SN74LXC1T45 具有可配置电平转换的 1 位双电源总线收发器

1 特性

- 完全可配置的双电源轨设计可允许各个端口在 1.1V 至 5.5V 范围内运行
- 稳健、无干扰电源时序控制
- 在 3.3V 至 5.0V 范围内，支持高达 420Mbps 的速率
- 施密特触发输入可实现慢速或高噪声输入
- 带有集成动态下拉电阻器的 I/O 有助于减少外部组件数量。
- 带集成静态下拉电阻器的控制输入允许浮动控制输入
- 高驱动强度（在 5V 时最高 32 mA）
- 低功耗
  - 最大值 3μA (25°C)
  - 最大值 6μA（–40°C 至 125°C）
- V_{CC} 隔离和 V_{CC} 断开 ($I_{off-float}$) 特性
  - 如果任何一个 V_{CC} 电源电压 < 100mV 或已断开，则所有 I/O 会下拉，然后成为高阻抗状态
- I_{off} 支持局部断电模式运行
- 兼容 LVC 系列电平转换器
- 控制逻辑（DIR 和 $\overline{OE}$）以 V_{CCA} 为基准
- 工作温度范围为 –40°C 至 +125°C
- 闩锁性能超过 100mA，符合 JESD 78 II 类规范
- ESD 保护性能超过 JESD 22 规范要求
  - 4000V 人体放电模型
  - 1000V 充电器件模型

2 应用

- 消除缓慢或嘈杂输入信号
- 驱动指示 LED 或蜂鸣器
- 机械开关去抖
- 通用 I/O 电平转换

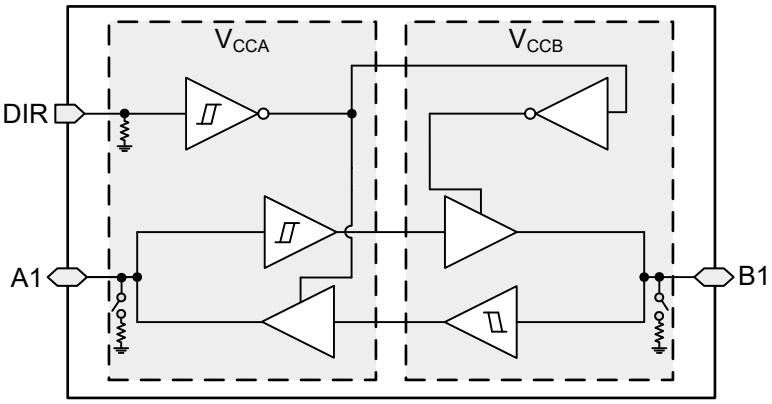
3 说明

SN74LXC1T45 是一款 1 位双电源同相双向电压电平转换器件。I/O 引脚 A 和控制引脚 (DIR) 以 V_{CCA} 逻辑电平为基准，I/O 引脚 B 以 V_{CCB} 逻辑电平为基准。A 引脚能够接受 1.1V 至 5.5V 的 I/O 电压，而 B 引脚可接受 1.1V 至 5.5V 的 I/O 电压。DIR 上为高电平时允许数据从 A 传输到 B，DIR 上为低电平时允许数据从 B 传输到 A。请参阅*器件功能模式*，简要了解控制逻辑运行。

器件信息 (1)

器件型号	封装	封装尺寸（标称值）
SN74LXC1T45DRL	SOT (6)	1.60mm × 1.20mm
SN74LXC1T45DRY	SON (6)	1.45mm × 1.00mm
SN74LXC1T45DBV	SOT-23 (6)	2.90mm × 1.60mm
SN74LXC1T45DCK	SC70 (6)	2.00mm × 1.25mm
SN74LXC1T45DTQ	X2SON (6)	1.00mm × 0.80mm

(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。



SN74LXC1T45 框图

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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 * (September 2021) to Revision A (December 2021)	Page
• 将数据表的状态从*预告信息*更改为*量产数据*	1

5 Pin Configuration and Functions

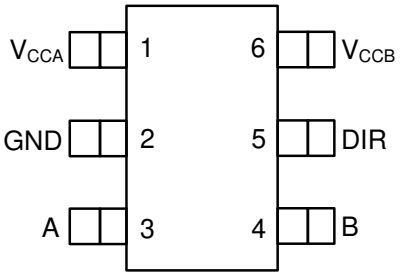


图 5-1. DBV 6-Pin SOT-23
Top View

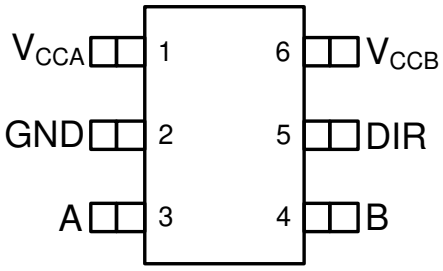


图 5-2. DCK 6-Pin SC70
Top View

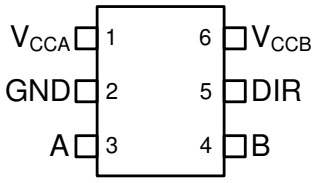


图 5-3. DRL Package Preview 6-Pin SOT
Top View

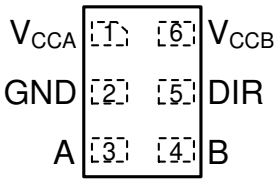


图 5-4. DRY Package Preview 6-Pin SON
Top View

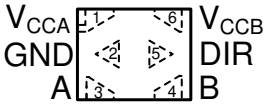


图 5-5. DTQ Package Preview 6-Pin X2SON Transparent Top View

表 5-1. Pin Functions

PIN		TYPE	DESCRIPTION
NAME	DBV, DCK, DRL, DRY, DTQ		
A	3	I/O	Input or output A. Referenced to V_{CCA}.
B	4	I/O	Input or output B. Referenced to V_{CCB}.
DIR	5	I	Direction-control signal for all ports. Referenced to V_{CCA}.
GND	2	—	Ground.
DIR	5	I	Direction-control signal for all ports. Referenced to V_{CCA}.
V_{CCA}	1	—	A-port supply voltage. 1.1 V ≤ V_{CCA} ≤ 5.5 V.
V_{CCB}	6	—	B-port supply voltage. 1.1 V ≤ V_{CCB} ≤ 5.5 V.

6 Specifications

6.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)(1)

			MIN	MAX	UNIT
V_{CCA}	Supply voltage A		– 0.5	6.5	V
V_{CCB}	Supply voltage B		– 0.5	6.5	V
V_I	Input Voltage(2)	I/O Ports (A Port)	– 0.5	6.5	V
		I/O Ports (B Port)	– 0.5	6.5	
		Control Inputs	– 0.5	6.5	
V_O	Voltage applied to any output in the high-impedance or power-off state(2)	A Port	– 0.5	6.5	V
		B Port	– 0.5	6.5	
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	50	mA
	Continuous current through V_{CC} or GND		– 200	200	mA
T_j	Junction Temperature			150	°C
T_{stg}	Storage temperature		– 65	150	°C

(1) Operation outside the *Absolute Maximum Ratings* may cause permanent device damage. *Absolute Maximum Ratings* do not imply functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Conditions* If briefly ooperating outside the *Recommended Operating Conditions* but within the *Absolute Maximum Ratings*, this device may not sustain damage, but it may not be fully functional. Operating the device in this manner may affect device reliability, functionality, performance, and shorten the device lifetime.
(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 6.5 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)	±4000	V
		Charged device model (CDM), per ANSI/ESDA/JEDEC JS-002(2)	±1000	

(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

over operating free-air temperature range (unless otherwise noted) (1) (2) (3)

				MIN	MAX	UNIT
V_{CCA}	Supply voltage A			1.1	5.5	V
V_{CCB}	Supply voltage B			1.1	5.5	V
I_{OH}	High-level output current		V_{CCO} = 1.1 V		–0.1	mA
			V_{CCO} = 1.4 V		–4	
			V_{CCO} = 1.65 V		–8	
			V_{CCO} = 2.3 V		–12	
			V_{CCO} = 3 V		–24	
			V_{CCO} = 4.5 V		–32	
I_{OL}	Low-level output current		V_{CCO} = 1.1 V		0.1	mA
			V_{CCO} = 1.4 V		4	
			V_{CCO} = 1.65 V		8	
			V_{CCO} = 2.3 V		12	
			V_{CCO} = 3 V		24	
			V_{CCO} = 4.5 V		32	
V_I	Input voltage (3)			0	5.5	V
V_O	Output voltage	Active State		0	V_{CCO}	V
		Tri-State		0	5.5	
T_A	Operating free-air temperature			–40	125	°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 control inputs and data I/Os of this device have weak pulldowns to ensure the line is not floating when undefined external to the device. The input leakage from these weak pulldowns is defined by the I_I specification indicated under the *Electrical Characteristics*.

6.4 Thermal Information

THERMAL METRIC(1)		SN74LXC1T45					UNIT
		DBV (SOT-23)	DCK (SC70)	DRL (SOT)	DRY (SON)	DTQ (X2SON)	
		6 PINS	6 PINS	6 PINS	6 PINS	6 PINS	
$R_{\theta JA}$	Junction-to-ambient thermal resistance	217.4	216.1	TBD	TBD	TBD	°C/W
$R_{\theta JC(top)}$	Junction-to-case (top) thermal resistance	136.0	143.6	TBD	TBD	TBD	°C/W
$R_{\theta JB}$	Junction-to-board thermal resistance	98.5	75.9	TBD	TBD	TBD	°C/W
Y_{JT}	Junction-to-top characterization parameter	75.8	58.5	TBD	TBD	TBD	°C/W
Y_{JB}	Junction-to-board characterization parameter	98.2	75.6	TBD	TBD	TBD	°C/W
$R_{\theta JC(bottom)}$	Junction-to-case (bottom) thermal resistance	N/A	N/A	TBD	TBD	TBD	°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 operating free-air temperature range (unless otherwise noted)(1) (2)

