOLDER PASTE EXAMPLE
 BASED ON 0.125 THICK STENCIL
 SCALE:18X

4214835/B 04/2024

NOTES: (continued)

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



SOT - 0.6 mm max height

1.7
1.5

PIN 1
ID AREA

1 6

4X 0.5

2X 1

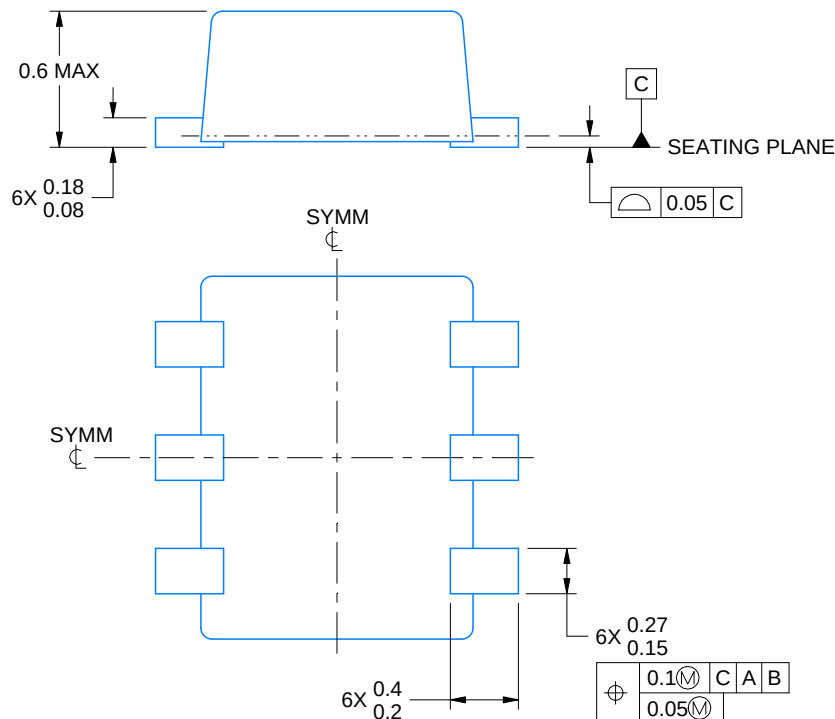
3 4

1.7
1.5
NOTE 3

1.3
1.1

6X 0.3
0.1

0.05
0.00 TYP



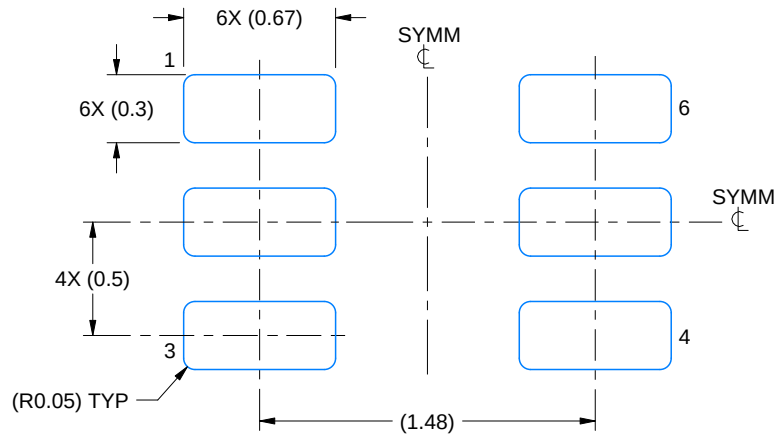
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. Reference JEDEC registration MO-293 Variation UAAD