PARAMETER		TEST CONDITIONS	V_{CCA}	V_{CCB}	Operating free-air temperature (T_A)									UNIT
					25°C			– 40°C to 85°C			– 40°C to 125°C			
					MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
V_{T+}	Positive-going input-threshold voltage	Data Inputs (Ax, Bx) (Referenced to V_{CCI})	1.1 V	1.1 V				0.44		0.88	0.44		0.88	V
			1.4 V	1.4 V				0.60		0.98	0.60		0.98	
			1.65 V	1.65 V				0.76		1.13	0.76		1.13	
			2.3 V	2.3 V				1.08		1.56	1.08		1.56	
			3 V	3 V				1.48		1.92	1.48		1.92	
			4.5 V	4.5 V				2.19		2.74	2.19		2.74	
			5.5 V	5.5 V				2.65		3.33	2.65		3.33	
		Control Input (DIR) (Referenced to V_{CCA})	1.1 V	1.1 V				0.44		0.88	0.44		0.88	V
			1.4 V	1.4 V				0.60		0.98	0.60		0.98	
			1.65 V	1.65 V				0.76		1.13	0.76		1.13	
			2.3 V	2.3 V				1.08		1.56	1.08		1.56	
			3 V	3 V				1.48		1.92	1.48		1.92	
			4.5 V	4.5 V				2.19		2.74	2.19		2.74	
			5.5 V	5.5 V				2.65		3.33	2.65		3.33	
V_{T-}	Negative-going input-threshold voltage	Data Inputs (Ax, Bx) (Referenced to V_{CCI})	1.1 V	1.1 V				0.17		0.48	0.17		0.48	V
			1.4 V	1.4 V				0.28		0.59	0.28		0.59	
			1.65 V	1.65 V				0.35		0.69	0.35		0.69	
			2.3 V	2.3 V				0.56		0.97	0.56		0.97	
			3 V	3 V				0.89		1.5	0.89		1.5	
			4.5 V	4.5 V				1.51		1.97	1.51		1.97	
			5.5 V	5.5 V				1.88		2.4	1.88		2.4	
		Control Input (DIR) (Referenced to V_{CCA})	1.1 V	1.1 V				0.17		0.48	0.17		0.48	V
			1.4 V	1.4 V				0.28		0.6	0.28		0.6	
			1.65 V	1.65 V				0.35		0.71	0.35		0.71	
			2.3 V	2.3 V				0.56		1	0.56		1	
			3 V	3 V				0.89		1.5	0.89		1.5	
			4.5 V	4.5 V				1.51		2	1.51		2	
			5.5 V	5.5 V				1.88		2.46	1.88		2.46	
ΔV_T	Input-threshold hysteresis (V_{T+} – V_{T-})	Data Inputs (Ax, Bx) (Referenced to V_{CCI})	1.1 V	1.1 V				0.2		0.4	0.2		0.4	V
			1.4 V	1.4 V				0.25		0.5	0.25		0.5	
			1.65 V	1.65 V				0.3		0.55	0.3		0.55	
			2.3 V	2.3 V				0.38		0.65	0.38		0.65	
			3 V	3 V				0.46		0.72	0.46		0.72	
			4.5 V	4.5 V				0.58		0.93	0.58		0.93	
			5.5 V	5.5 V				0.69		1.06	0.69		1.06	
		Control Input (DIR) (Referenced to V_{CCA})	1.1 V	1.1 V				0.2		0.4	0.2		0.4	V
			1.4 V	1.4 V				0.25		0.5	0.25		0.5	
			1.65 V	1.65 V				0.3		0.55	0.3		0.55	
			2.3 V	2.3 V				0.38		0.65	0.38		0.65	
			3 V	3 V				0.46		0.72	0.46		0.72	
			4.5 V	4.5 V				0.58		0.93	0.58		0.93	
			5.5 V	5.5 V				0.69		1.06	0.69		1.06	

6.5 Electrical Characteristics (continued)

over operating free-air temperature range (unless otherwise noted)(1) (2)

PARAMETER		TEST CONDITIONS	V_{CCA}	V_{CCB}	Operating free-air temperature (T_A)									UNIT
					25°C			– 40°C to 85°C			– 40°C to 125°C			
					MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
V_{OH}	High-level output voltage (3)	I_{OH} = – 100 µA	1.1V – 5.5V	1.1V – 5.5V				V_{CCO} – 0.1			V_{CCO} – 0.1			V
		I_{OH} = – 4 mA	1.4 V	1.4 V				1			1			
		I_{OH} = – 8 mA	1.65 V	1.65 V				1.2			1.2			
		I_{OH} = – 12 mA	2.3 V	2.3 V				1.9			1.9			
		I_{OH} = – 24 mA	3 V	3 V				2.4			2.4			
		I_{OH} = – 32 mA	4.5 V	4.5 V				3.8			3.8			
V_{OL}	Low-level output voltage (4)	I_{OL} = 100 µA	1.1V – 5.5V	1.1V – 5.5V						0.1			0.1	V
		I_{OL} = 4 mA	1.4 V	1.4 V						0.3			0.3	
		I_{OL} = 8 mA	1.65 V	1.65 V						0.45			0.45	
		I_{OL} = 12 mA	2.3 V	2.3 V						0.3			0.3	
		I_{OL} = 24 mA	3 V	3 V						0.55			0.55	
		I_{OL} = 32 mA	4.5 V	4.5 V						0.55			0.55	
I_I	Input leakage current	Control input (DIR) V_I = V_{CCA} or GND	1.1V – 5.5V	1.1V – 5.5V	-0.1		1	-0.1		2	-0.1		2	µA
		Data Inputs (5) (Ax, Bx) V_I = V_{CCI} or GND	1.1V – 5.5V	1.1V – 5.5V	– 0.3		1	– 1		1	– 2		2	µA
I_{off}	Partial power down current	A Port or B Port V_I or V_O = 0 V - 5.5 V	0 V	0 V - 5.5 V	– 1		1	– 2		2	– 2.5		2.5	µA
			0 V - 5.5 V	0 V	– 1		1	– 2		2	– 2.5		2.5	
$I_{off-float}$	Floating supply Partial power down current	A Port or B Port V_I or V_O = GND	Floating (6)	0 V - 5.5 V	– 1.5		1.5	– 2		2	– 2.5		2.5	µA
			0 V - 5.5 V	Floating (6)	– 1.5		1.5	– 2		2	– 2.5		2.5	
I_{CCA}	V_{CCA} supply current	V_I = V_{CCI} or GND I_O = 0	1.1V – 5.5V	1.1V – 5.5V			2			2			4	µA
			0 V	5.5 V	– 0.2			– 0.5			– 1			
			5.5 V	0 V			1			1			2	
		V_I = GND I_O = 0	5.5 V	Floating (6)			1			1			2	
I_{CCB}	V_{CCB} supply current	V_I = V_{CCI} or GND I_O = 0	1.1V – 5.5V	1.1V – 5.5V			2			2			4	µA
			0 V	5.5 V			1			1			2	
			5.5 V	0 V	– 0.2			– 0.5			– 1			
		V_I = GND I_O = 0	Floating (6)	5.5 V			1			1			2	
I_{CCA} + I_{CCB}	Combined supply current	V_I = V_{CCI} or GND I_O = 0	1.1V – 5.5V	1.1V – 5.5V			3			4			6	µA

6.5 Electrical Characteristics (continued)

over operating free-air temperature range (unless otherwise noted)(1) (2)

PARAMETER		TEST CONDITIONS	V_{CCA}	V_{CCB}	Operating free-air temperature (T_A)									UNIT
					25°C			– 40°C to 85°C			– 40°C to 125°C			
					MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
ΔI_{CCA}	V_{CCA} additional supply current per input	Control input (DIR): $V_I = V_{CCA}$ – 0.6 V A port = VCCA or GND B Port = open	3.0V - 5.5V	3.0V - 5.5V					50			75		µA
		A Port: $V_I = V_{CCA}$ – 0.6 V DIR = V_{CCA}, B Port = open	3.0V - 5.5V	3.0V - 5.5V					50			75		
ΔI_{CCB}	V_{CCB} additional supply current per input	B Port: $V_I = V_{CCB}$ - 0.6 V DIR = GND, A Port = open	3.0V - 5.5V	3.0V - 5.5V					50			75		µA
C_i	Control Input Capacitance	V_I = 3.3 V or GND	3.3 V	3.3 V		2.2			5			5		pF
C_{io}	Data I/O Capacitance	V_{CCO} = 0V V_O = 1.65V DC +1 MHz -16 dBm sine wave	3.3 V	3.3 V		4.3			10.5			10.5		pF

(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) Tested at $V_I = V_{T+(MAX)}$
(4) Tested at $V_I = V_{T-(MIN)}$
(5) For I/O ports, the parameter I_I includes the I_{OZ} current
(6) Floating is defined as a node that is both not actively driven by an external device and has leakage not exeeding 10nA

6.6 Switching Characteristics, V_{CCA} = 1.2 ± 0.1 V

See Figure 7-1 and Table 7-1 for test circuit and loading. See Figure 7-2, Figure 7-3, and Figure 7-4 for measurement waveforms.

PARAMETER		FROM	TO	Test Conditions	B-Port Supply Voltage (V_{CCB})														UNIT
					1.2 ± 0.1 V			1.5 ± 0.1 V			1.8 ± 0.15 V			2.5 ± 0.2 V			3.3 ± 0.3 V			5.0 ± 0.5 V			
					MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
t_{pd}	Propagation delay	A	B	-40°C to 85°C	6		85	4		41	3		36	1		33	1		34	1		44	ns
				-40°C to 125°C	8		55	6		37	5		33	3		30	3		30	2		33	
		B	A	-40°C to 85°C	6		85	5		71	4		67	3		60	3		57	3		58	
				-40°C to 125°C	8		55	6		47	6		43	5		38	4		37	4		36	
t_{dis}	Disable time	DIR	A	-40°C to 85°C	5		53	5		53	5		53	5		53	5		53	4		53	ns
				-40°C to 125°C	7		47	7		47	7		47	7		47	7		47	7		47	
		DIR	B	-40°C to 85°C	10		85	7		47	6		41	5		34	5		33	4		32	
				-40°C to 125°C	14		71	11		48	10		41	8		34	8		33	6		32	
t_{en}	Enable time	DIR	A	-40°C to 85°C	21		150	17		110	16		99	13		86	13		83	12		85	ns
				-40°C to 125°C	27		121	23		89	21		80	17		68	17		65	15		63	
		DIR	B	-40°C to 85°C	16		118	14		89	13		84	12		81	11		82	11		92	
				-40°C to 125°C	19		97	18		79	17		73	16		68	15		67	14		70	

6.7 Switching Characteristics, V_{CCA} = 1.5 ± 0.1 V

See Figure 7-1 and Table 7-1 for test circuit and loading. See Figure 7-2, Figure 7-3, and Figure 7-4 for measurement waveforms.

PARAMETER		FROM	TO	Test Conditions	B-Port Supply Voltage (V_{CCB})														UNIT
					1.2 ± 0.1 V			1.5 ± 0.1 V			1.8 ± 0.15 V			2.5 ± 0.2 V			3.3 ± 0.3 V			5.0 ± 0.5 V			
					MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
t_{pd}	Propagation delay	A	B	-40°C to 85°C	5		71	3		29	1		24	1		20	1		19	1		19	ns
				-40°C to 125°C	6		47	4		30	3		25	2		21	2		20	1		20	
		B	A	-40°C to 85°C	4		41	3		29	2		27	1		23	1		22	1		21	
				-40°C to 125°C	6		37	4		30	4		27	3		24	3		22	2		22	
t_{dis}	Disable time	DIR	A	-40°C to 85°C	2		26	2		26	2		26	2		26	2		26	2		26	ns
				-40°C to 125°C	4		27	4		27	4		27	4		27	4		27	4		27	
		DIR	B	-40°C to 85°C	8		71	6		38	5		32	3		25	3		24	2		22	
				-40°C to 125°C	12		61	10		39	9		34	6		26	6		25	4		23	
t_{en}	Enable time	DIR	A	-40°C to 85°C	17		106	13		63	12		54	9		44	9		41	8		39	ns
				-40°C to 125°C	23		92	19		64	17		56	14		45	14		42	12		40	
		DIR	B	-40°C to 85°C	12		90	10		51	9		45	8		40	7		39	7		39	
				-40°C to 125°C	16		69	14		51	13		47	12		42	11		40	10		40	

6.8 Switching Characteristics, V_{CCA} = 1.8 ± 0.15 V

See Figure 7-1 and Table 7-1 for test circuit and loading. See Figure 7-2, Figure 7-3, and Figure 7-4 for measurement waveforms.

PARAMETER		FROM	TO	Test Conditions	B-Port Supply Voltage (V_{CCB})																		UNIT
					1.2 ± 0.1 V			1.5 ± 0.1 V			1.8 ± 0.15 V			2.5 ± 0.2 V			3.3 ± 0.3 V			5.0 ± 0.5 V			
					MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
t_{pd}	Propagation delay	A	B	-40°C to 85°C	4		67	2		27	1		22	1		18	1		16	1		16	ns
				-40°C to 125°C	6		43	4		27	3		22	2		18	1		17	1		16	
		B	A	-40°C to 85°C	3		36	1		24	1		22	1		19	1		18	1		17	
				-40°C to 125°C	5		33	3		25	3		22	2		19	2		18	1		18	
t_{dis}	Disable time	DIR	A	-40°C to 85°C	2		21	2		21	2		21	2		21	2		21	1		21	ns
				-40°C to 125°C	3		22	3		22	3		22	3		22	3		22	3		22	
		DIR	B	-40°C to 85°C	7		65	5		35	4		29	2		22	2		21	1		19	
				-40°C to 125°C	10		56	8		36	7		30	6		24	5		22	3		20	
t_{en}	Enable time	DIR	A	-40°C to 85°C	15		96	11		54	10		46	8		36	7		34	6		31	ns
				-40°C to 125°C	20		82	17		56	15		48	13		38	12		35	10		33	
		DIR	B	-40°C to 85°C	11		80	9		42	7		37	7		33	6		31	6		30	
				-40°C to 125°C	14		60	12		43	11		39	10		34	9		33	9		32	

6.9 Switching Characteristics, V_{CCA} = 2.5 ± 0.2 V

See Figure 7-1 and Table 7-1 for test circuit and loading. See Figure 7-2, Figure 7-3, and Figure 7-4 for measurement waveforms.

PARAMETER		FROM	TO	Test Conditions	B-Port Supply Voltage (V_{CCB})														UNIT
					1.2 ± 0.1 V			1.5 ± 0.1 V			1.8 ± 0.15 V			2.5 ± 0.2 V			3.3 ± 0.3 V			5.0 ± 0.5 V			
					MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
t_{pd}	Propagation delay	A	B	-40°C to 85°C	3		60	1		23	1		19	1		15	1		14	1		13	ns
				-40°C to 125°C	5		38	3		24	2		19	1		15	1		14	1		13	
		B	A	-40°C to 85°C	1		33	1		20	1		18	1		15	1		14	1		14	
				-40°C to 125°C	3		30	2		21	2		18	1		15	1		14	1		14	
t_{dis}	Disable time	DIR	A	-40°C to 85°C	1		15	1		15	1		15	1		15	1		15	1		15	ns
				-40°C to 125°C	1		15	1		15	1		15	1		15	1		15	1		15	
		DIR	B	-40°C to 85°C	5		54	4		30	3		25	2		19	2		18	1		16	
				-40°C to 125°C	8		47	7		31	6		26	5		21	4		19	2		17	
t_{en}	Enable time	DIR	A	-40°C to 85°C	12		82	9		44	8		37	6		29	6		27	5		24	ns
				-40°C to 125°C	17		68	14		45	13		39	11		31	10		29	8		26	
		DIR	B	-40°C to 85°C	8		67	6		33	5		29	4		25	4		23	4		22	
				-40°C to 125°C	11		49	9		34	8		30	7		26	7		24	6		23	

6.10 Switching Characteristics, V_{CCA} = 3.3 ± 0.3 V

See Figure 7-1 and Table 7-1 for test circuit and loading. See Figure 7-2, Figure 7-3, and Figure 7-4 for measurement waveforms.

PARAMETER		FROM	TO	Test Conditions	B-Port Supply Voltage (V_{CCB})														UNIT
					1.2 ± 0.1 V			1.5 ± 0.1 V			1.8 ± 0.15 V			2.5 ± 0.2 V			3.3 ± 0.3 V			5.0 ± 0.5 V			
					MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
t_{pd}	Propagation delay	A	B	-40°C to 85°C	3		57	1		22	1		18	1		14	1		13	1		12	ns
				-40°C to 125°C	4		37	3		22	2		18	1		14	1		13	1		12	
		B	A	-40°C to 85°C	1		34	1		19	1		16	1		13	1		13	1		12	
				-40°C to 125°C	3		30	2		20	1		17	1		14	1		13	1		12	
t_{dis}	Disable time	DIR	A	-40°C to 85°C	1		14	1		14	1		14	1		14	1		14	1		14	ns
				-40°C to 125°C	1		14	1		14	1		14	1		14	1		14	1		14	
		DIR	B	-40°C to 85°C	5		49	3		27	3		23	1		18	2		17	1		15	
				-40°C to 125°C	8		44	6		28	5		24	4		19	4		18	2		16	
t_{en}	Enable time	DIR	A	-40°C to 85°C	12		78	8		39	7		33	6		26	5		25	4		22	ns
				-40°C to 125°C	16		64	13		40	11		35	9		28	9		26	7		23	
		DIR	B	-40°C to 85°C	8		64	6		30	5		26	4		23	4		21	4		20	
				-40°C to 125°C	11		46	9		31	8		27	7		24	6		22	6		21	

6.11 Switching Characteristics, V_{CCA} = 5.0 ± 0.5 V

See Figure 7-1 and Table 7-1 for test circuit and loading. See Figure 7-2, Figure 7-3, and Figure 7-4 for measurement waveforms.

PARAMETER		FROM	TO	Test Conditions	B-Port Supply Voltage (V_{CCB})														UNIT
					1.2 ± 0.1 V			1.5 ± 0.1 V			1.8 ± 0.15 V			2.5 ± 0.2 V			3.3 ± 0.3 V			5.0 ± 0.5 V			
					MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
t_{pd}	Propagation delay	A	B	-40°C to 85°C	3		58	1		21	1		17	1		14	1		12	1		11	ns
				-40°C to 125°C	4		36	2		22	1		18	1		14	1		13	1		11	
		B	A	-40°C to 85°C	1		44	1		19	1		16	1		13	1		12	1		11	
				-40°C to 125°C	2		33	1		20	1		16	1		13	1		12	1		11	
t_{dis}	Disable time	DIR	A	-40°C to 85°C	1		12	1		12	1		12	1		12	1		12	1		12	ns
				-40°C to 125°C	1		12	1		12	1		12	1		12	1		12	1		12	
		DIR	B	-40°C to 85°C	5		48	3		26	3		21	1		16	2		16	1		14	
				-40°C to 125°C	8		43	6		26	5		22	3		17	3		17	2		15	
t_{en}	Enable time	DIR	A	-40°C to 85°C	11		87	8		38	7		31	5		24	5		22	4		20	ns
				-40°C to 125°C	15		66	12		39	10		32	8		25	8		24	6		21	
		DIR	B	-40°C to 85°C	7		63	5		28	4		24	3		20	3		19	2		18	
				-40°C to 125°C	9		43	7		28	6		25	5		21	4		19	4		18	

6.12 开关特性：T_{sk}，T_{MAX}

在自然通风温度范围内测得（除非另有说明）

参数	测试条件		V_{CCI}	V_{CCO}	自然通风工作温度范围 (T_A)			单位
					-40°C 至 125°C			
					最小值	典型值	最大值	
T_{MAX} - 最大数据速率	50% 占空比输入 单通道开关 20% 脉冲 > 0.7*V_{CCO} 20% 脉冲 < 0.3*V_{CCO}	上行转换	3.0 V 至 3.6V	4.5 V 至 5.5 V	200	420		Mbps
			2.25 V 至 2.75 V	4.5 V 至 5.5 V	150	300		
			1.65 V 至 1.95 V	4.5 V 至 5.5 V	100	200		
			1.1 V 至 1.3 V	4.5 V 至 5.5 V	20	40		
			1.65 V 至 1.95 V	3.0 V 至 3.6V	100	210		
			1.1 V 至 1.3 V	3.0 V 至 3.6V	10	20		
			1.1 V 至 1.3 V	1.65 V 至 1.95 V	5	10		
		下行转换	4.5 V 至 5.5 V	3.0 V 至 3.6V	100	210		
			4.5 V 至 5.5 V	2.25 V 至 2.75 V	75	140		
			4.5 V 至 5.5 V	1.65 V 至 1.95 V	50	75		
			4.5 V 至 5.5 V	1.1 V 至 1.3 V	15	30		
			3.0 V 至 3.6V	1.65 V 至 1.95 V	40	75		
			3.0 V 至 3.6V	1.1 V 至 1.3 V	10	20		
			1.65 V 至 1.95 V	1.1 V 至 1.3 V	5	10		

6.13 Operating Characteristics

T_A = 25℃ (1)

PARAMETER		Test Conditions	Supply Voltage (V_{CCB} = V_{CCA})						UNIT
			1.2 ± 0.1V	1.5 ± 0.1V	1.8 ± 0.15V	2.5 ± 0.2V	3.3 ± 0.3V	5.0 ± 0.5V	
			TYP	TYP	TYP	TYP	TYP	TYP	
C_{pdA} (2)	A to B	A Port CL = 0, RL = Open f = 10 MHz t_{rise} = t_{fall} = 1 ns	3.2	3.4	3.5	3.7	3.9	5.1	pF
	B to A		19.4	19.6	19.8	20.4	21.8	25.7	
C_{pdB} (2)	A to B	B Port CL = 0, RL = Open f = 10 MHz t_{rise} = t_{fall} = 1 ns	19.3	19.5	19.7	20.4	21.6	25.3	pF
	B to A		3.3	3.5	3.6	4.0	4.4	5.0	