EXAMPLE BOARD LAYOUT

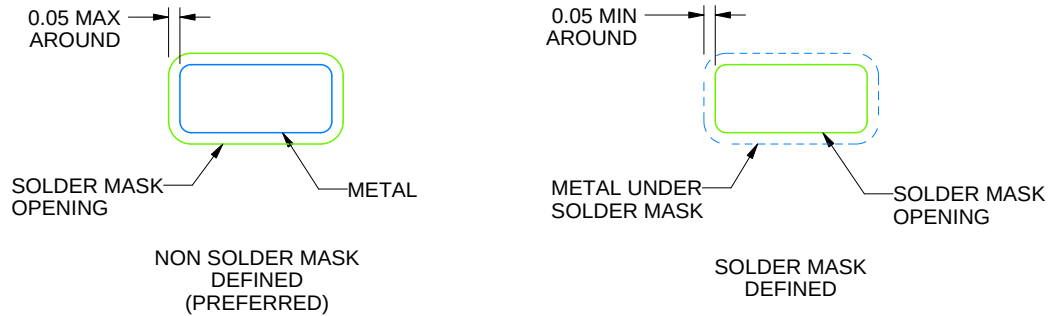
DRL0006A

SOT - 0.6 mm max height

PLASTIC SMALL OUTLINE



LAND PATTERN EXAMPLE
SCALE:30X



SOLDERMASK DETAILS

4223266/C 12/2021

NOTES: (continued)

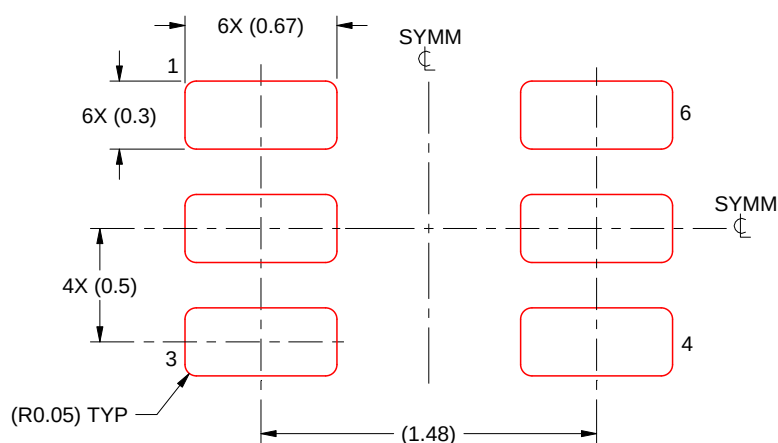
5. Publication IPC-7351 may have alternate designs.
6. Solder mask tolerances between and around signal pads can vary based on board fabrication site.
7. Land pattern design aligns to IPC-610, Bottom Termination Component (BTC) solder joint inspection criteria.

EXAMPLE STENCIL DESIGN

DRL0006A

SOT - 0.6 mm max height

PLASTIC SMALL OUTLINE



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

4223266/C 12/2021

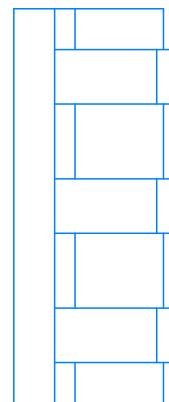
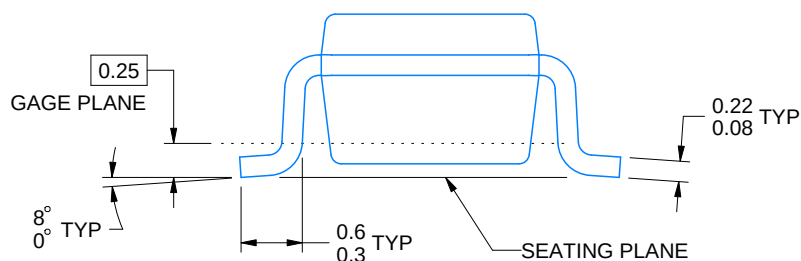
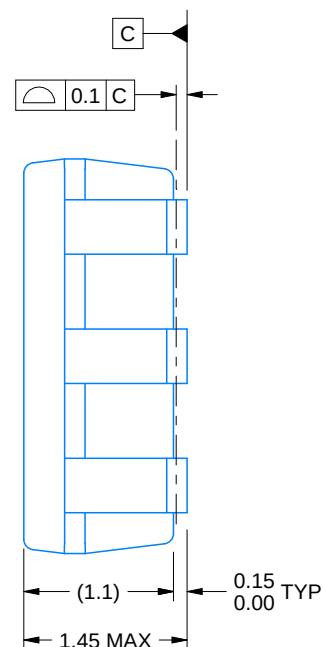
NOTES: (continued)