(1) For more information about power dissipation capacitance, see the CMOS Power Consumption and C_{pd} Calculation application report
(2) C_{pdA} and C_{pdB} are repectively A-Port and B-Port power dissipation capacitances per transceiver

6.14 Typical Characteristics

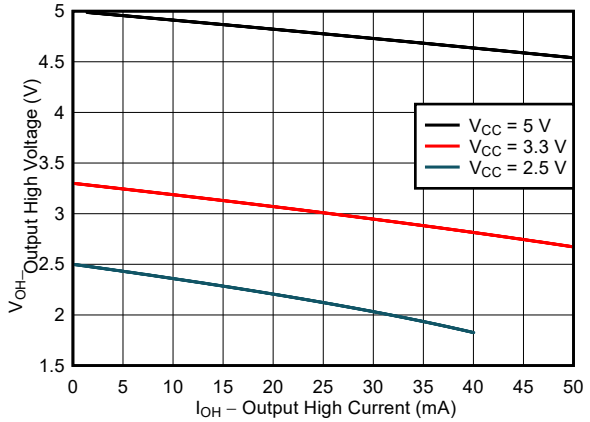


图 6-1. Typical (T_A=25°C) Output High Voltage (V_{OH}) vs Source Current (I_{OH})

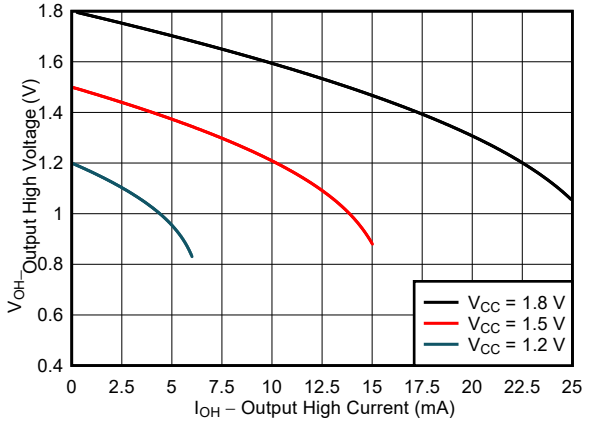


图 6-2. Typical (T_A=25°C) Output High Voltage (V_{OH}) vs Source Current (I_{OH})

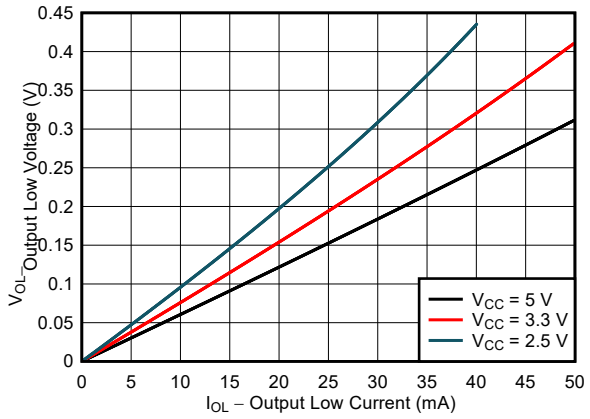


图 6-3. Typical (T_A=25°C) Output High Voltage (V_{OL}) vs Sink Current (I_{OL})

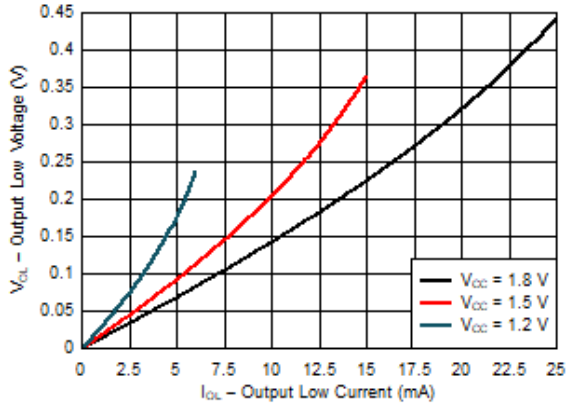


图 6-4. Typical (T_A=25°C) Output High Voltage (V_{OL}) vs Sink Current (I_{OL})

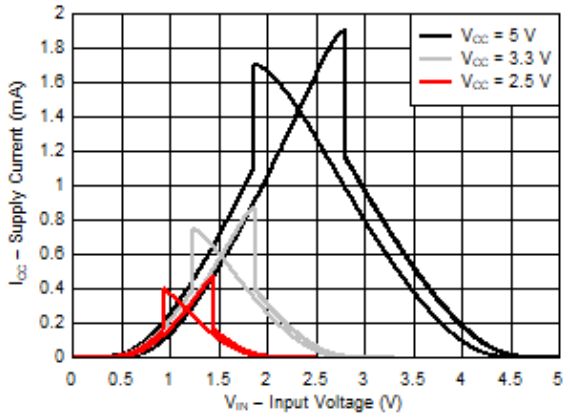


图 6-5. Typical (T_A=25°C) Supply Current (I_{CC}) vs Input Voltage (V_{IN})

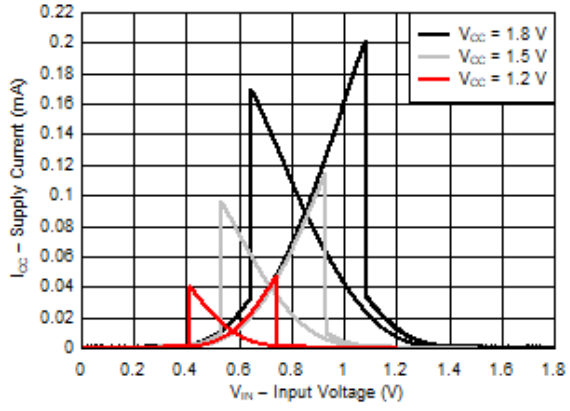


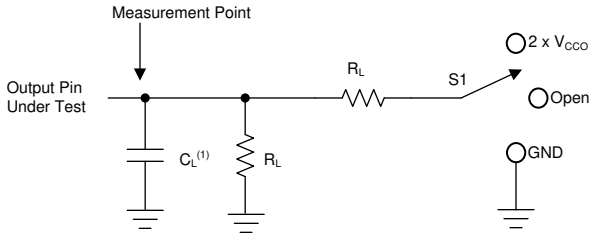
图 6-6. Typical (T_A=25°C) Supply Current (I_{CC}) vs Input Voltage (V_{IN})

7 Parameter Measurement Information

7.1 Load Circuit and Voltage Waveforms

Unless otherwise noted, all input pulses are supplied by generators having the following characteristics:

- f = 1 MHz
- Z_O = 50 Ω
- $\Delta t/\Delta V \leq$ 1 ns/V

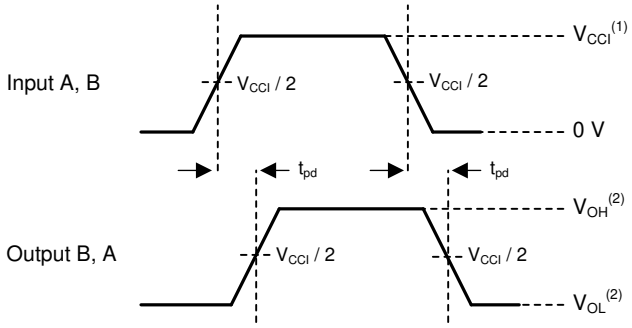


A. C_L includes probe and jig capacitance.

图 7-1. Load Circuit

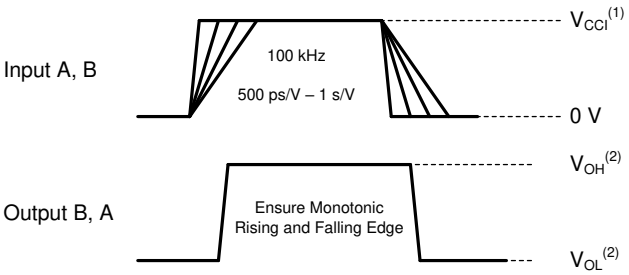
表 7-1. Load Circuit Conditions

Parameter		V_{CCO}	R_L	C_L	S_1	V_{TP}
t_{pd}	Propagation (delay) time	1.1 V – 5.5 V	2 kΩ	15 pF	Open	N/A
t_{en}, t_{dis}	Enable time, disable time	1.1 V – 1.6 V	2 kΩ	15 pF	2 × V_{CCO}	0.1 V
		1.65 V – 2.7 V	2 kΩ	15 pF	2 × V_{CCO}	0.15 V
		3.0 V – 5.5 V	2 kΩ	15 pF	2 × V_{CCO}	0.3 V
t_{en}, t_{dis}	Enable time, disable time	1.1 V – 1.6 V	2 kΩ	15 pF	GND	0.1 V
		1.65 V – 2.7 V	2 kΩ	15 pF	GND	0.15 V
		3.0 V – 5.5 V	2 kΩ	15 pF	GND	0.3 V



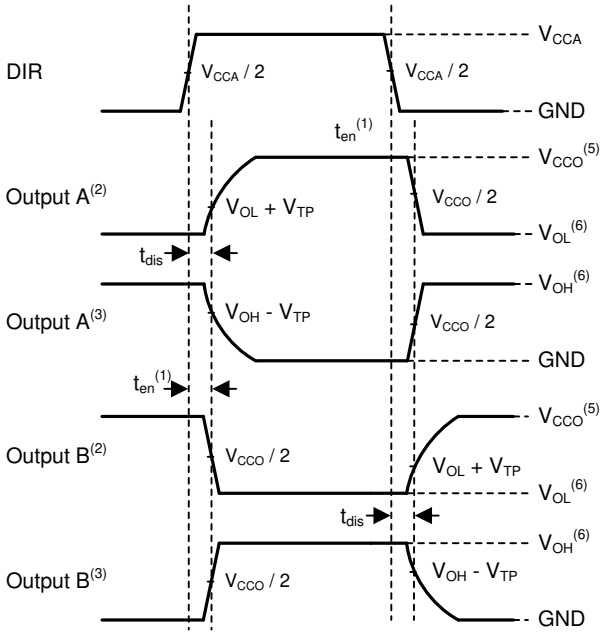
1. V_{CCI} is the supply pin associated with the input port.
2. V_{OH} and V_{OL} are typical output voltage levels that occur with specified R_L, C_L, and S_1

图 7-2. Propagation Delay



1. V_{CCI} is the supply pin associated with the input port.
2. V_{OH} and V_{OL} are typical output voltage levels that occur with specified R_L, C_L, and S_1

图 7-3. Input Transition Rise and Fall Rate



A. 1. Illustrative purposes only. Enable time is a calculation as described in *Enable Times.*
2. Output waveform on the condition that input is driven to a valid Logic low.
3. Output waveform on the condition that input is driven to a valid Logic high.
4. V_{CCI} is the supply pin associated with the input port.
5. V_{CCO} is the supply pin associated with the output port.
6. V_{OH} and V_{OL} are typical output voltage levels with specified R_L, C_L, and S_1.

图 7-4. Enable Time And Disable Time

8 Detailed Description

8.1 Overview

The SN74LXC1T45 is an 1-bit translating transceiver that uses two individually configurable power-supply rails. The device is operational with both V_{CCA} and V_{CCB} supplies as low as 1.1 V and as high as 5.5 V. Additionally, the device can be operated with $V_{CCA} = V_{CCB}$. The A port is designed to track V_{CCA}, and the B port is designed to track V_{CCB}.

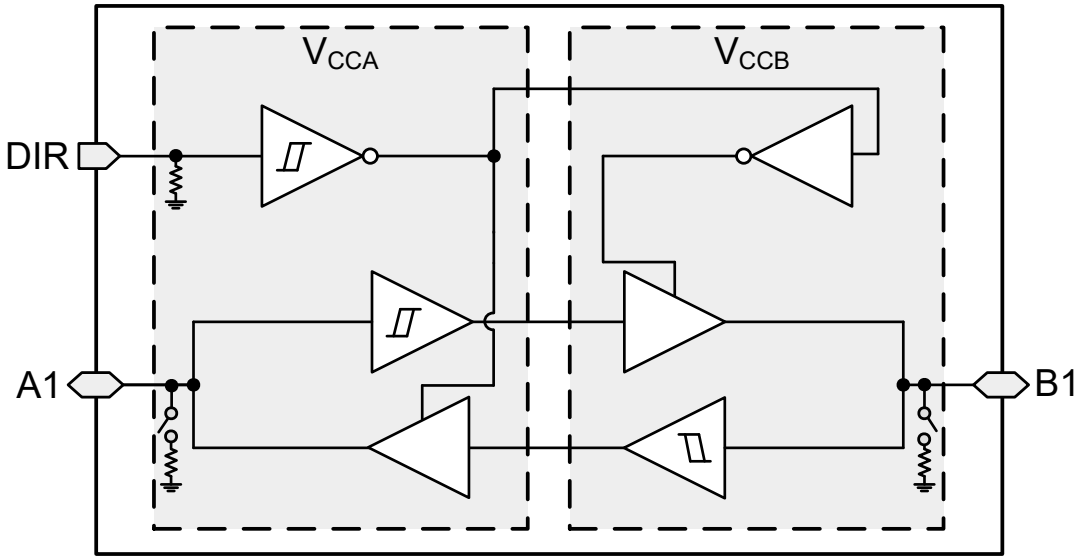
The SN74LXC1T45 device is designed for asynchronous communication between devices and transmits data from A to B or from B to A based on the logic level of the direction-control input (DIR). The control pins of the SN74LXC1T45 (DIR) is referenced to V_{CCA}. The input circuitry on both A and B ports is always active and must have a logic HIGH or LOW level applied to prevent excess ICC and ICCZ.

This device is fully specified for partial-power-down applications using the I_{off} current. The I_{off} protection circuitry ensures that no excessive current is drawn from or sourced into an input, output, or I/O while the device is powered down.

The V_{CC} isolation or V_{CC} disconnect feature ensures that if either V_{CC} is less than 100 mV or disconnected with the complementary supply within the recommended operating conditions, then both I/O ports are weakly pulled-down and then set to the high-impedance state by disabling their outputs while the supply current is maintained. The $I_{off-float}$ circuitry ensures that no excessive current is drawn from or sourced into an input, output, or I/O while the supply is floating.

Glitch-free power supply sequencing allows either supply rail to be powered on or off in any order while providing robust power sequencing performance.

8.2 Functional Block Diagram



8.3 Feature Description

8.3.1 CMOS Schmitt-Trigger Inputs with Integrated Pulldowns

Standard CMOS inputs are high impedance and are typically modeled as a resistor in parallel with the input capacitance given in the *Electrical Characteristics*. The worst case resistance is calculated with the maximum input voltage, given in the *Absolute Maximum Ratings*, and the maximum input leakage current, given in the *Electrical Characteristics*, using ohm's law (R = V ÷ I).

The Schmitt-trigger input architecture provides hysteresis as defined by ΔV_T in the *Electrical Characteristics*, which makes this device extremely tolerant to slow or noisy inputs. Driving the inputs slowly will increase dynamic current consumption of the device. For additional information regarding Schmitt-trigger inputs, see *Understanding Schmitt Triggers*.

8.3.1.1 I/O's with Integrated Dynamic Pull-Down Resistors

Input circuits of the data I/O's are always active even when the device is disabled. It is recommended to keep a valid voltage level at the I/O's to avoid high current consumption. To help avoid floating inputs on the I/O's during disabling, this device has 100-kΩ typical integrated weak dynamic pull-downs on all data I/O's. When the device is disabled, the dynamic pull-downs are activated for only a short period of time to help drive and keep low any floating inputs before the device I/O's become high impedance. If the I/O lines are to be floated after the device is disabled, then it is recommended to keep them at a valid input voltage level using the external pull-downs. This feature is ideal for loads of 30 pF or less. If greater capactive loading is present, then external pull-downs are recommended. If an external pull-up is required, then it should be no larger than 15 kΩ to avoid contention with the 100 kΩ internal pull-down.

8.3.1.2 Control Inputs with Integrated Static Pull-Down Resistors

Similar to the data I/O's, a floating control input can cause high current consumption. To help avoid this concern, this device has integrated weak static pull-downs of 5-MΩ typical on the control input (DIR). These pull-downs are always present. So for example if the DIR pin is left floating, then the B port will be configured as an input and the A port configured as an output.

8.3.2 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 routing 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. The electrical and thermal limits defined in the *Absolute Maximum Ratings* must be followed at all times.

8.3.3 Partial Power Down (I_{off})

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 V_{CC} Isolation and V_{CC} Disconnect ($I_{off-float}$)

This device has *I/O's with Integrated Dynamic Pull-Down Resistors*. The I/O's will get pulled down and then enter a high-impedance state when either supply is < 100 mV or left floating (disconnected), while the other supply is still connected to the device. It is recommended that the I/O's for this device are not driven and kept at a logic low state prior to floating (disconnecting) either supply.

The maximum supply current is specified by I_{CCx}, while V_{CCx} is floating, in the *Electrical Characteristics*. The maximum leakage into or out of any input or output pin on the device is specified by $I_{off(float)}$ in the *Electrical Characteristics*.

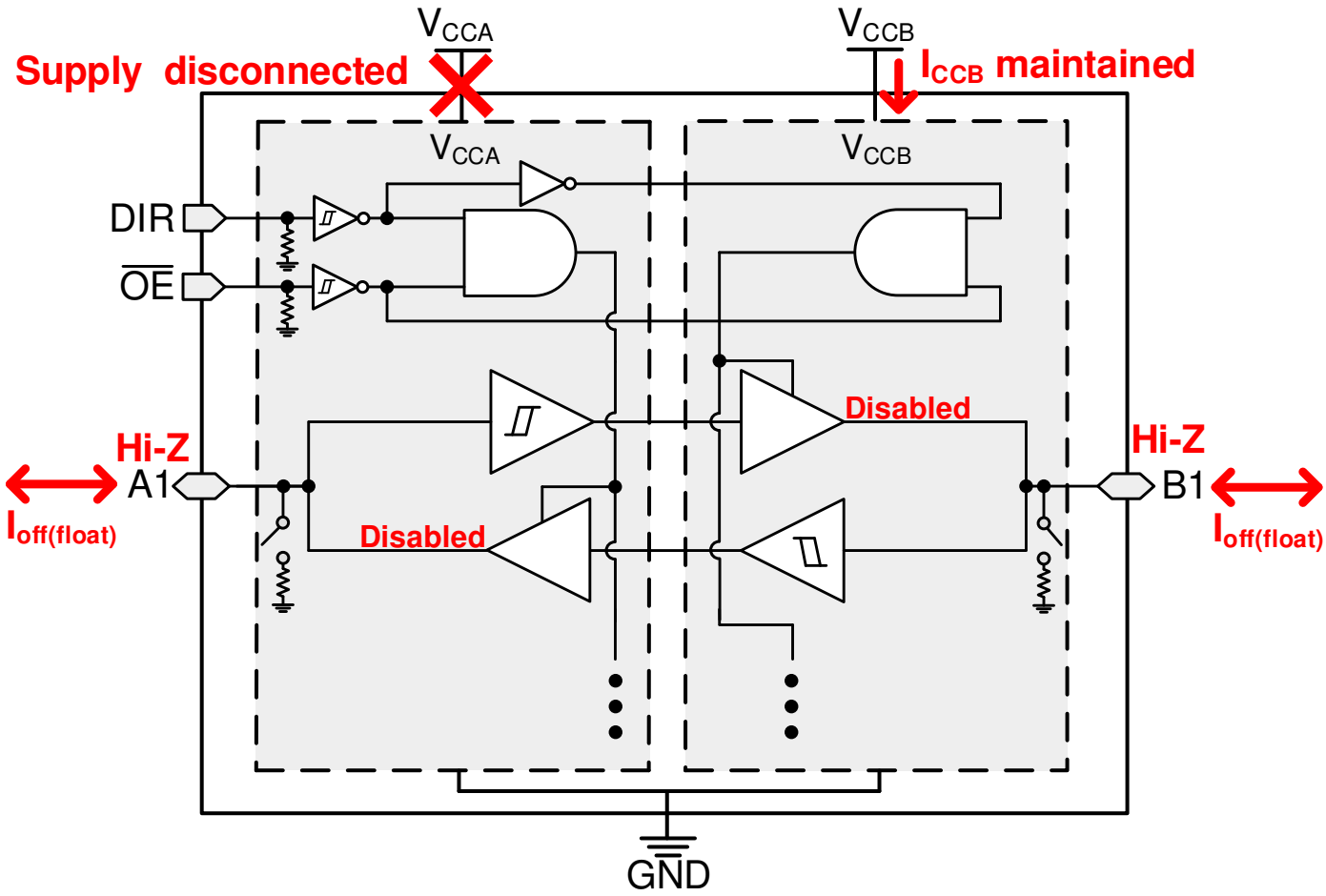


图 8-1. V_{CC} Disconnect Feature

8.3.5 Over-Voltage Tolerant Inputs

Input signals to this device can be driven above the supply voltage so long as they remain below the maximum input voltage value specified in the *Recommended Operating Conditions*.