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



SOT-23 - 1.45 mm max height

SMALL OUTLINE TRANSISTOR



ALTERNATIVE PACKAGE SINGULATION VIEW

4214840/E 02/2024

NOTES:

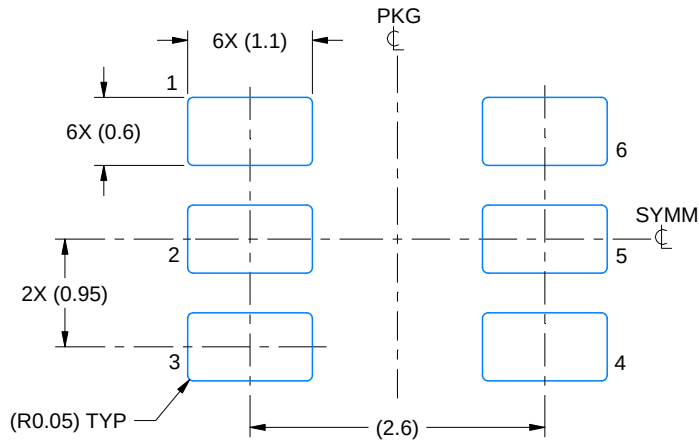
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. Body dimensions do not include mold flash or protrusion. Mold flash and protrusion shall not exceed 0.25 per side.
4. Leads 1,2,3 may be wider than leads 4,5,6 for package orientation.
5. Reference JEDEC MO-178.

EXAMPLE BOARD LAYOUT

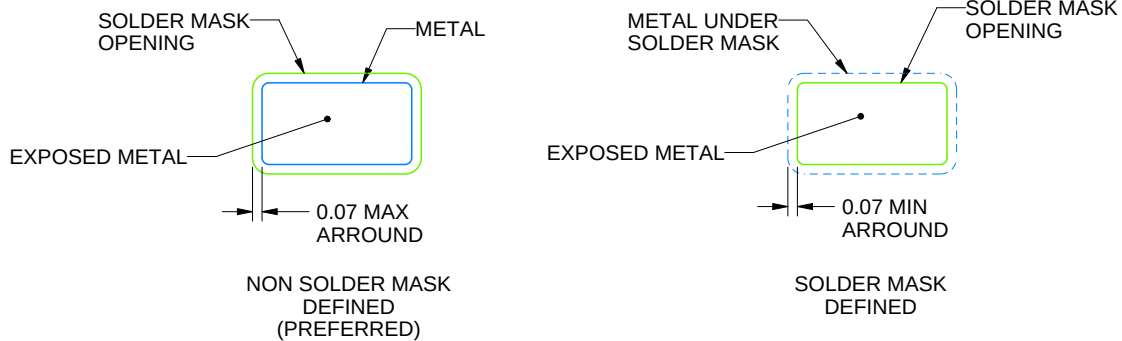
DBV0006A

SOT-23 - 1.45 mm max height

SMALL OUTLINE TRANSISTOR



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:15X



SOLDER MASK DETAILS

4214840/E 02/2024

NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.

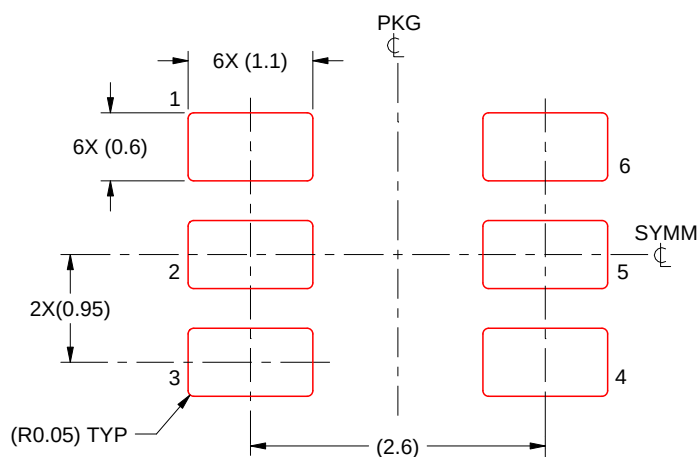
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

EXAMPLE STENCIL DESIGN

DBV0006A

SOT-23 - 1.45 mm max height

SMALL OUTLINE TRANSISTOR



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE:15X

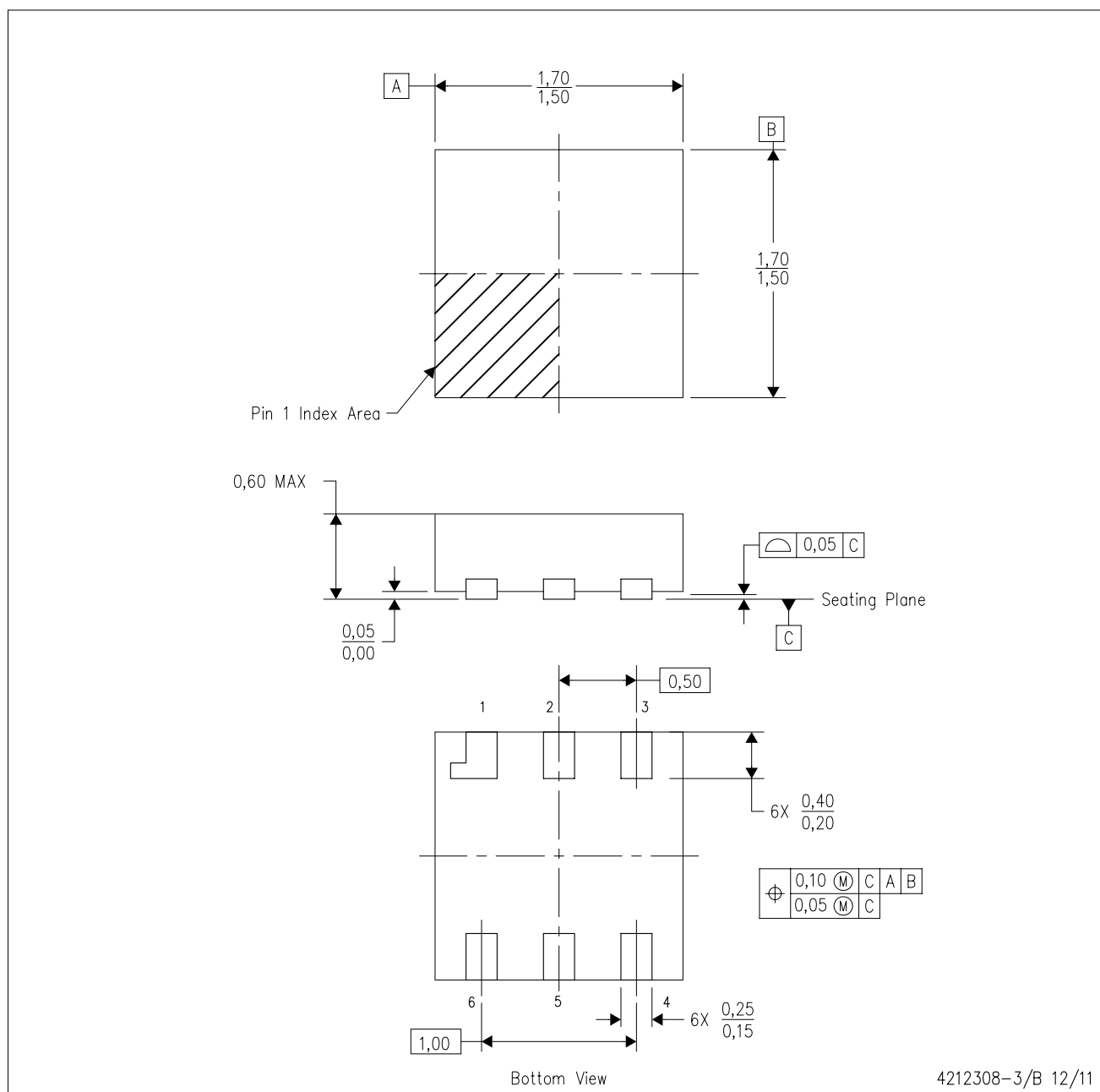
4214840/E 02/2024

NOTES: (continued)