8.3.6 Glitch-Free Power Supply Sequencing

Either supply rail may be powered on or off in any order without producing a glitch on the I/Os (that is, where the output erroneously transitions to VCC when it should be held low or vice versa). Glitches of this nature can be misinterpreted by a peripheral as a valid data bit, which could trigger a false device reset of the peripheral, a false device configuration of the peripheral, or even a false data initialization by the peripheral.

8.3.7 Negative Clamping Diodes

图 8-2 shows the inputs and outputs to this device that have negative clamping diodes.

CAUTION

Voltages beyond the values specified in the *Absolute Maximum Ratings* table can cause damage to the device. The input negative voltage and output voltage ratings may be exceeded if the input and output clamp current ratings are observed.

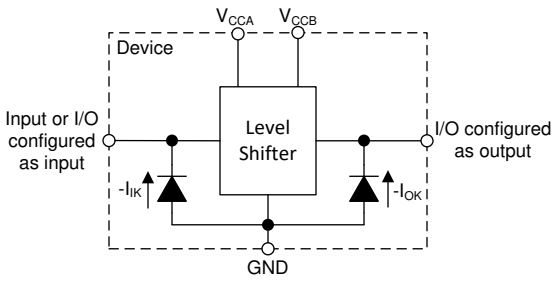


图 8-2. Electrical Placement of Clamping Diodes for Each Input and Output

8.3.8 Fully Configurable Dual-Rail Design

Both the V_{CCA} and V_{CCB} pins can be supplied at any voltage from 1.1 V to 5.5 V, making the device suitable for translating between any of the voltage nodes (1.2 V, 1.5 V, 1.8 V, 3.3 V, and 5.0 V).

8.3.9 Supports High-Speed Translation

The SN74LXC1T45 device can support 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 5.0 V.

8.4 Device Functional Modes

表 8-1. Function Table

CONTROL INPUTS (1)	PORT STATUS		OPERATION
DIR	A PORT	B PORT	
L	Output (Enabled)	Input (Hi-Z)	B data to A bus
H	Input (Hi-Z)	Output (Enabled)	A data to B bus

(1) Input circuits of the data I/Os are always active and should be kept at a valid logic level.

9 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。

9.1 Application Information

The SN74LXC1T45 device can be used in level-translation applications for interfacing devices or systems operating at different interface voltages with one another. The SN74LXC1T45 device is ideal for use in applications where a push-pull driver is connected to the data I/Os. The maximum data rate can be up to 420 Mbps when the device translates a signal from 3.3 V to 5.0 V.

9.2 Enable Times

Calculate the enable times for the SN74LXC1T45 using the following formulas:

$$t_{A\_en}\ (\text{DIR to A}) = t_{dis}\ (\text{DIR to B}) + t_{pd}\ (\text{B to A}) \quad (1)$$

$$t_{B\_en}\ (\text{DIR to B}) = t_{dis}\ (\text{DIR to A}) + t_{pd}\ (\text{A to B}) \quad (2)$$

In a bidirectional application, these enable times provide the maximum delay time from the time the DIR bit is switched until an output is expected. For example, if the SN74LXC1T45 initially is transmitting from A to B, then the DIR bit is switched; the B port of the device must be disabled (t_{dis}) 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 (t_{pd}). To avoid bus contention, care should be taken to not apply an input signal prior to the output being disabled (t_{dis} maximum).

9.3 Typical Application

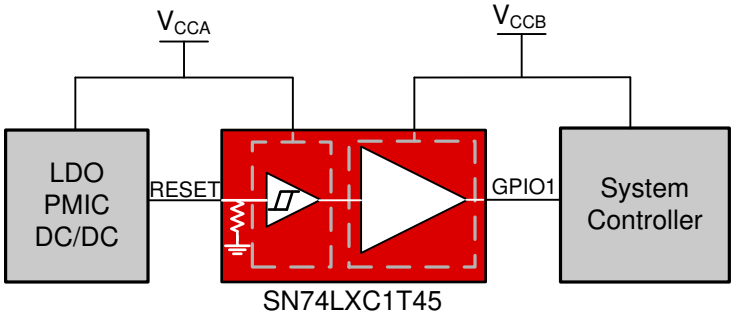


图 9-1. LED Driver Application

9.3.1 Design Requirements

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

表 9-1. Design Parameters

DESIGN PARAMETERS	EXAMPLE VALUES
Input voltage range	1.1 V to 5.5 V
Output voltage range	1.1 V to 5.5 V

9.3.2 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 SN74LXC1T45 device to determine the input voltage range. For a valid logic-high, the value must exceed the positive-going input-threshold voltage (V_{t+}) of the input port. For a valid logic low the value must be less than the negative-going input-threshold voltage (V_{t-}) of the input port.
- Output voltage range
  - Use the supply voltage of the device that the SN74LXC1T45 device is driving to determine the output voltage range.

10 Power Supply Recommendations

Always apply a ground reference to the GND pins first. This device is designed for glitch free power sequencing without any supply sequencing requirements such as ramp order or ramp rate.

This device was designed with various power supply sequencing methods in mind to help prevent unintended triggering of downstream devices, as described in *Glitch-free Power Supply Sequencing*.

11 Layout

11.1 Layout Guidelines

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

- Use bypass capacitors on the power supply pins and place them as close to the device as possible. A 0.1 µF capacitor is recommended, but transient performance can be improved by having both 1 µF and 0.1 µF capacitors in parallel as bypass capacitors.
- The high drive capability of this device creates fast edges into light loads so routing and load conditions should be considered to prevent ringing.

11.2 Layout Example

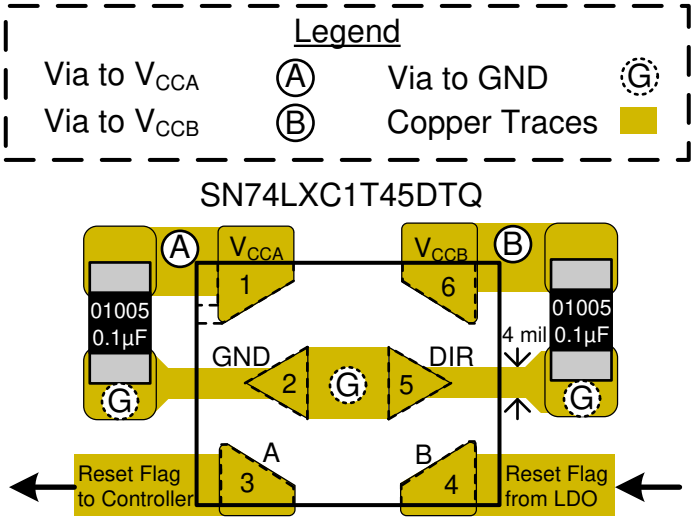


图 11-1. Layout Example – SN74LXC1T45

12 Device and Documentation Support

12.1 Device Support

12.1.1 Regulatory Requirements

No statutory or regulatory requirements apply to this device.

There are no special characteristics for this product.

12.2 Documentation Support

12.2.1 Related Documentation

For related documentation, see the following:

- Texas Instruments, *Understanding Schmitt Triggers* application report

12.3 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。

12.4 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》。

12.5 Trademarks

TI E2E™ is a trademark of Texas Instruments.
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12.6 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.

12.7 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
SN74LXC1T45DBVR	ACTIVE	SOT-23	DBV	6	3000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	2LSF	Samples
SN74LXC1T45DCKR	ACTIVE	SC70	DCK	6	3000	RoHS & Green	SN	Level-1-260C-UNLIM	-40 to 125	1L1	Samples
SN74LXC1T45DRYR	ACTIVE	SON	DRY	6	5000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	MK	Samples
SN74LXC1T45DTQR	ACTIVE	X2SON	DTQ	6	3000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	ME	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.

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.

DRY 6 USON - 0.6 mm max height

PLASTIC SMALL OUTLINE - NO LEAD

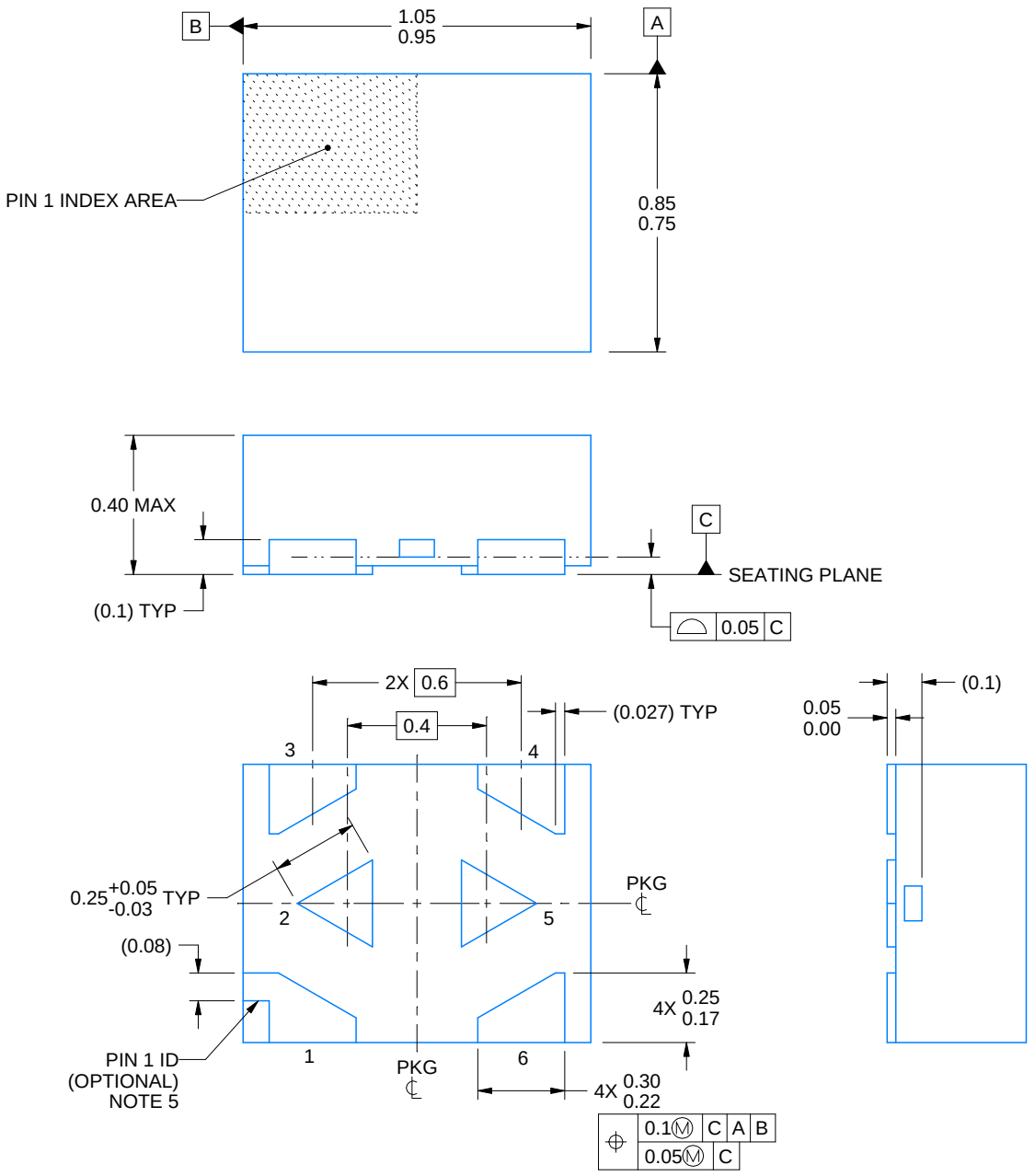
Images above are just a representation of the package family, actual package may vary.
Refer to the product data sheet for package details.