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

DPK (S-PUSON-N6)

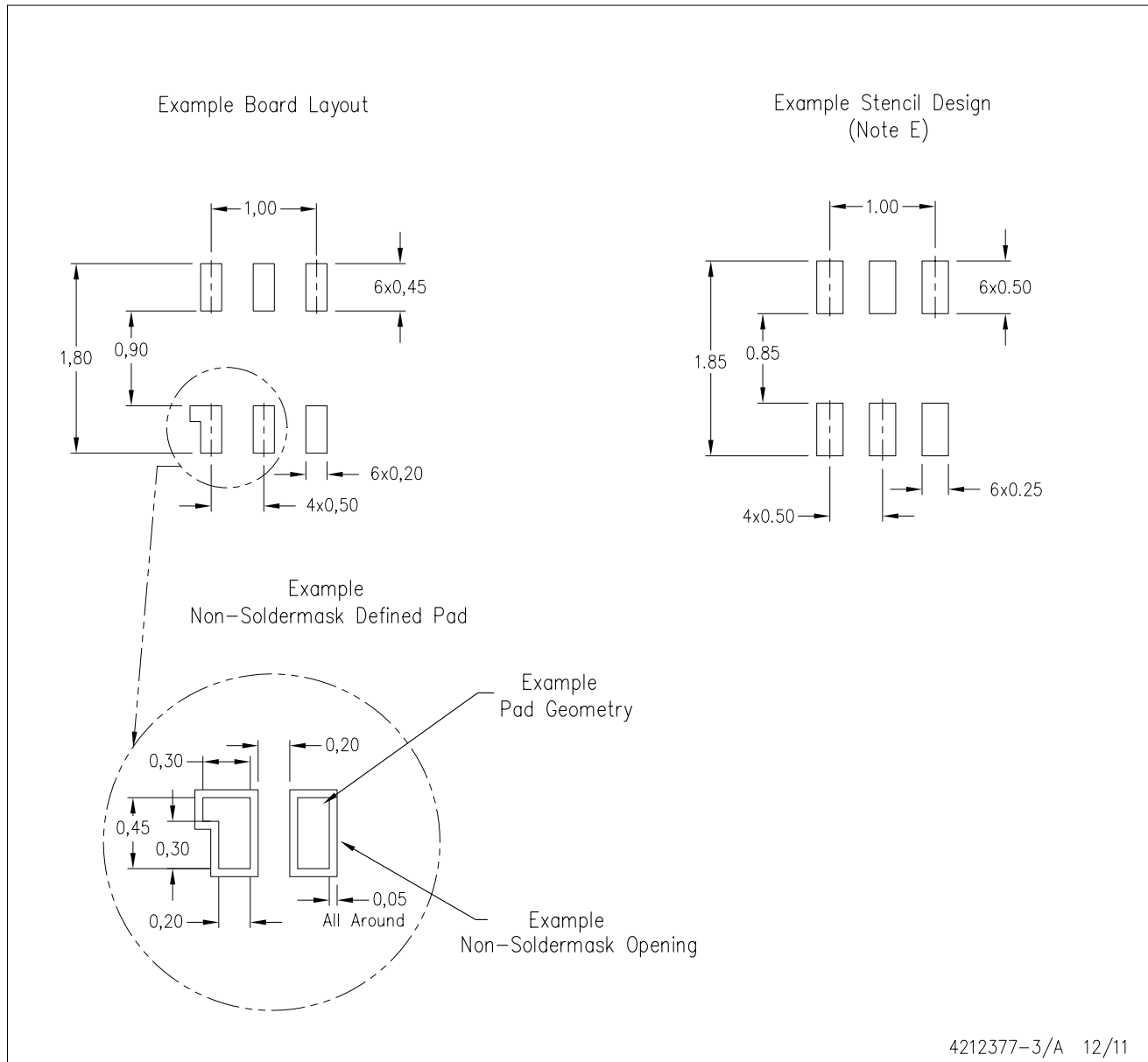
PLASTIC SMALL OUTLINE NO-LEAD



- 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.