DTQ0006A

PACKAGE OUTLINE

X2SON - 0.4 mm max height

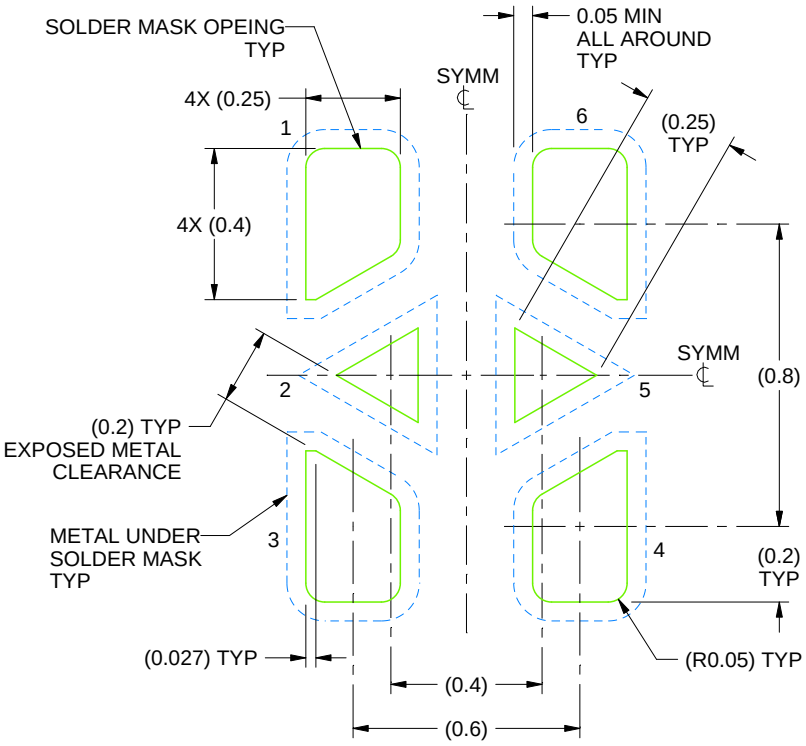
PLASTIC SMALL OUTLINE - NO LEAD



4224056/A 11/2017

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. The package thermal pads must be soldered to the printed circuit board for optimal thermal and mechanical performance.
4. The size and shape of this feature may vary.
5. Features may not exist. Recommend use of pin 1 marking on top of package for orientation purposes.

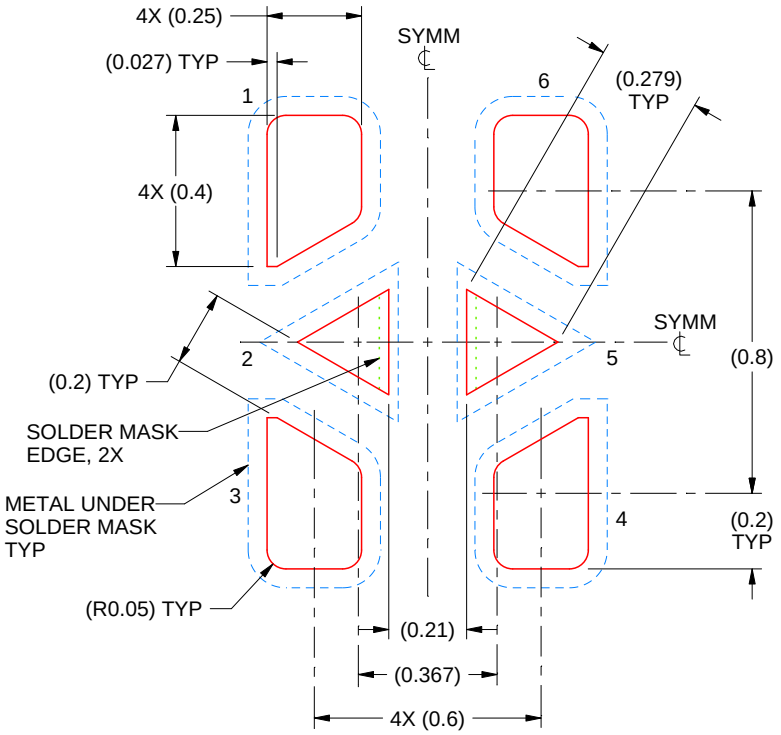


LAND PATTERN EXAMPLE
SOLDER MASK DEFINED
SCALE:50X

4224056/A 11/2017

NOTES: (continued)

6. This package is designed to be soldered to a thermal pads on the board. For more information, see Texas Instruments literature number SLUA271 (www.ti.com/lit/slua271).
7. Vias are optional depending on application, refer to device data sheet. If some or all are implemented, recommended via locations are shown.



SOLDER PASTE EXAMPLE
BASED ON 0.07 mm THICK STENCIL

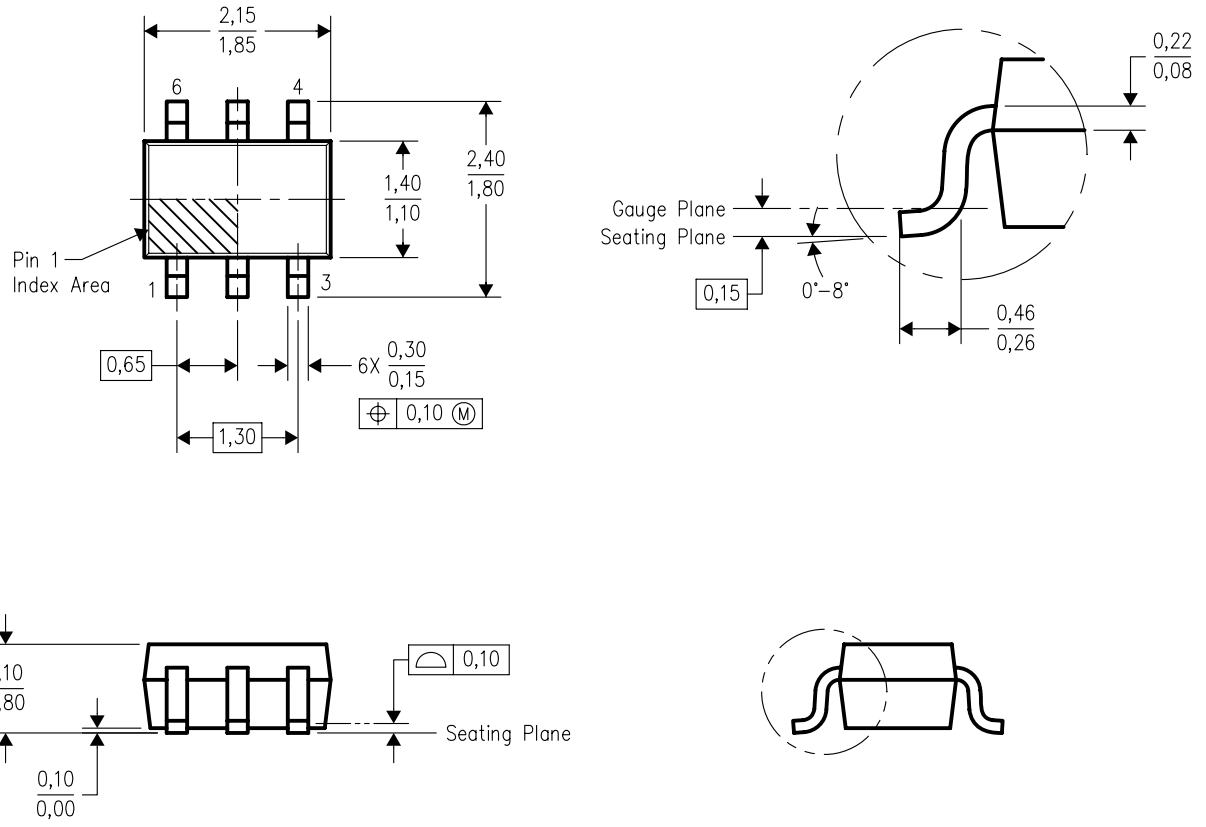
PRINTED SOLDER COVERAGE BY AREA UNDER PACKAGE
SCALE:50X

4224056/A 11/2017

NOTES: (continued)

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

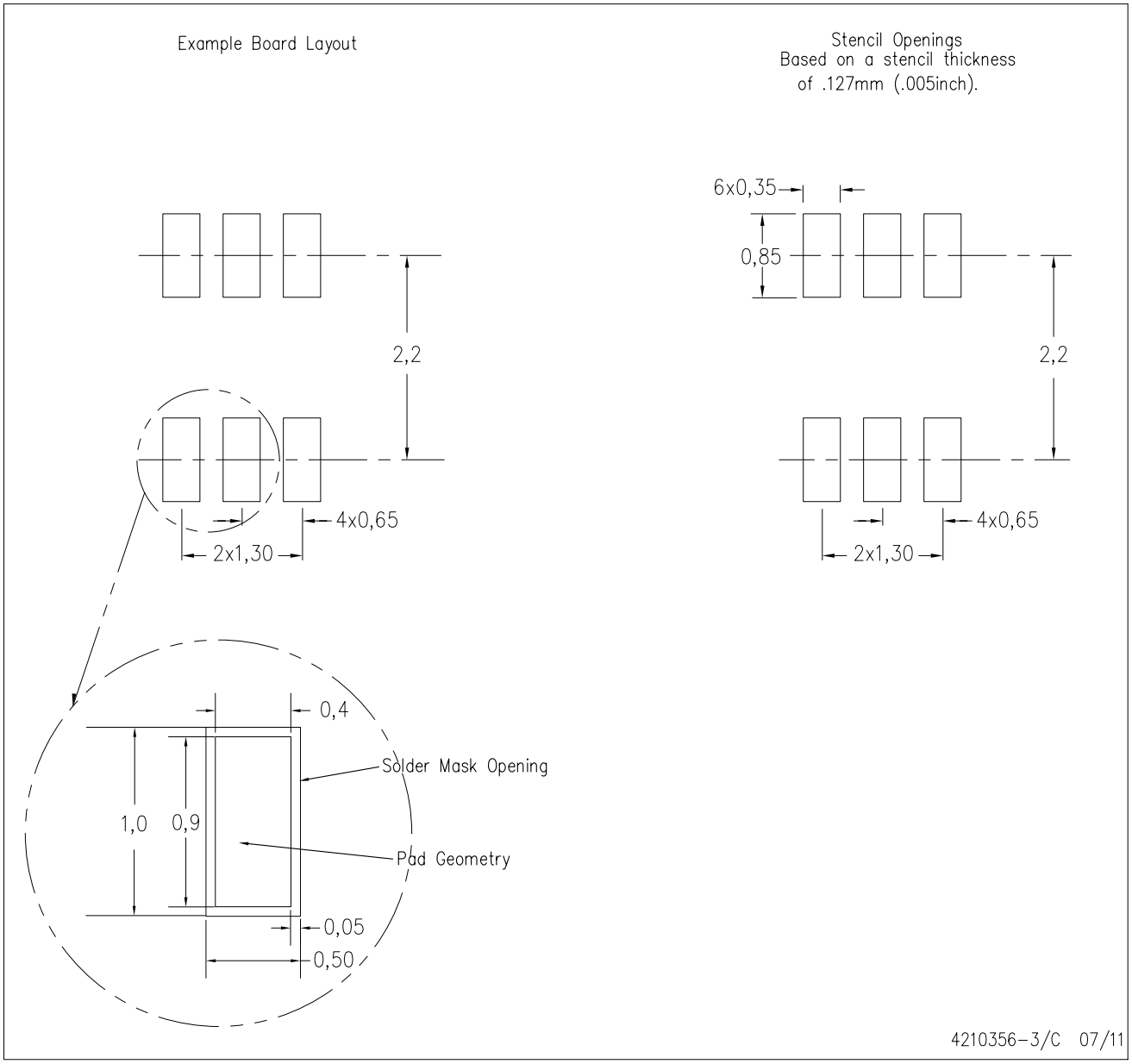
DCK (R–PDSO–G6) PLASTIC SMALL–OUTLINE PACKAGE



4093553–4/G 01/2007

NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion. Mold flash and protrusion shall not exceed 0.15 per side.
D. Falls within JEDEC MO–203 variation AB.

DCK (R–PDSO–G6) PLASTIC SMALL OUTLINE



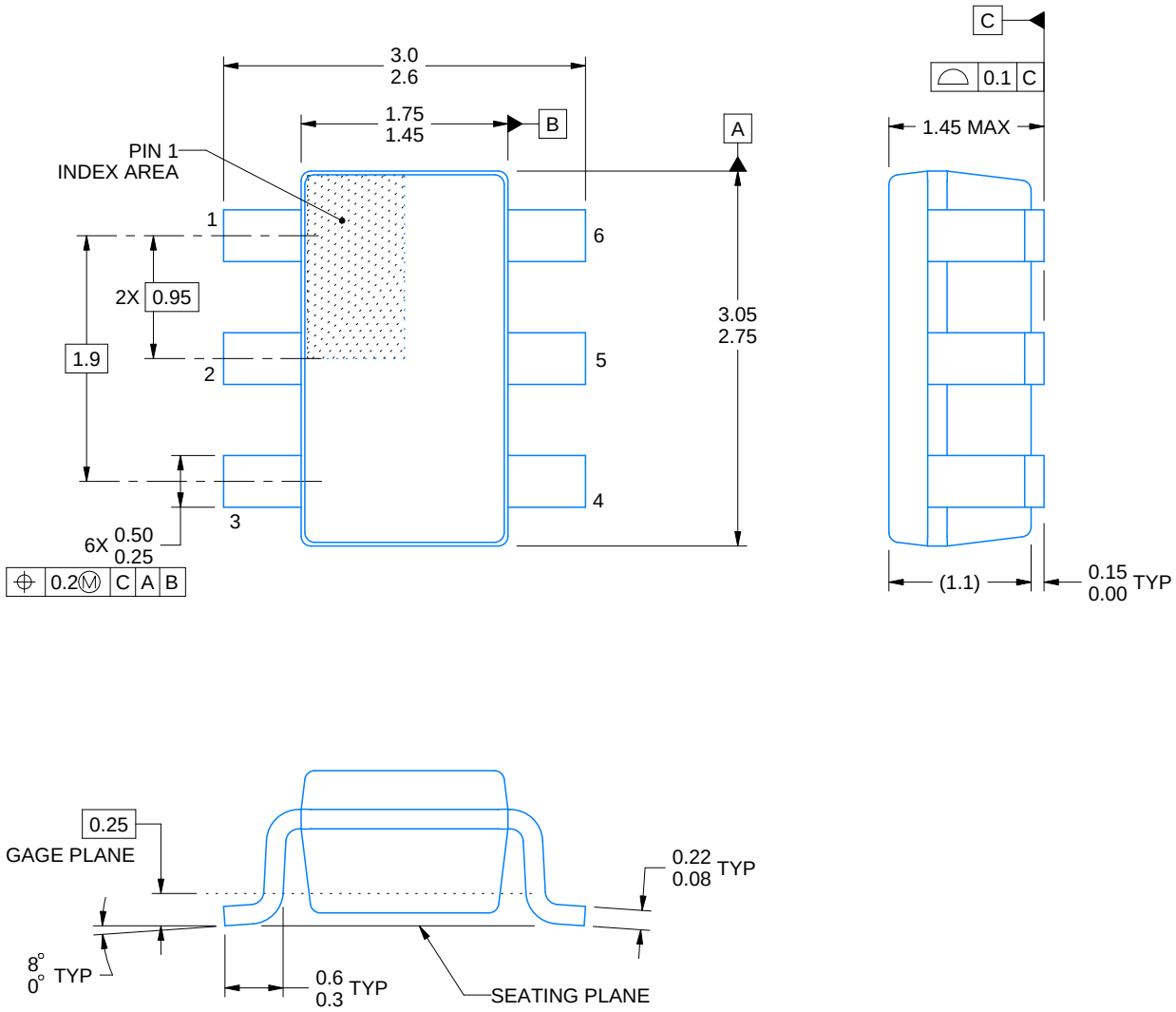
NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Customers should place a note on the circuit board fabrication drawing not to alter the center solder mask defined pad.
D. Publication IPC–7351 is recommended for alternate designs.
E. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Example stencil design based on a 50% volumetric metal load solder paste. Refer to IPC–7525 for other stencil recommendations.

PACKAGE OUTLINE

DBV0006A

SOT-23 - 1.45 mm max height

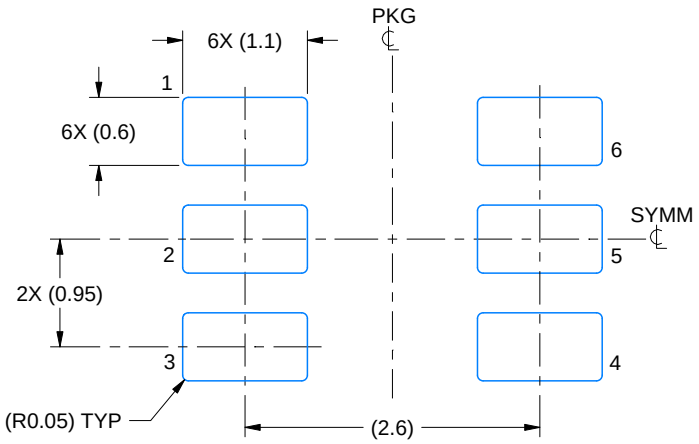
SMALL OUTLINE TRANSISTOR



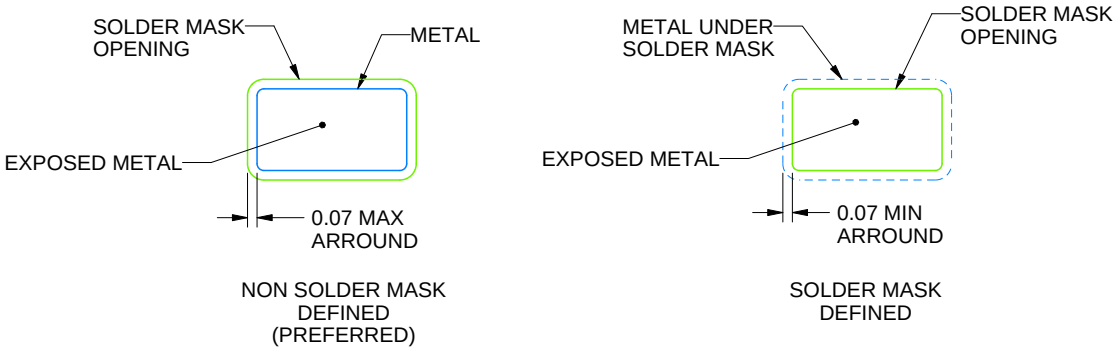
4214840/C 06/2021

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. Refernce JEDEC MO-178.



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:15X

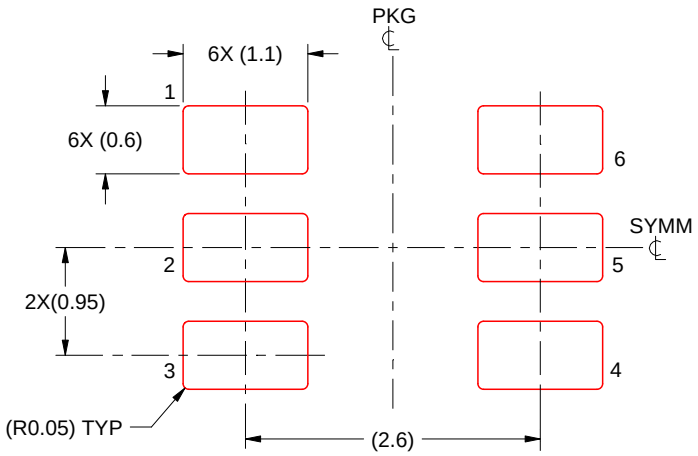


SOLDER MASK DETAILS

4214840/C 06/2021

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.



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

4214840/C 06/2021

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.

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