DPK (S-PUS0N-N6)

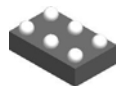
PLASTIC SMALL OUTLINE NO-LEAD



4212377-3/A 12/11

- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. Publication IPC-7351 is recommended for alternate designs.
 - D. Customers should contact their board fabrication site for minimum solder mask web tolerances between signal pads.
 - E. Maximum stencil thickness 0,127 mm (5 mils). All linear dimensions are in millimeters.
 - F. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC 7525 for stencil design considerations.
 - G. Side aperture dimensions over-print land for acceptable area ratio > 0.66. Customer may reduce side aperture dimensions if stencil manufacturing process allows for sufficient release at smaller opening.

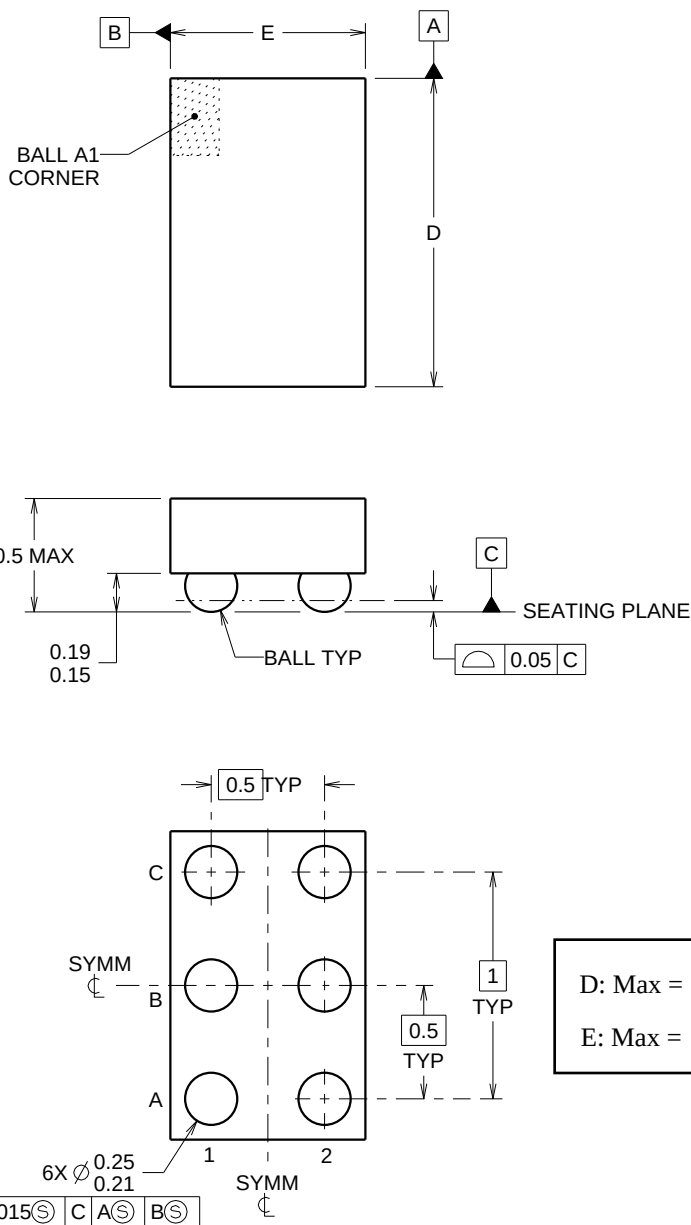
YZP0006



PACKAGE OUTLINE

DSBGA - 0.5 mm max height

DIE SIZE BALL GRID ARRAY



4219524/A 06/2014

NOTES:

NanoFree Is a trademark of Texas Instruments.

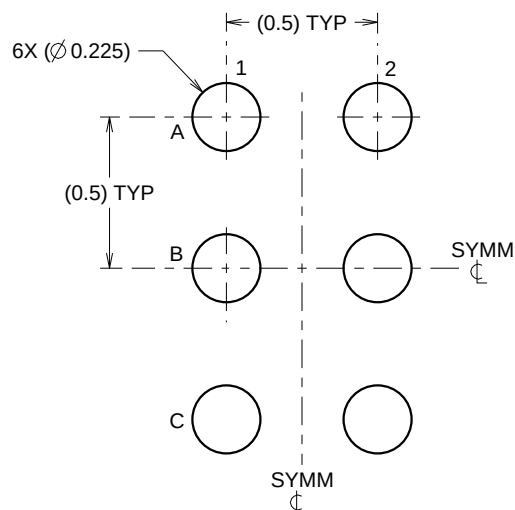
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. NanoFree™ package configuration.

EXAMPLE BOARD LAYOUT

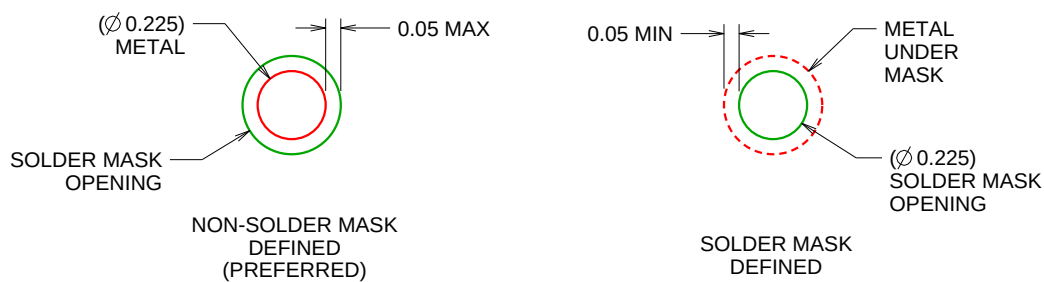
YZP0006

DSBGA - 0.5 mm max height

DIE SIZE BALL GRID ARRAY



LAND PATTERN EXAMPLE
SCALE:40X



SOLDER MASK DETAILS
NOT TO SCALE

4219524/A 06/2014

NOTES: (continued)

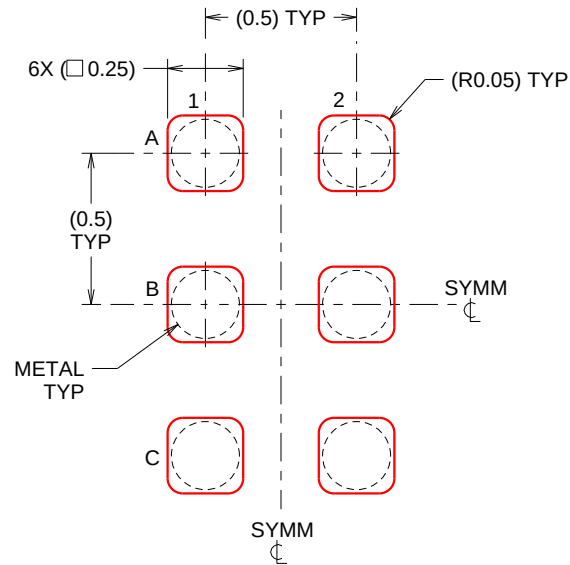
- Final dimensions may vary due to manufacturing tolerance considerations and also routing constraints. For more information, see Texas Instruments literature number SBVA017 (www.ti.com/lit/sbva017).

EXAMPLE STENCIL DESIGN

YZP0006

DSBGA - 0.5 mm max height

DIE SIZE BALL GRID ARRAY



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

4219524/A 06/2014

NOTES: (continued)

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

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